INTEROFFICE MEMORANDUM

digital COMPONENTS GROUP

TO: Ken Sills

DATE: November 21, 1977

FROM: Art Massicott AfM

DEPT: Components Group

EXT: 6777 LOC: MR2-2/A52

DCG POSITION

SUBJ: MASS STORAGE INPUTS

My view of the mass storage needs from the DCG vantage point center around competitive performance with leadership costs. Rather than pushing the edge of technology with the associated high risks, a more conservative first step that leads to a stronger market position due to financial strength, i.e., aggressive pricing with acceptable margins is needed. The second step, pushing technology from a position of market strength, which may require a significant engineering investment, should push us into a leadership product performance position.

For Example

- Rather than spend effort on the RX0X, first put effort into the RX04 to make it the most reliable low cost floppy available.
- A review of all the proposed products to make sure we are not excessively exposed from a technology risk standpoint.
- Pick technological conservative alternatives in each of the above areas as defined in your matrix, and emphasize these products.
- Look hard at the system enhancement area as a means of providing product leadership using our strength, ie., 11 ISP. Some level of intelligent disk may be the correct approach to persue.

Ken, as I think about your "Development Alternatives" I am not able to allocate the funds without some discussion in the medium and high end disk.

/sc

digital

INTEROFFICE MEMORANDUM

TO: Distribution

DATE: 14 December 1977
FROM: Ken Sills
DEPT: Disk Products
EXT: 5805
LOC/MAIL STOP: ML 1-3/E58

DEC 19 1977

SUBJ: Marketing Survey to Determine Mass Storage Investment Priorities

1) Introduction

This report contains the results of a marketing survey I recently conducted with key Product Lines to determine priorities that the Storage Systems POT should be factoring into the investment decision process. The level of response and concern by the Product Lines was very high. I thank the participants for their expeditious help. The survey results factored heavily into the FY79 Storage Systems investments recommendation recently presented to the Engineering Board of Directors (EBOD).

2) The Survey Instrument

The purpose of the survey was to determine relative priorities for major product areas in Storage Systems. Dealing with this question in terms of actual product tactics (schedules, pricing, introduction strategies, etc.) is next to impossible given diverse product line priorities and concerns. It also creates a lot of "smoke" due to nonstrategic issues. This tends to mask basic priorities. To alleviate this problem I created an investment model which is shown in the survey form (Exhibit 1). The model simply describes annual total development investment in FY79 and FY80 to maintain "today's" level of competitiveness, and a hypothetical better "leadership" position. The lower funding level approximates the Spring Beige Book Guideline for FY79 funding of these areas. The higher funding level is about 60% higher and represents an unrealistically large amount of funding in FY79. The question asked of the Product Lines is in which general product areas would they choose to spend incremental dollars and how would they split the dollars among chosen areas. The question was asked for 3 levels of investment between the two modelled funding levels (columns 1-3). It was stipulated that the level of investment for any product area must lie within the two modelled levels of funding. A sample of the raw data (EPG) is shown in Exhibit 2.

The product classifications were described as follows:

A) Floppy - Self explanatory

B) Disks - To cover a capacity range of 150X (5Mb to 750 Mb), 5 disk offerings are necessary if each offering is 2.5X - 3.0X the next smaller disk in capacity. Two of these should be "low-end", i.e., one platter devices. The smaller emphasizes entry cost, the larger max density/ 1 platter. Two are probably "medium" disks, i.e., 2-4 platter devices, and the highest capacity is an 8-10 platter "large" disk. Incremental spending on large disks moves us from a buy to a build posture.

C) System Enhancements - This general class of projects was described as encompassing NDS(New Disk System), Massbus Cache, new I/O busses, new standard interfaces, etc. System Enhancements is not limited to Disks as new Mass Storage subsystems will begin integrating disk and tape.

D) The two tape products are in general agreement with the Tape Products "2-product strategy". The small ½" tape should be thought of as "TS" class products, the large ½" tape as "TU" class products.

3) Data Reduction Method

A) For each input, the incremental dollars for each product area over the previous lower levels of funding was computed. These incremental dollars were then multiplied by a weighting factor to reflect priority. First priority incremental spending (i.e., within the $11.0M product development plant was weighted by 4, second priority =2, and third priority =1. These weightings are arbitrary, hopefully reasonable, and chosen by me. Note that there is only $.8M of first priority spending compared to $2M of second and third priority spending.

B) The weighted dollars for each area over all priorities were then added to get a point score. For example, in Exhibit 2, the point score given to large disks by EPG was:

$$(0 \times 4) + (.3 \times 2) + (1.5 \times 1) = 2.1$$

C) The point score is not a reasonable method of priority ranking since the survey contrained incremental spending on some projects to much lower levels than others. A reasonable ranking method is to compare the point score to the maximum possible score achievable by a product class if it were of absolute highest priority. For example, had EPG given highest priority to large disks, the point score would have been:

$$(.8 \times 4) + (1.2 \times 2) + (0 \times 1) = 5.6$$

The actual rating was therefore 38% of the maximum. This percentage is a fair statistic for ranking purposes.

D) The composite product line ranking of any product class was derived in two ways:

1) A straight unweighted average (Business Products given 1 vote)

2) A weighted average proportional to percentage projections of FY80 product line NOR for polled product lines.

4) Results of Survey

Exhibit 3 shows composite and product line results. The weighted and unweighted rankings do not differ significantly. The percentage scores indicate a breakdown into four general priority ranking groups. This data is shown in Exhibit 4.

5) Other Data

In addition to the quantitative survey, each product line was asked to submit a written statement of their Mass Storage problems, concerns, etc. These inputs are shown in Exhibit 5.

/ec

EXHIBIT 1

SAMPLE SURVEY SHEET

STORAGE SYSTEMS - DEVELOPMENT ALTERNATIVES ($MILLIONS/YEAR)

	NECESSARY INVESTMENT TO:		PRODUCT LINE CHOSEN ALTERNATIVES			
	MAINTAIN CURRENT POSITION*	ATTAIN LEADERSHIP POSITION**	1	2	3	4
FLOPPY	.5	1.0				
LOW DISK #1	1.5	2.0				
LOW DISK #2	1.5	2.0				
MEDIUM DISK #1	2.0	2.5				
MEDIUM DISK #2	2.0	2.5				
LARGE DISK	1.0	3.0				
SYSTEM ENHANCE	.5	1.5				
SMALL ½" TAPE	.4	.7				
LARGE ½" TAPE	.8	1.2				
	10.2	16.4	11.0	13.0	15.0	
+ 40% ADV DEV PROD MGMT, SUPPORT (NOT POT ALLOCATED)	4.1	6.6	4.4	5.2	6.0	
TOTAL	14.3	23.0	15.4	18.2	21.0	

* 5 years behind IBM on build products, 3 years on buys. Prices 20-40% higher than systems competition. Prices much higher than 3rd party vendors.

** Products with price and functionality equal to all competition with the exception of IBM.

STORAGE SYSTEMS INVESTMENT ALTERNATIVES	MAX POSSIBLE SCORE	OEM	LDP	IPG	TELC	EPG	Bus-OEM	Bus-END-USER	DDP	LCG	WEIGHTED TOTAL	UNWEIGHTED TOTAL	WEIGHTED RANK	UNWEIGHTED RANK
WEIGHTING FACTOR →		.25	.14	.06	.10	.03	.10	.07	.11	.14	1.00	—	—	—
		X	X	X	X	X	X	X	X	X	X	X	X	X
FLOPPY	2.0	1.0/50%	.5/25%	.5/25%	—	—	.8/40%	.5/25%	1.1/55%	—	.586/29%	.469/23%	6	8
LOW DISK 1	2.0	2.0/100%	2.0/100%	1.0/50%	—	1.6/80%	1.6/80%	1.1/55%	.8/40%	—	1.213/61%	1.1/55%	2	3
LOW DISK 2	2.0	1.0/50%	1.2/60%	.9/45%	.5/25%	1.0/50%	1.4/70%	1.0/50%	.7/35%	—	.839/42%	.813/41%	4	5
MEDIUM DISK 1	2.0	1.0/50%	1.0/50%	2.0/100%	—	1.0/50%	.5/25%	1.0/50%	1.6/80%	—	.836/42%	.719/46%	5	4
MEDIUM DISK 2	2.0	2.0/100%	1.0/50%	.5/25%	1.0/50%	2.0/100%	.7/35%	1.6/80%	1.6/80%	1.0/50%	1.328/66%	1.275/64%	1	1
LARGE DISK	5.6	—	.8/14%	—	3.0/54%	2.1/38%	2.4/43%	1.5/27%	3.0/54%	2.5/45%	1.50/27%	1.675/30%	8	7
SMALL 1/2" TAPE	1.2	—	.5/42%	—	.3/25%	—	—	—	—	.3/25%	.142/12%	.138/12%	9	9
LARGE 1/2" TAPE	1.2	—	.6/50%	.8/67%	.8/67%	—	—	.3/25%	—	.7/58%	.331/28%	.375/31%	7	6
SYSTEM ENHANCEMENTS	3.6	1.0/28%	1.6/44%	2.8/78%	3.6/100%	1.5/42%	1.8/50%	2.2/61%	.4/11%	4.7/131%	2.083/58%	2.200/61%	3	2

EXHIBIT 3

EXHIBIT 4

COMPOSITE PRODUCT LINE RANKINGS OF MASS STORAGE PRODUCTS

PRODUCT CLASS	PRIORITY (1=highest)	SURVEY POINTS
"Large" Mid-range Disks(e.g.R80/81)	1	66
"Small" Low-end Disks (emphasis on entry cost per box)	1	61
System Enhancements (e.g. NDS)	1	58
"Large" Low-end Disks (emphasis on max capacity/1 platter)	2	42
"Small" Mid-range Disks (e.g. $R80_{60}$, RK07, RM03)	2	42
Floppy Disks	3	29
Large ½" Magtape (e.g. "TU")	3	28
Large Disks (build strategy)	3	27
Small ½" Magtape (e.g. "TS")	4	12

OEM POSITION

My position on mass storage development priorities and strategies is based on five considerations

- budget limitations
- evolving OEM business mix by system size
- evolving corporate business mix by system size
- competitive position - now and possible in 3 years
- technology possibilities

Each of these is summarized below.

- We do not have the resources to develop all the proposed products in the proposed time frame; a strong case exists to exceed $14.3 million (the present guideline), but around $16.5 million is probably as high as we can go. Some projects will have to be slowed or eliminated.

- The OEM business in FY'81 will be concentrated in small ($0 - $25,000) and mid-range ($25 - $50,000) systems; 30% and 40%, respectively, is projected to come from these areas. This leads to a priority on the low (RX/RL) and mid-range (R80) disks as the key mass storage products.

- The corporate FY'81 projection is similar to the OEM one, with a smaller portion at the low end (15%) and a greater portion at the very high end (20% in the $200,000 and up range). This corporate picture supports a high priority emphasis on the RL and R80 programs (covering the remaining 65% of the business).

- Competitively, we are presently closest to achieving a leadership position (excluding IBM) in the RX and RL areas; our next closest is the R80. We are farther away in large disks and in tapes. Given limited resources, this perspective once again favors an emphasis on the RX, RL, and R80 programs; the cost of catching up is greater (too great) elsewhere.

- Four issues arise under the heading of technological possibilities. The first is the targetted maximum fixed/removable capacity at the subsystem level. Specifically, if we could (as IBM does) successfully engineer and market on the basis of a 10:1 ratio (versus the 5:1 now being targetted) the RL02 could be the small R80 companion at FCS, while the RL04 could be timed to coincide with the R81. This would enable us to conserve FY'79 funds by slowing down the RL04. The second issue concerns the possibility of the massbus cache becoming a "mid-life kicker" for the RM03 and RP06. If this proves feasible, the RM04/RK08 development may not be necessary,

at least not as soon as is presently being targetted. The third issue is the potential of NDS to enable integrated disk and tape subsystems at the higher end of the product spectrum, once again diminishing the need for the RM04/RK08 removable companion to our large disks. The fourth issue is the AZTEC development; if this succeeds it eliminates the need for an RX0X. Given this possibility, and the fact that the RL01 will be competitive at the 5Mb level through FY'79, it makes sense to slow down the RX0X development in FY'79 (current targetted FCS is Q4'79).

Based on these considerations, I have constructed an alternative 4 on your sheet (attached), assuming the current/leadership position trade-offs are the ones shown. Submerged in this set of trade-offs is the Massbus Cache versus RM04 issue. At present, I feel we should commit in FY'79 only to prototyping and testing the MBC and exploring with CDC the possibilities of an RM04 (the RK08 approach should be rejected on both performance and development cost grounds). We should seriously consider, if the MBC performance expectations are met, using it only as a stepping stone to NDS. If these expectations are not met, we should proceed with an RM04 development in FY'80.

It is still an open question in my mind whether a 10:1 fixed/removable ratio makes sense and thereby justifies a slowing of the RL04. With this one possible exception, though, my priorities are clearly on the RL and R80 programs.

LDP POSITION

The LDP position on Mass Storage development is as follows:

1) It is not necessary to attain leadership in floppies.

2) We should attain a leadership position in low-end disks (e.g. AZTEC and RL04). This is the first priority.

3) Mid-range disks should be second priority. Removability is an important feature.

4) Third priority, of equivalent importance, are NDS and Tapes.

   a) NDS is too expensive for small systems but would be very attractive for large VAX MUMPS systems.

   b) We need a good low-end tape. The TS04 is too expensive.

   c) Our high performance tape should be a buyout, and not supplied from CSS.

digital

INTEROFFICE MEMORANDUM

TO: KEN SILLS

CC: MIKE MARSHALL
CHARLIE SPECTOR

DATE: 17 NOVEMBER 1977
FROM: STEVE MIKULSKI
DEPT: INDUSTRIAL PRODUCTS GROUP
EXT: 3820
LOC/MAIL STOP: ML5-2/M11

SUBJ: DISK POT RECOMMENDATIONS

Steve

IPG POSITION

Attached is the priority chart you discussed with me. Fundamentally, I have shown the IPG priorities as incremental spending over your "maintain current position" figures. I would assume the lowest priorities in large disk development and small mag tapes (as shown).

I. IPG'S DISK STRATEGY IS:

A) Attain leadership products in low cost, low performance drives (i.e., RL series) and expand this posture to mid-range drives (i.e., RK series). Don't use fixed/removable technology, but rather totally removable medias and competitive dual drive subsystems.

B) Provide high performance, large capacity buy-outs vs. in-house developed drives.

II. ADDITIONAL CONCERNS

A) A low cost standard software distribution media is required. This is floppies on systems selling for under $30K i.e., RT11 and tape for larger systems (i.e. RSX, RSTS, TPS, VAS/VMS). This is solely for diagnostics and software distributions and must be cheap (i.e., less than $500).

B) I would like to see a very aggressive development plan in system enhancements as a single significant enhancement is a $1M item. I can currently project:

1. Better software (overlap, dual access, efficient failsafe, etc.).

2. Disk caching, error correcting, LSI technology, off-device directories, etc.

3. Packaging: combining backplanes, power supplies, and disks within common sheet metal.

4. Coupling bulk memory technology with disks (i.e., BEAMOS) and segmenting operating system software to be shared over processor and intelligent subsystems.

INTEROFFICE MEMORANDUM

TO: Ken Sills
CC: TELCO Marketing Committee
TELCO Management Committee
Russ Kruger

DATE: November 21, 1977
FROM: Luigi D'Angola
EXT. 246
LOC/MAIL STOP: NT

TELCO POSITION

SUBJ: STORAGE SYSTEMS - DEVELOPMENT ALTERNATIVES

Please find enclosed our answer to your questionnaire.

Please take note of the following facts:

- mass storage devices represent a large part of our budget
- we are presenting the October price cut on disks as the beginning of a new strategy in this part of the business
- we believe that in a few months we will have again a problem for the disk price
- it is our opinion that the only way to have a good price/performance ratio and a fair profit is to build in-house large mass storage devices
- we need an intelligent controller as soon as possible
- we believe that the disk and tape groups should work in conjunction with the multiprocessor group to introduce high availability features in the mass storage devices.

emw

Enclosure

Telephone Industry Products Group
digital

EPG POSITION

EPG Storage System Philosophy

EPG supports the following general guidelines:

1. For small disks, floppies through 20 MB, price is more critical than performance.

2. Small low cost (< $2,000 MLP) hard disks $\approx$ 5 MB are favored over floppies and/or tapes
   - . software distribution on large computer systems
   - . useful work in small dual drive configurations not at the expense of pricing.

3. Medium disks (up to 100 MB) should be dual, removable and have balance between price and performance. Ten percent higher price for better performance than competition is acceptable.

4. Large disks (> 300 MB) are not major concern but will be by '81 with VAX in full swing. Can afford to be behind IBM through '82.

5. Disk prices can only be viewed as part of a system price. Typically 20 - 25% of the system price is disk content.

6. Enhanced software back-up techniques should be part of all tape developments.

digital

INTEROFFICE MEMORANDUM

TO: Pat Mullen

DATE: 18 November 1977
FROM: Mike Gallup
DEPT: Business Products
EXT: 45657
LOC/MAIL STOP: MK-2/H32

mike

BUS - OEM POSITION

SUBJ: Disk Development Strategy

The key to successful distributor products is scope. PL 48 will do 45% of their business in D500s this year and 55% in D300s. It is more important to be mildly competitive across a broad range than to be highly competitive in a narrow range. The reason is that the wider the market base the OEM can compete in, the greater the return he will realize on his software development.

This strategy translates into the following investment levels:

- Continue to bring RX02, 04 and RL01 to market
- RL01 is competitive enough to leapfrog RL01F and go to RL02 at a later date.
- Continue to bring the RK07 to market and forestall RL04 in light of limited development dollars.
- Do Mass Bus cache and forestall RP07
- Tape developments are not that important to our market.

/sg

BUS - END USER POSITION

BUS - MANUFACTURING POSITION

As far as Product Line 41 (Manufacturing) is concerned, our main thrust is in the area of large 530's (11/34's) and 570's (11/70). Therefore, our primary needs tend to fall into the mid-range and large disk categories. In the near future, as communications becomes more important on low end systems, there is a need for high density small disk drives, e.g. RX04. Very few of our systems go out with tape. My main tape need over the next 18 months is for a cost reduced TU16.

BUS - DISTRIBUTOR POSITION

1) Low disk #1 to replace RK05 (or #2 if cost/performance and 1st customer ship is better). Need good entry level price system.

2) Medium disk #2 needed to fill gap. RK07 is desirable as it is the earliest to market. Tradeoff delivery against price.

3) System enhancements are important if they will improve COBOL throughput.

4) Small ½" tape cost/performance improvement over TU16 is needed to backup small disks.

DDP DISK PHILOSOPHY

1) At the low-end we need good, competitive storage products in the FONZ timeframe. The RL disks should provide a good base for this.

2) Our major business volumes will be in the mid-range. We need to be most price competitive and profitable in this range.

3) Prices are not as sensitive at the high-end. We have been able to successfully market buyout products. We need to be functional leaders (largest capacity) at the high-end.

digital

INTEROFFICE MEMORANDUM

TO: Ken Sills

CC: Phil Wilson
Franco Previd
George Hoff
Joe Viula
Brian Samuels
John Jorgensen

DATE: 16 NOV 77
FROM: Hap Prindle
DEPT: LCG Product Management
EXT: 6553
LOC/MAIL STOP: MR1-1/M74

LCG POSITION

SUBJ: Storage systems - Development alternatives from LCG

- Current Strategy

  RP07 - Q3 '79
  RP07+ - Q1 '80
  R80 - FY '81

  TS04 - Q4 '79 (2020)
  TU78 - Q3 '79

  T6250 - FY '81

- Investment in low capacity devices is not of interest to LCG

- Aggressive early buyout/codevelopment with PCM supplier is a requirement for large disks and tapes.

- LCG would like Mass Storage Development to assume diagnostic and integration responsibility for new devices on TOPS10 and TOPS20.

- Development of intelligent interface to allow attachment of varied competitive devices is of interest to LCG

- High Market Demand for high capcity/low cost 1/2" tape

- Consider 200 ips TU78 with additional funds

- Current systems in development at LCG provide for flexibility of device interface (MASSBUS, UNIBUS, NOS, AND SMD)

- Adherence to ANSI and FIPS standards may be requirement for Federal Business

sfa

EPG INPUTS

EXHIBIT 2

STORAGE SYSTEMS - DEVELOPMENT ALTERNATIVES ($MILLIONS/YEAR)

	NECESSARY INVESTMENT TO:		PRODUCT LINE CHOSEN ALTERNATIVES			
	MAINTAIN CURRENT POSITION*	ATTAIN LEADERSHIP POSITION**	1	2	3	4
FLOPPY	.5	1.0	0.5	0.5	0.5	
LOW DISK #1	1.5	2.0	1.8	2.0	2.0	
LOW DISK #2	1.5	2.0	1.5	2.0	2.0	
MEDIUM DISK #1	2.0	2.5	2.0	2.5	2.5	
MEDIUM DISK #2	2.0	2.5	2.5	2.5	2.5	
LARGE DISK	1.0	3.0	1.0	1.3	2.8	
SYSTEM ENHANCE	.5	1.5	0.5	1.0	1.5	
SMALL ½" TAPE	.4	.7	0.4	0.4	0.4	
LARGE ½" TAPE	.8	1.2	0.8	0.8	0.8	
	10.2	16.4	11.0	13.0	15.0	
+ 40% ADV DEV PROD MGMT, SUPPORT (NOT POT ALLOCATED)	4.1	6.6	4.4	5.2	6.0	
TOTAL	14.3	23.0	15.4	18.2	21.0	

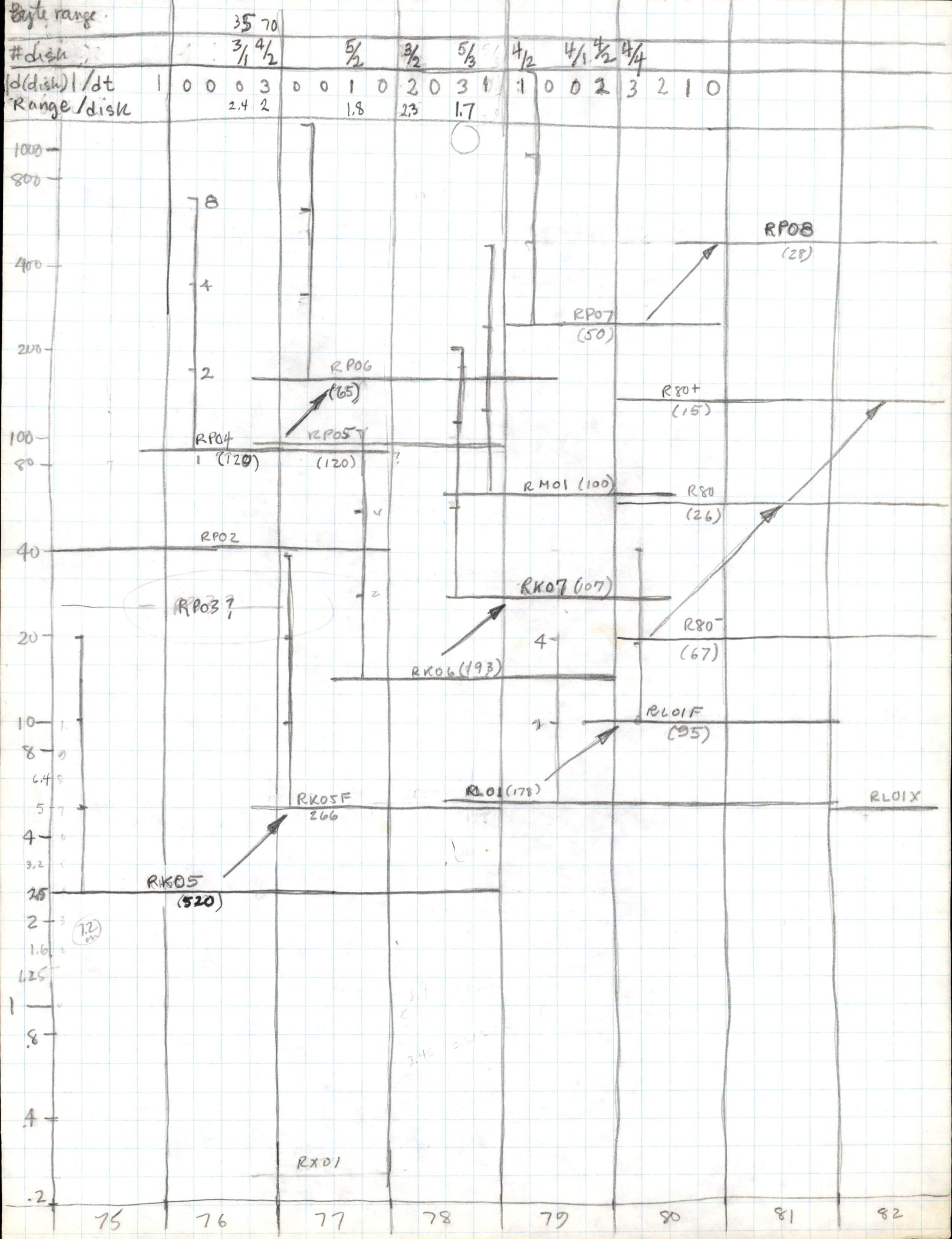
* 5 years behind IBM on build products, 3 years on buys. Prices 20-40% higher than systems competition. Prices much higher than 3rd party vendors.

** Products with price and functionality equal to all competition with the exception of IBM.

Gordon,

If there is any other data you'd like, I'll be glad to get it for you. I don't understand your holes and overlap analysis for CPU's so I haven't done that one. Overall, I think our product strategy stands up to scrutiny very well. The biggest risk is IBM migrating technology to small disks much faster than the historical trend thereby forming a new, harder to attain trend line. Can we meet to discuss this?

Ken Lillo


Byte range
35 70
#disk
3/1 4/2 5/2 3/2 5/3 4/2 4/1 4/2 4/4
d(disk)/dt 1 0 0 0 3 0 0 1 0 2 0 3 1 1 0 0 2 3 2 1 0
Range/disk
2.4 2
1.8
2.3
1.7
1000
800
400
200
100
80
40
20
10
8
6.4
5
4
3.2
2.5
1
.8
.4
.2
8
4
2
RP06
(65)
RP04
(120)
RP05
(120)
RP07
(50)
RP08
(28)
R80+
(15)
RM01 (100)
R80
(26)
RP02
RP03??
RK07 (007)
R80-
(67)
RK06 (193)
RL01F
(95)
RL01 (178)
RL01X
RK05F
266
RK05
(520)
RX01
75
76
77
78
79
80
81
82

Marketing Committee Why I'd like to allocate as much as needed (or can be effectively spent)

cc: OOD + ret

digital

INTEROFFICE MEMORANDUM

TO: ARNIE GOLDFEIN
PAUL BAUER
ALAN SILVER

Gordon

DATE: 22 APRIL 1977
FROM: KEN SILLS
DEPT: DISK PRODUCTS
EXT: 5805
LOC/MAIL STOP: ML1-3/E58

CC: DISTRIBUTION

SUBJ: GROWTH OF THE DISK BUSINESS

A reasonable justification for the Disk Products budget to grow at a faster rate than other engineering groups is that disks are growing at a faster rate than DEC as a whole and have a better potential product contribution. However, this issue has been clouded by the fact that disks are often grouped with floppies. Paul Bauer believes the growth of disk NOR as a percent of total NOR is primarily due to floppies. The attached analysis shows that this is not the case. Hard disk revenues are growing from 15.2% of NOR in FY76 to 24.1% in FY82. Over the same period the product contribution of hard disks grows from 59% to 68%. These potential business results certainly warrant the investment in engineering development to bring our strategy to fruition.

Obviously, the validity of this case is based upon the validity of the data. I have all backup data by product. The forecast compiled recently by Disk Product Management and used as a basis of this analysis was jointly compiled using the Manufacturing forecast, long range Corporate Planning forecast, inputs from Product Lines, etc. It is essentially in agreement with corporate growth plans and perceived Disk Business trends as seen in Corporate Planning data. Other assumptions are explicitly addressed in the analysis. I have tried to be conservative. I will be happy to discuss this with you if more detail or explanation is necessary.

/kmd

Ken

DISTRIBUTION:

GORDON BELL
BOB PUFFER
DICK BECKER
GRANT SAVIERS
CHET JU
KEVIN SMITH
STEVE ORR
WAYNE GALUSHA

DISK PRODUCT CONTRIBUTION ANALYSIS ($Millions except as noted)

	FISCAL YEAR							
HARD DISK DATA	76	77	78	79	80	81	82	COMMENTS
Gross Sales	124	207	334	471	598	799	1061	From 4/77 Disk Product Management Forecast
Average discount & Allowance percentage	10%	11%	12%	13%	14%	15%	16%	Increases as new disks become more competitive, OEM sales increase
Net Sales	112	184	294	410	514	679	891	
Mfg. Cost	36	52	89	121	150	190	240	From 4/77 Forecast
Mfg. Startup	2	4	4	4	4	4	4	$1M for Buyout, $3M for Internal
Field Service Expense	3	5	7	10	13	17	22	2.5% of Net Sales
Cost of Sales	41	61	100	135	167	211	266	
Gross Margin	71	123	194	275	347	468	625	
Engineering Expense	5	7	10	12	15	19	23	25% growth after FY79
Product Contribution	66	116	184	263	332	449	602	
Product Contribution % of Net Sales	59%	63%	63%	64%	65%	66%	68%	

(continued)

DISK PRODUCT CONTRIBUTION ANALYSIS ($Millions)

	FISCAL YEAR							
FLOPPY DATA	76	77	78	79	80	81	82	COMMENTS
Gross Sales	17	39	73	94	117	184	176	From 4/77 Forecast, 10% price cut in FY79 to $3900 due to RL01 and competitive pressure.
Net Sales	14	33	62	80	99	126	150	15% average discount
CORPORATE NOR	736	1060	1550	2000	2350	3000	3700	Average of Corp. Plan & Mfg. "high" Plan
Hard Disk %	15.2	17.4	19.0	20.5	21.9	22.6	24.1	
Floppy %	1.9	3.1	4.0	4.2	4.2	4.2	4.0	
Total disk % of Corporate NOR	17.1	20.5	23.0	24.7	26.1	26.8	28.1	Corporate long range forecast predicts 27.7% in FY81

#928

digital

INTEROFFICE MEMORANDUM

TO: Product Line Managers Committee

DATE: April 27, 1977
FROM: Grant Saviers
DEPT: Disk Products
EXT: 2357
LOC/MAIL STOP: ML1/E58

Grant

Gordon Bell
APR 29 1977

SUBJ: DISK STRATEGY PRESENTATION

The attached slides represent the Disk Strategy as enhanced by the Disk Review Committee (Irwin Jacobs, Chairman) and reported to the Operations Committee in February.

Our presentation will be structured as follows:

1. Presentation of the overall strategy.
2. Presentation of the product tactics.
3. Testing the strategy and tactics via
   a. Disk subsystems
   b. Competition - IBM at low end.
      DG at high end.
4. Discussion of issues raised since February.
5. Discussion of issues raised by Disk Review Committee.

For a comprehensive discussion of the issues, competitive analysis, etc., our latest Beige Book (April 21, 1977) is available upon request.

/nlh

Attachments

DISK STRATEGY

MAKE LOW AND MID-RANGE

BUY HIGH END

WINCHESTER COMING IN FAST

INCREASE FUNCTIONALITY OF SUBSYSTEMS

NO TAPE REQUIRED ON LOW AND MID-RANGE SYSTEMS

USE A MIXTURE OF REMOVABLE DEVICES (INTERCHANGE, BACKUP, SOFTWARE DISTRIBUTION) AND FIXED DEVICES (CAPACITY, LOW COST, RELIABILITY)

II. SUMMARY PRODUCT DATA

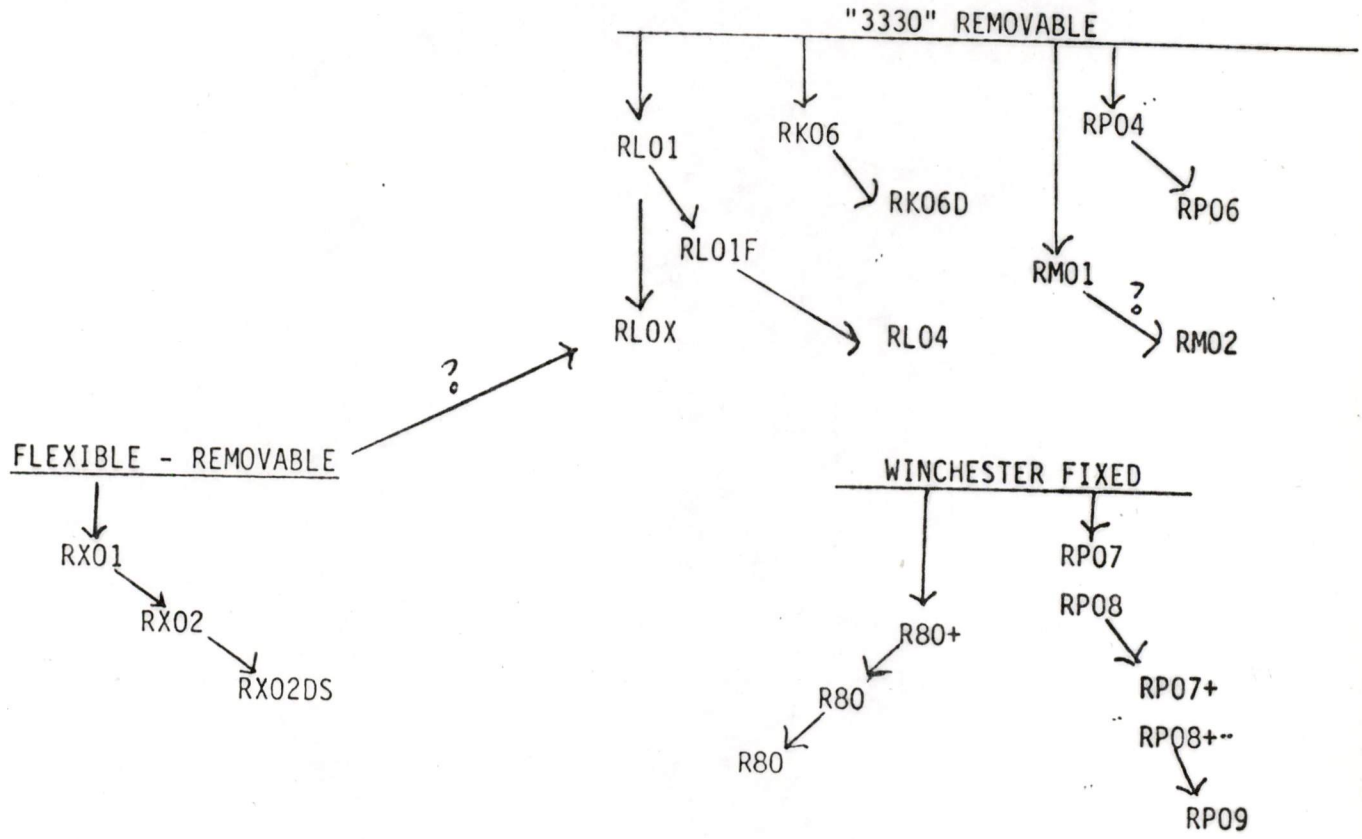
A. PRODUCT DESCRIPTIONS

PRODUCT	CAPACITY (MBYTES)	FIXED/ RMVBL	INTERNAL/ BUYOUT	FCS	COST*	CONCEPTUAL TARGETED SCHEDULED
RK05J	2.5	R	I	SHIPPING	1330	-
RK05F	5	F	I	SHIPPING	1300	-
RL01	5	R	I	Q2 FY'78	890	S
RL01F	10	F	I	FY'79	950G	T
RL04	28	R	I	FY'81	950G	T
RL0X	5	R	I	FY'82?	400G	C
RK06	14	R	I	SHIPPING	2700	-
RK07 (was RK06D)	28	R	I	Q3 FY'78	3000	S
RM03	67	R	B	Q2 FY'78	6700	S
$R80_{20}$	20	F	I	FY'80	1350G	C
$R80_{60}$	60	F	I	FY'80	1600G	T
$R80_{140}$	140	F	I	FY'80	2100G	T
RP04	88	R	B	SHIPPING	10600	-
RP05	88, 176	R	B	SHIPPING	11400	-
RP06	176	R	B	SHIPPING	11400	-
RP07, 7+	260, 520**	F	B	FY'79, 80	12500G	T
RP08, 8+	260, 520**	F	B	FY'80, 81	?	C
RP06 Replace	125	R	B	FY'80/81	?	C

*Costs are estimated FY'78 transfer cost unless followed by a "G" which indicates high volume cost goal.

**ISS product capacities are 284, 568 Mbytes.

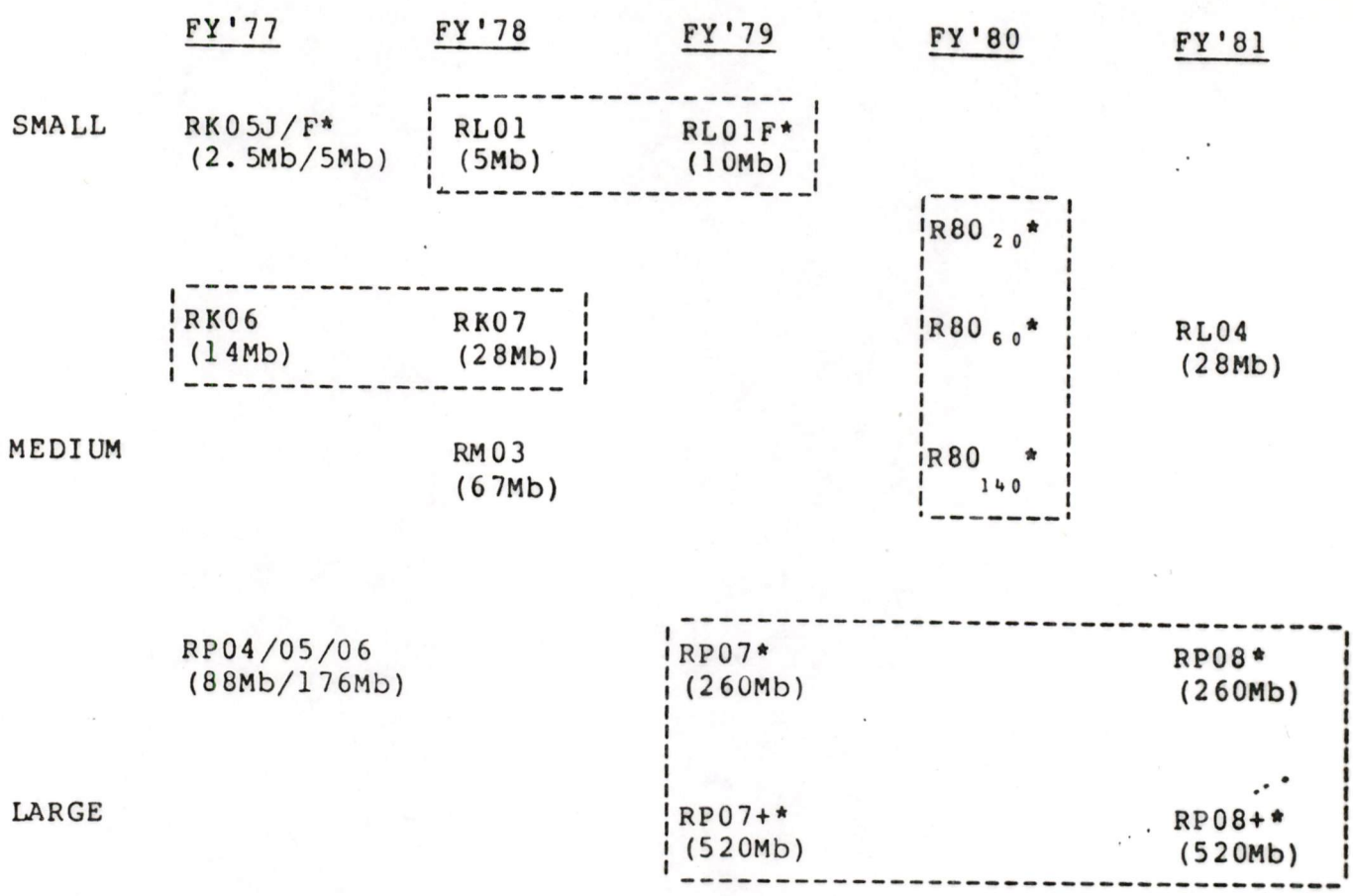
PRODUCT EVOLUTION



0.1 1.0 10 100 1000

SINGLE SPINDLE FORMATTED CAPACITY - MEGABYTES

E. PRODUCT TIMING



*Fixed Media Disks

Products encompassed by a dotted line = product family.

SUBSYSTEM STRATEGY

COMBINE THE FLEXIBILITY OF REMOVABLE MEDIA WITH THE INCREASED COST EFFECTIVENESS AND INCREASED RELIABILITY OF FIXED MEDIA IN MULTIPLE SPINDLES FOR HIGH SYSTEM AVAILABILITY AND PERFORMANCE

SYSTEM STRATEGY ALTERNATIVES

	FY'78	FY'79	FY'80	FY'81
SMALL	RK05J + RK05F 2 RL01	RL01 + RL01F	RL01 + RL01F	RL01 + RL01F
MEDIUM	2 RK06 2 RK06D 2 RM01	2 RK06D 2 RM01	2 RK06D $R80_{60}$ + RK06D	2 RL04 $R80_{60}$ + RL04
LARGE	2 RP06	RP07 + RM01 RP07 + RP06	$R80_{140}$ + RK06D RP07 + RM01 RP07 + RP06	$R80_{140}$ + RL04 RP08 + RM01 RP08 + RP06

IBM VS. DEC

LOW AND MID-RANGE PRODUCT INTRODUCTIONS

	IBM		DEC	
FISCAL YEAR	PRODUCT (MB)	SUBSYSTEM PRICE	PRODUCT (MB)	SUBSYSTEM PRICE
FY'77	10F + FLOPPY	$10K	2.5R + 5F 14R + 14R	$17K (5.4X) $27K (3.8X)
FY'78	75F + CARTR. SYS 34 (1/78) 13F	$25K $10K	5R + 5R 28R + 28R 67R + 67R	$10K (4.8X) $29K (4.1X) $38K (3.2X)
FY'79	20F + FLOPPY 20F + CARTR.	$10K $20K	5R + 10F	$10K (4.8X)
FY'80	40F + FLOPPY 40F + CARTR.	$10K $20K	60F + 28R	$25K (4.2X)
FY'81			28R + 28R	$10K (3.1X)

DG VS. DEC

HIGH-END PRODUCT INTRODUCTIONS

	DG		DEC	
FISCAL YEAR	PRODUCT (MB)	SUBSYSTEM PRICE	PRODUCT (MB)	SUBSYSTEM PRICE
FY'76	92R + 92R	$57K	88R + 88R 176R + 176R	$61K (2.8X) $79K (3.5X)
FY'77	96R + 96R	$46K	88R + 88R 176R + 176R	$64K (2.9X) $83K (3.6X)
FY'78	192R + 192R	$56K	67R + 67R 176R + 176R	$44K (3.2X) $64K (2.7X)
FY'79	288R + 288R ?	$60K	284F + 67R	$54K (3.1X)

ISSUES	RESPONSE
IBM SERIES/1 & SYSTEM 34 COMPETITION.	ACCELERATE 10 MB RL01F
BUDGET PROBLEM OF $500K $200K REDUCTION $300K OVERCOMMITMENT	ALT 1: SLOW RP07 SLOW R80 LESS R&D
	ALT 2: KILL RM03
	ALT 3: SLIP EVERYTHING 1 MONTH

CURRENT FY'78 PLAN - 4 PRODUCTS (2 DRIVE SUBSYSTEM)

		F/R	2 D + C	M.U.	FCS
RL01	2 X 5 MB	R	≃ $10K	4.8	Q2 FY'78
RK07	2 x 28 MB	R	≃ $26K	3.8	Q3 FY'78
RM03	2 X 67 MB	R	≃ $44K	~~3.2~~ 2.9	Q2 FY'78
RP06	2 X 176 MB	R	$83.4K ↓ $72K	3.4 3.0	SHIPPING
→ RK07	4 × 28	R	= 44.8	3.45	

ALTERNATIVE - 3 PRODUCTS (2 DRIVE SUBSYSTEM)

		F/R	2 D + C	M.U.	FCS
RL01	2 X 5 MB	R	≃ $10K	4.8	Q2 FY'78
RK07	2 X 28/42 MB	R	≃ $26K	3.8	Q3/Q4 FY'78
RP06	2 X 176 MB	R	$66K	2.7	SHIPPING

FY'79 (TARGET)

		F/R	1 D + C	M.U.	FCS
RP07	1 X 284 MB	F	$34K	3.3	FY'79
RM03 + RP07	1 X 67 MB 1 X 284 MB (351 MB)	R F	$53.5K	3.1	FY'79

ISSUES

1) RL01/RK05 PHASE IN

2) RP07 & R80 PROJECTS ARE CRITICAL TO STRATEGY (TIMING)

3) R80 TECHNICAL RISK AND ALTERNATIVES

4) RL04 & RLOX PRODUCT TIMING

5) 18 MONTHS FOR BUY OUT AND 30 MONTHS FOR INHOUSE DEVELOPMENT

6) SOME DISK ENGINEERING SHOULD MOVE TO COLORADO, NOW!

B. PRODUCT INTERFACES

PRODUCT	Q-BUS	OMNIBUS	UNIBUS	MASSBUS	NEW(2)
RK05J	RKV11	RK8A	RK11D		
RK05F	RKV11	RK8A	RK11D		
RL01	RLV11	RL8A	RL11		
RL01F	RLV11	RL8A	RL11		
RL04	X(1)	INTLGNT	INTLGNT		INTLGNT
RL0X	X(1)	?	X		?
RK06			RK611,711		
RK07 (Was RK06D)			RK711		
RM03			RH11	RH10,20,70	
$R80_{20}$	X(1)		INTLGNT		INTLGNT
$R80_{60}$	X(1)		INTLGNT		INTLGNT
$R80_{140}$	X(1)		INTLGNT		INTLGNT
RP04, RP05			RH11	RH10,20,70	
RP06			RH11	RH10,20,70	
RP07, 7+			RH11	RH10,20,70	
RP08, 8+			INTLGNT		INTLGNT
RP06 Replace			X	?	?

(1) With minimum functionality controller

(2) Intelligent subsystem with new I/O architecture for interface to existing busses. Intelligent controller also attaches to high speed internal CPU busses (VAX, KL, 11/70, etc.) replacing MASSBUS RH attachments.

- REFERENCE DATA -

C. PRODUCT SOFTWARE SUPPORT

PRODUCT	RT11	RSX11M V3	RSX11M V4	IAS	RSTS/E	STARLET	TOPS 10, 20
RK05J	C	C	P	C	C		
RK05F	C	C	P	C	C		
RL01	P		P	P	P		
RL01F	P		P	P	P		
RL04	G	G	G	G	G	G	G
RL0X	G	G	G	G	G	?	?
RK06		C	C	C	C	P	
RK07 (Was RK06D)		G	G	G	G	G	
RM03			P	P	P	P	P
$R80_{20}$	G	G	G	G	G	G	G
$R80_{60}$	G	G	G	G	G	G	G
$R80_{140}$	G	G	G	G	G	G	G
RP04, RP05		C(1)	P	C	C	P(2)	C
RP06		C(1)	P	C	C	P	C
RP07, 7+			G	G	G	G	G
RP08, 8+			G	G	G	G	G
RP06 Replace			G	G	G	G	G

(1) V3.1 support will be dropped at V4 FCS.

(2) RP05 only

KEY: Current
Planned
Goal

XIV. DISK PRODUCTS BUDGETS

A. Budget Data ($000 Omitted)

	Actual FY'77	FY'78 DEC. '76	FY'78 Now	FY'79	FCS
RL Family					
RL01	1,070	1,400	830	600	Q2 FY'78
RL01F	40	400	525	300	FY'79 (Target)
RL04	-	-	480	1,200	FY'81 (Target)
RL11 + extensions	273	100	250	200	Q2 FY'78
RL01K/01FK	177	200	345	200	Q2 FY'78/79
RL0X	-	-	-	600	Undefined
RL Total	1,560	2,100	2,430	3,100	
RK Family					
RK06	1,440	-	470	-	Shipping
RK07 (was RK06D)	316	1,000	900	350	Q3 FY'78
RK611/711	318	100	150	150	Shipping
RK06K/07K/RM03K	342	335	375	300	-
RK07 (Old)	280	-	-	-	Cancelled
MBA RK06/07 (Old)	58	-	-	-	Cancelled
RK Total	2,754	1,435	1,895	800	
RM/RP Family					
MBA/RM03	724	250	480	100	Q2 FY'78
RP05/06	27	-	-	-	Shipping
RP07	88	700	200	300	FY'79 (Target)
RP08	-	-	-	300	FY'81 (Target)
RP06 Replacement	-	-	-	300	FY'80/81
RM/RP Total	839	950	680	1,000	
R80 Family					
R80 & Backup	34	1,500	1,240	2,000	FY'80 (Target)
Intelligent Subsystems	55	300	390	700	FY'80 (Target)
R80K			255	300	
R80 Total	89	1,800	1,885	3,000	

(Cont'd on Next Page)

	Actual FY'77	FY'78 DEC. '76	FY'78 Now	FY'79	FCS
Components	280	325	300	400	-
Technology	604	1,500	1,500	1,700	-
Support	276	1,100	460	700	-
Product Mgmt.	158	250	250	400	-
Contingency	-	410	400	700	-
MBA Field Text Box	-	130	-	-	Cancelled
TOTAL BUDGET	6,560	10,000	9,800	11,800	

B. FY'78 Unresolved Issue

The $100K expense of bootstrap development is not budgeted for FY'78 or FY'79 by Disk Products. This expense has historically been borne by Dick Clayton's CSD Group. We believe that CSD should continue to fund bootstrap development and have therefore not allocated Disk Products funds for this purpose.

C. Consequences of $9.8M FY'78 Ceiling

The current Disk Products Strategy was formulated based on a $10.0M FY'78 funding level. Detailed budgeting revealed $10.3M was necessary for full implementation of the strategy. It has therefore been necessary to cut back development plans by $500K in FY'78:

1. There will be no video disk advanced development in FY'78 ($125K).

2. The RP07 program is funded at $150K lower than is required for external manufacturing and development. This very low level of funding adds risks to an FY'79 FCS.

