INTEROFFICE MEMORANDUM

DATE February 1, 1965

SUBJECT

TO H. Anderson
R. Best
H. Crouse
R. Beckman
R. Savell
R. Tringale

FROM D. Kuyamjian

The fifth re-coating of the General Instrument drum did not prove successful, and another attempt will be made.

By February 3, sufficient tests will have been run on the new coating to determine its acceptability.

S. Intagliata informed me that their advertised specifications for density are being revised to 1800 NRZ bits per inch from 2000.

ANDY

dec INTEROFFICE MEMORANDUM

DATE February 1, 1965

SUBJECT

TO
Jim McKalip

FROM
R. Lane

We are releasing construction requisitions for 163C memories. Will the new design be ready for deliveries starting in May 1965? Please answer to Andy since I will be out of town the balance of this week.

INTEROFFICE MEMORANDUM

DATE February 1, 1965

SUBJECT Display of PDP-8

TO Ken Olsen

FROM Frank Kalwell

CC: Stan Olsen
Harlan Anderson ✓
Nick Mazzarese
Ted Johnson

With the sale of our PDP-8's going exceptionally well, I feel we could possibly capture the entire market in the PDP-8 class by hiring a truck with a built-in power plant so an actual PDP-8 could be displayed country-wide.

Several years back, Reed & Prince in Worcester, who manufacture a line of recessed fasteners, advertised that a truck with the complete line would be in Maynard. At that time, all the mechanical engineers at DEC visited the truck and received a demonstration of their complete line which was extremely effective.

Possibly our sales offices could set up appointments ahead for such demonstrations. The cost of a basic 14 ft. walk-in van from Avis on a six months basis is $50.00 per week, plus 10¢ per mile with the lessee supplying the gas and Avis supplying the insurance. I'm certain lower rates can be obtained if such an idea proves worthy.

If you feel this is practical, perhaps we can discuss this further.

AND

dec INTEROFFICE MEMORANDUM

DATE February 2, 1965

SUBJECT Univ. of California Letter Dated 1-28-65.

TO Jack Shields

FROM Bob Lane

Attached is a copy of the above referenced letter and it is requested that you handle the matter.

Please note the nasty tone of the letter!

CC: Steve Mikulski

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
P. O. BOX 808
LIVERMORE, CALIFORNIA

January 28, 1965

Digital Equipment Corp.
Maynard
Massachusetts

Subject: Spare Parts PDP-6 Computer System

Gentlemen:

It is requested that you provide us with a complete recommended spare parts listing for the PDP-6 computer system. Under the provisions of the contract for purchase of this system, you are obligated to provide sufficient spare parts to maintain the PDP-6 operational for 6 months after delivery and acceptance of the system. It is requested that you assure us that such a spare parts complement is available, if not here at the Laboratory, in the immediate area.

It is our intention to cooperate fully with you people in bringing the PDP-6 up to operational status. However, should we have to supply parts for this system because they are not readily available to your engineers, it will be necessary to back-charge you for the cost of such units.

Please advise me immediately of the status of the spare parts list.

Very truly yours,

S. Fernbach, Head
Computation Division

SF:ke

cc:Ken Larsen
Don Rose
Russ Runyan
Bob Wyman

INTEROFFICE MEMORANDUM

DATE February 2, 1965

SUBJECT Adam's PDP-6

TO Harlan Anderson

FROM Ken Senior

CC: G. Bell
R. Beckman
S. Mikulski
J. Shields

After reading the new Adam's PDP-6 contract, I felt it was my place to inform those concerned of the job which lies ahead.

I have listed the separate jobs which require on-line time with an estimate of the time required in 8-hour shifts. With the exception of the drum, I think that the system could be ready by February 23rd.

Attached are:

1. List of jobs to be done.
2. The current schedule for the 237 Drum.

KS:sm
Enc. 2

1. List of jobs to be done on Adam's PDP-6.

Equipment	Job	On-Line Time No. of Shifts
162	Heat Test	1
166	Timing Measurements	2
166	Room Temperature Margins	4
166	Miscellaneous Troubles	3
166	Rear Buss on 6205's	1
390	Installation	1
390	Debug	1
All	Install Outstanding Mods	2
760	Room Temp Margins)	
166	Install Power Down Control)	1
	& Debug)	
163C #2	On-Line Debug)	1
163C #2	Room Temp Margins)	
163C #3	On-Line Debug)	1
163C #3	Room Temp Margins)	
516 with (1) 570	On-Line Debugging	5
516 with (2) 570's	On-Line Debug	1
167	Room Temp Margins	2
236	Preliminary On-Line Debug	5
237	Drum On-Line with 25% of Heads	5
630	On-Line Debug	1
630	Room Temp Margins	1
551	Room Temp Margins with Adam's Maindec	1
516	Room Temp Margins)	
570 #1	Room Temp Margins)	1
570 #2	Room Temp Margins)	
All	Final Inspection and Rework	3
All	Heat Test with Margins	6
All	Acceptance Tests	8
	TOTAL SHIFTS	58
	TOTAL 3 SHIFT DAYS	19 1/3

The estimate of 19 1/3 days is for a 3-shift operation. It assumes the availability of competent people on this basis.

2. The schedule for the Adam's 237 Drum is as follows:

Present	-	February 7	Off-Line Checkout
February 8	-	February 14	On-Line Checkout with 25% of the Heads
February 15	-	February 24	Installation of Remaining Heads at V.R.C. Plant
February 25	-	March 3	Off-Line checkout with 100% of heads. If drum is received from V.R.C. Plant on schedule.
March 4	-	March 10	On-Line Checkout with all Heads.

PDP-6 vs 6400

(1) Status of Software -

Size of compiler - 10K words
Size of monitor - 10K words.

(2) How do they write pure procedure?

(3) No interrupt facility for peripheral processor!

PDP-8 is better than the PPU.

(4) 2 or 3 PDP-6 arith. units equal one 6400.

(5) Compilation Times

(6) Many overhead instructions.

(7) Cannot extract easily for 1/2 word.

(8) Lack of byte instructions.

(9) Jump instruction problem.

INTEROFFICE MEMORANDUM

DATE February 3, 1965

SUBJECT

TO H. E. Anderson
Gordon Bell

FROM R. L. Lane

It would be very desirable to have a "graph pad" type program at the Int. Data Show in New York (May 1965). Please consider having this re-programmed for PDP-6. I understand it will take about 2 weeks of Dave Brown's time if we decide to do it.

I feel this type of program has good drawing power at shows and every person whom I have demonstrated it to so far has been quite impressed. Further, we don't have to rely on telephone lines for our demonstrations. Now is the time to start programming rather than the week before the show.

dec INTEROFFICE MEMORANDUM

DATE February 3, 1965

SUBJECT PDP-6

TO
Nick Mazzarese
Harlan Anderson
Gordon Bell

FROM
R. L. Lane

PDP-6 Projected Deliveries Through June 30, 1965.

Customer	Scheduled Delivery	Net Value	Credit Pending	Balance to be Shipped
MIT-MAC	Feb. 15, 1965	214,700	28,150	Complete
Brookhaven	March 15, 1965	95,760		Complete
Rutgers	March 15, 1965	175,000	100,000	Complete
Bonn Univ.	May 15, 1965	443,266		Complete
Rand Corp.	May 15, 1965	457,867		190,800
Adams Assoc.	Feb. 23, 1965	* 990,022		Complete
Oxford Univ.	March 15, 1965	73,520		Complete
Aachen Univ.	June 30, 1965	423,391		Complete
MIT - LNS	Feb. 15, 1965	66,700		50,000**
	Totals	2,940,226	128,150	
	Net Total	$2,812,076 during fiscal '65		

** approximate amount
* Rental @ 35,482.56 per month

INTEROFFICE MEMORANDUM

DATE February 3, 1965

SUBJECT ITT and MIT

TO
Nick Mazzarese
Dick Mills
Harlan Anderson ✓

FROM
R. Lane

The net value of the ITT P.O. scheduled for shipment this fiscal month is:

$249,011.	System
11,054.	Dual Switches
$260,065.	Total

The MIT Type 163C memory will be delivered on schedule during Feb. - $126,000.

The Fast Memory requires 2 weeks after the latest modification to the 1250 modules. This looks bad for Feb. Net value - $30,000.

The Character Generator* will be delivered on schedule
Net value - $11,600

*128 characters

INTEROFFICE MEMORANDUM

DATE February 3, 1965

SUBJECT Leased Equipment Policy

TO Harlan Anderson
Frank Kalwell
Tom Whalen
Ray Michele

FROM Fred Mariani

Current Situation:

The Digital Equipment Lease Policy was awarded to Marsh and McLellan Agency representing St. Paul Fire & Marine Insurance Company, on February 2, 1965. The valuation basis was decided by Dick Mills to be sales price rather than cost.

