SUBJECT: DRAFTING COMMITTEE MEETING MAY 31, 1963

TO:
DRAFTING COMMITTEE
K OLSEN
H ANDERSON
A HALL
K WAKEEN
W HINDLE
ENGINEERING PROJECTS COMMITTEE MEMBERS
BUILDING 4 ENGINEERS
DRAFTING ROOM SECTION CHIEFS

FROM:
DRAFTING COMMITTEE

This Committee was established to smooth the communication problems between Engineering and Drafting toward the end of spending less drafting time per project, filing fewer prints, finding faster those prints that are filed, and keeping track of projects in process. It would seem that if the schemes already suggested for use in controlling drawings and expediting work are explained, that will be enough to straighten out the problem. The system would then be published.

One of the four topics discussed was "What plan is used or should be used to get drawings into the system?" This discussion ended with the discovery that often not enough is learned about a drawing or project to assign it the proper number at the start of the drawing process. Answers to such questions as "How big a project is this going to be?" "What relation does it have to other projects?" "Is it a block schematic, assembly, detail, or circuit schematic?" .....will assure that the right block of numbers will be assigned at the right place in the system to allow for expansion and to see to it that the drawing has the right level of priority and craftsmanship assigned to it. An understanding of the assignment procedure by all those concerned should also give, as a by-product, clearer understanding of a project's "place in the sun".

Discussions of print categories such as "Sketch", "Limited Release", "Full Signature" or "Complete" prints pointed up some fuzziness in understanding of the area of responsibility of the signees and also the procedure of updating and revising prints easily. Somewhat sharper definitions will enable the engineers to be less worried about the Drafting Department and enable Drafting to spend less time on categories of prints which do not need to be of completely finished quality. Draftsmen should be able to get on and off certain jobs more quickly.

A good deal of time was spent learning about the master numbering system. It appears adequate but not clearly understood. Mutual understanding by everyone should provide much better classification and result in the ability to track down elusive prints and avoid duplication of work on related projects by unrelated groups.

A listing of numbers and print titles was discussed with some attention to what should be cross-referenced for easy retrieval of information. The Master Cards and The Book by General Categories can perhaps be expanded a bit by cross-referencing for the benefit of all.

Topics for the next meeting will be as follows:

1. Consideration of a list of what the numbering system is now and how to control properly the assignment of new numbers to various print types.

2. Clarification of the category of "Sketch" prints and other print classes as to who can get them and how they can be charged.

3. A discussion of how draftsmen and engineers are assigned to work together on various types of tasks.

T Stockebrand
L Prentice
R Melanson
L Hantman

TS:ASJ

INTEROFFICE MEMORANDUM

DATE May 29, 1963

SUBJECT PDP-6 Marketing, etc.

TO R. Lane

FROM Gordon Bell

A. Hall
A. Kotak
Computer Guidance Committee

I believe we should look at the possibilities of doing some aggressive classical marketing for PDP-6. For the present, however, the following must be considered and co-ordinated.

1. Programming Manual

2. I/O Scheme Finalization

   (a) Interrupt definition and write up
   (b) Tape Control(s) definition and write up
   (c) I/O structure

3. Micro Tape Control and Unit Specifications

   (a) Number of controls required
   (b) Improved performance of Micro Tapes (eg. automatic rewind)
   (c) Programming investigations
   (d) Time shared program preparation
   (e) Assemble - Compile
   (f) Sorting
   (g) General data storage

4. Sample Programs Investigating:

   (a) I/O
   (b) Matrix Operations
   (c) Sample data processing
   (d) Half word facilities
   (e) Index modification, etc.

5. Decisions regarding importance of future planning of instruction codes

   (a) Double precision fixed point
   (b) Double precision floating point
   (c) Extended character manipulation

6. Consolidate facts on Micro Tape system and schedule meeting regarding the Micro Tape with the Computer Guidance Committee June 13, 1963.

GB/ll

DEC INTEROFFICE MEMORANDUM

DATE May 29, 1963

SUBJECT PDP-6 Signal Conventions

TO L. Hantman
S. Lambert
A. Hall
A. Kotok
Engineering Projects Committee

FROM Gordon Bell

Signal Name Format

A signal name should be brief, but descriptive. The format for various signal types is:

1. Flip-flops

NAME f/f side (0, 1) (bit position)
eg. RUN 1 —◇ , or RUN 0 —◆ or
AR1 (17) —◆ MQ0 (0) —◇

2. Logic Levels

NAME —◆ ≡ ∼ NAME —◇ (for complement)
NAME —◇ ≡ ∼ NAME —◆ (for complement)

2A. The complement symbol

NAME —◆ ≡ ∼ NAME —◇ ≡ $\overline{\text{NAME}}$ —◇

3. Pulses

NAME ——▶

NAME ——▷

Name may include a T or P to denote a time sampled event or a pulse.

4. TRANSFER PULSE names and symbology

◁— or —▷ The register bits on right (or left) go to left (or right) at the command.

EXAMPLES:

AR ← MBJ	Jam transer MB to AR
AR ← MB0	0's side transfer
AR ← MB1	1's side (inclusion or transfer
AR ← MBJ RT	Jam transfer right side
AR ← MBJ LT	Jam transfer left side
AR SH LT	(shift left)
AR ← 0 ≡ AR CL ≡ 0 → AR,	Clear the AR
AR +1 RT	Add one to right side
MBJRT ← → MBJLT	Exchange left and right parts
IR (XD) ← MB1 (XD)	Transfer MB ones to IR, (the X and D parts only).
AR ← AR ∀ MB	(partial add)
SC ← MB1 (29-35)	MB bits (one's side) 29-35 go to SC.

5. Signal names are taken exactly and the two names:

   NAME 1 ≠ NAME 1

Abbreviations:

The following abbreviations are suggested, and if any of these words are used, these abbreviations must be used if the words are abbreviated.

Words do not have to be abbreviated, but words and their abbreviations may not be intermixed.

If the word "CLEAR" and its abbreviation "CL" are used on the same print, they refer to two separate signals.

Characters Used For Naming

1. All signal names consist of DEC Line Printer code characters. This included space.

2. There are no lower case letters.

3. There are no superscripts, subscripts or overbars (complement).

4. Signal names are delimited by at least two spaces.

Print Names

The print name should yield a 1-6 character mnemonic, which will be used as a

prefix on all signals originating on the print.

CP (Central Processor Abbreviations)

AR	Arithmetic Register (the main register of PDP-6)
MQ	Multiplier - Quotient Register
MB	Memory Buffered
MA	Memory Address
SC	Step Counter
IR	Instruction Register
PC	Program Counter

ACcumulator
X index
I indirect or defer

CM (Core Memory Abbreviations)

CMB	Core Memory Buffer
CMA	Core Memory Address
CMC	Core Memory Control

FM (Fast Memory Abbreviations)

FMB	Fast Memory Buffer
FMA	Fast Memory Address
FMC	Fast Memory Control

Logic Symbols

∧	AND
∨	INClusion or
⊻	Exclusive or
∽	NOT (the complement)
+	ADD
-	SUBTRACT
<-	Goes to Left
->	Goes to Right
Jam	
0	zero's side
1	one's side

Module Abbreviations

FF	flip flop
SA	Sense amplifier for core memory
PA	
BD	
DEC	
NOR≡ ∿ ∨	$\overline{\text{or}}$
NAND=∿∧	$\overline{\text{and}}$
INVerter	

Register Abbreviations

REGister	Register
CL	
SET	
COM	
SH	
ROT	
LT	
RT	
BH	
CRY	
PAD	
IOR	
XOR	
INCR	
DECR	
RESet	

Miscellaneous Signal Abbreviations

ACT	Active
ADRS	Address
BUF	Buffer
CHAR	Character
CHG	Change
CM	Core Memory
COMP	Completion
CTR	Counter
DONE	
FET	Fetch
INH	Inhibit
INTCHG	Interchange
IMM	Immediate
IN	Incoming
LC	Location Counter
MEM	Memory
MISC	Miscellaneous
MODE	
OTG	Outgoing
PROC	Processor
PSE	Pause
PTR	Pointer
PWR	Power
RD	Read
REP	Repeat
RPL	Replace
RS	Restart
RSP	Response
SEL	Select
SK	Skip
STRB	Strobe
SW	Switch
SYNC	Synchronize
T TP P	(Time, time pulse or pulse)
TS	Test
WAIT	
WC	Word Counter
WR	Write

dec INTEROFFICE MEMORANDUM

DATE May 29th, 1963

SUBJECT H. Anderson's Memo to S. Olsen re Princeton University dated May 23, 1963

TO S. Olsen

FROM D. Denniston

Could it be possible that Princeton is thinking of replacing the 7090 in their computation center? I have heard nothing to this effect, but I have sent out information on the PDP-6 to the head of Princeton's Computation Center as well as our other contacts there.

Dave Denniston

CC: H. Anderson
N. Mazzarese

dec INTEROFFICE MEMORANDUM

62-003

DATE May 29, 1963

SUBJECT Schedule of Activities

TO K. Olsen
S. Olsen
H. Anderson
R. Best

FROM K. Wakeen

EN 1157 AUTOMATIC MODULE TESTER

1. Instruction manual - written by 5/30/63.
   Printed and distributed by 7/15/63.

2. Install tester in new room by 6/1/63.

3. Complete programming for 4201 F.F. by 6/30/63.

4. Add programs for P.A. and C.D. gates 7/30/63.

5. Add micro-tape 7/30/63.

6. Add high speed printer 8/15/63.

7. All programs for testing production modules in by 9/1/63.

EN 1206 AUTOMATIC MODULE TESTER SALES

1. Add Burrough's modules 6/7/63.

2. Add Fairchild modules 6/30/63.

3. Other contacts which were established during and before EJCC Show will require concentrated follow-up during the next three months. The most active prospects to date are Burrough, Texas Instruments, and Fairchild.

4. Follow-up Weston Instruments 5/29/63 for resistor tester and computor.

H. Anderson

DEC INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE May 27, 1963

SUBJECT June Delivery Schedule-Modules

TO Maynard Sandler FROM Stan Olsen

The following is a list of modules required for delivery during the month of June. These include the MIT order, the AC Spark Plug and Holloman orders and in-house requirements.

We must determine immediately if there will be any delivery problems as we are counting on delivery of these units to gain and maintain a favorable position for renegotiation.

The first list shows all units ordered by MIT. It also indicates other customer requirements and in-house requirements for the same units. Quantities to be in stock by the twenty-first of June are noted also.

The second listing shows customer and in-house requirements for all other types of modules. (This list shows only internal requirements where they conflict with customer requirements.)

Model No.	Requirements	In Stock	To be Delivered to Stock by 6/21
1304	100	53	47
1561	70	11	59
1669	250	177	73
4102	700	113	587
4112	400	168	232
4113	360	89	273
4114	200	53	147
4115	300	90	110
4123	500	75	425
4127	300	0	300
4143	700	62	638
1151	150	10	140
4204	550	17	533
4205	400	114	286
4303	200	0	200
4407	18	18	0
4604	350	0	350
4677	130	25	105
1571	130	20	110
1914	200	23	177
4221	200	0	200
4410	200	73	127

Model No.	Requirements	In Stock	To be Delivered to Stock by 6/21
4606	800	0	800
1001	100	7	93
1954	40	0	40
1607	130	30	100

Other Units

63	25	0	25
201	1	0	0
668	1	0	1
722	10	21	0
730	4	1	3
743	5	27	0
749	2	0	2
765	1	0	1
801	6	0	10
901	7	22	0
1000	3	29	0
1103	31	429	0
1105	102	137	0
1110	20	13	7
1201	74	62	12
1204	30	62	0
1213	33	32	1
1310	25	30	0
1311	213	56	157
1404	5	19	0
1410	23	7	16
1501	12	29	0
1538	158	0	158
1556	5	0	5
1568	1	0	1
1616	5	3	2
1667	2	8	0
1667	2	8	0
1675	14	10	4
1682	25	0	25
1684	48	0	48
1705	7	1	6
1901	9	21	0
1906	1	12	0
1907	10	5	5
1909	30	0	30

Model No.	Requirements	In Stock	To be Delivered to Stock by 6/21
1910	21	14	7
1913	13	0	13
1918	1	14	0
1972	131	0	131
1976	102	28	74
1978	8	24	0
1982	27	10	17
1961	20	14	6
1963	20	17	3
3101	12	41	0
3110	21	16	5
3201	28	35	7
3301	7	23	0
3401	3	15	0
3410	4	18	0
3602	6	27	0
4105	737	627	110
4106	43	301	0
4110	88	184	0
4111	174	210	0
4117	4	11	0
4125	7	5	2
4126	36	29	5
4128	24	54	0
4150	28	37	0
4151	22	20	2
4201	305	37	268
4209	155	59	96
4213	93	0	93
4214	75	21	54
4215	399	76	323
4216	121	180	0
4218	72	4	68
4220	15	0	15
4222	12	0	12
4225	7	0	7
4301	409	21	388
4504	1	3	0
4603	152	133	19
4605	11	0	11
4667	178	6	172
4680	63	47	16
4682	6	2	4
4686	3	18	0
4702	25	1	24
6102	58	8	50
6603	2	10	0

INTEROFFICE MEMORANDUM

DATE May 27, 1963

SUBJECT

TO Stan Olsen
Nick Mazzarese
Harlan Anderson

FROM Kenneth H. Olsen

The sales department is apparently doing a good job in organizing trips. However, I think there is one more service which would be very useful.

I propose that we keep a file of hints on each town. This should include particularly suggestions of how one gets transportation to and from the airport. Someplaces a cab is the only way and someplaces a limousene is the only way. Then there are times when if you take several people on a cab the cab is very worthwhile. The sales should, for example, should warn people not to take the cab from New York to the New York Airport because one has to pay double fare. The distance isn't much farther than to Idlewild but the charge comes to twelve to fourteen dollars because the cabby cannot get a fare in return and therefore, he charges twice the price. However, another hint would be that a trip like that, one first dickers with the cabdriver if he is forced to make the trip. The same thing holds in taking trips from the airport out to the suburbs; one should settle on a price first and a little dickering can help.

We might also do well in keeping a file of good hotels and good places to eat in each of the towns.

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 27, 1963

SUBJECT

TO Dit Morse
cc: Gordon Bell

FROM Kenneth H. Olsen

I spent some time on Tuesday evening talking with Frank Engel, Head of the Computation Center at Harvard. He has rather negative attitudes about our company because our prices are so low. He feels that with low prices you just can't get any software; and therefore, he is trying to discourage our sales to Harvard. However, when I talked to him in some detail, I have concluded that there is a possibility we might some day replace the 7090 at Harvard with our PDP-6.

Engel has very strong feelings that it is necessary to have Fortran II if we were going to work in this market. He not only feels that Fortran IV would be an exceedingly difficult burden on him but he also feels that IBM is going to fail in their development of Fortran IV and lead many smaller companies along with them.

He feels it would cost him one or two hundred thousand dollars to adapt their present programs to Fortran IV and the only advantage in the end would be that they would take longer time to run in the computer.

If we're thinking of doing anything other than Fortran II for our computer, I would like to hear about it and make a very formal decision as to what we're doing.

Berkeley is also fascinated with the idea of replacing their 7090 with a PDP-6 but, of course, they'll wait and see how it develops and see whether or not we have Fortran.

Henry McDonald of Bell Labs., he's one of the department heads that's running their 7090 installation. He and a few of the other people there feel that it would be more efficient to have two 7040's than one 7090 and some day they may go that way. He's also toying with the idea that several PDP-6's might be better than two 7040's. However, he does feel that it will be important to be able to convert 7040 programs to PDP-6 in order to make this worthwhile. He thinks that we might include some hardware which would make this convension a lot easier. I was not in a position to make any contributions.

Bill Papian is fascinated with the possibility of getting the first PDP-6 for his group. They badly need a decent size computer down there for their operation and they want to commit themselves fairly soon. They are also plotting with the idea of making their own.

I told Bill that we might give them a discount if he has a group of people who really use the machine well and if he'll take the first one.

Dr. Bruce Waxman, from the National Institute of Health, is fascinated by our PDP-5 because it might make a good consolation prize for all the people who couldn't get LINC computers. However, we have to be able to tell them very soon what software will be available for this.

cc: Harlan E. Anderson
Stan Olsen
Nick Mazzarese

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 27, 1963

SUBJECT

TO Gordon Bell

FROM Kenneth H. Olsen

cc: Bob Savell

At the SJCC Bob Savell and I talked to Mr. George G. Keyes who was supervisor, Sales and Applications, Teletype Corporation, 5555 Touhy Skokie, Skokie, Illinois. He is very much interested in our applications that are used and I think he would be a good one to direct our questions to.

One of the most significant developments at the Trade Show was the fact that Teletype is developing a competitive spirit. This is truly revolutionary. They are not only feeling competitive with Western Union but with the new IBM system. They know the prices on all these things; they know how their equipment compares.

After careful questioning it turns out that the new Light Duty Page Printers are not really light duty but because of the lack of experience with them they don't want to promise too much. They do, however, say that after 500 hours of use they should be lubricated and after three or four lubrications the thing should be checked over mechanically.

Now it is not the number of hours of use, of course, but it is really the number of characters typed and so we might install a mechanical counter which after so many characters are typed would indicate that a lubrication is necessary.

They gave us inconsistent stories as to the availability of these typewriters and I think that it depends partly on the pressure we give them and how interested they are in our applications. One man said six months, another one said four weeks. Keyes was the man that said four weeks and I think if we challenged him on this, he could deliver in four weeks. I think we should immediately get an automatic send-receive set with Punch and Reader and use this to standardize our paper tape preparation.

They can make a new character set for very little money. If they have the characters engraved already it only costs $15 to set up for molding the cylinder and it probably costs very little more to have them engrave new characters. However, I suggest that we use the most standard character set available.

This unit was designed by Mr. Dreyfus who is one of the famous industrial designers. If I remember correctly he is the one who designed the present telephone. They also have their Model 35 unit which is equivalent to the present 23, redesigned by Dreyfus. It is the

same base and the same general lines as the Type 32; however, it is much heavier and bigger. And also, cost $1,500 compared with $500 for the Model 32. However, it has more freedom because of the stunt box. It has both vertical and horizontal tab. The vertical tab is programmed in approximately the same way as a line printer and I believe it is used mainly to skip lines when you come to the end and beginning of pages. They have a disc with pins in it to do the vertical tabing. It also has a few other features but I don't think these are very critical.

Because of the low price of the Type 33, people can readily afford to have spares so the relatively short life of the unit isn't as important. However, for continuous long-life applications we might suggest that people use Type 35. I think they might be able to plug it in the same socket.

At the Trade Show the Type 35 had a spocket feed paper and they said it will be available on the Type 32.

Kenneth H. Olsen

cc: Stan Olsen
Harlan Anderson

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 27, 1963

SUBJECT Suggestions for Future Trade Shows

TO Howie Painter

FROM Kenneth H. Olsen

cc: Stan Olsen
Jack Atwood

1. Completely set up all booths for shows at least two weeks before the show and leave them set up so that people involved in the show will have their chance to try out things and to make suggestions.

2. You have the responsibility for trade shows and if Jack Atwood's people hold you up, go along without them or let me know and I'll get them going. You are dependent on many people; but, you do have the responsibility and if you aren't getting this service from other people, I want to know immediately so they get things done on schedule.

3. We should schedule and list all work to be done several weeks or months before the show when there is no pressure on them. This way that the second or smaller shows such as the ASME Show will not suffer because of the bigger one. They never did get PDP-5 or 6 literature at New York.

4. Make sure that there are modern and good looking modules for each of the shows. They had ugly and obsolete units in New York.

5. Organize the literature at the show. We had odd collection of miscellaneous piles spread all over the booth in Detroit.

6. You're running this show. You tell people how to organize things and make sure they keep things clean. We want the ashtrays cleaned out, computer table kept neat, and the boxes of tapes put away, and above all keep the competitors literature off the tops of our tables. In New York we still had too many of our people standing around the booth with no job to do.

7. Someone should be at the booth an hour early every day to make sure that things are in shape. Those shows which have technicans to maintain the machines, they should be there one or two or three hours early to check the machines and run margins. There is little point in having them around during the day because we can't trouble-shoot the machines during the day anyway. I think one technican is enough because he can only do things that are useful before and after the shows.

8. We should have some way of telling people that we have an honest-to-goodness computer. We didn't get that message across at all in New York.

9. We should have an interesting program if we're going to have a computer at the show. The running contest in New York was deadly. We would have just as well left the machine at home.

10. All tool boxes and cases should have the same lock and every one involved should have a key to the lock. Wednesday morning we were trying to do things at the booth and there was no technicans around and nobody had a key to the tool boxes.

11. I think we should probably send fewer people to these shows. In Detroit many of our people seem to be standing around the booth wondering why there were in Detroit.

Kenneth H. Olsen

cc: Harlan Anderson
Stan Olsen
Nick Mazzarese

INTEROFFICE MEMORANDUM

DATE 5/24/63

SUBJECT Typical Lease Rates

TO K. Olsen
H. Anderson
W. Hindle
All Sales Personnel

FROM B. Maxcy

Chandler Leasing has given me the latest average rates that we can use in quoting to potential customers.