3. The R80 is underfunded by $125K.

4. The RL family is underfunded by $100K.

- REFERENCE DATA -

D. Consequences of $11.8M FY'79 Ceiling

1. We will be at an $11.8M running rate in Q4 FY'78. This implies that FY'79 will be a year of zero growth for Disk Products. Assuming normal inflation (i.e., from salary and service increases), we will have to operate with a total hiring freeze (including college recruiting) and will possibly have to resort to a reduction in manpower levels.

2. Major product developments will proceed at a minimum funding level (e.g., R80, RL04).

3. There will be no growth of our Advanced Development effort in FY'79.

4. No additional projects can be assumed in FY'79 without a reprioritizing of current product tactics and schedules. The contingency is too low to allow for a reasonable margin of error in budget projections.

5. An $11.8M funding level is at least $1.5M less than the budget level consistent with earlier disk strategies approved by the Disk Review Committee and Disk Strategy Committee. The consequence is fewer or stretched out programs. The Product Lines should be lowering their expectations as a result.

05 05F /01 /01F /08 /07 /04 /04 /05 /RM01 /R80 /06 /07 /08

2.5 5 5 10 14 28 28 88 88 67 20 60 140 176 250 520 — Bytes

DP

5.1 6.5 3.5 4 9.5 9.7 4 27.2 31.4 16 5.4 6.4 8.4 36.5 34 47 — Drive price

DC

1.3 1.33 0.89 0.95 2.7 3 0.95 10.7 10.6 6.7 1.35 1.6 2.1 11.4 12.5 14.5 — Drive cost

DP÷DC

3.92 4.89 3.93 4.21 3.52 3.23 4.21 2.54 2.96 2.39 4 4 4 3.2 2.72 3.24 — markup

CP

4.4 4.4 2 2 6 6 10 9.5 9.5 10 10 10 10 9.7 10 10 — Control price

CC

0.5 0.5 0.275 0.275 1 1 1.8 1.8 1.8 1 1.6 1.6 1.6 1.65 1 1 — " cost

CP÷CC

8.8 8.8 7.27 7.27 6 6 5.56 5.28 5.28 10 6.25 6.25 6.25 5.88 10 10 — " markup

Grant, Ken Sills
Bruce
Let me recommend APL to you.
cc
Arnie – We need a library of common functions e.g. plots for PM's. Gordon.

DP÷B

2.04 1.3 0.7 0.4 0.679 0.346 0.143 0.309 0.357 0.239 0.27 0.107 0.06 0.207 0.136 0.0904 Price/Byte

DC÷B

0.52 0.266 0.178 0.095 0.193 0.107 0.0339 0.122 0.12 0.1 0.0675 0.0267 0.015 0.0648 0.05 0.0279 Cost/Byte

SPT (Sys. Price Total)

1 — 9.5 10.9 5.5 6 15.5 15.7 14 36.7 40.9 26 15.4 16.4 18.4 46.2 44 57
2 — 14.6 17.4 9 10 25 25.4 18 63.9 72.3 42 20.8 22.8 26.8 82.7 78 104
4 — 24.8 30.4 16 18 44 44.8 26 118 135 74 31.6 35.6 43.6 156 146 198
8 — 45.2 56.4 30 34 82 83.6 42 227 261 138 53.2 61.2 77.2 302 282 386

SCT (Sys. Cost Total)

1.8 1.83 1.17 1.23 3.7 4 2.75 12.5 12.4 7.7 2.95 3.2 3.7 13.1 13.5 15.5
3.1 3.16 2.06 2.18 6.4 7 3.7 23.2 23 14.4 4.3 4.8 5.8 24.5 26 30
5.7 5.82 3.84 4.08 11.8 13 5.6 44.6 44.2 27.8 7 8 10 47.3 51 59
10.9 11.1 7.4 7.88 22.6 25 9.4 87.4 86.6 54.6 12.4 14.4 18.4 92.8 101 117

SPT÷SCT Sys. Markup

5.28 5.96 4.72 4.9 4.19 3.93 5.09 2.94 3.3 3.38 5.22 5.13 4.97 3.54 3.26 3.68
4.71 5.51 4.38 4.6 3.91 3.63 4.86 2.75 3.14 2.92 4.84 4.75 4.62 3.38 3 3.47
4.35 5.22 4.17 4.42 3.73 3.45 4.64 2.65 3.06 2.66 4.51 4.45 4.36 3.3 2.86 3.36
4.15 5.06 4.06 4.32 3.63 3.34 4.47 2.6 3.01 2.53 4.29 4.25 4.2 3.25 2.79 3.3

BT Total Bytes

1 2.50E0 5.00E0 5.00E0 1.00E1 1.40E1 2.80E1 2.80E1 8.80E1 8.80E1 6.70E1 2.00E1 6.00E1
2.50E2 5.20E2
2 5.00E0 1.00E1 1.00E1 2.00E1 2.80E1 5.60E1 5.60E1 1.76E2 1.76E2 1.34E2 4.00E1 1.20E2
5.00E2 1.04E3
4 1.00E1 2.00E1 2.00E1 4.00E1 5.60E1 1.12E2 1.12E2 3.52E2 3.52E2 2.68E2 8.00E1 2.40E2
1.00E3 2.08E3
8 2.00E1 4.00E1 4.00E1 8.00E1 1.12E2 2.24E2 2.24E2 7.04E2 7.04E2 5.36E2 1.60E2 4.80E2
2.00E3 4.16E3

SPT÷BT P/Byte

3.8 2.18 1.1 0.6 1.11 0.561 0.5 0.417 0.465 0.388 0.77 0.273 0.131 0.263 0.176 0.11
2.92 1.74 0.9 0.5 0.893 0.454 0.321 0.363 0.411 0.313 0.52 0.19 0.0957 0.235 0.156 0.1
2.48 1.52 0.8 0.45 0.786 0.4 0.232 0.336 0.384 0.276 0.395 0.148 0.0779 0.221 0.146 0.0952
2.26 1.41 0.75 0.425 0.732 0.373 0.188 0.323 0.37 0.257 0.333 0.128 0.0689 0.214 0.141 0.0928

SCT÷BT C/Byte

0.72 0.366 0.233 0.123 0.264 0.143 0.0982 0.142 0.141 0.115 0.147 0.0533 0.0264 0.0741 0.054 0.0298
0.62 0.316 0.206 0.109 0.229 0.125 0.0661 0.132 0.131 0.107 0.108 0.04 0.0207 0.0695 0.052 0.0288
0.57 0.291 0.192 0.102 0.211 0.116 0.05 0.127 0.126 0.104 0.0875 0.0333 0.0179 0.0671 0.051 0.0284
0.545 0.278 0.185 0.0984 0.202 0.112 0.042 0.124 0.123 0.102 0.0775 0.03 0.0164 0.0659 0.0505 0.0281

Grant (Do priorities) Paper

- We owe a speeded-up RL01F plan; also RK07+
→ Price/voi analysis for RM03/RM07/RK07

move ~~to get rid of rk/b more make~~ buyout out

DISK STRATEGY

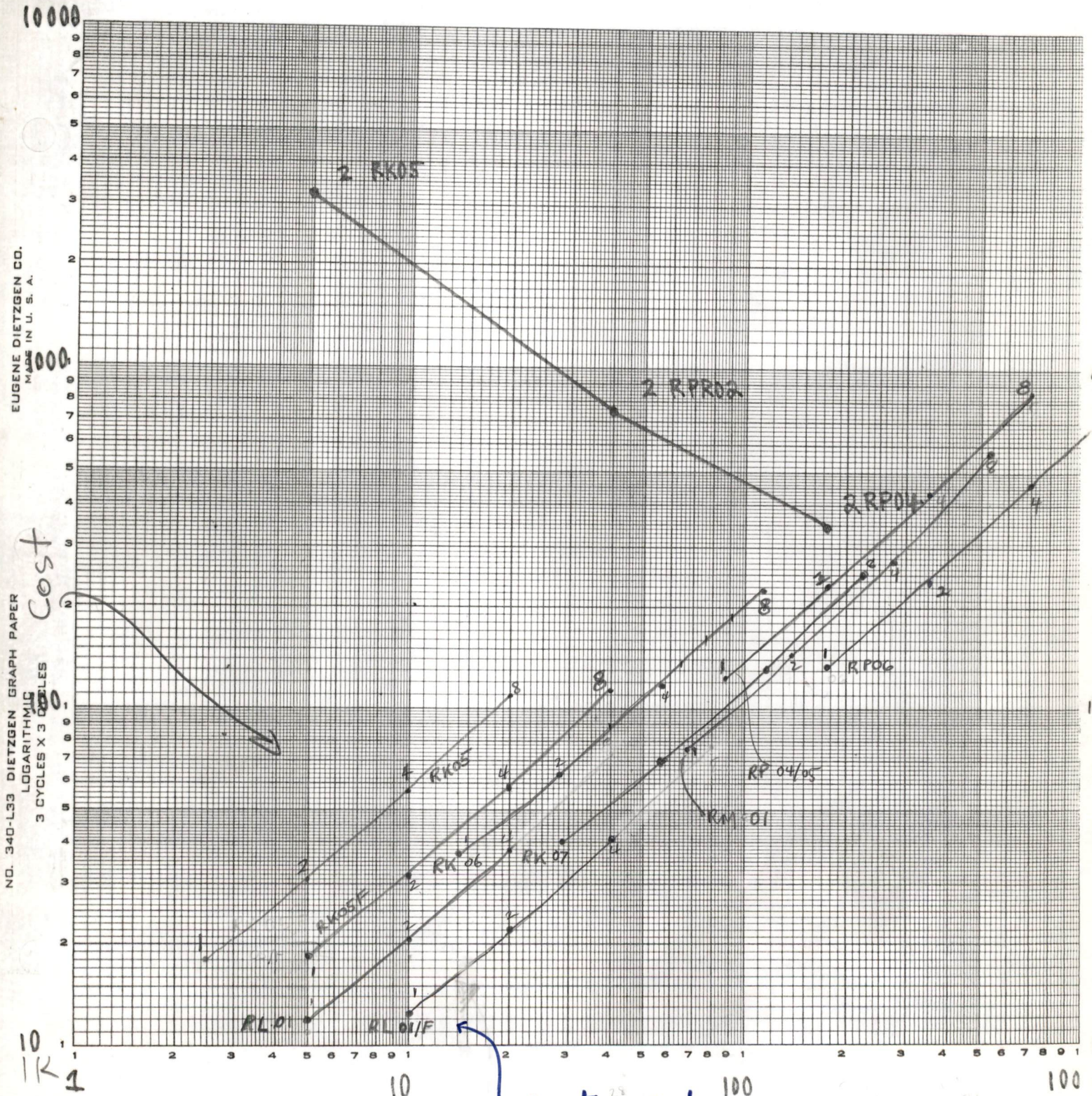
- 0 → RM01 ; 0 → RP04
- {RP05, RP06} → Memorex Mfg.
  (eliminate WF, WM chain)
- RK07 is highest priority
- RL01F is 2nd highest "
- R80 is 3rd highest
- Eliminate all other projects until these projects are staffed and managed to Schedule.

DISK STRATEGY

- RM01 | RM03 ; RP04 ← 0
- RP05, RP06 → Memorex Mfg.
  (for Field Integ.)
- R80

subsystem $ price / MB

FY76



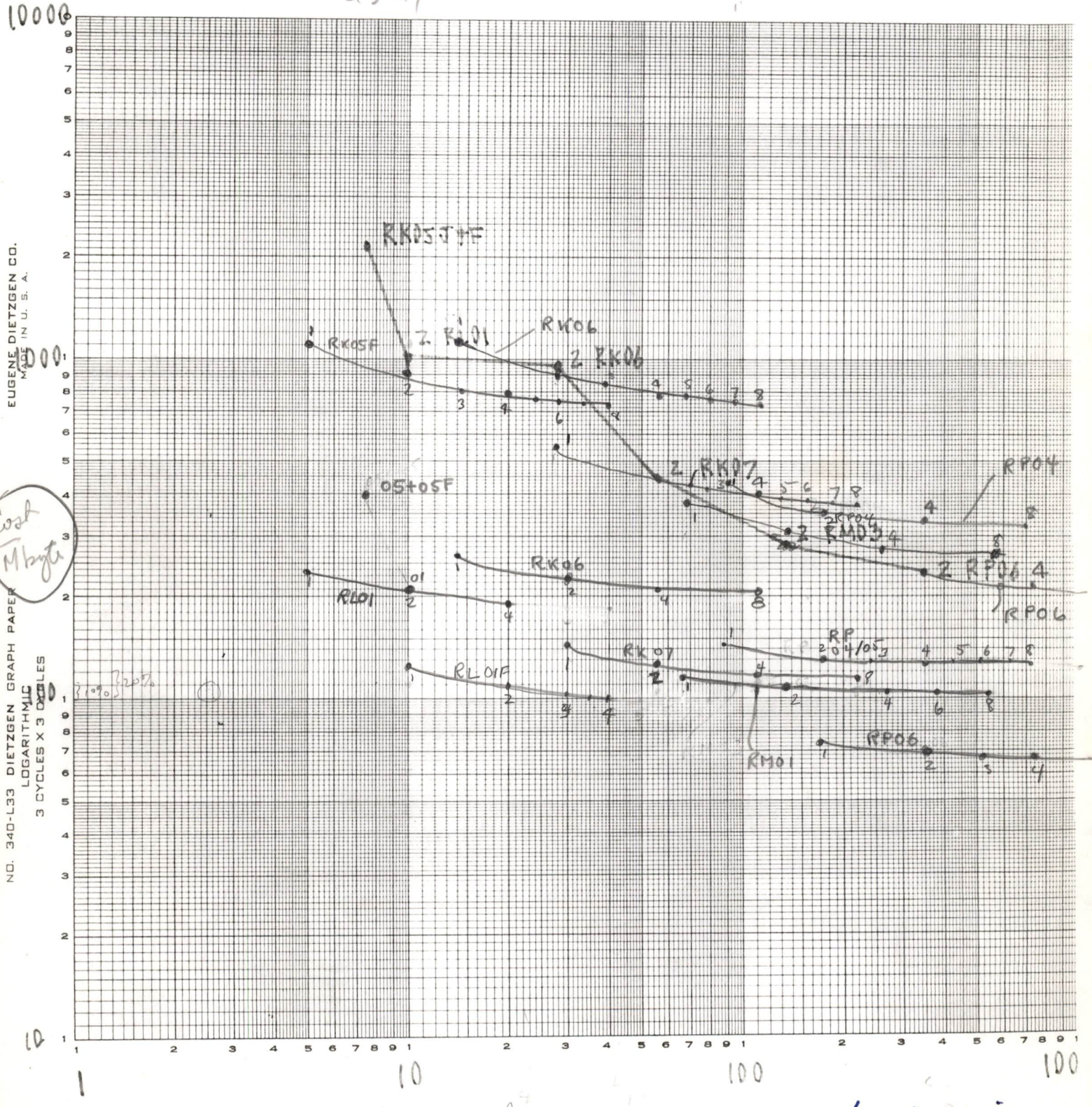
Cost

system cost.

RK05F -

RK07 + 4 × RK05

Q3 Q4 FY78



EUGENE DIETZGEN CO. MADE IN U. S. A.

NO. 340-L33 DIETZGEN GRAPH PAPER LOGARITHMIC 3 CYCLES X 3 CYCLES

Cost / Mbyte

10000 1000 100 10

1 10 100 100

System cost / system gain
system bytes

Size

XI. DISK PRODUCTS BUDGETS

A. Budget Data ($000 Omitted)

	Actual FY'77	FY'78 DEC. '76	FY'78 Now	FY'79	FCS
RL Family					
RL01	1,070	1,400	~~1,000~~ 830	600	Q2 FY'78
RL01F	40	400	~~550~~ 525	300	FY'79 (Targe
RL04	-	-	~~500~~ 480	~~1,000~~ 1200	FY'81 (Targe
RL11 + extensions	273	100	~~210~~ 250	~~200~~	Q2 FY'78
RL01K/01FK	177	200	~~300~~ 345	~~200~~	Q2 FY'78/79
RL0X	-	-	-	~~400~~ 600	Undefined
RL Total	1,560	2,100	~~2,560~~ 2430	2,700	
RK Family					
RK06	1,440	-	~~300~~ 470	-	Shipping
RK07 (was RK06D)	316	1,000	900	350	Q3 FY'78
RK611/711	318	100	~~125~~ 150	150	Shipping
RK06K/07K/RM03K	342	335	~~335~~ 375	300	-
RK07 (OLD)	280	-	-	-	Cancelled
MBA RK06/07 (Old)	58	-	-	-	Cancelled
RK Total	2,754	1,435	~~1,660~~ 1895	800	
RM/RP Family					
MBA/RM03	724	250	~~470~~ 480	100	Q2 FY'78
RP05/06	27	-	-	-	Shipping
RP07	88	700	~~265~~ 200	300	FY'79 (Targe
RP08	-	-	-	300	FY'81 (Targe
RP06 Replacement	-	-	-	~~200~~ 300	FY'80/81
RM/RP Total	839	950	~~735~~ 680	~~1,200~~ 1400 1000	
R80 Family					
R80 & Backup	34	1,500	~~1,300~~ 1240	2,000	FY'80 (Targe
Intelligent Subsystems R80K	55	300	~~300~~ 390 255	700 300	FY'80 (Targe
R80 Total	89	1,800	~~1,600~~ 1885	~~2,700~~ 3 000	

(Cont'd on Next Page)

	Actual FY'77	FY'78 DEC. '76	FY'78 Now	FY'79	FCS
Components	280	325	~~353~~ ~~663~~ 300	~~500~~ ~~800~~	-
Technology	604	1,500	~~1642~~ 1500 ~~1,332~~	~~1700~~ ~~1,600~~	-
Support	276	1,100	~~600~~ 480	~~600~~	-
Product Mgmt.	158	250	250	400	-
Contingency	-	410	400	~~1700~~ ~~1,400~~	-
MBA Field Text Box	-	130	-	-	Cancelled
TOTAL BUDGET	6,560	10,000	9,800	11,800	

49%

20%

B. FY'78 Unresolved Issue

The $100K expense of bootstrap development is not budgeted for FY'78 or FY'79 by Disk Products. This expense has historically been borne by Dick Clayton's CSD Group. We believe that CSD should continue to fund bootstrap development and have therefore not allocated Disk Products funds for this purpose.

C. Consequences of $11.8M FY'79 Ceiling

1. We will be at an $11.8M running rate in Q4 FY'78. This implies that FY'79 will be a year of zero growth for Disk Products. Assuming normal inflation (i.e., from salary and service increases), we will have to operate with a total hiring freeze (including college recruiting) and will possibly have to resort to a reduction in manpower levels.

2. Major product developments will proceed at a minimum funding level (e.g., R80, RL04).

3. There will be no growth of our Advanced Development effort in FY'79.

4. No additional projects can be assumed in FY'79 without a reprioritizing of current product tactics and schedules. The contingency is too low to allow for ~~new, as yet undefined, projects.~~ a reasonable margin of error in budget projections

Disk Transfer Cost of Goods
($Millions)

	FY'76	FY'77	FY'78	FY'79	FY'80	FY'81	FY'82
RK05J	9.2	13.0	16.9	7.8	4.6	2.6	.7
RK05F	-	1.3	2.7	2.7	2.0	1.3	.7
RL01	-	-	2.0	15.1	26.7	40.1	44.5
RL01F	-	-	-	4.8	9.5	14.3	15.2
RL0X	-	-	-	-	-	-	7.2
Total	9.2	14.3	21.6	30.4	42.8	58.3	68.3
RP02	1.5	1.2	.6	-	-	-	-
RK06	-	2.7	14.9	13.5	8.1	2.7	-
RK07	-	-	.6	12.0	18.0	12.0	3.0
RL04	-	-	-	-	-	7.6	19.0
Total	1.5	3.9	16.1	25.5	26.1	22.3	22.0
RP03	1.6	.8	-	-	-	-	-
RP04, 5	18.0	15.9	15.9	12.7	9.5	5.3	1.1
RM03	-	-	3.4	10.1	13.4	10.1	6.7
R80 60	-	-	-	-	2.4	12.0	24.0
Total	19.6	16.7	19.3	22.8	25.3	27.4	31.8
RP06	-	9.1	18.2	20.5	19.4	13.7	5.7
RP07/07+	-	-	-	5.0	12.5	-	-
RP08/08+	-	-	-	-	-	19.5	35.5
RP06 replace.	-	-	-	-	-	8.0	20.0
R80 140	-	-	-	-	3.2	15.8	31.5
Total	-	9.1	18.2	25.5	35.1	57.0	87.0
RS03, 4	1.0	1.5	1.5	1.0	.5	-	-
RX Dual	4.0	9.0	17.0	24.0	30.0	38.0	45.0
Controllers, Media, etc.	5.3	8.2	14.1	19.4	24.0	30.5	38.1
Total	10.3	18.7	32.6	44.4	54.5	68.5	83.1
GRAND TOTAL	40.6	62.7	107.8	148.6	183.8	233.5	292.2

SCT÷BT

0.72	0.366	0.233	0.123	0.264	0.143	0.0982	0.142	0.141	0.115	0.147	0.0533	0.0264	0.0741	0.054	0.0298
0.62	0.316	0.206	0.109	0.229	0.125	0.0661	0.132	0.131	0.107	0.108	0.04	0.0207	0.0695	0.052	0.0288
0.57	0.291	0.192	0.102	0.211	0.116	0.05	0.127	0.126	0.104	0.0875	0.0333	0.0179	0.0671	0.051	0.0284
0.545	0.278	0.185	0.0984	0.202	0.112	0.042	0.124	0.123	0.102	0.0775	0.03	0.0164	0.0659	0.0505	0.0281

(DP+CP)÷B

3.8	2.18	1.1	0.6	1.11	0.561	0.5	0.417	0.465	0.388	0.77	0.273	0.131	0.263	0.176	0.11

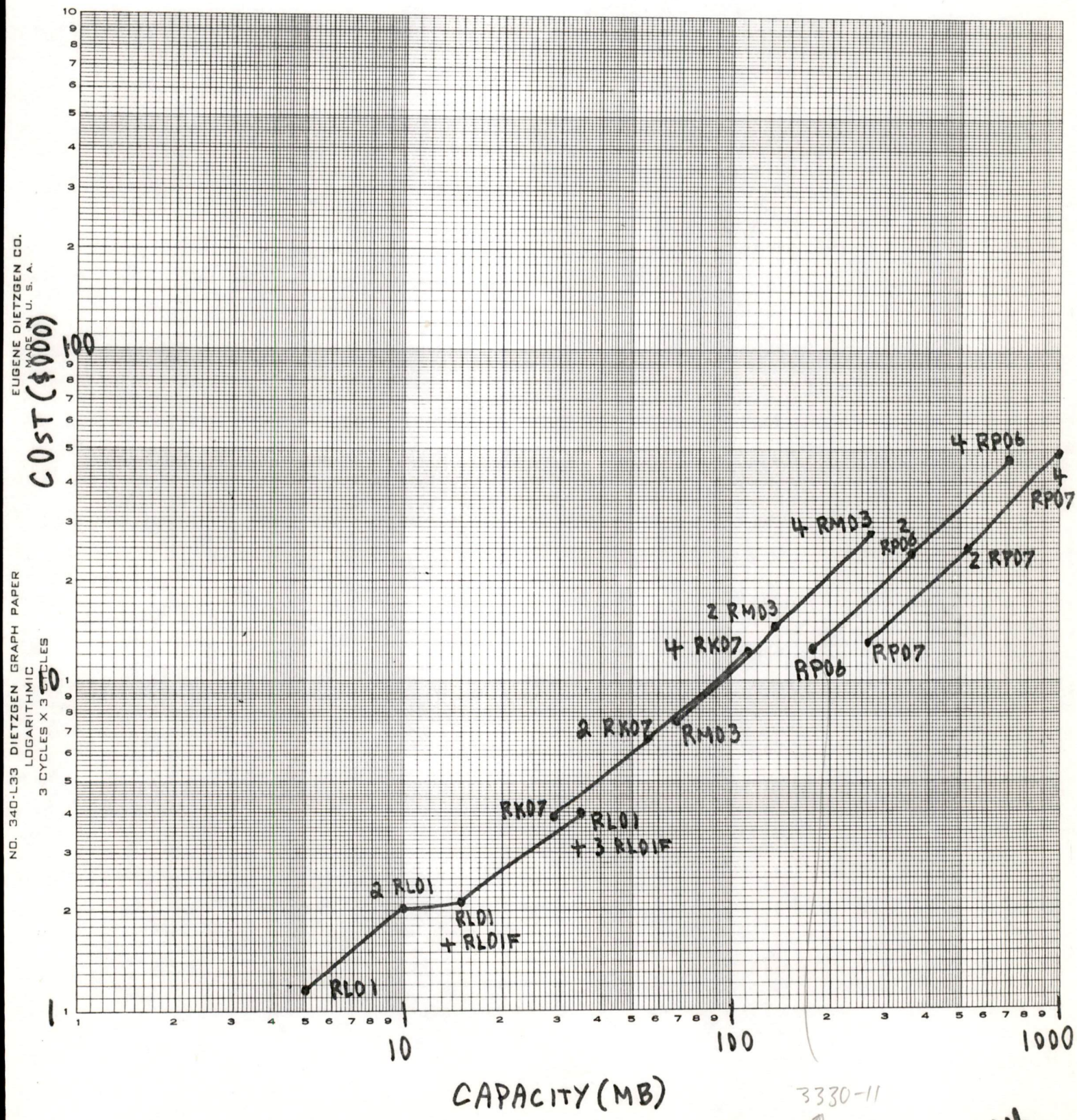
```
                @E BLANK ALTMOD RCVSPEED:1200 XMTSPEED:110
NODEBREA NOTIDY NORTCOMP
NOSLAVE NOHDX REMOTE
Please LOGIN or ATTACH

.
.\
?\?

.LOGIN


MIT TIP 410 #: 12
@1 78
Trying...
 Open

CMU10A 8.3/DEC 6.02VM 21:01:47 TTY110
Type 'HELP' if you need it.
.login n600sb28
JOB 19 CMU10A 8.3/DEC 6.02VM TTY110
Password: sbell

Other jobs same PPN
2102
0.
Thu 2200...New LISP on SYS:; see DOC:LISP.DOC
Thu 2130...New 'standard' system KSETs. See FONTS.NEW[A730KS00]
Wed 0100...Bulletin Board messages.  Type HELP BULLETIN or HELP BOARD.
       ...SYS:NEWS(4-6)
HYDRA: 11-Apr-77 C.mmp down beginning at 2000 for emers. hardware maint.
perations schedule: SCHED.DOC[N810HY97]
      28-Mar-77 Last chance to set your stuff out of OLDMDIR.


ty.mail.box

? MAIL.BOX (0) file was not found

.r apl
TERMINAL..key
hiK> new version, report errors to pollacK AT CMUA
APL-10 CMU E10(13)
TTY110 21:03:01 MONDAY 11-APR-77 BELL [7245,154430]
```

```
CLEAR WS

      )WIDTH
120
      )WIDTH 150
WAS 120
      DIGITS
VALUE ERROR
       DIGITS
      ^
      )DIGITS 3
WAS 7
      DC← 1.3 1.33 .89 .95 2.7 3 .95 10.7 10.6 6.7 1.35 1.6 2.1 11.4 12.5 14.5
      DC
1.3  1.33  0.89  0.95  2.7  3  0.95  10.7  10.6  6.7  1.35  1.6  2.1  11.4  12.5  14.5
      B← 2.5 5 5 10 14 28 28 88 88 67 20 60 140 176 250 520
      DC
1.3  1.33  0.89  0.95  2.7  3  0.95  10.7  10.6  6.7  1.35  1.6  2.1  11.4  12.5  14.5
      DP← 5.1 6.5 3.5 4 9.5 9.7 4 27.2  31.4 16 5.4 6.4 8.4 36.5 34 47
      DP
5.1  6.5  3.5  4  9.5  9.7  4  27.2  31.4  16  5.4  6.4  8.4  36.5  34  47
      CC← .5 .5 .275 .275 1 1 1.8 1.8 1.8 1 1.6 1.6 1.6 1.65 1 1
      D←DCC
0.5  0.5  0.275  0.275  1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65  1  1
      CP←4.4 4.4 2 2 6 6 10  9.5 9.5 10 10 10 10 9.7 10 10
      CP
4.4  4.4  2  2  6  6  10  9.5  9.5  10  10  10  10  9.7  10  10.



           B
2.5  5  5  10  14  28  28  88  88  67  20  60  140  176  250  520
      DP
5.1  6.5  3.5  4  9.5  9.7  4  27.2  31.4  16  5.4  6.4  8.4  36.5  34  47
      DP×B
12.7  32.5  17.5  40  133  272  112  2.39E3   2.76E3   1.07E3   108  384  1.18E3   6.42E3   8.50E3   2.44E4
      DP÷B
2.04  1.3  0.7  0.4  0.679  0.346  0.143  0.309  0.357  0.239  0.27  0.107  0.06  0.207  0.136  0.0904
      1000×DP÷B
2.04E3   1.30E3   700  400  679  346  143  309  357  239  270  107  60  207  136  90.4
      C
VALUE ERROR
       C
      ^
      DC
1.3  1.33  0.89  0.95  2.7  3  0.95  10.7  10.6  6.7  1.35  1.6  2.1  11.4  12.5  14.5
      B
2.5  5  5  10  14  28  28  88  88  67  20  60  140  176  250  520
      DC×1000÷B
520  266  178  95  193  107  33.9  122  120  100  67.5  26.7  15  64.8  50  27.9
      DP×1000÷B
2.04E3   1.30E3   700  400  679  346  143  309  357  239  270  107  60  207  136  90.4



                DP÷DC
3.92  4.89  3.93  4.21  3.52  3.23  4.21  2.54  2.96  2.39  4  4  4  3.2  2.72  3.24
      CP
4.4  4.4  2  2  6  6  10  9.5  9.5  10  10  10  10  9.7  10  10
      CC
0.5  0.5  0.275  0.275  1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65  1  1
      CP÷CC
8.8  8.8  7.27  7.27  6  6  5.56  5.28  5.28  10  6.25  6.25  6.25  5.88  10  10
```

```
      N←1 2 4 8
      No,XB
  2.50E0    5.00E0    5.00E0    1.00E1    1.40E1    2.80E1    2.80E1    8.80E1    8.80E1    6.70E1    2.00E1    6.00E1
        1.76E2    2.50E2    5.20E2
  5.00E0    1.00E1    1.00E1    2.00E1    2.80E1    5.60E1    5.60E1    1.76E2    1.76E2    1.34E2    4.00E1    1.20E2
        3.52E2    5.00E2    1.04E3
  1.00E1    2.00E1    2.00E1    4.00E1    5.60E1    1.12E2    1.12E2    3.52E2    3.52E2    2.68E2    8.00E1    2.40E2
        7.04E2    1.00E3    2.08E3
  2.00E1    4.00E1    4.00E1    8.00E1    1.12E2    2.24E2    2.24E2    7.04E2    7.04E2    5.36E2    1.60E2    4.80E2
        1.41E3    2.00E3    4.16E3
      No,XB÷1000
  0.0025  0.005   0.005   0.01    0.014   0.028   0.028   0.088   0.088   0.067   0.02    0.06    0.14    0.176   0.25
  0.005   0.01    0.01    0.02    0.028   0.056   0.056   0.176   0.176   0.134   0.04    0.12    0.28    0.352   0.5
  0.01    0.02    0.02    0.04    0.056   0.112   0.112   0.352   0.352   0.268   0.08    0.24    0.56    0.704   1
  0.02    0.04    0.04    0.08    0.112   0.224   0.224   0.704   0.704   0.536   0.16    0.48    1.12    1.41    2
      B
2.5 5 5 10 14 28 28 88 88 67 20 60 140 176 250 520
      )WIDTH
150
      )WIDTH 164
WAS 150
      No,XB÷1000
  0.0025  0.005   0.005   0.01    0.014   0.028   0.028   0.088   0.088   0.067   0.02    0.06    0.14    0.176   0.25
  0.005   0.01    0.01    0.02    0.028   0.056   0.056   0.176   0.176   0.134   0.04    0.12    0.28    0.352   0.5
  0.01    0.02    0.02    0.04    0.056   0.112   0.112   0.352   0.352   0.268   0.08    0.24    0.56    0.704   1
  0.02    0.04    0.04    0.08    0.112   0.224   0.224   0.704   0.704   0.536   0.16    0.48    1.12    1.41    2

      BT←N

      N
1 2 4 8
      BT←No,XB
      ⍴BT
4 16
      BT
  2.50E0    5.00E0    5.00E0    1.00E1    1.40E1    2.80E1    2.80E1    8.80E1    8.80E1    6.70E1    2.00E1    6.00E1
        2.50E2    5.20E2
  5.00E0    1.00E1    1.00E1    2.00E1    2.80E1    5.60E1    5.60E1    1.76E2    1.76E2    1.34E2    4.00E1    1.20E2
        5.00E2    1.04E3
  1.00E1    2.00E1    2.00E1    4.00E1    5.60E1    1.12E2    1.12E2    3.52E2    3.52E2    2.68E2    8.00E1    2.40E2
        1.00E3    2.08E3
  2.00E1    4.00E1    4.00E1    8.00E1    1.12E2    2.24E2    2.24E2    7.04E2    7.04E2    5.36E2    1.60E2    4.80E2
        2.00E3    4.16E3
      P←PDPT←No,XDP
      DPT
   5.1    6.5    3.5    4      9.5    9.7    4      27.2   31.4   16     5.4    6.4    8.4    36.5   34     47
  10.2   13     7      8      19     19.4   8      54.4   62.8   32     10.8   12.8   16.8   73     68     94
  20.4   26     14     16     38     38.8   16     109    126    64     21.6   25.6   33.6   146    136    188
  40.8   52     28     32     76     77.6   32     218    251    128    43.2   51.2   67.2   292    272    376
      DCT←No,XDC
      DCT
  1.3    1.33   0.89   0.95   2.7    3      0.95   10.7   10.6   6.7    1.35   1.6    2.1    11.4   12.
  2.6    2.66   1.78   1.9    5.4    6      1.9    21.4   21.2   13.4   2.7    3.2    4.2    22.8   25
  5.2    5.32   3.56   3.8    10.8   12     3.8    42.8   42.4   26.8   5.4    6.4    8.4    45.6   50
  10.4   10.6   7.12   7.6    21.6   24     7.6    85.6   84.8   53.6   10.8   12.8   16.8   91.2   100
      CCT←4 16⍴CC
      CCT
0.5  0.5  0.275 0.275 1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65 1  1
0.5  0.5  0.275 0.275 1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65 1  1
0.5  0.5  0.275 0.275 1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65 1  1
0.5  0.5  0.275 0.275 1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65 1  1
```

```
      CPT←4 16⍴CP
      CPT
  4.4   4.4   2     2     6     6     10    9.5   9.5   10    10    10    10    9.7   10    10
  4.4   4.4   2     2     6     6     10    9.5   9.5   10    10    10    10    9.7   10    10
  4.4   4.4   2     2     6     6     10    9.5   9.5   10    10    10    10    9.7   10    10
  4.4   4.4   2     2     6     6     10    9.5   9.5   10    10    10    10    9.7   10    10
      CPT←CPT+⊢+++⊢T⊢P⊢C⊢⊢T⊢P⊢C

SPT←CPT+DPT
      SCT←CCT+DCT
      SPT
  9.5   10.9   5.5   6     15.5  15.7  14    36.7  40.9  26    15.4  16.4  18.4  46.2  44    57
 14.6   17.4   9     10    25    25.4  18    63.9  72.3  42    20.8  22.8  26.8  82.7  78    104
 24.8   30.4   16    18    44    44.8  26    118   135   74    31.6  35.6  43.6  156   146   198
 45.2   56.4   30    34    82    83.6  42    227   261   138   53.2  61.2  77.2  302   282   386
      SCT
 1.8    1.83   1.17  1.23  3.7   4     2.75  12.5  12.4  7.7   2.95  3.2   3.7   13.1  13.5  15.5
 3.1    3.16   2.06  2.18  6.4   7     3.7   23.2  23    14.4  4.3   4.8   5.8   24.5  26    30
 5.7    5.82   3.84  4.08  11.8  13    5.6   44.6  44.2  27.8  7     8     10    47.3  51    59
 10.9   11.1   7.4   7.88  22.6  25    9.4   87.4  86.6  54.6  12.4  14.4  18.4  92.8  101   117
      SPT⊢×÷SCT
5.28  5.96  4.72  4.9   4.19  3.93  5.09  2.94  3.3   3.38  5.22  5.13  4.97  3.54  3.26  3.68
4.71  5.51  4.38  4.6   3.91  3.63  4.86  2.75  3.14  2.92  4.84  4.75  4.62  3.38  3     3.47
4.35  5.22  4.17  4.42  3.73  3.45  4.64  2.65  3.06  2.66  4.51  4.45  4.36  3.3   2.86  3.36
4.15  5.06  4.06  4.32  3.63  3.34  4.47  2.6   3.01  2.53  4.29  4.25  4.2   3.25  2.79  3.3
      SPT÷BT×1000
0.0038    0.00218   0.0011    0.0006    0.00111   0.000561  0.0005    0.000417  0.000465  0.000388  0.00077   0.000273
    0.000176  0.00011
0.00292   0.00174   0.0009    0.0005    0.000893  0.000454  0.000321  0.000363  0.000411  0.000313  0.00052   0.00019
    0.000156  0.0001
0.00248   0.00152   0.0008    0.00045   0.000786  0.0004    0.000232  0.000336  0.000384  0.000276  0.000395  0.000148
    0.000146  0.0000952
0.00226   0.00141   0.00075   0.000425  0.000732  0.000373  0.000188  0.000323  0.00037   0.000257  0.000333  0.000128
    0.000141  0.0000928
      SPT×1000÷BT
3.80E3    2.18E3    1.10E3    6.00E2    1.11E3    5.61E2    5.00E2    4.17E2    4.65E2    3.88E2    7.70E2    2.73E2
    1.76E2    1.10E2
2.92E3    1.74E3    9.00E2    5.00E2    8.93E2    4.54E2    3.21E2    3.63E2    4.11E2    3.13E2    5.20E2    1.90E2
    1.56E2    1.00E2
2.48E3    1.52E3    8.00E2    4.50E2    7.86E2    4.00E2    2.32E2    3.36E2    3.84E2    2.76E2    3.95E2    1.48E2
    1.46E2    9.52E1
2.26E3    1.41E3    7.50E2    4.25E2    7.32E2    3.73E2    1.88E2    3.23E2    3.70E2    2.57E2    3.33E2    1.28E2
    1.41E2    9.28E1
      SPT÷1⊢1⊢BT
3.8   2.18  1.1   0.6   1.11  0.561 0.5   0.417 0.465 0.388 0.77  0.273 0.131 0.263 0.176 0.11
2.92  1.74  0.9   0.5   0.893 0.454 0.321 0.363 0.411 0.313 0.52  0.19  0.0957 0.235 0.156 0.1
2.48  1.52  0.8   0.45  0.786 0.4   0.232 0.336 0.384 0.276 0.395 0.148 0.0779 0.221 0.146 0.0952
2.26  1.41  0.75  0.425 0.732 0.373 0.188 0.323 0.37  0.257 0.333 0.128 0.0689 0.214 0.141 0.0928
      CPT÷BT
1.76  0.88  0.4   0.2   0.429 0.214 0.357 0.108 0.108 0.149 0.5   0.167 0.0714 0.0551 0.04
0.88  0.44  0.2   0.1   0.214 0.107 0.179 0.054 0.054 0.0746 0.25 0.0833 0.0357 0.0276 0.02
0.44  0.22  0.1   0.05  0.107 0.0536 0.0893 0.027 0.027 0.0373 0.125 0.0417 0.0179 0.0138 0.01
0.22  0.11  0.05  0.025 0.0536 0.0268 0.0446 0.0135 0.0135 0.0187 0.0625 0.0208 0.00893 0.00689 0.00

      v⊢v(DC+CC)×B⊢B⊢×÷B
0.72  0.366  0.233  0.123  0.264  0.143  0.0982  0.142  0.141  0.115  0.147  0.0533  0.0264  0.0741  0.054  0.0298
      DC
1.3  1.33  0.89  0.95  2.7  3  0.95  10.7  10.6  6.7  1.35  1.6  2.1  11.4  12.5  14.5
      CC
0.5  0.5  0.275  0.275  1  1  1.8  1.8  1.8  1  1.6  1.6  1.6  1.65  1  1
      B
2.5  5  5  10  14  28  28  88  88  67  20  60  140  176  250  520
```

FY79 DISK SUBSYSTEMS



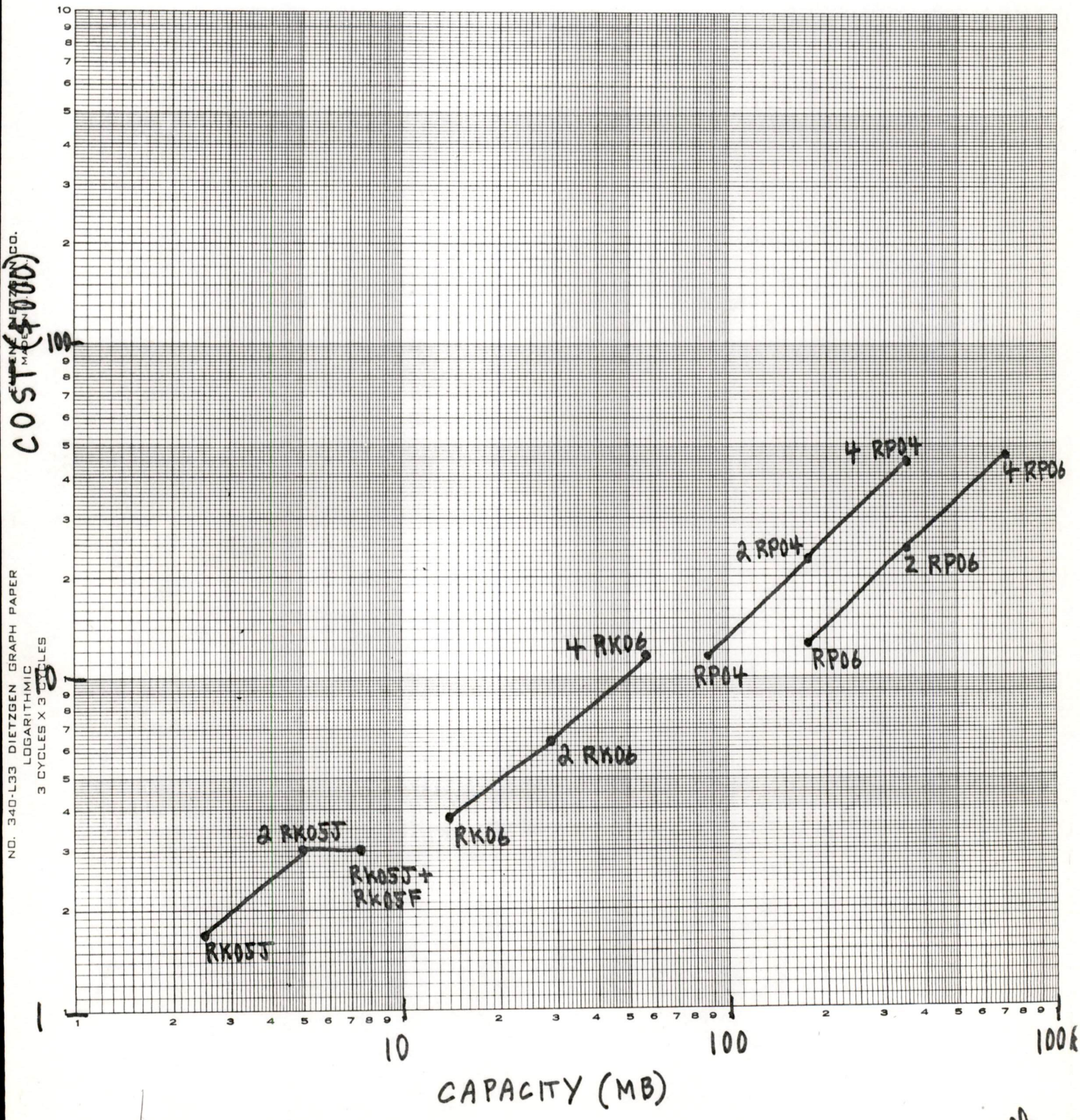
3330-11

priced at 25% below

4 = 5 = 6
Cost

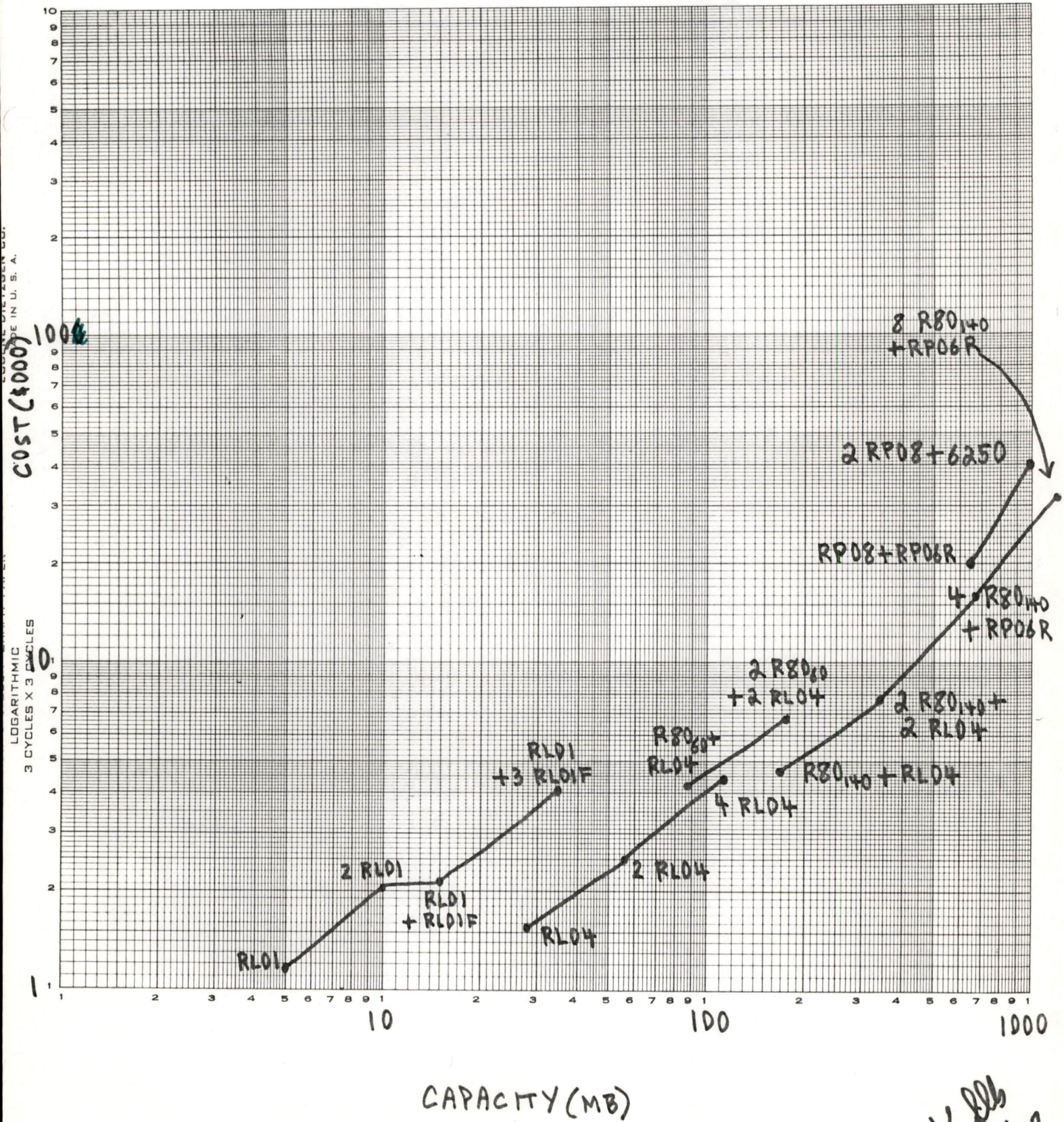
K Dlls 4/12/77

FY77 DISK SUBSYSTEMS

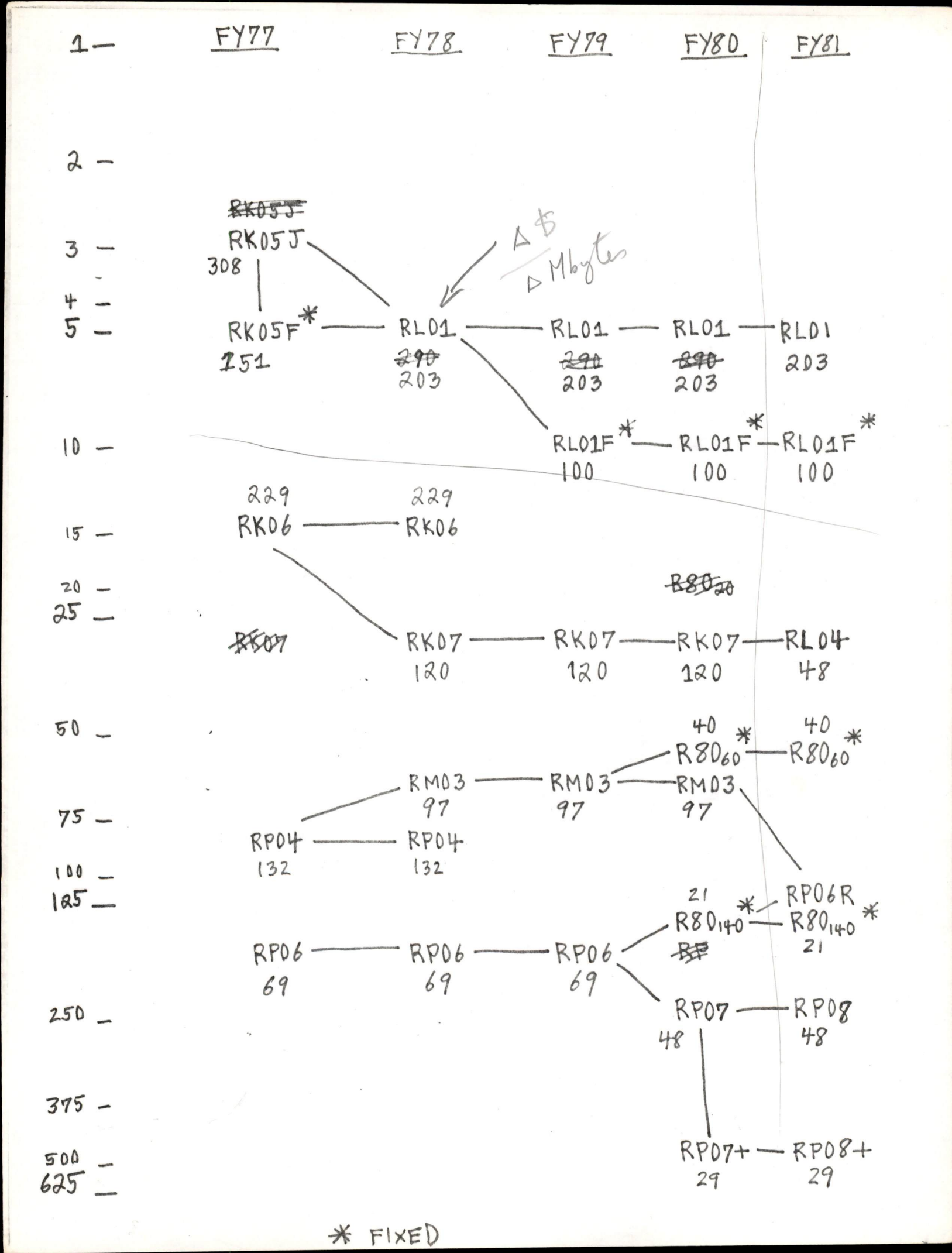


K Falls
4/12/77

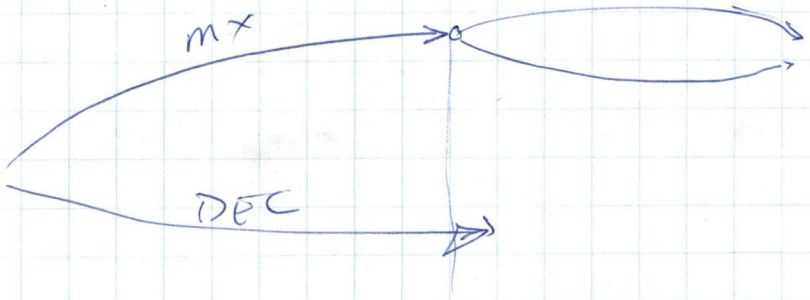
FY81 DISK SUBSYSTEMS



K. Bbb
4/12/77


1
2
3
4
5
10
15
20
25
50
75
100
125
250
375
500
625
FY77
FY78
FY79
FY80
FY81
RK05J
308
RK05F*
151
RL01
290
203
Δ$
ΔMbytes
RL01
291
203
RL01
290
203
RL01
203
RL01F*
100
RL01F*
100
RL01F*
100
229
RK06
229
RK06
RK07
120
RK07
120
RK07
120
RL04
48
R80 20
40
R80₆₀*
40
R80₆₀*
RM03
97
RM03
97
RM03
97
RP04
132
RP04
132
21
R80₁₄₀*
RP06R
R80₁₄₀*
21
RP06
69
RP06
69
RP06
69
RP07
48
RP08
48
RP07+
29
RP08+
29