Scope of Coverage: (All risk of direct Physical loss or Damage to the property covered)

Each unnamed[1] location in which we place our equipment on lease will have a limit of coverage of $400,000.00, however, we will pay only for the coverage needed as reported to the insurance company at the end of each month. Any location having a value in excess of this limit would be specifically named[2] and the value needed insured. The catastrophe limit on this policy is set at $1,000,000.00.

Necessary Communications:

A copy of the signed Lease Agreement (including the configuration of the system and the Agreed Valuation regardless of the length of the lease)

Date of shipment. (If partial - Configuration of each shipment)

Date of return. (If partial - Configuration of each Receipt)

1. Unnamed - All location values reported as one lump sum.
2. Specifically Named - (e.g. Adams Associates) The sales value of the equipment located on the premises of the lessee or his designee exceeds $400,000.

dec INTEROFFICE MEMORANDUM

DATE February 3, 1965

SUBJECT (below)

TO Bob Lane

FROM Jack Shields

SUBJECT: MIT MAC INSTALLATION OF: 2μsec Memory 163C
Fast Memory, 162
Character Generator, 342

1. 163C Memory Status as of 2-2-65

   a. Power Supply in Model Shop needs components. Hope to have by 2-5-65

   b. Modules 1996 -26
      1997 - 1 by 2-9-65 From Production
      1998 -13

      42551-23 by 2-5-65 From Production

   c. Release from production test by 2-16-65

   d. Test on In-house Computer, 1 Day: This must be coordinated with Bob Beckman

   Possible delivery on 2-18-65 if all dates are met.

2. 162 Fast Memory

   a. We should make 15-20 February date: Most likely on the 17th.

3. Character Generater, 342

   a. Will make it if prior commitments to Customers listed below are met.

      1. U. of Western Australia
      2. Lincoln Labs
      3. New York University
      4. MIT MAC

CC: H. Anderson ✓ B. Savell
B. Brooks B. Beckman
K. Senior

dec INTEROFFICE MEMORANDUM

DATE February 4, 1965

SUBJECT F-61 Brochure

TO
H. Anderson ✓
G. Bell
All PDP-6 Sales Personnel

FROM RLL
R. L. Lane

Attached is a copy of the PDP-6 brochure (F-61) for immediate "red-lining" for reprinting of same.

INTEROFFICE MEMORANDUM

DATE February 4, 1965

SUBJECT

TO Stan Olsen
Harlan Anderson
Nick Mazzarese
George Rice

FROM Ted Johnson

Sanders has told a reliable information source that the reason they wouldn't consider the PDP-6 is that they felt delivery would be too risky. In view of this element, we would have to have RFI proof some of our modules.

dec INTEROFFICE MEMORANDUM

DATE FEBRUARY 4, 1965

SUBJECT 50-CYCLE EQUIPMENT

TO JACK SMITH

FROM STEVE MIKULSKI

The following 50-cycle equipment is scheduled to come through Production:

BONN - Serial No. 10

2 - 161 50-Cycle Memories (Delivery 2/22/65 and 3/8/65)
1 - 136 Data Control
1 - 551 Transport Control
2 - 555 Transports
1 - 461 Card Reader
1 - 516 Control with a 521 Interface
2 - 570 Transports
1 - 346 Display
1 - Half Duplex 630 Communication System with 3 stations
1 - 646 Line Printer

AACHEN - Serial No. 12

2 - 161 50-Cycle Memories
1 - 136 Data Control
1 - 551 Transport Control
2 - 555 Transports
1 - 461 Card Reader
1 - 516 Control with 521 Interface
2 - 570 Transports
1 - Half Duplex 630 with six stations
1 - 646 Line Printer

Anticipated delivery dates for the above are reflected on my delivery schedule dated February 4, 1965.

SM:vc

cc: Harlan Anderson
Bob Beckman
Gordon Bell
Bob Pate
Jim Sullivan

dec INTEROFFICE MEMORANDUM

DATE FEBRUARY 4, 1965

SUBJECT 50 CYCLE TYPE 161 MEMORY SYSTEMS FOR BONN AND AACHEN PDP-6'S

TO JACK SMITH FROM STEVE MIKULSKI

My schedule indicates that in order to meet the Bonn delivery date, the first memory, which was originally due from Production on January 11, 1965, can be delivered no later than February 22, 1965. The second 50 Cycle Memory must be delivered on March 8, 1965, originally scheduled on February 8, 1965. A 60 Cycle 161 Memory, referred to as the Adams backup memory, is scheduled for delivery on March 1, 1965.

Additional 161 memories as follows:

AACHEN - requires two 50 Cycle Memories, one for delivery on May 26, 1965, and the second for delivery on June 14, 1965.

LNS - requires a memory delivery on June 28, 1965, however, this memory is currently in existence and Production will furnish the memory control and interface portion of the memory, stacks coming from existing memories.

One 5μsec. 161 memories being returned from MAC will be used on the test floor as a checkout memory.

SM:vc

cc: Harlan Anderson
Bob Beckman
Gordon Bell
Bob Pate
Jim Sullivan

dec INTEROFFICE MEMORANDUM

DATE FEBRUARY 4, 1965

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TO JACK SMITH

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SM:vc

cc: Harlan Anderson
Bob Beckman
Gordon Bell
Bob Pate
Jim Sullivan

dec INTEROFFICE MEMORANDUM

DATE FEBRUARY 4, 1965

SUBJECT PRODUCTION SCHEDULE

TO BOB BECKMAN FROM STEVE MIKULSKI

With reference to Bob Lane's memo of January 25, 1965, the following production schedule appears firm:

SERIAL NO.	CUSTOMER	DATE FOR PROCESSOR CHECKOUT COMPLETION
7	DEC System Programming Sales	February 15, 1965 (including 626, 760)
8	Rutgers	March 15, 1965 (System)
9	Rand	April 1, 1965 (626, 760, 761)
10	Bonn	March 8, 1965 (System) May 15, 1965 (System delivery date contingent upon equipment delivery from Production as shown on production schedule dated February 3.)
11	DEC System Programming	April 15, 1965 (626,760,761, no options)
12	AACHEN	June 15, 1965 (626,760)
13	LNS	July 1, 1965 (626, 760)
14		August 15, 1965 (626, 760)

SM:vc

cc: Harlan Anderson
Gordon Bell
Bob Pate
Jack Smith
Bob Lane
Jim Sullivan

digital MEMO

WASHINGTON OFFICE
1430 K Street, N.W.
Washington, D.C. 20005

February 5, 1965

To: Harlan Anderson

From: Howie Painter

Subject: ACM Sponsored Time-Sharing Seminar

Dear Andy:

Received a call today from Alex Bumsted of SDC, who is the local ACM Chapter's seminar coordinator. He said that the Washington ACM Chapter is holding a series of five lectures on Time-Sharing during the month of March, and wondered if we would like to participate on one of the evenings.

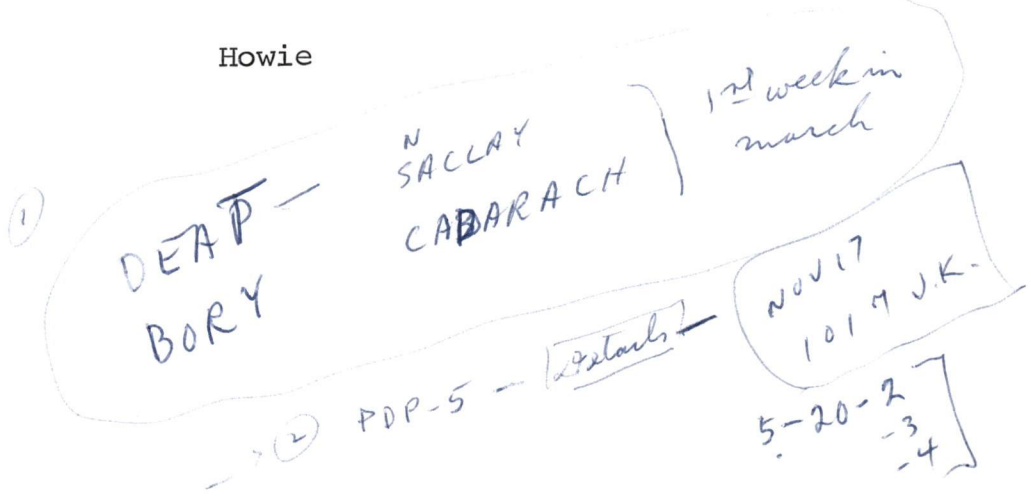
I have tentatively committed DEC to the evening of Tuesday March 30th. I wonder if you could designate someone to make a PDP-6 presentation at this time?