For convenience, use the maximum rate for quotes under $100,000 and the minimum rate for quotes over $100,000. Please remember that these should not be quoted as firm commitments as they are just an indication of what is available. In many cases these rates can be sharpened up, especially where large amounts of money are involved, or the customer has an unusually good credit rating.

The following table should be of some help.

Average Leasing Rates

Term of Lease	(Monthly Payment - Percent listed below x purchase price = monthly payment)		(Percent listed below x purchase price = amount required to purchase equipment at end of lease)
1 year	8.5 - 9%	108	4 - 5%
2 year	4.3 - 4.8%	115	8 - 9%
3 year	3.1 - 3.2%	115	10%
4 year	2.41 - 2.51%	120	10%
5 year	2.0 - 2.1%	126	10%

Lease renewal rates average 5% per year for a one (1) year renewal and 4% per year for a two (2) or three (3) year renewal.

After expiration of warranty, a maintenance contract is available. The yearly rate is 5% of the purchase price.

BM/jr

dec INTEROFFICE MEMORANDUM

DATE May 24, 1963

SUBJECT Henry McDonald of Bell Labs. Murray Hill, New Jersey

TO Nick Mazzarese

FROM Kenneth H. Olsen

cc: Harlan Anderson
Stan Olsen

582-3000
X 4235

During our conversation with Henry McDonald he outlined a possible solution to one of his problems. He wants a 16K Memory to which he would like to tie a large number of typewriters. This in turn would be tied to a 7090. He doesn't call this timesharing because they are basicly against what most of the other people are doing in this area. The solution he would like to hear our reaction and price too is a 16K 12 bit memory with a PDP-6. The PDP-6 would load up one or two K blocks of memory from a typewriter then dump it into the computer or would unload the computer and dump it out on to the typewriter. There would be one block of memory which would be programmed to the PDP-4 but the rest of it would be used as temporary storage.

My notes are not very complete on this but I think it would be a good idea if someone would call McDonald and get the complete story from him.

cc: Dave Dennison

INTEROFFICE MEMORANDUM

1.5 a

DATE May 23, 1963

SUBJECT Inspection of Facilities At Mid Western Instruments, Tulsa, Oklahoma

TO Ken Olsen
Harlan Anderson
Richard Best
Gordon Bell

FROM Roland Boisvert

Persons Contacted:

R. Morrow	President of Mid Western
S. Keller	Vice President Telex
W. Harrison	Chief Engineer
B. Hall	Production Manager
B. Brown	Marketing Manager

Itenerary of Visit:

A. Plant Tour
B. General Engineering Meeting
C. Marketing Practices Meeting
D. Revisit To Areas Of Interest
E. Seminar On PDP-4
F. Discussion of general nature concerning transports at CDC, and short seminar on all products with emphasis on the PDP-6.

Additions To The Plant Tour:

A. Machine facilities: These are divided into two groups; a model shop approximately the size of our machine shop with approximately the same facilities, and a production facility of 15 to 20 lathes from 10" to possibly 16" capacity, although probably only 14", and about 25 milling machines. Approximately two-thirds of these are Bridgeports of various ages and sizes and the remainder are #2 Brown and Sharpe milling machines. They also have at least one Harding horizontal miller for extremely precise work on the magnetic heads. They have surface grinders, but I did not see any other grinding facilities. Their machine facilities are much too crowded to be efficient, and all of their production is stagered through ESF units that is sequentially put through the machine facility. Separate machines or separate groups are not assigned to any particular project. They do a considerable amount of lapping and they have excellent equipment for this work. Production is in charge of Mr. Burl Hall. He not only seems to know their operations but also the short comings of their operations. I am sure that he is aware of what the increase in production of tapes we contemplate would mean to his operation. They can do considerable in-plant manufacturing of details which would have to be sent to outside vendors. The facility for making printed boards is just barely that, and is the minimum that can be gotten along with. The camera facilities are a real jury rig and they are using ammonium sulfate for etching with the barest facilities imaginable.

B. We spent considerable time discussing the tape hub with the personnel directly involved in the assembly of the tape transport and Bruce Brown of the Sales Department. Several sketches were made of the improvements that we felt were necessary. The most difficult thing, I believe, for them to do would be to bring the air through bleeding holes directly over the tape gaps as suggested by Roland. This is not impossible as they use a shear type valve to bring air into the arms at the present time. There is no reason why this same type of nozzle valve could not be used to bring air into the clamp unit that is directly over these heads. This would mean some modification and experimentation to prove its worth, but the feasibility is quite reasonable.

C. I believe our strongest contacts, that is the people most sympathetic to our position and most cognizant of it, are Mr. Steve Keller and Mr. William Brown from Technical Instruments, their representatives in this area. Mr. Keller again raised the question of whether or not they could use our control circuits and our logic and have us manufacture these for them if they felt it was an advantage. They do have an outside source in or about Tulsa that can make printed circuit boards for them but, as mentioned above, they do not have sufficient facilities for in-plant manufacture of these items. Both Mr. Keller and Mr. Brown are well aware of the advantage of putting a working transport in each of our sales offices in this country, and I believe they will bring what prestige they have to bear to bring this about.

D. The welding area is very small and is geared to their five transports per month. Evidently they do not use this area for much other than producing frames for these transports. At present it consists of one National Cylinder Gas Company's 200 amphere heliarc welding machine and associated equipment, very good welding jigs, an experienced welder, and possibly two helpers. I do not believe they would experience any difficulty in expanding the facility or to change it over to steel welding if they decide to go along with our cabinetry and to produce it in that area. They have room for expansion for a reasonably large welding shop. The man in charge seems to be extremely competent. I have seen no report in the bi-weekly that people from Mid Western called at our booth, but I believe their engineer in charge of marketing and Mr. M. E. Morrow were in Detroit for a directors meeting at the Telex Corporation. Probably both of these people called at our booth. Mr. Keller was in

Detroit later in the week and may have called to look over our set-up at the Eastern Joint Computer show.

Mr. R. G. Morrow is president of Mid Western Instruments Company, Mr. M. E. Morrow is chairman of the board of both the Telex Corporation and Mid Western Instrument, and General Gregory is Mr. M. E. Morrow's first administrative assistant. I believe General Gregory was in the Air Force and was instrumental in the development of the Sikorsky helicopter for use with the Air Force.

Loren Prentice

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The plant tour consisted of a visit to the production area, the administrative area, and the engineering area of Mid Western Instruments. In general, we were very impresssed with both the plant and the personnel that we met in all the areas.

The manufacturing of tape units is presently set at five per month, and Mid Western does have the facilities and the man power to expand this production effort to approximately 32 transports per month before taxing either personnel or facilities. In addition, there is, if necessary, approximately 10,000 square feet of expansion space available in the present building.

The traffic flow through Mid Western is somewhat broken. However, sometime in the next year they plan to correct this factor and give a straight flow to their production lines. The special area of interest to us was the construction of the heads and transports. In both of these areas we saw much improvement over the previous production practices employed by Mid Western. To be specific, one of these areas was the change in the manner of referencing the vacuum column to the main casting.

Roland Boisvert

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My impression of the plant was that they had no production line of tape transports. There were two completed transports and several empty frames. I felt that the work force looked padded in all areas except head assembly.

Bob Hughes

****

While walking through the Mid Western plant, I was not impressed by their production line. There seemed to be disorganization of parts flow through the line. Production is accomplished through many departments where each department is scattered randomly throughout the building. I was told that steps are being taken towards smoother production operations.

The standards lab was well equipped with secondary standards and I noticed they have resistor and voltage standards that are better than ours. The scopes are checked every three months against the Tektronix, oven controlled frequency meter.

Static skew tests for the M3000 read/write head are accomplished with an off line testing rig. The read head is used as a write head during these tests. Likewise the write head is used as a read head.

Reliability or life tests are recorded with a pen-graph recorder. Mid Western has accumulated a large amount of reliability data on a few transports and we will receive the data sheets in the near future.

Steve Lambert

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B. General Engineering Meeting

The general engineering meeting consisted of discussing with the chief engineer and the production engineers those modifications which we considered necessary to effectively operate the Mid Western transport from the computer. The problems that were involved on Mid Western's part were presented in a general plan of attack which will wait upon our decision to either accept or reject the transport. In addition, we discussed reel hubs. The quick release hub they have designed we found to be unsatisfactory, and we gave them a short dissertation on what we thought a quick release hub should be. We found that on their 728 Audio Tape Recorder this hub in basic principle existed, and that a slight modification to this hub would readily fit our requirements. We also talked about the possibility of blowing air on the tape such that it would act over the pole tips of the head onto the tape thereby creating what we felt would be very intimate tape contact with the head.

Roland Boisvert

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C. Marketing Practices

At the marketing practices meeting we discussed the standard contracts and arrangements that Mid Western has with O.E.M. customers and their favorite customer, the government. Basically, these amount to ordering a certain amount of transports at a particular price and then a re-order would move us into a new discount category. Our account would then be credited on the basis of the total order for the transports in a year's time. We also at this time talked to Steve Keller about buying the transports at CDC and having them retro-fitted for the state purposes both here and the factory and possibly in field offices and for show purposes. Mr. Keller said that he could not speak with authority to actually do this at this time but he would go into it with the president of Telex. He advised us that he felt that Mid Western would be much happier to present to us five transports at cost rather than to see us do anything at all with CDC. He very strongly stated that, "they bought those things, now let them rot with them". He did indicated that he felt that some reasonable agreement as far as transports for display purposes could be reached.

How does ? CDC enter ? the picture

Roland Boisvert

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The problem here is not ~~changing~~ changing O.E.M. accounts less than the government. The government does not want a "favored customer" (unless it is the government).

Bob Hughes

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Mr. Keller stated catagorically that Mid Western would, "rather give Digital Equipment Corporation units at cost rather than rework those C.D.C. units" and even "give to Digital Equipment Corporation five units on consignment rather than have Digital Equipment Corporation pick up the five C.D.C. machines."

We discussed with Bruce Brown the sequence of negotiations between Mid Western and Digital Equipment Corporation. There seems to be three distinct phases through which we will pass:

A. Prototype - return to Digital Equipment Corporation of prototype after Pierrre Foret completes the rework as defined by Digital Equipment Corporation. Tie to our computer and decide if the tape deck is acceptable. An estimated price of this tape deck is $11,900. including Mid Western's hardware and read/write electronics. To be concluded prior to June 15th.

B. Semi Modified Transports: As defined by actual commitments a minimum number of tape transports be ordered as semi modified

units. Bruce Brown feels that a firm pricing structure will not be available at this point in time - estimated to be July 1 - and that the best approach would be to price the transports after this first order is nearly completed. However, on this point I feel we should, as a point of considering Mid Western as a source, have an estimate of pricing in all quantities based on the prototype.

What protection against future price changes?

C. Final configuration specifications and pricing: Based upon the prototype as a standard the final specifications are to be written and final pricing structure to be established in quantities to one hundred units and an O. E. M. contract be written.

Mr. J. A. Arrington is sending along a statement of Mid Western's O.E.M. Account Policy for reference in establishing an O.E.M. discount based on accumulated orders over an approximate twelve month period.

Henry Crouse

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Interface Meeting

While the marketing practices meeting was being held, Mr. Griffen, Mr. Foret, Loren Prentice and I held a meeting to discuss the mechanical and electrical interface requirements. Mr. Griffen submitted a list of modifications (enclosed) that Mid Western would like to supply. It was decided that if all the specs listed were included in the transport that much of our control logic would be redundant. Therefore, some of the items will be deleted.

PDP-4 Seminar

During Monday afternoon, I gave a one and one half hour seminar to approximately twenty Mid Western employees. A classroom approach was used in describing computer systems in general. Half of the individuals present were not familiar with comput ers. Thus, I purposely took time to familiarize them with computer jargon. I discussed the majority of options available and how they are attached to the computer. Particular emphasis was placed on tape systems describing the use of a computer and options to test tape transports. I emphasized the fact that the same computer may be used by different departments. Also, an explanation of customer service, PDP-4 reliability, quality and sales advantages was pointed out. A note was added on the programming material available.

Everyone seemed to be very attentive throughout the seminar. There were pointed questions on practically all the items I spoke about. It was evident that at this time Mid Western does not feel like buying a PDP-4. However, there was a great deal of interest. Bruce Brown asked if we would rent the PDP-4 to them. I referred him to Harlan Anderson.

Steve Lambert

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MIDWESTERN INSTRUMENTS

MI-428-1 A

From: Mr. T. H. Griffin

Date: May 15, 1963

To: Mr. P. G. Foret

Subject: M3000 (DEC) Signal Definitions

The following signals have been incorporated in the DEC modification in compliance with their requests and our effort to achieve closer IBM compatibility. There are some departures from IBM in that some additional status lines are made available, such as status EOT, LOCAL AND WRITE LOCKOUT, and the prime of SELECT & LOAD POINT is not made available.

The balance of the standard IBM input/output lines will be included in the 800 BPI program.

All inputs require minus 6 volts ±1 volt to initiate their respective functions, and zero volts to disconnect. Input impedances are on the order of 15K thus allowing parallel operation of several transports without appreciable loading on the source.

All outputs supply a low impedance minus 6 volt ±1 volt level, capable of driving up to a 10 ma load, in the active state and a low impedance 0 volt level corresponding to the function's logical prime.

All functions require d-c level control with the exception of the RWD operation which may be initiated by means of a pulse whose "up-time" is sufficiently long to insure relay closure.

The following is a brief description of the proposed modifications including signal definitions.

SELECT: There are ten (10) machine select lines made available for the purpose of remotely selecting a particular transport for on-line operation. Each of the 10 lines corresponds to a particular manual address switch setting such that upon energizing that line corresponding to the preselected setting, the transport will be logically enabled.

If the proper line is not selected, no REMOTE operation may be performed; however, all LOCAL functions will remain intact. There are no rise time specifications on this line.

SELECT & READY: This output says that the machine has been selected, the tape is loaded into the vacuum columns, all interlocks are closed, and the transport is under REMOTE control. This line will remain at minus 6 volts (except during RWD) until the select line is dropped, the address selector switch is changed, the machine is placed in LOCAL control, or any one of the interlocks are broken.

REWIND: Upon energizing this line, any existing tape motion command is interrupted and inhibited until completion of the REWIND operation. This line may be pulsed provided that the pulse time duration is sufficient to allow relay closure (approx. 10 ms). The only requirement to initiate the REWIND operation is that there be tape on both reels as sensed by means of the "Broken-tape" optical sensing station.

The operation overrides a normal fail condition and may be started with tape in or out of the vacuum columns. Once started, the operation depends upon the tape distribution on the take-up (machine) reel. If sufficient tape is on the reel (high speed zone), tape will be drawn out of the vacuum columns, if it is not already out, and a normal high speed rewind will commence. Upon optically sensing a low tape condition, the high speed operation will terminate and the tape is automatically loaded in the columns. Upon closing the column interlocks, a low speed (normal velocity) rewind begins until LOAD POINT is sensed at which time the transport stops and the REWIND operation terminates.

Had REWIND been selected in a low tape zone, the operation would simply drive the tape REVERSE to LOAD POINT.

Once a REWIND has been initiated, it may not be interrupted in REMOTE until LOAD POINT has been reached or a broken tape condition occurs.

Switching from REMOTE to LOCAL does not affect REWIND; however, the operation may be manually terminated by depressing the STOP pushbutton. In LOCAL control, the transport will sense and stop on both end-of-tape and load-point reflective markers. Either of these markers may be cleared by depressing the FWD or RVS pushbuttons.

In REMOTE control, the end-of-tape marker is sensed but does not alter machine operation.

If the transport happens to be at LOAD POINT, the REWIND function is inhibited. The next GO command will clear the internal interlock in REMOTE whereas depressing either the FWD or REVERSE pushbuttons will clear LOAD POINT in LOCAL pperation.

REWIND & UNLOAD: Functionally, this operation is equivalent to the REWIND operation with the exception that LOAD POINT is logically disabled and tape is allowed to completely unload off the machine reel.

The operation may be selected by means of a pulse whose duration is sufficiently long to insure relay closure. This signal may initiate a RWD & UNLOAD operation or, if energized during a normal RWD, it will cause tape to be unloaded.

Both the REWIND and REWIND & UNLOAD lines require that the transport be selected, however the SELECT line may be dropped, after a time sufficiently long to insure the rewind relay to pull in to conserve computer time.

SELECT & REWIND: This is an output indicating that the transport has started to rewind. This line switches from 0 volts to -6 volts as soon as the rewind relay has been energized. It is held at this level until either the select line is dropped or the rewind operation is completed.

SELECT & LP: This output indicates that the transport has been selected, the load point reflective marker is photo sensed, and the unit is ready for the next instruction.

This line will remain at 0 volts if a RWD & UNLOAD is in progress even though the load point reflective marker is momentarily photo sensed.

SELECT & EOT: This output indicates that the transport has been selected and the End-of-Tape reflective marker is photo sensed. The output is in the form of a minus 6 volt pulse, the duration of which is a function of tape velocity.

FORWARD: This input requires a minus 6 volt level and if the unit has been selected and ready (not in rewind), it will initiate forward tape motion at the specified velocity. If in LOCAL operation, forward tape motion will be interrupted upon photo sensing the end-of-tape reflective marker.

REVERSE: This input requires a minus 6 volt level and if the unit has been selected and ready (not in rewind), it will initiate reverse tape motion at the specified velocity. Photo sensing the load-point reflective marker will terminate the REVERSE tape drive operation in both LOCAL and REMOTE operation.

The absence of both FORWARD and REVERSE tape motion commands with the unit selected and ready will result in the STOP tape motion condition.

The unit may be programmed without regard to tape motion command sequence under automatic control; however, each command must be a minimum of 1 ms in duration in order to allow the tape motion control circuitry to stabilize.

In LOCAL control the STOP pushbutton must be depressed prior to changing direction of tape motion in order to clear the previous motion command.

STATUS LOCAL: All transport output lines are logically disabled (0 volts) upon selecting LOCAL operation except for this line which switches to minus 6 volts thus indicating the unit is not under automatic control.

STATUS WRITE LOCKOUT: This line indicates that the write lockout ring has been mounted on the supply reel thus enabling the transport recording circuitry.

T. H. Griffin

THG:mc

dec INTEROFFICE MEMORANDUM

DATE May 23, 1963

SUBJECT

TO Harlan Anderson

FROM George O'Dea

Lincoln Barber telephoned today and stated that the bank has a customer known as Industrial Metal Products Co., Inc. at 90 Morse Street in Norwood. This company specializes in the manufacture of precision sheet metal products and their President is one Charles E. Perry.

Linc thought that possibly DEC might have a need for the services of this company which he recommends highly.

He will be calling you next week to see whether or not you feel this is worth pursuing.

George

GTO 'D:ncs

NEP

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 21, 1963

SUBJECT Memories for PDP-6

TO Al Blumenthal

Arthur Hall
Computer Guidance Committee

FROM Gordon Bell

The present schedule for PDP-6 Memory development is:

1. Operational Breadboard of 8,192 word, 36 bit by July 15, 1963. (5 microsecond cycle time)

2. Component count of item 3 for pricing by October 1, 1963.

3. Production Model of 16,384 word x 36 bits by December 1, 1963. (4 microsecond, cycle time)

4. Production model of 16,384 word x 36 bits by June 1, 1964. (2 microsecond cycle time).

GB/11

INTEROFFICE MEMORANDUM

DATE 21 May 1963

SUBJECT In House Acceptance Test Procedures; Computer Systems

TO E. Harwood
R. Hughes
K. Fitzgerald

FROM R. Beckman
N. Mazzarese

cc: K. Olsen
H. Anderson
S. Olsen
S. Mikulski
R. Wilson
J. Rutschman

The following procedures have been established for final acceptance testing and shipping of computer systems:

1. Final electrical and mechanical inspections must be signed off before starting acceptance tests.

2. Final shipping arrangements will not be made before completion of acceptance tests.

3. All modifications and wiring on machines must be completed before starting acceptance tests.

4. Any discrepancies during acceptance tests will be corrected as they are discovered before proceding with the testing.

5. After completion of acceptance tests, the system will be moved to the crating area and prepared for shipping with no further inspections or machine operation.

6. Copies of the completed acceptance tests will be furnished to customer with the delivery of the system.

Enclosure - Acceptance Test Form

INTRODUCTION

The following forms are to be used with all computer installations. The program operation portion of the tests will vary depending upon the system under test, however, the general forms will be used for all systems.

DESCRIPTION OF TEST

The MECHANICAL inspection during the test consists of visually inspecting all solder connections for excess flux, burnt wires, excess flux, bad joints and general dress of wires. The power cords should be examined for the proper connectors. A close check should be made on the internal and external appearance such as long loose wires, tape on cables between racks, console appearance, etc. The final mechanical inspection report should be reviewed.

The object of the test is to view the system through the "eyes" of the customer to assure that it looks like a new piece of equipment.

The IO equipment should be examined very closely as this equipment is most often used by the customer and under constant observation. The reader should be examined for cleanliness, loose parts, mailed screws, etc. The typewriter or teleprinter should be examined for proper connectors, new ribbon and platen, proper impression setting, etc.

The ELECTRICAL inspection should examine all indicators for proper operation. The final electrical inspection reports should be reviewed. The software library tapes should be tested for proper operation.

Any discrepancies should be both noted and corrected as they are discovered.

The following pages should be completed by the customer relations representative and signed by the checkout technician. A copy of the forms will be forwarded with the system under test to the customer.