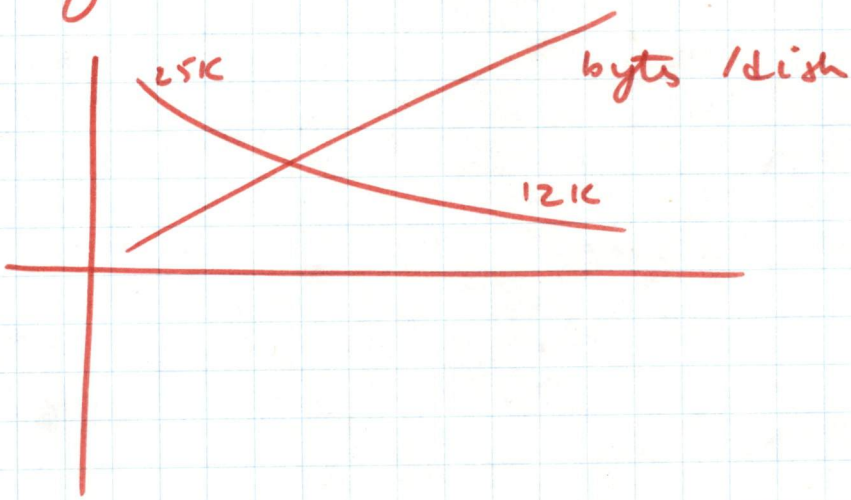
* FIXED



Big disk (RP06)

75 - 150 K worth of disks

400 #



DISK SUBSYSTEMS – PRIMARY OFFERINGS EVOLUTION

COMPANY CONFIDENTIAL

RP03

MB

2 RP07 + RM81
$88/MB

2 RP06
$193/MB

RP07 + RM81
$143/MB

2 R80$_{40}$ + RK06D
$127/MB

2 R80$_{40}$ + RL04
$108/MB

2 RP04
$346/MB

RP05

2 RM81
$328/MB

R80$_{40}$ + RK06D
$173/MB

R80$_{40}$ + RL04
$139/MB

R80$_{60}$ + RK06D
$284/MB

R80$_{60}$ + RL04
$224/MB

2 RK06D
$512/MB

2 RL04
$240/MB

2 RPR02
$762/MB

2 RK06
$1000/MB

RL01 + 2 RL01F
$580/MB

4 RL0X
$500/MB

RL01 + RL01F
$667/MB

2 RL01
$900/MB

2 RL0X
$500/MB

RK05 + RK05F
$2187/MB

2 RK05
$3000/MB

1 RL01
$1100/MB

1 RL0X
$500/MB

1 RK05
$3960/MB

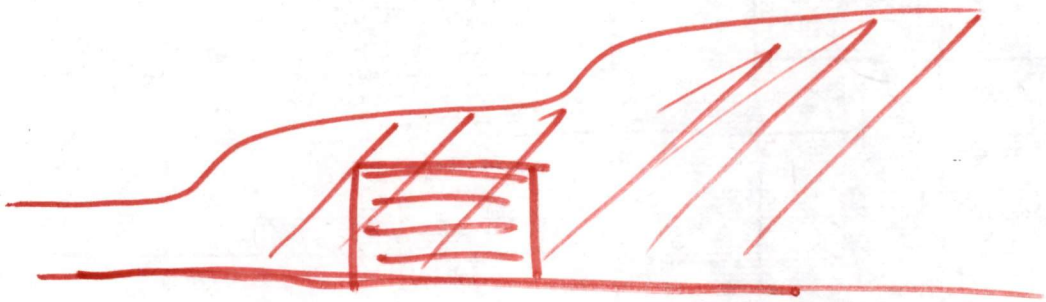
2 1MB FLOPPY
≈ $3000/MB

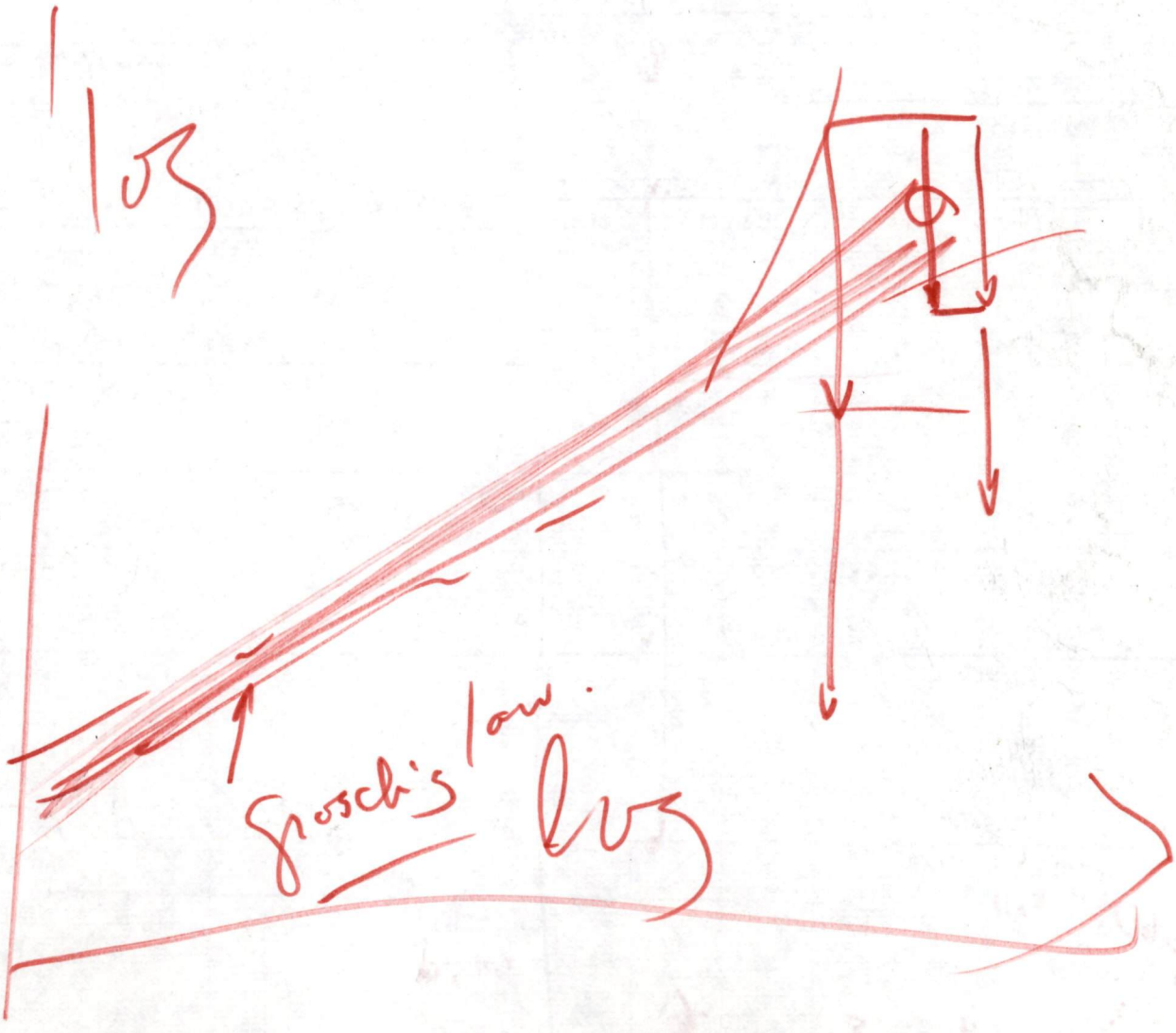
FY76 | FY77 | FY78 | FY79 | FY80 | FY81 | FY82

1000 100 10

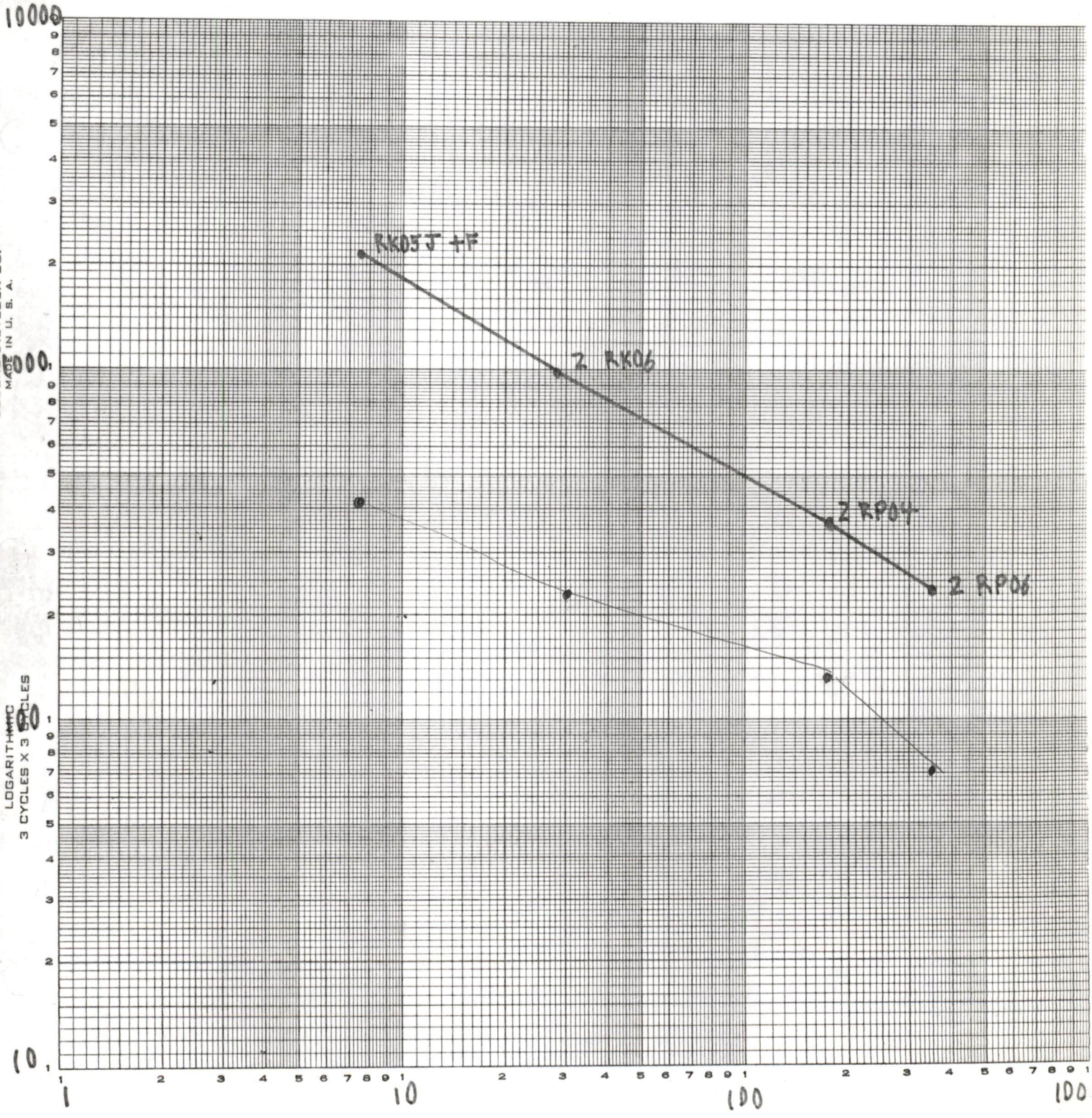
DIETZGEN CORPORATION
MADE IN U.S.A.

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

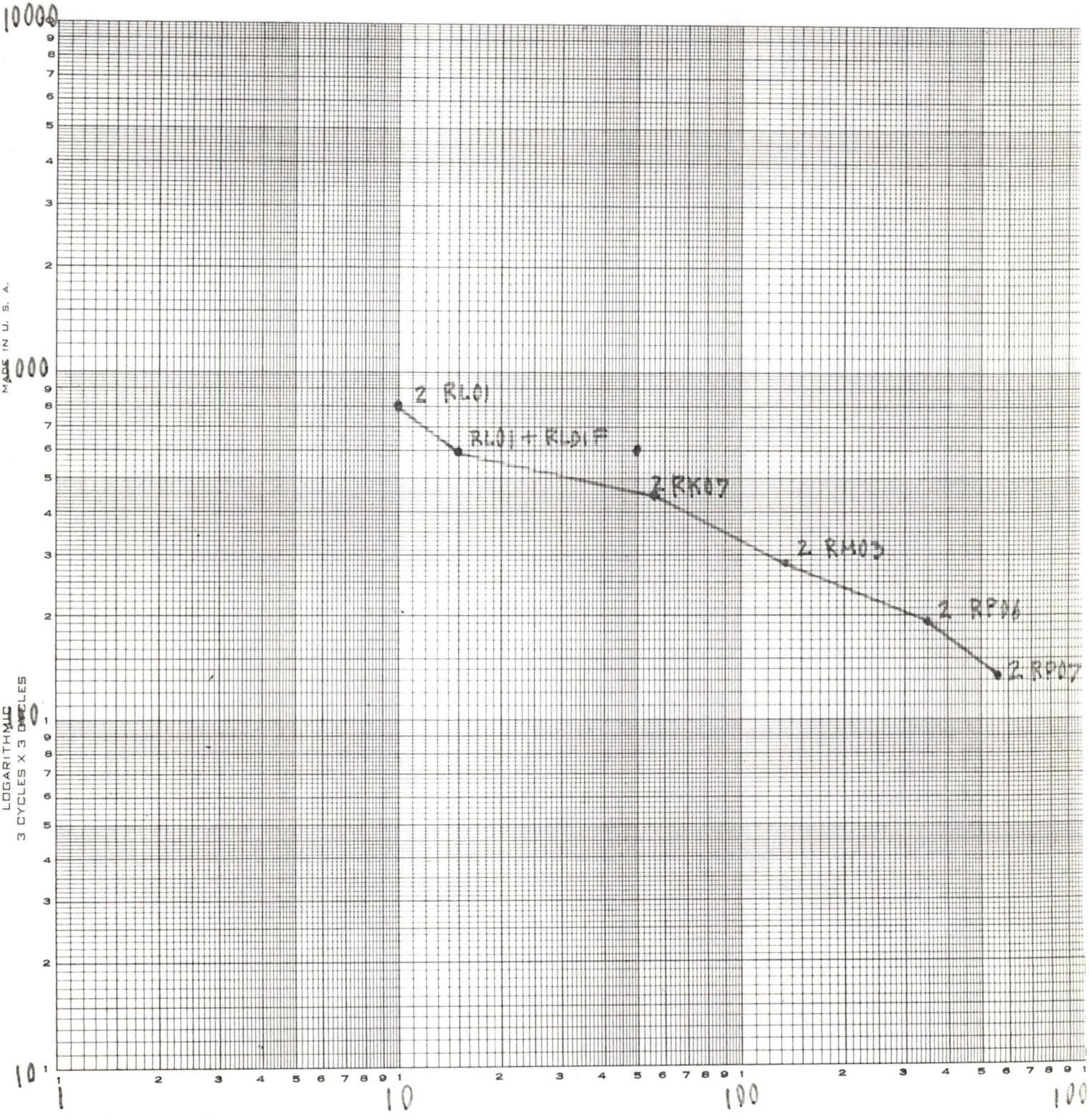



log
Gosch's law
log

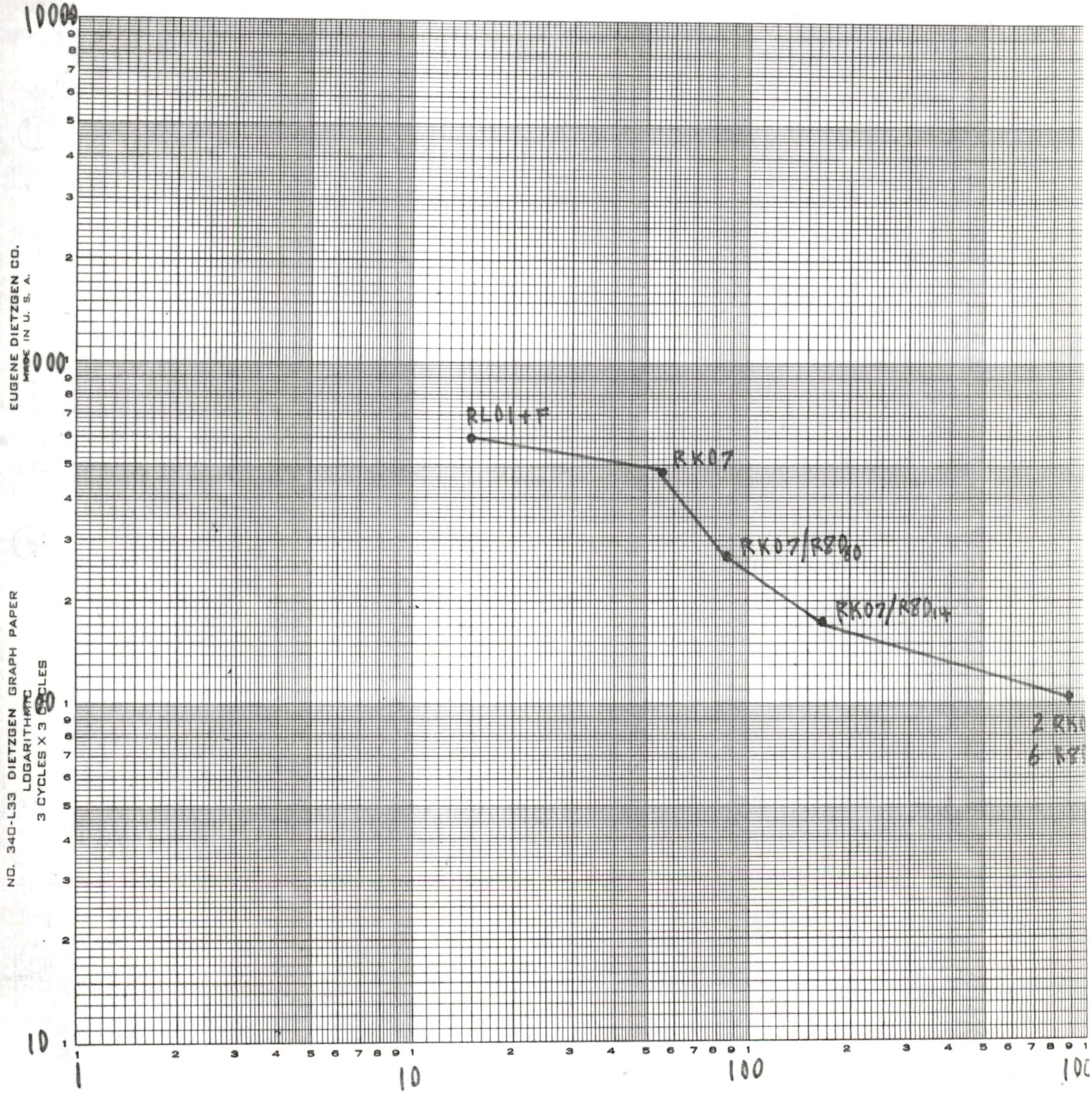
FY77

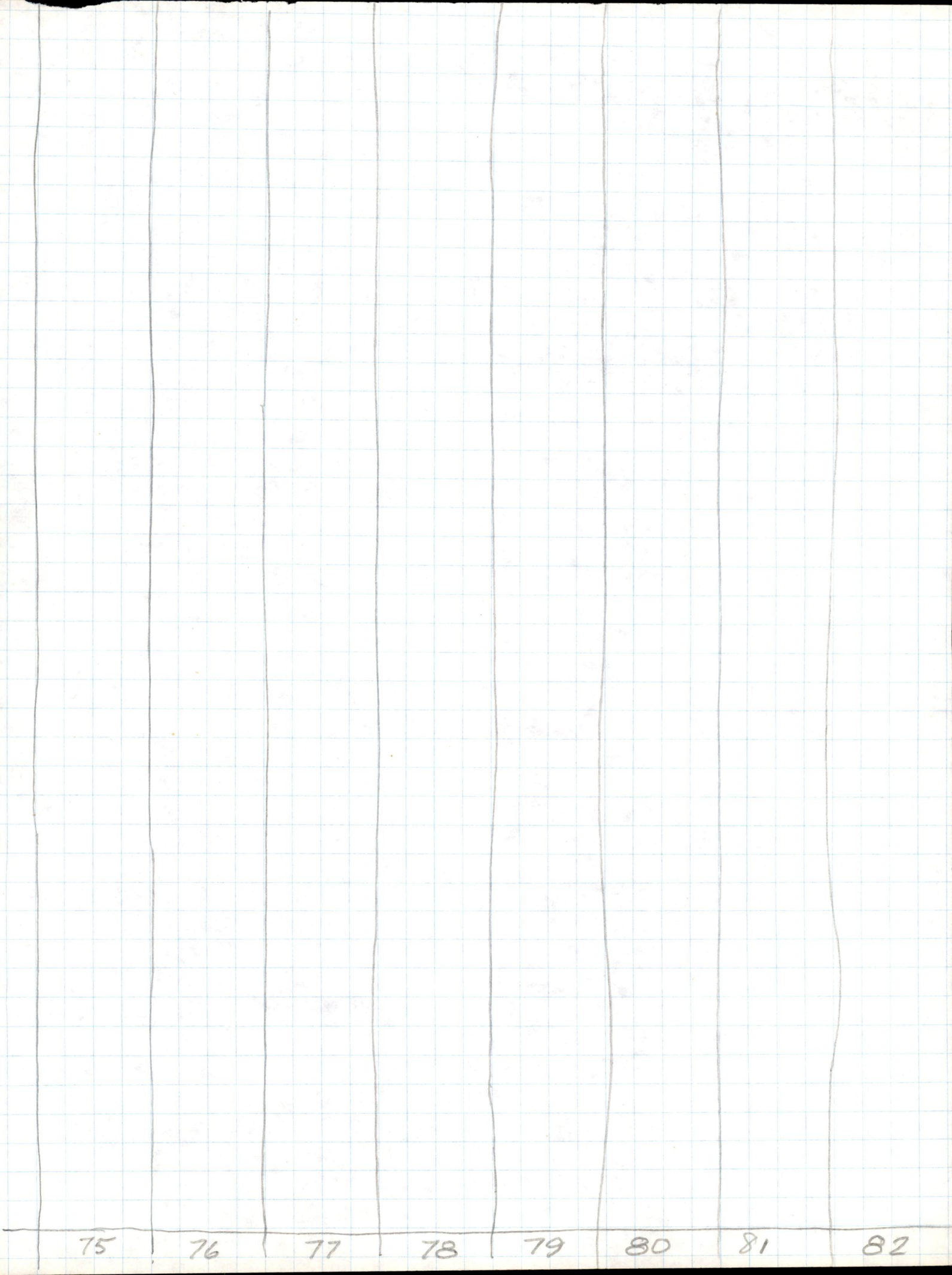

RK05J +F
2 RK06
2 RP04
2 RP06
10000
1000
100
10
1
10
100
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-L33 DIETZGEN GRAPH PAPER
LOGARITHMIC
3 CYCLES X 3 CYCLES

FY79


2 RL01
RL01 + RL01P
2 RK07
2 RM03
2 RP06
2 RP07
10000
1000
100
10
1
1
10
100
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-L33 DIETZGEN GRAPH PAPER
LOGARITHMIC
3 CYCLES X 3 CYCLES

FY80


RL01+F
RK07
RK07/RB80
RK07/RB04
2 RK
6 RF
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-L33 DIETZGEN GRAPH PAPER
LOGARITHMIC
3 CYCLES X 3 CYCLES
1
10
100


75
76
77
78
79
80
81
82

	B		DC		DP	CP	CC			
	Size/#t/#d		Drive Cost/ cost/MB		Drive Prio	Contrib Pr/cost				
DF32										
DF64										
RS 256										
RS03					9.5	5.4				
RS04					13.8	7.4				
RX01					1.05	2.0				
RX02										
RX04										
RK03	2.5									
05	2.5	1	1.3	520	5.1	4.4	.5	—	1	
05F	5	2	1.33	266	6.5	4.4	.5	—	2	
RL01	5	3	89	178	3.5	2.	.275	—	3	
02=01F	10	4	95	95	4.	2.	.275	—	4	
~~0X~~	~~5~~		~~.4~~	~~800~~						
~~RP02~~	~~20~~		~~3~~	~~1500~~						
RK06	14	5	27	193	9.5	6	1	—	5	
RK07=06F	28	6	3	107	9.7	6	1	—	6	
RL04	28	7	.95	34	4	10	1.8			
~~RP03~~	~~40~~		~~8~~	~~200~~						
RP04	88	8	10.7		27.2	9.5	1.8			
RP05	88	9	10.6		31.4	9.5	1.8			
RM01/03	67	10	6.7	100	16	10	1			
RS0$_{20}$	20	11	1.35	67	5.4	10	1.6			
60	60	12	1.6	27	6.4	10	1.6			
140	140	13	2.1	15	8.4	10	1.6		12	
RP06	176	14	11.4	65	36.5	9.7	1.65	—		
RP07	250	15	12.5	50	34	10	1			
RC07 + 520		16	14.5		47	10	1			

(information qualified: ?--estimated, !--committed, otherwise--proposed)

	FCS	List Price		Transfer Cost		Product Manager (Group Manager)
RS04	FY74,Q4	$ 22120	-0%	$ 7400	-0%	Kevin Smith
		15200	-0	5170	+3	(Grant Saviers)
{1024KB fixed head disk }						
RK05J/8	FY72,Q4	$ 8300	-0%	$ 1656	+4%	K. Srivastava
		5600	-0	1330	+4	(Grant Saviers)
{2.5MB removable disk cartridge for the PDP-8}						
RK05F/8	FY76,Q4	$ 8900	-0%	$ 1626	+4%	K. Srivastava
		6200	-0	1300	+4	(Grant Saviers)
{5MB non-removable disk cartridge for the PDP-8}						
RK05J/11	FY72,Q4	$ 10450	-0%	$ 1750	+4%	K. Srivastava
		5600	-0	1330	+4	(Grant Saviers)
{2.5MB removable disk cartridge for the PDP-11}						
RK05F/11	FY76,Q4	$ 11050	-0%	$ 1720	+4%	K. Srivastava
		6200	-0	1300	+4	(Grant Saviers)
{5MB non-removable disk cartridge for the PDP-11.}						
RL01	FY78,Q2!	$ 6400?	-0%	$ ~~1600?~~ 1150	~~-18%~~	Wayne Galusha
		4000?	-0	~~1300?~~ 875	~~-24~~	(Grant Saviers)
{5MB removable cartridge disk for $1800 including dual drives (10MB) and controller}						
RL01F (RL02, RSL+)	FY79,Q4?	$ 7400?	-0%	$ 1360?	-18%	Wayne Galusha
		5000?	-0	~~1040?~~ 950	-24	(Grant Saviers)
{A 10MB fixed media complement to the RL01.}						
RK06	FY77,Q2	$ 17000	+2%	$ 3750	-0%	Steve Orr
		10450	+2	2650	-0	(Grant Saviers)
{14MB removable cartridge disk}						
RK07 (RK06D)	FY78,Q3?	$ 18000?	+2%	$ 3900?	-0%	Steve Orr
		11500?*	+2	2800?	-0	(Grant Saviers)
{28MB removable cartridge disk for $6500 including dual drives and controller; budget includes RK06 support}						
RL04	FY81,Q1?	$ 14000?	-0%	$ 2750?	-0%	Wayne Galusha
		4000?*	-0	950?	-0	(Grant Saviers)
{28MB removable disk companion to the R80 with an intelligent (programmable) controller and packaging supporting mixes of up to 4 R80's and R104's. The controller does automatic error recovery, seek and sector optimization, online diagnosis, error						

- = FCS "?" indicates next release of a currently shipping product
- Prices and costs include controller, formatter, and first drive
- Second and subsequent drive prices and costs shown on second line

...vation qualified: ?--estimated, !--committed, otherwise--proposed)

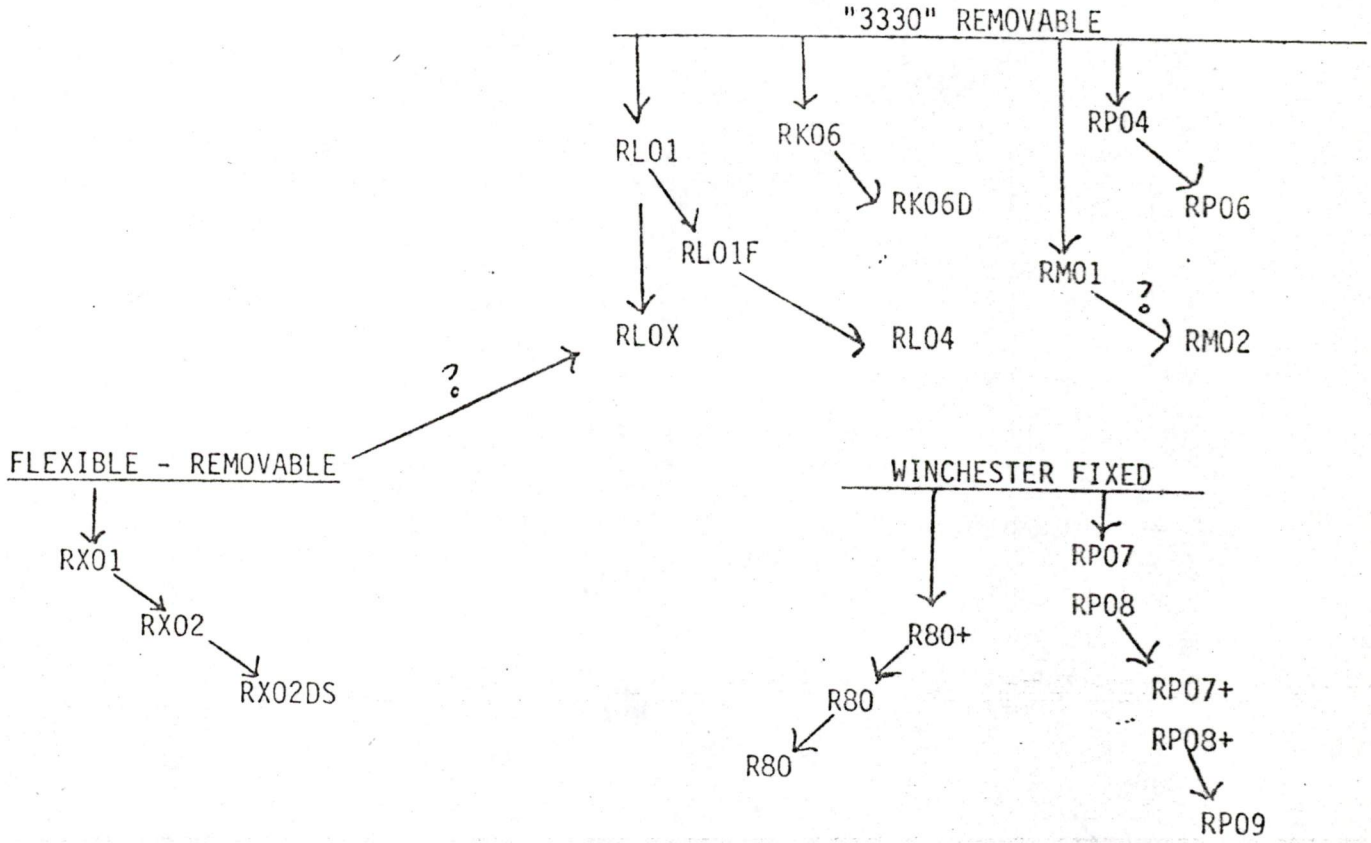
	FCS	List Price	Transfer Cost (with annual percentage change)	Product Manager (Group Manager)
		logging, performance and statistical logging.}		
R80-	FY80,Q2?	$ 15400? -0% 5400? -0	$ 2950? -0% 1350? -0	Grant Saviers (Grant Saviers)
	{20MB single platter non-removable disk with intelligent (programmable) controller} - see RM80 ?			
R80	FY80,Q2?	$ 16400? -0% 6400? -0	$ 3200? -0% 1600? -0	Grant Saviers (Grant Saviers)
	{60MB dual platter non-removable disk with intelligent (programmable) controller} - see RM80 ?			
R80+	FY80,Q2?	$ 18400? -0% 8400? -0	$ 3700? -0% 2100? -0	Grant Saviers (Grant Saviers)
	{140MB four platter non-removable disk with intelligent (programmable) controller} - see RM80 ?			
RM03 (RM01)	FY78,Q2!	$ 26000 -0% 16000 -0	$ ~~7000~~ 7700 -2% ~~6000~~ 6700 -2	Kevin Smith (Grant Saviers)
	{67MB formatted capacity, removable CDC Massbus disk with 28ms average seek and 8.3ms or 12.5ms average latency}			
RP04	FY75,Q4	$ 36750 -0% 27200 -0	$ 12600 -0% 10670 -0	Kevin Smith (Grant Saviers)
	{88MB ISS buyout disk pack} 9.55		1.30	
RP05	FY76,Q4	$ 40950 -0% 31400 -0	$ 12500 -0% 10797 -0	Kevin Smith (Grant Saviers)
	{88MB MRX buyout disk pack upgradable to a RP06} 55		108 / 12.5 / 17	
RP06	FY76,Q4	$ 46200 -0% 36500 -0	$ 13000 -0% 11350 +1	✓ Kevin Smith (Grant Saviers)
	{176MB MRX buyout dual density RP05} 9		1.65	
RP07	FY79,Q3	$ 44000 -0% 34000 -0	$ 13000 -0% 12000 -0	Kevin Smith (Grant Saviers)
	{260MB formatted capacity, fixed media, Massbus disk with head per track option.}			
RP07+	FY79,Q4	$ 57000 -0% 47000 -0	$ 15500 -0% 14500 -0	Kevin Smith (Grant Saviers)
	{520MB formatted capacity, fixed media, Massbs disk with head per track option.}			

- FCS "#" indicates next release of a currently shipping product
- Prices and costs include controller, formatter, and first drive
- Second and subsequent drive prices and costs shown on second line

SUBSYSTEM STRATEGY

COMBINE THE FLEXIBILITY OF REMOVABLE MEDIA WITH THE INCREASED COST EFFECTIVENESS AND INCREASED RELIABILITY OF FIXED MEDIA IN MULTIPLE SPINDLES FOR HIGH SYSTEM AVAILABILITY AND PERFORMANCE

PRODUCT EVOLUTION



0.1 1.0 10 100 1000

SINGLE SPINDLE FORMATTED CAPACITY - MEGABYTES

Bell, Gordon

ML 12-1/A51

Mike I believe you have to get serious and cc: Lemaire / Clo xer / Clayton + Rot address the 16K chip / high vol. Semiconductor supply and stop flogging cores beyond useful life.

digital

INTEROFFICE MEMORANDUM

TO: Mike Gutman
Bob Peyton
Grant Saviers

CC: Paul Bauer
Gordon Bell

DATE: 28 MAR 77
FROM: Stanton Pearson
DEPT: OOD Planning
EXT: 2424
LOC/MAIL STOP: ML12-3/E13

SUBJ: SUMMARY SECTION FOR STORAGE SYSTEMS BEIGE BOOK

This Spring Disk, Tape, and Main Memory are scheduled to be put into the same Beige Book.

The title of the Beige Book will be "Storage Systems."

Assumption: Several people would benefit if we had a summary section, four to five pages, that described our thinking on how the storage elements fit together over time.

If you buy the assumption, how would we go about getting the summary?

I have arranged meetings with each of you to exchange ideas on this subject.

SHP:ssc

How's the BEAMOS work coming?

Gordon

Size, cost (C/64) price c1

8

added
RX01
02
04
RS64
RS256

RK03

Acton 263
5137

Cambridge

Fault Tolerance

Ornstein, S. M. W. R. Crowther, M. F. Kraley, R. D. Bressler, A. Michel, and F. E. Heart, "Pluribus - A Reliable Multiprocessor," AFIPs Proceedings, National Computer Conference, 1975, pp. 551-559.

Arizienis, A., G. C. Gilley, F. P. Mathur, D. A. Rennels, J. A. Rohr, and D. K. Rubin, "The STAR (Self-Testing and Repairing) Computer: An Investigation of the Theory and Practice of Fault-Tolerant Computer Design," IEEE Transactions on Computers, Vol. C-20, No. 11, November 1971, pp. 1312-1321.

Hamer-Hodges, K. J., "Fault Resistance and Recovery within System 250," International Conference on Computer Communication, Washington, D. C. Oct. 1972.

DN	RK05	~~RK05F~~	RK06	~~RP07~~
DCS	1.3		2.7	10.6
DRR	5.1		9.5	25.9
CCS	1		1	1.8
CPR	4.4		6	9.1
BY	2.5		14	88

i 8

1 2 3

Multiprocessors

Heart, F. E., S. M. Ornstein, W. R. Crowther, and W. B. Baker, "A New Minicomputer/Multiprocessor for the ARPA Network," AFIPs Proceedings, National Computer Conference, 1973, pp. 529-537.

Wulf, W. A., and C. G. Bell, "C.mmp - A Multi-Mini-Processor," AFIPs Proceedings, Fall Joint Computer Conference, 1972, pp. 765-777.

263-5137
Ken Sicilia

RL01 Pivotal in Small Systems ←

How could we make a mkt. around it?

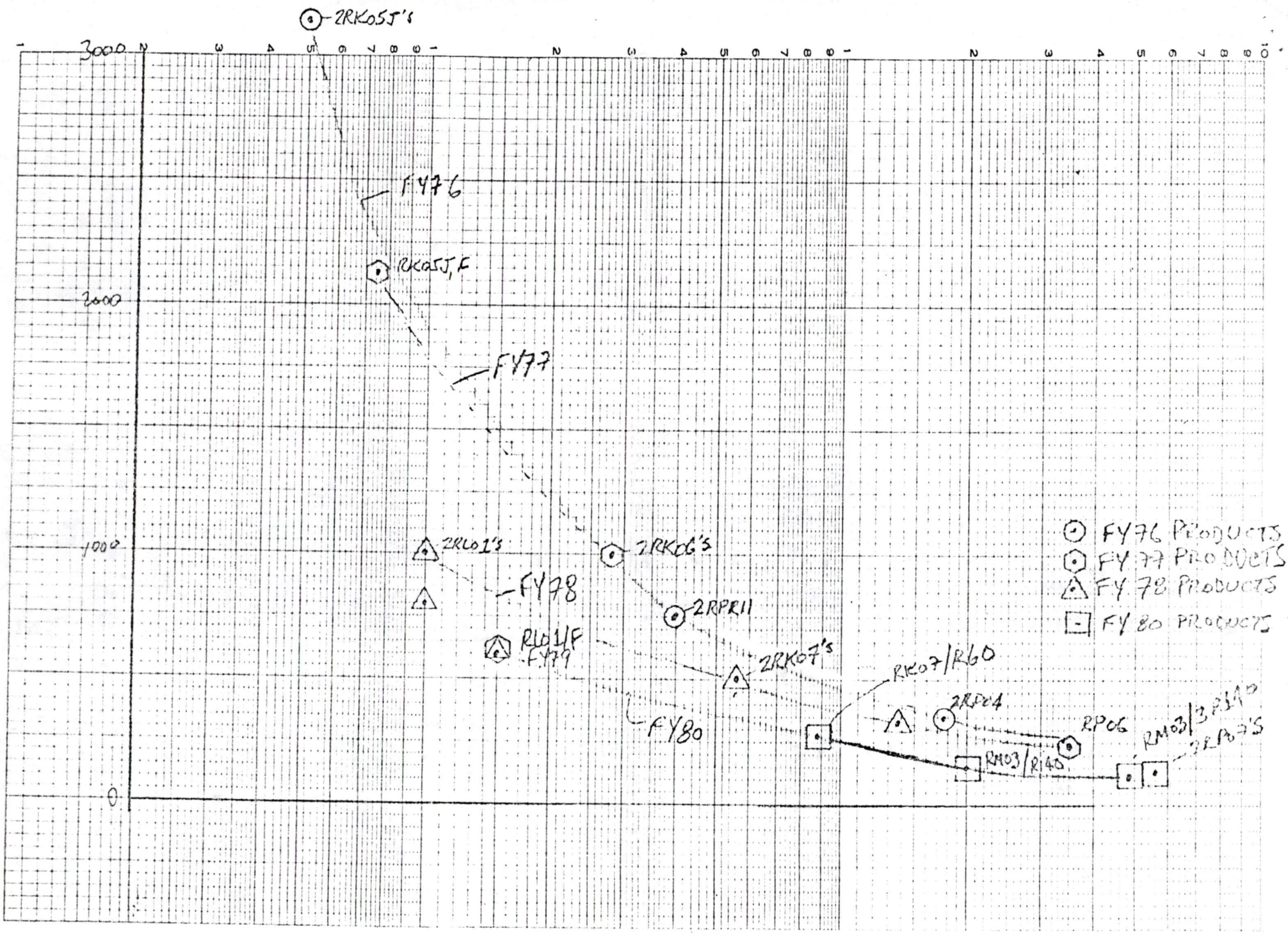
RP07

what is RM03 Controller at 784? page 24 Maxtron ads?

get rid of WF → WM

How do get more coupling among products.

RL04 ↔ R80 at same time.



DISK PRODUCTS LIST

FY76	RK05J	RPR02	RP04
Capacity	5	40	176
Price	$ 16K	$ 30K	$ 61K
Price/MB	$3200	$750	$346

FY77	RK05J/F	RK06	RP04	RP06
Capacity	7.5	28	176	350
Price	$ 16K	$27.5K	$ 64K	$ 83K
Price/MB	$2133	$ 980	$363	$237
% Change from 1976 Curve	-9%	-0-	-0-	-20%

FY78	RK05J/F	RL01	RK06	RK07	RM03	RP06
Capacity	7.5	10	28	56	134	350
Price	$ 16K	$ 10K	$27.5K	$ 25K(3.6X)	$ 38K(3X)	$ 83K
Price/MB	$2133	$1000	$ 980	$446	$283	$237
% Change from 1977	-	-44%	-0-	-29%	-29%	-

FY79	RL01	RL01/F	RK07	RM03	RP06	RP07
Capacity	10	15	56	134	350	520
Price	$ 8K	$ 9K	$ 25K	$ 38K	$ 69K	$ 75K (3X)
Price/MB	$800	$600	$446	$283	$197	$134
% Change from 1978	-	-40%	-	-	-17%	-42%

FY80	RL01/F	RK07	RK07/R60	RK07 ~~RM03~~/R140	2 RK07 6 ~~RM03~~/R140
Capacity	15	56	88	~~207~~ 168	93.4 ~~134~~ ~~487~~ 896
Price	$ 9K	$ 27K	$ 24K(4X)	$~~33.5K~~ 29.4K (3.6X)	$52.5K(4X)
Price/MB	$600	$482	$272	~~$157~~ 178	$ ~~187~~ 93.104
% Change from 1979	-	-	-30%	-43%	Same as RP(

(7) The R60 and R140 have potential to be significant additions to the Product Group. But control of cost objectives will be essential unless we want some ho-hum products. I would put these products in the same category as the LA36 and RL01 in terms of importance of unit cost control as a prerequisite to market success. Another reason why cost reduction of the RK07 is important is to insure that the RK07/R60 combination will have minimal price/MB ($200 cost reduction on RK07 may be easier than $200 on R60).

(8) The RM03 and three R140's fall right next to two RP07's, again highlighting the need for cost control on R140. "Replacing" RP07's with RM03 plus three R140's does not appear to be a foregone conclusion. Also, looks like the RP08 effort should start at 520 MB/spindle or better and not even bother with 260 MB/spindle unless a depopulated version of 520 MB is seen as necessary for compatibility, extending smartness downward, etc.

/bca

digital

INTEROFFICE MEMORANDUM

TO: Grant Saviers, Mike Riggle, Kevin Smith, Wayne Galusha, Ken Sills, Phil Arnold, Bob Jack

DATE: March 24, 1977
FROM: Steve Orr
DEPT: Disk Products
EXT: 6439
LOC/MAIL STOP: ML1/E58

SUBJ: PRICE/MB OF DISKS - POSSIBLE MEASURE OF MARKET SUCCESS

NOTE: This is in no way a comment on Pricing or Profit of Disks.

Attached are price/MB point plots of our disk products connected by a curve for a given year.

If we say that (1), a product that fills a gap along the curve in a given year is one (less significant) indicator of a product potential success and that (2), introducing a product below the curve is a second (more significant) indicator of a product's success. Then we may draw some interesting observations.

(1) The curve has not moved down at all in either FY76 or FY77. The one exception is the RP06 with a 20% price/MB.

(2) The RL01, as no surprise to anyone, offers a significant price/MB reduction of 44%.

(3) The RK06 may appear to the customer only as a gap filler. The RK07 (RK06D) offers a 29% price/MB reduction from previous curve at $25K for two drive subsystem. Cost reduction of the RK06/RK07 should be undertaken to insure product cost gets to $2300 (or better) for the RK06 and $2500 (or better) for the RK07 leaving Westfield to allow aggressive pricing.

(4) RL01F and an RL11/RL01 subsystem price reduction in FY79 represents another significant contribution to the low end, moving the curve down at that end by 40% from the prior year.

(5) At $38K for two drive subsystems, the RM03 falls 29% below the previous curve. This aggressive pricing forces the RK07 price margins down if both are to coexist. Again citing the need for cost reduction effort on the RK06/07.

(6) The RP07 represents a significant increase in our offering. It moves the curve down by 42% and extends the high end somewhat.

42

300

Gordon—

Size of programs seems to be something everyone "wants" to forget. To accurately trace utility and language size will take a few hours. The project has started. We'll need to plug in firm numbers later.

5.1 = 1.7
6.5
4.8 = 7.5

Note: original of sketch returned Gordon

Digital Interoffice Memo

Subject: COMPLETE FAMILY TREE AND HOW MANY DISKS/TAPES?

To: Bob Puffer, Grant Saviers, Ken Sills, Kevin Smith

Date: 11 MAY 77
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

F/U 5/18

Could you get the dates to make a tape, fixed head, moving head family tree for cpu's? (It would go back to the PDP-1.) For disks the axis probably should be approximately log (bytes) and tape it would be density.

The tree shows relationships: the start of a branch is the start of a project; the module is FCS; and the terminals its death.

From this figure we should get some understanding about product life, number of disks, time to market, etc.

The attached memo forms the question and presents a metric for cpu's. In looking at the disk strategy another metric |d(disk)|/dt is needed together with the average age/disk. The time disk strategy is also attached and the metrics are given. It's clear we must have more idealistic goals:

1. Disks have to be separated > x2 (and preferably x3) in capacity from one another. (See the range/disk)

2. A new disk must replace an old one based on a cost/performance metrics of 41% for high end (x2 each 2 yrs.) and at least 26% for low end (x2 each 3 yrs.)

3. Disks should have a lifetime of more than 3 years.

Can we plot these metrics?