Other companies participating in the lecture series will be: G.E., Control Data, Univac, and SDC. The subject should concern time-sharing as it applies to the PDP-6. This should give us an excellent opportunity to present the PDP-6 and all of its timesharing aspects to a group of 40 to 50 people from the Washington area.

The time of the lecture will be from 6:30 to 8:30 on March 30th. I would appreciate receiving the name of whoever will give the presentation, along with a short biography within a week or so. I will then forward this to Bumsted so that it can be used for publicity purposes.

Best regards,

Howie



dec INTEROFFICE MEMORANDUM

DATE February 9, 1965

SUBJECT Rutgers PDP-6 Software

TO Larry Portner

FROM R. P. Harris

Rutgers University is scheduled for a PDP-6 delivery during March of this year. The system will consist of a processor, 16K memory, and a paper tape I/O.

On Thursday evening, February 11th, I am meeting with Dr. Plano here in Maynard to discuss:

(1) software that will be available from DEC for his system.

(2) his systems software design for his special physics interface.

I am requesting that you and any other representatives from programming, that you feel necessary, meet with us to discuss these matters.

CC: R. Lane
H. Anderson

dec INTEROFFICE MEMORANDUM

DATE FEBRUARY 9, 1965

SUBJECT PDP-6

TO BOB LANE

FROM BOB BECKMAN

PDP-6 proposals are still going out without paper tape readers included. It has been something like six months since the decision was made to make the reader a part of the basic machine just as the teleprinter. People do not seem to be getting the word or else they are forgetting about it, and proposals keep going out without readers included.

The simplest, quickest and least expensive way to cover this point would be to put out a new price list. If this had been done six months ago, we would not still be having troubles about paper tape readers.

We presently have four systems on order where we have agreed to "lend" a paper tape reader so that we will have half a chance of making the system operational. Right now we are averaging 50% of our PDP-6 sales where we give away a $9,000 option. If quotes keep going out without it, that percentage is going to go up.

RJB:vc

cc: Harlan Anderson
Gordon Bell

Harlan Anderson

These first two pages are a summary of the following report and indicate the effort needed for the biomedical market.

1. Market

   a. Biomedical Researchers need 200 - 300, PDP-8, LINC type machines in the next 2 to 3 years

   b. Federal Government & Industry are supporting biomedical researcher very heavily. (The transition of Federal spending is from Defense to Health & Education and the Natural Science.)

   c. Present competition has not yet entered biomedical market

2. Additional Sales Support Needed to Be Successful in the Biomedical Market

   a. Applications Programmer - Familiar with researcher's problems and applications

   b. Full time applications engineer responsible for the design of special logic packages. Also for design modification to existing systems.

   c. Additional full time salesman to make market aware of DEC's potential and products. Sell PDP-8, LINC's & Flip-Chips.

3. Advertising

   a. Regular ads in "Science" & similar periodicals that cover the biomedical research area. (PDP-8, LINC & Flip-Chip)

   b. Application notes on all biomedical installation, with programs. Make notebooks of these and all published articles & papers for all salesmen.

   c. Attend the three best shows with on-line demonstrations.

4. Pricing - LINC

   a. Discontinue Educational Discount
      Price $43,600 system

   b. Offer only I/O where existing logic & wiring prints can be obtained.

5. Competition - Spear (LINC)

a. Has at least one order
b. Will deliver (??) in April
C. Is redesigning logic packages (Microcircuits)

BIOMEDICAL OUTLOOK

By Mort Ruderman
December 29, 1964

Market

The potential of the biomedical market in the next few years appears to be quite good. The effort needed to capture and to get a good foothold into this area is the following: An applications programmer that is familiar with the applications and the data that the biomedical people are processing. He should have a working knowledge of the programming characteristics and operating features of all our equipment. He should understand the applications programs already available on the LINC to the extent that he can demonstrate their usefulness and describe how they can be applied to the researcher's problems. He should develop certain programs for the PDP's to make them more attractive to this market. Basic programs such as auto-correlation, fourier analysis and other statistical tools are necessary.

Sales

Through sales, DEC has to make themselves well known to these people. In the past year DEC has had exceptionally good exposure into this area. LINC has contributed to this exposure where people associate the LINC with DEC. Also more recently with the PDP-8 and its price that is not only attractive to these people but is feasible monetarily. People presently familiar with DEC in biomedicine are people advanced with computer technology. These people are knowledgeable enough to know that they can use existing general purpose systems. The big market that DEC wants to attract, however, are the people that are not presently at this stage of understanding. Support is now being given in these areas by N.I.H. and this is the market that we want to entrench ourselves in and capture. An indication that more money is being made available in biomedical research than has been in the past is: 1. The size of the grants 2. General national emphasis in biomedical research 3. The announcement that 3 billion dollars in the next five years is to be allocated to medical research is also very encouraging. At least one other full time sales person is needed in this effort. People in the field offices cannot become familiar with this wide area of the biomedical researchers. A sales individual will never be a biologist, however, he can become familiar with some of the problem areas and the approaches to these areas and the applications.

Advertising

Concentrate biomedical orientated ads in Trade journals that correspond to the biomedical audience. The systems DEC should publicize are: PDP-7, PDP-8, LINC Computer and Flip-Chip Modules. Some of the worthy publications and ones that have been found to be the proper areas to advertise in are:

1. "Science" magazine, a weekly and it has 110,000 subscribers.

2. "Biomedical Instrumentation" is more on the technician's level, than the researcher.

3. "Medical Electronics" seems to be a very good quarterly.

4. "Journal of Experimental Analysis and Behavior" this is a journal that we should at this time be advertising our Flip-Chip modules. This is published bi-monthly and is geared towards people doing behavioral work. DEC has not been able to sell our modules to these people only because ours were too good for them and they could sacrifice quality for price. Competitors advertising in this journal consistently are: Massey Dickenson, Gracen Statler, Lehigh Valley, B.R.S., Tech. Serv., Ionics. It costs $125 for a full page ad.

Another concept in the advertising area that DEC could capitalize on and is needed as the #1 sales tool is an accumulation of application notes. If every salesman has a three ring binder with 3 to 4 doz. published papers or application notes on how our systems are used in biomedical research, this would open and keep open all existing doors. This effort has begun with duplicates of articles that will be given to a few sales offices.

LINC Computer

The LINC effort has been successful to date:

1. Twenty initial LINC's = $460,000 in modules.

2. Three system kits purchased at $24,000 each - Total $72,000.

3. Four systems individually purchased at $25,000 - Total $100,000

4. Three kits delivered - Total $120,000

5. One system, American Cyanamid, $47,000. Four systems more presently on order - Unit Price $44,000 - Total Price $176,000.

6. Miscellaneous Modules $200,000 - Total to Date $1,200,000

Due to the lack of Center Development Office releasing available information, the LINC's have by no means sold in the quantity they should have. It has not had much publicity, through advertising or published papers. LINC sales, almost entirely, will be through grant funding. This procedure is as follows: There are three deadlines annually: November 1, February 1, and July 1. Once a researcher submits a grant request, 3 months after it is submitted, it is reviewed by a lay committee of experts who review their request and the worthiness of their experiments. At this time after the 3 months it is decided how much of his initial grant request he will receive and when he will receive it. This determined, it takes him from a minimum of maybe two or three weeks to three months to receive this actual money. There could be as much as 9 months from the time DEC sells a researcher on a system to the time he actually can purchase the system. There are some ways around this, one is that he is usually notified at least 3 months prior to receiving the funding that he is going to receive funding and at this time a letter of intent could be accepted and his system scheduled into production. Another method around this is to deliver it early, then to bill immediately upon his receipt of funding. Another alternative is usually these people do have some small funds available up to $1,000 a month. DEC can rent or lease them a machine until funding becomes available for a 3 or 6 month period.

There are many new areas other than the grant procedure that certainly are markets for biomedical systems. These are in commercial research facilities. One of the biggest in this particular area are pharmaceutical houses. These people invest a great deal of money in research, have money immediately available and DEC has been in contact with a number of these people.

Another area, of course, is the Government where a great deal of biomedical research is done and their funding is generally available prior to this 9 month period.

However, whether these people are in commercial research, in the academic area, or the Government, they all primarily

have the same interest in mind. They read the same journals and attend the same meetings. It behooves us again to advertise and get the message to these people and to be in constant contact so as to be familiar with their needs. The next few years, the bigger majority of the machines that DEC sells to this field are going to be the small very flexible machines. As people grow in ability then they certainly will be buying faster, bigger, and more expensive systems.