IN HOUSE ACCEPTANCE TEST

SERIAL NO. _____ DATE _____

MECHANICAL INSPECTION

FINAL MECHANICAL INSPECTION REPORT ____

WIRING AND SOLDER ____

INTERNAL CLEANLINESS ____

EXTERNAL CLEANLINESS ____

PROPER POWER CONNECTION ____

RUNNING HOUR METER CONNECTED ____

IO EQUIPMENT

READER ____

PUNCH ____

TYPEWRITER OR TELEPRINTER ____

OPTIONAL EQUIPMENT (as noted)

____

____

____

____

____

____

____

____

____

____

____

ACCEPTANCE TESTS (page 2)

ELECTRICAL INSPECTION

CONSOLE INDICATORS ___

OPTION INDICATORS ___

STANDARD ACCEPTANCE TEST COMPLETED ___

SOFTWARE INSPECTION

MAINTENANCE TAPES ___

WRITE-UPS ___

LIBRARY TAPES ___

WRITE -UPS ___

other test (as noted)

COMPUTER CHECKOUT REP. _____ DATE _____

ACCEPTANCE TEST OPER. _____ DATE _____

ACCEPTED BY CUST. REL. _____ DATE _____

PDP-1 COMPUTER SYSTEM

PRE-DELIVERY AND POST-INSTALLATION TEST PROCEDURE

This test procedure shall be followed for basic PDP-1 computers and installations with central processor options as noted below. Part I describes the testing routines that demonstrate hardware operation. Part II is an operational test of the computer utilizing library program tapes furnished in the software package.

Part I

General: Test procedure consists of operating the following maintenance routines for the length of time specified in the given sequence. Approximate time required for a standard PDP-1 is four hours.

1. MAINDEC-3 Address Test Program (F-39-3)
   Time: 30 minutes (total time)
   Function: Program detects multiple addressing and failure to address all 4096 locations of each memory tested.

2. MAINDEC-2 Memory Checkerboard (F-39-2)
   Time: 30 minutes (one memory module)
   15 minutes/module (machines with multiple modules)
   Function: Program tests proper memory operation by placing various patterns in adjacent storage locations to induce worst possible "noise" with cross-coupling.

3. MAINDEC-1 Instruction Test (F-39-1)
   Time: 30 minutes
   Function: A sequence of routines which test all PDP-1 instructions except multiply/divide and the IOT group. For deferable instructions indirect addressing is tested. The augmented instructions are tested with the defer bit both 1 and 0.

4. Multiply/Divide Test (DEC-105)
   Time: 30 minutes
   Function: The program generates random numbers, and uses them in multiply and divide operations. Sense switch settings allow the program to test both step instructions and automatic instructions.

5. MAINDEC-10 Read Binary Test (F-39-10)
   Time: 15 minutes
   Function: Test the performance of the photoelectric reader during binary operation. It detects the picking up or dropping of bits, clutch and brake operation.

6. MAINDEC-11 Read Alpha Test (F-39-11)
   Time: 15 minutes
   Function: Test the performance of the photoelectric reader during alphanumeric operation. It detects picking up or dropping bits, clutch and brake operation.

7. MAINDEC-13 Punch Test (F-39-13)
   Time: Punch one box of tape (approximately 25 minutes)
   Function: Test paper tape punch by punching random numbers in all possible variations of punch instruction in both binary and alpha modes. Detects picking up or dropping bits in both binary and alpha modes.

8. Type-in, Type-out Test (DEC-106)
   Time: 30 minutes
   Function: Exercise all typewriter characters available on the computeriter. Tests for proper coding both typing out and typing in.

9. Sequence Break Test (omitted if Type 120 installed)
   Time: 15 minutes
   Function: Exercise typewriter, reader, and punch through the use of the one channel sequence break system.

10. Optional Equipment (See Appendix A)

Part II

General: Test procedure demonstrates the operation of the computer and the basic programming system. The basic programming system consists of four programs: The MACRO Assembler, Expensive Typewriter, DDT and Compatible Reproduce. The total time of program operation is approximately four hours.

1. Expensive Typewriter
   Function: A typewriter control program which allows generation and modification of a MACRO symbolic program.

2. DDT
   Function: A debugging program for machine language tapes with added features for tapes assembled by MACRO. It is also useful in preparing new programs.

3. MACRO Assembler
   Function: Assemble coded program tapes into machine language tapes.

The tests will include operation of above mentioned tapes. Assembled programs will be demonstrated. Programs assembled by MACRO shall produce recognizable operations in accordance to the system under test. If desired, the customer may substitute special programs for assembly, however, it is the responsibility of the customer to prepare and test such special programs in advance.

A satisfactory test shall consist of a total of 8 hours of operational time, and a maximum of 45 minutes of down time during the entire period of testing time.

Operational time is defined as unattended computer operation without manual intervention unless the operating directions of the program require it. Necessary manual setup operations (i.e. insertion of paper tape in the reader) are considered part of the operational time

Down time is defined as the time during which operation of the test is halted for the performance of corrective maintenance.

SYSTEM ACCEPTANCE TEST FOR PDP-1 COMPUTER

☐ Type 20 Sequence Break (0.25 hr.)
☐ Extra Memory

PART I TEST	Time in Hours	OPERATE TIME		DOWN TIME		REMARKS	APPROVAL
		Start	Stop	Start	Stop		
1. Memory Address MAINDEC 3	0.5						
2. Memory Checkerboard MAINDEC 2	0.5						
3. Instruction Test MAINDEC 1	0.5						
4. Mul./Div. Test (STEP & AUTO)	0.5						
5. Reader Test MAINDEC 10 MAINDEC 11	0.5						
6. Punch Test MAINDEC 12	Approx. 0.5						
7. Typewriter Test	0.5						
8. Sequence Break							

PDP-4 COMPUTER SYSTEM

PRE-DELIVERY AND POST-INSTALLATION TEST PROCEDURE

This test proceedure shall be followed for the basic PDP-4 computers and installations with the central processor options as noted below.
Part I describes the testing routines that demonstrate hardware operation. Part II is an operational test of the computer utilizing library tapes furnished in the software package.

Part I

General: Test procedure constists of operating the following maintenance routines for the length of time specified in the given sequence. Approximate time required for a standard PDP-4 is four hours.

1. MAINDEC 43 Address test program
   Time: 30 minutes (total time)
   Function: Program detects multiple addressing and failure to address all 4096 locations of each memory tested.

2. Checkerboard test (digital 4-4-M)
   Time: 30 minutes (one memory module)
   15 minutes/module (machines with multiple memories)
   Function: Program tests proper memory operation by placing various patterns in adjacent storage locations to induce worst posible "noise" with cross-coupling.

3. Instruction test (modified digital 4-15-M)
   Time: 30 minutes
   Function: A sequence of routines with test all of the PDP-4 instructions except the IOT group.

4. ACU test (see optional equipment)

5. Reader and Punch test (digital 4-5-M)
   Time: 60 minutes
   Function: Punch test consists of punching various patterns on paper tape and reader test consists of reading these patterns. Approximately one box of paper tape should be punched.

6. Teleprinter test (digital 4-6-M)
   Time: 30 minutes
   Function: Test print out and type in of the teleprinter. It can exercize all characters available on the keyboard.

7. Clock interrupt test (digital 4-14-M)
   Time: 30 minutes
   Function: Tests operation of the clock, reader, punch and teleprinter in the interrupt mode.

PART II

General: Test procedure demonstrates the operation of the computer and the basic programming system. The basic programming system consists of four programs: The Assembler, Edmund the editor (an on-line symbolic editor), DDT and Tape reproducer. The total time of program operation is approximately four hours.

1. Edmund the editor
   Function: A teleprinter control program which allows generation and modification os symbolic tapes for the assembler.

2. DDT
   Function: A debugging program for machine language tapes with added features for tapes produced by the assembler. It is also useful in preparing new programs.

3. PDP - 4 Assembler
   Function: Assemble code program tapes into machine language tapes.

The tests willi include operation of the above mentioned tapes. Assembled programs will be demonstrated. Programs assembled by the PDP-4 assembler shall produce recognizable operations in accordance to the system under test. If desired, the customer may substitute special programs for assembly, however, it is the responsibility of the customer to prepare and test such programs in advance.

A satisfactory test shall consist of a total of 8 hours of operational time, and a maximum of 45 minutes of down time during the entire period of testing time.

Operational time is defined as unattended computer operation without manual intervention unless the operating directions of the program require it. Necessary manual setup operations (i.e. insertion of paper tape in the reader) are considered part of the operational time

Down time is defined as the time during which operation of the test is halted for the performance of corrective maintenance.

ACCEPTANCE TESTS

worksheet

extra memory module ( )

test	time(hr)	start	finish	remarks	approval
Memory Address Test MAINDEC 43	0.5				
Checkerboard Test digital 4-4-M	0.5				
Instruction Test digital 4-15-M	0.5			Place nop's in 7725, 7726 of Contest to surpress I/O equip. Start in loc 7700.	
ACU Test (if applicable)	0.5				
Reader and Punch Test digital 4-5-M	1.0				
Teleprinter test digital 4-6-M	0.5				
Clock interrupt test digital 4-14-M	0.5				

H. Anderson

DEC SALES PERSONNEL ATTENDING TRADE SHOWS IN 1963

S.N.R.A.

Name	Show	Dates
S. Olsen	SJCC	May 21-23
	WESCON	Aug. 20-23
	INEL	Sept. 2-7
	IRE-CANADA	Sept. 30-Oct. 2
	NEC	Oct. 28-30
	NEREM	Nov. 4-6
	FJCC	Nov. 12-14
H. Painter	SJCC	May 21-23
	AFCEA	June 4-6
	APAC	Aug.29-Sept.4
	ISA	Sept. 9-12
	IRE-CANADA	Sept.30-Oct.2
	NEC	Oct. 28-30
	NEREM	Nov. 4-6
	CEM	Nov. 18-20
N. Mazzarese	SJCC	May 21-23
	ACM	Aug. 27-30
	INEL-BASEL	Sept. 2-7
	ISA	Sept. 9-12
	NEC.	Oct. 28-30
	NEREM	Nov. 4-6
	FJCC	Nov. 12-14
P. Bonner	NEREM	Nov. 4-6
J. Burley	DES	May 20-23
	AFCEA	June 4-6
	APAC	Aug.29-Sept.4
	N.C. IRE	October
	CEM	Nov. 18-20
D. Denniston	DES	May 20-23
T. Johnson	WESCON	Aug. 20-23
	FJCC	Nov. 12-14
J. Koudela	SJCC	May 21-23
	NEREM	Nov. 4-6
J. O'Connell	IRE-CANADA	Sept.30-Oct.2
	NEC	Oct. 28-30
	NEREM	Nov. 4-6

Name	Show	Dates
G. Rice	SJCC	May 21-23
	ISA	Sept. 9-12
	NEREM	
A. Titcomb	ISA	Sept. 9-12
	CEM	Nov. 18-20
	NEREM	
D. Smith	ISA	Sept. 9-12
	NEREM	
M. Ruderman	NEC	Oct. 28-30
	NEREM	Nov. 4-6
R. Lane	SJCC	May 21-23
	FJCC	Nov. 12-14
F. Gould	SJCC	May 21-23
	ISA	Sept. 9-12
	NEC	Oct. 28-30
	NEREM	Nov. 4-6
G. Moore	APAC	Aug.29-Sept.4
	CEM	Nov. 18-20
	NEREM	
K. Larsen	WESCON	Aug. 20-23
R. Oakley	WESCON	Aug. 20-23
	FJCC	Nov. 12-14
R. Colman	WESCON	Aug. 20-23
	ACM	Aug. 27-30
	FJCC	Nov. 12-14
D. Doyle	SJCC	May 21-23
	IRE-CANADA	Sept.30-Oct.2
Gunter Huewe	INEL	Sept. 2-7
Field Service Man - Maynard	DES	May 20-23
	SJCC	May 21-23
	APAC	Aug. 29-Sept.4
	ISA	Sept. 9-12
	IRE-CANADA	Sept.30-Oct.2
	NEC	Oct. 28-30
	NEREM	Nov. 4-6
	CEM	Nov. 18-20
	FJCC	Nov. 12-14

INTEROFFICE MEMORANDUM

DATE May 22, 1963

SUBJECT Federal Manufacturers Excise Tax

TO Stan Olsen FROM Dick Mills

Up to the present time we have not as yet included a paragraph in our standard proposal calling out the application of Federal Manufacturers Excise Tax on our computing equipment. The following paragraph is meant to cover this situation:

Federal Manufacturers Excise Tax:

"In addition to the sales price of this equipment, the buyer agrees to pay any Federal Manufacturers Excise Taxes which may be imposed by the United States Government on the seller on the above named equipment".

# # #

cc: K. Olsen
H. Anderson ✓
G. O'Dea
N. Mazzarese

INTEROFFICE MEMORANDUM

DATE May 20, 1963

SUBJECT

TO K. Olsen
H. Anderson
S. Olsen

FROM J. Smith

Due to an Engineering Change, the 555 Micro tape project has been halted. A new scheme utilizing SRC's is now under test in Engineering. They feel a new model will be available by the middle of next week.

Harlan Anderson

INTEROFFICE MEMORANDUM

DATE 5/17/63

SUBJECT SDS - New Computer

TO Ted Johnson
cc: ~~Stan~~ Olsen
Nick Mazzarese

FROM Bob Oakley
RO'ebr

Max Palevsky, President of SDS headed-up a presentation to the Telecommunications Systems Research Group at JPL on May 15. The presentation dealt primarily with the SDS 9300 Computer which will be available next February. The SDS 9300 seems to be designed for the purpose of high speed, real-time data reduction incorporating multiple four thousand word memory modules of which access to and from each can be accomplished simultaneously by either program or external devices.

A program break system will be incorporated which will look similar to the PDP-1 Sequence Break System. The primary exception being that it will not automatically store the contents of registers. The first priority break channel will always be connected to the power fail circuit to enable re-start of the program when power is re-stored after a momentary power fail. (This is quite important in many applications in the Telemetry processsing stations at tracking stations).

Some otherbasic specifications are listed below. (Most are Palevsky's approximations):

1. Memory Cycle Time - 1.75 /us.
2. Add time - 3.50 /us.
3. Price Basic 9300 (with 4K memory) $215K
4. Price 4K Memory addition $30K-40K
5. Mag Tape - 60KC-800BPI-75ips
6. Basic Machine hardware - 2-6 foot electronic racks and 1 control console.

TO: HARLIN ANDERSON

DEC MEMO

SUBJECT: VISIT WITH DR. JACK V. KANE
BTL, MURRAY HILL

DATE 5/16/63

TO Stan Olsen
Nick Mazzarese
Dick Best
Gordon Bell
Bob Savelle
Jerry Moore
Barbera Stephenson

FROM Dave Denniston

I spent the better portion of Tuesday, May 14th with Jack Kane and his group at Bell Labs. This was a very informal visit since I have known Jack Kane for a couple of years. Jack has been interested in displays for some time, and his group has now interfaced two to the SDS 910. These displays are actually two techtronic scopes controlled by electronics they have constructed (he claims about $2K each), including a light pen made out of an eye brow pencil. Although I get the impression that he would like to have a display with a larger screen, Jack did mention that he was quite satisfied with the performance of these displays which he has built, and they are providing him with the quick look at his data that he desires. His objection to one of our displays is price. I might also mention that he has, in the past, inquired about such things as just a light pen with amplifier, and the cost of one of our display cabinets with the CRT and deflection amplifiers only. At this point, I rather doubt that we can do anything to interest him in a display other than by making him an outright gift of one.

Over a year ago when Jack was first thinking about getting a computer for pulse height analysis, I gave him quite a bit of literature on the PDP-4 and talked to him a number of times. His decision to buy the SDS 910 was made solely on the basis of price. He readily admits that as far as he is concerned, the PDP-4 has all of the capabilities that he could desire. I really think that Jack is the sort of person who is willing to spend a year or so trying to make a less expensive piece of equipment perform like the high-priced model.

Jack is now quite interested in the PDP-5, and I left the preliminary specifications with him, and as a matter of fact, he spent all of lunch time going through them. He feels that this is just the sort of machine that people in the pulse height analysis business need, and, naturally, the price range is quite impressive to him. This machine has made him re-evaluate his "it has to be much cheaper to do things serially" idea.

The one feature of the PDP-5 which Jack is unhappy with is the built-in A-to-D converter. I believe that he has already mentioned this to Gordon. He claims that in the pulse height analysis business or that in any field where a distribution of pulse heights is desired, a feedback type of A-to-D converter using a ladder network may not be desirable since the uniformity of channel width is of

the utmost importance, and where a large number of channels are desired, say 512, people will not consider this type of converter. He is presently using a fairly straightforward voltage to pulse width A-to-D technique. An input pulse, variable in amplitude, provides a ramp with a negative slope. The initial value of the ramp is proportional to the input pulse, and the period of the decaying ramp provides a gating level to a clock which then increments a scaler. In the converters he has, a 20 megacycle clock and scaler are used. Jack mentioned that this technique was very common in the pulse height analysis field. He also claims that the same type of conversion is most applicable to the medical field for histograms.

In Gordon's memo of May 7th to Nick, he mentioned that the "advent of an SDS machine probably means a start of a decline in modules sales there" (at BTL). I don't believe that this will turn out to be so, for in the first place, Jack is using our modules as part of his interface and I spent a short time talking with one of his people, Ed Gere, on Tuesday outlining some logic that he is interested in adding. Ed Gere also mentioned that he really was beginning to wonder about the claim of increased reliability with silicon semi-conductors, due to the experiences they have had. As far as anyone else at the Labs is concerned, I have heard no mention of the SDS machine or SDS modules except from one computer prospect who only mentioned the difficulty initially encountered with Jack's machine. Jack and Ed were, in fact, experiencing difficulties during my visit. A program which had run previously was indicating errors on read-in. (Paper tape does not stop on error.) They ran several SDS diagnostic routines but could find no machine trouble. At that point, Ed mentioned that for all but about one of there past problems, the diagnostic routines had not brought to light any of the troubles.

There is one area in which SDS really puts us to shame and this is their software write-ups. Although Jack Mentioned that they do not always include everything that is desirable to know about the routine, the write-ups themselves are extremely well done compared to what we have to offer, in my opinion. Jack specifically asked me to bring along some of our program write-ups, and I must say I was somewhat embarassed to show him what ours look like as compared to SDS (even though we may have far better and more exact information in our write-ups).

H. Anderson

INTEROFFICE MEMORANDUM

To: All Below

Date: May 16, 1963

From: Arthur Hall

The following is the distribution list for PDP-6.

All Memos:

G. Bell, A. Hall, E. Harwood (2 copies), R. Lane, R. Best, B. Scudney, R. Melanson (2 copies), A. Kotok.

In addition to the above, the following should receive all memos which refer to: Sales, Marketing, Advertising, Major Configuration Changes or other important policy matters:

K. Olsen, H. Anderson, S. Olsen, N. Mazzarese (2 copies), J. Atwood, S. GRover.

Expenditures (outside DEC) for equipment or services exceeding $1,000:

G. O'Dea, H. Crouse

Labor and/or Material Accounting:

R. Mills, F. MacLean

Programming and Design as it concerns Programming:

H. Morse, S. Piner, N. Hurley, M. Graetz, L. Hantman, L. Gossel

IO Equipment and Interface:

R. Savell (2 copies), R. Boisvert (2 copies), T. Stockebrand, S. Lambert, E. T. Johnson.

Production and/or Field Service & changes to equipment in Production or in the field:

M. Sandler, J. Smith (3 copies), R. Beckman, J. Shields (3 copies), R. Hughes, K. Doering.

Any changes in Physical Configuration or Production Methods:

L. Prentice, K. FitzGerald, S. Miller.

Suggestions for changes to the list above should be directed to Arthur Hall.

INTEROFFICE MEMORANDUM

DATE May 16, 1963

SUBJECT TECHNICAL MANUAL PRODUCTION

TO K. H. Olsen
H. E. Anderson
S. C. Olsen
R. L. Best

FROM Jack Atwood

Our people working on technical manuals met recently with our four principal customers - Bob Savell, Bob Beckman, Roland Boisvert, and Arthur Hall. We discussed in detail ways and means of speeding the production of equipment manuals.

The discussion produced several points of agreement which I think will be most helpful in the future:

1. The level of detail of the text and its accompanying diagrams should stop outside the individual packages. To go inside the modules in this type of text not only wastes writing and illustrating time; it also tends to confuse the reader by branching too far from the main stream of the explanation.

2. However, there is a place for circuit descriptions in many manuals. This is particularly helpful from a sales standpoint. These descriptions should be somewhat more detailed than the catalog pages, but they do not need to be too extensive. They should be available in prepackaged form for ready inclusion where needed.

3. The biggest saving in technical illustration time can be achieved if engineering drawings are produced originally in satisfactory form. Virtually all drawings produced by Jon Fadiman's group, for example, are readily reproducible in his manuals. Many drawings available from the computer group, on the other hand, must be both reorganized and redrawn.

4. The project engineer on most peripheral equipment projects should be able to produce a workable outline of his piece of gear in four to eight hours of dictation. This, together with adequate drawings, should enable the technical writer to produce a manual in a matter of days or weeks, rather than months or years!