Mid 79 the picture (from the time line) is, for example:

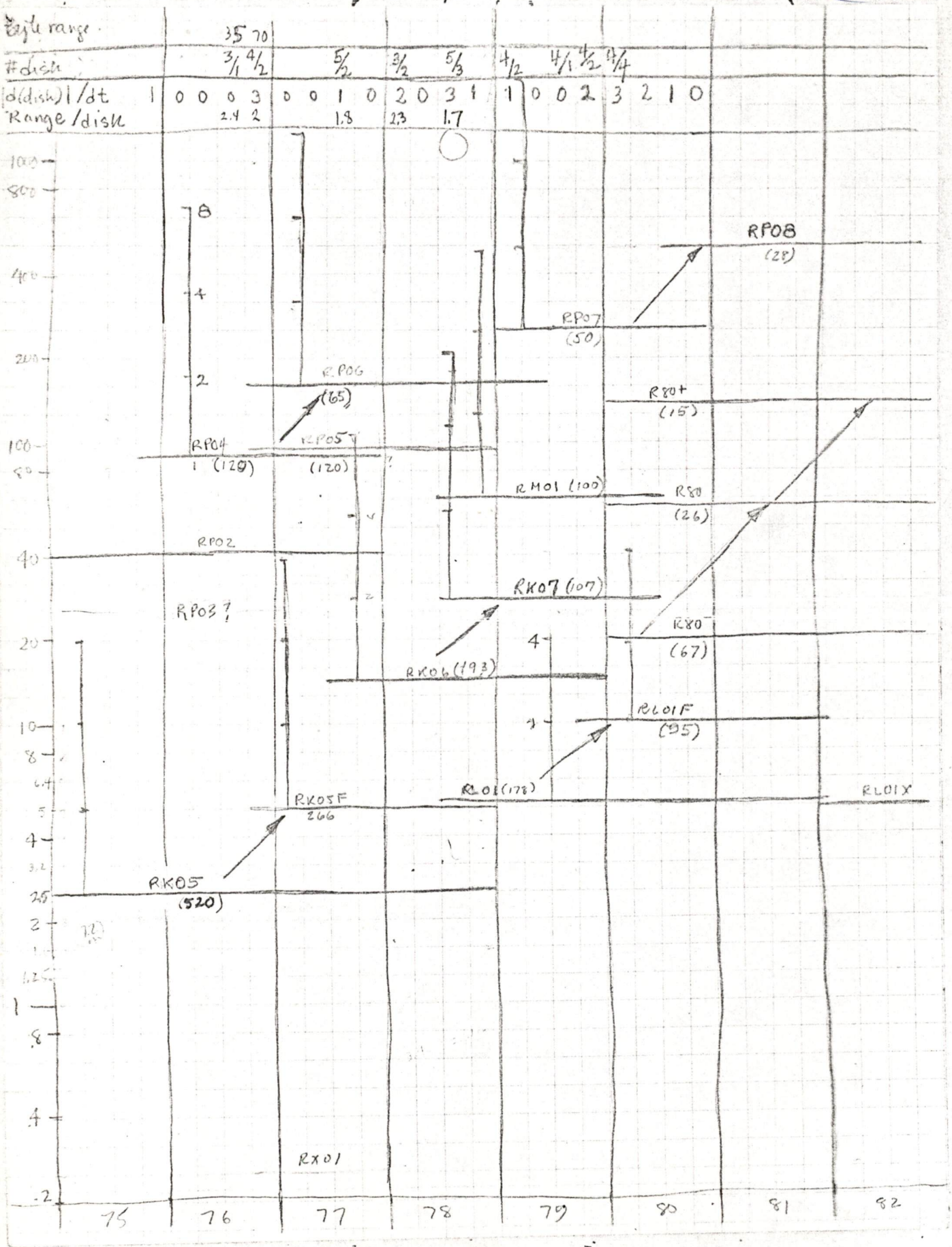
Disk	Size	Factors
RL/RK	5	
		x2
RL01F	10	
		x1.4
RK06	14	
		x2
RK07	28	
		x2.4
RM03	66	
		x1.33
RP05	88	
		x2
RP06	176	

$$\text{Range/Disk} = 2 \times 35.2^{\frac{1}{7}} = 2.02$$

(This doesn't look good! Is it correct?) Is it clear why we shouldn't have so many?

GB:ljp

(original attached)



Digital Interoffice Memo

Subject: How Big Is the cpu Family?

To:			Date:	5 JAN 77
	OOD	M/C	From:	Gordon Bell
	Paul Bauer	Janice Carnes	Dept:	OOD
	Ed Corell	Bruce Delagi	Loc.:	ML12-1 Ext.: 2236
	Howard Fineman	John Levy		
	Ken Olsen	Grant Saviers		
	Steve Teicher	Mike Tomasic		

This is a suggestion for a presentation to the board presenting our cpu, disk, printer, etc. families in terms of ranges.

Ken has been suggesting we either cut machines or explain why there are so many. Since I can't bear to part with members of the family, I was able to rationalize that we have the right number of machines...as compared with IBM. (And with what I think users need.) Ironically, I took IBM to task in 1970 for having too many models...(7 or 11). I proposed only three by using multiprocessors.

The 04/34 and 45/55 pairs are considered as 1 machine each. The LA36/180/120 is similar. This is a significant innovation in design technology and it may be the best way to approach designs in other areas (e.g., tapes, disks, some software). In this way we get 2 products with 1 effort and set of plans!

IBM's strategy on the 360 was to have a factor of:

-- X 2 gap in price to separate the models
X 3 gap in performance

$3/2$

This means perf = k X cost

See Bell/Newell p587 for analysis/data (attached)

Note

Models 20 - 91 Price (mins) 1:105
Price (avgs) 1:65
Price (min-min to max of max) 1:125?

20 - 91 Perf 1:300 (probably high)

Models 20, 25*, 30, 40, 44*, 50, 65, 75, 85*, 91, 95**

* later or ** special model

7 or 10 (or 11) models depending how you count

$125 = 1.99^{7}$ <--- original plan

$125 = 1.6^{10}$ <--- what got sold (neglecting #95)

$65 = 1.36^{2}$ = 300 <--- should be 2 for Grosch's law to hold

---

Note we do a better job now then IBM did on 360! Current 11's

	Range	Issues Range	Original 20
1.	03	10-20	11/20 - (20-50K)
	04	20-30	
	34	40-80	
	45	45-75	$1.7^6 = \frac{250}{10}$
	55	60-100	
	70	90-250	or

$2.25^4 = 25$

6 machines
or
4 machines if we count 04/34 and 45/55 as one. The PDQ will replace 45/55.

2. Factor of 2 in price is probably all a single machine can do.

Therefore $25^{3/2} = 125$ performance factor we should have. We get 70 for plain Fortran...but probably more when it's floppy vs. RP06.

3. Can't do all designs at one time! (This causes more models, less separation.) In essence there always has to be phasing blips.

4. Must treat 8, 10, 11 as separate, possible competitive, product lines - like Chevy, Olds, Cadillac. Each have a range and a set of customers that move across the range.

5. Engineering resources = f(range, volume, # systems).

6. Our planning is more complex because we may sell at 2 or 3 levels of integration (i.e., chips, boards, box, box + software).

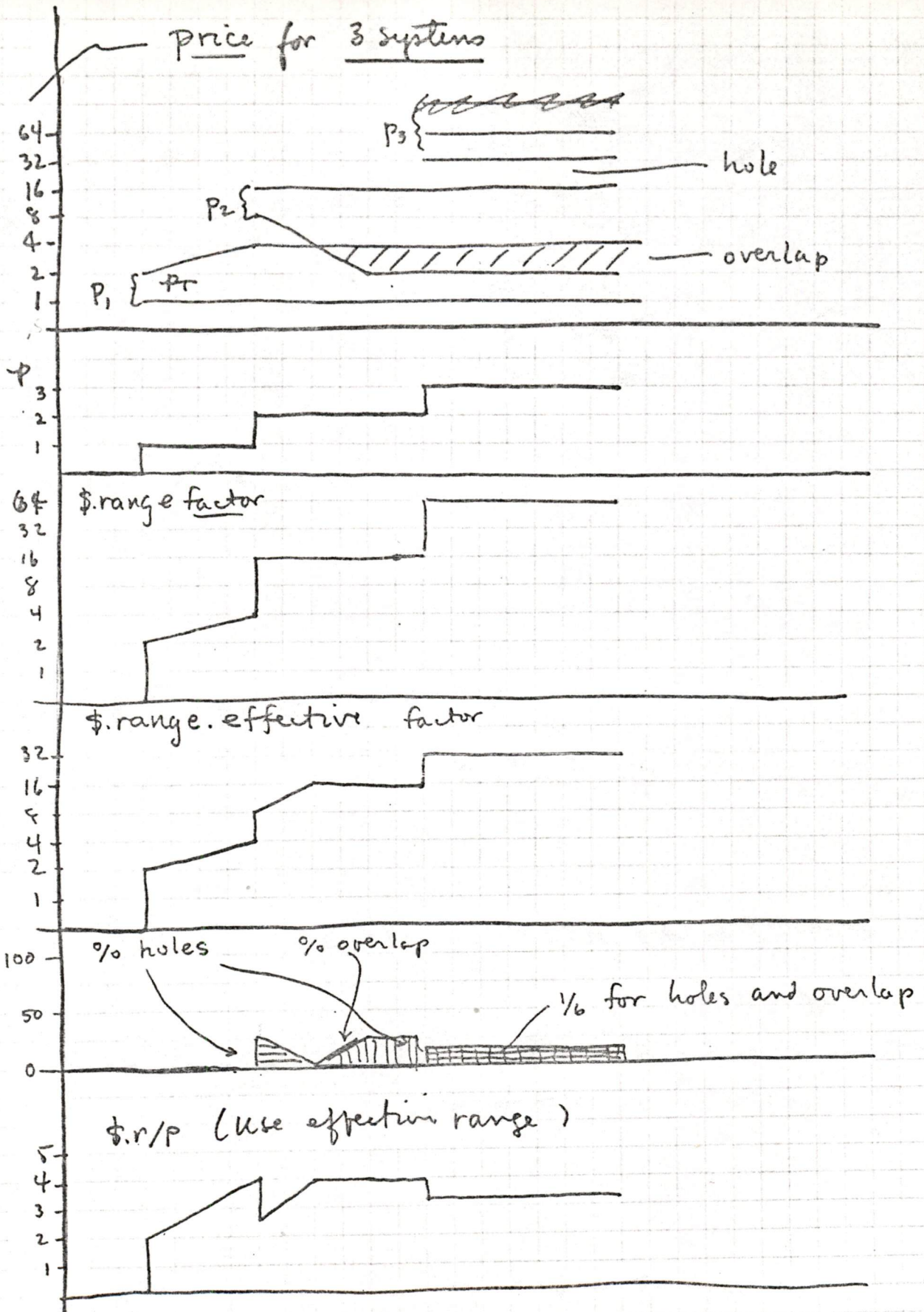
The attached metrics are ones I'd like to use for measuring range(t) for all products - disks, cpu's, printers, etc. We can measure each family and all the machines. Note, we can get >100% overlap.

$.range - from lowest price to highest price includes holes

p - # of processors or units in catalog

$.range.effective - subtracts holes (e.g., 11-10 gap) in range to get an effective coverage

$.r/p = $.range 1/p



GB 1/2/77

digital

DIGITAL EQUIPMENT GMBH

DATUM:

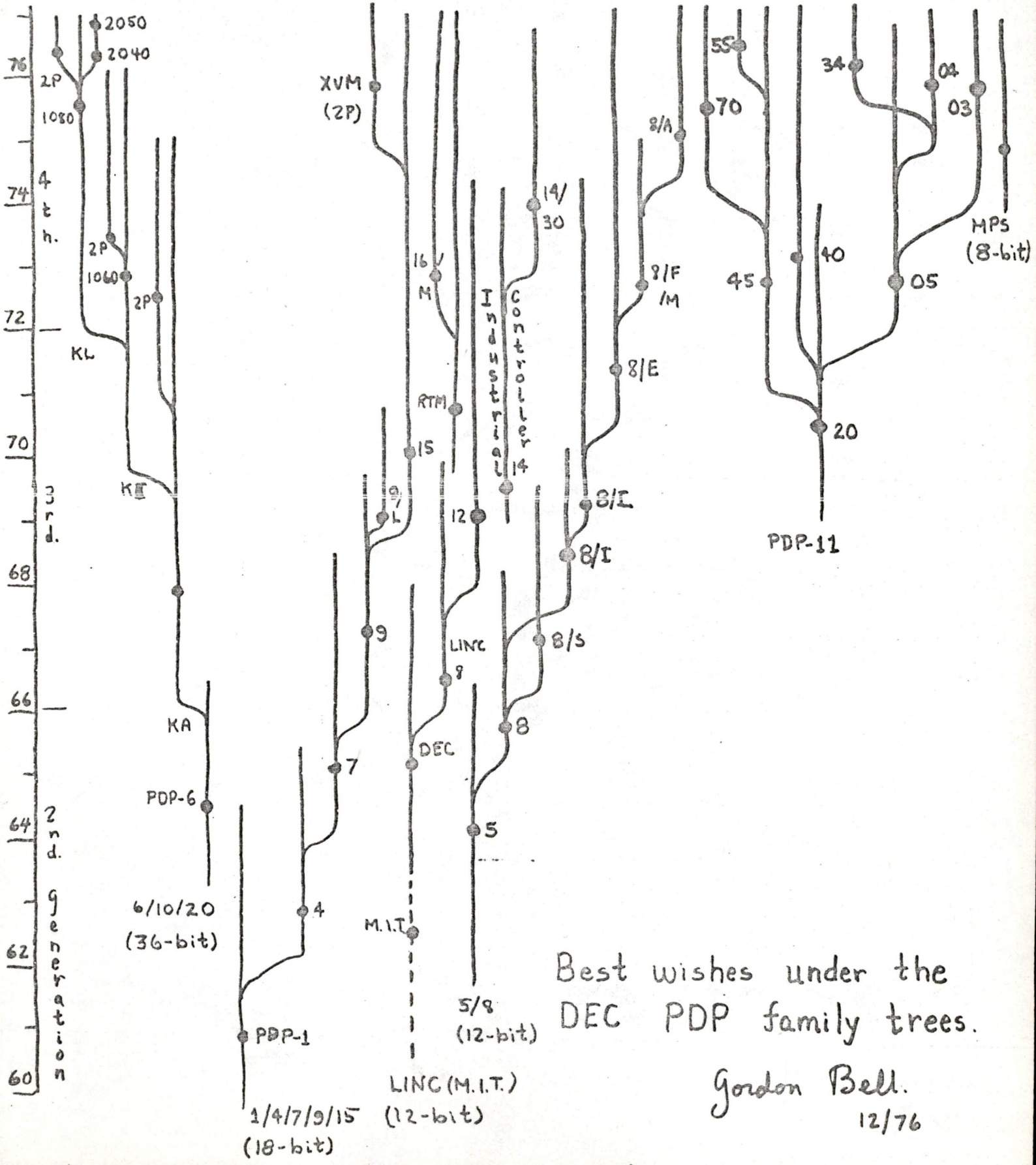
Note, there is a similar set of measures for performance.

%-overlap = log ($.overlap diff.)/log ($.range)

%-holes = log ($.holes)/log ($.range)

GB:ljp

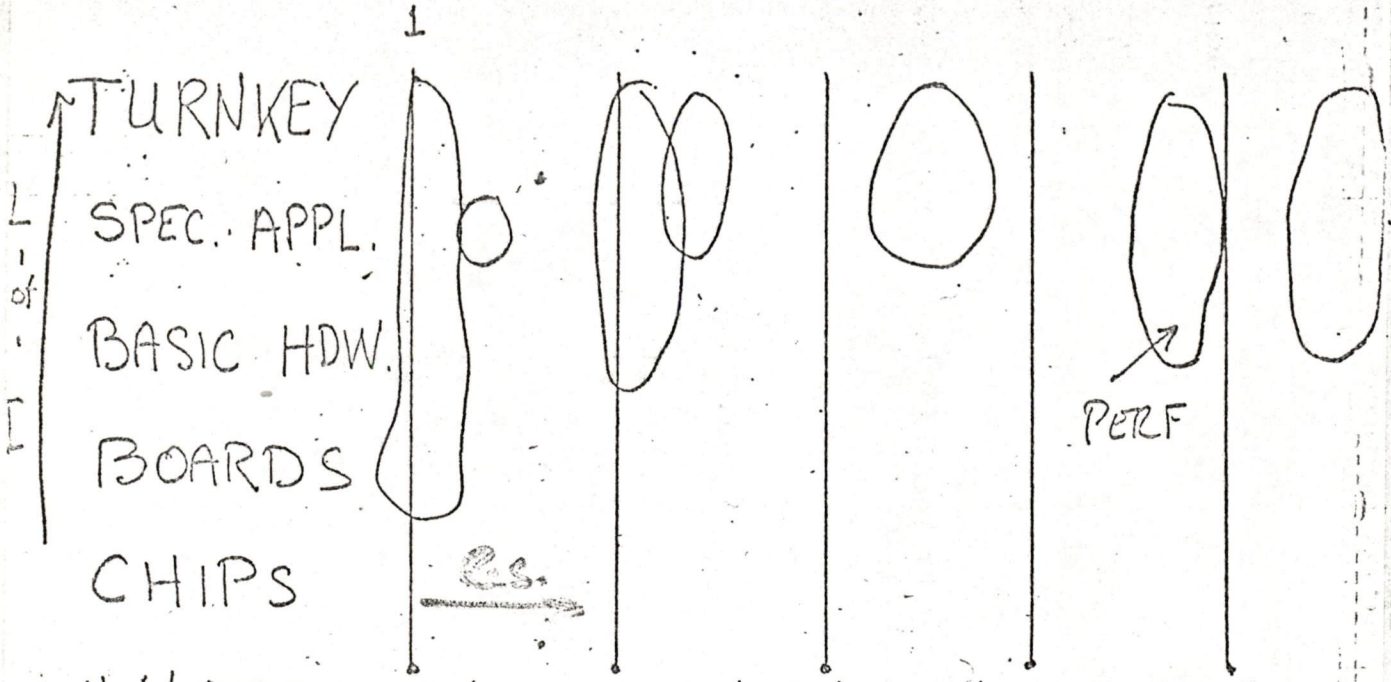
Attachments



Best wishes under the DEC PDP family trees.

Gordon Bell.
12/76

GEN. → Purp



PRICE	.6-10	2-20	10-50	30-150	50-250
PERF. (Basic)	1	2	4	10	20
Perf. (Sci)	3	1	5	40	70
Perf ~ Price^2	1	4	25	225	625
Perf ~ Price$^{\frac{1}{2}}$	1	2	5	15	25

Mem. size: (1) 4K-28KW ... -128KW (32) (256) 1MW

Table 4 IBM System/360 Pc (power: cost) and an alternative design based on multiprocessors

Given			Proposed multiprocessor alternatives			
model	Pc.power	Pc.cost	Quantity.Pc	Pc.model	Pc.power	Pc.cost
20	1	0.00049	1	25	1.5	0.0005
25	1.5	0.00050	1	25	1.5	0.0005
30	2	0.0013	2	25	3	0.001
			2	20	2	0.00098
40	6	0.003	4	25	6	0.002
			6	20	6	0.00294
44	30	0.0041	1	44	30	0.0041
50	15	0.012	1	44	30	0.0041
65	63	0.022	2	44	60	0.0082
75	92	0.037	3	44	90	0.012
			2	65	126	0.044
85	252	0.087	8	44	240	0.033
91	314	0.091	11	44	330	0.045

s between a 4 × 1 power processor and 20 power processor. The largest gap in the System/360 is a factor of 3 between Models 30 and 40.

Conclusions

The IBM System/360, by achieving a production record, has fulfilled its principal design objective. The technical goals, however, are of interest to us here. The most interesting aspect of the design is achieving a performance range of 314 to 1 over a series of models, with a primary-memory size range of 2,048 to 1 for various computer configurations. Thus a user is given a very large set of configuration alternatives. The SLT technology, though not integrated-circuit, is certainly of the third generation. Using SLT the fabrication of the models is superb.

There is a vast array of secondary-memory and terminal devices to couple with almost any other system. The System/360 is the first computer to make extensive use of microprogramming. Microprogramming is used for the definition of the System/360 instruction-set processor, but, more important, microprograms define previous IBM computers so that a user can operate satisfactorily during the interim period when older programs are being updated to use the System/360. There are provisions for multicomputer structures. Within a single computer structure there is adequate means of peripheral switching so that reliable and high-performance structures can be assembled. Early structures do not provide multiprocessing; we have suggested multiprocessing as a technique to achieve the same performance-range objectives. The io processor, though rather elaborate, provides a certain commonality.

The instruction-set processor for the System/360, based on a general-registers structure, appears to be overly complex, yet incomplete, because there are so many data types. The addressing mechanism and lack of multiprogramming ability make the System/360 a hard machine to appreciate fully. Although we praise microprogramming as a means of accomplishing compatibility with the past, it appears to stand in the way of getting the most performance from the hardware. Perhaps of most significance, the System/360 may have a greater lifetime than any past computer.

Selected Bibliography

Architecture and logical structure: AmdaG64a (TeagH65)[1], BlaaG64a[2], BlaaG64b[2]; General implementations: AmdaG64b[2], CartW64, PadeA64[2], StevW64[2]; Microprogramming: GreeJ64, TuckS67, WebeH67; Formal description of Pc[5]: FalkA64[2]; Performance and reviews: HillJ66, SoloM66; Model 40 modifications for multiprogramming: LindA66; Model 67: ArdeB66, FikeR65, GibsC66, LaueH67; Model 85: ContC65[3], LiptJ65[3], PadeA65[3]; Model 91 architecture and technology: AndeD67[4], AndeS67[4], BolaL67[4], FlynM67[4]a, LangJ67[3], LloyR67[4], SechR67[4], TomaR67[4]; Model 92 (proposed): ContC64 (GrimR65a), AmdaG64c (GrimR65b), ChenT64 (GrimR65c); Serviceability: CartW64; Other references: AdamC62, CorbF62, GrosH53, SharW69, WilkM65; IBM reference manuals: IBM System/360 Functional characteristics manuals for each model, IBM System/360 Configurator (diagram) for each model, A22-6821-4 IBM System/360 Principles of Operation, A22-6810-8 IBM System/360 System Summary

[1] ( ) denotes the review of previous article.
[2] *IBM Systems Journal*, vol. 3, nos. 2 and 3, 1964.
[3] *IBM Systems Journal*, vol. 7, no. 1, 1968.
[4] *IBM Journal of Research and Development*, vol. 11, no. 1, January, 1967.
[5] Given in A Programming Language/APL [Iverson, 1962].

DISK STRATEGY

Change

- 0 → RM01 ; 0 → RP04
- {RP05, RP06} → Memorex Mfg.
  (eliminate WF, WM chain)

Priority

- RK07F is highest priority
- RL01F is 2nd highest "
- R80 is 3rd highest
- Eliminate all other projects until these projects are staffed and managed to Schedule.

Speed up?

digital

INTEROFFICE MEMORANDUM

TO: Gordon Bell
Ken Sills
Mike Riggle

DATE: June 1, 1977
FROM: Grant Saviers
DEPT: Disk Products
EXT: 2357
LOC/MAIL STOP: ML1/E58

SUBJ: A SIMPLE MODEL OF MAKE VERSUS BUY DISK ENGINEERING

ASSUMPTIONS:

1. We have a goal of being competitive and self-sufficient.
2. Consequence to (1), Advanced Development should be about 20% of total spending.
3. A competitive "make" product costs $4 million per year including components, pack, drive, diagnostics and subsystem, and a midlife "kicker" and has a three-year life.
4. An innovative, cost competitive "buy" product costs $1 million per year for vendor selection, diagnostics, and the subsystems.
5. If we made everything, three products (small, medium, large) give adequate coverage of the range.
6. It takes 1.5 "buys" to cover the range of one "make."
7. Administration and Product Management are overheads included in project spending.

			START- ANNUALIZED RATE
ZERO MAKE			
1.5 X 3 X Buy	=	$ 4.5M	Q3 FY'76
ONE MAKE			
1 X Make	=	$ 4.0M	
1.5 X 2 X Buy	=	3.0M	
Adv. Dev.	=	1.7M	
		$ 8.7M	Q1 FY'78
TWO MAKE			
2 X Make	=	$ 8.0M	
1.5 X 1 X Buy	=	1.5M	
Adv. Dev.	=	2.5M	
		$11.0M	Q2 FY'79
THREE MAKE			
3 X Make	=	$12.0M	
Adv. Dev.	=	3.0M	
		$15.0M	Q3 FY'80

Budget assumptions:

FY'78 @ $9.8M
20% growth in FY'79
25% growth in FY'80

COMMENT

"Competitive" is used to imply on-the-heels-of IBM, or better than or equal to Memorex, CDC and ISS.

This model is one way to answer the question "What does it take?"

With the current budget growth guidelines, thinking about making large disks in addition to small and medium, is wishful thinking. We should tell the Product Lines this.

To the extent that our current "make" products are not "competitive," they cost less to develop (e.g., DG's RP04).

Inflation, decentralization, phased programs, increased emphasis on DMT and MTBF will probably continue to escalate development costs at 10 to 20%/year.

Therefore, the START dates are optimistic.

/nlh

digital

INTEROFFICE MEMORANDUM

TO: Gordon Bell

CC: Bob Puffer
Ken Sills
Kevin Smith

DATE: May 13, 1977
FROM: Grant Saviers
DEPT: Disk Products
EXT: 2357
LOC/MAIL STOP: ML1/E58

SUBJ: DISK FAMILY TREE AND RANGE

Your range analysis for our disk products seems inconsistent with the previous analysis that you did in January for the CPU family. I would argue that since "the 04/34 and 45/55 pairs are considered as one machine each," it is unfair to consider the RL01/RL01F, RK06/RK07, and RP05/RP06 as six members as opposed to three. I haven't gone and done it but I think I could show that there are fewer wires, etch changes and parts different between these disk pairs than the CPU pairs. The CPU analysis doesn't consider also all of those options designed to extend the range of a machine. How should one consider EIS, CIS, warm floating points and hot floating points? Some of these are fairly large chunks of hardware certainly bigger than the hardware differential between some of the disk pairs.

I conclude that we have four products in mid-79 covering a capacity range factor of 35X. A factor of 35 is 2.43^4 as compared to our CPU range of 25X or 2.25^4.

I agree that we need more idealistic goals and should be more aggressive in pursuing technology improvements. Ken Sills will plot the metrics you requested.

/nlh

Grant

Digital Interoffice Memo

Subject: COMPLETE FAMILY TREE AND HOW MANY DISKS/TAPES?

To: Bob Puffer, Grant Saviers,
Ken Sills, Kevin Smith

Date: 11 MAY 77
From: Gordon Bell
Dept: OOD
Loc.: ML12-1 Ext.: 2236

FILE
REPLY

F/U 5/18

Could you get the dates to make a tape, fixed head, moving head family tree for cpu's? (It would go back to the PDP-1.) For disks the axis probably should be approximately log (bytes) and tape it would be density.

The tree shows relationships: the start of a branch is the start of a project; the module is FCS; and the terminals its death.

From this figure we should get some understanding about product life, number of disks, time to market, etc.

The attached memo forms the question and presents a metric for cpu's. In looking at the disk strategy another metric |d(disk)|/dt is needed together with the average age/disk. The time disk strategy is also attached and the metrics are given. It's clear we must have more idealistic goals:

1. Disks have to be separated > x2 (and preferably x3) in capacity from one another. (See the range/disk)

2. A new disk must replace an old one based on a cost/performance metrics of 41% for high end (x2 each 2 yrs.) and at least 26% for low end (x2 each 3 yrs.)

3. Disks should have a lifetime of more than 3 years.

Can we plot these metrics?

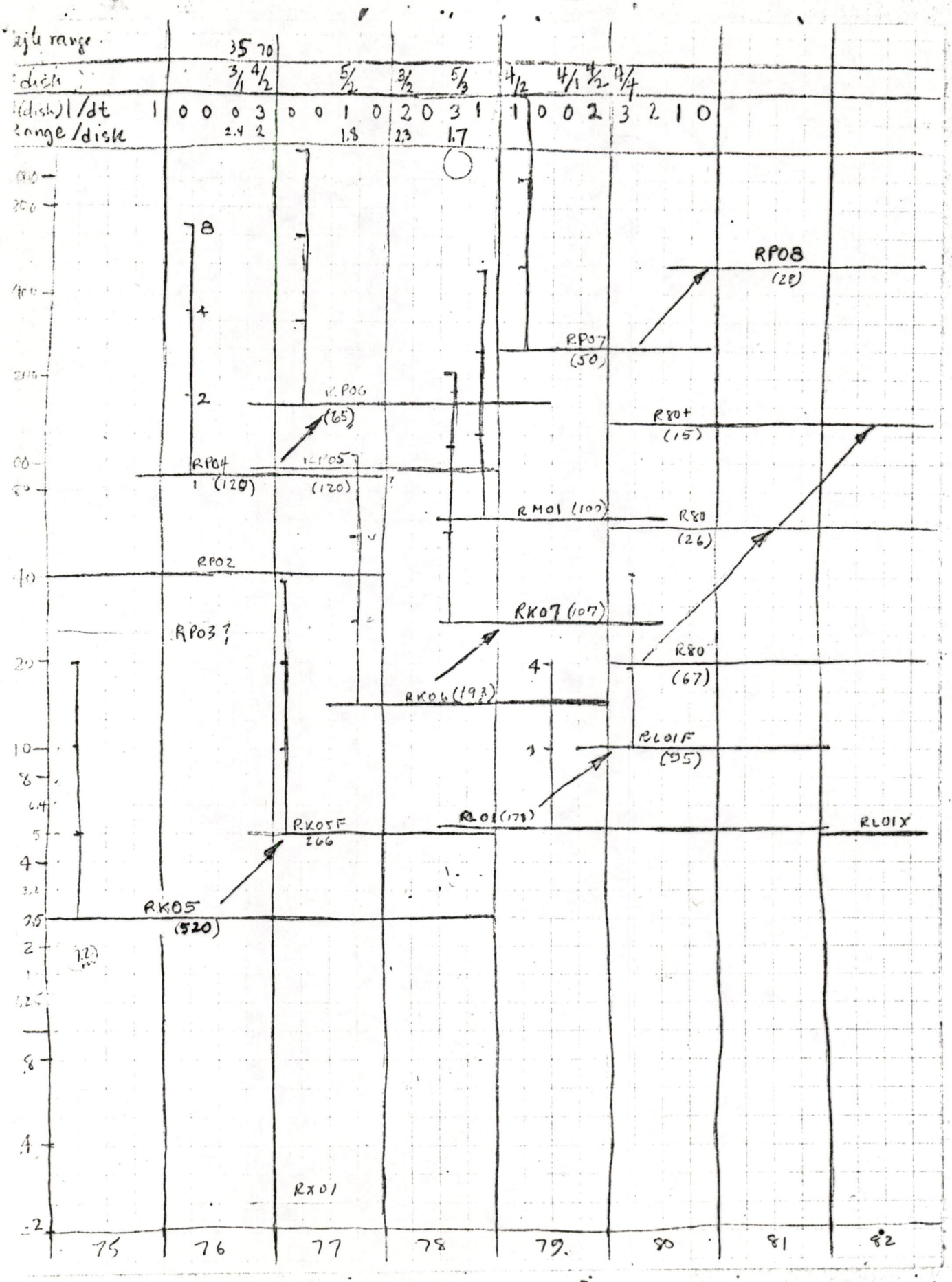
Mid 79 the picture (from the time line) is, for example:

Disk	Size	Factors
RL/RK	5	
		x2
RL01F	10	
		x1.4
RK06	14	
		x2
RK07	28	
		x2.4
RM03	66	
		x1.33
RP05	88	
		x2
RP06	176	

$$\text{Range/Disk} = 2 \times 35.2^{\frac{1}{7}} = 2.02$$

(This doesn't look good! Is it correct?) Is it clear why we shouldn't have so many?

GB:ljp
Attachment


35 70
3/1 4/2 5/2 3/2 5/3 4/2 4/1 4/2 4/4
1 0 0 0 3 0 0 1 0 2 0 3 1 1 0 0 2 3 2 1 0
2.4 2 1.8 2.3 1.7
8
4
2
RP04
1 (120)
RP05
(120)
RP06
(65)
RP07
(50)
RP08
(28)
R80+
(15)
RM01 (100)
R80
(26)
RP02
RP03?
RK07 (107)
R80
(67)
RK06 (193)
4
RL01F
(95)
RL01 (178)
RL01X
RK05F
266
RK05
(520)
RX01
75
76
77
78
79
80
81
82

Attachment

Grant Saviers

Digital **Interoffice Memo**

Subject: How Big Is the cpu Family?

To:			Date: 5 JAN 77
	OOD	M/C	From: Gordon Bell
	Paul Bauer	Janice Carnes	Dept: OOD
	Ed Corell	Bruce Delagi	Loc.: ML12-1 Ext.: 2236
	Howard Fineman	John Levy	
	Ken Olsen	Grant Saviers	
	Steve Teicher	Mike Tomasic	

This is a suggestion for a presentation to the board presenting our cpu, disk, printer, etc. families in terms of ranges.

Ken has been suggesting we either cut machines or explain why there are so many. Since I can't bear to part with members of the family, I was able to rationalize that we have the right number of machines...as compared with IBM. (And with what I think users need.) Ironically, I took IBM to task in 1970 for having too many models...(7 or 11). I proposed only three by using multiprocessors.

The 04/34 and 45/55 pairs are considered as 1 machine each. The LA36/180/120 is similar. This is a significant innovation in design technology and it may be the best way to approach designs in other areas (e.g., tapes, disks, some software). In this way we get 2 products with 1 effort and set of plans!

IBM's strategy on the 360 was to have a factor of:

-- X 2 gap in price to separate the models
X 3 gap in performance

$3/2$

This means perf = k X cost

See Bell/Newell p587 for analysis/data (attached)

Note

Models 20 - 91 Price (mins) 1:105
Price (avgs) 1:65
Price (min-min to max of max) 1:125?

20 - 91 Perf 1:300 (probably high)

Models 20, 25*, 30, 40, 44*, 50, 65, 75, 85*, 91, 95**

* later or ** special model

7 or 10 (or 11) models depending how you count

$125 = 1.99$ <--- original plan

$125 = 1.6^{10}$ <--- what got sold (neglecting #95)

$65 = 1.36^{2}$ = 300 <--- should be 2 for Grosch's law to hold

---

Note we do a better job now then IBM did on 360! Current 11's

	Range	Issues Range	Original 20
1.	03	10-20	11/20 - (20-50K)
	04	20-30	
	34	40-80	
	45	45-75	
	55	60-100	
	70	90-250	

$1.7^{6} = \frac{250}{10}$

or

$2.25^{4} = 25$

6 machines
or
4 machines if we count 04/34 and 45/55 as one. The PDQ will replace 45/55.

2. Factor of 2 in price is probably all a single machine can do.

Therefore $25^{3/2} = 125$ performance factor we should have. We get 70 for plain Fortran...but probably more when it's floppy vs. RP06.

3. Can't do all designs at one time! (This causes more models, less separation.) In essence there always has to be phasing blips.

4. Must treat 8, 10, 11 as separate, possible competitive, product lines - like Chevy, Olds, Cadillac. Each have a range and a set of customers that move across the range.

5. Engineering resources = f(range, volume, # systems).

6. Our planning is more complex because we may sell at 2 or 3 levels of integration (i.e., chips, boards, box, box + software).

The attached metrics are ones I'd like to use for measuring range(t) for all products - disks, cpu's, printers, etc. We can measure each family and all the machines. Note, we can get >100% overlap.

$.range - from lowest price to highest price includes holes

p - # of processors or units in catalog

$.range.effective - subtracts holes (e.g., 11-10 gap) in range to get an effective coverage

$.r/p = $.range 1/p

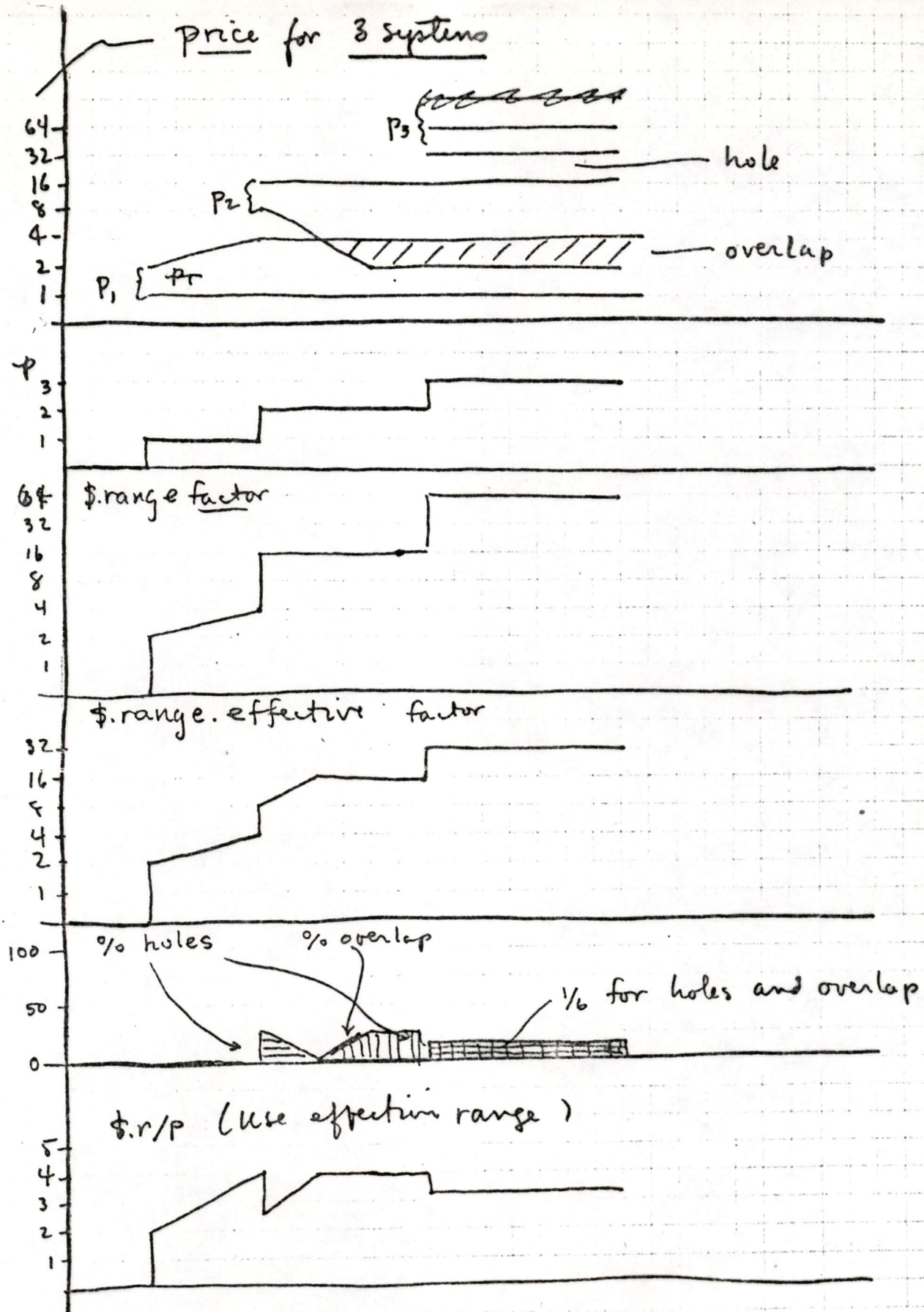
Note, there is a similar set of measures for performance.

%-overlap = log ($.overlap diff.)/log ($.range)

%-holes = log ($.holes)/log ($.range)

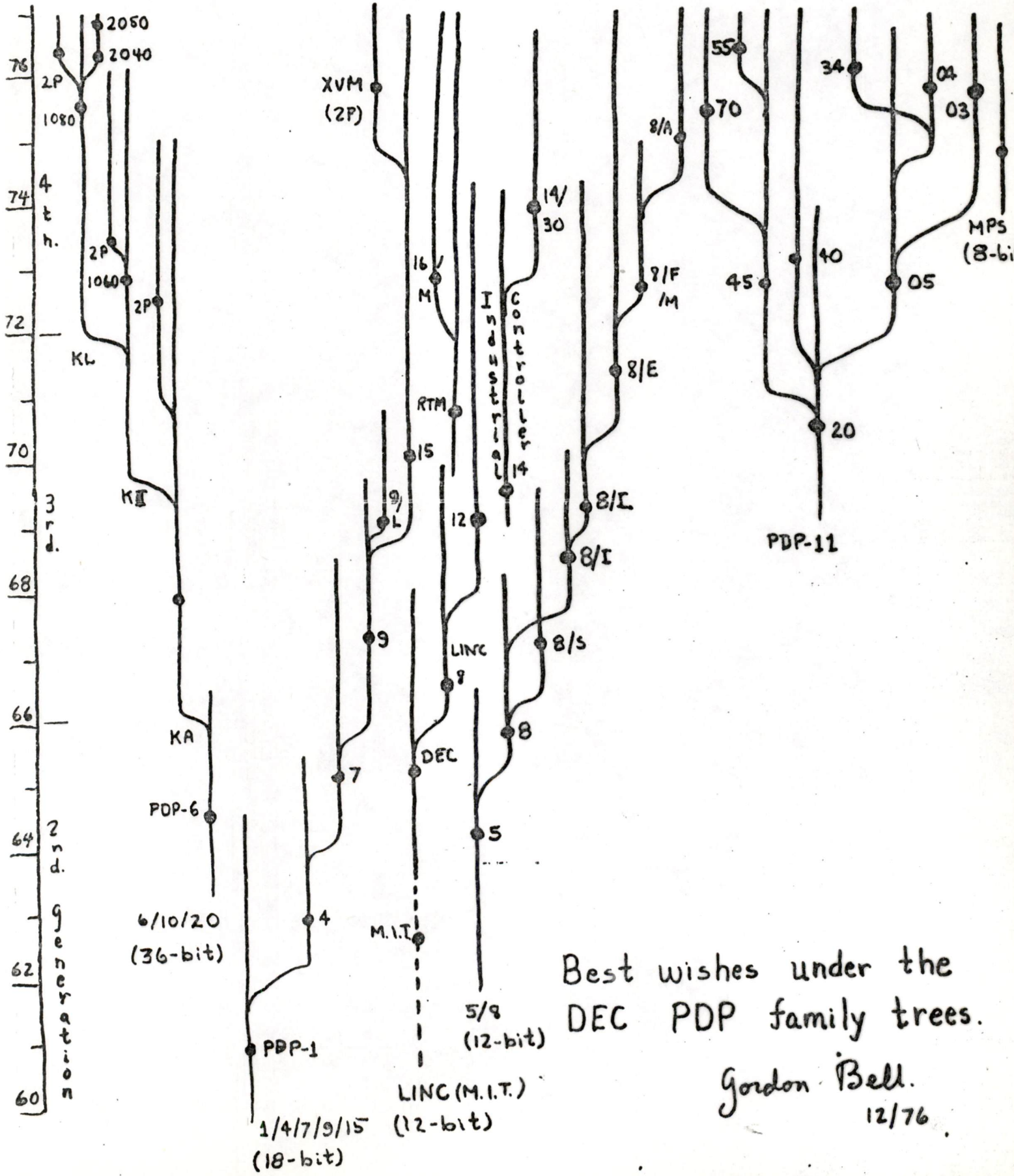
GB:ljp

Attachments



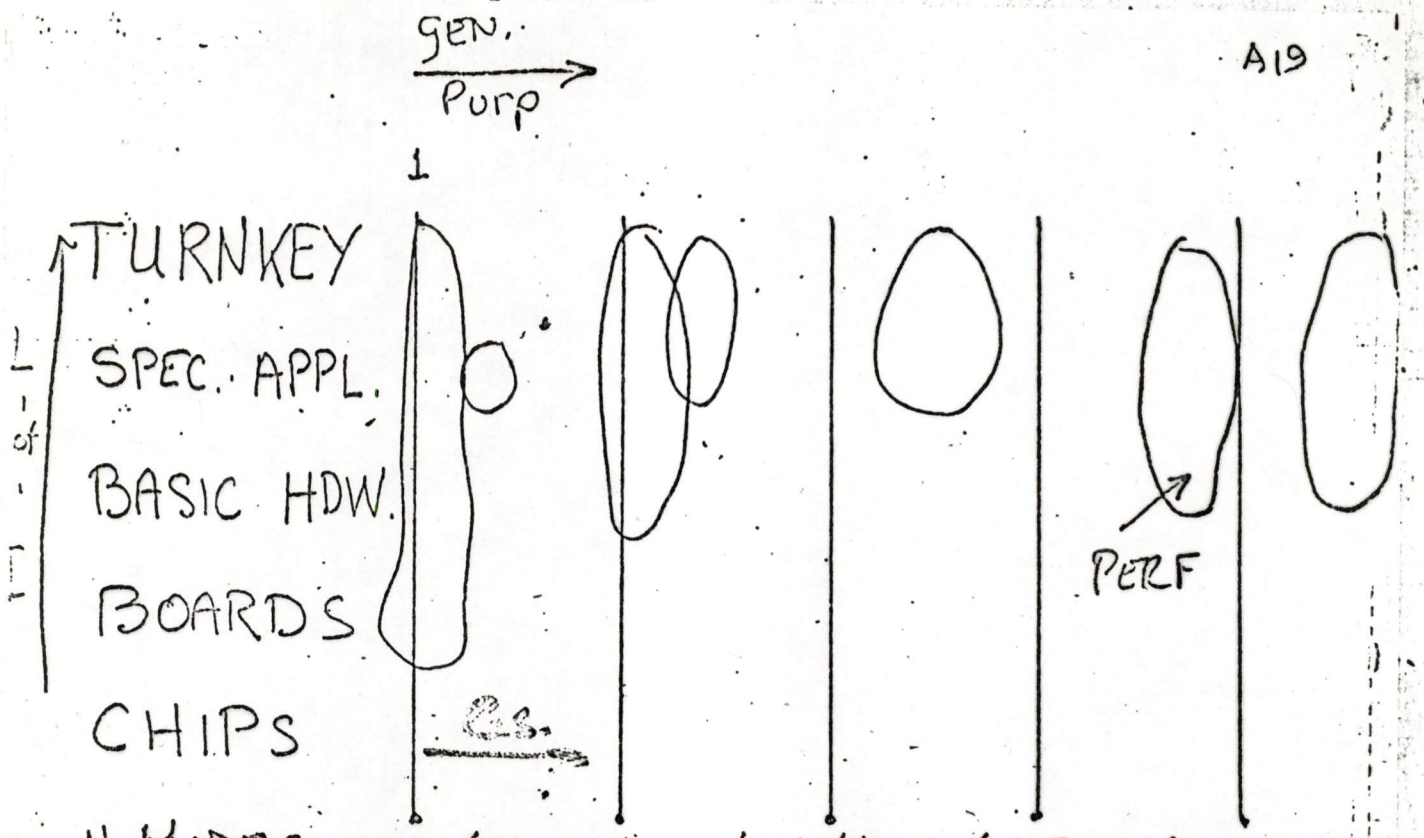
gB 1/2/77

digital
DIGITAL EQUIPMENT GMBH



Best wishes under the DEC PDP family trees.

Gordon Bell.
12/76



11 MODELS: 03 / 04 / 05 / 34 / 40 / 45 / 70

PRICE	.6-10	2-20	10-50	30-150	50-250
PERF. (Basic)	1	2	4	10	20
Perf. (Sci)	3	1	5	40	70
Perf ~ Price^2	1	4	25	225	625
Perf ~ Price$^{\frac{1}{2}}$	1	2	5	15	25

Mem. size: (1) 4K-28KW ... -128KW (32) (256) 1MW

Table 4 IBM System/360 Pc (power: cost) and an alternative design based on multiprocessors

Given			Proposed multiprocessor alternatives			
model	Pc.power	Pc.cost	Quantity.Pc	Pc.model	Pc.power	Pc.cost
20	1	0.00049	1	25	1.5	0.0005
25	1.5	0.00050	1	25	1.5	0.0005
30	2	0.0013	2	25	3	0.001
			2	20	2	0.00098
40	6	0.003	4	25	6	0.002
			6	20	6	0.00294
44	30	0.0041	1	44	30	0.0041
50	15	0.012	1	44	30	0.0041
65	63	0.022	2	44	60	0.0082
75	92	0.037	3	44	90	0.012
			2	65	126	0.044
85	252	0.087	8	44	240	0.033
91	314	0.091	11	44	330	0.045

between a 4 × 1 power processor and 20 power processor. The largest gap in the System/360 is a factor of 3 between Models 30 and 40.

Conclusions

The IBM System/360, by achieving a production record, has fulfilled its principal design objective. The technical goals, however, are of interest to us here. The most interesting aspect of the design is achieving a performance range of 314 to 1 over a series of models, with a primary-memory size range of 2,048 to 1 for various computer configurations. Thus a user is given a very large set of configuration alternatives. The SLT technology, though not integrated-circuit, is certainly of the third generation. Using SLT the fabrication of the models is superb.

There is a vast array of secondary-memory and terminal devices to couple with almost any other system. The System/360 is the first computer to make extensive use of microprogramming. Microprogramming is used for the definition of the System/360 instruction-set processor, but, more important, microprograms define previous IBM computers so that a user can operate satisfactorily during the interim period when older programs are being updated to use the System/360. There are provisions for multicomputer structures. Within a single computer structure there is adequate means of peripheral switching so that reliable and high-performance structures can be assembled. Early structures do not provide multiprocessing; we have suggested multiprocessing as a technique to achieve the same performance-range objectives. The io processor, though rather elaborate, provides a certain commonality.

The instruction-set processor for the System/360, based on a general-registers structure, appears to be overly complex, yet incomplete, because there are so many data types. The addressing mechanism and lack of multiprogramming ability make the System/360 a hard machine to appreciate fully. Although we praise microprogramming as a means of accomplishing compatibility with the past, it appears to stand in the way of getting the most performance from the hardware. Perhaps of most significance, the System/360 may have a greater lifetime than any past computer.

Selected Bibliography

Architecture and logical structure: AmdaG64a (TeagH65)[1], BlaaG64a[2], BlaaG64b[2]; General implementations: AmdaG64b[2], CartW64, PadeA64[2], StevW64[2]; Microprogramming: GreeJ64, TuckS67, WebeH67; Formal description of Pc[5]: FalkA64[2]; Performance and reviews: HillJ66, SoloM66; Model 40 modifications for multiprogramming: LindA66; Model 67: ArdeB66, FikeR65, GibsC66, LaueH67; Model 85: ContC68[3], LiptJ68[3], PadeA68[3]; Model 91 architecture and technology: AndeD67[4], AndeS67[4], BolaL67[4], FlynM67[4]a, LangJ67[3], LloyR67[4], SechR67[4], TomaR67[4]; Model 92 (proposed): ContC64 (GrimR65a), AmdaG64c (GrimR65b), ChenT64 (GrimR65c); Serviceability: CartW64; Other references: AdamC62, CorbF62, GrosH53, SharW69, WilkM65; IBM reference manuals: IBM System/360 Functional characteristics manuals for each model, IBM System/360 Configurator (diagram) for each model, A22-6821-4 IBM System/360 Principles of Operation, A22-6810-8 IBM System/360 System Summary

[1] ( ) denotes the review of previous article.
[2] *IBM Systems Journal*, vol. 3, nos. 2 and 3, 1964.
[3] *IBM Systems Journal*, vol. 7, no. 1, 1968.
[4] *IBM Journal of Research and Development*, vol. 11, no. 1, January, 1967.
[5] Given in A Programming Language/APL [Iverson, 1962].

digital

INTEROFFICE MEMORANDUM

TO: Bob Puffer

DATE: January 29, 1976
FROM: Grant Saviers
DEPT: Disk Products
EXT: 2357
LOC/MAIL STOP: ML1/E58

COMPANY CONFIDENTIAL

SUBJ: SUMMARY DISK STRATEGY

TECHNICAL POSITION - IBM has improved the areal recording density at 34% per year since 1963. Their large disk products have increased in capacity at this rate while the price has remained essentially flat at $25K per spindle. DEC's product technology lags IBM by two years for purchased disk products (RP's) and by 4.5 years for manufactured products (RK05 and RK06).