There is no direct measure of what the LINC has done for DEC or what doors it has opened. It can only be said that there are 35 existing LINC's some of which would not be customers of ours if not for the LINC. These people are committed to DEC and buy substantial quantities of modules continually. Many of them have also purchased additional LINC's which, if we had not been able to provide they might have bought some other competitive system. Areas that LINC's have also opened doors to are PDP-8's. The European market, especially in biomedical, through the LINC and visits to this country by biomedical researchers (who don't make it a point to visit with industry but do visit many of the universities such as M.I.T. and Washington University), have seen LINC's in operation and have brought the word back to Europe again giving DEC good exposure. A good indication of the magic name of the LINC today is that the ad in "Science" and the N.I.H. Show have returned a minimum of 60 direct letter inquiries, plus a number of bingo cards and a good deal of telephone calls inquiring about price, delivery, and specifics of the LINC.

The future of the LINC is very difficult to predict at this time and I think it would be a report in itself. We are committed to approximately 20 LINC's which is 12 more than we have purchase orders for at this writing. It is going to take 6 to 9 months to sell these additional 12 and this is going to take a good hard sales effort. This is mainly due to the grant procedure. The next deadline is February 1. The people that will get grant approval in this period could receive delivery in the early Summer. After that, the next deadline is July 1 and anybody that would get grant approval in this period would receive a LINC sometime around the end of 1965 or the beginning of 1966. People in neurophysiology or physiology feel that the LINC is the greatest machine they have ever seen.

COMPETITION

DEC's competition for the LINC, for all intensive purposes, is a company called Spear Corp. located in Waltham, Mass.

They have seven engineering or high level administrative people working on this. They are redesigning it with micro-circuits and hope to sell it in the vicinity of $40,000. Spear has a commitment for their first one and have stated that they will deliver one in April. They are only changing our logic packages. This is the only redesign - the LINC tape, the scope, the operator's console, and the data terminal box for input-out remains exactly the same and they will be purchasing these from the same vendors that DEC does. Center Development, of course, is available for consultation for anything that is not evident in the documentation of the LINC and they are in very close contact with Spear. Spear has gotten an awful lot of support in certain areas from Center Development Office. I don't think they could cater to the same market as well as DEC could because they are in the process or marketing of LINC's I think we should be consistently aware of them and watch them very carefully. At this time their paper design is complete. They have purchased a complete system, components and microcircuits from Motorola, and data terminal box and scopes are in the process of being fabricated. Therefore, it is not unrealistic to think Spear might be kept going by special systems to biomedical research because they will entertain some of these nonstandard systems and they hope to offer the capability of taking any biomedical application and applying it to the LINC and supplying all of the necessary engineering and interface.

I wish I could say that the PDP-8's could capture each and every LINC sale, however, this is not true. The PDP-8, as it stands today, is a more powerful system for doing statistical analysis and certain other off-line applications. However, two points I would like to make evident on the PDP-8 is: 1. When someone is considering a PDP-8, he can also consider our normal competition in these areas. Since a basic PDP-8 for biomedical areas alone is not sufficient and some I/O is needed such as scope etc. 2. The PDP-8 presently does not have the program package that the LINC has, which allows someone with little background to immediately make use of a system and use it for on-line application.

Pricing

Since the LINC was priced when DEC had educational discounts on all systems but since has discontinued this policy, I strongly recommend that if we are to capture anything but the academic area such as the pharmaceuticals, the military, and the Government that are doing biomedical research, not to reduce the discount price but to make this price available to everybody. And to make the LINC available

at $43,600. This makes it extremely attractive to the people who are not able to get academic discounts and since our competition does not have academic discounts but a single price, then this particular obstacle does not have to be overcome.

Summary

In summary, as a company, DEC has to make an investment in personnel in the next year to strongly entrench ourselves in the biomedical market. We can do this through advertising, a dynamic sales effort and through compamy sponsored engineering in the proper areas, to have a complete package for these researchers. The market is going to be a growing market in the next few years and if DEC is there first with the best then there is not much room for anybody else.

To indicate some of the natural progression in the past, two years ago, people from Technical Measurements Corporation, developed the CAT computer. These people sold approximately 1,000 CAT computers in two years. They were priced exactly right for the market because at that time funding on an individual basis was quite low in the 10 to $15,000 area. However, in the past two years, funding has become more abundant. A need for these systems has been proven and therefore funding, to this degree has become available. Also, Federal funding through Health, Education and Welfare, (which National Institutes of Health, the Public Health Service and Cancer and Heart Research are all part of) is continually increasing.

dec INTEROFFICE MEMORANDUM

DATE February 9, 1965

SUBJECT Comments on January's Operations

TO Harlan Anderson
cc Dick Mills

FROM Denny Doyle

1. Despite a high sales volume (65K), our monthly statements indicates a net loss of $1,966. This was due mainly to two factors:

   a) Low mark-up on sales because of customers' eligibility for quantity discounts.

   b) The application of $3,188.89 worth of customs duties, some of which were really related to sales made in previous months.

2. Total sales to the end of January are $271K. The prospect of achieving a total volume of $600K during fiscal year 64-65 is very poor. Our sales volume is definitely not limited by market potential but rather by our ability to produce. Orders on hand have been totalling approximately $100,000 during the past three months. Module delivery has dropped to approximately sixty days on an average, as opposed to ten days at this time a year ago. Based on my own appreciation of our market potential in Canada, I would estimate that we have been production-bound by a factor of 50% during the months of November, December and January. Assuming that this situation will continue through June 30 (which it will because of PDP-8 demand), then in order to deliver $300K worth of equipment, we must be working with a market potential of $600K or $100K per month. It is unlikely that the Canadian demand for our products will equal this magnitude before June 30, 1966.

Denny

INTEROFFICE MEMORANDUM

DATE February 9, 1965

SUBJECT University of Sherbrooke

TO Harlan Anderson

FROM Roger Handy

I talked to Paul Brunelle of Sherbrooke today and received some discouraging news. Paul feels that the Administration will forfeit the large NRC grant in favor of a request for a meager $8-$10,000 to upgrade their present equipment. Thus they will delay the big decision for at least another year. However, there is no guarantee of subsequent NRC grants. Attached is a letter I sent to Paul last week which I thought might enhance DEC's chances.

January 29, 1965

Mr. Paul Brunelle
University of Sherbrooke
Sherbrooke, Quebec, Canada

Dear Paul,

By now Jack Richardson has undoubtedly talked to you about his efforts to locate a possible candidate for the position of Computation Center director. He may also have asked your opinion about the advisability of our demonstrating PDP-6 Fortran capabilities by referencing the Maynard system via remote TWX located in Sherbrooke.

I am enclosing a small pamphlet describing the computer conference to be conducted in Louisiana next summer especially for University personnel. DEC is providing the PDP-6 expressly for this conference. I mention this to you, Paul, to emphasize the fact that DEC has tailored the PDP-6 hardware and software to suit the needs of University Computation facilities.

Dr. James Oliver, Director of the Conference, is with us in Maynard this week. When I told him about your situation in Sherbrooke, he offered the following suggestions Jim said for me to tell Sherbrooke that he would welcome to the conference any individual who the University thought had the potential to direct its computation center. Not only would this individual benefit from instruction provided during the conference, but he would be invited to stay on at the University of Southwestern Louisiana to work with the Computation Center - perhaps to even teach some courses - until he decided he had enough knowledge of the PDP-6 and sufficient insight into the business of running a University Computation Center. I offer this suggestion as a possible compromise solution in the event you are unable to find a qualified, experienced director.

Mr. Paul Brunelle
University of Sherbrooke

January 29, 1965

My trip back to Montreal was hazardous but safe. I was disappointed that the Sherbrooke snow had not fallen on New Hampshire and Vermont as well.

I shall be in contact with you shortly if the idea of a Fortran demonstration has merit.

Best personal regards,

Roger Handy

RH/pm

Copy to Harlan Andrews

FEB 9 1965

DISCUSSION WITH MR. HUGH MACARTHUR, NATIONAL SHAWMUT BANK,

28th January, 1965

1. He advised of the possibility of hedging on expected purchases of dollars to repay the parent company from Australian sales.

2. He advised on the possibility of borrowing money in the U.S.A. to finance computer "time payments" in Australia. U.S.A. credit is cheaper than Australian.

   The National Shawmut could give about four years at 6% with ½% going to the U.S. overseas credit guarantee department (2½ years say on an order for $50,000).

3. He promised to contact the Melbourne Stock Exchange (secretary, Mr. Ralph Lee), to provide any background information the Exchange might wish to have on DEC.

Copy to Howlan Anderson

FEB 9 1965

REPORT ON DISCUSSIONS RE PRICING IN AUSTRALIAN CURRENCY

29th January, 1965

Following a visit of Mr. Hugh MacArthur from the National Shawmut Bank in Boston, we have had discussions with the Bank of New South Wales regarding the conversion of our equipment prices to Australian currency.