Obviously, some pressure for better drawings is forthcoming from the Drawing Standards Committee. In addition, people like Bob Savell and Bob Beckman are going to apply pressure where it is most useful to upgrade the effort in this direction. This all contributes to a general improvement.

Still, I do feel that some pressure from a higher level would have even more immediate results. Dick, as chief engineer, or Ken, as president, could certainly apply pressure on the engineering group as a whole to produce better drawn and better thought-out diagrams without waiting for a final report on each detail of technique from the Drawing Standards Committee. Any help along this line would be most appreciated.

H. Anderson

DEC MAY - DECEMBER 1963 - TRADE SHOW SCHEDULE

Show	Place	Dates	Booth
Design Engineering Show	New York City	May 20-23	10' self-contained
Spring Joint Computer Conf.	Detroit	May 21-23	40'
A.F.C.E.A.	Washington, D.C.	June 4-6	10' self-contained
Western Electronic Show & Conv.	San Francisco	Aug. 20-23	20'
Assoc. of Computing Machinery	Denver	Aug. 27-30	20'
American Psychological Association Convention	Philadelphia Ben Franklin Hotel	Aug.29 - Sept.4	24'
INEL	Basel, Switzerland	Sept. 2-7	
Instrument Society of America Annual Instrument Automation Conference & Exhibit	Chicago	Sept. 9-12	20'
IRE - Canadian Electronics Conference & Exposition	Toronto	Sept.30 - Oct. 2	20'
N.C.I.R.E.	Greensboro, N.C.	October	self-contained
National Electronics Conference	Chicago	Oct. 28-30	20'
Northwest Electronics Research & Engineering Meeting	Boston	Nov. 4-6	20'
16th Annual Conference on Engineering & Medicine	Baltimore	Nov. 18-20	
American Institute of Electrical Engineers Conference on Magnetism and Magnetic Materials	Atlantic City	Nov. 11-15	20' (?)
Fall Joint Computer Conference	Las Vegas	Nov. 12-14	40' or 20'

dec INTEROFFICE MEMORANDUM

DATE 15 May 1963

SUBJECT PDP-4 for Kie Corporation

TO Stan Olsen FROM Bob Beckman

cc: Ken Olsen
Harlan Anderson
Nick Mazzarese

Subject computer was shipped this date without having passed all of the established inspections and tests.

Due to last minute modifications and additions to this machine it was impossible to follow the normal acceptance test procedures and still deliver by the promised date. Final repair work was completed and a few of the test programs were run briefly before releasing the machine for shipment. Complete on-site acceptance tests will be run after installation.

May 15, 1963

57 Magnetic Tape Control

Computer Guidance Committee

S Lambert

Obviously the 57 Control has been tossed through much controversy. The fact of the matter is that I am trying to produce a control that satisfies everybody's needs. This is impossible. When the 57 control was conceived, there were no thoughts about connecting the IBM transports to it. However, after the first model was in production, a meeting was held and the outcome suggested we integrate the IBM transports onto the control at a latter date. The latter date has arrived.

This month I redesigned the 57 adding features but not changing the basic control. The reason behind the change was to incorporate the interface requirements of the IBM and Midwestern transports. As a result, a new set of drawings, a new (or modified) Programming Manual, a new Maintenance Manual and Control Tester must be worked on. This seems like a lot of work for me but I feel that I can have the majority of the work accomplished by June 15th.

The transition thrown into the existing Programming Manual is small. The manual implies that the Type 50 transport is capable of 556 density IBM format. Presently we are comparing the transports against IBM to see if this statement is true. If we find that some transports work and others are marginal then an addendum should be attached to the manual stating "We don't guarantee 556 when using Type 50 transports. My analysis of the Potter and IBM skew tolerance (the problem) suggests to me that we should never have trouble as long as both transports are kept to within 50% maximum skew.

To eliminate confusion, the redesigned 57 has been assigned the numbers (520) to operate Potter transports, (521) to operate Midwestern transports (522) to operate IBM transports. The Programming and Maintenance manuals will contain (57) as the titles and each manual will be broken into sections 520, 521 and 522. Any additions or deletions to the existing sales material will take the form of an addendum.

In the last month or two, I have had a large number of personal factors to take care of or get adjusted to. As a result the maintenance manual has not been completed on the assigned date. Paul Scriven has helped tremendously in gathering data and writing a portion of the manual. Of course, the manual will have to be modified for Midwestern and IBM.

What does the new 57 look like as compared to the old?

The new control will be controlled by two crystal clocks and is capable of 200, 556 and 800 densities. The old control was clocked by the PDP-4 timing chain. The new control will contain its own Current Address (CA) and Word Count (WC) registers, where the old control used Memory Locations 4 and 5 as (CA) and (WC). The reason behind these modifications is to allow more flexible timing restrictions at 112.5 ips tape speeds, for the programmer. These modifications also allow the 57 to be connected to either the PDP-1, PDP-4, PDP-5, and possibly the PDP-6.

In addition to the old control, the 57 now has a new IOT command for transferring data to the (CA) and (WC) and reading the (CA) to the AC. The control has two additional tape commands and status flags. The commands are Rewind/Unload and Dual Level Read (two commands for Midwestern and IBM only). The status flags are Data Request Late (DRL) and Tape Miss Character (TMC). Everything else remains the same as stated in the Programming Manual with the exception that the programmer has more machine time available.

The physical appearance of the control changes radically in reference to module locations. To facilitate the three interface requirements, the four mounting panels of logic have been broken into a 3 - 1 combination. Three mounting panels are considered as basic logic where the fourth is the interface logic. Between the third and fourth panel there are standoff tie points. This allows us to stock the basic logic and when a customer orders we solder on the fourth. For the interface between computer and control 3-50 pin Amphenol Plugs will be used. Two of these plugs will be identical to the Type 24 Drum interface. The third will carry IOT's and extra AC inputs not used by the drum.

Two panels of logic are required in addition to the three basic logic panels to operate IBM transports. All the specifications outlined for the 57 are true for IBM except IBM does not produce a status for Near Load Point or Near End Point. More panel space is required for the IBM transport plug (equivalent to additional mounting panel).

The basic logic contains 2 eighteen bit buffers, buffer control logic, and time delays. The basic unit has a data band width of 200,000 kc. In reality, any device may be connected to this logic where a time function is required before and after data transfer. Skew tolerances are adjustable on data transfer-in and up to three data transfer rates and skew factors may be selected by program. In addition other devices may utilize one of the eighteen bit buffers without using the available time delays. To incorporate this last feature an additional set of gates must be supplied at the Data Buffer plus priority logic must be added to the (CA) and (WC). This in truth then makes part of the basic logic a Data Channel. It is suggested that only one such device be added if any. All data lines between the basic logic and interface panels are 6 data levels + parity (negative for a one) out and six data pulses + parity (positive for a one) in.

What's new?

Near the end of April I designed two new modules (4304 and 4305). These modules are used with the 4303 integrating delay and cut the cost of tape controls considerably. The purpose of the modules is to make one 4303 look like n 4303's. For every six 4303's used previously, one 4303 and one 4304 take their place at .3 times the original cost. Before, it cost me $1910.00 and now it costs approximately $630.00 for delays and logic control.

The module is well on its way to production through the proper channels. Test data sheets, tester and models are almost complete. The production release is presently in drafting. Test procedure and module specifications will be available shortly.

Midwestern Type 570 Transport Control?

I devoted the majority of my time to the Midwestern transport during the first week in May. After completing the design, I received a memo from Gordon Bell proposing a common buss system. The idea sounds great between computer and control but NOT BETWEEN CONTROL AND TRANSPORT. Ridiculous. The cost of transport controls would skyrocket. Can one imagine commutating 30 to 40 wires?

The basic 570 Control is designed for multiplex operation. That is, two tape controls may address the same transport separately. The logic is set up so that when the customer desires multiplex operation, he buys an additional mounting panel called B Control and plugs it into the existing A Control. Each mounting panel carries a maximum of 12 modules. For multiplex operation 4 - 50 pin cannon plugs are required in each transport. The logic is designed that more transport controls could be added in a priority arrangement. The basic A Control with read/write logic uses 22 modules where the B Control uses 7 modules.

The first control unit will be out of production by the last week in May. It is planned to have the 521 tape control out approximately the same time. However, drafting has held me back a week and who knows when they will be finished.

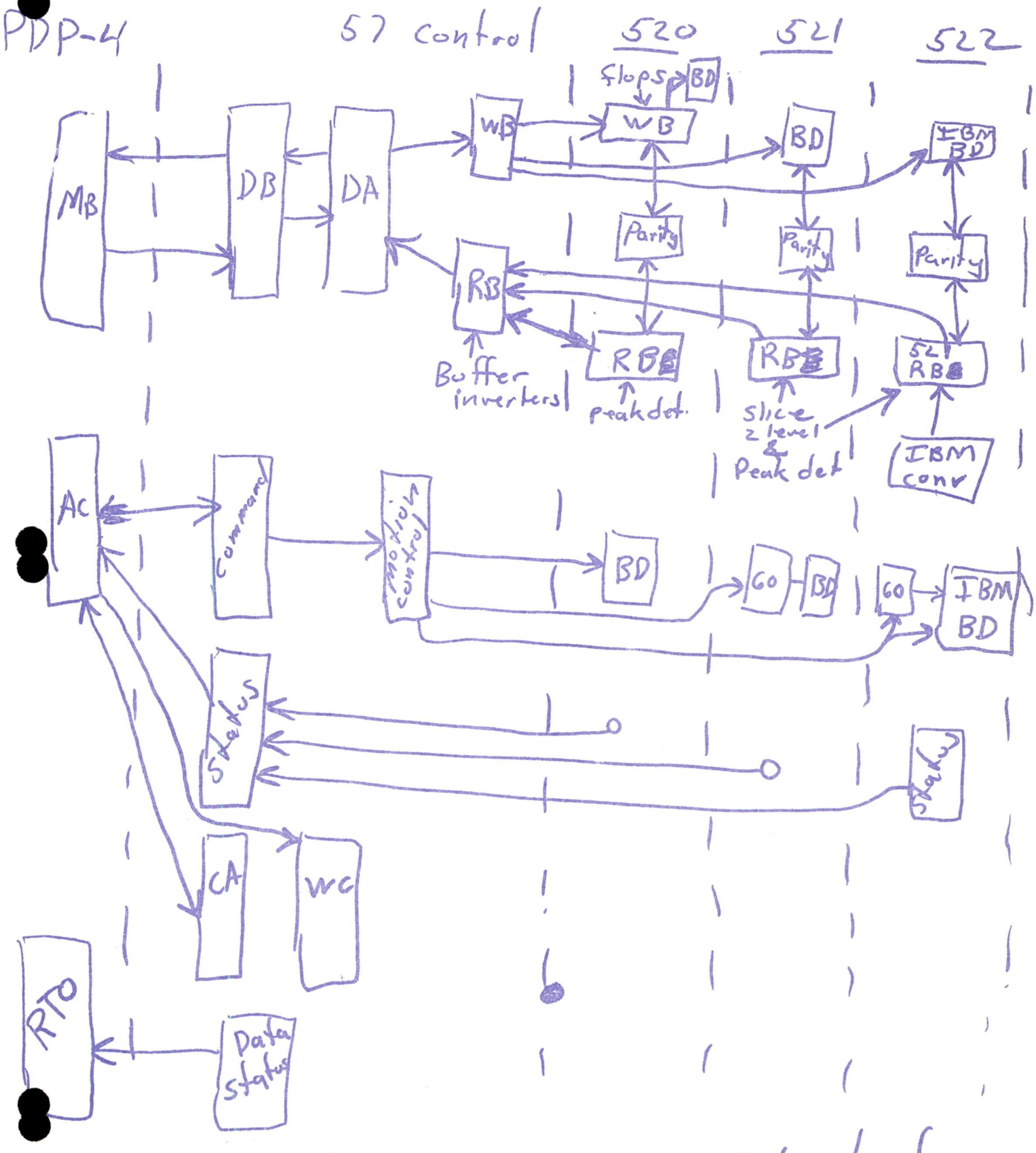
I've suggested to Scott Miller that two transport select switches might have great sales potential for multiplex or time sharing of transports. There is valid logic reasoning behind this suggestion. If computer A has programs written using transports 1 and 2 and computer B has a program using the same unit numbers but B wants transports of his own not being used by A, what does B do?

Anything else?

Yes, I'm still hep on wirelisting. How? Refer back to a memo that I wrote a month ago. Presently the 570 is on cards with a wiring diagram for backup. I have found a great amount of the problems in the initial stage are emotions, documentation and ease of handling. Errors crop up every time the list changes hands. The key punch operator has trouble reading the scribbles and she finds it difficult to switch to and from alpha and numerical modes.

I've been doing this work in my spare time (What spare time?) and hope to see results soon.

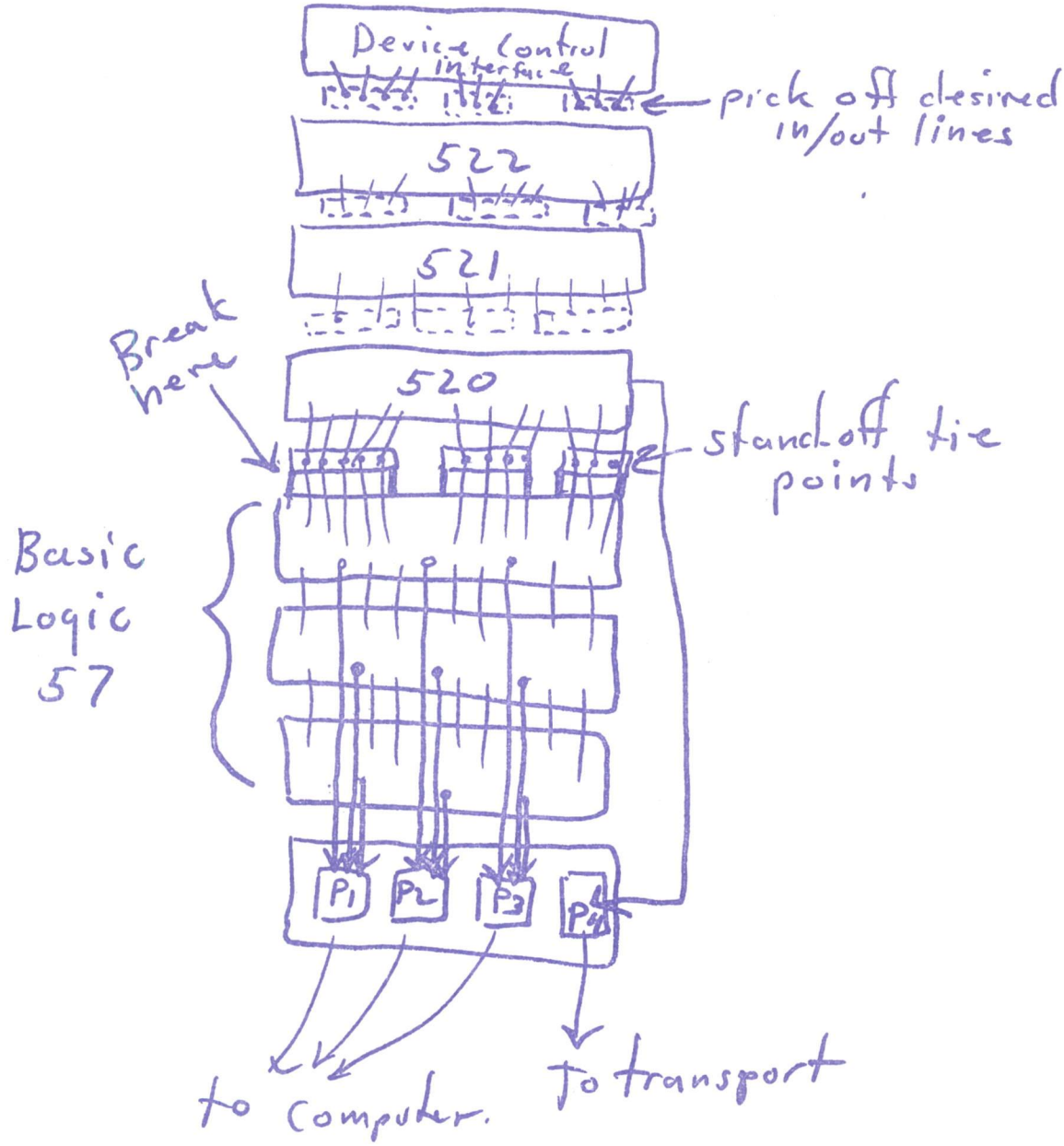
Type 57 Mag tape Control



S. Lambert
5/14/63

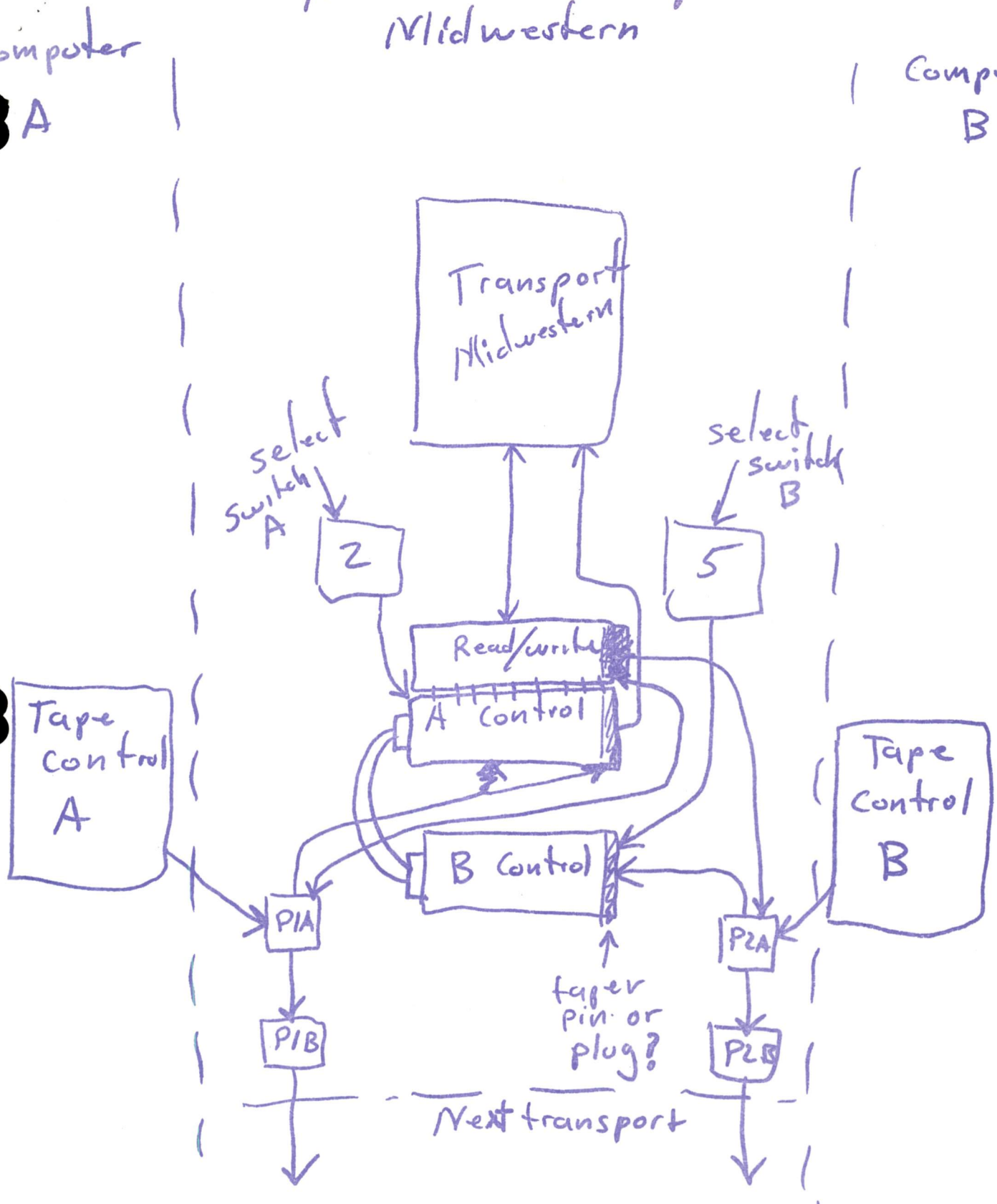
Type 57 control

520, 521, 522 interface or other



S. Lambert
5/14/63

Type 570 Transport Control
Midwestern



S. Lambert
5/14/63

INTEROFFICE MEMORANDUM

DATE 5/15/63

SUBJECT A to D Prices

TO K. Olsen
H. Anderson
W. Hindle
R. Best
S. Olsen
N. Mazzarese
D. Morse
S. Grover
G. Bell
S. Lambert
R. Boisvert
R. Savell
All Sales Personnel

FROM R. F. Maxcy

The following items have been priced and are available on a five month delivery. A write-up is enclosed.

General Purpose A to D Converter (up to 11 bits)	$5,000
General Purpose 64 Channel Multiplexer and Control	3,600
Multiplexer Switch 1578	425

Description of our General Purpose A to D Computers and Multiplexers

The general purpose analog to digital converter may be used to convert input analog voltages into digital number of up to 11 bits. The A to D converter communicates with the computer via the IO. Conversions are initiated by computer request.