COMPETITION - Currently, 20% of the disks attached to DEC CPU's are not supplied by DEC. The lost business ranges from 40% in the OEM Product Line to 12% in end-user markets.

CURRENT PRODUCT STRATEGY - The current strategy is to build subsystems of multiple removable spindles separated by at least factors of four in capacity and two in cost.

FUTURE STRATEGY - We expect a strong industry wide move towards fixed media for larger capacity on-line storage because of cost and reliability advantages. Removable disk storage will dominate low-end systems for backup, off-line storage, and software distribution. Intermediate and large systems will require limited amounts of removable 70 to 100 Mbyte disk storage mixed with higher capacity fixed media storage.

Our goals are:

1. Technologically lag the 1963-1976 IBM technology trend line by less than 18 months with at least one buy product ASAP.

2. Manufacture low and medium capacity ($\leq$100 Mbyte) products with costs equal to components suppliers. Technology should lag IBM by less than 2.5 years by late 1979.

3. Upgrade our subsystems technology especially in the area of "familiness", upgradability, system performance, and RAS features.

4. Reduce corporate dependency on disk profits to permit realistic pricing of disk subsystems.

SHORT TERM PRODUCT TACTICS (<1.5 YEARS)

LOW END -1. Ship RK05F in Q4 FY76, subject to review of announcement and backlog impact.
2. Ship RSL in Q4 FY77. Stress meeting cost and schedule objectives.

MID RANGE-1. Ship RK06 in Q1 FY77.
2. Ship RK07 ASAP at 47 or 70 Mbytes.
3. Back up RK07 with a buyout able to ship in Q3 FY77. Defer RK07 versus buyout decision until Q2 FY77.

HIGH END -1. Ship RP06 in Q4 FY76.

INTERMEDIATE TERM PRODUCT DEFINITIONS (1.5 to 3 YEARS)

It is believed that very economical mid to high capacity fixed media products can be designed with 3350 technology (a la Memorex Maverick - an extended S/32 drive). Exploring the product space made practical by this technology is key before defining specifications and placing products.

LONG TERM PRODUCT DEFINITIONS

No meaningful statements can be made about products with an FCS in 1980 or later without substantial fundamental technological investigations.

BUSINESS FORECAST - Disk NOR is growing more rapidly than total NOR due to demand for increased capacity compounded by significant growth of the Commercial Product Lines. Data Base Management Software will add additional impetus that is probably currently underestimated by DEC forecasters.

DISK BUSINESS BY74-FY79

	ACTUAL		FORECAST			
	FY74	FY75	FY76	FY77	FY78	FY79
CORP NOR	422	533	730	970	1250	1620
CORP GROWTH	-	26%	37%	33%	29%	29%
DISK NOR	40.5	71.4	130	197	270	362
DISK GROWTH	-	75%	82%	52%	37%	34%
DISK NOR AS % CORP	9.6	13.4%	17.8%	20.3%	21.6%	22.3%
GROSS MARGIN	62%	60%	60%	60%	60%+	60%+
5% DISK NOR	2.0	3.57	6.5	9.9	13.5	18.1

All data is estimated by Disk Product Management.

1/2-Inch TAPE STRATEGY

The 1/2-inch tape objective is to offer a range of magtape commensurate with the disk and system products. This includes two high performance options (1600 and 6250 bpi) to appropriately support RP04, RP06, and RK08 products. Beyond that the 3850 technology will be evaluated from both technological and memory hierarchy standpoints. Below that performance area low-cost, low-performance tape systems will be produced to cover the minimum backup and I/O applications on a cost effective basis.

Strategy to be employed is to buy out technological advances (or joint venture) and develop replacements from the low end progressing as engineering and manufacturing expertise allow attractive financial return opportunities.

Tactics include: combining TU10/TU16 into a common drive (TU16 modified to incorporate common competitive design features) for long-term vacuum column Massbus offering; introducing performance and feature oriented buyout TU47 (75-125 ips with auto load); development of low-cost tension tape system to replace TU10 in low usage applications; buyout or co-venture a 125 ips 6250 bpi system. A three product offering can be achieved with two drives and three controllers only if we manufacture the TU47/TU6250 drive.

SMALL SYSTEM STORAGE STRATEGY

The objective in the small system storage area is to maintain our leadership position gained in the floppy disk area as the small system range extends.

The strategy is buy or license technological advances in floppies, develop the desk-top storage and explore DS310 successor requirements for larger low-performance storage.

Tactics include: evaluation of double density floppy disks; evaluate "Krypton" type storage requirements and determine viability of Nicoud floppy, cassette, cartridge, CCD, bubbles, and undertake development; evaluate requirements of multi-user Classic-type systems to determine viability of floppies, super-floppies, unfloppy, or RSL.

30,000

Bob Peyton
Tape Engineering
January 28, 1976

SECOND SOURCING

Tape Engineering employs second sourcing for common electromechanical components such as motors, solenoids, and brakes as a normal procedure. In addition, critical items, such as tape heads, are sourced in-house and outside. We generally dual source mechanical parts.

We generally do not plan to multiple source major peripherals but rather plan on supplanting them with in-house manufacture if warranted. This decision is based on risk/return analysis both objective and strategic. Risk factors include vendor viability, corporate product impact, cost to qualify or develop, and assets employed. Return factors include margins and profits, control of supply, upside demand safety, development of technology for next generation or unique product development and proprietary position.

The CalComp drive situation was a case in point where their long-term viability was in question, and an in-house development would provide excellent returns in all the above-mentioned categories. There also were no plug replacement vendors at the drive level interface. In the meantime demand forecasts increased above nominal expectations and deliveries got behind schedule. It was determined that the best way of building buffer stock and protect against their internal ploblems was to execute the previously negotiated license, buy kits from them and then from their vendors, and assemble the drives here. However, the primary emphasis was to help them succeed on their catch-up schedule with acceptable quality drives.

To this end we (1) temporarily provided on-site material control support,

(2) permanently are providing purchasing and QC support,

(3) provided more sophisticated test equipment for better yields,

(4) negotiated a large contract (at slightly higher price),

(5) given them larger firm delivery commitments,

(6) provided no charge-back repaire of defective drives,

(7) doing design testing and verification,

(8) made all levels of CalComp management aware of the critical nature of their success.

Our current plan to back them up (for the long term) is to evaluate the risk/return of either the license route (with reproduction of heavy tooling) or production of our in-house design.

#1248

digital

INTEROFFICE MEMORANDUM

TO: OPERATIONS COMMITTEE

DATE: January 29, 1976
FROM: Bob Puffer
DEPT: Hardware Development
EXT: 2863
LOC/MAIL STOP: ML1/E38

SUBJ: Tape & Disk Family Strategy

Attached is a chart showing our current and proposed disk and tape offerings out through the end of FY79. The chart is organized to show the disks with the tape units that complement them. Also attached are summaries of our disk and 1/2-inch tape strategies, our second sourcing strategy, and a brief report on the efforts we have been making to insure CalComp's success in supplying us the floppies we need while at the same time guarding against their failure via an in-house licensing program.

rml
Att.

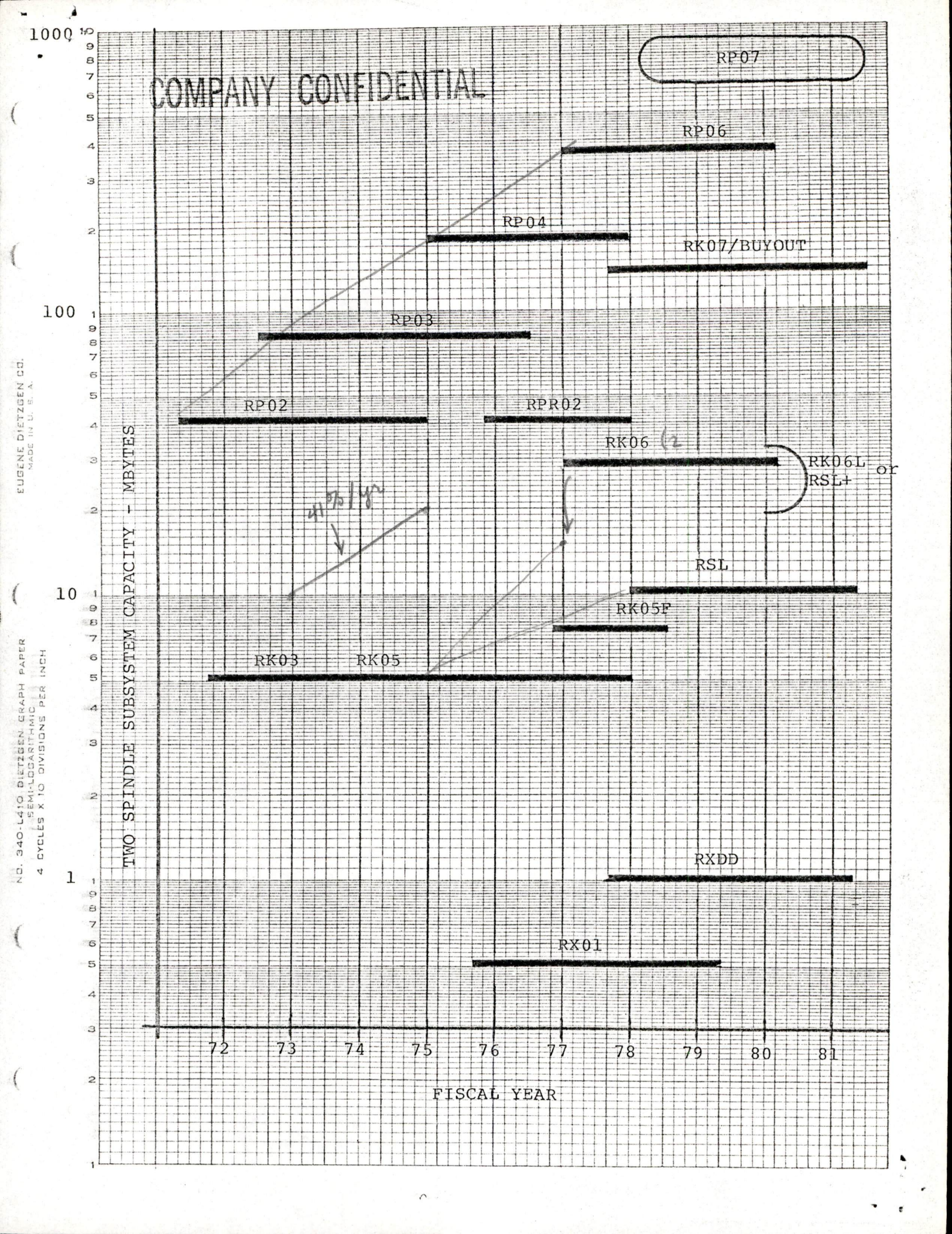
Bob

DISK & TAPE FAMILIES

TWO DISK CAPACITIES, MBYTES

FCS	.5-1	5-10	20-40	140-180	210-350	600-1200
1/76	RX01	RK05 / TU10 (TS03)	RPR02 / TU16	RP04 / —	—	— / —
7/76	RX01 (license)	RK05F	RK06 / TU16	/ —	RP06 / TU70	— / —
1/77	RX01 (Make)			/ TU47		— / —
7/77		RSL / TS04	TS04	Buyout (RK07)		— / —
7/78	RX02 (Double Density)		RSL+		TU6250	RP07 Buyout / ?
7/79					RK08	/ ?

Note: — indicates a product gap


COMPANY CONFIDENTIAL
TWO SPINDLE SUBSYSTEM CAPACITY - MBYTES
1000
100
10
1
RP07
RP06
RP04
RK07/BUYOUT
RP03
RP02
RPR02
RK06
RK06L
RSL+
or
RSL
RK05F
RK03
RK05
RXDD
RX01
72
73
74
75
76
77
78
79
80
81
FISCAL YEAR
EUGENE DIETZGEN CO.
MADE IN U.S.A.
NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

STORAGE

ACTION ITEMS FROM LAST REVIEW

1. STOP TA78 ? - NOT RECOMMENDED

   - IMPACT TO -3B RELEASE, NO TA81 IN TIME FOR CODE FREEZE
   - 2 TO 1 PERFORMANCE Δ

2. STOP RX52, RX50H ? - RECOMMEND CHANGE

   - WRAP-UP RX50
   - BUYOUT 1/2 HEIGHT
   - EXAMINE HIGH DENSITY + 3"
   - SHORT MANPOWER

Impact of FY'83 Funding Plans:

1.) The lowest budget growth rate is in the fundamental technology areas. This is inconsistent with the technology gap and expected future competition.

2.) The historical trend in underfunding memories continues and will produce uncompetitive memory products during the mid eighties.

3.) Recent data shows that Fujitsu will soon cross the IBM technology frontier, causing a probable two year gap for Digital by FY'85, under current plans.

4.) We shall miss expected major new markets and growth opportunities in replicated video and audio disks with a major impact to our P.C. plans. This market will be conceded to the leading Japanese suppliers.

5.) We are not funded to support lower cost personal and portable computers, strategy & leadership.

6.) In SSD's view, Digital is 5 years behind in the development of Data Base Machine Technology. Can we continue to be in this position?

SSD PROJECT PRIORITIZATION LIST

SMALL STORAGE SYSTEMS - P. BAUER

PROJET NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	FY'85 NOR ($M)
Priority 1:			
RX50	Steve Radoff	925	460
RD50	Clint Wooten	175	-
RD51	Clint Wooten	330	580
AZTEC	Carl Blatchley	4,900	246
1/2 Ht. Buyout Disk*	John Glavin	1,150	
RDXX	Ed East	380	183
1/2 Ht. Buyout Floppy	Steve Radoff	300	
100 MB 5.25" Disk	John Glavin	0	[in CX Budget]
Common Electronics	John Glavin	1,385	
Priority 2			
RAINBOW Hard Disk	Duncan Power	300	
Priority 3			
Advanced Floppy	Jenny Ryan	225	163
5.25" Make Disk/Floppy ($1,000 P.C.)	J.Glavin/S.Radoff	0	
AZTEC-II**	Carl Blatchley	50	6

* The buy-out strategy negates the strategy of low-cost P.C. leadership.

** Minimal FY'83 budget impact. Priority to be re-examined in Q4.

Priority 4:

NONE

Priority 5:

NONE

SSD PROJECT PRIORITIZATION LIST

ELECTRONIC STORAGE DEVELOPMENT - P. VAN ROEKENS

PROJECT NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	SOURCE	FY'85 NOR ($M)
Priority 1:				
11/780 64K Upgrade	B. Coates	658	SSD	104
MS11-PB 1MB MOS MEM.	R. Given	199	SSD	42
VENUS 4MB Array	D. Ellis	252	LSG	41
SCORPIO Memory	R. Given	244	SSD	
		200	32-BIT	
MSV11-JA/JB	R. Given	494	SSD	69
NAUTILUS Memory	R. Given	162	32-BIT	45
Priority 2				
JUPITER 1MB Array	D. Ellis	170	LSG	12
Priority 3				
DIAG. ASSIST MODULE	R. Given	400	TVG	
Priority 4:				
NONE				
Priority 5:				
NONE				

SSD PROJECT PRIORITIZATION LIST

MID-RANGE & LARGE DISK DEV. - T. BURNIECE

PROJECT NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	FY'85 NOR ($M)
Priority 1:			
RA81	Mike Hammer	1,208	500
RA60	Bert Miller	3,467	350
HSC50	Ralph Platz	4,519	60
UDA52	Bill Mathrani	448	100
RAXX	Pete Svendsen	1,900	
RAXY*	Pete Svendsen	45	
BSA50	Bill Mathrani	800	
RDZX (100 MB 5.25")	Bert Miller	1,129	20
Priority 2:			
NONE			
Priority 3			
HSC Cache	Ralph Platz	500	10
Data Base Machine	-	-	-
Priority 4:			
NONE			
Priority 5:			
NONE			

* Minimal FY'83 budget impact. Priority to be re-examined in Q3/Q4 '83 based on RA60 market acceptance.

SSD PROJECT PRIORITIZATION LIST

TAPES ENGINEERING - D.W. BROWN

PROJECT NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	FY'85 NOR ($M)
Priority 1:			
TA78	M. Cucina/D. Christman	793	62
TU81/TA81	M. Cucina	604	112
MAYA	B. Richmond	2,308	116
Priority 2:			
NONE			
Priority 3:			
TU80	M. Cucina	509	38
Priority 4:			
NONE			
Priority 5:			
NONE			

ATTACHMENTS

A. SMALL STORAGE - PAUL BAUER

B. ELECTRONIC STORAGE - PETE VAN ROEKENS

C. MID RANGE STORAGE - TOM BURNIECE

D. MAGNETEIC TAPE STORAGE - DAVID W BROWN

Bauer

****
* digital *
****

INTEROFFICE MEMORANDUM

TO: Grant Saviers

cc: SSD

DATE: 4 October 1982
FROM: Paul Bauer
DEPT: SMALL STORAGE SYSTEMS
EXT: 223-6581
LOC: ML01-3/T62

SUBJ: SMALL STORAGE SYSTEMS BUDGET REVIEW

Following is the information requested in Bob Flynn's memo of 9/27/82.

I. High Level Summary of Changes to Plans

The Small Storage System plan was based on an increase in staffing from our present 94 people to 121 at end of year. With zero population growth and the latest inputs from the system groups the following major changes occur:

1. Because of people constraints, the Rainbow add on box and the RDXX do not get developed, and Aztec II is deferred 1 Quarter.

2. Based on the latest input from the systems groups, we have put projects for an 1/2 height minifloppy (RX26) buyout and an 1/2 height 5 1/4" hard disk ahead of the Rainbow add on, Aztec II and RDXX projects. The revised priority ranking is contained in section D. of this package.

3. With these revisions, we are still missing some resources to accomplish all our tasks.

4. These changes put us firmly back on a buy out path. It is clear that leadership will not be achieved in floppies or very small disks, and there will be morale problems among the development teams when faced with the prospect of more buyouts.

5. The floppy effort is most profoundly hit by the zero population growth. The combination of RX50 project completion and the move to Westboro has left them short many people, and they will have difficulty restaffing under the present people rules. This resource shortage will hamper our efforts to sell the RX50 OEM, since we will have no futures to discuss.

d i g i t a l

INTEROFFICE MEMORANDUM

TO: Grant Saviers MLO3-6/E94

DATE: 10/5/82 Tue 16:21:30
FROM: David W. Brown
DEPT: TAPES ENGINEERING
EXT: 292-2070
LOC: YWO/G2

CC: SSD STAFF

SUBJECT: TA78 VS. TU81

1. Performance Comparison on HSC

The attached graph compares TA81 and TA78 performance on HSC. In summary:

	TA78	TA81
HSC Local Backup	1	.6
VMS Image Backup @ 200 KBYS	1	.6
VMS File Backup @ 75 KBYS	1	.7

Comments:

a. HSC will have a very fast local image backup which is expected to keep the 125 ips TA78 running continuously. The TA81 performance will be limited by the 75 ips speed.

b. For file-oriented backup routines, the HSC is a data path only and contributes nothing to tape performance. No buffering for streaming tape drives has been provided in HSC.

c. DECsystem 10 and 20 software routines like Dumper have not been rewritten to provide buffering for streaming tape drives. This will have to be done or the performance of the TA81 will drop far below what is shown above. This will certainly be unacceptable.

2. FRS Impact

This decision would also leave HSC without any tape until May, 1984, when VMS 3B will be released, because TA81 misses the window for VMS 3.4. Under the current plan, TA78 will be available at HSC FRS in Q4, FY83.

11 months
8 months

We have explored the possibility of using TA78 prototypes for software development to permit a Q2, FY84, FRS on TA81 on HSC under VMS 3.4. The VMS people have told us that this is not a workable plan because of the differences between 3B and 3.4 and because extensive field experience with the TA78 will not be generated under this plan.

3. Budget Impact

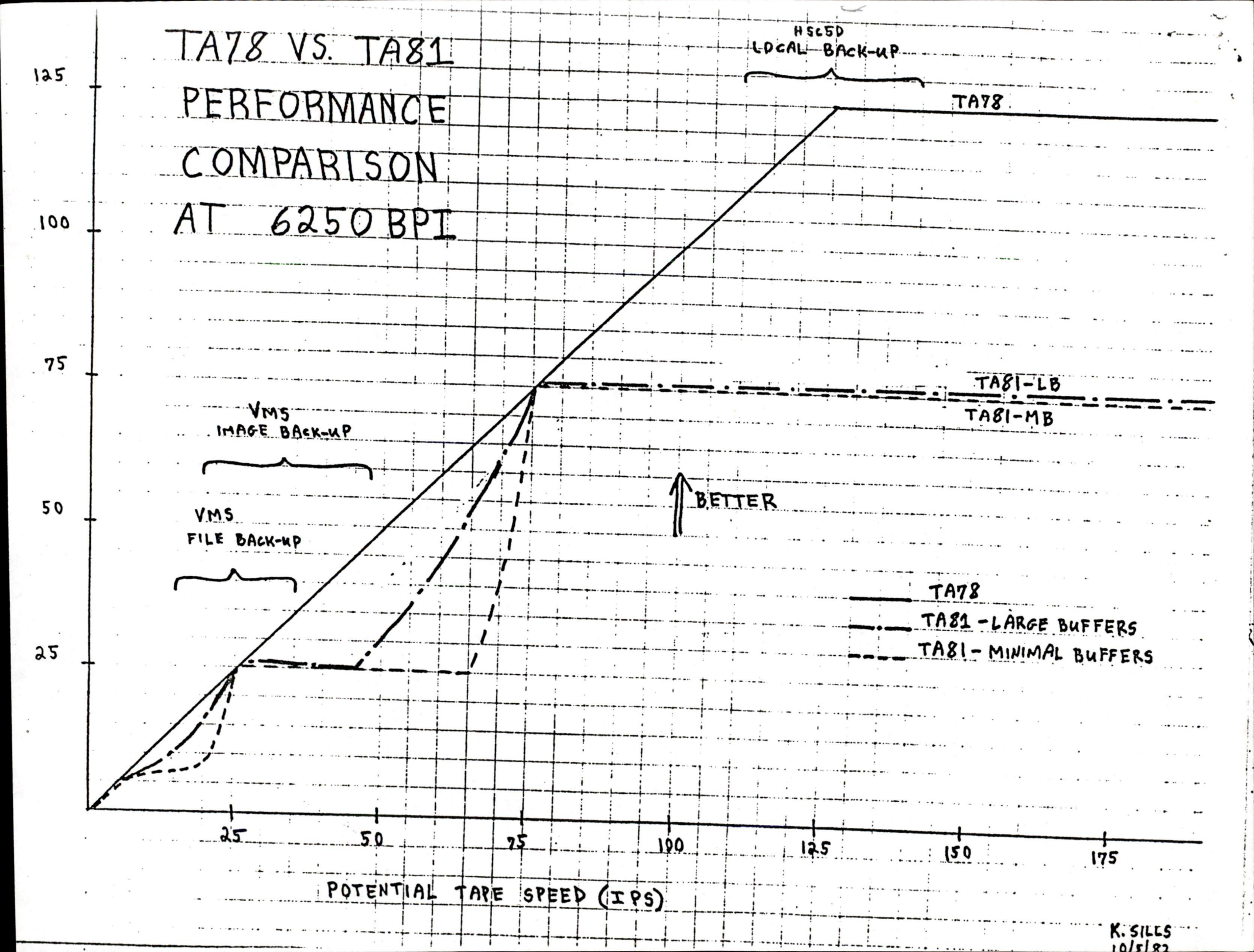
If we cancel the TA78 and continue work on the TA81, three people can be freed up for work on MAYA. The FY82 budget impact will be a $200K transfer to MAYA.

DWB/br

Attachment

DWB:3

LOOKD
1MB 55sec
600MB 300 " = 50min


TA78 VS. TA81
PERFORMANCE
COMPARISON
AT 6250 BPI
HSC50
LOCAL BACK-UP
TA78
TA81-LB
TA81-MB
VMS
IMAGE BACK-UP
VMS
FILE BACK-UP
BETTER
TA78
TA81 - LARGE BUFFERS
TA81 - MINIMAL BUFFERS
125
100
75
50
25
25
50
75
100
125
150
175
POTENTIAL TAPE SPEED (IPS)
K. SILLS
10/5/82

SSD FY83 BUDGET (EX JRDC)

ORIGINAL FY83 PLAN $54321

CURRENT HEADCOUNT (INCL. CONT.) 729

ORIGINAL PLAN Y.E. HEADCOUNT ~780

BUDGET FORECAST (ORIG PLAN)

UNFUNDED MEMORY ENG. (~$1400)

PROJ. OVERRUN (~$1400)

BAUER, ECO; BROWN, MAYA + ECO

($2800)

IMPACT OF ZPG + WAGE FREEZE $1800

POTENTIAL OVERRUN ($1000)
(2%)

CONTINUING TO WORK MEMORY ENG FUNDING + EXPENSE ISSUES.

SMALL MANPOWER STORAGE LOADING FY83-FY84 SYSTEMS SCHEDULE

ORITIZE ROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
AZTEC II	BLATCHLEY	MGR	E02								
	COLE	SERVO/ANAL	E03					50	75	75	75
	BELLETTIER	SUPERVISOR	E05					50	75	75	75
	KIRK	ANALOG	E09					50	50	50	50
	LEWIS	ANALOG/DIG	E11					100	100	100	100
	VESESKIS	SERVO/ANAL	E09					50	75	100	100
	WALTERS	DIGITAL	E09					50	100	100	100
	BAGLEY	DIGITAL	E13					100	100	100	100
	WILDING-WH	M-CODE	E09					50	100	100	100
	ZAYAS	M-CODE	E07					50	100	100	100
	*REQ 50520	M-CODE	E09					50	75	100	100
	CUFFY	MGR	E02					100	100	100	100
	HAMBLEN	ANALOG/DIG	E07					"	"	"	"
	STRYER	ANALOG	E07					50	100	100	100

SMALL MANPOWER STORAGE LOADING FY83-FY84 SYSTEMS SCHEDULE

PRIORITIZE PROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
1/2 Height 5 1/2" Hard Disk											
	WOTTON	Supervisor	E05				50	100	100	100	100
	SCHNEIDER	M.E.	E03	100	100	100	100	100	100	100	100
	STILLMAN	M.E.	E09					50	75	100	100
	WALLACE	ANOLOG	E07				100	100	100	100	100
	MECH ENG		E09		100	100	100	100	100		
	MECH DESIGN		E09								
	TOOLING ENG		E09								
	HEADS?MEDIA		E09								
	R/W		E07								
	u CODE & DEVIC LOGIC		E09								
	STEPPER ALGORITHM		E07								
	THREE TECHNICIANS		E72								
	NICHOLE	TECH.	E71					100	100	100	100
	GUADAGNOLE	TECH.	E62					100	100	100	100
	*OPEN	TECH	E72					50	100	100	100
	HANSON	TECH	E90	100	75	75	75	100	100	100	100
RX52											
	*East-Repla.	Supervisor	E05	-	50	100	100	100	100	100	100
	*Berthiaume	M.E.	E11	-	100	100	100	100	100	100	100
	*Hatherill-Repl.	Tech.	E90	-	50	100	100	100	100	100	100
RDXX	East	Supervisor	E05		50	100	100	100	100	100	100
	STILLMAN	M.E.	E09	75	75	75	100	100	50	25	
	WALLACE	Analog	E07		50	75	100				
	D53751	Analog	E09		100	100	100	100	100	100	50
	D53752	Logic	E09		25	100	100	100	100	100	50
	Hanson	Tech	E09	100	100	100	100	100	100	100	100
	*Open	Tech	E72	0	100	100	100	100	100	100	
	*Open	Tech	E62	50	50	100	100				

Impact of FY'83 Funding Plans:

1.) The lowest budget growth rate is in the fundamental technology areas. This is inconsistent with the technology gap and expected future competition.

2.) The historical trend in underfunding memories continues and will produce uncompetitive memory products during the mid eighties.

3.) Recent data shows that Fujitsu will soon cross the IBM technology frontier, causing a probable two year gap for Digital by FY'85, under current plans.

4.) We shall miss expected major new markets and growth opportunities in replicated video and audio disks with a major impact to our P.C. plans. This market will be conceded to the leading Japanese suppliers.

5.) We are not funded to support lower cost personal and portable computers, strategy & leadership.

6.) In SSD's view, Digital is 5 years behind in the development of Data Base Machine Technology. Can we continue to be in this position?

SSD PROJECT PRIORITIZATION LIST

SMALL STORAGE SYSTEMS - P. BAUER

PROJET NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	FY'85 NOR ($M)
Priority 1:			
RX50	Steve Radoff	925	460
RD50	Clint Wooten	175	-
RD51	Clint Wooten	330	580
AZTEC	Carl Blatchley	4,900	246
1/2 Ht. Buyout Disk*	John Glavin	1,150	
RDXX	Ed East	380	183
1/2 Ht. Buyout Floppy	Steve Radoff	300	
100 MB 5.25" Disk	John Glavin	0	[in CX Budget]
Common Electronics	John Glavin	1,385	
Priority 2			
RAINBOW Hard Disk	Duncan Power	300	
Priority 3			
Advanced Floppy	Jenny Ryan	225	163
5.25" Make Disk/Floppy ($1,000 P.C.)	J.Glavin/S.Radoff	0	
AZTEC-II**	Carl Blatchley	50	6

* The buy-out strategy negates the strategy of low-cost P.C. leadership.

** Minimal FY'83 budget impact. Priority to be re-examined in Q4.

Priority 4:

NONE

Priority 5:

NONE

SSD PROJECT PRIORITIZATION LIST

ELECTRONIC STORAGE DEVELOPMENT - P. VAN ROEKENS

PROJECT NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	SOURCE	FY'85 NOR ($M)
Priority 1:				
11/780 64K Upgrade	B. Coates	658	SSD	104
MS11-PB 1MB MOS MEM.	R. Given	199	SSD	42
VENUS 4MB Array	D. Ellis	252	LSG	41
SCORPIO Memory	R. Given	244	SSD	
		200	32-BIT	
MSV11-JA/JB	R. Given	494	SSD	69
NAUTILUS Memory	R. Given	162	32-BIT	45
Priority 2				
JUPITER 1MB Array	D. Ellis	170	LSG	12
Priority 3				
DIAG. ASSIST MODULE	R. Given	400	TVG	
Priority 4:				
NONE				
Priority 5:				
NONE				

SSD PROJECT PRIORITIZATION LIST

MID-RANGE & LARGE DISK DEV. - T. BURNIECE

PROJECT NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	FY'85 NOR ($M)
Priority 1:			
RA81	Mike Hammer	1,208	500
RA60	Bert Miller	3,467	350
HSC50	Ralph Platz	4,519	60
UDA52	Bill Mathrani	448	100
RAXX	Pete Svendsen	1,900	
RAXY*	Pete Svendsen	45	
BSA50	Bill Mathrani	800	
RDZX (100 MB 5.25")	Bert Miller	1,129	20
Priority 2:			
NONE			
Priority 3			
HSC Cache	Ralph Platz	500	10
Data Base Machine	-	-	-
Priority 4:			
NONE			
Priority 5:			
NONE			

* Minimal FY'83 budget impact. Priority to be re-examined in Q3/Q4 '83 based on RA60 market acceptance.

SSD PROJECT PRIORITIZATION LIST

TAPES ENGINEERING - D.W. BROWN

PROJECT NAME	RESPONSIBLE ENGINEER	FY'83 BUDGET ($K)	FY'85 NOR ($M)
Priority 1:			
TA78	M. Cucina/D. Christman	793	62
TU81/TA81	M. Cucina	604	112
MAYA	B. Richmond	2,308	116
Priority 2:			
NONE			
Priority 3:			
TU80	M. Cucina	509	38
Priority 4:			
NONE			
Priority 5:			
NONE			

ATTACHMENTS

A.	SMALL STORAGE	- PAUL BAUER
B.	ELECTRONIC STORAGE	- PETE VAN ROEKENS
C.	MID RANGE STORAGE	- TOM BURNIECE
D.	MAGNETEIC TAPE STORAGE	- DAVID W BROWN

Bauer

****
* digital *
****

INTEROFFICE MEMORANDUM

TO: Grant Saviers

cc: SSD

DATE: 4 October 1982
FROM: Paul Bauer
DEPT: SMALL STORAGE SYSTEMS
EXT: 223-6581
LOC: ML01-3/T62

SUBJ: SMALL STORAGE SYSTEMS BUDGET REVIEW

Following is the information requested in Bob Flynn's memo of 9/27/82.

I. High Level Summary of Changes to Plans

The Small Storage System plan was based on an increase in staffing from our present 94 people to 121 at end of year. With zero population growth and the latest inputs from the system groups the following major changes occur:

1. Because of people constraints, the Rainbow add on box and the RDXX do not get developed, and Aztec II is deferred 1 Quarter.

2. Based on the latest input from the systems groups, we have put projects for an 1/2 height minifloppy (RX26) buyout and an 1/2 height 5 1/4" hard disk ahead of the Rainbow add on, Aztec II and RDXX projects. The revised priority ranking is contained in section D. of this package.

3. With these revisions, we are still missing some resources to accomplish all our tasks.

4. These changes put us firmly back on a buy out path. It is clear that leadership will not be achieved in floppies or very small disks, and there will be morale problems among the development teams when faced with the prospect of more buyouts.

5. The floppy effort is most profoundly hit by the zero population growth. The combination of RX50 project completion and the move to Westboro has left them short many people, and they will have difficulty restaffing under the present people rules. This resource shortage will hamper our efforts to sell the RX50 OEM, since we will have no futures to discuss.

SMALL STORAGE SYSTEMS
OCTOBER BUDGET PASS
FY83

PRIORITIZE PROGRAMS	QTR FY83	TOTAL DEVELOP # ENG'S	PROJECT EFFORT # TECH'S	PEOPLE DIAGNOS-TICS	LOADING PRODUCT # ENG'S	3K9 SUPPORT # TECH'S	FY83 MANPOWER COST	PROJECT SPENDING $K Q1FY83	Q2FY83	Q3FY83	Q4FY83	FY83 TOTAL
PROGRAM OFFICE	Q1-Q4	4.0 4.0										
TOTAL $K							320.0	85.0	95.0	105.0	115.0	400.0
PRODUCT SUPPORT	Q1-Q4				1.0 1.0	1.0 1.0						
RX02/RK07	$K						125.0	37.0	39.0	36.0	38.0	150.0
RX50	Q1	10.0	5.0	2.0	1.5	1.0	297.5					
	Q2	5.0	3.0	2.0	1.5	1.0	175.0					
	Q3				2.0	1.0	51.3					
	Q4				2.0	1.0	51.3					
RX50 DEVEL							454.0	340.0	410.0			750.0
RX50 PROD. SUPP.							185.0	40.0	40.0	160.0	160.0	400.0
RD50	Q1	1.5	1.8	1.0	1.5	1.0	90.9					
	Q2	1.5	1.3	1.0	1.5	1.0	85.3					
	Q3	1.0	1.0	1.0	1.0	1.0	62.5					
	Q4				0.5	1.0	21.3					
RD50 DEVEL							173.0	100.0	40.0	35.0		175.0
RD50 PROD. SUPP.							135.0	31.0	46.0	56.0	67.0	200.0
RD51	Q1	2.8	1.8	0.5			74.7					
	Q2	2.3	1.0	0.5			56.3					
	Q3	2.0	1.0	0.5	0.5		61.3					
	Q4	1.0	0.3	1.0	0.5		32.8					
RD51 DEVEL							245.0	100.0	110.0	75.0	45.0	330.0
RD51 PROD SUPP.							20.0			10.0	20.0	30.0
AZTEC	Q1	22.0	9.0	5.0			541.3					
	Q2	22.0	9.0	6.0	1.5		571.3					
	Q3	22.0	9.0	6.0	1.5		571.3					
	Q4	22.0	9.0	3.0	1.5		571.3					
FORECAST								1100.0	1300.0	1500.0	1600.0	5500.0
AZTEC DEVE							2501.0	1100.0	1200.0	1300.0	1300.0	4900.0
AZTEC PROD SUPP							90.0	30.0	46.0	48.0	76.0	200.0
COMMON ELECTRONIC SET	Q1	8.5	1.0	2.5			181.3					
	Q2	14.0	1.0	2.5			291.3					
	Q3	14.2	1.5	2.5			300.9					
	Q4	15.5	2.5	3.0			338.1					
C.E.S. DEV ELCP.							1279.5	200.0	300.0	400.0	495.0	1395.0

PROJECT	QTR	PROJECT DEVEL. # ENG'S	# TECH'	DIAGNOS TICS	PRODUCT SUPPORT # ENG'S	# TECH'	MANPOWER COST	Q1FY81	PROJECT SPENDING Q2FY83	Q3FY83	$K Q4FY83	TOTAL FY83
FLOPPY EXTENSIONS												
RX50	Q2	0.5					10.0					
WRAP-UP	Q3	1.5	0.3				32.8					
	Q4	0.8	0.3				17.8					
TOTAL							60.6	10.0	90.0	50.0	25.0	175.0
1/2 HEIGHT	Q2	1.5	1.0				41.3					
5 1/4"	Q3	3.0	2.0				92.5					
FLOPPY	Q4	3.3	2.0				97.5					
BUY-OUT												
TOTAL DEV.							211.3	10.0	50.0	110.0	130.0	300.0
PROD SUPP											20.0	20.0
RXXX	Q2	2.0	1.0				51.3					
	Q3	3.5	1.8				89.7					
	Q4	3.5	1.8				89.7					
TOTAL							230.6	5.0	55.0	90.0	100.0	250.0
* 1/2 HEIGHT	Q1	1.0	1.0				31.3					
5 1/4"	Q2	9.0	4.0				225.0					
HARD DISK	Q3	9.0	5.0				236.3					
	Q4	9.0	5.0		0.5		251.9					
TOTAL							744.4	50.0	225.0	325.0	350.0	950.0
* RX52 #2	Q2	1.5	0.5				35.6					
	Q3	2.0	1.0				51.3					
	Q4	2.0	1.0		0.5		66.9					
TOTAL RX52							153.8		35.0	60.0	130.0	225.0
* RXXX #2	Q1	0.8					16.0					
	Q2	3.0	2.3				85.9					
	Q3	4.5	2.3				115.9					
	Q4	5.0	2.5				128.1					
TOTAL RXXX							345.9	25.0	75.0	125.0	155.0	380.0
* AZTEC II #2	Q4			3.0			50.0				50.0	50.0
RAINBOW	Q2	0.7	1.8				34.3					
OUTSIDE	Q3	1.3	1.5				42.9					
	Q4	0.8	1.0				27.3					
							104.4	TO BE	FUNDED	OUTSIDE OF	STORAGE	SYSTEMS

		SMALL PEOPLE	STORAGE SUMMARY	SYSTEMS FY83				GROUP	SPENDING	SUMMARY	FY83	
Q1	94 *	50.5	19.5	12.0	4.0	3.0	PROD. DEV	1990.0	2690.0	2770.0	3070.0	10520.0
Q2	115.0	44.5	25.0	12.0	5.5	3.0	PROD.SUPP	138.0	171.0	310.0	391.0	1000.0
Q3	117.0	56.0	25.0	12.0	6.0	3.0	PROGRAM	85.0	95.0	105.0	115.0	400.0
Q4	118.0	46.5	25.0	12.0	6.5	3.0	OFFICE					
				SEC = 5			FORECAST	2213.0	* 2956.0	3185.0	3566.0	11920.0
		PEOPLE	COST	*	7356.1		BUDGET	2163.0	2681.0	2710.0	3006.0	10560.0
							SHORTFALL	-50.0	-275.0	-475.0	-560.0	-1360.0

SMALL MANPOWER, STORAGE LOADING FY83-FY84, SYSTEMS SCHEDULE

PRIORITIZE PROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
RX50	RYAN	SUPERVISOR	E05	100	50						
	EAST	SUPERVISOR	E05	100	50						
	CARMAN	M.E.	E09	100	50						
	WARREN	M.E.	E11	100	50						
	BERTHIAUME	M.E.	E11	100	50						
	BROWN	LOGIC	E09	100	50						
	ENGLESON	CIR.DES.	E11	100	50						
	CHAUTIN	ANALOG	E09	100	50						
	PAQUIN	R/W	E09	100	50						
	COLLEGE	E.E.	E13								
	CRITTENTEN	TECH	E73	100	50						
	MUTNANSKY	TECH	E90	100	50						
	KAPENAS	TECH	E70	100	50						
	HATHERILL	TECH	E72	100	50						
	AUBREY	TECH	E71	100	50						
RD50	WOTTON	SUPERVISOR	E05	50	50	50					
	NEWFELL	LOGIC	E11	100	100	50					
	NICHOLE	TECH	E71	100	100	100					
	JANUSK	TECH	E62	25	25						
RD51	WOTTON	SUPERVISOR	E05	50	50	50	50				
	WALLACE	ANALOG	E07	100	50	25					
	STILLMAN	M.E.	E09	25	25	25					
	EVAN	ANALOG	E11	100	100	100	50				
	BERQUIST	TECH	E72	100	100	100	25				
	JANUSK	TECH	E62	25							
AZTEC	BLATCHLEY	MGR	E02	100	100	100	100	50	25		
	COLE	SERVO/ANAL	E03					50	25		
	BELLETTIER	SUPERVISOR	E05					50	50	25	
	KIRK	ANALOG	E09								
	LEWIS	ANALOG/DIG	E11					50	25		
	VESESKIS	SERVO/ANAL	E09					50			
	WALTERS	DIGITAL	E09								
	BAGLEY	DIGITAL	E13					50			
	WILDING-WH	M-CODE	E09					50			
	ZAYAS	M-CODE	E07					50	25		
	*REQ 50520	M-CODE	E09					100	50	50	50
	DUFFY	MGR	E02								
	HAMBLEN	ANALOG/DIG	E07								
	STRYER	ANALOG	E07					50			

SMALL MANPOWER STORAGE LOADING FY83-FY84 SYSTEMS SCHEDULE

PRIORITIZE PROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
AZTEC	PARIKH	MGR	E02	100	100	100	100	50	25		
	GIFFORD	M.E.	E07					100	50		
	HINLEIN	M.E.	E07					50	25		
	HEARN	M.E.	E07					75			
	HUTNAK	M.E	E09					50			
	NEWMAN	ANALYSIS	E11								
	O'DAY	M.E.	E11								
	CONDON	EQUIP. DES	N09								
	CITTA	TECH	E71					100	100		
	PILLEY	TECH	E73					50			
	MITCHELL	TECH	E90								
	LANDIS	TECH	E70								
	FEUERSTEIN	TECH	E								
	ERLICHMAN	TECH	E70								
	IVES	TECH	E83					50			
	NEWELL	TECH	E82					100	50		
	O'LEARY	TECH	E82								
COMMON ELECTRONIC SET	POWER	SUPV.	E05	-	40	60	75	100	100	100	100
	BROWN	ANALOG	E07	100	100	100	100	100	100	100	100
	CLINE	ANALOG	E11	100	100	100	100	100	100	100	100
	ROLLINS	ANALOG	E07	100	100	100	100	100	100	100	100
	*REQ 52702	ANALOG	E09	-0-	100	100	100	100	100	100	100
	FILGATE	LOGIC	E07	50	100	100	100	100	100	100	100
	HATT	SERVO	E09	100	100	100	100	100	100	100	100
	WEINRICH	LOGIC	E09	100	100	100	100	100	100	100	100
	SETO	LOGIC	E09		100	100	100	100	100	100	100
	HELLER	LOGIC	E11					50	100	100	100
	NEWFELL	LOGIC	E11			50	100	100	100	100	100
	EVAN	ANALOG	E11				50	100	100	100	100
	2 - ENG	LOGIC	E07		200	200	200	200	200	200	200
	1 - ENG	ANALOG	E09		100	100	100	100	100	100	100
	JANUSK	TECH	E62		25	75	100	100	100	100	100
	BEREQUIST	TECH	E90		100	100	100	100	100	100	100

SMALL MANPOWER STORAGE LOADING FY83-FY84 SYSTEMS SCHEDULE

PRIORITIZE PROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
FLOPPY EXTENSIONS											
RX50 WRAP-UP	RYAN	SUPERVISOR	E05	-	-	25	25				
	CARMAN	M.E.	E09	-	25	50	25				
	WARREN	M.E.	E11	-	25	50	25				
	CRITTENDEN	TECH	E73	-	-	25	25				
1/2 HEIGHT 5 1/4" BUY-OUT FLOPPY	RADOFF	MGR.	E02	-	-	100	100	50	50	25	
	BROWN	LOGIC	E09	-	50	100	100	100	100		
	WARREN	M.E.	E11	-	-	50	75	50	50	50	
	*CHAUTIN-REPLA.	E.E.	E09	-	50	50	50				
	CRITTENDEN	TECH.	E73	-	50	75	75	100	100	100	
	*KAPENAS-REPLA.	TECH	E70	-	50	100	100	100	100		
	*AUBREY-REPLA.	TECH	E71	-	-	25	25				
RXXX	RYAN	SUPERVISOR	E05.	-	25	50	50	100	100	100	100
	*NEED R/W	R/W	E09	-	50	100	100	100	100	100	100
	CARMEN	M.E.	E09	-	25	50	50	100	100	100	100
	*CHAUTIN-REPLA.	E.E.	E09	-	50	50	50	100	100	100	100
	ENGLESON	C.R.DES.	E11	-	50	100	100	100	100	100	100
	*MUTNANSKY-REPL.	TECH	E09	-	50	100	100	100	100	100	100
	*AUBREY-REPL.	TECH	E71	-	50	75	75	100	100	100	100

SMALL MANPOWER STORAGE LOADING FY83-FY84 SYSTEMS SCHEDULE

PRIORITIZE PROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
AZTEC II. (Cont.)	PARIKH	MGR	E02					50	75	100	100
	GIFFORD	M.E.	E07					"	50	100	100
	HINLEIN	M.E.	E07						50	50	50
	HEARNHINLE	M.E.	E07					"	"	"	"
	HUTNAK	M.E.	E09					"	"	"	"
	NEWMAN	ANALYSIS	E11					100	100	100	100
	O'DAY	M.E.	E11					50	50	50	50
	CONDODN	Equip.	N09					"	"	"	"
	CITTA	TECH	E71					50	100	100	100
	MILLEY	TECH	E73					"	"	100	100
	MITCHELL	TECH	E90					"	"	"	"
	LANDIS	TECH	E70					100	100	100	100
	ERLICHMAN	TECH	E70					100	100	100	100
	IVES	TECH	E83					50	100	100	100
	NEWELL	TECH	E82						50	100	100
	O'LEARY	TECH	E82					100	100	100	100
RAINBOW	POWER	SUPV.	E05	"	40	40	25				
	HELLER	LOGIC	E11	"	50	100	50				
	JANUSK	TECH	E62	"	75	50	50				
	*OPEN	TECH	E62	"	100	100	100				

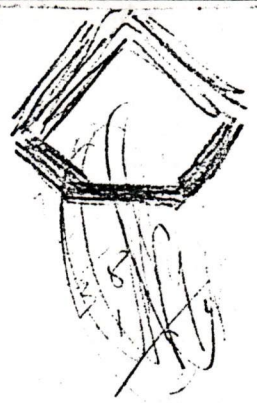
				SMALL MANPOWER	STORAGE LOADING FY83-FY84	SYSTEMS SCHEDULE					
ORITIZE OGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
AGNOSTIC	GRAY	SUPERVISOR	S10	100	100	100	100	100	100	100	100
	MOSCARILLO	LIBR. REL.	J61	100	100	100	100	100	100	100	100
RX50	CUADRI	DIAG	J13	100	100						
	CHESTER		J11	100	100						
RX52	CUADRI		J13			100	100	50	50	50	50
	CHESTER		J11			100	100				
ZTEC	POWERS		J11	100	100	100	50	50	50		
	CHEN		J11	100	100	100	100	100			
	CHIN		J13	100	100	100					
	DOUCETTE		CONTR	100	100	100					
	NEALE			100	100	100	100				
	DOWD		COOP	100							
	NICKEL°G		J15		100	100					
MON ELE	ROSS		J13	100	100	100	100	100	100	100	100
	FEELEY		J15	100	100	100	100	100	100	100	100
TEC II	POWERS		J11				50	50	50	100	100
	NICKEL°G		J15				100	100	100	100	100
	CHIN		J13				100	100	100	100	100
	CHEN		J11						100	100	100
	CHESTER		J11					100	100	100	100
DUCT PORT	SMITHER	MGR	E02	100	100	100	100	100	100	100	100
/RKC7/	RAYMOND	PS ENG	E07	100	100	100	100	50	50	50	50
	GREEN	PS TECH	E61	100	100	100	100	50	50	50	50
X50	HILDEBRANT	PS ENG	E07	100	100	100	100	100	100	100	100
	CHAUTIN	PS ENG	E07			100	100	100	100	100	100
	MCLAUGHLIN	PS TECH	E62	100	100	100	100	100	100	100	100
050	FUZZY	PS ENG	E07	100	100	100	100	100	100	100	100
	HOWELL	PS TECH	E90	100	100	100	100	100	100	100	100
TEC	HAMBLEN	AZTEC-ENG		100	100	100	100	100	100	100	100
	BETHLAHME	AZTEC-ENG			100	100	100	100	100	100	100
	FELERSTEIN	AZTEC-TECH									
X52	*OPEN*	PS ENG	E07				50	100	100	100	100
	OPEN	PS TECH	E90						50	100	100
EC II	*OPEN*	PS ENG	E07					50	50	100	100
DXX	*OPEN*	PS ENG	E07			50	100	100	100	100	100

25

SMALL STORAGE SYSTEMS
MANPOWER NEEDS

PROJECT	TECHNICAL SKILLS	JOB CODE	QTR NEEDED
AZTEC	M-Code Eng.	E09	Q2
Floppies	East Replacement-Supervisor	E05	Q2
	Berthiaume Replacement - Mech.	E11	Q2
	Chautin Replacement - Elec.R/W	E09	Q3
	Read Write	E09	Q3
Common Elect.	Analog Eng.	E09	Q2
	Analog Eng.	E09	Q2
	Logic Eng.	E07	Q2
	Logic Eng.	E07	Q2
1/2 Hgt. 5 1/4" Hard Disk	Mech. Eng.	E09	Q2
	Mech. Design	E09	Q2
	Tooling Eng.	E09	Q2
	Heads/Media	E09	Q2
	R/W	E07	Q2
	U Code + Devic. Logic	E09	Q2
	Stepper Algorithm	E07	Q2
	Technician	E72	Q2
	Technician	E72	Q2
	Technician	E72	Q2
RDXX	Analog Eng.	E09	Q2
	Logic Eng.	E09	Q2
	Technician	E72	Q2
RAINBOW	Technician	E62	Q2
Prod. Support			
- Floppy Extensions	Prod. Support Eng.	E07	Q4
- 1/2 Height 5 1/4" Hard Disk	Prod. Support Eng.	E07	Q3

Ed Sypek
10/4/82



IV. PROJECT INVESTMENT PRIORITY AND RESPONSIBLE ENGINEERS LIST

Priority 1 - Absolutely critical to Strategy

PROJECT	ENGINEER	FY83 BUDGET ($K)	FY85 NOR ($M)
RX50	Steve Radoff	750+175	460
RD50	Clint Wotton	175	-0-
RD51	Clint Wotton	330	580
Aztec	Carl Blatchley	4900	246
		6155	
RD52 Common Elec. Set Drive	John Glavin	1385	NA
		7540	
Floppy Extension			
RX50 Wrap Up	Steve Radoff	175	NA
1/2 Hgt. buy out	Steve Radoff	300	NA
Advanced Floppy	Jenny Ryan	250	NA
		725	
1/2 Hgt. low cost hard disk	John Glavin	1150	NA

Priority 2 - Substantial Existing Commitment

RX52	Jenny Ryan	225	163
RDXX	Ed East	380	183
Aztec II	Carl Blatchley	50	6
		655	

Priority 3 - Supports Base Strategy

Rainbow	Duncan Power	300	

/4/82
G.