We are placed at a disadvantage in Australia by not quoting a local price, and believe that the extra effort involved in doing this will improve our competitive position. From our discussion with Mr. Richardson (Overseas Currency Department of Head Office, Bank of New South Wales), the Bank can give the following services:

1. They will mail to us daily the current exchange rate for buying dollars.

2. They will give the rate at any time ('phone extension 460).

3. They will give us a forward hedging rate at any time ('phone 460).

4. They will obtain a forward hedging rate once a firm order is received. Normally this can only be done six months in advance (i.e. six months before the payment is made in dollars). Extension 460 is Mr. Boucher or Mr. Richardson.

I am proposing to devise a basis for quoting prices in Australian currency, such that we are reasonably covered against possible variations in the cost of dollars, but do not over-price our equipment and lose a competitive advantage.

I plan to see Mr. Colin Cousens or Mr. Jim Grose (extension 211) in the Overseas Currency Department in March to discuss the problem further.

The cost of transportation is a similar consideration and also needs tidying up, so we can be more final about the local cost of our equipment.

ANDY

dec INTEROFFICE MEMORANDUM

DATE FEBRUARY 9, 1965

SUBJECT PDP-6

TO BOB LANE

FROM BOB BECKMAN

yes, but very few,

PDP-6 proposals are still going out without paper tape readers included. It has been something like six months since the decision was made to make the reader a part of the basic machine just as the teleprinter. People do not seem to be getting the word or else they are forgetting about it, and proposals keep going out without readers included. wrong!

The simplest, quickest and least expensive way to cover this point would be to put out a new price list. If this had been done six months ago, we would not still be having troubles about paper tape readers. DONE 1-31-65

We presently have four systems on order where we have agreed to "lend" a paper tape reader so that we will have half a chance of making the system operational. Right now we are averaging 50% of our PDP-6 sales where we give away a $9,000 option. If quotes keep going out without it, that percentage is going to go up.

RJB:vc

cc: Harlan Anderson
Gordon Bell

Re: Paper tape Readers!

Customers	with	without
1 MAC	✓	
2 BROOKHAVEN	✓	
3 U. of W.A	✓	
4 RUTGERS	✓	
5 ADAMS		✓
6 BONN	✓	
7 ARCHEN		✓
8 LNS	✓	
9 RAND	✓	
10 Oxford	✓	
11 BERKLEY	✓	
12 WSU	✓	

Beckman! Go back to school. This time take statistics! Bob!

INTEROFFICE MEMORANDUM

DATE February 10, 1965

SUBJECT DEFECTIVE TRANSISTORS FROM PDP-6 AT BROOKHAVEN

TO Jim Cudmore

FROM Bob Kudera

Six transistors and a diode were sent from the van mounted PDP-6 at Brookhaven. Tests were conducted in an attempt to determine the deficiencies of the components. All components were from 6205 flip flops. Diode D39 was found to be open. Transistors Q83 and Q21 of bit 22 were found to have open emitter to base junctions. The parameters of transistors Q20 and Q46 of bit 22 and Q47 and Q24 of bit 8 were measured. These transistors passed all specifications. The parameters measured were $V_{CE(sat)}$, bandwidth, I_{CBO}, I_{EBO}, and stored charge. The final inspection sheets for the rework on the PDP-6 show that only one pin of the 6205's was reworked and this pin was in bit one.

Transistor Q83 and diode D39 appear to have opened at the same time since the destruction of one probably would not cause the destruction of the other. Based on microscopic examination of the transistor it would seem that too much voltage accidently applied to the pins leading to the bases of transistors Q83 and Q21 caused their destruction.

cc: H. Anderson
R. Hughes
J. Shields
R. Clements

dec INTEROFFICE MEMORANDUM

DATE February 10, 1965

SUBJECT

TO H. Anderson
R. Best
H. Crouse
R. Beckman
R. Tringale

FROM D. Kuyamjian

The most recent re-coating of the G.I. drum also failed to pass inspection.

G.I.'s chief engineer, Sal Intagliata has informed me that he feels a new plating process is in order and will be developed. Since this could take quite a while, he declined to project a delivery date for our drum.

DIGITAL MAYN

DIGITAL EQLA
@SG. NO. 113
2/9/65

TO HARLAN ANDERSON
FROM DICK MUSSON

CHARLES BAKER PLANNING ON BEING IN MAYNARD FOR APPROXIMATELY 2 WEEKS, ARRIVING FEBRUARY 23RD. HE WILL BRING PROTOTYPE OF REMOTE CONSOLE. ALSO, RAND IS RATHER UPSET WITH ONE OF OUR LETTERS THAT REFER TO "LETTER OF INTENT" THAT WE HAD ALREADY RECEIVED. THEY WOULD APPRECIATE OUR REFRAINING FROM STATING THIS.

HE PRESENTLY ANTICIPATES FIRM ORDER BY MARCH 15TH.

OUR CONTRACT UNACCEPTABLE, AS THIS WOULD BE AGREEMENT BETWEEN US AND THE AIR FORCE, WHICH REQUIRES STANDARD GOVERNMENT CONTRACT. HE IS PRESENTLY TRYING TO OBTAIN AN OFFICIAL LETTER OF INTENT. HE WILL DISCUSS THIS WITH YOU WHILE AT MAYNARD.

END

END OR GA

A @P

Harlan Anderson
Pls note,
J. Fadiman

RECEIVED
1965 FEB 11 AM 8:48
DIGITAL EQUIPMENT CORP.
SALES DEPARTMENT

11.FEB
14.40 ;+
DIGITAL MAYN

DIGITAL MCHN

TWX NO.24 2-11-65

TO JON FADIMAN
FROM GUENTER HUEWE

WE JUST HAVE BEEN IN PARIS TO FIX THE PDP-5 OF MR. MOURETON, WE PUT IN NEWLOGIC FOR PROGRAMMED READING, TELETYPE STILL NOT WORKING PROPERLY, WE HAVE HAD A TECHNICIAN FROM THE TELETYPE REPRESENTATIVE IN PARIS ON SITE, BUT WE WERE NOT ABLE TO FIX IT. IT IS ABSOLUTELY NECESSARY THAT YOU SHIP A NEW TELETYPE UNIT TO PARIS AT ONCE, (220 V, 50 CPS) , PEOPLE ARE ANNOYED ALREADY. SHIP A SPARE 4706 AND 4707 TO MUNICH, WE ARE NOT SURE WHETHER THESE WILL WORK PROPERLY. WE DEFINITELY NEED TO HAVE ADDITIONAL SPARE PARTS FOR ALL INSTALLATIONS IN OUR AREA IN MUNICH, EVEN A COMPLETE TELETYPE SET, TWX SHIPPING DATES FOR TELETYPE FOR PARIS AND TELETYPE MODULES FOR MUNICH ASAP, PARIS PEOPLE NEED HELP IMMEDIATELY, THEY WANT TO USE THE PDP-5, THEIR APPLICATION IS VERY URGENT.

TO STAN OLSEN
FROM GUENTER HUEWE

WE HAVE INSTALLED IN EUROPE THREE PDP-5'S IN THE MEANTIME, I DID NOT ESPECT TO HAVE AS MUCH TROUBLE AS WE DO HAVE. ALL COMPUTERS HAVE HAD WIRING ERRORS IN IT, I AM SORRY TO SAY BUT EITHER DEC'S SHECK-OUT PROCEDURE IS NOT SUFFICIENT OR CHECK-OUT IS NOT DONE PROPERLY. WE DID NOT GAIN A GOOD REPUTATION WITH OUR COMPUTERS HERE IN EUROPE. THIS IS DANGEROUS FOR FUTURE SELLING OF PDP'S. IT WOULD BE VERY EXPENSIVE TO MAINTAIN A LARGE SERVICE DEPARTMENT HERE IN MUNICH AND RUN A COMPLETE CHECK-OUT AFTER AN INSTALLATION, I THINK IT WOULD BE LESS EXPENSIVE TO IMPROVE THE CHECK-OUT IN MAYNARD, AT LEAST FOR EUROPEAN INSTALLATIONS. PLEASE LET ME KNOW WHAT YOU THINK ABOUT IT. AS SOON AS I HAVE TIME I WILL COME TO MAYNARD TO DISCUSS OUR PROBLEMS IN MORE DETAIL.

END OR GA PLS

RECEIVED
1965 FEB 11 AM 8:48
DIGITAL EQUIPMENT CORP.
SALES DEPARTMENT

INTEROFFICE MEMORANDUM

DATE February 11, 1965

SUBJECT MAXIMUM SECURITY STORAGE FACILITIES

TO

K. Olsen
H. Anderson
S. Olsen
J. Atwood
G. Bell
D. Best
H. Crouse
A. Hall
W. Hindle
B. Hughes
B. Lassen
R. Melanson
D. Mills
L. Prentice
M. Sandler

FROM B. Farnham

We have recently entered into a yearly contract with Ultra Security Records Vault, Incorporated for storage of company records which, for the most part, are on micro film.