The input range on the ADC is 0 to -10 volts. The speed of the conversion is proportional to the number of bits and the desired accuracy. The output of the A to D converter is an 11 bit binary number in two's complement notation. A ground input corresponds to the largest positive output; -10 volt input corresponds to the largest negative number. The digital output always is transferred to the most significant bits of the computer word.

The A to D converter is controlled by two IOT's. One instruction requests that a conversion be made. A second instruction requests that the results of the A to D be read into the computer. The time between these two instructions must be sufficient to allow complete conversion.

GENERAL PURPOSE 64 CHANNEL MULTIPLEXER CONTROL.

The general purpose multiplexer control was designed to be used with the general purpose A to D converter. It will allow up to 64 channels of information to be multiplexed into the input of the ADC. Multiplexer switches are available in groups of four. Multiplexer control is pre-wired for 64 channels so that additional channels can easily be added at a later date.

The multiplexer control has two modes of operation, sequential addressing or individual addressing. Individual addressing allows any converter channel to be selected, by IOT. After the channel has been selected, the converter will automatically perform a conversion. A variation on this IOT may be used to tell the multiplexer to increase the channel number by one and then convert. When this instruction is used, the multiplexer will automatically reset to zero if an advance is requested when it is on its last channel.

dec INTEROFFICE MEMORANDUM

DATE May 15, 1963

SUBJECT

TO K. Olsen
H. Anderson
S. Olsen
N. Mazzarese

FROM J. Smith

Teletype Corporation has halted production and shipment of all BERPE 11 punches. This is due to field complaints in relation to paper tape tearing. A number of complaints have been received over a period of weeks which they feel necessitates an Engineering Change. Shipments from Teletype have been falling behind for a number of weeks but they have been promising they would rectify the situation. It was just yesterday that Purchasing learned the real reason for the delay was the Engineering hold. To date Purchasing has been unsuccessful in their attempts to expedite information as to new shipping dates.

This cutoff of shipments without notification leaves us in a rather poor situation. BERPE 11's are used on both our PDP-1 and PDP-4 computers. Our present inventory level is at 0, with both PDP-1 and PDP-4 computers constructed for May in need of punches. I have contacted our field service people and they do not feel that paper tearing has been a problem here at DEC.

I would suggest that a call to one of their ~~tape~~ top people may help expedite this situation. The punch they manufactured prior to the hold has been satisfactory and will be acceptable. If this is not possible, information as to a new shipping schedule will be of great value for our future scheduling.

H. Anderson

INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE May 14, 1963

SUBJECT Type 54 Tape Control

TO Computer Guidance Committee FROM Dit Morse

I intend to bring this subject up at the Computer Guidance Committee meeting of 5-15-63 for the purpose of discussing the possibility of (1) obsoleting the tape control or (2) downgrading the responsibility we assume in regard to programming.

The points in favor of some action are:

1. The control is extremely hard to use.
2. We have sold only one.
3. Operation of the in-house control has not been satisfactory.
4. Foxboro is unsatisfied with the programs we have furnished.
5. Type 51 hindsight
6. The type 57 is only (2xtype 54) dollars!

On the other hand, in favor of keeping the present control are

1. It is inexpensive.
2. It is somewhat less restrictive in the formatting of data.

The overall summary is that we presently offer a tape system which consists of the type 54 control and programs. However, I believe we will spend an amount of time and effort maintaining systems containing the type 54 which will be out of proportion to the returns in monetary profits, computers sold or satisfied customers.

There may be a strong case for the control as part of small data collection systems where the number of dollars is especially significant to the user. Perhaps if such a case arises, the type 54 should be sold as a "special option."

INTEROFFICE MEMORANDUM

DATE May 13, 1963

SUBJECT PDP-6

TO Richard Best
Robert Savell
Roland Boisvert
Tom Stockebrand
Al Blumenthal
Burt Scudney
Alan Kotok
Arthur Hall
Roger Melanson
Jack Atwood
Ed Harwood
Nick Mazzarese
Ken Olsen
Harlan Anderson
Win Hindle
Richard Mills
George O'Dea
Henry Crouse
Maynard Sandler
Dit Morse
R. Lane
Stu Grover
R. Beckman

FROM Gordon Bell

Enclosed is a matrix of sub-system hardware components for the PDP-6 system to provide familiarity.

The component development, sales, testing, etc. will be controlled by Arthur Hall, and includes:

1. Assignment of job numbers and accounting charge systems for any and all PDP-6 projects or expenditures.

2. Assignment of print numbers and print control. (I will cosign all designs initially)

3. Scheduling

4. Print conventions, signal naming, etc.

5. General liasion with all groups.

We are beginning to embark on a development program that will require considerable amounts of time and effort on the part of many in the company. The project will be roughly the size of the PDP-1 development, and includes in addition to the hardware shown in the matrix, equal amounts of effort in the following areas:

1. Programming

2. Marketing and Sales (continuing after the initial development).

3. Programming and Maintenance manuals.

4. Field service and customer liaison.

5. Production, checkout.

The prototype machine will be shown first at the Fall Joint Computer Conference, November 20, 1963 in Las Vegas.

The marketing effort will be handled by the Computer Sales Department, under R. Lane.

The Sales Department is holding a briefing on the machine on Tuesday, May 14 at 3:00 in the sales conference room.

PDP-6 PROJECT 5/8/63 G.B.

	OPTIONAL DEVICE	DELIVERY TO PROTOTYPE	RESPONSIBILITY	NEW MODULES REQUIRED	CABINETS	MTG. PANELS	DRAFTING INFO. PANELS (LAYOUTS)	SYSTEM DIAGRAMS	FLOW DIAGRAM	CABLE DIAGRAM		BLOCK SCHEMATICS	WIRING DIAGRAMS	CABLE LISTS		MECHANICAL	DESIGN				
16,384 Worcore Memory - 4.0μ sec		8/1/63	A.B./E.T.J	2	1.5	13-18	1	1	1	2		4	6	6		Yes				Time	16K-36 Bit Words
Memory Control System		7/1/63	E.H.	4								4				Yes				Mech. & CKTS.	
Memory Test - PDP-4 Inter-Connection		7/15/63	E.H.					1				2	1	6							
0.5μs - 16 Word Memory	X	10/15/63	B.S.	2	0.5	6+	1	1	1	2		5	3	6		Yes				Time	
I/O Processor	X	10/1/63	A.K./G.B.		1.0	12	1	1	2	2		4	3	20		Yes				Concepts	
CPU		10/1/63	A.K./G.B.	16	2.0	22	2	2	10	2		20	10	20		Yes				Concepts Circuits, Time	
CPU - I/O Interface		10/1/63	A.K./G.B.	3	1.0	11	1	1	2	2		4	3	20		Yes				Concepts	
CPU Console		10/1/63	A.K./G.B.		1.0	1	1	1		2		2	1	6		Yes	Yes				
Display	X	11/1/63	R.S.		1.0	4		1	1	1		4	2	6		Yes	Yes				Display Hardware
Teleprinter		10/1/63	R.S./G.B.		.08	1		1				1	1	1							3-Model 33
Paper Tape Reader - Punch	X	10/1/63	R.S./G.B.	2				1				2	1	2							Brpe-11, 3500
Microtape Control & Microtape		10/1/63	R.B./T.S.		.25	3	1	1	2	2		4	2	4						Concepts	3 - 555
IBM Format Mag. Tape	X	11/1/63	R.B.		.5	6	1	1	2	2		6	2	4							2 - 50A
Card Reader	X	11/1/63	R.S.		.08	1		1				1	1	2							1-Burrough Card Reade
Line Printer	X	11/1/63	R.S.		.08	1		1				1	1	2							1-120 Col. 300 Lpm - Holley
Time Sharing System	X	12/1/63														Yes	Yes			Concepts	
Teletype System	X	12/1/63																		Concepts	
Bulk Storage (Drum)-(Disc)	X	12/1/63	E.T.J.													Yes	Yes			Equipment	Not Used

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 10, 1963

SUBJECT Attached Arithmetic Execution Times Table

TO "PDP Distribution List" FROM Pete Bonner

Due to the encountered increased demand for arithmetic operating times for both of our computers, the attached table has been compiled. The figures comprising this table were gathered from presently existing tables and "educated guesses" as to function execution times.

The table is being circulated only within DEC with the intent of having missing times filled in, correct times certified and incorrect times corrected. Where it is applicable, it would seem highly desirable to have minimum, maximum and average times.

It is hoped that serious consideration will be given to correcting and updating this table. Toward this end, I would appreciate having all responses directed to me.

Function	Arithmetic Execution Times for PDP-1 (In Microseconds, Including All Access) Fixed 18	Float 18-18	Fixed 36	Float 36-18	Arithmetic Execution Times for PDP-4 (In Microseconds, Including All Access) Fixed 18	Fixed 36	Float 36-18
Addition	10	720	180	790	16	96	min. 360 max. 336 ave.
Addition*							1,000
Subtraction	10	750	180	710	24	128	min. 360 max. 336 ave.
Subtraction*							
Multiplication	14 min. 25 max. 20 ave.	470	795	1,500	40 min. 256 max. 148 ave.	700	min. 700 max. 500 ave.
Multiplication*					2,500	8,500	10,000
Division	30 min. 40 max. 35 ave.	470	950	1,625	200	min. 720 max. 650 ave.	min. 820 max. 750 ave.
Division*					3,100	10,000	10,000
Sine-Cosine	390			12,000	2,550		6,840
Sine-Cosine*							
Tangent							
Tangent*							
Arcsine	1,035						
Arcsine*							
Arccosine	965						
Arccosine*							
Arctangent	2,035						
Arctangent*							
Square Root	715			3,025	1,420		1,630
Square Root*							
Exponential		660					825
Exponential*							
Logarithm							
Logarithm*							

*Without Extended Arithmetic Unit in PDP-4

Pete Bonner 5/1/63

Software not included

PDP-6 PROJECT

H.E.Q. 5/10/63

5/8/63 gb

DRAFTING INFO.

	OPTIONAL DEVICE	DELIVERY TO PROTOTYPE	RESPONSIBILITY	NEW MODULES REQUIRED	CABINETS	MTG. PANELS	PANELS (LAYOUTS)	SYSTEM DIAGRAMS	FLOW DIAGRAMS	CABLE DIAGRAM	BLOCK SCHEMATICS	WIRING DIAGRAMS	CABLE LISTS	MECHANICAL DESIGN	PROBLEMS (SPECIAL.)	SPECIAL EQUIPMENT IN PROTOTYPE
16,384 WORD CORE MEMORY - 4.0 μsec (4 mounting panels per system)		8/1/63	A.B. / ETJ	2	1.5	13-18	1	1	1	2	4	6	6	YES	TIME	16K-36 bit WORDS
MEMORY CONTROL SYSTEM		7/1/63	E.H.	4							4			YES	MECH. + CKTS.	
MEMORY TEST - PDP-4 INTER-CONNECTION		7/15/63	E.H.	—	—	—		1			2	1	6			
0.5 μs - 16 WORD MEMORY	X	10/15/63	B.S.	2	0.5	6+	1	1	1	2	5	3	6	YES	TIME	
I/O PROCESSOR	X	10/1/63	A.K. / GB		1.0	12	1	1	2	2	4	3	20	YES	CONCEPTS	
CPU		~~9/1/63~~ 11/1/63	A.K / GB	16	2.0	22	2	2	10	2	20	10	20	YES	CONCEPTS, CIRCUITS, TIME	
CPU - I/O INTERFACE		10/1/63	AK / GB	3	1.0	11	1	1	2	2	4	3	20	YES	CONCEPTS	1
CPU CONSOLE		10/1/63	AK / GB		1.0	1	1	1		2	2	1	6	YES	YES		
DISPLAY	X	11/1/63	R.S.	—	1.0	4		1	1	1	4	2	6	YES	YES		DISPLAY - HARDWARE
TELEPRINTER		10/1/63	RS / GB		.08	1		1			1	1	1				3 - MODEL 33
PAPER TAPE READER - PUNCH	X	10/1/63	RS / GB	2				1			2	1	2				BRPE-11, 3500
MICROTAPE CONTROL & MICROTAPE		10/1/63	R.B. / T.S.	—	.25	3	1	1	2	2	4	2	4		CONCEPTS		3-555
IBM FORMAT MAG TAPE	X	11/1/63	R.B	0	.5	6	1	1	2	2	6	2	4				2-50A
CARD READER	X	11/1/63	R.S.		.08	1		1			1	1	2				1-BURROUGHS CARD READER
LINE PRINTER	X	11/1/63	R.S		.08	1		1			1	1	2				1-120 col. - 300 lpm HALEY
TIME SHARING SYSTEM	X	12/1/63	—	—	—	—	—	—	—	—	—	—	—	YES	YES	CONCEPTS	—
TELETYPE SYSTEM	X	12/1/63	—	—	—	—	—	—	—	—	—	—	—			CONCEPTS	—
BULK STORAGE (DRUM) - (DISC)	X	12/1/63	ETJ	—	—	—	—	—	—	—	—	—	—	YES	YES	EQUIPMENT	NOT USED

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 9, 1963

SUBJECT I/O Equipment for PDP-6

TO Henry Crouse
Robert Savell
Arthur Hall

Computer Guidance Committee

FROM Gordon Bell

The I/O equipment on PDP-6 Prototype should now include:

1. 200 card/minute Burroughs Card Reader (for PDP-4 initially)
2. Holley 120 column, 300 line/minute line printer (for PDP-4 initially)
3. 3-model 33 Teletypes
4. 1 BRPE Punch
5. 1 Digitronics 3500 Reader
6. 8 - 18 bit, 4096 word core stacks

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 9, 1963

SUBJECT Rough Price Estimate for PDP-6 Core Memory System

TO Computer Guidance Committee

Richard Best
Al Blumenthal
Maynard Sandler
Arthur Hall
Burt Scudney

FROM Gordon Bell

There will be a 1st pass price on the core memory system for PDP-6 at the Computer Guidance Committee meeting on May 15, 1963. Today we have nearly all unknowns, but the component parts estimates we need, and can estimate are:

1. Price for 4096, 8192, and 16,384 word 36 bit memories (4.0 microsecond, and 5.0 microsecond)

2. Circuits:

   A. PA Bus drivers modules (special mechanical)
   B. Flip-flops
   C. Input gating modules (special mechanical)

This estimate will begin to give us an estimate of PDP-6 selling price.

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 9, 1963

SUBJECT

TO Ted Johnson

Henry Crouse
Computer Guidance Committee

FROM Gordon Bell

The Computer Guidance Committee has decided against ordering a drum for DEC use.

dec INTEROFFICE MEMORANDUM

DATE May 9, 1963

SUBJECT G. Bell's Memo referencing Sales Communication Network

TO Gordon Bell FROM Stan Olsen

cc: Ken Olsen
Harlan Anderson
Dick Best
Bob Savell
Jon Fadiman
Tom Stockebrand

Intra-sales department communications have been well defined and re-defined over the past couple of years, and at this point are probably approximately 90 percent effective. The cooperation has been tremendous and at times it seems some of our sales people have built-in dictating machines. The intra-DEC communications, on the other hand, are almost completely "word-of-mouth." Some exceptions are Barbara Stephenson, Don White, and Jon Fadiman and his people.

When Sales Call Reports are received, one copy is routed to the appropriate person or persons and another copy is put into the permanent Customer File. When we get to the point where all sales leads are put on to Sales Call Reports, we can then think about sending out a general activity report.

INTEROFFICE MEMORANDUM

DATE May 9, 1963

SUBJECT

TO K. Olsen
H. Anderson
S. Olsen
W. Hindle
M. Sandler
J. Myers
B. Farnham

FROM Mort Ruderman

Wes Clark is quite concerned about not having received any modules to date for the Linc computers he is building. The main reason that we have not sent any modules to date has been that we were waiting until we had the full complement for two Linc computers before our first delivery. We, however, delivered 50 mounting panels and 250 unassembled 1951 modules as of this date.

I have just checked with Bill Farnham as to what the status is of our first delivery to MIT Center Development Office. The situation is as follows: We will ship by next Wednesday, May 15, the full complement for 2 complete Linc computers with the exception of 3 module types. These are: the 1571, 4604, and 4221. The quantity needed of the 1571 and 4604 will be delivered by May 22, 1963. The 4221 will be delivered by June 1, 1963 - the absolute deadline.

The schedule for the remainder of the MIT order is as follows:

Modules for 2 Linc Computers - by June 15

Modules for 8 more Linc Computers - by June 30

Modules for 8 more Linc Computers - by July 30

I am attaching the latest confirming letter from Wes Clark as to the types and quantities for the entire MIT order.

dec INTEROFFICE MEMORANDUM

DATE May 7, 1962

SUBJECT ADVERTISING DEPARTMENT ORGANIZATION

TO K. H. Olsen FROM J. L. Atwood

CC H. E. Anderson
S. C. Olsen

It should be helpful to you in reviewing the personnel requisitions from this department to know how the people we are asking for will fit into our overall operation. The attached exhibits should give you this information. They are:

1. A copy of our weekly schedule of morning "work-in-progress" review meetings and afternoon planning sessions. The purpose of the morning meetings is to touch base quickly with members of the department to check on the progress of jobs already in the works. The afternoon sessions, which include only the persons immediately concerned, are to check on our efforts in the various areas of activity which we should be covering.

2. A list of these activities or functions with examples to show what the titles cover.

3. A proposed table of organization for the department, showing the various specialists I feel should eventually be available to service the company's advertising, sales promotion, public relations, and graphic arts requirements. The names of persons already on the staff and assigned to particular jobs are shown in the appropriate boxes.

4. A list of these specialists by job title together with a brief job description on each.

The table and the descriptions indicate the lines of responsibility I would like to set up in order to assure proper supervision of each person in the department without overloading any one individual with supervisory duties.

Two things are worthy of special mention. First, the job titles are not necessarily the titles these individuals presently hold, nor are they necessarily the titles we will finally settle on. Second, the job list (No. 4 above) is broken down into five groupings based on responsibility, professional requirements and projected salary levels. The maximum and minimum rates for these groups might be: Classification A, $200 plus; Classification B, $150 to 200; Classification C, $100 to 150; Classification D, $75 to 100; and Classification E, $62 to 75.

ADVERTISING DEPARTMENT WEEKLY SCHEDULE

Time	Monday	Tuesday	Wednesday	Thursday	Friday
0830-0900	Production Group: Jack Helene Jackie Alex Bruce Jim Frank	Graphic Arts Group: Jack Helene George Bob Warren Barb	Production Group: Jack Helene Jackie Alex Bruce Jim Frank	Direct Mail Group: Jack Jackie Gert Fran Nan Carol Stacia Flo	Production Group: Jack Helene Alex Bruce Jim Frank
1300-1330	Promotional Publicity	Operational Publicity	Inquiry Processing	Operational Publications	Promotional Advertising
1330-1400	Promotional Publications	Special Events	C & SF Mailings	Operational Aids	Technical Publications
1400-1430	Promotional Aids	Plant Improvements	Special Mailings	Technical Articles	Industrial Design
1430-1500	Employment Advertising	House Organ	Bulk Mailing	Biweekly or Dept. Notes*	Trade Shows

* Biweekly and Department Notes on alternate weeks

ADVERTISING FUNCTION EXAMPLES

Promotional Publications: Module Catalog, PDP-1 Manual, Logic Handbook, Customer Catalogs.

Operational Publications: Plant Facilities Brochure, Employee Handbook, Recruiting Folder.

Promotional Advertising: Space advertising intended to promote the sale of modules, computers andsystems.

Operational Advertising: Employment Ads and Spots.

Operational Publicity: New Space News Release, New Appointment Releases.

Operational Aids: Employee Badges, Employee Orientation Program

Special Events: Armed Forces Day Exhibit, Open Houses, Plant Tours.

Plant Improvements: New In-Plant Direction Signs, Lobby Renovation Program.

Inquiry Processing: Forwarding of requested literature and up-dating of direct mail list.

Customer and Sales Forces Mailings: Mailings of selected material to persons on the customer list and on the sales staff.

Special Mailings: Employee Mailings, Show Mailings, "Opinion Leader" Mailings.

Bulk Mailing: Monthly mailing to all persons on direct mail list.

Promotional Publicity: New Product and New Literature Releases, Cooperative Publicity with Customers and Vendors.

Promotional Aids: Product Photographs, Sales Force Binders, Special Displays.

Trade Shows: Promotional Exhibitions.