STEM ICE ND	DEC FY81	BEST COMPETITION FY81	DEC FY83	BEST COMPETITION FY83	DEC FY85	BEST COMPETITION FY85	DEC FY87	BEST COMPETITION FY87
K P .5K	TU58 .25MB DC100 CARTRIDGE TAPE				RX50 2 x 400KB $175 DRIVE			
					1/2 RX52 800KB REM. $150 DRIVE PORTABLE PERSONAL COMPUTER	TANDON'S 1-2MB 1/2 HT 5 1/4" FLOPPY REM. $150 DRIVE OR TANDON'S 3.5" UFLOPPY (SONY COMPATIBLE)		
5K 25K	RX02 2 x .5MB REMOVABLE QBUS, UBUS $975 SUBSYS. $3900 MLP	DSD 480 2 x 1.0MB REMOVABLE $4000 MLP	RX50 2 x 400 KB REMOVABLE $350 SUBSYS. $995 MLP(1)	TEAC FD55E 1/2 HT 5 1/4" FLOP. 400KB REM. $150 DRIVE	1/2 RX52/ 1/2 HT RD50 800KB/5MB REM./FIXED $150/$225 DRIVES	TANDON'S 1-2MB 1/2 HT 5 1/4" FLOPPY - REM. $150 DRIVE + TANDON'S 5MB 1/2 HT 5 1/4" FIXED DISK $300 DRIVE		
					RX50 2 x 400KB $175 DRIVE	SEE NOTE 2		
	WPS78		PC100 PC200 PC300		PC100+ PC200+ PC300+			
25K ó	RX02 2 x .5MB REMOVABLE QBUS, UBUS	DSD 480 2 x 1.0MB REMOVABLE	RD50/RX50 10MB/ 2 x 400KB FIXED/REM	BUYOUT(5) 10-20MB 5 1/4"	RD52/MAYA 50-100MB/50MB FIXED/TAPE	BUYOUT 50-100MB 5 1/4" FIXED		

to	REMOVABLE	REMOVABLE	15MB)	10-20MB	50-100MB/50MB	50-100MB
	QBUS, UBUS		2 x 400KB	5 1/4"	FIXED/TAPE	5 1/4" FIXED
.6K	$975 SUBSYS.		FIXED/REM.	FIXED + 800KB	CT, QBUS, UBUS	+ TANDON
	$3900 MLP	$4000 MLP	CT, QBUS,	5 1/4" FLOPPY	$650/$350	CARTRIDGE TAPE
			UBUS		DRIVES	$1000 + $350
			$625(4)/$250			
			DRIVES			
			$3000 MLP(3)			

			RD51/RX50			
			10MB/			
	DECMATE I		2 x 400KB			
			FIXED/REM.		PC350+,	
			$600-$700(4)/		LCP-5+	
			$250			
			PC350, LCP-5			
6K	RL02/RL02	DSD 880x/30	RC25 (AZTEC)	LARK II	AZTEC II	HITACHI 812
	10MB/10MB	32MB/1MB	25MBF+25MBR	20.4MBF +	75MBF+75MBR	128MB FIXED +
	REM./REM.	FIXED/FLOP.		20.4MBR		TAPE
0K	QBUS, Q-22		QBUS, UBUS		QBUS, UBUS	
	$1400/$1100		$2972	$4931	$2300	$6450
	$6.9K/$5.6K	$9200 MLP	$9900 MLP			
			12MBITS/IN2	5MBITS/IN2	24MBITS/IN2	
				or		
				LYNX/PUMA		
				10MB/42MB		
	11/23, 11/23+,		11/730,	REM./FIXED	LOW COST 11/730	
	11/24, 11/34,		ORION, LCP-8	$4300	SCORPIO, ORION	
	11/44, WPS 200		11/23+		LCP-8	

ES:

PC300 - Includes Controller
Any number of 1/2 HT 5 1/4" floppies and micro floppies
Imputed hardware MLP for PC350 - priced at $3500 which includes CTAB-10 software
Buyout price
Many vendors will begin delivering 10-20MB drives in FY83

Bob Flynn

OCT 5 1982

****
* d i g i t a l *
****

INTEROFFICE MEMORANDUM

TO: Grant Saviers

cc: SSD

DATE: 4 October 1982
FROM: Paul Bauer
DEPT: SMALL STORAGE SYSTEMS
EXT: 223-6581
LOC: ML01-3/T62

SUBJ: PROJECT PROPOSALS IN RESPONSE TO LAST SSD WOODS MTG.

Attached are proposals from the Small Storage group in response to the product needs identified at the last SSD Woods meeting.

1/2 Height 5 1/4" Floppy Buyout
1/2 Height 5 1/4" 10MB Hard Disk

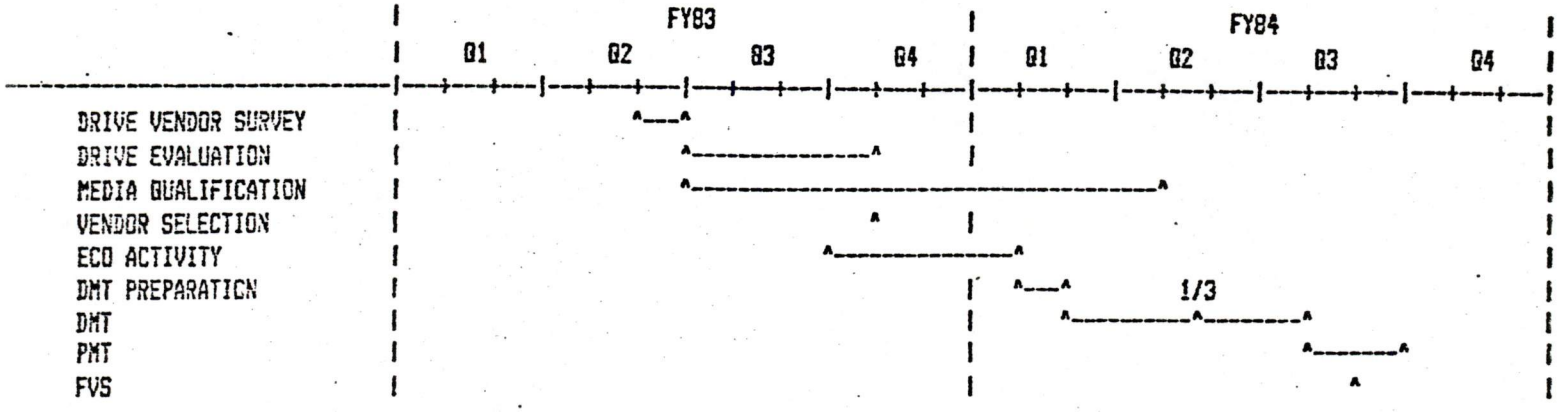
The budget and manpower consequences of these proposals have been incorporated into the latest budget review and analysis.

/mpc

DOUBLE-SIDED HALF-HEIGHT FLOPPY BUYOUT

GETS: DOUBLE SIDED CAPACITY (818Kb/DISK)
PRODUCT QUAL IN MAYNARD
SHORTEST TIME TO MARKET
LOW COST
RX50 CONTROLLER INTERFACE

DON'T GETS: COMPETITIVE TECHNOLOGY BASE
1.2Mb/DISK
NEW MEDIA



		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
1	ENGINEERS	0	1	3	3	2	2	1	0
		0	20	60	60	40	40	20	0
2	TECHNICIANS	0	0	2	2	2	1	1	0
		0	0	23	23	23	11	11	0
3	P.C.DESIGN	0	0	0	0	0	0	0	0
4	MECH.DRAFTING	0	0	0	10	5	5	0	0
5	DIAGNOSTIC ENG.	0	0	6	5	3	3	0	0
6	TEE	0	0	0	0	0	0	0	0
7	MTA	0	0	0	0	0	0	0	0
8	ENPP	0	0	0	0	0	0	0	0
9	COMP.ENG.	0	0	0	3	3	5	0	0
10	UL & DEC102	0	0	10	5	10	5	0	0
11	RELIABILITY	0	0	0	0	8	24	8	0
12	MODEL SHOP	0	0	5	10	0	0	0	0
13	TOOLING	0	0	0	0	0	0	0	0
14	MATERIAL	0	0	15	15	20	0	0	0
15	ECO	0	0	0	0	0	0	0	0
16	CONTINGENCY	0	0	10	10	10	10	0	0
	--- TOTALS ---	0	20	129	141	122	103	39	0

FIRST YEAR PROJECT TOTAL - $289K

SECOND YEAR PROJECT TOTAL - $264K

PROJECT GRAND TOTAL - $553K

17	HEADS/MEDIA	0	0	30	35	20	10	5	0
18	CAPITAL	0	0	20	10	0	0	0	0

E. EAST 29-SEP-82

DOUBLE-SIDED HALF-HEIGHT FLOPPY BUYOUT - COST JUSTIFICATION

1. ENGINEERS:	4.5Q	EE- DEVELOPE A TEST AND EVALUATION PROGRAM TO ACCESS THE MATURITY OF THE DRIVE BY MEASURING IT AGAINST ITS SPEC. DEVELOPE TEST TECHNIQUES AND HARDWARE AND CARRY OUT THE TEST PROGRAM.
	2.0Q	ME- EVALUATE THE MECHANICAL MATURITY OF DRIVES AND DEVELOPE VENDOR IMPLIMENTED ECO'S
	5.5Q	SUPERVISOR- COST, SCHEDULE, AND TECHNICAL MANAGEMENT OF PRODUCT QUALIFICATION, MANAGE THE INTERFACE WITH THE VENDOR.
2. TECHNICIANS:	8.0Q	TECH[4]- SUPPORT ELECT. AND MECH. TEST AND EVALUATION, DEVELOP AND CONFIGURE TEST HARDWARE, SUPPORT QUALIFICATION OF THE PRODUCT.
4. MECH.DRAFTNG:	20K	DEVELOPE VENDOR ECO DOCUMENTATION AND RELEASE DRIVE AND MEDIA PACKAGE.
5. DIAG.ENG.:	17K	MODIFY DIAGNOSTIC SOFTWARE FOR PRODUCT QUAL.
9. COMP.ENG.:	11K	EVAL. AND LIFE TEST OF SELECTED CRITICAL COMPONENTS AND COMPONENT FAILURE ANALYSIS
10. UL&DEC102:	30K	SHOCK AND VIBRATION (8K),PACKAGING SHOCK (6K), UL & PRODUCT SAFETY (4K), THERMAL (8K), EMI/RFI/FCC (4K).
11. RELIABILITY:	40K	20 WEEK DMT TO EVALUATE MTBF, DATA RELIABILITY, INTERCHANGE, AND MEDIA WEAR AT 2K PER WEEK.
12. MODEL SHOP:	15K	TOOLING TO EVALUATE MECHANISM AND ACCELERATE WEAR (DOOR AND COLLET CLAMP).
14. MATERIAL:	50K	70 DRIVES AT $500 EACH (25K),VARIOUS TEST HARDWARE, FIXTURING, AND CABLING (5K).
16. CONTINGENCY:	40K	NEEDED FOR UNCERTAINTY OF OFF-SHORE VENDOR'S COST AND SCHEDULE RISK.
17. HEADS/MEDIA:	100K	SPECIFY AND QUALIFY VENDORS FOR DOUBLE SIDED MEDIA. SUPPLY QUALIFIED AND TESTED MEDIA FOR DVT AND DMT. DEVELOPE PROCEEDURES AND TEST EQUIPMENT FOR MANUFACTURING TO VERIFY MEDIA QUALITY.
18. CAPITAL:	30K	VT103 TEST SYSTEMS (20K), POWER SUPPLIES AND TEST CONTROLLERS (10K).

E. EAST 29-SEP-82

many copy phil + Ed + peterson

JG 22

PROPOSAL LOW COST WINCHESTER AND FLOPPY SUBSYSTEM

J. Glavin
8/30/82

1.0 Introduction

1.1 Purpose

1.2 Scope

2.0 Product Goals and Priorities

2.1 System Goals

2.2 Winchester Goals

2.3 Floppy Goals

2.4 Controller Goals

2.5 Priorities

3.0 Product Description/Specfication

3.1 Drives

4.0 Alternatives

4.1 Drives

4.1.1 Buyouts

4.1.2 DEC Designed and Built

4.2 Controller

4.3 Advantages/Disadvantages

4.3.1 Drives

4.3.2 Controller

5.0 Product Cost

5.1 Present Hardware Cost

5.2 Drive Costs

5.2.1 Drive Costs for Seperate Mechanisms

5.2.2 Integrated RD/RX Costs

5.3 Controller Costs

6.0 Development Tasks

7.0 Schedule/Development Cost

8.0 Issues/Concerns

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this proposal is to examaine the alternatives and feasibility for attaining the lowest cost, 5 1/4 inch, half (1/2) height winchester + floppy subsystem.

The goal is to maintain RD50/RX50 performance at minimum cost.

1.2 SCOPE

Areas which will be studied under this proposal are:

1. Examination and comparison with present subsystem costs.

2. Development of a low cost controller capable of supporting

   - (1) RX50
   - (1) RD50 and/or (1) removable disk.

3. Examine make/buy for 1/2 height RX50 and 1/2 height RD50.

The details for the 1/2 height RX50 will not be addressed under this proposal and can be found under the appropriate proposal from the Floppy Development Group.

2.0 PRODUCT GOALS AND PRIORITIES

2.1 SYSTEM GOALS

* Low cost entry level system.

* System will always be configured with hard disk.

* System transportable media must be RX50 compatible.

* Storage power requirements $\leq$ RD50 +RX50.

* Form factor cannot exceed one full option slot.

* Subsystem transfer cost $700 - $850.

* FVS H2;FY'84.

2.2 WINCHESTER GOALS

* Minimum RD50 capacity and performance.
  - 5MB formatted capacity
  - 170 ms Avg. access time
* Interface = RD50.
* RD51 capacity and performance ASAP.
  - 10MB formatted capacity
  - 85 ms Avg. access time

2.3 FLOPPY GOALS

* Media backwards compatible to RX50.
* Capacity: 400KB minimum.
* Reliability = RX50
* Interface = RX50.
* Performance: Not an issue; don't sacrifice cost for performance.

2.4 CONTROLLER GOALS

* Supports
  - Single RX50
  - Single RD50 and/or single removable disk.
* CT bus.
* Single CT option Slot (5.2" X 12").
* Power $\leq$ RCD50 controller.

2.5 PRIORITIES

1. Time to market @ $800.
2. Lower cost.
3. Removable disk.
4. RD51 capacity and performance.

Note: These are the PC350 priorities.

3.0 PRODUCT DESCRIPTION/SPECIFICATIONS

3.1 DRIVES

	Winchester	Floppy
Configuration	5MB fixed	Single removable diskette
Formatted capacity	5MB/drive	400KB/drive
Avg. latency	8.33MS	100MS
Avg. access time	≤ 170MS	264MS
Functional Specifications		
Recording density	10K bpi	
Track density	345 tpi	96 tpi
Disks	1	1
RPM	3600	300
MTBF	11000 P.O.H. 50% duty cycle	2000 P.O.H 30% duty cycle
Error rates		
Soft	10^{10}	10^{9}
Hard	10^{12}	10^{12}
Seeks	10^{6}	10^{6}
Transfer rate	5MB/sec.	250Kb/sec.
Power	25W TYP (+5; +12)	17W TYP (+5; +12)
Environmental	DEC STD 102 class B	DEC STD 102 media class A
Dimensions		
Height	1.625"	1.625"
Width	5.75"	5.75"
Length	8.0"	8.5"
Weight	5#	5#
Interfaces	ST506 (RD50)	RX50

4.0 ALTERNATIVES

4.1 DRIVES

4.1.1 BUYOUTS

- TEAC; 1/2 height, 96tpi
- Tandon
  1/2 height, 5 1/4" fixed disk
- Seagate

4.1.2 DEC DESIGNED AND BUILT

Two seperate mechanisms

- 1/2 RX50
- 1/2 RD50
- Common controller

Integrated RD/RX

- Shared spin and/or positioner motor
- Shared electronics
- Common controller

4.2 CONTROLLER

* Multiple disk controller and PLL chips
  - AMD
  - Signetics
  - Western Digital
* WD1010 winchester controller ship + WD1793 floppy disk controller chip.

4.3 ADVANTAGES/DISADVANTAGES

4.3.1 DRIVES

Seperate Mechanisims	Advantages	Disadvantages
In-house	- Develop in-house expertise in 5 1/4 inch disks. - Lower product cost. - Design with extensibility as a goal. - Leverage off in-house heads media expertise.	- Higher development costs. - Requires more DEC resources.
Buyout	- Lower development cost requires less DEC resources.	- Solves vendor's technical problems and puts him in business. - 1/2 height products are not in volume production yet, making product a high risk. - Higher product cost. - Extensibility unkown. - Single sourced.
Integrated mechanism	- Lower product cost - High MTBF	- Requires full option slot; limiting packaging flexibility. - More intricate mechanism; increased assembly time. - Eliminates 1/2 height RX50 product. - Longer development time (1 qtr).

4.3.2 CONTROLLER

	Advantages	Disadvantages
Multiple disk controller + P11 chips	- Lower product cost - Lower power consumption - Smaller size	- Chips availability (9 - 12 months away). - Specs not firm. - High risk. - Performance of PLL and data seperator chip unknown.
WD1010 + 1793	- Chips available sooner. (3 months) - Specs not as volatile	- Higher cost. - Higher power consumption. - Real estate risk for 5.2" X 12" board.

5.0 HARDWARE COSTS

5.1 PRESENT HARDWARE COSTS

	FY'83	FY'84	FY'85
RD50			
Drive (1)	$641 ($564)	$590 ($513)	$539 ($487)
Controller			
Mat'l.	$200	$148	$169
Assy & Test	$ 60	$ 37	--
Cables	$ 12	$12	$ 12
Subtotal	$913 ($836)	$787 ($710)	$720 ($668)
RX50			
Drive	$234	$200	$175
Controller			
Mat'l.	$ 71	$ 63	$ 78
Assy. & Test	$ 38	$ 28	--
Cables	$ 6	$ 6	$ 6
Subtotal	$349	$297	$259
Subsystem total	$1262 ($1185)	$1084 ($1007)	$979 ($927)

(1.) Parenthetical numbers represent targeted RD50 costs.

5.2.2 INTEGRATED RD/RX COSTS

SEPERATE MECHANISMS

Material

Floppy	$118
Hard disk	$195
	$313

Assy. & Test

	Domestic	Far East
Floppy	$ 40	$ 20
Hard disk	$ 96	$ 30
	$136	$ 50

Maximum savings obtainable using integrated mechanism.

Material:

Floppy spin motor	-	$12
Floppy positioner motor	-	$11
Transfer mechanism	+	$ 5
Net mat'l. savings	-	$18
Labor:		$ 30 $ 20
Total Savings		$48/$426 = 11% Domestic $38/$339 = 11% Far East

Conclusion: Doesn't appear that an 11% saving in transfer cost is worth sacrificing the packaging flexibility of seperate mechanisms.

5.3 CONTROLLER COSTS (FY'84 $)

MULTI DISK CONTROLLER CHIP + PLL

Mat'l.	$115
Assy. & Test	$ 40
	$155

WD1010 + WD1793

Mat'l.	$179
Assy. & Test	$ 60
	$239

5.2 DRIVE COSTS

5.2.1 DRIVE COSTS FOR SEPERATE MECHANISMS

FY'84$

Buyout

RD50

Tandon	$300
Seagate	$400

Floppy

TEAC ($125 + 15% landed) $144

DEC Designed/Built

RD50

Heads 2 @ $19	$ 38
Media 1 disk	27
Stepper/pulley	19
Spindle mtr.	20
Casting/frame	15
Sensors	6
Connectors	2
Flex cable	5
Filter	3.50
Misc.	10
electronics	60
	$195

Assy & test

1.5hrs. @7.85/hr. 725% OH	$ 96	
Far East 1.5/hrs @ $20/hr	$ 30	
Total	$291	Domestic
	$225	Far East

Floppy

	$135	Domestic
	$114	Far East
Subsystem Total	$339 - $426	* $87 savings in Far East.

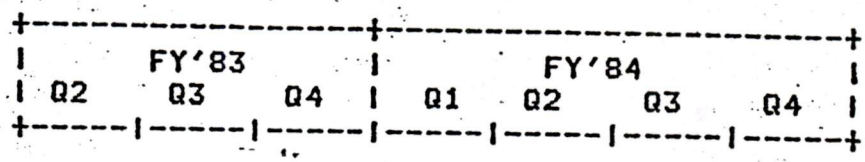
SCHEDULE

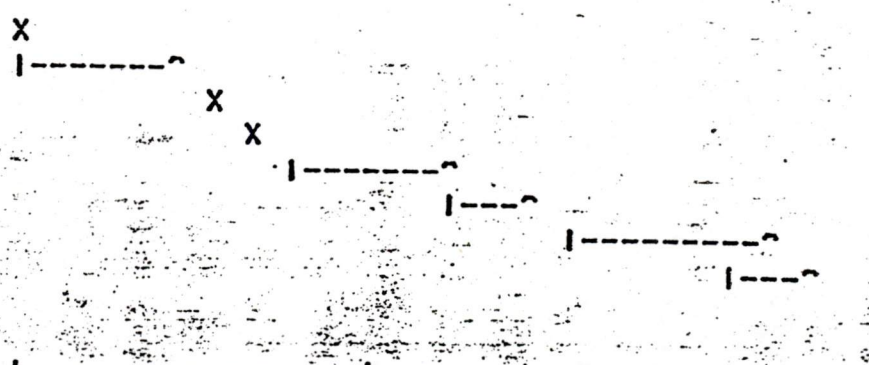
BUYOUT

EVALUATION UNITS	Q3'83
EVALUATION/ECO	Q4'84
QUALIFICATION	Q1 - Q2'84
FVS	Q2'84
FRS	Q3'83

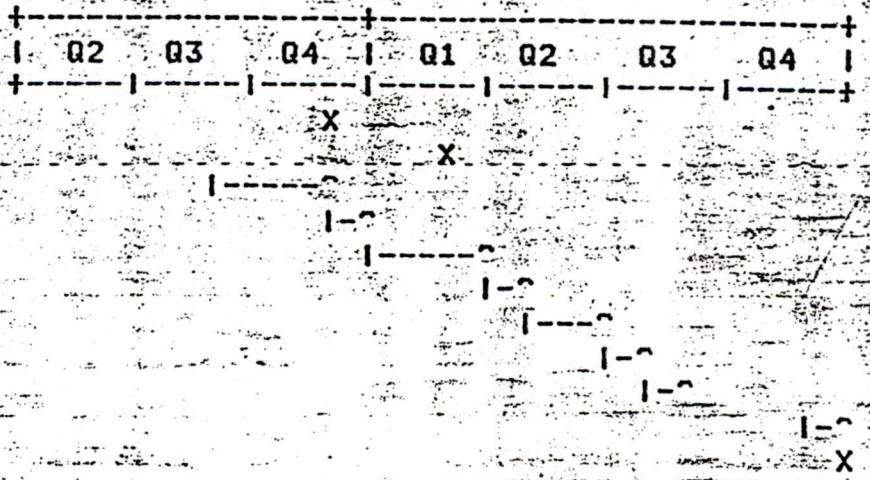
DEC DESIGN/BUILD

START	Q2'83
DESIGN COMPLETE	Q3'83
FUNCTINAL B.B.	Q3'83
FUNCTINAL PROTO	Q3'83
DVT PHASE I	Q4'83
DVT PHASE II	Q1'84 SOFT TOOLED PARTS
DMT START	Q1'84
DMT COMPLETE	Q3'84
FVS	Q4'84





CONTROLLER



RD DEVELOPMENT BUDGET

	FY'83			FY'84				FY'85	
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
INTERNAL									
Engineers									
Supervisors	1	1	1	1	1	1	1	1	.5
Mech. Eng.	2	2	2	2	2	2	2	1	.5
Mech. Design	1	1	1	1	1	1	1	.5	
Tooling Eng.	1	1	1	1	1	1	1	.5	
Heads/Media	1	1	1	1	1	1	1	.5	.5
R/W	1	1	1	1	1	1	1	1	.5
u Code+Devic. Logic	1	1	1	1	1	1	1	.5	.5
Stepper Algorithm	1	1	1	1	1	1	1	.5	
	9	9	9	9	9	9	9	5.5	2.5
Eng. $	180	180	180	203	203	203	203	138	63
Techs.									
Elect.	2	3	3	3	3	3	3	1.5	1.5
Mech.	2	2	2	2	2	2	2	1	1
	4	5	5	5	5	5	5	2.5	2.5
Tech. $	45	56	56	63	63	63	63	34	34
Other									
Labor	225	241	241	266	266	266	266	172	97
Material	5	15	20	30	40	15	10	5	2
Tooling		10	20	20	15	10			
ECO						10	25	75	25
Total Internal	230	266	281	316	321	301	291	252	124
External									
Reliability				35	35				
Model Shop	5	10	15	15	10	5			
Design Services	10	30	40	20	15				
Comp. Eng.		5	10	15	15	10	5		
Test Equip.				10	45	45	20		
Tech. Writing				10	20	20	20		
Heads/Media	5	15	30	30	30	15	15	5	
Total External	20	60	95	135	170	95	60	5	
Proejct Total	250	326	376	451	491	396	351	257	124
	952			1689				381	
	3022								

CONTROLLER DEVELOPEMENT BUDGET
==========

	FY'83			FY'84				FY'85
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Internal								
Engineers								
Elect. Engineers		1	2	2	1	1	1	.5
u Code		1	1	1	1	1	1	.5
Diagnostic		.5	1	1	1	1	.5	
		2.5	4	4	3	3	2.5	1
Techs								
Elect.		1	2	2	2	2	2	1
Total Labor $		62	103	140	118	118	106	39
Materials		3	5	10	5	5	2	2
ECO							15	50
Internal Total		65	108	150	123	123	123	91
External								
Design Services			15	10	5			
Model Shop			2	2	1			
Component			5	5				
Test Equip.				15	15	15	15	
LSI Comp. Eng.				10	35	35		
Tech. Writing				10	15	15	10	
External Total			22	52	71	65	25	
Project Total		65	130	202	194	188	148	91
	195			732				91
	1018							

d i g i t a l

INTEROFFICE MEMORANDUM

To : Bob Flynn

cc : SSD Staff

Date: 7 October 1982
From: Peter van Roekens
Dept: Electronic Storage
Ext : 223-1965
Loc : ML21-2 E64
Enet: KRYPTN::VANROEKENS

PvR

Subj: Information Package

The following package contains the five items requested by yourself and Rick Corben.

CHANGES TO PLAN

There are no changes to the plans to bring them into conformance with EMC guidelines because the plans were submitted after the guidelines were developed. The one major issue that ESD has been working is funding.

With our manpower frozen, we still have a problem covering our run rate. This situation was caused by a rapid fall off of the indirect and external funds that the group had received in previous years. The problem has been eased by getting 200K from Scorpio and an expected 417K from TVG. My current estimate of the deficit at the end of FY '83 is about 1M. We are continuing to look for ways to bring in additional funding.

The remaining items are attached. Item 3 has been updated to reflect the increased funding. Items 2, 4, and 5 are being submitted for the first time.

CHART II

ESD

OTHER

PROJECT NAME AND SUMMARY	$K ENGINEERING BUDGET FY'83	FY'84	FY'85
TOOLS AND TESTERS	464.5	613.2	795.0
ENGINEERING SUPPORT	201.7	252.6	316.0
ADVANCED DEVELOPMENT	192.0	250.0	312.5
PRODUCT MANAGEMENT	244.0	285.0	330.0

CHART I

ESD

PRODUCT DEVELOPMENT

Product Name And Summary Description	Current Phase	FRS	IRR %	NOR Lifetime $B	ENG. EXP. Lifetime $M	NPSU[C] $M	SERV Summary $M	ENGINEERING EXPENSE $K '83	'84	'85
11/780	2	Q4/83	N/A	$.3	1.914	.142	N/A	658.3	- -	- -
MS11-PB	3	Q2/83	N/A[A]	$.1	.762	.116	N/A	189.5	- -	- -
VENUS	2	Q2/84	57%	$.2	.961	.207	N/A	251.7	128.7	- -
SCORPIO	1	Q1/85	N/A[B]	$1.1	.783	.114	N/A	444.0	400.0	- -
ORION	1	Q4/84	N/A[B]	$.5	$.800	.149	N/A	494.0	250.0	- -
NAUTILUS	0	N/A	N/A	N/A	.470	N/A	N/A	162.0	297.0	- -
JUPITER	2	Q3/83	51%	$.1	.979	.157	N/A	168.5	223.3	- -
DIAGNOSTIC ASSIST[D] MODULE	0	N/A	N/A	N/A	.889	N/A	N/A	417.0	472.0	- -

[A] To Be Completed for Phase 3 Business Plan October 1983

[B] To Be Completed for Phase 1 Business Plan October 1983

[C] Includes Original RAM Designed Into Original Board - Not Subsequent RAM Upgrades

[D] Not Formally Committed from TVG

PROGRAM MANPOWER PLAN (ELECTRONIC STORAGE DEVELOPMENT)

GROUP MANAGER: PETER VAN ROEKENS

ASSUMPTIONS:

1. REFERENCE (NOTE A). MS780E HAS OVERRUN AND FUNDING IS NOT AVAILABLE FROM TW. THIS PROJECT CONSTITUTES A MAJOR PART OF ESD'S FY83 BUDGET VARIANCE.

2. REFERENCE (NOTE B). SCORPIO FUNDING FOR FY84 IS BEING NEGOTIATED.

3. REFERENCE (NOTE C). NAUTILUS FUNDING FOR FY84 IS BEING NEGOTIATED.

4. REFERENCE (NOTE D). THE DAM MODULE PROGRAM IS NOT PRESENTLY FUNDED; HOWEVER, WE EXPECT FULL FUNDING TO BE FURNISHED BY TVG. (PRESENTLY WE ARE WORKING IN AN INVESTIGATIVE PHASE FUNDED BY TVG.

5. REFERENCE (NOTE E). SEVERAL HARDWARE/SOFTWARE PROGRAMS ARE BEING SOUGHT FOR THE LAST HALF OF FY83 AND ARE: MA780, CT 100 ADD-ON, HSC 50, AND VENUS TCY. THESE PROGRAMS, IF SECURED, WOULD DIMINISH THE UNASSIGNED HEADCOUNT.

PRIORITIZED PROGRAM	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
1. DYNAMIC RAM EVAL	D. MORENO	393	ML	DEVICE ENG.	E09	EFT	.5	.5	.5	.5	.5	.5	.5	.5
	K. YEE	393	ML	TEST EQUIP ENG.	E09	EFT	1	1	1	1	1	1	1	1
	B. O'HALLORAN	393	ML	TEST ENG.	E11	EFT	1	1	1	1	1	1	1	1
	P. CASEY	393	ML	TEST TECH.	E70	TFT	.5	.5	.5	.5	.5	.5	.5	.5
	P. RAYMOND/ NEW HIRE	393	ML	DEVICE ENG.	E11	EFT		.25	.25	.25	1	1	1	1
							2.5/.5	2.75/	2.75/	2.75/	3.5/	3.5/	3.5/	3.5/
								.5	.5	.5	.5	.5	.5	.5
2. DRAM MULTIVENDOR	D. MORENO	393	ML	DEVICE ENG.	E09	EFT	.5	.5	.5	.5	.5	.5	.5	.5
	D. EIDENS	393	ML	TEST EQUIP TECH	E73	TFT		.5	.5	.5	.5	.5	.5	.5
	P. CASEY	393	ML	TEST OPERATOR	E50	TFT	.5	.5	.5	.5	.5	.5	.5	.5
							.5/.5	.5/1	.5/1	.5/1	.5/1	.5/1	.5/1	.5/1
3. LIFE TEST SYSTEMS	D. STONE	393	ML	TEST EQUIP ENG.	E09	EFT	1	1	1	1	1	1	1	1
	D. EIDENS	393	ML	TEST EQUIP TECH	E73	TFT		.5	.5	.5	.5	.5	.5	.5
	K. LYSETH	393	ML	TEST EQUIP TECH	E70	TFT	1	1	1	1	1	1	1	1
	D. KENDALL	393	ML	TEST OPERATOR	E50	TFT	1	1	1	1	1	1	1	1
	S. GORDON	392	ML	SOFTWARE DESIGN	J13	EFT	1	1	1	1	1	1	1	1
							2/2	2/2.5	2/2.5	2/2.5	2/2.5	2/2.5	2/2.5	2/2.5
4. VAX 11/780 (64K)	T. ZACCONI	392	ML	MANAGE	E02	EFT	1	1	.3	.3				
	J. OBBARD	392	ML	SUPERVISE	E07	EFT	1	1	1	.3				
	J. STEGEMAN	392	ML	LOGIC DESIGN	E07	EFT	.2							
	J. LYNCH	392	ML	LOGIC DESIGN	E11	EFT	1	1	1					
	D. WHITEHOUSE	392	ML	COORDINATE	E07	EFT	1	1	1	.5				
	L. DERENNE	392	ML	BUILD/DEBUG	E90	TFT	1	1	1	.5				
	L. REID-SIRACO	392	ML	DOCUMENT	E71	TFT	1							
	J. MELOSKI	392	ML	BUILD/DOCUMENT	E72	TFT	1	1						
	R. CROUSE	392	ML	BUILD	B44	NCP	1	1		(RETURNS TO SCHOOL)				
	S. LIGHT	392	ML	ADMINISTRATOR		AFT	1	1						
	D. SENERCHIA	392	ML	BUILD		EFT	1	1						
							5.2/5	5/4	3.3/1	1.1/ .5				
5. MS11-P	J. JANETOS	392	ML	LOGIC DESIGN	E11	EFT	1	.3						
	J. SANGERMANO	392	ML	LOGIC DESIGN	E09	EFT	.3							
	D. EIDENS	392	ML	BUILD/DEBUG	E73	TFT	1		(TRANSFER TO CC 393)					
							1.3/1	.3						

A

PRIORITIZED PROGRAM	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
6. VENUS	J. PARE	392	ML	LOGIC DESIGN	E09	EFT	1	.8	.5	.5	.5	.5	.3	.3
	B. KENDALL	392	ML	ELECTRONIC TECH	E71	TFT	1	.7						
	R. STANLEY	392	ML	ELECTRONIC TECH	E73	TFT			.5	.5	.5	.3		
	S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT	.5	.25						
							1.5/1	1.05/.7	.5/.5	.5/.5	.5/.5	.5/.3	.3	.3
7. SCORPIO	K. MAMAYEK	392	ML	LOGIC DESIGN	E09	EFT	1	1	1	1	1	1	1	1
	J. STEGEMAN	392	ML	LOGIC DESIGN	E07	EFT	.8	1	1	1	.5	.5		
	J. SANGERMANO	392	ML	LOGIC DESIGN	E09	EFT	.7	1	1	1	1	1		
	V. TRIOLO	392	ML	GATE ARRAY DESIGN	E11	EFT	1	1	1	1	1			
	J. DINOPOLOUS	392	ML	BUILD/DEBUG	E90	TFT	.7	1	1	1	1	1	1	1
	K. CLEVELAND	392	ML	SOFTWARE DIAG	E90	TFT			1					
							3.5/.7	4/1	4/2	4/1	3.5/1	2.5/1	1/1	1/1
8. JUPITER	N. RIEGELHAUPT	392	ML	LOGIC DESIGN	E07	EFT	1	1						
	J. PARE	392	ML	LOGIC DESIGN	E09	EFT		.2	.5	.5	.5	.5	.5	
	R. STANLEY	392	ML	ELECTRONIC TECH	E73	TFT	1	1	.5	.5	.5	.5	.7	
	S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT	.5	.25						
							1/1.5	1.45/1	.5/.5	.5/.5	.5/.5	.5/.5	.5/.7	
9. ORION	R. ELY	392	ML	LOGIC DESIGN	E09	EFT	1	1	1	1	1	1	1	
	J. RANTALA	392	ML	GATE ARRAY DESIGN	E11	EFT	1	1	1	1	1			
	L. CHISVIN	392	ML	TESTER/SOFTWARE	E90	TFT	1	1	1	1	1			
	G. DONOGHUE	392	ML	BUILD/DEBUG	E72	TFT	1	1	1	1	1			
	B. DUPRE	392	ML	SOFTWARE DESIGN	J15	EFT		1	1			1	1	1
	K. LANGLAIS	392	ML	SOFTWARE DESIGN	J11	EFT		.3	.3					
							2/2	3.3/2	3.3/2	2/2	2/2	1/1	1/1	0/1
10. MXV11-B	D. MANION	392	ML	SUPERVISE	E90	TFT	.5	.1						
	H. COLLINS	392	ML	LOGIC DESIGN	E09	EFT	.1							
	D. SOVIE	392	ML	BUILD/DEBUG	E72	TFT	1	.5						
							.1/1.5	0/.6						

B

PRIORITIZED PROGRAM	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE	FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4	
11. MRV11-D	D. MANION	392	ML	SUPERVISE	E20 TFT	.5	.5							
	J. LAVRANCHUK	392	ML	LOGIC DESIGN	E11 EFT	1	1							
	K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90 TFT	1								
	J. DINOPOLOUS	392	ML	BUILD/DEBUG	E90 TFT	.3								
	K. CHINNASWAMY	392	ML	BUILD/DOCUMENT	B43 NCP	1	1	(RETURNS TO SCHOOL)						
	B. DUPRE	392	ML	SOFTWARE DESIGN	J15 EFT	1								
						2/2.8	1/1.5							
12. NAUTILUS	P. NATUSCH	392	ML	LOGIC DESIGN	E09 EFT	1	1	1	1	1	1	1	1	
	N. RIEGELHAUPT	392	ML	LOGIC DESIGN	E07 EFT			1	1	1	1	1	1	C
	B. KENDALL	392	ML	BUILD/DEBUG	E90 TFT			.5	1	1	1	1	1	
	K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90 TFT				1	1				
						1/0	1/0	2/.5	2/2	2/2	2/1	2/1	2/1	
13. VIDEO RAM	P. RAYMOND/ NEW HIRE	393	ML	DEVICE ENG.	E11 EFT	.75	.75	.75	.75					
14. STATIC RAM EVALUATION	F. QUADRI/ NEW HIRE	393	ML	DEVICE ENG.	E07 EFT	1	1	1	1	1	1	1	1	
	J. TESSARI	393	ML	TEST ENG.	E11 EFT	1	1	1	1	1	1	1	1	
	B. HUNT	393	ML	TEST TECH.	E73 TFT	1	1	1	1	1	1	1	1	
						2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1	
15. DAM	J. JANETOS	392	ML	LOGIC DESIGN	E11 EFT		.7	1	1	1	1	1		
	S. ROCHEFORT	392	ML	BUILD/DEBUG	B43 NCP			1	1	(RETURNS TO SCHOOL)				
	D. MANION	392	ML	SUPERVISE	E90 TFT		.4	.5	.5	.5	.5	.5		
	H. COLLINS	392	ML	LOGIC DESIGN	E09 EFT	.9	1	1	1	1	1			D
	D. SOVIE	392	ML	BUILD/DEBUG	E72 TFT		.5	1	1	1	1	1		
	M. KAKKAD	392	ML	SOFTWARE DESIGN	J13 EFT		1	1	1	1	1	1		
						.9/0	2.7/ .9	3/2.5	3/2.5	3/1.5	3/1.5	3/1.5		

OTHER	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
. PROJECT MANAGEMENT	D. ELLIS	392	ML	LG. SYST. DEV. MAN	E02	EFT	1	1	1	1	1	1	1	1
	T. ZACCONI	392	ML	MED. SYST. DEV. MAN	E02	EFT			.7	.7	1	1	1	1
	R. GIVEN	392	ML	SM. SYST. DEV. MAN	E05	EFT	1	1	1	1	1	1	1	1
	D. DUTTON	393	ML	DEVICE TECH DEV MAN	E05	EFT	1	1	1	1	1	1	1	1
	B. MURPHY	392	ML	MEM. DIAG. DEV. MAN	J11	EFT	1	1	1	1	1	1	1	1
	D. HURLBUT	392	ML	SM. SYST SUPERVISOR	E05	EFT	1	1	1	1	1	1	1	1
	B. COATES	392	ML	ENGINEERING MANAGER	E02	EFT	1	1	1	1	1	1	1	1
. PRODUCT MANAGEMENT	D. HALEY	392	ML	SM SYST PRODUCT MAN	E23		1	1	1	1	1	1	1	1
	J. AUSTIN	392	ML	MED/LG SYST PRO MAN	E22		1	1	1	1	1	1	1	1
	P. DURANT	392	ML	PROD. MANAGEMENT	E18		1	1	1	1	1	1	1	1
	D. RICE	392	ML	SECRETARIAL	G48	GFT	1	1	1	1	1	1	1	1
. CONSULTANT	D. SMELSER	392	ML	CONSULTANT	E03	EFT	1	1	1	1	1	1	1	1
	J. STEGEMAN	392	ML	CONSULTANT	E07	EFT					.5	.5	1	1
. ASSEMBLY	P. MIKELS	392	ML	ASSEMBLY	E50	TFT	1	1	1	1	1	1	1	1
	D. GAGE	392	ML	ASSEMBLY	E50	TFT	1	1	1	1	1	1	1	1
. TOOL SUPPORT	R. SIRACO	392	ML	TESTERS	E36	TFT	1	1	1	1				
	L. PEARCE *	392	ML	DATA ENTRY SPECIAL.		JPT	1	1	1	1				
. 2224 UPGRADE	D. CARUSO	392	ML	SOFTWARE DESIGN	J15	EFT		1	1	1				
. MD407	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13	EFT		.2	.2	.5				
. TEST STRATEGY	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13	EFT		.3	.3	.5				
. MS11-P 2228	M. KAKKAD	392	ML	SOFTWARE DESIGN	J13	EFT	1							
. CT100/2226C	D. CARUSO	392	ML	SOFTWARE DESIGN	J15	EFT	1							
	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13	EFT	1	.5	.5					

* PERMANENT PART-TIME

- OTHER
- JUPITER TCY
- RAINBOW 2224
- CT ADD ON
- VENUS TCY
- SECRETARIAL

- OTHER

NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
K. LANGLAIS	392	ML	SOFTWARE DESIGN	J11	EFT	1	.7	.3					
S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT		.5	1	.3				
K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90	TST		1						
S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT				.7				
S. BARNARD	392	ML	SECRETARIAL	G49	GFT	1	1	1	1	1	1	1	1
M. POCHINI	392	ML	SECRETARIAL	G48	GFT	1	1	1	1	1	1	1	1
S. GOGUEN	392	ML	SECRETARIAL	G47	GFT	1	1	1	1	1	1	1	1
D. DUVARNEY	392	ML	SECRETARIAL	G54	GFT	1	1	1	1	1	1	1	1
R. GOODWIN	392	ML	MATERIAL EXPEDITER	B66	NCP	1	1	1	1	1	1	1	1

UNASSIGNED	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE	FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
	J. SANGERMANO	392	ML	LOGIC DESIGN	E09 EFT							1	1
	V. TRIOLO	392	ML	LOGIC DESIGN	E11 EFT						1	1	1
	J. DINOPOLOUS	392	ML	ELECTRONIC TECH	E90 TFT								
	H. COLLINS	392	ML	LOGIC DESIGN	E09 EFT							1	1
	D. SOVIE	392	ML	ELECTRONIC TECH	E72 TFT								1
	J. JANETOS	392	ML	LOGIC DESIGN	E11 EFT								1
	J. LAVRANCHUK	392	ML	LOGIC DESIGN	E11 EFT			1	1	1	1	1	1
	S. ROCHEFORT	392	ML	COOP ELEC.	B43 NCP								1
	R. ELY	392	ML	LOGIC DESIGN	E09 EFT							.2	.7
	G. DONOGHUE	392	ML	ELECTRONIC TECH	E72 TFT						.2	.3	1
	N. RIEGELHAUPT	392	ML	LOGIC DESIGN	E07 EFT		.3	.5					1
	J. PARE	392	ML	LOGIC DESIGN	E09 EFT				.7	1	1	1	1
	R. STANLEY	392	ML	ELECTRONIC TECH	E73 TFT				.5	1	1	1	1
	B. KENDALL	392	ML	ELECTRONIC TECH	E71 TFT			1	1	1	1	1	1
	J. OBBARD	392	ML	LOGIC DESIGN	E07 EFT					1	1	1	1
	D. WHITEHOUSE	392	ML	LOGIC DESIGN	E07 EFT					1	1	1	1
	J. MELOSKI	392	ML	ELECTRONIC TECH	E72 TFT						1	1	1
	D. CARUSO	392	ML	SOFTWARE DESIGN	J15 EFT						1	1	1
	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13 EFT							1	1
	K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90 TFT							1	1
	B. DUPRE	392	ML	SOFTWARE DESIGN	J15 EFT				1	1	1	1	1
	S. GORDON	392	ML	SOFTWARE DESIGN	J13 EFT								
	S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95 EFT					1	1	1	1
	M. KAKKAD	392	ML	SOFTWARE DESIGN	J13 EFT								1
	K. LANGLAIS	392	ML	SOFTWARE DESIGN	J11 EFT			.4	1	1	1	1	1
	R. SIRACO	392	ML	SOFTWARE DESIGN	E36 TFT					1	1	1	1
	J. STEGEMAN	392	ML	LOGIC DESIGN	E07 EFT							1	1
	J. RANTALA	392	ML	GATE ARRAY DESIGN	E11 EFT		.				1	1	1
	L. CHISVIN	392	ML	TESTER/SOFTWARE	E90 TFT						1	1	1
	D. MANION	392	ML	SUPERVISE	E90 TFT			.5	.5	.5	.5	.5	1
	P. RAYMOND	393	ML	DEVICE ENGINEER	E11 EFT	.25							
	J. LYNCH	392	ML	LOGIC DESIGN	E11 EFT				1	1	1	1	1
	L. DERENNE	392	ML	BUILD/DEBUG	E90 TFT				.5	1	1	1	1
	L. REID-SIRACO	392	ML	BUILD	TFT		1	1	1	1	1	1	1
	D. SENERCHIA	392	ML	DESIGN	EFT			1	1	1	1	1	1
	S. LIGHT	392	ML	ADMINISTRATOR	AFT			1	1	1	1	1	1
*	L. PEARCE	392	ML	DATA ENGRY SPECIAL.	JPT					1	1	1	1
	P. GREENAWAY/ K. CHINNASWAMY	392	ML	BUILD/DOCUMENT	B44 NCP			1	1				
	S. ROCHEFORT/ R. CROUSE	392	ML	BUILD/DOCUMENT	B43 NCP			1	1	1	1	1	1

* PERMANENT PART-TIME

ESD/SSD

APPENDIX C - PROJECT INVESTMENT PRIORITY AND

RESPONSIBLE ENGINEER LIST

PRIORITY 1 - ABSOLUTELY CRITICAL TO BASE STRATEGY

FUNDING GROUP	PROJECT NAME	RESP. ENG.	FY'83 BUDGET	FY'85 NOR
SSD	11/780 64K UPGRADE	B. COATES	.658	$104m
SSD	MS11-PB 1MB UNIBUS MOS MEMORY	R. GIVEN	.199	$41.8m
LSG	VENUS 4MB ARRAY	D. ELLIS	.252	$40.8m
SSD 32-BIT SYSTEM	SCORPIO	R. GIVEN	.244 .200 --- .444	$6.9m
SSD	ORION	R. GIVEN	.494	$69.1m
32-BIT SYS.	NAUTILUS	R. GIVEN	.162	$45.0m

PRIORITY 2 - SUBSTANTIAL EXISTING CUSTOMER COMMITTMENT

FUNDING GROUP	PROJECT NAME	RESP. ENG.	FY'83 BUDGET	FY'85 NOR
LSG	JUPITER 1MB ARRAY	D. ELLIS	.169	$12.2M

PRIORITY 3 - SUPPORTS BASE STRATEGY

FUNDING GROUP	PROJECT NAME	RESP. ENG.	FY'83 BUDGET	FY'85 NOR
TVG	DIAGNOSTIC ASSIST MODULE	R. GIVEN	.417	N/A

LMM/PVOD

MEMORY PRODUCT PRICE BAND CHART

PRICE BAND	FY'83 DEC	FY'83 COMPETITION	FY'85 DEC	FY'85 COMPETITION	FY'87 DEC	FY'87 COMPETITION
625K - 1.6M	PDP-10, 256KB $24K/MB	512KB $15K/MB	JUPITER, 4MB $3.5K/MB	4MB $1.6K/MB	JUPITER 4MB $2.5K/MB	8MB $1.2K/MB
250K - 625K	- - 11780, 1MB $3.2K/MB	 1MB $2K/MB	VENUS 4MB $3.0K/MB 11780 4MB $2.1K/MB	4MB $1.6K/MB 4MB $1.6K/MB	VENUS 4MB $2.0K/MB 11780 4MB $1.5K/MB	8MB $1.2K/MB 8MB $1.2K/MB
100 - 250K	11750, 1MB $3.2K/MB	1MB $2K/MB	11750, 1MB $2.1K/MB	4MB $1.6K/MB	NAUTILUS 8MB $1.5K/MB	8MB $1.2K/MB
40 - 100K	11730, 1MB $3.2K/MB 1144, 1MB $3.5K/MB	1MB $2K/MB 1MB $3K/MB	11730, 1MB $2.1K/MB	4MB $1.5K/MB	SCORPIO, 2MB $2.0K/MB	4MB $1.2K/MB
16 - 40K	1123B, 1/2MB $5.4K/MB	1/2MB $2.8K/MB	ORION Q/U 2MB $3.3K/MB	2MB $1.6K/MB	ORION 2MB $2.0/MB	4MB $1.2K/MB
2.5 - 16K	LSI-11, 256KB $3.8K/MB	1/2MB $2.6K/MB	ORION, 2MB $3.3K/MB	2MB $1.6K/MB	NOT DEFINED	4MB $1.2K/MB

1) THIS CHART IS FOR ADD-ON MEMORY ONLY. PRICES REFLECT OUR MOST COMPETITIVE PRICE. MEMORY REVENUE/MB IN PACKAGED SYSTEMS WILL BE HIGHER.