Ultra Security is an ex-navy gun emplacement sight that is buried in the side of a hill located south of Boston. It offers maximum security, humidified air and specializes in the storage of microfilm.

The type of records stored in a facility of this type are those vital for reconstruction of the company, it is not a dead storage area.

Our present arrangements include the storage of vital accounting, drafting and programming records.

If any of the above addressees feel that their departments have vital records that should be under maximum security, out of the Maynard, plant, and not already included in the storage of accounting, drafting and programming records, I will be glad to make the necessary arrangements.

CONFERENCE REPORT

PRESENT FOR CLIENT

J. L. Atwood
S. Grover
A. Stephens
R. Belden
J. Ridgeway

PRESENT FOR AGENCY

R. Todd

CLIENT Digital Equipment Corp.

DATE February 11, 1965

PLACE Maynard, Mass.

SUBJECT

ROUTE TO

D.B. Miller
T.P. Howard
J. E. Rodwell
W. Mostad
R. Todd
C.J. Raines
R. Venn
G.M. Papazian
P.S. Monti
N. Lamb
R. Piera

NOTES

1. Approved schedule for 1965 advertising was given to the agency. Agency is to estimate costs.

2. Three ads on "Flip-Chip" modules are planned at present. The first, 7288-5-0001 and (other size) 7288-5-0005 ("These modules made Digital famous"), has already been produced. 7288-5-0005 is to be inserted in Electronics, March and Electro-technology, March.

   The second module ad (M2) will be on applications, using the Elapsed Time Indicator application developed by John Jones. This is to be inserted in the March 1 issue of Electronic News, the April issue of Computer Design, and the April issue of Electromechanical Design. Mr. Todd will call John Jones on February 12 for more information on module applications.

   The third module ad (M3) will be to OEMs, stressing the modules' relevance to the make-or-buy decision. Mr. Nangle will supply information for this. This ad is to appear in an April issue of Electronic News, the April issue of Electronic Industries, and other magazines to be scheduled.

3. Eight ads on DEC computers are planned at present:

   PDP-8:

   Spread for Datamation and Computer Design, both March: "The PDP-8 is a powerful, integrated-circuit computer!" (7288-5-0007)

   One-page version of 7288-5-0007 for Electronic News, March 22 (IEEE Show issue).

   Spread for Scientific American: "Roll the PDP-8 into your office or lab." (7288-5-0002)

lp bw on oceanographic applications. Don Moffitt at the agency has considerable background information on this. Mr. C'Hagan is the expert in this area at DEC

PDP-7:

lp bw on process control applications of the PDP-7. Don Belden has information.

PDP-6:

lp bw

Software:

lp bw. Jack Ridgeway has information.

Biomedical computers:

lp bw. Mort Ruderman has information.

Pulse Height Analyzer:

lp bw. John Jones has information.

4. The agency is also to develop a "Flip-Chip" Promotion Package for salesmen's use.

5. The agency will find out if DEC's recruiting advertising is at the national rate. If so, the agency will issue a blanket contract covering the space for ads which DEC will place.

Rita Venn please note.

6. Process Control:

Advertising to promote the use of PDP computers in process control will be based on the PDP-7 and the PDP-8, with the dominant emphasis on the former. The PDP-7, incidentally, was developed from the PDP-4 and the PDP-8 from the PDP-5; this is important in that it means that much of the program development, debugging and proving out has already been done for the new machine.

PDP computers are being used for process control at a cement plant, steel mill blast furnace, power plants, brass extrusion plant (where the machine is also used for inventory control and production scheduling), a Nabisco cookie and cracker plant, chemical plant, nuclear reactor, petro-chemical plant, and others. The Nabisco installation is the subject of a major article in the current issue of FOOD PROCESSING; the computer used in DEC's although no credit is given.

One of the "in" words in process control today is DDC, for Direct Digital Control.

Primary machine buying considerations in this area are 1) price, 2) reliability under variations of temperature and humidity, and 3) applications. In this last respect, it is significant that computers in the PDP family have been used for two years by processing companies.

It is also important that the computers have fast, parallel input/output capability, arithmetic speed, and all-silicon logic.

The PDP-7 is a reliable, low-priced, flexible (easy to interface) process control computer.

All input/output devices are buffered. Transfer between devices occurs in 1.75 microseconds.

The core memory is non-volatile, so that nothing is lost from the core memory in the event of a power interruption in the plant. The memory bank is isolated for protection. Optionally, built-in protection against power transients is offered.

Parity checking is provided.

Drum memory systems are available for the machines. (Drum memories offer much faster access to memory than tape memories and are more economical than core memories.) These drum memories are accessed through a built-in direct memory channel, making installation very easy and economical.

The machine instruction contains a 13-bit address, permitting direct access to 8,000 words.

Priority interrupt capability of the machines permits a very large number of program interrupt channels.

In the ads, we should mention the DEC modules, particularly their low price. These are important in constructing interfacing devices for process control applications.

We should probably also mention the OEM discount structure for the computers, after checking with Mr. Mazzarese.

Currently, The Foxboro Company is using PDP computers for control systems, although there is no formal arrangement with DEC and no exclusivity.

7. Software:

Some excellent material on DEC software is available in an ad ("How do you speed up program preparation?") which DEC ran in the August, 1964, issue of DATAMATION as well as in other books.

Good software enhances the power of the machines. It results in cleaner, neater, more efficient programs. And DEC now has software which is believed to be substantially superior to that of competitors.

There is a group in the company which use-tests all programs (certifying them, as it were) and provides documentation to the customers. This last is very important: the ease and efficiency with which a program may be used depends on the clarity, completeness and orderliness of its documentation. DEC's program documentation is complete, rigorous, rational and easy to use, with flow charts and well-commented listings.

The existence of an active group of users of DEC programs is as important as anything else in the software picture. Important organizations and companies are members of this group, which is called DECUS (Digital Equipment Computer Users Society). Like IBM's SHARE, DECUS is a means of users' exchanging information on programming changes and developments to their mutual benefit. The active existence of DECUS demonstrates the availability of usable programming material.

With the delivery of a PDP computer, you get the complete package of software. This includes:

on-line debugging routine (called DDT!)
editor
symbolic assemblers
utility programs (mode conversion, dump routine, etc.)
elementary function subroutines
diagnostic and maintenance programs
macro assemblers on the PDP-6 and PDP-8 (ability to use user-defined macros)

DEC software works with all peripheral equipment including DECtape.

FORTRAN capability is a good indication of the power of a computer.

DEC offers a programming course to users of PDP computers.

It was suggested that one idea for an ad might involve showing a photograph of a stack of the software documents, the very size of which would be impressive to knowledgeable people in the computer field. A theme for an ad campaign might be "better results" because of DEC's superior software; Mr. Ridgeway will forward to Mr. Todd some examples to support a "better results" theme.

INTEROFFICE MEMORANDUM

DATE February 12, 1965

SUBJECT PDP-8 as a Competitor to the Univac 1004

TO Harlan Anderson
Gordon Bell
Jim Burley

FROM Nick Mazzarese

Several days ago, I received a memo from Andy noting that several people had expressed an interest in the possibility of using the PDP-8 in combination with a line printer, card reader, etc. as a competitor for the Univac 1004. The 1004 is basically a remote terminal which can output punched card information over telephone lines or receive information from a line printer over telephone lines. It is very much akin to our proposed plans for the 338 which would provide a remote display capability.

We had examined this possibility when we first introduced the PDP-5. At that time, we rejected it for several reasons:

1. Typically, people looking for this type of equipment require a rental plan.

2. The cost of our peripheral equipments are so high that the low cost of our processor gets swamped out.

3. We felt that the competition might be rather fierce because this is an area where people like Univac and IBM have a reasonably good stronghold.

With the PDP-8 some of these considerations may no longer be valid. If, for example, we could offer a line of low cost peripherals, especially line printers and card readers, or if we would be willing to offer a more generous rental plan, i.e., 1/40 or 1/50 rather than 1/30, we might be able to compete with people like Univac in this field. However, my feelings are that for the present we have enough good possibilities that this one seems to be in the back seat. If you have any information which invalidates my assumptions, I would be glad to hear it because of our interest in the general area of remote terminals (338).

dec INTEROFFICE MEMORANDUM

DATE 11th February, 1965.

SUBJECT Imperial College - PDP-6

TO Jon Fadiman
H. Anderson
R. Lane

FROM John Leng
Geoff Finch

1. Imperial College (IC) had selected PDP-6 as the most suitable computer for their job assuming that NIRNS would allow them to engage in a long term lease.