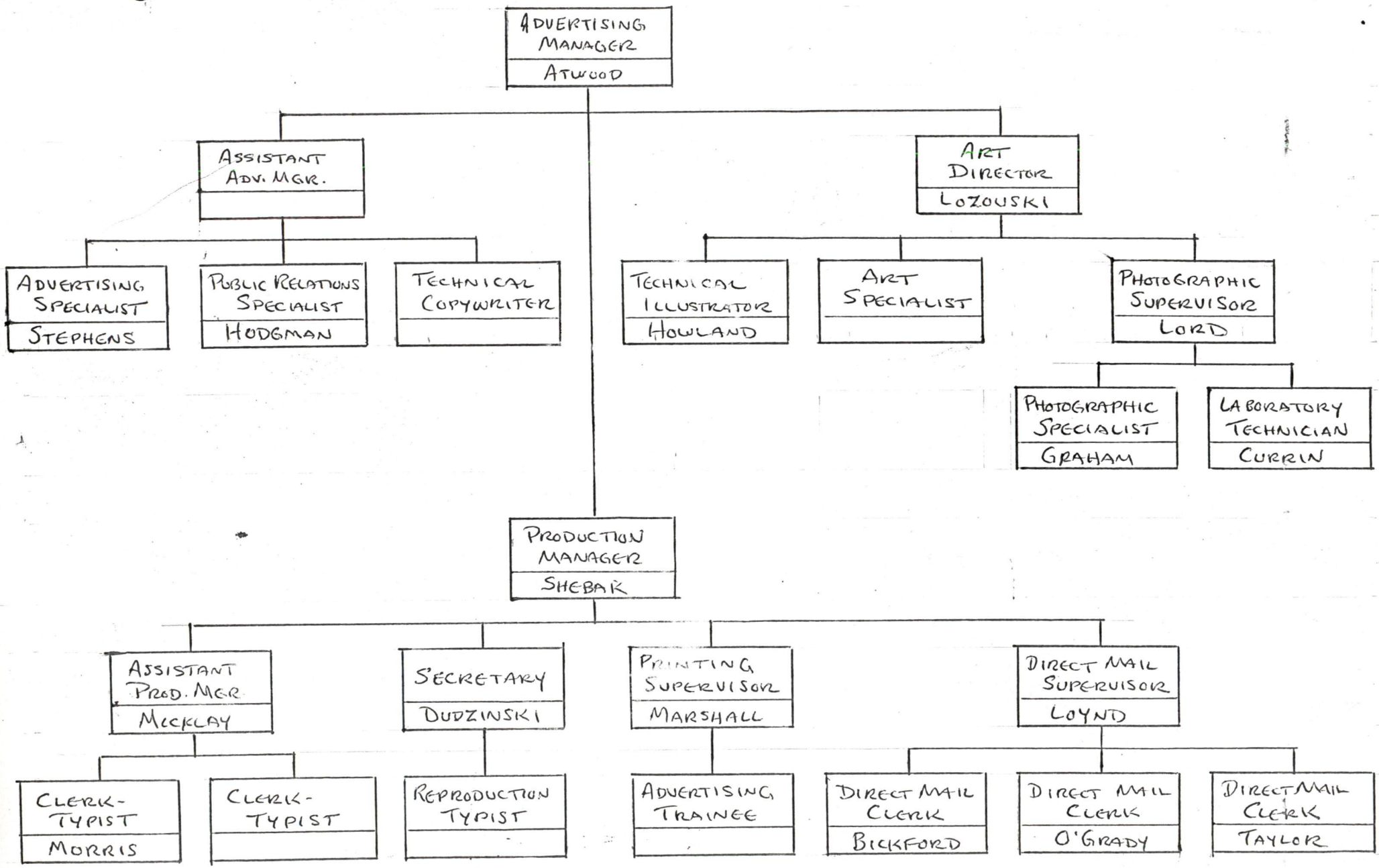
Technical Publications: PDP-1 Maintenance Manual, Replacement Schematic Books, Input-Output Manual.

Technical Articles: Feature stories on Digital engineering accomplishments.

House Organ: Monthly Employee Publication.

Industrial Design: Carton Designs, Packaging, Labels, Test Data Cards.

Graphic Arts Service: Office Forms, Production Positives, Printing, Collating, Binding.



PROPOSED TABLE OF ORGANIZATION - ADVERTISING DEPARTMENT

ADVERTISING JOB DESCRIPTIONS

Job Title	Duties
	CLASSIFICATION A
Advertising Manager	Overall responsibility for advertising and public relations effort and supervision of department personnel.
	CLASSIFICATION B
Assistant Advertising Manager	Responsible for promotional and operational publications, promotional and operational advertising, and monthly bulk mailings. Supervises advertising and public relations specialists and technical copywriter. Manages department in absence of the advertising manager.
Art Director	Responsible for layouts, design and finished art and for plant photography. Also responsible for certain industrial design and plant improvement projects. Supervises technical illustrator, art specialist and photographic supervisor.
	CLASSIFICATION C
Production Manager	Responsible for production and distribution of advertising material, for certain outside professional services, and for job control and cost accounting. Supervises assistant production manager, printing supervisor, direct mail supervisor, and reproduction typing projects handled by secretary.
Advertising Specialist	Responsible for trade shows, promotional publicity, sales aids, inquiry processing, customer mailings, sales force mailings, and special mailings.
Public Relations Specialist	Responsible for employee publication, operational publicity, technical articles, training aids, and special events.

Job Title	Duties
Technical Copywriter	Assists in the preparation of technical material by the assistant advertising manager and the advertising and public relations specialists. Supervises preparation of graphics for technical manuals.
Photographic Supervisor	Responsible for all in-plant photographic operations. Supervises photographic specialist and laboratory technician.
Technical Illustrator	Responsible for all illustrations of a technical nature for departmental projects. Assists in the preparation of layouts and mechanicals.

CLASSIFICATION D

Assistant Production Manager	Responsible for certain supplies and services, departmental inventories, and for collating, binding, and shipping of printed material. Assists with all phases of advertising production and handles the work in the absence of the production manager. Supervises two clerk-typists.
Printing Supervisor	Responsible for all in-plant printing operations, for the securing of printing supplies and for the maintenance of printing and binding equipment. Supervises advertising trainee and keypunch operator when latter is doing presswork.
Direct Mail Supervisor	Responsible for the processing of inquiries and mailings and maintenance of the mailing list. Supervises three direct mail clerks.
Art Specialist	Assists in the preparation of mechanicals for printed material. Handles sign work, special displays and other similar assignments.
Photographic Specialist	Assists with all in-plant photography, particularly copy camera work, for advertising and production.
Secretary	Processes departmental correspondence and handles mail distribution. Does reproduction typing.

Job Title	Duties
	CLASSIFICATION E
Laboratory Technician	Operates darkroom. Handles stats, photoprints, photographic typesetting, and photocopying.
Direct Mail Clerk	Responsible for the packaging and forwarding of all mailings, requested literature and literature for shows.
Direct Mail Clerk	Responsible for keypunching of all new direct mail information. Also fills in on small offset press when needed.
Direct Mail Clerk	Assists with the maintenance of the direct mail list and types mailing label sets.
Reproduction Typist	Types material for reproduction and does simple paste-ups.
Clerk-Typists	Assist with typing, filing, collating, binding, and mailing. Are shifted from assignment to assignment as needed.
Advertising Trainee	Responsible for all receiving in Building 12 and for forwarding of completed jobs. Fills in when needed, either on the press or in the darkroom.

INTEROFFICE MEMORANDUM

DATE April 10, 1962

SUBJECT Additional Discounts on Future ITT Orders

TO K. Olsen, H. Anderson, S. Olsen, R. Mills, M. Sandler, B. Gurley

FROM Nick Mazzarese

A meeting will be held in Mr. Ken Olsen's office today, April 10 at 2:30pm to discuss:

1. Discounts on future ITT orders

2. Subcontracting of module construction and testing to ITT

In order that you may prepare your thoughts before you come to the meeting, a brief outline of the items to be discussed is included.

The present discount system offers 10% off on orders of six or more computers. ITT presently has such an order in effect. In order to act as an inducement to ITT to place firm orders (orders not easily cancelled), it is proposed that a more attractive discount schedule be used.

The proposed system is as follows:

1. An initial order which is subject to cancellation by ITT can be placed for up to 12 computers. This would be similar to their present order.

2. Orders for additional computers would be on a firm basis (cancellation would be subject to a heavy penalty) and would be subject to additional discounts.

The discounts would be as follows:

6 computers	11% discount
12 computers	12% discount
18 computers	13% discount
24 computers	14% discount
30 computers	15% discount
36 computers	16% discount
42 computers	17% discount
48 computers	18% discount

first 6
— next 6
— next 6
etc.
↓

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CENTER DEVELOPMENT OFFICE
FOR COMPUTER TECHNOLOGY IN THE BIOMEDICAL SCIENCES
292 MAIN STREET, CAMBRIDGE 42, MASSACHUSETTS, PHONE 491-1934

9 May 1963

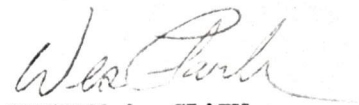
Mr. Mort Ruderman
Digital Equipment Corporation
Maynard, Massachusetts

Dear Mort:

The list contained in this letter supersedes all earlier lists. It is based on a final count of types required and will not change by more than two or three units per machine. 20 LINCs are assumed; spares have not yet been included.

1 LINC	20 LINCs	TYPE
36	720	4143
6	120	4114
12	240	4115
31	620	4102
16	320	4112
12	240	4113
12	240	4127
22	440	4204
19	380	4205
24	480	4123
8	160	1151
6	120	4221
9	180	1669
5	100	4303
5	100	4410
1	20	4407
2	40	1304
12	240	4604
31	620	4606
3	60	1561
5	100	4677
6	120	1571
14	280	1914
5	100	1001
2	40	1954
2	40	1914 Side Plate Retainer

Very truly,



WESLEY A. CLARK

WAC:ga

INTEROFFICE MEMORANDUM

DATE May 9, 1963

SUBJECT T.M.C. and Bell Tel Labs.

TO Dave Denniston

FROM Kenneth H. Olsen

cc: S. Olsen
N. Mazzarese
H. Anderson
G. Bell
B. Savell

We had some visitors on Wednesday, May 8th from Technical Measurement Corporation in North Haven, Connecticut. They are interested in using one of our computers in their pulse height analyzers. They are now running into competition with people who are using computers because computers are so much more in general. One of the people using computers is Mr. J. V. Kane of the Bell Telephone Laboratories who bought the SDS computer. They pointed out that Kane very badly wants a cathode ray display for his computer and I told him that we would follow up on this. I think it would be a good idea if you visited him and tried to sell this display and if necessary we could even send people down from the plant.

Kenneth H. Olsen

KHO:ncs

Andy

INTEROFFICE MEMORANDUM

DATE May 9, 1962

SUBJECT Required Delivery of Potters

TO

FROM Jack Smith

ASSIGNED	COLOR	REQ. DEL. DATE
ADX-2	Blue	Received
ADX-2	Blue	4/23/62
ADX-2	Blue	4/23/62
ADX-2	Blue	4/30/62
JPL	Gray	Received
JPL	Gray	5/14/62
ADX-2	Blue	5/21/62
ADX-2	Blue	5/28/62
ADX-6	Blue	5/31/62
ADX-6	Blue	6/4/62
ADX-6	Blue	6/7/62
ADAMS	Gray	6/11/62
CRC	Gray	6/14/62
ADX-7	Blue	6/18/62
ADX-7	Blue	6/21/62
ADX-7	Blue	6/25/62
PDP-4	Gray	6/28/62
PDP-4	Gray	7/2/62
MIT	Gray	7/5/62
MIT	Gray	7/9/62
ADX-2	Blue	7/11/62
ADX-2	Blue	7/16/62
ADX-2	Blue	7/19/62
ADX-2	Blue	7/23/62
ADX-2	Blue	7/26/62
ADX-2	Blue	7/30/62
DEC	Gray	8/3/62

21 currently on order

ASSIGNED	COLOR	REQ. DEL. DATE
DEC	Gray	8/6/62
ADX-8	Blue	8/9/62
ADX-8	Blue	8/13/62

POTTER INSTRUMENT COMPANY, INC.

ANNUAL AGREEMENT

Agreement: Customer agrees to place an order for an annual nominal quantity of identical units to be delivered at a nominal rate in order to qualify under the terms of this agreement. Minimum quantity that can be ordered is 36 units.

Discounts: All discounts applicable for this contract shall be effective for the units scheduled for delivery in accordance with the rates mutually agreed upon between Potter and the customer or as changed by the customer in accordance with the terms of this agreement under Increases or Decreases clauses. The specific monthly discount rate shall be in accordance with Schedule 1.

Increases: Customer can order increases in rate up to a maximum of double the nominal rate specified for this contract upon 90 days notice to Potter and will be entitled to a higher discount rate, if any, commencing with the month that the higher rate is scheduled for delivery.

Decreases: Customer can order decreases in rate down to a minimum of 3 units per month upon 90 days notice to Potter. Lower discount rate, if applicable, shall be effective commencing with the month that the lower rate is scheduled for delivery.

Termination with Timely Notice: If the customer provides Potter with 120 days notice that the rate of delivery is reduced to less than 3 units per month, this agreement shall be terminated effective on the last day of the month for which the delivery rate of 3 units per month is specified.

1. If the initial quantity of the order has been delivered, the discount rate in accordance with schedule 1 will apply.
2. If the initial quantity of the order has not been delivered, a discount schedule in accordance with the standard Potter quantity discounts will apply.

Termination without Timely Notice: If termination notice of 120 days is not provided to Potter, then discount rates and termination charges in accordance with standard Potter discount schedules and termination shall apply.

This agreement is available effective 21 January 1963.

SCHEDULE I

FOR MARK 906 II TRANSPORTS

Specified Monthly Contract Schedule Units Per Month	Applicable Discount Rate Percentage
3	10
4	12
5	14
6	16
7	18
8	19
9	20
10	20
11	21
12	21
13	22
14	22
15	23
16	23
17	24
18	24
19	25
20	25

INTEROFFICE MEMORANDUM

DATE May 8, 1963

SUBJECT Progress of Micro Tape 555 (Production Aspect)

TO K. Olsen
H. Anderson
S. Olsen
M. Sandler
G. O'Dea
R. Mills

FROM J. Smith

Target date for a lot of 10, July 1, 1963 (tested).

All parts have been ordered and delivery quotes of not later than the end of May have been received on most items. Motors, magnetic heads, and transformers have the longest delivery and will require special expediting attention.

There has been a delay in the release of chassis prints due to the time required by Engineering to evaluate motors and magnetic heads. These problems have been resolved and I have been assured that chassis prints will be released today. I was hoping that this release date would have come much sooner because of its importance to all future operations. Chassis construction involves 95% of all unit wiring.

We should, at this time, break down the remaining time into the various operations to be completed. Remaining time to completion of project (July 1, 1963) is 7 weeks. Of this 7 weeks, three weeks must be allocated to testing and inspection. One week is required for chassis construction by our shop and one week for model construction. This leaves only two weeks for the remaining operation which is actual production wiring and construction. Presently, we do have the in-house capability to wire this lot of 10 units in two weeks but many other projects will be delayed. Required production hours can be gained through overtime and sub-contracting. It is my intention at this time, to sub-contract standard PDP-1 and PDP-4 wiring. This will make available in-house production hours that can be allocated to Micro unit construction. Without sub-contracting, the project will be delayed by approximately one month, August 1, 1963. Estimated sub-contracting cost is $3,000 payable in July.

INTEROFFICE MEMORANDUM

DATE May 8, 1963

SUBJECT

TO Stan Olsen
George O'Dea,
Harlan Anderson ✓
Jack Atwood
Howie Painter

FROM Kenneth H. Olsen

I got a call on Wednesday morning May 8th from Mr. Harris of the Commerce Department in Washington in answer to a letter that we had sent to them. They have Electronic Trade Shows in Europe and would like to know if we are interested. It will be several weeks before they have the dates firm and he will send this information to me. They have a show scheduled for London on late November or early December of 1963 and one in Frankfurt in January of '64. This one in Frankfurt will be timed so that people can go both to the Paris Conference Show and the Frankfurt show on one trip to Europe.

I told him that we were interested and he pointed out that they are only interested in showing off sophisticated electronics. He didn't give me a chance to assure him that ours were sophisticated but this will probably be important when we finally pass on an answer to them.

INTEROFFICE MEMORANDUM

DATE: 5/8/63

SUBJECT: Sales Trip to Europe

TO: K. Olsen
H. Anderson
S. Olsen
W. Hindle
G. Bell
D. Morse
G. Rice
J. Fadiman

FROM: N. Mazzarese

Summary

1. Wednesday, April 17th

   A. College de France, University of Paris
   Mr. Bloch - PDP-4, Hough Powell Device

   At College de France, we'll start selling modules within about three months and there is about a 40% probability that we'll be able to sell them a computer in the next six months.

   As everyone else, they are interested in PEPR and HPD.

2. Thursday, April 18th

   A. Institute Physique Nuclear, University of Geneva
   Dr. Maeder - Modules, Displays

   We may sell some modules here over the next year, but Guenter is going to have to work extremely hard at it. Dr. Maeder is convinced that Phillips modules are quite adequate.

   B. CERN

Tor Lingjaerde	-	PEPR	Acoustic Spark Chamber
Bogden Maglic	-	Physicist	
Richard Keyser	-	Programmer	
Dr. Farley	-	Computer Expert	
Dr. I. Pizer	-	Type 31 Display	

   There are two distinct computer interests at CERN. One is the PEPR System with Tor Lingjaerde and the other is the Acoustic Spark Chamber Machine. The probability of getting the PEPR System is 40%.

For the spark chamber application, we've come from zero probability up to about 60% probability of getting a machine. At this point, its pending a timing analysis on our part.

In any case, Dr. Pizer will buy a Display.

C. Societe Electronique Nuclear
Louis Kaluszyner - Wants to be our representative

3. Friday, April 19th

A. Harwell, NIRNS
David Lord - Modules

Harwell, AERE
Mr. Kandiah
John Montague
Arnold Jones
Dr. Bretscher - Head of Nuclear Physics Division
Jim Hailstone - Computer Expert

This is a longer term thing, but I feel confident that we will have a computer order from them within the next year. They were somewhat naive but a reasonably dynamic group of people. I also think that one machine here will mean many more. They are watching Chalk River with interest.

Details

Wednesday, April 17, 1963 - College de France, Monsieur Bloch

We definitely have a sale of at least modules here. There are three possible routes that the College de France may take.

1. They may buy a complete system from us including a Hough Powell Device.

2. They may buy just the Hough Powell Device from us and a 160A computer.

3. They may buy just the modules from us and either a PDP-4 or 160A.

They are prompted to buy a 160A because Saclay (French AEC) will be purchasing a CDC 3600 and they wish to be compatible with this 3600.

I explained that the PDP-4 would also be compatible, and I think that Jon Fadiman's trip this month will be a terrific follow-up.

His application involves taking data from a Hough Powell Device and putting it into IBM format on tape.

Thursday, April 18, 1963 - Institute Physique Nuclear, Dr. Maeder

Dr. Maeder was formerly at CERN and now works at this school of the University of Geneva. He is extremely interested in our Display, that is, the Type 30 and has a long term interest in our computers. He is poor. We should keep in touch with him in order to be there when he decides he needs a computer definitely.

I promised to get him information on the Display, namely, how do we prevent overshoots on the CRT when we go from all 1's to all 0's. We have also promised to send him the price for converting our power supplies to 50 cycles 220 volts.

This meeting was from 9:00 A.M. to 10:00 A.M.

At 11:00 A.M., we were at CERN where we had a meeting with Bogden Maglic, Richard Keyser, Dr. I. Pizer, and Tor Lingjaerde.

We started off by discussing the PDP-1 but it soon became apparent that the PDP-4 was the machine that best meets their requirements because of the floating point arithmetic times.

They were interested in the following:

1. How much arithmetic does Martin Deutsch do in his application.

2. They would like to know all of the operation times for our arithmetic prophecies, and I promised to send them a chart for this.

3. They are interested in our drums and they would like more complete information on them.

4. They would like to know our 36-18 Floating Point times for cosine and sine.

This meeting lasted from 11:00 A.M. until 4:00 P.M. At 4:30 Tor Lingjaerde took us to visit Mr. Louis Kaluszyner who is the manager of a new Company formed in Switzerland by a French Company called Societe de Applications Industrielles de la Physique.

They were mainly interested in representing us in Switzerland, and I indicated that we already had a Munich office to handle this.

In the course of our conversation, some interesting things came up.

1. That TRW is marketing its control computers in Europe through a joint venture with a company whose initials are CSF. Its a French Company, and they have already sold ten computers in France alone.

2. CDC may have lost its sales of two of its 3600's which it had in Europe, to 7090's.

Friday, April 19, 1963 - AERE Harwell

While I was here I had a chance to talk to many of the people at Harwell about our computer. It was rather a unique experience because they were not aware of the speed, Input-Output capability and availability of a computer in the price range of a PDP-1 or PDP-4.

In general many of them are naive, as far as computer techniques go, but there is a great deal of excitement over the possibility of using computers in on-line applications.

They have a high respect for both Martin Deutsch at MIT and the people at Chalk River. As these people are already our customers, we are in pretty good shape here. It's interesting to note that they were not aware of the fact that DEC manufactured a PDP-1 computer or, in fact, that it did exist at all.

I think we have a lot of work to do here.