2) DEC PRICES ARE ACTUAL FOR '83; ASSUMED COMPETITIVE AT THAT POINT. DEC PRODUCTS EASY TO PLUG ARE DECREASED IN PRICE FASTER THAN THOSE WITH CUSTOM LSI OR COMPLEX GATE ARRAYS.

3) COMPETITION IS ASSUMED TO BE U.S. AND JAPANESE SEMICONDUCTOR MANUFACTURERS.

4) THIS REFLECTS ESD'S CURRENT PLAN AND BUDGET. PLANS TO GET HIGHER DENSITY IN FY'87 NEED TO BE DEVELOPED.

PVOD 9/82

SMALL MANPOWER STORAGE LOADING FY83-FY84 SYSTEMS SCHEDULE

PRIORITIZE PROGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
AZTEC II. (Cont.)	PARIKH	MGR	E02					50	75	100	100
	GIFFORD	M.E.	E07					-	50	100	100
	HINLEIN	M.E.	E07						50	50	50
	HEARNHINLE	M.E.	E07					-	-	-	-
	HUTNAK	M.E.	E09					-	-	-	-
	NEWMAN	ANALYSIS	E11					100	100	100	100
	O'DAY	M.E.	E11					50	50	50	50
	CONDODN	Equip.	N09					-	-	-	-
	CITTA	TECH	E71					50	100	100	100
	MILLEY	TECH	E73					-	-	100	100
	MITCHELL	TECH	E90					-	-	-	-
	LANDIS	TECH	E70					100	100	100	100
	ERLICHMAN	TECH	E70					100	100	100	100
	IVES	TECH	E83					50	100	100	100
	NEWELL	TECH	E82						50	100	100
	O'LEARY	TECH	E82					100	100	100	100
RAINBOW	POWER	SUPV.	E05	-	40	40	25				
	HELLER	LOGIC	E11	-	50	100	50				
	JANUSK	TECH	E62	-	75	50	50				
	*OPEN	TECH	E62	-	100	100	100				

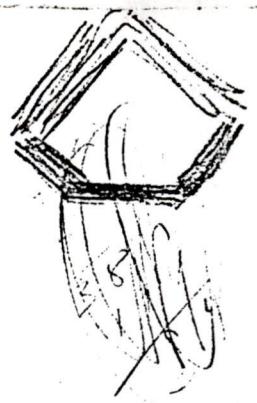
			SMALL MANPOWER	STORAGE LOADING FY83-FY84	SYSTEMS SCHEDULE					
ORITIZE OGRAM	NAME	TECHNICAL SKILL	JOB CODE	Q1FY83	Q2FY83	Q3FY83	Q4FY83	Q1FY84	Q2FY84	Q3FY84	Q4FY84
GNOSTIC	GRAY	SUPERVISOR	E10	100	100	100	100	100	100	100	100
	MOSCARILLO	LIBR. REL.	J61	100	100	100	100	100	100	100	100
RX50	CUADRI	DIAG	J13	100	100						
	CHESTER		J11	100	100						
RX52	CUADRI		J13			100	100	50	50	50	50
	CHESTER		J11			100	100				
ZTEC	POWERS		J11	100	100	100	50	50	50		
	CHEN		J11	100	100	100	100	100			
	CHIN		J13	100	100	100					
	DOUCETTE		CONTR	100	100	100					
	NEALE			100	100	100	100				
	DOWD		COOP	100							
	NICKEL°G		J15		100	100					
ON ELE	ROSS		J13	100	100	100	100	100	100	100	100
	FEELEY		J15	100	100	100	100	100	100	100	100
EC II	POWERS		J11				50	50	50	100	100
	NICKEL°G		J15				100	100	100	100	100
	CHIN		J13				100	100	100	100	100
	CHEN		J11						100	100	100
	CHESTER		J11					100	100	100	100
UCT PORT	SMITHER	MGR	E02	100	100	100	100	100	100	100	100
/RKC7/	RAYMOND	PS ENG	E07	100	100	100	100	50	50	50	50
	GREEN	PS TECH	E61	100	100	100	100	50	50	50	50
X50	HILDEBRANT	PS ENG	E07	100	100	100	100	100	100	100	100
	CHAUTIN	PS ENG	E07			100	100	100	100	100	100
	MCLAUGHLIN	PS TECH	E62	100	100	100	100	100	100	100	100
050	FUZZY	PS ENG	E07	100	100	100	100	100	100	100	100
	HOWELL	PS TECH	E90	100	100	100	100	100	100	100	100
TEC	HAMBLEN	AZTEC-ENG		100	100	100	100	100	100	100	100
	BETHLAHME	AZTEC-ENG			100	100	100	100	100	100	100
	FELERSTEIN	AZTEC-TECH									
X52	*OPEN*	PS ENG	E07				50	100	100	100	100
	OPEN	PS TECH	E90						50	100	100
EC II	*OPEN*	PS ENG	E07					50	50	100	100
XX	*OPEN*	PS ENG	E07			50	100	100	100	100	100

25

SMALL STORAGE SYSTEMS
MANPOWER NEEDS

PROJECT	TECHNICAL SKILLS	JOB CODE	QTR NEEDED
AZTEC	M-Code Eng.	E09	Q2
Floppies	East Replacement-Supervisor	E05	Q2
	Berthiaume Replacement - Mech.	E11	Q2
	Chautin Replacement - Elec.R/W	E09	Q3
	Read Write	E09	Q3
Common Elect.	Analog Eng.	E09	Q2
	Analog Eng.	E09	Q2
	Logic Eng.	E07	Q2
	Logic Eng.	E07	Q2
1/2 Hgt. 5 1/4" Hard Disk	Mech. Eng.	E09	Q2
	Mech. Design	E09	Q2
	Tooling Eng.	E09	Q2
	Heads/Media	E09	Q2
	R/W	E07	Q2
	U Code + Devic. Logic	E09	Q2
	Stepper Algorithm	E07	Q2
	Technician	E72	Q2
	Technician	E72	Q2
	Technician	E72	Q2
RDXX	Analog Eng.	E09	Q2
	Logic Eng.	E09	Q2
	Technician	E72	Q2
RAINBOW	Technician	E62	Q2
Prod. Support			
- Floppy Extensions	Prod. Support Eng.	E07	Q4
- 1/2 Height 5 1/4" Hard Disk	Prod. Support Eng.	E07	Q3

Ed Sypek
10/4/82



IV. PROJECT INVESTMENT PRIORITY AND RESPONSIBLE ENGINEERS LIST

Priority 1 - Absolutely critical to Strategy

PROJECT	ENGINEER	FY83 BUDGET ($K)	FY85 NOR ($M)
RX50	Steve Radoff	750+175	460
RD50	Clint Wotton	175	-0-
RD51	Clint Wotton	330	580
Aztec	Carl Blatchley	4900	246
		6155	
RD52			
Common Elec. Set Drive	John Glavin	1385	NA
		7540	
Floppy Extension			
RX50 Wrap Up	Steve Radoff	175	NA
1/2 Hgt. buy out	Steve Radoff	300	NA
Advanced Floppy	Jenny Ryan	250	NA
		725	
1/2 Hgt. low cost hard disk	John Glavin	1150	NA

Priority 2 - Substantial Existing Commitment

RX52	Jenny Ryan	225	163
RDXX	Ed East	380	183
Aztec II	Carl Blatchley	50	6
		655	

Priority 3 - Supports Base Strategy

Rainbow	Duncan Power	300	

/4/82
G.

STEM ICE ND	DEC FY81	BEST COMPETITION FY81	DEC FY83	BEST COMPETITION FY83	DEC FY85	BEST COMPETITION FY85	DEC FY87	BEST COMPETITION FY87
K	TU58 .25MB DC100 CARTRIDGE TAPE				RX50 2 x 400KB $175 DRIVE			
5K					1/2 RX52 800KB REM. $150 DRIVE PORTABLE PERSONAL COMPUTER	TANDON'S 1-2MB 1/2 HT 5 1/4" FLOPPY REM. $150 DRIVE OR TANDON'S 3.5" UFLOPPY (SONY COMPATIBLE)		
5K 25K	RX02 2 x .5MB REMOVABLE QBUS, UBUS $975 SUBSYS. $3900 MLP	DSD 480 2 x 1.0MB REMOVABLE $4000 MLP	RX50 2 x 400 KB REMOVABLE $350 SUBSYS. $995 MLP(1)	TEAC FD55E 1/2 HT 5 1/4" FLOP. 400KB REM. $150 DRIVE	1/2 RX52/ 1/2 HT RD50 800KB/5MB REM./FIXED $150/$225 DRIVES	TANDON'S 1-2MB 1/2 HT 5 1/4" FLOPPY - REM. $150 DRIVE + TANDON'S 5MB 1/2 HT 5 1/4" FIXED DISK $300 DRIVE		
	WPS78		PC100 PC200 PC300		RX50 2 x 400KB $175 DRIVE PC100+ PC200+ PC300+	SEE NOTE 2		
25K 5	RX02 2 x .5MB REMOVABLE	DSD 480 2 x 1.0MB REMOVABLE	RD50/RX50 10MB/ 2 x 400KB	BUYOUT(5) 10-20MB 5 1/4"	RD52/MAYA 50-100MB/50MB FIXED/TAPE	BUYOUT 50-100MB 5 1/4" FIXED		

Lo	REMOVABLE	REMOVABLE	10MB)	10-20MB	50-100MB/50MB	50-100MB
	QBUS, UBUS		2 x 400KB	5 1/4"	FIXED/TAPE	5 1/4" FIXED
6K	$975 SUBSYS.		FIXED/REM.	FIXED + 800KB	CT, QBUS, UBUS	+ TANDON
	$3900 MLP	$4000 MLP	CT, QBUS,	5 1/4" FLOPPY	$650/$350	CARTRIDGE TAPE
			UBUS		DRIVES	$1000 + $350
			$625(4)/$250			
			DRIVES			
			$3000 MLP(3)			

			RD51/RX50			
			10MB/			
			2 x 400KB			
	DECMATE I		FIXED/REM.		PC350+,	
			$600-$700(4)/		LCP-5+	
			$250			
			PC350, LCP-5			
5K	RL02/RL02	DSD 880x/30	RC25 (AZTEC)	LARK II	AZTEC II	HITACHI 812
	10MB/10MB	32MB/1MB	25MBF+25MBR	20.4MBF +	75MBF+75MBR	128MB FIXED +
	REM./REM.	FIXED/FLOP.		20.4MBR		TAPE
3K	QBUS, Q-22		QBUS, UBUS		QBUS, UBUS	
	$1400/$1100		$2972	$4931	$2300	$6450
	$6.9K/$5.6K	$9200 MLP	$9900 MLP			
			12MBITS/IN2	5MBITS/IN2	24MBITS/IN2	
				or		
				LYNX/PUMA		
				10MB/42MB		
	11/23, 11/23+,		11/730,	REM./FIXED	LOW COST 11/730	
	11/24, 11/34,		ORION, LCP-8	$4300	SCORPIO, ORION	
	11/44, WPS 200		11/23+		LCP-8	

ES:

PC300 - Includes Controller
Any number of 1/2 HT 5 1/4" floppies and micro floppies
Imputed hardware MLP for PC350 - priced at $3500 which includes CTAB-10 software
Buyout price
Many vendors will begin delivering 10-20MB drives in FY83

OCT 5 1982

BOB FLYNN

****
* digital *
****

INTEROFFICE MEMORANDUM

TO: Grant Saviers

cc: SSD

DATE: 4 October 1982
FROM: Paul Bauer
DEPT: SMALL STORAGE SYSTEMS
EXT: 223-6581
LOC: ML01-3/T62

SUBJ: PROJECT PROPOSALS IN RESPONSE TO LAST SSD WOODS MTG.

Attached are proposals from the Small Storage group in response to the product needs identified at the last SSD Woods meeting.

1/2 Height 5 1/4" Floppy Buyout
1/2 Height 5 1/4" 10MB Hard Disk

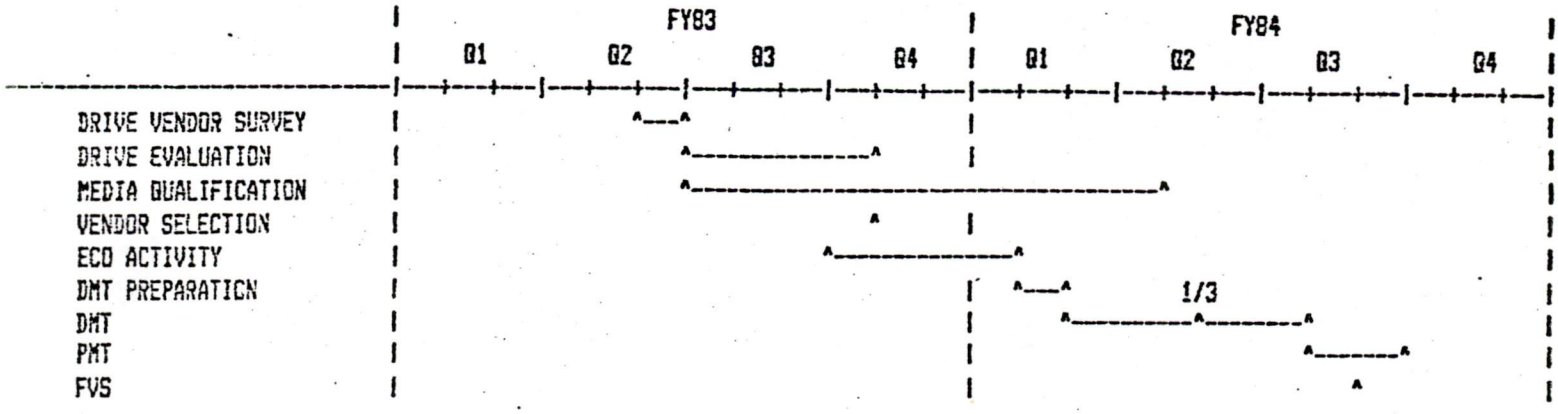
The budget and manpower consequences of these proposals have been incorporated into the latest budget review and analysis.

/mpc

DOUBLE-SIDED HALF-HEIGHT FLOPPY BUYOUT

GETS: DOUBLE SIDED CAPACITY (818Kb/DISK)
PRODUCT QUAL IN MAYNARD
SHORTEST TIME TO MARKET
LOW COST
RX50 CONTROLLER INTERFACE

DON'T GETS: COMPETITIVE TECHNOLOGY BASE
1.2Mb/DISK
NEW MEDIA



1	ENGINEERS	0	1	3	3	2	2	1	0	
		0	20	60	60	40	40	20	0	
2	TECHNICIANS	0	0	2	2	2	1	1	0	
		0	0	23	23	23	11	11	0	
3	P.C.DESIGN	0	0	0	0	0	0	0	0	
4	MECH.DRAFTING	0	0	0	10	5	5	0	0	
5	DIAGNOSTIC ENG.	0	0	6	5	3	3	0	0	
6	TEE	0	0	0	0	0	0	0	0	
7	MTA	0	0	0	0	0	0	0	0	
8	ENPP	0	0	0	0	0	0	0	0	
9	COMP.ENG.	0	0	0	3	3	5	0	0	
10	UL & DEC102	0	0	10	5	10	5	0	0	
11	RELIABILITY	0	0	0	0	8	24	8	0	
12	MODEL SHOP	0	0	5	10	0	0	0	0	
13	TOOLING	0	0	0	0	0	0	0	0	
14	MATERIAL	0	0	15	15	20	0	0	0	
15	ECO	0	0	0	0	0	0	0	0	
16	CONTINGENCY	0	0	10	10	10	10	0	0	
	--- TOTALS ---	0	20	129	141	122	103	39	0	

FIRST YEAR PROJECT TOTAL - $289K

SECOND YEAR PROJECT TOTAL - $264K

PROJECT GRAND TOTAL - $553K

17	HEADS/MEDIA	0	0	30	35	20	10	5	0	
18	CAPITAL	0	0	20	10	0	0	0	0	

E. EAST 29-SEP-82

DOUBLE-SIDED HALF-HEIGHT FLOPPY BUYOUT - COST JUSTIFICATION

1. ENGINEERS:	4.5Q	EE- DEVELOPE A TEST AND EVALUATION PROGRAM TO ACCESS THE MATURITY OF THE DRIVE BY MEASURING IT AGAINST ITS SPEC. DEVELOPE TEST TECHNIQUES AND HARDWARE AND CARRY OUT THE TEST PROGRAM.
	2.0Q	ME- EVALUATE THE MECHANICAL MATURITY OF DRIVES AND DEVELOPE VENDOR IMPLIMENTED ECO'S
	5.5Q	SUPERVISOR- COST, SCHEDULE, AND TECHNICAL MANAGEMENT OF PRODUCT QUALIFICATION, MANAGE THE INTERFACE WITH THE VENDOR.
2. TECHNICIANS:	8.0Q	TECH[4]- SUPPORT ELECT. AND MECH. TEST AND EVALUATION, DEVELOP AND CONFIGURE TEST HARDWARE, SUPPORT QUALIFICATION OF THE PRODUCT.
4. MECH.DRAFTNG:	20K	DEVELOPE VENDOR ECO DOCUMENTATION AND RELEASE DRIVE AND MEDIA PACKAGE.
5. DIAG.ENG.:	17K	MODIFY DIAGNOSTIC SOFTWARE FOR PRODUCT QUAL.
9. COMP.ENG.:	11K	EVAL. AND LIFE TEST OF SELECTED CRITICAL COMPONENTS AND COMPONENT FAILURE ANALYSIS
10. UL&DEC102:	30K	SHOCK AND VIBRATION (8K),PACKAGING SHOCK (6K), UL & PRODUCT SAFETY (4K), THERMAL (8K), EMI/RFI/FCC (4K).
11. RELIABILITY:	40K	20 WEEK DMT TO EVALUATE MTBF, DATA RELIABILITY, INTERCHANGE, AND MEDIA WEAR AT 2K PER WEEK.
12. MODEL SHOP:	15K	TOOLING TO EVALUATE MECHANISM AND ACCELERATE WEAR (DOOR AND COLLET CLAMP).
14. MATERIAL:	50K	70 DRIVES AT $500 EACH (25K),VARIOUS TEST HARDWARE, FIXTURING, AND CABLING (5K).
16. CONTINGENCY:	40K	NEEDED FOR UNCERTAINTY OF OFF-SHORE VENDOR'S COST AND SCHEDULE RISK.
17. HEADS/MEDIA:	100K	SPECIFY AND QUALIFY VENDORS FOR DOUBLE SIDED MEDIA. SUPPLY QUALIFIED AND TESTED MEDIA FOR DVT AND DMT. DEVELOPE PROCEEDURES AND TEST EQUIPMENT FOR MANUFACTURING TO VERIFY MEDIA QUALITY.
18. CAPITAL:	30K	VT103 TEST SYSTEMS (20K), POWER SUPPLIES AND TEST CONTROLLERS (10K).

E. EAST 29-SEP-82

many copy phil + Ed + peterson

JG 22

PROPOSAL LOW COST WINCHESTER AND FLOPPY SUBSYSTEM

J. Glavin
8/30/82

1.0 Introduction

1.1 Purpose

1.2 Scope

2.0 Product Goals and Priorities

2.1 System Goals

2.2 Winchester Goals

2.3 Floppy Goals

2.4 Controller Goals

2.5 Priorities

3.0 Product Description/Specfication

3.1 Drives

4.0 Alternatives

4.1 Drives

4.1.1 Buyouts

4.1.2 DEC Designed and Built

4.2 Controller

4.3 Advantages/Disadvantages

4.3.1 Drives

4.3.2 Controller

5.0 Product Cost

5.1 Present Hardware Cost

5.2 Drive Costs

5.2.1 Drive Costs for Seperate Mechanisms

5.2.2 Integrated RD/RX Costs

5.3 Controller Costs

6.0 Development Tasks

7.0 Schedule/Development Cost

8.0 Issues/Concerns

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this proposal is to examaine the alternatives and feasibility for attaining the lowest cost, 5 1/4 inch, half (1/2) height winchester + floppy subsystem.

The goal is to maintain RD50/RX50 performance at minimum cost.

1.2 SCOPE

Areas which will be studied under this proposal are:

1. Examination and comparison with present subsystem costs.

2. Development of a low cost controller capable of supporting

   - (1) RX50
   - (1) RD50 and/or (1) removable disk.

3. Examine make/buy for 1/2 height RX50 and 1/2 height RD50.

The details for the 1/2 height RX50 will not be addressed under this proposal and can be found under the appropriate proposal from the Floppy Development Group.

2.0 PRODUCT GOALS AND PRIORITIES

2.1 SYSTEM GOALS

* Low cost entry level system.

* System will always be configured with hard disk.

* System transportable media must be RX50 compatible.

* Storage power requirements $\leq$ RD50 +RX50.

* Form factor cannot exceed one full option slot.

* Subsystem transfer cost $700 - $850.

* FVS H2;FY'84.

2.2 WINCHESTER GOALS

* Minimum RD50 capacity and performance.
  - 5MB formatted capacity
  - 170 ms Avg. access time
* Interface = RD50.
* RD51 capacity and performance ASAP.
  - 10MB formatted capacity
  - 85 ms Avg. access time

2.3 FLOPPY GOALS

* Media backwards compatible to RX50.
* Capacity: 400KB minimum.
* Reliability = RX50
* Interface = RX50.
* Performance: Not an issue; don't sacrifice cost for performance.

2.4 CONTROLLER GOALS

* Supports
  - Single RX50
  - Single RD50 and/or single removable disk.
* CT bus.
* Single CT option Slot (5.2" X 12").
* Power $\leq$ RCD50 controller.

2.5 PRIORITIES

1. Time to market @ $800.
2. Lower cost.
3. Removable disk.
4. RD51 capacity and performance.

Note: These are the PC350 priorities.

3.0 PRODUCT DESCRIPTION/SPECIFICATIONS

3.1 DRIVES

	Winchester	Floppy
Configuration	5MB fixed	Single removable diskette
Formatted capacity	5MB/drive	400KB/drive
Avg. latency	8.33MS	100MS
Avg. access time	≤ 170MS	264MS
Functional Specifications		
Recording density	10K bpi	
Track density	345 tpi	96 tpi
Disks	1	1
RPM	3600	300
MTBF	11000 P.O.H. 50% duty cycle	2000 P.O.H 30% duty cycle
Error rates		
Soft	10^{10}	10^{9}
Hard	10^{12}	10^{12}
Seeks	10^{6}	10^{6}
Transfer rate	5MB/sec.	250Kb/sec.
Power	25W TYP (+5; +12)	17W TYP (+5; +12)
Environmental	DEC STD 102 class B	DEC STD 102 media class A
Dimensions		
Height	1.625"	1.625"
Width	5.75"	5.75"
Length	8.0"	8.5"
Weight	5#	5#
Interfaces	ST506 (RD50)	RX50

4.0 ALTERNATIVES

4.1 DRIVES

4.1.1 BUYOUTS

- TEAC; 1/2 height, 96tpi
- Tandon
  1/2 height, 5 1/4" fixed disk
- Seagate

4.1.2 DEC DESIGNED AND BUILT

Two seperate mechanisms

- 1/2 RX50
- 1/2 RD50
- Common controller

Integrated RD/RX

- Shared spin and/or positioner motor
- Shared electronics
- Common controller

4.2 CONTROLLER

* Multiple disk controller and PLL chips

  - AMD
  - Signetics
  - Western Digital

* WD1010 winchester controller ship + WD1793 floppy disk controller chip.

4.3 ADVANTAGES/DISADVANTAGES

4.3.1 DRIVES

Seperate Mechanisims	Advantages	Disadvantages
In-house	- Develop in-house expertise in 5 1/4 inch disks. - Lower product cost. - Design with extensibility as a goal. - Leverage off in-house heads media expertise.	- Higher development costs. - Requires more DEC resources.
Buyout	- Lower development cost requires less DEC resources.	- Solves vendor's technical problems and puts him in business. - 1/2 height products are not in volume production yet, making product a high risk. - Higher product cost. - Extensibility unkown. - Single sourced.
Integrated mechanism	- Lower product cost - High MTBF	- Requires full option slot; limiting packaging flexibility. - More intricate mechanism; increased assembly time. - Eliminates 1/2 height RX50 product. - Longer development time (1 qtr).

4.3.2 CONTROLLER

	Advantages	Disadvantages
Multiple disk controller + P11 chips	- Lower product cost - Lower power consumption - Smaller size	- Chips availability (9 - 12 months away). - Specs not firm. - High risk. - Performance of PLL and data seperator chip unknown.
WD1010 + 1793	- Chips available sooner. (3 months) - Specs not as volatile	- Higher cost. - Higher power consumption. - Real estate risk for 5.2" X 12" board.

5.0 HARDWARE COSTS

5.1 PRESENT HARDWARE COSTS

	FY'83	FY'84	FY'85
RD50			
Drive (1)	$641 ($564)	$590 ($513)	$539 ($487)
Controller			
Mat'l.	$200	$148	$169
Assy & Test	$ 60	$ 37	--
Cables	$ 12	$12	$ 12
Subtotal	$913 ($836)	$787 ($710)	$720 ($668)
RX50			
Drive	$234	$200	$175
Controller			
Mat'l.	$ 71	$ 63	$ 78
Assy. & Test	$ 38	$ 28	--
Cables	$ 6	$ 6	$ 6
Subtotal	$349	$297	$259
Subsystem total	$1262 ($1185)	$1084 ($1007)	$979 ($927)

(1.) Parenthetical numbers represent targeted RD50 costs.

5.2.2 INTEGRATED RD/RX COSTS

SEPERATE MECHANISMS

Material

Floppy	$118
Hard disk	$195
	$313

Assy. & Test

	Domestic	Far East
Floppy	$ 40	$ 20
Hard disk	$ 96	$ 30
	$136	$ 50

Maximum savings obtainable using integrated mechanism.

Material:

Floppy spin motor	- $12
Floppy positioner motor	- $11
Transfer mechanism	+ $ 5
Net mat'l. savings	- $18

Labor:	$ 30	$ 20
Total Savings	$48/$426 = 11% Domestic $38/$339 = 11% Far East	

Conclusion: Doesn't appear that an 11% saving in transfer cost is worth sacrificing the packaging flexibility of seperate mechanisms.

5.3 CONTROLLER COSTS (FY'84 $)

MULTI DISK CONTROLLER CHIP + PLL

Mat'l.	$115
Assy. & Test	$ 40
	$155

WD1010 + WD1793

Mat'l.	$179
Assy. & Test	$ 60
	$239

5.2 DRIVE COSTS

5.2.1 DRIVE COSTS FOR SEPERATE MECHANISMS

FY'84$

Buyout

RD50

Tandon	$300
Seagate	$400

Floppy

TEAC ($125 + 15% landed) $144

DEC Designed/Built

RD50

Heads 2 @ $19	$ 38
Media 1 disk	27
Stepper/pulley	19
Spindle mtr.	20
Casting/frame	15
Sensors	6
Connectors	2
Flex cable	5
Filter	3.50
Misc.	10
electronics	60
	$195

Assy & test

1.5hrs. @7.85/hr. 725% OH	$ 96	
Far East 1.5/hrs @ $20/hr	$ 30	
Total	$291	Domestic
	$225	Far East

Floppy

	$135	Domestic
	$114	Far East

Subsystem Total $339 - $426 * $87 savings in Far East.

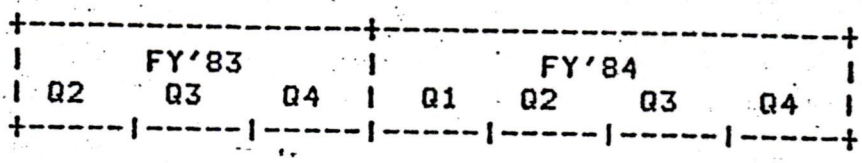
SCHEDULE

BUYOUT

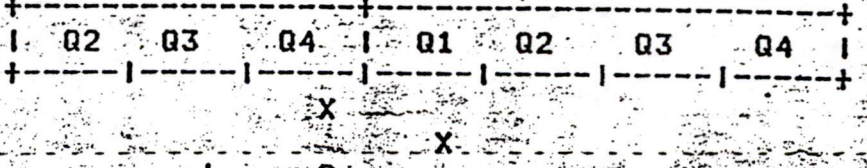
EVALUATION UNITS	Q3'83
EVALUATION/ECO	Q4'84
QUALIFICATION	Q1 - Q2'84
FVS	Q2'84
FRS	Q3'83

DEC DESIGN/BUILD

START	Q2'83
DESIGN COMPLETE	Q3'83
FUNCTINAL B.B.	Q3'83
FUNCTINAL PROTO	Q3'83
DVT PHASE I	Q4'83
DVT PHASE II	Q1'84 SOFT TOOLED PARTS
DMT START	Q1'84
DMT COMPLETE	Q3'84
FVS	Q4'84



START
DESIGN COMPLETE
FUNCTIOANAL BB
FUNCTINAL PROTO
DVT PHASE I
DVT PHASE II
DMT
PMT
FVS
X



CONTROLLER

CHIPS:SAMPLES
PRODUCTION
DESIGN
FUNCTIONAL BB
1'st PASS PROTO
DVT
2nd PASS PROTO
DMT
RELEASE
PMT
FVS

RD DEVELOPMENT BUDGET
==========

	FY'83			FY'84				FY'85	
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
INTERNAL									
Engineers									
Supervisors	1	1	1	1	1	1	1	1	.5
Mech. Eng.	2	2	2	2	2	2	2	1	.5
Mech. Design	1	1	1	1	1	1	1	.5	
Tooling Eng.	1	1	1	1	1	1	1	.5	
Heads/Media	1	1	1	1	1	1	1	.5	.5
R/W	1	1	1	1	1	1	1	1	.5
u Code+Devic. Logic	1	1	1	1	1	1	1	.5	.5
Stepper Algorithm	1	1	1	1	1	1	1	.5	
	9	9	9	9	9	9	9	5.5	2.5
Eng. $	180	180	180	203	203	203	203	138	63
Techs.									
Elect.	2	3	3	3	3	3	3	1.5	1.5
Mech.	2	2	2	2	2	2	2	1	1
	4	5	5	5	5	5	5	2.5	2.5
Tech. $	45	56	56	63	63	63	63	34	34
Other									
Labor	225	241	241	266	266	266	266	172	97
Material	5	15	20	30	40	15	10	5	2
Tooling		10	20	20	15	10			
ECO						10	25	75	25
Total Internal	230	266	281	316	321	301	291	252	124
External									
Reliability				35	35				
Model Shop	5	10	15	15	10	5			
Design Services	10	30	40	20	15				
Comp. Eng.		5	10	15	15	10	5		
Test Equip.				10	45	45	20		
Tech. Writing				10	20	20	20		
Heads/Media	5	15	30	30	30	15	15	5	
Total External	20	60	95	135	170	95	60	5	
Proejct Total	250	326	376	451	491	396	351	257	124
	952			1689				381	
	3022								

CONTROLLER DEVELOPEMENT BUDGET
==========

	FY'83			FY'84				FY'85
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Internal								
Engineers								
Elect. Engineers		1	2	2	1	1	1	.5
u Code		1	1	1	1	1	1	.5
Diagnostic		.5	1	1	1	1	.5	
		2.5	4	4	3	3	2.5	1
Techs								
Elect.		1	2	2	2	2	2	1
Total Labor $		62	103	140	118	118	106	39
Materials		3	5	10	5	5	2	2
ECO							15	50
Internal Total		65	108	150	123	123	123	91
External								
Design Services			15	10	5			
Model Shop			2	2	1			
Component			5	5				
Test Equip.				15	15	15	15	
LSI Comp. Eng.				10	35	35		
Tech. Writing				10	15	15	10	
External Total			22	52	71	65	25	
Project Total		65	130	202	194	188	148	91
	195			732				91
	1018							

d i s i t a l

INTEROFFICE MEMORANDUM

To : Bob Flynn

cc : SSD Staff

Date: 7 October 1982
From: Peter van Roekens
Dept: Electronic Storage
Ext : 223-1965
Loc : ML21-2 E64
Enet: KRYPTN::VANROEKENS

PvR

Subj: Information Package

The following package contains the five items requested by yourself and Rick Corben.

CHANGES TO PLAN

There are no changes to the plans to bring them into conformance with EMC guidelines because the plans were submitted after the guidelines were developed. The one major issue that ESD has been working is funding.

With our manpower frozen, we still have a problem covering our run rate. This situation was caused by a rapid fall off of the indirect and external funds that the group had received in previous years. The problem has been eased by getting 200K from Scorpio and an expected 417K from TVG. My current estimate of the deficit at the end of FY '83 is about 1M. We are continuing to look for ways to bring in additional funding.

The remaining items are attached. Item 3 has been updated to reflect the increased funding. Items 2, 4, and 5 are being submitted for the first time.

CHART II

ESD

OTHER

PROJECT NAME AND SUMMARY	$K ENGINEERING BUDGET FY'83	FY'84	FY'85
TOOLS AND TESTERS	464.5	613.2	795.0
ENGINEERING SUPPORT	201.7	252.6	316.0
ADVANCED DEVELOPMENT	192.0	250.0	312.5
PRODUCT MANAGEMENT	244.0	285.0	330.0

CHART I

ESD

PRODUCT DEVELOPMENT

Product Name And Summary Description	Current Phase	FRS	IRR %	NOR Lifetime $B	ENG. EXP. Lifetime $M	NPSU[C] $M	SERV Summary $M	ENGINEERING EXPENSE $K '83	'84	'85
11/780	2	Q4/83	N/A	$.3	1.914	.142	N/A	658.3	- -	- -
MS11-PB	3	Q2/83	N/A[A]	$.1	.762	.116	N/A	189.5	- -	- -
VENUS	2	Q2/84	57%	$.2	.961	.207	N/A	251.7	128.7	- -
SCORPIO	1	Q1/85	N/A[B]	$1.1	.783	.114	N/A	444.0	400.0	- -
ORION	1	Q4/84	N/A[B]	$.5	$.800	.149	N/A	494.0	250.0	- -
NAUTILUS	0	N/A	N/A	N/A	.470	N/A	N/A	162.0	297.0	- -
JUPITER	2	Q3/83	51%	$.1	.979	.157	N/A	168.5	223.3	- -
DIAGNOSTIC ASSIST[D] MODULE	0	N/A	N/A	N/A	.889	N/A	N/A	417.0	472.0	- -

[A] To Be Completed for Phase 3 Business Plan October 1983

[B] To Be Completed for Phase 1 Business Plan October 1983

[C] Includes Original RAM Designed Into Original Board - Not Subsequent RAM Upgrades

[D] Not Formally Committed from TVG

PROGRAM MANPOWER PLAN (ELECTRONIC STORAGE DEVELOPMENT)

GROUP MANAGER: PETER VAN ROEKENS

SSUMPTIONS:

- REFERENCE (NOTE A). MS780E HAS OVERRUN AND FUNDING IS NOT AVAILABLE FROM TW. THIS PROJECT CONSTITUTES A MAJOR PART OF ESD'S FY83 BUDGET VARIANCE.
- REFERENCE (NOTE B). SCORPIO FUNDING FOR FY84 IS BEING NEGOTIATED.
- REFERENCE (NOTE C). NAUTILUS FUNDING FOR FY84 IS BEING NEGOTIATED.
- REFERENCE (NOTE D). THE DAM MODULE PROGRAM IS NOT PRESENTLY FUNDED; HOWEVER, WE EXPECT FULL FUNDING TO BE FURNISHED BY TVG. (PRESENTLY WE ARE WORKING IN AN INVESTIGATIVE PHASE FUNDED BY TVG.
- REFERENCE (NOTE E). SEVERAL HARDWARE/SOFTWARE PROGRAMS ARE BEING SOUGHT FOR THE LAST HALF OF FY83 AND ARE: MA780, CT 100 ADD-ON, HSC 50, AND VENUS TCY. THESE PROGRAMS, IF SECURED, WOULD DIMINISH THE UNASSIGNED HEADCOUNT.

PRIORITIZED PROGRAM	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
1. DYNAMIC RAM EVAL	D. MORENO	393	ML	DEVICE ENG.	E09	EFT	.5	.5	.5	.5	.5	.5	.5	.5
	K. YEE	393	ML	TEST EQUIP ENG.	E09	EFT	1	1	1	1	1	1	1	1
	B. O'HALLORAN	393	ML	TEST ENG.	E11	EFT	1	1	1	1	1	1	1	1
	P. CASEY	393	ML	TEST TECH.	E70	TFT	.5	.5	.5	.5	.5	.5	.5	.5
	P. RAYMOND/ NEW HIRE	393	ML	DEVICE ENG.	E11	EFT		.25	.25	.25	1	1	1	1
							2.5/.5	2.75/	2.75/	2.75/	3.5/	3.5/	3.5/	3.5/
								.5	.5	.5	.5	.5	.5	.5
2. DRAM MULTIVENDOR	D. MORENO	393	ML	DEVICE ENG.	E09	EFT	.5	.5	.5	.5	.5	.5	.5	.5
	D. EIDENS	393	ML	TEST EQUIP TECH	E73	TFT		.5	.5	.5	.5	.5	.5	.5
	P. CASEY	393	ML	TEST OPERATOR	E50	TFT	.5	.5	.5	.5	.5	.5	.5	.5
							.5/.5	.5/1	.5/1	.5/1	.5/1	.5/1	.5/1	.5/1
3. LIFE TEST SYSTEMS	D. STONE	393	ML	TEST EQUIP ENG.	E09	EFT	1	1	1	1	1	1	1	1
	D. EIDENS	393	ML	TEST EQUIP TECH	E73	TFT		.5	.5	.5	.5	.5	.5	.5
	K. LYSETH	393	ML	TEST EQUIP TECH	E70	TFT	1	1	1	1	1	1	1	1
	D. KENDALL	393	ML	TEST OPERATOR	E50	TFT	1	1	1	1	1	1	1	1
	S. GORDON	392	ML	SOFTWARE DESIGN	J13	EFT	1	1	1	1	1	1	1	1
							2/2	2/2.5	2/2.5	2/2.5	2/2.5	2/2.5	2/2.5	2/2.5
4. VAX 11/780 (64K)	T. ZACCONI	392	ML	MANAGE										
	J. OBBARD	392	ML	SUPERVISE	E02	EFT	1	1	.3	.3				
	J. STEGEMAN	392	ML	LOGIC DESIGN	E07	EFT	1	1	1	.3				
	J. LYNCH	392	ML	LOGIC DESIGN	E07	EFT	.2							
	D. WHITEHOUSE	392	ML	COORDINATE	E11	EFT	1	1	1					
	L. DERENNE	392	ML	BUILD/DEBUG	E07	EFT	1	1	1	.5				
	L. REID-SIRACO	392	ML	DOCUMENT	E90	TFT	1	1	1	.5				
	J. MELOSKI	392	ML	BUILD/DOCUMENT	E71	TFT	1							
	R. CROUSE	392	ML	BUILD	E72	TFT	1	1						
	S. LIGHT	392	ML	ADMINISTRATOR	B44	NCP	1	1		(RETURNS TO SCHOOL)				
	D. SENERCHIA	392	ML	BUILD		AFT	1	1						
						EFT	1	1						
							5.2/5	5/4	3.3/1	1.1/ .5				
5. MS11-P	J. JANETOS	392	ML	LOGIC DESIGN	E11	EFT	1	.3						
	J. SANGERMANO	392	ML	LOGIC DESIGN	E09	EFT	.3							
	D. EIDENS	392	ML	BUILD/DEBUG	E73	TFT	1		(TRANSFER TO CC 393)					
							1.3/1	.3						

A

PRIORITIZED PROGRAM	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
6. VENUS	J. PARE	392	ML	LOGIC DESIGN	E09	EFT	1	.8	.5	.5	.5	.5	.3	.3
	B. KENDALL	392	ML	ELECTRONIC TECH	E71	TFT	1	.7						
	R. STANLEY	392	ML	ELECTRONIC TECH	E73	TFT			.5	.5	.5	.3		
	S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT	.5	.25						
							1.5/1	1.05/.7	.5/.5	.5/.5	.5/.5	.5/.3	.3	.3
7. SCORPIO	K. MAMAYEK	392	ML	LOGIC DESIGN	E09	EFT	1	1	1	1	1	1	1	1
	J. STEGEMAN	392	ML	LOGIC DESIGN	E07	EFT	.8	1	1	1	.5	.5		
	J. SANGERMANO	392	ML	LOGIC DESIGN	E09	EFT	.7	1	1	1	1	1		
	V. TRIOLO	392	ML	GATE ARRAY DESIGN	E11	EFT	1	1	1	1	1			
	J. DINOPOLOUS	392	ML	BUILD/DEBUG	E90	TFT	.7	1	1	1	1	1	1	1
	K. CLEVELAND	392	ML	SOFTWARE DIAG	E90	TFT			1					
							3.5/.7	4/1	4/2	4/1	3.5/1	2.5/1	1/1	1/1
8. JUPITER	N. RIEGELHAUPT	392	ML	LOGIC DESIGN	E07	EFT	1	1						
	J. PARE	392	ML	LOGIC DESIGN	E09	EFT		.2	.5	.5	.5	.5	.5	
	R. STANLEY	392	ML	ELECTRONIC TECH	E73	TFT	1	1	.5	.5	.5	.5	.7	
	S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT	.5	.25						
							1/1.5	1.45/1	.5/.5	.5/.5	.5/.5	.5/.5	.5/.7	
9. ORION	R. ELY	392	ML	LOGIC DESIGN	E09	EFT	1	1	1	1	1	1	1	
	J. RANTALA	392	ML	GATE ARRAY DESIGN	E11	EFT	1	1	1	1	1			
	L. CHISVIN	392	ML	TESTER/SOFTWARE	E90	TFT	1	1	1	1	1			
	G. DONOGHUE	392	ML	BUILD/DEBUG	E72	TFT	1	1	1	1	1	1	1	1
	B. DUPRE	392	ML	SOFTWARE DESIGN	J15	EFT		1	1					
	K. LANGLAIS	392	ML	SOFTWARE DESIGN	J11	EFT		.3	.3					
							2/2	3.3/2	3.3/2	2/2	2/2	1/1	1/1	0/1
10. MXV11-B	D. MANION	392	ML	SUPERVISE	E90	TFT	.5	.1						
	H. COLLINS	392	ML	LOGIC DESIGN	E09	EFT	.1							
	D. SOVIE	392	ML	BUILD/DEBUG	E72	TFT	1	.5						
							.1/1.5	0/.6						

B

PRIORITIZED PROGRAM	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE	FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4	
11. MRV11-D	D. MANION	392	ML	SUPERVISE	E09	TFT	.5	.5						
	J. LAVRANCHUK	392	ML	LOGIC DESIGN	E11	EFT	1	1						
	K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90	TFT	1							
	J. DINOPOLOUS	392	ML	BUILD/DEBUG	E90	TFT	.3							
	K. CHINNASWAMY	392	ML	BUILD/DOCUMENT	B43	NCP	1	1	(RETURNS TO SCHOOL)					
	B. DUPRE	392	ML	SOFTWARE DESIGN	J15	EFT	1							
							2/2.8	1/1.5						
12. NAUTILUS	P. NATUSCH	392	ML	LOGIC DESIGN	E09	EFT	1	1	1	1	1	1	1	1
	N. RIEGELHAUPT	392	ML	LOGIC DESIGN	E07	EFT			1	1	1	1	1	1
	B. KENDALL	392	ML	BUILD/DEBUG	E90	TFT			.5	1	1	1	1	1
	K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90	TFT				1	1			
							1/0	1/0	2/.5	2/2	2/2	2/1	2/1	2/1
13. VIDEO RAM	P. RAYMOND/ NEW HIRE	393	ML	DEVICE ENG.	E11	EFT	.75	.75	.75	.75				
14. STATIC RAM EVALUATION	F. QUADRI/ NEW HIRE	393	ML	DEVICE ENG.	E07	EFT	1	1	1	1	1	1	1	1
	J. TESSARI	393	ML	TEST ENG.	E11	EFT	1	1	1	1	1	1	1	1
	B. HUNT	393	ML	TEST TECH.	E73	TFT	1	1	1	1	1	1	1	1
							2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1
15. DAM	J. JANETOS	392	ML	LOGIC DESIGN	E11	EFT		.7	1	1	1	1	1	
	S. ROCHEFORT	392	ML	BUILD/DEBUG	B43	NCP			1	1	(RETURNS TO SCHOOL)			
	D. MANION	392	ML	SUPERVISE	E90	TFT		.4	.5	.5	.5	.5	.5	
	H. COLLINS	392	ML	LOGIC DESIGN	E09	EFT	.9	1	1	1	1	1		
	D. SOVIE	392	ML	BUILD/DEBUG	E72	TFT		.5	1	1	1	1	1	
	M. KAKKAD	392	ML	SOFTWARE DESIGN	J13	EFT		1	1	1	1	1	1	
							.9/0	2.7/ .9	3/2.5	3/2.5	3/1.5	3/1.5	3/1.5	

OTHER	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
. PROJECT MANAGEMENT	D. ELLIS	392	ML	LG. SYST. DEV. MAN	E02	EFT	1	1	1	1	1	1	1	1
	T. ZACCONI	392	ML	MED. SYST. DEV. MAN	E02	EFT			.7	.7	1	1	1	1
	R. GIVEN	392	ML	SM. SYST. DEV. MAN	E05	EFT	1	1	1	1	1	1	1	1
	D. DUTTON	393	ML	DEVICE TECH DEV MAN	E05	EFT	1	1	1	1	1	1	1	1
	B. MURPHY	392	ML	MEM. DIAG. DEV. MAN	J11	EFT	1	1	1	1	1	1	1	1
	D. HURLBUT	392	ML	SM. SYST SUPERVISOR	E05	EFT	1	1	1	1	1	1	1	1
	B. COATES	392	ML	ENGINEERING MANAGER	E02	EFT	1	1	1	1	1	1	1	1
. PRODUCT MANAGEMENT	D. HALEY	392	ML	SM SYST PRODUCT MAN	E23		1	1	1	1	1	1	1	1
	J. AUSTIN	392	ML	MED/LG SYST PRO MAN	E22		1	1	1	1	1	1	1	1
	P. DURANT	392	ML	PROD. MANAGEMENT	E18		1	1	1	1	1	1	1	1
	D. RICE	392	ML	SECRETARIAL	G48	GFT	1	1	1	1	1	1	1	1
. CONSULTANT	D. SMELSER	392	ML	CONSULTANT	E03	EFT	1	1	1	1	1	1	1	1
	J. STEGEMAN	392	ML	CONSULTANT	E07	EFT					.5	.5	1	1
. ASSEMBLY	P. MIKELS	392	ML	ASSEMBLY	E50	TFT	1	1	1	1	1	1	1	1
	D. GAGE	392	ML	ASSEMBLY	E50	TFT	1	1	1	1	1	1	1	1
. TOOL SUPPORT	R. SIRACO	392	ML	TESTERS	E36	TFT	1	1	1	1				
	L. PEARCE *	392	ML	DATA ENTRY SPECIAL.		JPT	1	1	1	1				
. 2224 UPGRADE	D. CARUSO	392	ML	SOFTWARE DESIGN	J15	EFT		1	1	1				
. MD407	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13	EFT		.2	.2	.5				
. TEST STRATEGY	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13	EFT		.3	.3	.5				
. MS11-P 2228	M. KAKKAD	392	ML	SOFTWARE DESIGN	J13	EFT	1							
. CT100/2226C	D. CARUSO	392	ML	SOFTWARE DESIGN	J15	EFT	1							
	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13	EFT	1	.5	.5					

* PERMANENT PART-TIME

OTHER

- JUPITER TCY
- RAINBOW 2224
- CT ADD ON
- VENUS TCY
- SECRETARIAL

- OTHER

NAME	CC	SITE	TECHNICAL SKILL	JOB CODE		FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
K. LANGLAIS	392	ML	SOFTWARE DESIGN	J11	EFT	1	.7	.3					
S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT		.5	1	.3				
K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90	TST		1						
S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95	EFT				.7				
S. BARNARD	392	ML	SECRETARIAL	G49	GFT	1	1	1	1	1	1	1	1
M. POCHINI	392	ML	SECRETARIAL	G48	GFT	1	1	1	1	1	1	1	1
S. GOGUEN	392	ML	SECRETARIAL	G47	GFT	1	1	1	1	1	1	1	1
D. DUVARNEY	392	ML	SECRETARIAL	G54	GFT	1	1	1	1	1	1	1	1
R. GOODWIN	392	ML	MATERIAL EXPEDITER	B66	NCP	1	1	1	1	1	1	1	1

UNASSIGNED	NAME	CC	SITE	TECHNICAL SKILL	JOB CODE	FY83 Q1	FY83 Q2	FY83 Q3	FY83 Q4	FY84 Q1	FY84 Q2	FY84 Q3	FY84 Q4
	J. SANGERMANO	392	ML	LOGIC DESIGN	E09 EFT							1	1
	V. TRIOLO	392	ML	LOGIC DESIGN	E11 EFT						1	1	1
	J. DINOPOLOUS	392	ML	ELECTRONIC TECH	E90 TFT								
	H. COLLINS	392	ML	LOGIC DESIGN	E09 EFT							1	1
	D. SOVIE	392	ML	ELECTRONIC TECH	E72 TFT								1
	J. JANETOS	392	ML	LOGIC DESIGN	E11 EFT								1
	J. LAVRANCHUK	392	ML	LOGIC DESIGN	E11 EFT			1	1	1	1	1	1
	S. ROCHEFORT	392	ML	COOP ELEC.	B43 NCP								
	R. ELY	392	ML	LOGIC DESIGN	E09 EFT								1
	G. DONOGHUE	392	ML	ELECTRONIC TECH	E72 TFT								
	N. RIEGELHAUPT	392	ML	LOGIC DESIGN	E07 EFT								
	J. PARE	392	ML	LOGIC DESIGN	E09 EFT							.2	.7
	R. STANLEY	392	ML	ELECTRONIC TECH	E73 TFT						.2	.3	1
	B. KENDALL	392	ML	ELECTRONIC TECH	E71 TFT		.3	.5					1
	J. OBBARD	392	ML	LOGIC DESIGN	E07 EFT				.7	1	1	1	1
	D. WHITEHOUSE	392	ML	LOGIC DESIGN	E07 EFT				.5	1	1	1	1
	J. MELOSKI	392	ML	ELECTRONIC TECH	E72 TFT			1	1	1	1	1	1
	D. CARUSO	392	ML	SOFTWARE DESIGN	J15 EFT					1	1	1	1
	I. CHAVIS	392	ML	SOFTWARE DESIGN	J13 EFT					1	1	1	1
	K. CLEVELAND	392	ML	SOFTWARE DESIGN	E90 TFT						1	1	1
	B. DUPRE	392	ML	SOFTWARE DESIGN	J15 EFT				1	1	1	1	1
	S. GORDON	392	ML	SOFTWARE DESIGN	J13 EFT								
	S. HARRINGTON	392	ML	SOFTWARE DESIGN	J95 EFT					1	1	1	1
	M. KAKKAD	392	ML	SOFTWARE DESIGN	J13 EFT								1
	K. LANGLAIS	392	ML	SOFTWARE DESIGN	J11 EFT			.4	1	1	1	1	1
	R. SIRACO	392	ML	SOFTWARE DESIGN	E36 TFT					1	1	1	1
	J. STEGEMAN	392	ML	LOGIC DESIGN	E07 EFT							1	1
	J. RANTALA	392	ML	GATE ARRAY DESIGN	E11 EFT		.				1	1	1
	L. CHISVIN	392	ML	TESTER/SOFTWARE	E90 TFT						1	1	1
	D. MANION	392	ML	SUPERVISE	E90 TFT			.5	.5	.5	.5	.5	1
	P. RAYMOND	393	ML	DEVICE ENGINEER	E11 EFT	.25							
	J. LYNCH	392	ML	LOGIC DESIGN	E11 EFT				1	1	1	1	1
	L. DERENNE	392	ML	BUILD/DEBUG	E90 TFT				.5	1	1	1	1
	L. REID-SIRACO	392	ML	BUILD	TFT		1	1	1	1	1	1	1
	D. SENERCHIA	392	ML	DESIGN	EFT			1	1	1	1	1	1
	S. LIGHT	392	ML	ADMINISTRATOR	AFT			1	1	1	1	1	1
*	L. PEARCE	392	ML	DATA ENGRY SPECIAL.	JPT					1	1	1	1
	P. GREENAWAY/	392	ML	BUILD/DOCUMENT	B44 NCP					1	1	1	1
	K. CHINNASWAMY							1	1				
	S. ROCHEFORT/	392	ML	BUILD/DOCUMENT	B43 NCP					1	1	1	1
	R. CROUSE							1	1				

* PERMANENT PART-TIME

ESD/SSD

APPENDIX C - PROJECT INVESTMENT PRIORITY AND

RESPONSIBLE ENGINEER LIST

PRIORITY 1 - ABSOLUTELY CRITICAL TO BASE STRATEGY

FUNDING GROUP	PROJECT NAME	RESP. ENG.	FY'83 BUDGET	FY'85 NOR
SSD	11/780 64K UPGRADE	B. COATES	.658	$104m
SSD	MS11-PB 1MB UNIBUS MOS MEMORY	R. GIVEN	.199	$41.8m
LSG	VENUS 4MB ARRAY	D. ELLIS	.252	$40.8m
SSD 32-BIT SYSTEM	SCORPIO	R. GIVEN	.244 .200 --- .444	$6.9m
SSD	ORION	R. GIVEN	.494	$69.1m
32-BIT SYS.	NAUTILUS	R. GIVEN	.162	$45.0m

PRIORITY 2 - SUBSTANTIAL EXISTING CUSTOMER COMMITTMENT

FUNDING GROUP	PROJECT NAME	RESP. ENG.	FY'83 BUDGET	FY'85 NOR
LSG	JUPITER 1MB ARRAY	D. ELLIS	.169	$12.2M

PRIORITY 3 - SUPPORTS BASE STRATEGY

FUNDING GROUP	PROJECT NAME	RESP. ENG.	FY'83 BUDGET	FY'85 NOR
TVG	DIAGNOSTIC ASSIST MODULE	R. GIVEN	.417	N/A

MEMORY PRODUCT PRICE BAND CHART

PRICE BAND	FY'83 DEC	FY'83 COMPETITION	FY'85 DEC	FY'85 COMPETITION	FY'87 DEC	FY'87 COMPETITION
625K - 1.6M	PDP-10, 256KB $24K/MB	512KB $15K/MB	JUPITER, 4MB $3.5K/MB	4MB $1.6K/MB	JUPITER 4MB $2.5K/MB	8MB $1.2K/MB
250K - 625K	- - 11780, 1MB $3.2K/MB	 1MB $2K/MB	VENUS 4MB $3.0K/MB 11780 4MB $2.1K/MB	4MB $1.6K/MB 4MB $1.6K/MB	VENUS 4MB $2.0K/MB 11780 4MB $1.5K/MB	8MB $1.2K/MB 8MB $1.2K/MB
100 - 250K	11750, 1MB $3.2K/MB	1MB $2K/MB	11750, 1MB $2.1K/MB	4MB $1.6K/MB	NAUTILUS 8MB $1.5K/MB	8MB $1.2K/MB
40 - 100K	11730, 1MB $3.2K/MB 1144, 1MB $3.5K/MB	1MB $2K/MB 1MB $3K/MB	11730, 1MB $2.1K/MB	4MB $1.5K/MB	SCORPIO, 2MB $2.0K/MB	4MB $1.2K/MB
16 - 40K	1123B, 1/2MB $5.4K/MB	1/2MB $2.8K/MB	ORION Q/U 2MB $3.3K/MB	2MB $1.6K/MB	ORION 2MB $2.0/MB	4MB $1.2K/MB
2.5 - 16K	LSI-11, 256KB $3.8K/MB	1/2MB $2.6K/MB	ORION, 2MB $3.3K/MB	2MB $1.6K/MB	NOT DEFINED	4MB $1.2K/MB

1) THIS CHART IS FOR ADD-ON MEMORY ONLY. PRICES REFLECT OUR MOST COMPETITIVE PRICE. MEMORY REVENUE/MB IN PACKAGED SYSTEMS WILL BE HIGHER.