2. Financial people at NIRNS turned down the long-term commitment as each budget has to be approved annually.

3. Thus we're back at "Square One" with IC having £84K to spend this year.

4. We have worked out a proposal that might be acceptable to DEC, Maynard. Perhaps you could comment by Telex "Yes", "No" or possibly another arrangement that could be acceptable.

5. Sell following system to the Mercantile Leasing Corporation (MLC):

PDP-6 Processor

16K, 2 us. Memory

Paper Tape I/O

DECtape

IBM Tape

TOTAL COST Approx. £ 354K

6. Lease back from them over 5 years at their favourable rate of 115%. Total cost over 5 years £407K i.e. £82K per year.

7. Lease to IC for one year for £*84K.

8. Try and obtain LOI from IC for as many years as possible up to 5.

9. Having the "6" installed at IC for one year our chances should be at least 50% of keeping it there.

Cont'd. .....

10. If they don't intend to renew their rental we will have nearly a years notice because the following year's budget will be approved within a few months of the initial installation this coming Fall.

11. This will give us plenty of time to find another customer if need be.

12. We feel this scheme makes reasonable sense and if carried out will be a good investment in the foreign operations of the Company, at the same time returning an immediate profit. Whether it makes business sense when viewed together with all your other commitments at Maynard we don't know.

John Leng.

c.c. S. Olsen
N. Mazzarese

February 11, 1965

PDP-6 MODULE PROBLEMS

R. Savell
B. Scudney
R. Best
H. Anderson
R. Beckman

L. White

Module circuit problems which have been encountered in PDP-6 Check-out fall into the two areas of the 6205 - 6615 system problems and the general 6000 series modules problems. The 6205 - 6615 situation has been further complicated by the inability of the 6205 tester to detect 6205 module failures which do appear in the computer. Most 6205 failures have been resolved, therefore, by blindly replacing transistors in the affected circuit. The major difficulty with the other 6000 series modules has been the low noise rejection of these circuits. These noise problems have been circumvented by isolating affected base circuits with resistors.

Specific 6000 Series Problems:

1. A transistor gate which is operating in saturation will tend to cut off by a positive noise peak of 0.3-0.5 volts at the base input. The resulting negative 1 - 2 volt spike at the collector will then drive other gates; gated pulse amplifiers, especially, can be turned on in this manner.

2. Pulsing the emitter of a transistor gate to ground when the input to the base is at -3 volts causes a positive peak in the -3 volt level. The peak amplitude has been observed to be as great as 0.6 volt.

3. If 3 or 4 transistor gates are paralleled into one collector load, the fall time at the collector varies inversely with the + 10 voltage level. This characteristic is particularly noticeable when gates are combined to form a flip-flop, since the flop may fail when the + 10 is lowered a few volts.

I would expect the fall time to begin increasing when the + 10 supply was lowered to a level at which the transistor base-emitter was forward biased. I would not, however, expect a variation in fall time as the + 10 supply is increased above + 10 volts.

4. In a logical AND circuit consisting of three transistor gates in series, the top transistor had a ground level input, the input to the second transistor was a negative level with an overshoot going to -5 volts, and the input to the grounded transistor was a negative pulse. When the level overshoot and the pulse were coincident, the collector output glitched positive and turned on a pulse amplifier.

6205 Problems

1. With an AR complement pulse about 2.2 volts in amplitude and 25-30 ns wide, the AR flip-flop was double complementing. Placing 100Ω in series with the base input of the pulse gating transistor eliminated the problem.

2. Ringing on the MB 1 output line has caused false bit transfers to the AR, MI, and MQ flip-flops.

3. False AR carry pulses have been generated during data transfers to the AR.

4. 6205 failures have occurred after running with the ± 10 supply lowered to about + 5 volts for about one hour. The failures have then persisted after the supply voltage was returned to + 10.

6615 Problems

1. The output pulse amplitude changes with loading.

2. The output pulse amplitude changes with the amplitude of the input pulse.

6205 - 6615 System Problems

1. The 6205 modules show position sensitivity, i.e., a module operating in one location will not operate in another location.

2. The 6205 module tester does not detect 6205 failures which will occur in the computer.

3. Pulses generated by the 6205 - 6615 modules decrease in amplitude at lower temperatures causing start-up or morning sickness type failures.

INTEROFFICE MEMORANDUM

DATE February 15, 1965

SUBJECT

TO R. Savell

FROM B. Dill

The following is a list of PDP-6 options and their status as production items as of today.

OPTION		STATUS	COMMENT
516	Tape Control	Unacceptable	No Checkout Procedure
520	Tape Unit Interface	Acceptable	
521	Tape Unit Interface	Acceptable	
522	Tape Unit Interface	Acceptable	
646	Line Printer Control	Acceptable	
551	DECtape Control	Acceptable	
461	Card Reader Control	Acceptable	
136	Data Control	Acceptable	
163	Memory Control	Unacceptable	No Checkout Procedure
162	F.F. Memory	Unacceptable	No Personnel Trained
161	Memory Control	Unacceptable	No Checkout Procedure
346	Display	Unacceptable	No Personnel Trained on 344 Interface Portion

INTEROFFICE MEMORANDUM

DATE February 15, 1965

SUBJECT 45th Meeting of the Test Equipment Committee

TO Richard L. Best

FROM Russell Doane

Members of the Committee:

Robert Hughes, Chairman
Russell Doane, Secretary
Win Hindle
George Gerelds
Jim Cudmore
Steve Lambert
Ed Harwood
Jack Shields
Bill Titelbaum

1. A new sampling plug-in for 540-series Tek. 'scopes was announced recently, for delivery late in the year. We have ordered two; Type 1S1. No price yet.

2. For more immediate needs, the committee decided we need one additional Type 561, 567, or 661 'scope. Choice between these two was left up to Bob Hughes, Russ Doane, Joe Sutton, and Ron Evans at a later meeting with John DesJardins, Tek's field man. We now have three 567 'scopes with digital readout: one in module test, digital readout used full time; one in semiconductor test, digital readout used about half the time; one in Special Systems, digital readout used part of the time. Therefore, we have about enough digital readout capability even if one digital readout is down for repairs. The choice therefore narrowed to a 561 or 567 without digital readout plug-in, or 661 (561=567 as a non-digital 'scope).

   The decision was to buy a 661 with the new 5T3 timing unit, because the following advantages seem to be worth the extra cost ($3480-2250= $1230):
   a) Wider selection of sampling rates with the 661 makes it possible to interpret and use displays that are difficult to use on the 561.
   b) Controls are far easier to use.
   c) The new 5T3 allows low rep-rate signals to be clearly observed, such as those produced by mercury choppers; it plots several points for each input signal when the rep-rate is low.

   This 'scope will augment our three 567's and one 661 for use in the following areas: Special Systems, Semiconductor Test, Production Test, Automatic Module Tester, Circuit Design.

3. There are four areas presently using our three Boonton Electronics electrometers intensively: Model Shop, Semiconductor Test, Production Test, A-D. We decided to buy a fourth to fill the need.

4. We will buy a third EDC reference supply, because Computer Checkout and Field Service are finding two insufficient. We now have one rated at 0.02% and one rated at 0.01% accuracy. The new one will be a 0.02% instrument.

5. From Triplett we are ordering the following:

6	630NA 20,000 ohms-per-volt multimeters
2	630NS 200,000 ohms-per-volt multimeters
10	310 pocket multimeters (for field service)
10	310-type leather cases

We evaluated samples of Weston's new Model 80, which we found acceptable except more expensive than the 630NA and difficult to calibrate; and a Selectest Super 50, which is as expensive but less convenient to use, with fewer scales. Both instruments are rated at 1% of full-scale accuracy, but inferior scale overlap makes their worst-case accuracy rating lower than the 1 1/2% 630NA worst-case accuracy.

6. Bill Titelbaum will order 50 sync cables and two-dozen probes, as both are hard-to-find but essential 'scope accessories. One cathode-follower sampling probe has been ordered by Jim Cudmore for Semiconductor Test and Automatic Module Test, since presently there are no spares. Four of the probes will be X1, the rest X10. Half will have BNC connectors, half UHF.

7. Arthur Hall has rented a wattmeter and other meters for short-term use, and we will not buy a wattmeter if this solution appears satisfactory.

Next meeting will be March 15, 1965 at 1:30 p.m. in Bob Hughes' Office.

RD/kmk

INTEROFFICE MEMORANDUM

DATE February 16, 1965

SUBJECT

TO H. Anderson
J. Fadiman
R. Lane
R. Best
H. Crouse
R. Tringale

FROM D. Kuyamjian

Attached is our present delivery schedule for Anelex Line Printers. Printer #4 has been moved from June to July since we have no committment for it.