The people talked to were:

Mr. Kandiah (he'll be visiting Chalk River next month to discuss on-line computer applications). I promised to send him more information on the Displays 30 and 31 and our Module Catalogue. Arnold Jones, AERE Nuclear Physics Division, John Montague, AERE Nuclear Physics Division, Dr. Bretscher, AERE Nuclear Physics Division (he's the boss here, and I think we made a good impression), Jim Hailstone, AERE NPD (computer expert) he is basically a Ferranti lover, but he listened with interest to the PDP-1 PDP-4 pitch. B. W. Hooton, AERE NPD, and David Lord NIRNS (our module customer who helped set this whole thing up). I promised to send him a new price list for our modules. He also gave me the following tip: that Saclay, the French Government Atomic Energy Commission is working with College de France and doing some of their bubble chamber work, and they will probably be spending a good deal of money in the future as France is getting very interested in Atomic Energy developments. Suggested that we drop Dr. A. LeVeque at Saclay, PDP-1 and module infomation.

dec INTEROFFICE MEMORANDUM

DATE May 7, 1963

SUBJECT SDS 910 at BTL with J. V. Kane

TO Nick Mazzarese

FROM Gordon Bell

Stan Olsen
Harlan Anderson

These people ordered the computer September, 1962. The computer was delivered March 1, and operating April 15 with 6 weeks of un-reliable operation. BTL is an important customer, and uses lots of DEC logic.

The advent of an SDS machine probably means the start of a decline in module sales there. Kane is now happy with SDS.

A paper describing this work was given at the Monterey conference on Pulse Height Analyzers.

With the ability to "Add 1" to memory as a standard feature of PDP-4, the system performs at least as well as SDS.

Everyone is looking at computers-for-analyzers, and people are using SDS, ASI (maybe) and CDC-160, but about the first was a PDP-1 at Chalk River. Our good work on computers for Bubble Chamber Analysis should be complemented, and extended to the pulse height analyzers.

If there is anything we can do to get BTL back, I suggest we do so, because the SDS name will undoubtedly spread there. Kane is quite impressed that we have a $27K computer, and might be persuaded to switch to it, given sufficient persuasion. Brookhaven is also getting an SDS machine. There is no question but what people respect Argonne, Brookhaven, BTL, Berkeley and MIT and these are the key places for computer usage for physics.

INTEROFFICE MEMORANDUM

DATE May 7, 1963

SUBJECT Interesting Displays by J. V. Kane, BTL

TO Ken Olsen
Harlan Anderson
Richard Best
Robert Savell
Nick Mazzarese
Allan Kotok
Dit Morse

FROM Gordon Bell

I've seen a new display idea. Kane blasted me about spending $15K for a DEC display, and also that there are no knobs on our display. He used a Tektronix rack mounted with A to D which is faster, and cheaper than ours (no good for light pen, however).

This was connected to a display that included Y=left half of MA, X=right half of MA, Z= contents of MB. In this manner, one sees a program run, just as a program can be listened to with A-D converters or audio-amplifier connected to various bits. These pictures were fascinating, but I think the thing: maybe of quite limited use, but the important thing was his philosophy regarding displays. This type of display he calls a "Memory Display". For Nuclear Data, this is an excellent display.

Kane's Display Philosophy (interpreted by Gordon Bell)

1. A display is some thing for an experimenter to use, therefore all controls, vertical gain and position, horizontal gain and position, intensity should be available.

2. All displays should be able to monitor anything. X, Y, Z can be connected to any place on the computer to suit the experiment. This he accomplished by a selectro-board.

3. Experimenter needs to photograph the display.

4. Experimenter may sometime want a larger monitor scope, but not very often, and only for the light pen.

5. All variables can be mixed together to provide skewed character plotting (by mixing X and Y).

Summary

If Bob Savell is in the New York area, he should chat with Kane about displays.

H. Anderson

INTEROFFICE MEMORANDUM

DATE May 6, 1963

SUBJECT Results of the Pulse Height Analyzer Conference at Monterey, California sponsored by the National Academy of Sciences

TO Computer Guidance Committee Members
George Rice
Jon Fadiman

FROM Gordon Bell

Summary

Right now computers are being used to do pulse height analysis. There are presently 3 installations:

1. E. Norbeck, CDC-160, then CDC-160A (less than 2 years old).
2. J. Leng, AECL, PDP-1 (less than 1 year old).
3. J. V. Kane, BTL (SDS-910 1 month old).

People are going to switch to computers for this purpose because they are less expensive, and more flexible. It will be a gradual change over the following years.

Computers being used in the very near future include:

1. Argonne (ASI)
2. Brookhaven - Spinrad (SDS)

We might do something now in this field, as it requires no hardware development.

The Conference

The principal issue was "Are Computers Better Than Pulse Height Analyzers For Height Analysis?" Since there was obviously considerable arguement, I will only say that more and more computers will be used for this purpose, but there will always remain (and perhaps should too) some special purpose analyzers.

The people attending were quite solid citizens in the instrumentation/usage field. Any outbursts by computer people caused a reaction of defense because the computer people were saying that special purpose work was a waste of time, (or the work of the instrumenters was of negligible value).

People At The Conference

My list of those in attendance has been given to the Sales Department. This should be a working background for a mailing list. The following institutions/people stood out for one reason or another.

There were people who needed instruments for their work. There were people who felt that they were serving science by piling various special purpose systems together to serve the scientists (poor engineers) and there were some good engineers.

1. BTL - J. V. Kane:

   A user, and one of the brightest people there. He is very impatient with incompetance, very slightly egocentric. I'm sorry we are not selling to him. The computer background of Kane and BTL will put them ahead.

2. Brookhaven - R. L. Chase:

   R. L. Chase was there, and is very bright, but careful. Spinrad was not there. Spinrad and Chase should be able to help Brookhaven because of their computer background.

3. Iowa - Ed Norbeck:

   Ed Norbeck is a good physicist, I believe, and is only mildly impatient with general incompetance.

4. Berkeley

   Goulding, I believe, suggested computers for pulse height work in 1958. Goulding is good, quiet, and generally nice to visit. Some of the other people there were average electronics instrumenters. It would be nice to get a PDP there in this group.

5. Harwell - England

   Both Drs. Cook - Yarborough and Kandiah are considered to be good in instrumentation. They occasionally spoke too wisely, and too dogmatically to be great. They have a tape system that would rival any poorly designed medical, or telemetry data-gathering systems. Only the fact that I was working for an industrial organization that might someday want to sell them equipment made me refrain from commenting on its outstandingly poor design.

We certainly should make a concerted effort for them to buy a PDP-1, 4 or 5 as they will see the BTL and AECL systems. They like our Micro Tape.

6. AECL

John Leng had lots of good comments on analyzer systems, and hopefully if he comes to DEC, his experience can be put to some use.

Specific Information Requests

1. All the people from Bologna, Italy wanted computer information.

2. Dr. L. Katz (University of Saskatchewan, Saskatchewan, Canada) wanted information on PDP-4, 5.

3. Dr. E. Norbeck (University of Iowa, Iowa City, Iowa) wanted information on PDP-5 and Micro Tape.

4. Dr. P. K. Patwardhan (Atomic Energy of Canada, Chalk River, Ontario, Canada) wanted information on PDP-1, 4, and 5 and Micro Tape.

5. Dick A. Mack (LRL Berkeley) wanted information on Micro Tape.

6. Dr. Russel Heath (Phillips Petroleum, Idaho Falls, Idaho) wanted information on Display 7040.

7. Dr. R. L. Chase (Brookhaven National Lab., Upton, Long Island, New York) wanted information on PDP-5.

8. Dr. _____ at Yale specifically asked for someone to call on him. He is a physicist, wears a mustache, and works near or adjacent to Bromley. He is thinking about a PDP-1, but wants a sales call. The PDP-1 would connect to a Victoreen Analyzer, the 709, and have a display.

What To Do Now In The Pulse Analyzer Field

A package might include:

1. PDP-1, 4 or 5

2. Scope Display (Tektronix is fine)

3. Micro Tape (maybe a drum instead or two)

4. Two A to D converters of ramp generator kind.

5. Some software, or notice that shared software will be distributed.

I think the significant thing is that we provide all the hardware for a fixed price so that there is nothing else to buy for an experimenter.

As a minimum, a sales letter should be sent out now by Sales (co-signed by myself and Nick or George) to all attendees. If someone is available to work on this sales project now, I am certain it will prove profitable.

The general subject of the conference will be placed on the agenda of the Wednesday, May 8, 1963 Computer Guidance Committee meeting.

GB/ll

INTEROFFICE MEMORANDUM

DATE: May 6, 1963

SUBJECT: Numbering System for Computer Options

TO: K. Olsen, H. Anderson, S. Olsen, N. Mazzarese, J. Koudela, R. Maxcy, J. Atwood, S. Grover, R. Reed, R. Best, G. Bell, T. Stockebrand, D. White, R. Savell, R. Boisvert, R. Melanson (4), J. Smith, E. Harwood, S. Miller, R. Dill, J. Myers

FROM: A. Hall

Attached is a list of the numbers assigned to computer options.

Persons requiring numbers for new options should consult Arthur Hall. All such numbers are subject to change by the Computer Guidance Committee.

Options have been and will be assigned two or three digit numbers. The first digit of the number indicates the broad category into which the options fall.

First digit of #	Option category
1	Primarily Logic
2	Drums and Disk Files
3	Illuminated Displays
4	Card Handling Equipment Punches Even #'s Readers Odd #'s
5	Magnetic Tape Equipment
6	Printers and Typewriters
7	Paper Tape Equipment

Multipurpose equipment which does not naturally fall into a particular category will be assigned depending upon its primary purpose.

Unlisted numbers and numbers listed but not described are unassigned and may be used.

PRIMARILY LOGIC OPTIONS

Option #	For PDP-	Cost	Description
10	1	10,300	Automatic Multiply & Divide
11	DO NOT USE		
12	1	30,000	Magnetic Core Memory Module
12A	1		Special (time Sharing) Memory
13	1		Special (Time Sharing) Memory Switch
14	DO NOT USE		
15	1		Magnetic Core Memory Extension Control
15A	1		Memory Extension Control for Special (Time Sharing) Memory
16	4	9,000	Magnetic Core Memory Extension Control
17	4	24,000	Magnetic Core Memory Module 4K, for 4B only
18	4	9,150	Extended Arithmetic Control Unit
19	1	9,000	High Speed Channel Control
100 through 119	DO NOT USE		
120	1	15,300	16 Channel Sequence Break System
123	1	11,000	High Speed Data Channel
125	4		Real Time Option
126	4		Foxboro Real Time Option
130	DO NOT USE		
131	1		Data Control (R.B.)
132	4		Clock Multiplexer (G.B.)
133	4		Data Interrupt Multiplexer (G.B.)
134	4		Memory Expansion of 4K to 8K (PDP-4C)(A.B.)
135	4		Memory Module, 8K (PDP-4C) (A.B.)
140	1	1,950	Relay Buffer
150	4		IBM 7090 Connection Interface

DRUMS AND DISC FILES

Option #	For PDP-	Cost	Description
20			
21	SAVE FOR R. Best		
22			
23	1		Parallel Drum (BBN System)
24A	4	31,600	16,384 Word Block Transfer Drum System
24B	4	36,300	32,768 Word Block Transfer Drum System
24C	4	43,400	65,536 Word Block Transfer Drum System
25			Drum File System
26			
27	SAVE FOR R. Best		
28			
29			
200 through 219	DO NOT USE		

ILLUMINATED DISPLAYS

Option #	For PDP-	Cost	Description
30	1 & 4	14,300	Visual 16-inch CRT Display
31	1	41,200	Ultra-precision Display
31A	1		Ultra-precision Display
31B	1	41,200	Ultra-precision Display
32	1 & 4	1,300	Light Pen
33	1 & 4	4,900	Symbol Generator
34		3,061 3,906	Display w/o Tectronics Scope (#503) Display with Tectronics Scope (#503)
35	1 & 4		Variable Field Light Pen
36	} SAVE FOR R. Best		
37			
38			
39			
300 through 319	DO NOT USE		
330	1 & 4		Incremental Display

CARD HANDLING EQUIPMENT

Option #	For PDP-	Cost	Description
40	1 & 4	15,000	Card Punch Control
41	4	14,900	Card Reader and Control (200 cpm)
42	SAVE FOR R. Best		
43			
44			
45			
46			
47			
48			
49			
400 through 419	DO NOT USE		
421	1	14,900	Card Reader and Control (200 cpm)

MAGNETIC TAPE HANDLING EQUIPMENT

Option #	For PDP-	Cost	Description
50	1 & 4	18,000	Magnetic Tape Transport
51	1	7,500	Magnetic Tape Control Unit
52	1	38,000	Magnetic Tape Control Unit
53	SAVE FOR R. Best		
54	4	7,000	Magnetic Tape Control Unit
55	SAVE FOR R. Best		
56	DO NOT USE		
57	4		Magnetic Tape Control Unit
58	SAVE FOR R. Best		
59			
500 through 509	DO NOT USE		
510	1		Block Transfer Tape Control
550			Micro Tape Control (Word Transfer)
555			Micro Tape
570			Magnetic Tape Transport

PRINTERS AND TYPEWRITERS

Option #	For PDP-	Cost	Description
60			
	SAVE FOR R. Best		
61			
62	1 & 4	72,800	Line Printer and Control
63	SAVE FOR R. Best		
64	1 & 4		(300 lpm) High Speed Printer
65	4	7,000	Printer-Keyboard and Control
66	1		Teletype Interface Module
67			
68	SAVE FOR R. Best		
69			
600 through 609	DO NOT USE		
650 through 679	DO NOT USE		

PAPER TAPE HANDLING EQUIPMENT

Option #	For PDP-	Cost	Description
70			
71			
72	SAVE FOR R. Best		
73			
74			
75		5,000	Perforated Tape Punch and Control
76	4	13,900	On-Line, Off-Line Flexo and Logic
77			
78	SAVE FOR R. Best		
79			
710 through 799	DO NOT USE		

INTEROFFICE MEMORANDUM

DATE May 3, 1963

SUBJECT NEW DEVELOPMENTS IN A TO D AND D TO A CONVERTER CIRCUITS

TO Sales Engineers

FROM B Stephenson

A variety of new modules have been developed which expand our capabilities in the ADA line. With these new modules, it appears that we could build converters in house with accuracies comparable with 11 bits. However, we do not yet have sufficient data to guarantee that a module customer could take these components and put them together resulting in a system of this accuracy. I would, however, feel quite safe in guaranteeing an 11 bit monotinicity to a module customer who has sufficient equipment to adjust and test his converter. He would, of course, have to be very careful. It appears that the speed of an 11 bit system would be in the range of 7 or 8 microseconds per step.

The new modules may also be used to increase the speed of our present 10 bit converters. A new level amplifier package which is considerably faster than our previous high accuracy unit, is also much faster and will allow us to run a 10 bit successive approximation converter 3.4 microseconds per bit with the 4678 and 1574 modules and approximately 2.7 microseconds per bit with the 4679 and 1574 modules.

Certainly, at this time, it is possible for us to construct D to A converters with a monotinicity of 12 bits. Probably the biggest difficulty in this area is the fact that the ladder network has an output impedance of 1000 ohms. Generally, therefore, it is desirable to follow the ladder network by an operational amplifier. We are presently looking into the possibility of bringing out such modules but they are not yet available.

The new ladder network has provisions for biasing for bi-polar output. This would allow an output range of ± 5 volts. We do not have the power supplies available for a bi-polar unit. However, these can be easily obtained since there are a variety of manufacturers who specialize in this area.

A multiplexer switch is presently going into production. This switch should be available in about a month and a more detailed brochure on its use, etc., will be available before then. More specifically, these new modules are:

Comparator. A new comparator circuit, Type 1572, is replacing our Type 1547. In fact, the 1547 is no longer being manufactured and 1572s are being shipped directly in their place. The new comparator circuit has the same pin connections and is the same with respect to function. However, the new comparator is, in general, a much better unit. It is more stable, has less common mode effect and responds better after having been driven very hard into saturation. The new comparator has a considerably greater DC resolution. The speed of this circuit is approximately the same, or better than, that shown in the present A to D converter handbook for up to 10 bits. When the comparator is asked to resolve less than 10 millivolts, (which the old comparator could not do at all), the transition time increases considerably. For example, to discriminate a 5 millivolt signal in a successive approximation converter will require about 6 microseconds.

Level Amplifiers. Our Type 4677A level amplifier is no longer being manufactured since the transistors used in this circuit are not available. A new level amplifier, Type 4678, is now available and can be used in high accuracy systems. A new level amplifier contains five circuits per package and has a separate input for analog ground reference which can be isolated from the digital ground. The transition time in the new level amplifier is .8 microseconds (as compared to 1.5 microseconds for the 4677A). The output impedence of this circuit is nominally 2 ohms. The variation in output impedence between the negative and positive states is less than 1.5 ohms. The offset voltage for negative output is .5 to 1.5 millivolts. The offset voltage for a ground output is zero to 1 millivolt. This circuit is non-inverting. Input is 1/2 unit base load.

Another new module, the Type 4679, is now in the works. This unit will be a more direct replacement for the 4677A since it will be an inverting circuit and will have four circuits to the package with the same pin connections as the 4677A. The one addition will be a separate terminal for the analog ground. This unit will be considerably faster than the 4678 and will have the same (or greater) accuracy. More news on this later.

Power Supplies. Type 1704 is a new power supply for use in systems of 9 bits or more. Detailed specifications on this unit will be available at a later date. However, several of these units have been used in systems for within the company and have operated extremely well. (Most specs are in the 100's of microvolt region or better).

Ladder Network. A new metal film ladder network, Type 1574, is now available and is recommended for high accuracy systems. A preliminary data sheet is available on this module. The effective temperature coefficient and the resolution of the trimming potentiometers are better for this module than our previous high accuracy ladder Type 1564. It is also faster.

Multiplexer. A multiplexer switch package should be available in about one month. The switch operates in less than half a microsecond and has been tested in the house with a 10 bit converter and operates quite well. Detailed information on the specifications for the switch and how to use the switch will be available later.

BS:ASJ

B Stephenson
May 3, 1963

TESTING AN A TO D CONVERTER

In a successive approximation analog to digital converter, the switching band should be as narrow as possible. (The switching band is the area where the digital output may alternate between two values). This is opposed to the concept in a digital voltmeter (or ADC using the continuous conversion method), where it is desirable to have a built in hysterisis so that the output does not switch unless the input has moved almost a full step. When these switching bands are narrow, this is a very good place for testing the converter. Some very simple checks include the following: All switching points should occur at the correct voltage. An accuracy test should be run on all switching points. However, for specialized tests on temperature effect, stability, etc., it is quite satisfactory to use just a few points. For this kind of tests I would recommend the following points be used:

00...001	00...011...1	11...1011...1
00...010	00...100...0	11...1100...0
00...011	00...100...01	11...1100...01
00...100		
00...101		

Monotinicity Check. When precision equipment is not available for a detailed test, it is advisable to make at least a monotinicity check. This can be done quite easily with a power supply and a potentiometer of less than 1K. With this simple equipment, it is possible to start at zero and increase the voltage and check that each state exists and that the states exist in the correct order. For systems of more than 6 or 7 bits, it is, of course, difficult to get a potentiometer with this kind of resolution and so two potentiometers in series could be used or input could be divided down into ranges each one overlapping the others and each one being checked separately for monotinicity.

Accuracy. The DC accuracy can be measured with a high accuracy voltage reference or with stable, ripple-free, variable power supply and a high accuracy meter. When the ADV is run at a rapid rate, the indicator lights should show fairly well when each switching band starts. The voltage at this point can be compared to the theoretical voltage to determine the DC accuracy. As well as recording the DC input at the switching point, the width of the switching band should be noted and a check should be made to see that the switching point occurs at the same place when the voltage is approached in an increasing or decreasing fashion. The switching point should also remain the same when the frequency of conversions is varied from DC to the maximum value.

Response to Transients. This is particularly important if a multiplexer input is to be used. If, between alternate conversions, the input is switched between zero and a given voltage, the indicator lights should record the switching point at the same position as on DC.

It is also advisable to make this check at a low frequency, i.e., operating the converter from a push button and manually switching the voltage to a higher value, back to the original value, to a lower value, back to the original value, etc. This test determines whether or not the comparator circuit is capable of responding to an input signal after having been saturated very hard in one direction for a long time. If the converter does not operate properly under this test, it usually means that the time per step is not sufficient for the comparator to come out of saturation and resolve the input signal.

Repeatability. This is a test designed to determine if there is any noise in the system. This test can be run quite easily when a digital computer is available. The converter input is set at a DC value and the computer is programmed to repeatedly ask for conversions, read out the results and print any high or low values which deviate from the first (or the first two if a switching point is being examined).

When a computer is not available this same test can be implemented with a bank of toggle switches and a single diode gate. Here you set an input voltage, not at switching point, read the output in lights, and then set this number into a bank of toggle switches. The Type 4139 diode gate or two of these gates, can be used to compare the A to D output with the toggle switches and the converter can be run at its maximum rate and stopped whenever the toggle switches and the A to D do not agree.

Temperature checks can be made using the same logic as for DC accuracy tests with the temperature being at varied.

BS:ASJ

HINTS ON CONSTRUCTING A HIGH ACCURACY ANALOG-DIGITAL CONVERTER

From: B Stephenson

May 3, 1963

The ladder drivers for the most significant bits should be placed adjacent to the ladder network and for the lesser significant bits adjacent to that etc. The power supply should be placed next to this so that long leads are avoided as much as possible.

A separate analog ground should be used. This means that the separate ground pins from the ladder drivers and the ground pin from the power supply (and possibly grounding on unused terminals in the ladder network), should be tied together through one line only (i.e., no ground loops) and then tied to the chassis at only one point. The analog input or output signal can then be tied to the analog ground. This is done to reduce as much as possible the effect of pulses and other transients which tend to occur on a digital ground.