2) DEC PRICES ARE ACTUAL FOR '83; ASSUMED COMPETITIVE AT THAT POINT. DEC PRODUCTS EASY TO PLUG ARE DECREASED IN PRICE FASTER THAN THOSE WITH CUSTOM LSI OR COMPLEX GATE ARRAYS.

3) COMPETITION IS ASSUMED TO BE U.S. AND JAPANESE SEMICONDUCTOR MANUFACTURERS.

4) THIS REFLECTS ESD'S CURRENT PLAN AND BUDGET. PLANS TO GET HIGHER DENSITY IN FY'87 NEED TO BE DEVELOPED.

digital

INTEROFFICE MEMO

TO: BOB FLYNN
CC: GRANT SAVIERS
DAVE BROWN
PAUL BAUER
PETE VAN ROEKENS
MIKE RIGGLE
CX ENG STAFF

DATE: 4 OCT 1982
FROM: TOM BURNIECE
DEPT: STORAGE SYSTEMS ENGINEERING
EXT: 522-2100
LOC/MAIL STOP: CXO1-1/Q21

SUBJ: RICK CORBEN'S 5 ADDITIONAL ITEMS FOR OC WOODS

I've attached the following per your 9/27 EMS:

(1) Summary of Changes -- We have combined the RAXX/XY program under the funding previously earmarked for RAXX only and started the 100-MB, 5-1/4" project (RDZX) under the funds previously earmarked for RAXY only, but otherwise the EMC process has not affected our FY83 plans (see attached Beige Book Chart 3.1).

(2) Revised Budget and Deliveries -- See attached Project Alternatives Chart and revised 5-year budget (I don't know what charts I and II from June 14 are).

(3) List of People Freed Up -- None, since none of the CX projects have been cancelled or redirected, except as in (1) above. As a matter of fact, we are going to be in serious trouble soon if we continue to not replace our losses (e.g. Bill Glover, Tony Perlick, etc.).

(4) Priority Listing of All Projects - see attached.

(5) Price Band Charts for FY83-87 Products - see attached. (I have not heard from Eli Glazer.)

Note that we do not have any funding or available resources for our "OEM" plans and with the current headcount freeze, I'm afraid we may have to "forget it".

ORG: SSD/CX DATE: 9/14/82 PREPARED BY: TOM BURNIECE
PAGE 1 OF 1 PAGES

PRODUCT NAME & DESCRIPTION	CURR PHAS	FRS*	TRANS COST*	EST. SPENDING THRUFY82 ($K)	BUDGET ($K) FY83	FY84	FY85	FY86	EST TOTL DEV ($K)	RESP PROG OFF.
RA60 - 205MB REMOVABLE MEDIA SDI DRIVE	2	Q383 (C) Q283 (T)	$3000 (C,85)	7174a	3467a	1000a 819b	1400b	850b	11641a	CX
RA81 456MB FIXED MEDIA SDI DRIVE	3	Q183 (C)	$4800 (C,84)	4011a	1208a 105b	850b	615b	414b	5219a	CX
RAXX 1000 MB FIXED MEDIA SDI DRIVE/RAXY-REMOVABLE COMPANION	0	Q485 (T)	<$2500 (T)	208a	1945a	4873a	6204a	4741a	20000a	CX
RDZX - 100+MB 5-1/4" FIXED MEDIA DRIVE	PRE0	Q484 (T)	<$1000 (T)	0	1129a	4469a	7296a	5000a	18000a	CX
HSC50 - HIGH PERFORMANCE/FUNCTIONALITY CI TO SDI/STI CONTROLLER	2	6/83 (C)	$8400 (C)	7369	4519	2112a 1214b	720b	360b	14.000	CX
HSC CACHE - 4MB CACHE FOR HSC50	0	Q4 FY84 (T)	$6600 (T)	100	500	950	900	200b	2,450	CX
UDA52 UPGRADE TO UDA50	2	12/82 (C)	$1500 (C)	208	448	150	--	-	877	CX
BSA50 BI TO SDI/STI CONTROLLER FOR SCORPIO & NAUTILUS	0	FY86 (T)	$1400 (T)	--	800	3058	3000	1500	8,358	CX
DATABASE MACHINE - BACK END PROCESSOR FOR DATA BASE SEARCHING ON SDI DISKS	PRE0	FY86 (T)	$10-20K (T)	NOT FUNDED	NOT FUNDED	--	-	--	TBD	CX

*INDICATE WHETHER FRS AND TRANSFER COST ARE TARGET (T) OR COMMITTED (C)

NOTES: a. ACTUAL DEVELOPMENT COSTS.
b. ENGINEERING CONTINUATION NOT COUNTED IN DEVELOPMENT COSTS.

CX ENGINEERING 5-YEAR BUDGET (IN K DOLLARS) 10/4/82

	FY82 ACTUAL	FY83 PLAN	FY84 FCST	FY85 FCST	FY86 FCST
DEVELOPMENT:					
UDA/RA80	2802	0	0	0	0
RA81 & SWFT	3335	1208.1	0	0	0
RA60 & SWFT	3731	3467	1000	0	0
SDI	135	55	0	0	0
SUPERCAB	82	130	0	0	0
HSC50	3007	4518.7	3326	0	0
RAXX/RAXY & SWFT	177	1945	4873	6204	4741
RDZX	0	1129	4469	7296	5000
BSA 50	0	800	3058	3000	1500
UDA 52	251	447.8	150	0	0
HSC CACHE	0	500	950	900	200
HSC ENHANCE	0	0	0	600	2810
CONTINGENCY	0	135.8	0	4114	16095
FCC	N/A	211.7	0	0	0
DIAG. RELEASE	0	25.3	0	0	0
SUBTOTAL	13520	14573.7	17826	22114	30346
CONTINUATION:					
RL/RK CART & SWFT	42	62.6	128	64	40
RL01/02	316	341.1	250	200	200
RM'S/RP06	453	517.5	200	150	100
RP07	80	83	111	110	0
RM/RA80/RA81	1280	936	1624	1275	1014
UDA	0	565	160	100	100
RA60 & SWFT	0	0	819	1400	850
HSC50	0	0	0	720	360
SUBTOTAL	2171	2505.2	3292	4019	2664
TOTAL	15691	17078.9	21118	26133	33010
OTHER:					
CX ADMIN	726	654	834	1014	1194
PROD MGM'T	325	578.1	651	729	949
LSI DEVEL	623	931	1072	1255	1244
CAD TOOLS	176	596	750	1000	1250
DES. ASSUR.	0	100	200	300	400
CTLR. COMPET.	0	0	0	150	170
DRIVE COMPET.	0	0	0	200	250
PERSONNEL	N/A	148	175	200	225
SUBTOTAL	1850	3007.1	3682	4848	5682
GRAND TOTAL	17541	20086	24800	30981	38692

NOTES: UDA52, HSC CACHE & RK07 CART WERE NOT IN ORIGINAL FY82 BUDGET OR BASEPLAN. RAXX/XY AND RDZX REPLACE RA65/85/90 IN FY82 BASEPLAN. THE CONTINGENCY FUNDS FOR FY83 COULD BE USED FOR DBM BUT ARE CURRENTLY EARMARKED FOR ECO'S PERSONNEL FUNDING WAS NOT IN ORIGINAL FY83 BUDGET SUBMITTAL, BUT HAS NOW BEEN INCLUDED FOR FY83 86.

CX FY83 PROJECT PRIORITIES

Project Name	Responsible Eng.	FY83 BUDGET	FY85 NOR
PRIORITY 1 - ABSOLUTELY CRITICAL TO STRATEGY			
RA81 (FRS achieved)	Mike Hammer	$ 1208.1K	$ 500M
RA60 (announced)	Bert Miller	$ 3467	$ 350M
HSC50 (will announce 12/6)	Ralph Platz	$ 4518.7	$ 60M
UDA52 (released)	Bill Mathrani	$ 447.8	$ 100M
RAXX/XY (FRS (T) IS Q4FY85)	Pete Svendsen	$ 1945	0
BSA50 (FY85 FRS TBD)	Bill Mathrani .	$ 800	TBD
	PRIORITY 1 SUBTOTAL	$12386.6K	$1010M+
PRIORITY 2 SUBSTANTIAL EXISTING COMMITMENT			
PRIORITY 3 - SUPPORTS BASE STRATEGY			
RDZX (FRS (T) IS Q4FY84)	Bert Miller	$ 1129K	$ 20M*
HSC Cache (FRS(T)IS Q4FY84)	Ralph Platz	$ 500	$ 10M*
DBM (currently A/D only)	None	0	N/A
	PRIORITY 3 SUBTOTAL	$ 1629K	$ 30M+
PRIORITY 4 - GOOD BUSINESS, NOT STRATEGIC AT CORPORATE LEVEL			
OEM Disks (not funded)	None	0	$ 29M
	PRIORITY 4 SUBTOTAL	0	$ 29M

*(Rough estimate, business plan not complete)

CX FY83 PROJECT PRICE BAND CHARTS

SYSTEM PRICE	FY83	FY85	FY87
$100K-500K	UDA50 RA81 RA60	HSC50 HSC Cache RA81 RA60 UDA50	DBM HSC50 HSC Cache RAXX/XY BSA50
$ 50K-100K	UDA50 RA81 RA60	UDA50 RA81 RA60	UDA50 BSA50 RAXX/XY
$ 10K- 50K	N/A	RDZX	BSA50 RAXX/XY RDZX
$ 5K- 10K	N/A	N/A	N/A
$ 1K- 5K	N/A	N/A	N/A

PRODUCT	BEST ALTERNATIVE	Consequences of Best Alternative: TECHNICAL	SYSTEMS	* UNDISCOUNTED CASH FLOW (DELTA $)	CONSEQUENCES OF "NO PRODUCT"	CONSEQUENCES OF SLOWDOWN	BEST PRODUCT TODAY
RA60	None, already announced	N/A	N/A	N/A	N/A	N/A	RA60
RA81	None, already announced	N/A	N/A	N/A	N/A	N/A	RA81
HSC	No Product (CI dies stay with Massbus & Unibus. Possibly find a buyout for CI to SI attachments.	Massbus not as fast Less Competitive Lose arch. momentum (future cache, DMB, file servers, etc.) Lose people.	Poor maintainability in field. Stay w/MB disks (buyouts) and MB tapes (TM78) or use SI drives w/UDA & TS tapes on Unibus. Performance on highend systems suffers if use MB. Lower performance backup. Requires more software (drive) development.	($173M)*	Current CI cluster development depending on HSC50 device. High Availibility goals of VAX COMPLEX SYSTEMS eliminated. No replacement for the high performance controller. Give up market share.	Miss VMS v-3B support of HSC50. This is the clusters release so clusters would ship without high Performance disk subsystems. Jupiter would have no disks at FRS. It is solely dependent on HSC50 for disk storage. Increased HSC50 program cost.	HSC
HSC CACHE	No Product - put Cache in CPU or main memory.	Lower performance (Increase access time). Increase performance requirements for Adv. disks.	Not competitive with IBM, etc.	(>$25M)*	Cache should be a money maker It is targeted at a relative price insensitive market & will be required for clusters & the next generation of VAX & LCG processors.	Delayed Competitiveness. IBM & others already announced cache	HSC Cache
RAXX/RAXY	Buyout	"Go out of Engineering business" at state-of-art for High end disk.	Unknown Probably higher cost (1.6 times markup)	(280 M):	Lose competitive position with IBM & Japan at highend and mid-range (heart of DEC systems business).	Will delay introduction at least 6 months no longer be on technology leading edge	None Today RSDII/PSDII & Eagle II are coming FY85

*Note: The above cash flows do not account for the impact that will be felt on Digital's high-end processors or the loss of storage device sales. This leveraged amount should be in excess of ($500M).

PRODUCT	BEST ALTERNATIVE	Consequences of Best Alternative TECHNICAL	SYSTEMS	UNDISCOUNTED CASH FLOW (DELTA $)	CONSEQUENCES OF "NO PRODUCT"	CONSEQUENCES OF SLOWDOWN	BEST PRODUCT TODAY
RD2X (100 MB, 5¼" winl)	Buyout —	"Go out of Engineering business at state-of-art for highend 5¼".	Lose competitive position at highend of 5 ¼" disk business (lowend of 32-bit systems business).	(100M)	Won't have competitive mid-range disks in 5¼" form factor.	Will delay introduction at least 6 mo no longer be on technology leading edge	None, may be some in FY85
BSA	I. Assume no BI (1) If on VAX, develop new bus, need BSA equivalent for this bus.	Unknown	Possibly use industry STD microbus; Advantage: allows diskaubsystem OEM business. Disadvantage: loses unique I/O (plugable).	($25M)	No disk attachment to BI. If no BI then we will have to address the performance issues that surround the UNIBUS controller space.	No disk subsystem for BI Scorpio systems at FRS. Due to early Scorpio board-level announcement, we need to speed up, not slow down, to have controllers when third-party vendors will.	None
	(2) stay w/Unibus (i) LSI-UDA	New development program. Cost reduced & size reduced UDA.	Allows future systems to use Adv. packages. No parity checking. Performance not as good.		Won't have competitive mid-range disk from a performance point.		
	(ii) Stay w/UDA	Possibly have to repackage.	Packaging incompatibility (cooling, size, connector) with future smaller systems. Consequence: constrains packaging on those systems.		Currently have a product gap between UDA50 and HSC50.		
	(3) Use Q-bus-develop QDA	Major development program.	Future VAX stay w/Unibus or add Q-bus.		Qbus not good enough.		
	II. Assume BI (1) limit to low end, but use BI AZTEC.		Cost too high for low end. Less system flexibility. Systems also need Unibus to get other SI devices of use NI - requires BSA develpment				
DBM	Buyout	May not gain key strategic technology knowledge to compete w/ Japanese 5th generation	Will require SDI interface & MSCP protocol to attach our disks. DEC host interfaces will also have to be accommodated. Costs will be higher. Risk that avail. buyouts will be competitive.	(>$300M)*	If never have a DBM could lose significant competitive position. If delay DBM to later market window & lose sales, including systems.	Project is currently not funded. Need to fund to acheive an FY85 product.	Britton-Lee shipping. Servio is best new design.

PROJECT INVESTMENT PRIORITY

FUNDING GROUP	PROJECT NAME	RESPONSIBLE ENGINEER	FY83 BUDGET	FY85 NOR
PRIORITY 1 - ABSOLUTELY CRITICAL TO STRATEGY				
Tape Engineering	TU81/TA81	Mike Cucina/ Dave Christman	$604K	$112 Million
	MAYA	Bob Richmond	$2308L	$116 Million
	TA78	Dave Christman	$793K	$62 Million
PRIORITY 2 - SUBSTANTIAL EXISTING COMMITMENT				
Tape Engineering	TU80	Mike Cucina	$509K	$38.4 Million
PRIORITY 3 - SUPPORTS BASE STRATEGY				
Tape Engineering	YANKEE	Bob Richmond	---	---
	~~Optical Disk~~ Digital Audio Players → Daitillo Bryant	Charlie Smith	---	TBD

	FY83-DEC	FY83-COMP	FY85-DEC	FY85-COMP	FY87-DEC	FY87-COMP
> 625K	TU78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,300/ $48,000 M-Bus VAX DECSYSTEM-20	IBM 3420-6 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $11,500/ $57,300	TA78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,500/ $52,000 HSC50 VAX DECSYSTEM-20 DECSYSTEM-40	OCOTILLO High density/ performance Cartridge Tape 20,000 - 32,000 BPI $15,000/ 60,000 (est.)	TA78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,500/ $52,000 HSC50 VAX DECSYSTEM-20 DECSYSTEM-40	OCOTILLO High density/ performance Cartridge Tape 20,000 - 32,000 BPI $15,000/ 60,000 (est.)
250 - 625K	TU78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,300/ $48,000 M-Bus VAX DECSYSTEM-20	IBM 3420-6 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $11,500/ $57,300	TA78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,500/ $52,000 HSC50 VAX DECSYSTEM-20 DECSYSTEM-40	OCOTILLO High density/ performance Cartridge Tape 20,000 - 32,000 BPI $15,000/ 60,000 (est.)	TA78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,500/ $52,000 HSC50 VAX DECSYSTEM-20 DECSYSTEM-40	OCOTILLO High density/ performance Cartridge Tape 20,000 - 32,000 BPI $15,000/ 60,000 (est.)
			TA81 Industry Compatible 1600/6250 BPI 25/75 ips $7,100/ $22,000 HSC VAX	TELEX Industry Compatible 800/1600/ 6250 BPI 45 ips $8,000	TA81 Industry Compatible 1600/6250 BPI 25/75 ips $7,100/ $22,000 HCS VAX	
	TU77 Industry Compatible Start/Stop Tape 800/1600 BPI 125 ips $12,500/ $36,800 M-Bus PDP-11/VAX DECSYSTEM-10/20	IBM 3420-5 Industry Compatible Start/Stop Tape 800/1600 BPI 125 ips $11,200/ $56,100	TU81 Industry Compatible 1600/6250 BPI 25/75 ips $6,600/ $18,000 Unibus VAX	STC Avalanche Industry Compatible 1600/6250 BPI 50 ips $9,000	TU81 Industry Compatible 1600/6250 BPI 25/75 ips $6,600/ $18,000 Unibus VAX	
				YANKEE Leadership High density Cartridge tape 15,000 BIP 200 ips $1,400/$5,000 S.I. Interface VAX Family	OCOTILLO High density/ performance Cartridge Tape 20,000 - 32,000 BPI $15,000 - 60,000 (est.)	

	FY83-DEC	FY83-COMP	FY85-DEC	FY85-COMP	FY87-DEC	FY87-COMP
100 - 250K	TU78 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $14,300/ $48,000 M-Bus VAX DECSYSTEM-20	IBM 3420-6 Industry Compatible Start/Stop Tape 1600/6250 BPI 125 ips $11,500/ $57,300	TU81 Industry Compatible 1600/6250 BPI 25/75 ips $6,600/ $18,000 Unibus VAX	STC Avalanche Industry Compatible 1600/6250 BPI 50 ips $9,000	TU81 Industry Compatible 1600/6250 BPI 25/75 ips $6,600/ $18,000 Unibus VAX	STC Avalanche Industry Compatible 1600/6250 BPI 50 ips $9,000
	TU77 Industry Compatible Start/Stop Tape 800/1600 BPI 125 ips $4,400/ $36,800 M-Bus PDP-11/VAX DECSYSTEM-10/20	IBM 3420-5 Industry Compatible Start/Stop Tape 800/1600 BPI 125 ips $11,200/ $56,100	XXX	XXX	XXX	XXX
	TU80 Industry Compatible 1600 BPI Tape 25/100 ips $3,900/ $10,000 Unibus PDP-11/VAX	IBM 8809 Industry Compatible 1600 BPI 12.5/100 ips $4,000/ $12,000	TU80 Industry Compatible 1600 BPI Tape 25/100 ips $3,900/ $10,000 Unibus PDP-11/VAX	IBM 8809 Industry Compatible 1600 BPI 12.5/100 ips $4,000/ $12,000	TU80 Industry Compatible 1600 BPI Tape 25/100 ips $3,900/ $10,000 Unibus PDP-11/VAX	IBM 8809 Industry Compatible 1600 BPI 12.5/100 ips $4,000/ $12,000
					YANKEE High density Cartridge tape 15,000 BPI 200 ips $1,400/$5,000 S.I. Interface VAX Family	OCOTILLO High density/ performance Cartridge Tape 20,000 - 32,000 BPI $15,000/ 60,000 (est.)
			MAYA Leadership Low-end Cartridge Tape 8,000 BPI 75 ips $500/$2,000 Q-Bus, CT PDP-11, VAX	3M HCD75 1/4 inch Cartridge Streamer 67 MB Capacity $3,500	MAYA Leadership Low-end Cartridge Tape 8,000 BPI 75 ips $500/$2,000 Q-Bus, CT PDP-11, VAX	

	FY83-DEC	FY83-COMP	FY85-DEC	FY85-COMP	FY87-DEC	FY87-COMP
40 - 100K	TU80 Industry Compatible 1600 BPI Tape 25/100 ips $3,900/ $10,000 Unibus PDP-11/VAX	IBM 8809 Industry Compatible 1600 BPI 12.5/100 ips $4,000/ $12,000	TU80 Industry Compatible 1600 BPI Tape 25/100 ips $3,900/ $10,000 Unibus PDP-11/VAX	IBM 8809 Industry Compatible 1600 BPI 12.5/100 ips $4,000/ $12,000	TU80 Industry Compatible 1600 BPI Tape 25/100 ips $3,900/ $10,000 Unibus PDP-11/VAX	IBM 8809 Industry Compatible 1600 BPI 12.5/100 ips $4,000/ $12,000
		DEI 1/4 inch Cartridge Streamer 20 MB Capacity $2,500	MAYA Leadership Low-end Cartridge Tape 8,000 BPI 75 ips $500/$2,000 Q-Bus, CT PDP-11, VAX	DEI 1/4 inch Cartridge Streamer 20 MB Capacity $2,500	MAYA Leadership Low-end Cartridge Tape 8,000 BPI 75 ips $500/$2,000 Q-Bus, CT PDP-11, VAX	DEI 1/4 inch Cartridge Streamer 20 MB Capacity $2,500
16 - 40K		DEI 1/4 inch Cartridge Streamer 20 MB Capacity $2,500	MAYA Leadership Low-end Cartridge Tape 8,000 BPI 75 ips $500/$2,000 Q-Bus, CT PDP-11, VAX	DEI 1/4 inch Cartridge Streamer 20 MB Capacity $2,500	MAYA Leadership Low-end Cartridge Tape 8,000 BPI 75 ips $500/$2,000 Q-Bus, CT PDP-11, VAX	DEI 1/4 inch Cartridge Streamer 20 MB Capacity $2,500

****
* d i g i t a l *
****

TO: GRANT SAVIERS

cc: see "CC" DISTRIBUTION

DATE: FRI 1 OCT 1982 10:33 AM EDT
FROM: DAVID W BROWN
DEPT: STORAGE SYS. ENG.
EXT: 292-2070
LOC/MAIL STOP: YWO/YWO

MESSAGE ID: 5177308090

SUBJECT: EMC ACTION ITEMS - YOUR EMS OF 9/21/82

| d | i | g | i | t | a | l |

INTEROFFICE MEMORANDUM

TO: Grant Saviers

cc: SSD Staff
Ray Ochester
Ken Sills
Alan White
Bill Munson

DATE: 1 October 1982
FROM: David W. Brown
DEPT: Tape Engineering
EXT: 292-2070
LOC: YWO/G2

performance diff.?

SUBJ: EMC ACTION ITEMS - YOUR EMS OF 9/21/82

1. Regarding cancellation of TA78 and the use of TA81 in its place in order to solve the Maya FY83 funding short-fall:

   a. If we decide to do this, it will free up 3 people who can be assigned immediately to Maya. The remaining 2 will continue HSC tape development so that TA81 can be shipped on schedule Q2, FY84. This would solve half of our FY83 Maya funding shortfall of $500K.

   b. I am forwarding to you Ray Ochester's summary of the LCG problem with this decision. He states that it puts the Jupiter program revenue of $1.6B at risk, and that TA81 will not solve their problem.

   c. In addition to the LCG problem with TA81 performance, there is a $100M gross margin problem with this decision.

	TA78	TA81
MLP Per Unit	$52K	$25K
Cost Per Unit	14K	7K
Gross Margin	$38K	$18K

Per Unit

If we converted all 5000 units of TA78 to TA81, we would leave $100M gross margin on the table. See Ken Sills' memo also forwarded today.

d. This decision also would leave HSC without any tape until May 84 when VMS 3B will be released because TA81 misses the window for VMS 3.4. Under the current plan, TA78 will be available at HSC FRS in Q4, FY83. There is a serious question about whether HSC is viable without a tape for the first year of shipments, in view of the recent loss of cluster support until 3B is released.

e. This decision also makes Klipa less attractive, since one of the Klipa strategies is to permit migration of TU78 massbus drives to HSC TA78's.

f. Alan White estimates that there would be a $10.8M LDP revenue impact if we made this decision. His memo also is being forwarded.

g. Bill Munson's summary of the TIG impact emphasizes the importance of TA81 benchmarking compared with TA78. Bill's memo will be forwarded.

h. There is $400K of manufacturing capital in place for TA78 that will have to be written off or redeployed. Rough cut is a $250K P&L write-off.

i. In view of these problems, I recommend that we solve the Maya funding shortfall in some other way. The $200 - $250K benefit to Maya isn't worth the cost.

2. Regarding a Maya joint venture, we will add TEAC to the candidate list. I do not believe that it is in our best interest to disclose Maya to Tandon because it is unlikely that we could put together a joint venture. We are actively discussing joint venture possibilities with a number of potential partners as you know. The impact of a joint venture on Maya looks to me as follows:

a. By establishing a joint venture with a cartridge vendor, we can earn cartridge license revenue of $500K to $2.5M, starting in FY84 or 85. We could elect to use some of this revenue to offset tooling expenses which are expected to be as follows:

	FY83	FY84
Tooling Expenses	$30K	$100K

I doubt that we could realize any of this help in FY83.

b. Licensing the drive should earn us license revenues

of $1M to $5M, probably again starting in FY84 or FY85."

3. Paul Bauer has indicated that if he cancels RX52 but retains floppy advanced development, he could make available engineering resources in the 2H FY83 time frame that would be very useful for Maya. I believe that Paul is working up a more detailed impact statement.

Memos forwarded today:

1. Grant Saviers, Sept. 21, 1982 -- EMC Action Items
2. Ray Ochester, Sept. 30, 1982 -- LCG Need for TA78
3. Bill Munson, Sept. 30, 1982 -- TA78 Requirements for TIG
4. Alan White, Sept. 30, 1982 -- TA78 Forecast Impact
5. Ken Sills, Sept. 30, 1982 -- Further Arguments for Continuing TA78

1-OCT-82 11:35:03 S 01574 CLEM
CLEM MESSAGE ID: 5177310933

"CC" DISTRIBUTION:

BILL MUNSON
SSD STAFF:
RAY OCHESTER
ALAN WHITE
KEN SILLS

****
* d i g i t a l *
****

TO: JOHN SWAN

cc: HAP PRINDLE
JON ROULEAU

DATE: THU 30 SEP 1982 2:55 PM EDT
FROM: ALAN WHITE
DEPT: LDP BUSINESS PLANNING
EXT: 231-6517
LOC/MAIL STOP: MRO2-2/D13

MESSAGE ID: 5177230639

SUBJECT: TA78 FORECAST IMPACT

THE FOLLOWING ARE MY COMMENTS RE: THE POTENTIAL ELIMINATION OF THE TA78 PRODUCT WITH RESPECT TO THE LDP MARKET FORECAST. HAP WILL YOU PLEASE REVIEW AND CONFIRM/COMMENT TO PRODUCT MANAGEMENT?

- THE CURRENT SHIP FORECAST (U.S. & GIA ONLY) FOR TA78 PRODUCT IS:

(UNITS)	Q1	Q2	Q3	Q4	TOTAL FY'84
SYSTEMS	5	7	13	10	35
AFTER MARKET	5	6	7	7	25
TOTAL	10	13	20	17	60

- THE PROBABLE IMPACT BECAUSE OF THE LOSS OF THIS PRODUCT WILL BE 80% OF SYSTEM SALES AND 100% OF THE INSTALLED BASE MARKETING SALES. IN TERMS OF DOLLARS THIS MEANS:

  - 28 SYSTEMS X $305K (AVERAGE SYSTEM PRICE) = $8.5M

  - 25 INSTALLED BASE SALES X $90K (TRANSPORT, HSC50, DATA CHANNEL) = $2.3M

  - TOTAL IMPACT FY'84 = $10.8M

- THERE ARE SEVERAL ISSUES WHICH SHOULD BE NOTED WHICH SUBSTANTIATE THIS POSITION.

  1. THERE IS NO REASONABLE ALTERNATIVE WITHIN DEC'S TAPE PRODUCT MIX WHICH ADDRESSES THE NEEDS OF REAL TIME HIGH AVAILABILITY (I.E., CLUSTER ARCHITECTURE) SYSTEMS. LDP HAS BEEN VERY SUCCESSFUL IN THE TU78 VAX SYSTEM SPACE BECAUSE OF THE 125 IPS/6250 BPI OFFERING. CONTINUED SUCCESS IS CONTINGENT ON HAVING BOTH DISK AND TAPE IN THIS SYSTEM SPACE.

  2. THE TA81 TIME TO MARKET IS TOO LONG (Q3 FY'84). THE LOSS OF THE TA78 WOULD MEAN NO TAPE PRODUCT IN THE HSC50 SPACE FOR 6-8 MONTHS.

  3. ALTHOUGH CHEAPER, THE TA81 OFFERS ONLY 25/75 IPS AT 1600/6250 BPI WHICH AT BEST CASE REPRESENTS A MINIMUM 40% PERFORMANCE LOSS FROM THE TA78 PRODUCT. 468KB/SEC PEAK TRANSFER SPEED FOR THE TA81 IS TOO SLOW.

4. THE USE OF DISK AS BACK-UP (I.E. RA60) IS NOT A COST EFFECTIVE ALTERNATIVE FOR ARCHIVING DUE TO THE RELATIVE COST OF MEDIA. THIS ASSUMES WE HAVE SUCCESSFULLY MOVED AWAY FROM MASSBUS TECHNOLOGY.

5. TAPES HAVE THE BENEFIT OF SYSTEM INDEPENDENCE AS THEY CONFORM TO ANSI/INDUSTRY STANDARDS. NOTE THAT OUR DISKS ARE DEC UNIQUE, A FEATURE WHICH IS BOTH A RISK AND AN OPPORTUNITY.

6. THE TA78'S SOLD TO THE INSTALLED BASE WILL BE INCREMENTAL BUSINESS DRIVEN BY A MARKETING STRATEGY WHICH PROMOTES MIGRATION. NO PRODUCT MEANS NO MIGRATIONS.

o CONCLUSION:

- GIVEN THE DIRECTION OF THE 32 BIT SYSTEM MANAGEMENT AND INCREASED PRESSURE BY THIRD PARTY PLUG COMPATIBLES IN THE AFTERMARKET, I SUPPORT THE CONTINUED EFFORT REQUIRED TO BRING THE TA78 TO MARKET.

30-SEP-82 15:25:19 S 03539 MR16
MR16 MESSAGE ID: 5177268220

1-OCT-82 10:29:55 S 01088 MLCG
MLCG MESSAGE ID: 5177331278

1 OCT-82 11:44:50 S 01684 CLEM
CLEM MESSAGE ID: 5177311021

"CC" DISTRIBUTION:

BILL MUNSON RAY OCHESTER KEN SILLS
SSD STAFF: ALAN WHITE

****
* d i g i t a l *
****

TO: DAVID W BROWN

cc: JOHN SWAN
LARRY TASHBOOK

DATE: THU 30 SEP 1982 3:18 PM EDT
FROM: KEN SILLS
DEPT: STORAGE SYSTEMS
EXT: 292-2149
LOC/MAIL STOP: YWO/YWO

MESSAGE ID: 5177210195

SUBJECT: FURTHER ARGUMENTS FOR CONTINUING TA78

1. The TA78 sales forecast is for approx. 5000 units over 4 years. The concensus of management opinion is that there is very little price elasticity of demand for this class of tape device on large systems. Therefore, if TA81's were to be substituted on a one for one basis for TA78's, Digital would incur a $135M NOR loss, and a $100M gross margin loss over this 4 year period:

	TA78	TA81	LOSS
MLP	$52K	$25K	$27K X 5000 = $135M
COST	14K	7K	
GROSS MARGIN	$38K	$18K	$20K X 5000 = $100M

Assuming that price elasticity is present, then more than two TA81's would have to be sold for every forecasted TA78 unit replaced to achieve a breakeven gross margin. This is unrealistic for two reasons:

a. Additional tape units on a system add little, if any, functionality to the system.

b. The TA78 forecast has already been impacted by TA81 in the forecast. Where price sensitivity was present, the forecast already reflects TA81 preference.

One way the above loss could be mitigated is if the cutomer chose to spend the "saved" dollars by enhancing the system in some other way - more disks, terminals, etc. This is a dubious argument since most customers buy to satisfy an applications need, not to spend a prescribed amount of money.

2. A further NOR loss would occur from lost high-end system sales. Incremental system sales due to a $27K lower system price would be more than offset by lost system sales due to the lower functionality of the TA81 (see following re: functionality). Jupiter engineering and marketing have strongly stated that they "have no system" without the TA78 and will have to re-examine announcement plans.

3. The TA81 will not be available for VMS V3.4 field test in 2/83. VMS V3.5 will not support any new hardware. The next opportunity

for software support is VMS V3B. Hardware for this release must be available for field test in 7/83. This is very risky for TA81 since first protos will be available in 2/83. Even assuming this date is met, the implication is still that HSC50 has no tape until 5/84, nearly a year after HSC50 FRS. HSC50 Product Management and Development feel that this will make HSC50 an unviable product, particularly after recently losing cluster support until a year after FRS.

4. TA81 does not exhibit robust performance in all environments like the TA78 start/stop drive. When the customer uses Digital supplied tape utilities, sufficient buffering, asynchronous I/O command queuing, etc. will all be intact to assure reasonable performance. However, no performance guarantee can be made for previously written private applications programs. Running these programs may cause severe performance degradation of the TA81 tape. This is particularly true for GCR mode of the TA81 where there is no start/stop fall-back like PE. The TA81 is not a generalized tape solution for the high-end system. It is a low end interchange and back-up device for the system that is specifically non-tape intensive.

   Tape performance robustness on a high-end system is a marketing necessity. ALL applications must perform reasonably. A situation where, for example, 90% of customers are satisfied and 10% are extremely dissatisfied is unacceptable.

30-SEP-82 20:30:47 S 03698 MLEM
MLEM MESSAGE ID: 5177278481

1-OCT-82 11:42:25 S 01656 CLEM
CLEM MESSAGE ID: 5177311014

"CC" DISTRIBUTION:

BILL MUNSON RAY OCHESTER KEN SILLS
SSD STAFF: ALAN WHITE

****
* d i g i t a l *
****

TO LARRY TASHBOOK

cc: see "CC" DISTRIBUTION

DATE: THU 30 SEP 1982 2:00 PM EDT
FROM: BILL MUNSON
DEPT: TIG
EXT: 264-7436
LOC/MAIL STOP: MK1-1/D29

MESSAGE ID: 5177210130

SUBJECT: TA78 REQUIREMENTS FOR TIG

The TA78 continues to be a high impact product for TIG. Given the large configuration, transaction-orientation of major segments of our business, our customers clearly need high-performance, high-quality, high-density tape products to configure "balanced" systems with large (huge?) amounts of non-removable disk storage.

Until proven under "system operation" (i.e., effective OS and/or subsystem functionality) and demonstrated device/technology maturity, streaming tape products should not serve as our sole tape offering. Of special concern may be the effectiveness they demonstrate in transaction/journal/roll-back/ roll-forward/etc applications, versus the proven capabilities of the proven TA78-like functionality.

30-SEP-82 20:08:22 S 03339 MKEM
MKEM MESSAGE ID: 5177049134

"CC" DISTRIBUTION:

DAVID W BROWN JOHN SWAN TIG MGMT COMM:
TIG MKTG COMM:

1 OCT-82 11:41:13 S 01646 CLEM
CLEM MESSAGE ID: 5177311012

"CC" DISTRIBUTION:

BILL MUNSON RAY OCHESTER KEN SILLS
SSD STAFF: ALAN WHITE

****
* d i g i t a l *
****

TO: DAVID W BROWN
JOHN SWAN
cc: BRUCE CAMPELIA
PER HJERPPE

DATE: THU 30 SEP 1982 11:19 AM EDT
FROM: RAY OCHESTER
DEPT: LCG MARKETING
EXT: 231-4117
LOC/MAIL STOP: MR2-2/C2

MESSAGE ID: 5177209923

SUBJECT: LCG NEED FOR TA78

The TA78 is the only tape drive to be supported on the Jupiter (DECsystem-4050). A tape drive is required for backup, archiving and data interchange - not only with the RA81 on an HSC, but also in standard mainframe computer tape applications. The requirement is for a medium to heavy duty start-stop tape drive.

The TA81 IS NOT an acceptable substitute due to its lack of performance and functionality to support our product needs.

Other potential alternatives for the Jupiter (ie., a block mux or massbus interface) have been ruled out by Gordon Bell unless they are done as a part of the HSC-50 project, and therefore done as a corporate implementation. Colorado Springs has rejected these alternatives as non-viable. Other options are unavailable because the Jupiter only has a CI/NI interconnect capability.

Therefore, there is no alternative available to replace the TA78 as the Jupiter tape subsystem. We are reviewing the Jupiter pricing and announcement proposal at PPC and the Operations Committee on 4 Oct 82. Our present forecast for TA78 is approximately 1650 units over a four year period. Without the TA78, we do not have a complete Jupiter System to announce or deliver. The projected revenue for the Jupiter system is $1,615 Million, and is at risk without the TA78.

30-SEP-82 19:09:23 S 02337 MLCG
MLCG MESSAGE ID: 5177230201

1 OCT-82 11:40:37 S 01633 CLEM
CLEM MESSAGE ID: 5177311005

"CC" DISTRIBUTION:

BILL MUNSON
SSD STAFF:
RAY OCHESTER
ALAN WHITE
KEN SILLS

d i g i t a l

INTEROFFICE MEMORANDUM

TO: Grant Saviers MLO3-6/E94

DATE: 10/5/82 Tue 16:21:30
FROM: David W. Brown
DEPT: TAPES ENGINEERING
EXT: 292-2070
LOC: YWO/G2

CC: SSD STAFF

SUBJECT: TA78 VS. TU81

1. Performance Comparison on HSC

The attached graph compares TA81 and TA78 performance on HSC. In summary:

	TA78	TA81
HSC Local Backup	1	.6
VMS Image Backup @ 200 KBYS	1	.6
VMS File Backup @ 75 KBYS	1	.7

Comments:

a. HSC will have a very fast local image backup which is expected to keep the 125 ips TA78 running continuously. The TA81 performance will be limited by the 75 ips speed.

b. For file-oriented backup routines, the HSC is a data path only and contributes nothing to tape performance. No buffering for streaming tape drives has been provided in HSC.

c. DECsystem 10 and 20 software routines like Dumper have not been rewritten to provide buffering for streaming tape drives. This will have to be done or the performance of the TA81 will drop far below what is shown above. This will certainly be unacceptable.

2. FRS Impact

This decision would also leave HSC without any tape until May, 1984, when VMS 3B will be released, because TA81 misses the window for VMS 3.4. Under the current plan, TA78 will be available at HSC FRS in Q4, FY83.

11 months
8 months

We have explored the possibility of using TA78 prototypes for software development to permit a Q2, FY84, FRS on TA81 on HSC under VMS 3.4. The VMS people have told us that this is not a workable plan because of the differences between 3B and 3.4 and because extensive field experience with the TA78 will not be generated under this plan.

3. Budget Impact

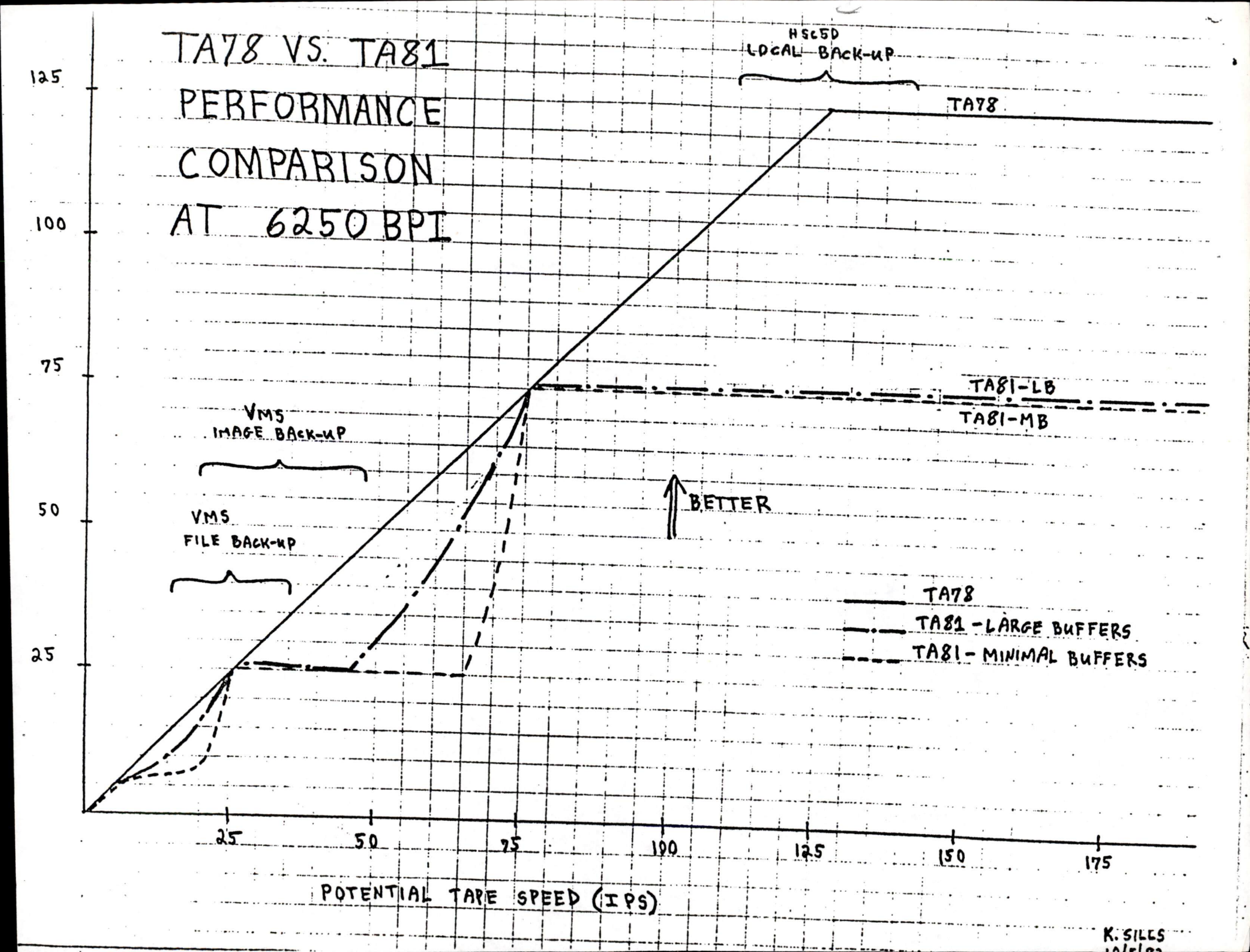
If we cancel the TA78 and continue work on the TA81, three people can be freed up for work on MAYA. The FY82 budget impact will be a $200K transfer to MAYA.

DWB/br

Attachment

DWB:3

LOOKB
1MB 55sec
60MB 30 min = 50 min


TA78 VS. TA81
PERFORMANCE
COMPARISON
AT 6250 BPI
HSC50
LOCAL BACK-UP
TA78
TA81-LB
TA81-MB
VMS
IMAGE BACK-UP
VMS
FILE BACK-UP
BETTER
TA78
TA81 - LARGE BUFFERS
TA81 - MINIMAL BUFFERS
125
100
75
50
25
25
50
75
100
125
150
175
POTENTIAL TAPE SPEED (IPS)
K. SILLS