The ladder drivers will have a small offset voltage. For the Type 4678 the offset is as listed above. For the Type 4677, the offset for negative output is approximately 2 millivolts; for a ground output, it is approximately 8 millivolts. This may be compensated for by adding a small amount of positive bias to one or more of the unused bits of the ladder and by increasing the reference supply by a few millivolts. At the same time, it is sometimes desirable to add a positive bias equal to one-half of the least significant bit so that the switching points occur at the midpoint between the states instead of exactly on the state itself, (in digital terms, this is rounding off a number rather than truncating). I would recommend adding the bias and adjusting the supply voltage after the converter has been fully constructed and the ladder network and comparator circuit have been adjusted. Ladder adjustment is always done with the unused bits of the ladder network grounded. After these adjustments have been finished, the positive bias should be added to the least significant bits until the switching point for the first state is at the desired point (our + 10 volts supply for bias. Remember that on the least significant bit, a one volt change in the input will cause a change in the output of less than 1/10 LSB. Bias of 1/2 LSB, with one volt input change causes an error of 1/20 LSB). The converter should then be set for the mid-scale point and the negative voltage adjusted so that the output is at the right value at this point. The midpoint is taken for this last adjustment since the comparator has also been adjusted at this point and the common mode effect should be zero. Also it is preferable to have less error in the smaller numbers than in the larger numbers.

BS:ASJ

dec INTEROFFICE MEMORANDUM

DATE May 7, 1963

SUBJECT Your letter of April 30, 1963

TO D Doyle, Ottawa Office

FROM B Stephenson

Thanks so much for your letter in regard to the two customers who wanted the 7 bit conversions in 10 microseconds or less. I agree with you completely that we don't want to introduce them to a combined parallel-feedback technique unless we absolutely have to. Fortunately, I think we can help them without doing that.

The conversion time depends on the number of bits in two ways. First, the number of steps are proportional to the number of bits. Second, since the comparator circuit is required to switch on a smaller input voltage change, the switching time of the converter circuit also increases with the number of bits. For the 7 bit case, a standard technique using our regular modules would take about 16.5 microseconds. For a 6 bit converter, the standard technique would require less than 12 microseconds. Actually, however, the conversion itself doesn't take this long. This time assumes we take N + 1 steps for an N bit converter just so that we can use our standard clock or delay to time things out. However, the output of the last flip-flop, doesn't have to set up so the last step can be reduced to about .2 of a microsecond. If you are going to read out of the converter right away, you don't even need to use the last flip-flop. In this case you could read the value of the least significant bit directly off the comparator. This will eliminate an extra delay for end of conversion. If they do this, then the conversion time for a 6 bit system would be 10 microseconds and for a 7 bit system, 14.5 microseconds.

If they are not planning to use the multiplexer, it is also possible to cut off another step or two by having some additional comparators which are permanently biased to the appropriate reference voltages. Then, instead of pre-setting the converter register to 10000 etc, the most significant bits would be jammed immediately to their appropriate value and the other bits would be set to 1000.

For example, suppose you had one comparator pre-biased to -5 volts and the output of this comparator gated directly to the most significant bit in the converter buffer. Then the start pulse would immediately set the converter buffer to either 01000 or to 1100000. This would reduce the total conversion time to N-1 steps, for which a 6 bit system would require 8.4 microseconds and for a 7 bit system would require 12.5 microseconds.

Another conversion step could be eliminated if you add two more comparators so that the second most significant bit can also be jammed in at the same time as the converter buffer is set up. These two comparators would be biased to -2.5 and -7.5 volts. In this case, you would not want to jam in the number in binary because of the possibility of one comparator being right at the switching point. Instead you would jam the number in in a Gray code and put a small Gray to binary code converter on the output of the

second flip-flop (in this case the greater binary converter is just a single exclusive OR). The conversion time for 6 bits would be 6.8 microseconds and for 7 bits would be 10 microseconds.

By the way, these numbers assume that you also took advantage of reading directly out of the comparator for the least significant bit.

If they plan to use a multiplexer with the converter, then this techn ique of adding comparators onto the most significant bits is not so practical since you then have to allow time for the multiplexer to set up. In a normal successive approximation converter, with a high speed multiplexer, the setup time from the first step of the conversion can also be the same time that the multiplexer is changing value. Thus, the multiplexing doesn't really add anything to the conversion time unless the switching time is longer than the setup time. We have a multiplexer switch which we will be announcing soon and I have been using it on a system here. It switches in less than half a microsecond and on a 10 bi t system I haven't been able to detect any appreciable error due to it.

If they want to add a multiplexer, and they feel the full 7 bits are necessary, then they will have to go to some variation on the parallel-feedback scheme in order to complete the conversion in less than 10 microseconds. I have drawn up a rough sketch of a simplified version of this to give you an idea of what it would entail. I have not tried this version out so I can't guarantee any performance and would also want to double check the logic again if they want to consider it seriously, but I think this will give you a general idea of the situation. The converter that I illustrated is a 7 bit unit which converts two bits per step. Rather than using two full D to A converters, I have used one D to A converter and two smaller ones. The ladder applies biasing voltages of ± 1/2 of the trial bit. The number in the D to A converter corresponds to the voltage accumulated so far plus a new trial bit; therefore, the point V_1 would correspond to the voltage decided on so far plus the trial bit; the voltage at V^1 corresponds to the voltage decided upon so far plus 1/2 of the trial bit and the voltage at V^{11} corresponds to the voltage decided upon so far plus 3/2 of the trial bit. This resistor network divides the reference voltages in half so the actual input voltage range would be zero to -5 volts instead of zero -10 volts. Unfortunately, this means that the converter circuits have to resolve smaller voltage difference, hence they require an additional .2 of a microsecond to switch. Also, input capacitance of so many comparators and the large resistor impedence will also slow the individual step time down somewhat. This can be overcome by reducing the inherent impedence of the ladder network. (It could be probably reduced by a factor of three without affecting the accuracy on a 7 bit system. However, I doubt if this will be necessary as I think the system would probably operate well under 10 microseconds without difficulty.)

You may wonder about a few of the things on the sketch, for example, the 1310 delay lines. We have found they go to higher speed systems. It is actually possible for a change in a flip-flop to produce enough of a transient in the ladder network that, if the comparator circuit is sitting near the edge of switching, it will feed back to the input and enable a sufficient part of a .4 microsecond pulse to cause the flip-flop to switch which shouldn't. This may not be necessary to worry about in a 7 bit system, I really don't know, but I have shown the delay lines in case.

Each pair of bits in the converter buffer are coded in Gray code so that if one comparator is in the process of switching when sampled, it will not cause any catastrophic errors. Thus, the order of increasing counts for a pair of bits is 00, 01, 11, and 10. Note, however, it isn't a full Gray code. The counting sequence for 4 bits would be as follows:

Every Other Bit in Gray	Binary
0000	0000
0001	0001
0011	0010
0010	0011
0100	0100
0101	0101
0111	0110
0110	0111
1100	1000
1101	1001
1111	1010
1110	1011
1000	1100
1001	1101
1011	1110
1010	1111

To get from this code into pure binary, you simply complement every other bit if the bit preceding it holds a one. This is what I have done with a pair of diode gates which you see located on the bits with weights 2^{-2}, 2^{-4}, 2^{-6}.

One other minor detail. This particular sketch shows a +10 bias voltage and positive level amplifiers. We don't presently have either a +10 volt, high accuracy supply or positive amplifier. I am sure the whole thing can be scaled up so that they don't have to be positive. However, I think this is a lot easier to think about.

As I mentioned before, I don't think you will have to go to such an elaborate technique as this but if they do feel they are interested in something like this, let me know and I will look into the situation some more.

Also on the subject - we have a variety of new A to D converter packages (enclosed describes them briefly.) I would recommend these new packages for all A to D converter applications. These are our Type 1574 ladder network, our Type 1704 -10 reference supply, our Type 4678 and 4679 level amplifiers, our Type 1572 comparator. The 1574, 1572 and 4678 are completed and you should have or should receive shortly some product notes on these. The 1704 has been in use quite a bit and we are very happy with it. We have had some delay in getting the components which would allow us to make a sufficient batch to quote test specs on it so this will be just a little while. It is an excellent unit, much better than our old 1562. The Type 4679

is a new Level Amplifier which I designed to replace the Type 4677A. We can't make any more 4677A's because we can't get the transistors for it. The 4679 will be a high accuracy unit but will switch in a tenth of a microsecond or less, I think. I will let you know more on that as soon as possible.

Also, while we are on the subject, we are considering offering some standard A to D's as computer options for module customers or for anyone else who wants them. So far we are planning just two systems, one is what we call a low speed system which will be about 15 microseconds for 7 bits and 18 for 8 bits, 23 for 9 bits, 30 for 10 bits - something on this order. The other will be our very high speed, 6 microseconds 10 bit unit. Do you think that there is enough interest in a high speed low accuracy system to warrant offering one? If so, how fast and how many bits do you think we would want it to be?

BS:ASJ
Encls

+10v

5K V' 2K

5K V'' 2K

V

1K

3K

$\bar{D}_1$

$\bar{D}_3$

$\bar{D}_2$

-10v

4679

1574

2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5} 2^{-6} 2^{-7}

-10v

1704

D_1 D_2 D_3 D_4

CLEAR

1607

4604

1572

C_1 C_2 $\bar{C}_3$

TP1 TP2 TP3

START

Clear

Conversion almost complete

7 BIT HIGH SPEED ADC
0 to -5 volts in

BWS 5/2/63

INTEROFFICE MEMORANDUM

DATE May 3, 1963

SUBJECT GROUP INSURANCE DIVIDEND

TO Works Committee

FROM Personnel Committee

The Personnel Committee proposes that the employees' share (50%) of the $17,700 group insurance dividend be returned to all group insurance plan participants in the following manner:

1. Reduce the amount of the employee's individual weekly contribution by 15%. This is calculated to return the employees' share of the dividend in approximately one year.

   Does this apply to voluntary part?

2. Each participant will be notified by letter (to the home) signed by K. H. Olsen. The letter will clearly state that the contribution reduction was made possible because of our excellent experience rating during the previous year and that continuance of a reduced employee contribution will depend entirely on future experience ratings.

3. Because a reduction of this nature is subject to yearly change, John Hancock strongly suggests that we do not change the amount of employee contribution indicated in the insurance booklet.

4. The proposed reduction to be effective immediately.

INTEROFFICE MEMORANDUM

DATE May 2, 1963

SUBJECT Upcoming Deadlines for Technical Conference Papers

TO R. Best
J. Fadiman
G. Bell
H. Morse
T. Stockebrand
R. Doane
R. Savell
A. Blumenthal

FROM Stu Grover

CC K. Olsen
H. Anderson
S. Olsen

Again there are two technical paper deadlines of more than passing interest coming in about a month:

FJCC	Nov. 12-14	Las Vegas	Deadline June 3
NEREM	Nov. 4,5,6	Boston	Deadline June 7

As usual I have the essential information on these meetings and will be pleased to provide any writing, editing, or preparation services requested.

INTEROFFICE MEMORANDUM

DATE May 1, 1963

SUBJECT Meeting At 11:00 a.m. April 26, 1963 To Discuss Various Display Projects

TO
Ken Olsen
Harlan Anderson
Stan Olsen
Dick Best
Gordon Bell
Arthur Hall
Bill Long
Nick Mazzarese
Bob Hughes
Win Hindle

FROM Bob Savell

Following is a list of projects discussed with comments and action status on each project if known.

1. PDP-6 Display

Present plans are that it will be packaged in a standard computer cabinet located in the Central Processor. Gordon would like character generation, vector plotting and as much speed as possible. Ken would like to keep it simple and as inexpensive as possible. First pass at cost reduction does not look very promising. Second pass in progress looks somewhat more promising. Ken Olsen, Robert Savell and William Long will meet during this week to discuss progress. Work is continuing on high priority basis.

2. Less Expensive 16" Display

This may or may not be the same as the PDP-6 Display. No specific conslusions were reached.

3. High Speed Displays Such As Electrostatically Deflected Displays

No immediate full time work, low priority.

4. Character Generators

Possibility of starting on faster character generator was discussed. There was some disagreement as to whether more flicker-free characters were needed than we have at present. If agreement can be reached that they are needed, then faster generators are one way to approach the problem. Low priority.

5. Line Drawing Displays

No real agreement that customers are ready for a combination of incremental display and line and curve generators at the prices we would probably have to charge to sell them. Low priority.

6. Projection Displays

Fairly general agreement that this seems to be a good approach to the large screen problem, however many other projects more pressing. Low priority.

7. Remote Displays

Apparently numbers of people have asked the company for remote display systems recently, although until this meeting I had only heard of one inquiry of this sort. General concensus was that remoting may mean many different things to different people. We will decide how far we can reasonably inexpensively remote a display from the computer and make a definite statement. Priority medium.

8. Multiplex Display

Same comments as in number seven. We will give thought to a proposal for both multiplex and fairly remote operation. Priority medium.

9. Display Adapters For IBM 7090 and 1410, Control Data 160A

Formal decision was made sometime ago to complete these units. They are being completed on a high priority basis since there is much interest in all three of them. Any further display adapters must be considered very carefully before we decide to undertake their design.

10. Ultra-Precision Display

Loose ends on present design will be complted as soon as possible with no further attempt to improve on the specifications at present, at least not on a high priority basis.

11. Color Display

Second unit is installed on one of Customer Relation's PDP-1s. Outside of absolutely necessary loose ends to be cleaned up, no more work will be done on color display.

12. Light Pen and Light Pen Amplifier

There are three problems in this area:

1. Fix the noisy pens and amplifiers.
2. The Electronics Systems Laboratories pen
3. New design, probably Fiber Optics

Item #1 has highest priority with good prospects for a solution during this week. The ESL light pen will be worked in as soon as possible there after, again on a high priority basis. I believe the Fiber Optics light pipe to be the best permanent solution for a variety of reasons. It will be worked in as soon as possible after the ESL pen.

13. Eyeball & Camera Equipment 16mm, 35mm, 70mm, Slide & Polaroid

No discussion on this project.

A 35mm camera has been selected for sometime now. It is the Automax Model G-2R distributed by TRAID. Selection of a polaroid unit has been proceeding at an extremely slow pace and by fits and starts primarily due to the reluctance of camera manufacturers to do anything about changing lenses on their cameras. It is beginning to appear that the only solution is for us to buy our own lenses and modify the cameras ourselves.

No work has been done as yet on eyeball systems, however, I believe that work should begin as soon as possible on at least a simple eyeball system for simple film reading systems ie, not PEPR systems.

I would consider both the above items, the eyeball and camera, as medium priority items.

14. Storage Tubes

General consensus was that storage tubes are really not a project, but are a possible method of solution to problems of speed of generation of characters and other flicker-free displays. No action was taken other than to say that we would continue to consider them as a possible solution.

15. TV Type Display Systems

Same comments as for #14.

16. PEPR Systems

Some diagreement as to whether we should go the whole way and make the eyeball equipment for PEPR Systems or stop at the cathode ray tube face. In any event, the systems would be somewhat different from the 31 System as it now exists. R. Savell, D. Chin, R. Tringale, and G. Rice will visit MIT to learn what we can about the CRT portion of the system. No priority was assigned.

17. Special Display Systems

This includes one of a kind type display systems such as the request for proposal which I recently received from Jack Dennis of MIT. This request asks for a modified Type 33 Symbol Generator, a Line Generator, a Vector Generator, a Light Pen Tracking Cross Generator, logic provisions for slave display scopes, and various other items.

Harlan Anderson feels that we should consider such requests very carefully. He feels that we should as far as possible devote our engergies to developing products which we can sell with quite minor modifications rather than devoting our energies to special systems. I agree with him.

INTEROFFICE MEMORANDUM

SUBJECT: JOB ALLOCATION, MECHANICAL DESIGN DATE: May 1, 1963

TO: All Engineers
Ken Olsen
Stan Olsen
H. Anderson
N. Mazzarese
M. Sandler
J. Smith
R. Maxcy
R. Maroni
K. Peirce
H. Crouse
W. Brackett
W. Hindle

FROM: LOREN PRENTICE

To better acquaint all engineers and management with job responsibility within the mechanical design department, a memo will be issued periodically as required.

Engineer	Job number or EN number	Description	% complete
Ron Cajolet	1026	Burroughs Tape	Hold
	1064	Shock Mtg. table & casting rings for precision adj.	70%
	100-00	Master template holder & board holder for second dynasert pantograph	90%
	1016	Mounting for diode memory	80%
	1177	14 plug brass bar with 22 pin Amphenol connectors	80%
	2523	Remote reader table layout	85%
	2484	Incremental Plotter display	99%
	2531	Plug Panel	50%
	1199	Mag Tape Unit 580 Development	1%

Engineer	Job number or EN number	Description	% complete
Scott Miller	2112	Automatic Module Test Room	95%
	1026	Tape Transport 570	5%
	1136	Micro Tape '6 Pack'	75%
	1157	Automatic Module Tester Logo	95%
	1177	DC/12	95%
	1178	PDP-6	85%
	1189	Tape Control 510 Panel	90%
	1190	Data Control 131 Panel	90%
	2522 2488	Reader - Spooler Comb.	98%
	1196	Midwest Tape Unit Development	5%
Ken FitzGerald	1023	Additional assembly jig for 1914 mounting panels	20%
	1000	Paint adhesion on steel components	30%
	1053	Welding jigs for standard computer cabinets	70%
	1000	Sheet metal, machine, cabinet assembly and carpenter shop supervision and administration	
	1000	Engineering technician tool boxes	90%
	1178	PDP-6 console mechanical design and prototype fabrication	25%

Engineer	Job number or EN number	Description	% complete
Loren Prentice	1136	555 Tape Unit	95%
	1097	Mod. development	75%
	1065	Large display	10%
	1177	PDP-3 computer (24-36 bit)	25%
	1184	Variable field light pen First three units	85%
	1179	Display 30 cost reduction survey	95%
	1000	Building layout	50%

Jobs Pending - Unassigned		Assigned Electronic Eng.
1151	Large Tape Storage - Hold	T. Stockebrand
1165	Projection display	R. Savell
1180	Camera equipment for 30 display	R. Savell
1181	Camera equipment for 31 display	R. Savell
1182	Electrostatic display development	R. Savell
1086	Holley printer	R. Savell
1064	Eye-ball unit	R. Savell

INTEROFFICE MEMORANDUM

DATE May 1, 1963

SUBJECT Meeting with Dave Packer

TO Ken Olsen

FROM George O'Dea

cc: Harlan Anderson
Maynard Sandler

We have made a date for yourself and Harlan to meet with Dave Packer on Monday morning, May 6th at 10:30 to get a sneak preview of the information he wishes to present to the Works Committee on the following day.

If the time is inconvenient, please let me know and I will speak to Dave and rearrange the schedule.

George O'Dea

GO'D:ncs

DIGITAL EQUIPMENT CORPORATION

MODULE STANDARD COST SHEET

Description Model 1105 Inverters

Date Standard Cost Established April, 1963

Labor:

	Hours	Amount	Cumulative Labor	Cumulative Overhead	Cumulative Total
Assemble	.350	$ .637	$ .637	$ .892	$1.529
Plugs	.060	.109	.746	1.044	1.790
Dip	.020	.036	.782	1.095	1.877
Resolder	.140	.255	1.037	1.452	2.489
Transistors	.030	.055	1.092	1.529	2.621
Handles	.030	.055	1.147	1.606	2.753
Inspect (Before)	.110	.200	1.347	1.886	3.233
Test	.060	.130	1.477	2.019	3.496
Pack & Inspect after Test	.080	.170	1.647	2.192	3.839
Total Labor			$ 1.647		

Overhead:

140/102 % X Labor ($ 1.347 / .300) 1.886 / .306

Raw Materials (see reverse side) 12.991

Manufactured Parts (see reverse side) 3.232

Outside Contracts

TOTAL STANDARD COST PER UNIT $ 20.062

Raw Materials:

Part Number	Description	Total Units	Standard Cost Per Unit	Total Standard Cost
68K ¼W 10	Resistor	5	$ .023	$ .115
3K ¼W 05	Resistor	5	.044	.220
1.5K ¼W 05	Resistor	3	.044	.132
560 10 ½W	Resistor	1	.021	.021
.01 GMV	Capacitor	2	.104	.208
82MMF 05	Capacitor	5	.041	.205
D662	Diode	4	.160	.640
D001	Diode	3	.150	.450
MA 90	Transistor	5	2.200	11.000
			Total Raw Materials	$ 12.991

Manufactured Parts:

2003	Plug	1	$ 1.338	$ 1.338
1105-4105-6105	Etched Board	1	1.647	1.647
2016	Handle	1	.247	.247
			Total Manufactured Parts	$ 3.232

Module 1105

Selling Price	$67.00
Standard Cost	$20.06
Actual Cost	$21.20 (latest)

Board

Materials	$ .55
Labor	.40
Overhead	.70
Total Cost	$1.65

Board with Resistors, Transistors, etc. and Plug

Materials	$15.97
Labor	.75
Overhead	1.04
Total Cost	$17.76

Completed Module

	Standard	Actual	Variance
Materials	$16.22	$15.77	$ (.45)
Labor	1.65	1.55	(.10)
Overhead	2.19	3.88	1.69
Total Cost	$20.06	$21.20	$ 1.14