CONTRACT	RELEASES	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Anelex Corporation Series 5 Line Printer Qty: 10 Contract: 11-64/3-66 Dlvy. Cycle: 5 months	Release #1-ten units		#2 300 lpm 120 col 50~22V 15,500 BONN 15th	#3 300 lpm 120 col 50~220V 15,500 AACHEN 14th		#5 1250 lpm 132 col 60~115V 25,910 WASH S.U. 15th	#6	#7	#8	#9	#10
		26th	15th	28th							
		15th	15th	14th	26th						
			15th	14th	15th	23rd					
					15th	15th	27th				
						15th	13th	27th			
							13th	15th	27th		
		15th	15th	28th		#4 15th					
				#1 300 lpm 120 col 60~115V 15,500 U. of TEXAS 14th							

SPEED, INPUT REQUIREMENTS

CHARACTER SET

NUMBER OF COLUMNS

CANNOT BE CHANGED AFTER THESE DATES WITHOUT CANCELLATION CHARGES AND/OR EXTENSION OF DELIVERY DATES.

— EQUIPMENT MAY BE CANCELLED PRIOR TO THIS DATE WITHOUT INCURRING CANCELLATION CHARGES

/ EQUIPMENT CANCELLED PRIOR TO THIS DATE MAY INCUR CHARGES FOR PARTS BUT NOT LABOR.

NOTE: Unit #3 Character Drum to be supplied with zero (0) and letter (O) not slashed.

Signed by _____ Date _____
Anelex Corporation

Signed by _____ Date _____
Digital Equipment Corporation

INTEROFFICE MEMORANDUM

DATE February 17, 1965

SUBJECT

TO Harlan Anderson

FROM Kenneth H. Olsen

General Doriot called and said there are three companies who have expressed an interest in DEC. They are Remington Rand, Data Control and the small control company which is run by Chester Nimitz, Jr. I told General they should all buy DEC equipment but they are only interested in DEC because they want us to solve their problems, not because they should be joined with us. They are just too lazy to figure out how to use computers and they think making ties with us will solve their problems.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE February 17, 1965

SUBJECT

TO J. McKalip (516, 163)
B. Long (346)
B. Colburn (161)

FROM R. E. Savell

cc: H. Anderson
G. Bell

The attached memorandum was sent at my request by Bud Dill of Peripheral Equipment Checkout. Would you please take the necessary steps to have the above items accepted by Peripheral Equipment Checkout and let me know the date by which that acceptance will occur.

RES/mro

dec INTEROFFICE MEMORANDUM

DATE February 17, 1965

SUBJECT PDP-6 Sales

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

FROM R. L. Lane

The sales for PDP-6 have never looked better!

The following ten (10) prospects are on the verge and we stand a better than excellent chance of getting our share.

U. S. Naval Labs., Corona, California

The competition is an IBM 360/50. They have no programming capabilities and want a "batch operating system" with expansion to time sharing. They need a programmer for one year to run this operation - we are doing a new proposal to go out 2-19-65. They will decide before March 15. No discount on this sale.

EG&G - Santa Barbara, California

They have sent out revised specs which all but say PDP-6. The decision has been made and requests are going in to AEC next week. I am sending a new proposal immediately. This is a 24% discount sale.

United A/C, East Hartford

They have re-initiated activity. We feel that a decision will be made in the next three months. We have always felt PDP-6 was their choice but funding their problem. Things must come to a head there soon. This is a no discount sale.

A/C Spark Plug

We proposed a small system some time ago. A/C has recently upgraded it to about 200K to 250K. (No discount.) It is a 16K, 5μsec, system. They expect a decision within 6 weeks. Roger feels that Harris Hyman (who was in the lobby of A/C Spark Plug and is doing some consulting for them) may influence which direction they take.

Univ. of Cal., Berkeley

They are sold on PDP-6 and have requested funds from NIH. Decision will be forthcoming about March 15, 1965. This is a 20% discount plus a free CRT. I feel this will promote other users to PDP-6. Delivery still scheduled for August.

Rand

In the bag!

Aachen

Looks very good! Will do time sharing on a 5μsec, 32K machine. Purchase order is expected by June 1, 1965.

Applied Logic, Princeton, N.J.

We have received an L.O.I. for an August delivery ($409,000). This is a drum system and they plan to do display work and time sharing. No Magnetic Tape at all. They have $300,000 and need to rent the additional $109,000. We must work out an agreement with Chandler leasing. They have ARPA money and want an August delivery. This is a no discount sale.

Oxford University, England

They are giving us an L.O.I. They have already purchased the I/O equipment for delivery in March. We may have a problem about what to do with it. This is a 32K, 2μsec system (no drum). We have been embarrassed on performance of FORTRAN. Expect to deliver in 3/4 quarter, calendar '65. (Physics application) 20% Discount Sale.

Imperial College, London, England

We have been selected but we also must rent system. We have several proposals to decide upon from John Leng. If we will lease I feel we can get an immediate order. 25% Discount Sale.

Washington State University

They have reduced the field to an IBM 360/62 and DEC. We are to receive a contract revision in the near future. I feel this is a maximum effort on our part to deliver a system of this magnitude. This is a 20% discount system and probability of sale about 66%. We must provide COBOL and much programming support.

Stanford

John McCarthy feels he has his money and is considering the IBM 360/60-70. He will come east to negotiate a contract when he gets his money. He wants large low cost memories. Gordon Bell should participate in selling of this system at that time.

In summary:

Customer	Probability	% Discount	Drum	Disc	Del.	Net Income
U.S.N., Corona	50	0		✓		800,000
EG&G	95	24				350,000
Applied Logic	66	0	✓			400,000
Oxford	75	20				525,000
Imperial College	50	20 +				300,000
U. A/C	33	0				
A/C Spark Plug	50	0				275,000
U. of Cal., Berk.	75	20 +				300,000
Wash. State U.	66	20	✓	✓		900,000
Stanford	20	20	✓	✓		1,000,000
Rand	95	24	✓	X		650,000
Aachen	90	20				423,000

INTEROFFICE MEMORANDUM

DATE February 17, 1965

SUBJECT Rough Cost Estimate to Interface a CDC-9200 Space 1200 Card Per Minute Card Reader to PDP-6

TO R. Lane
H. Anderson

FROM R. E. Savell

Enclosed is the additional cost which I estimate would be involved to interface a Control Data Corporation Model 9200 Card Reader to PDP-6. These costs are above and beyond the present price of the Burroughs 800 Card Per Minute Reader which we now offer as a standard option.

The CDC 9200 has a number of features that are better than the Burroughs Unit such as the speed of 1200 vs. 800 cpm, a dual read station instead of a single read station giving somewhat better error detection, and a small - 240 card - second stacker into which a few defective cards can be directed. Aside from these features it is approximately the same as the Burroughs Card Reader.

From the limited data which I have available on the Reader it seems as if it would not be too difficult to interface. However, I do not believe that we should offer to do this for the following reasons:

1. We will have to tie up engineering time and money to design a new interface, write a diagnostic program, train Field Service and In-house technicians and engineers, support a one-of-a-kind unit in the field and stock spare parts, to say nothing of the effect that this change may have on our system programs due to differences in timing and what appear to be slight differences in operation between the CDC Unit and the Burroughs Unit.

2. When we sell one shot items we are in the business of selling services and not products. One shot items are very difficult to estimate and make a reasonable profit on.

The enclosed price does not include an operating or maintenance manual. These items could easily add a total of $5,000 to $6,000 to the sales price. It does not include any changes to system programs.

It does include engineering, diagnostic program, training of our people and spare parts.

RES/mro

COMPANY CONFIDENTIAL

ACCOUNTING
SERIAL NO _____

DEC PRICING FORM
COST ESTIMATE

SUMMARY

TOTAL DEVELOPMENT COST	# 11783.-
TOTAL SALES & ADVERTISING COST	-
TOTAL MANUFACTURING & MISCELLANEOUS COST	1000.-
SUGGESTED SELLING PRICE	# 25566.-
ESTIMATOR	R. Sewell
PRICER	E. Simeone
APPROVED SELLING PRICE	
APPROVED BY	DATE
COMMENTS	

EQUIPMENT NAME Control for CDC 9100-1700 CPM Card Reader TYPE _____

PURPOSE & DESCRIPTION Rough estimate of additional cost to connect card reader to 9200/PDP-6

CUSTOMER _____ DATE 2-17-65

ENGINEERING DEVELOPMENT COST ESTIMATE

LABOR AND OVERHEAD

	MECH. ENGINEER	TECHNICIAN	ELEC. ENGINEER	ASSEMBLER AND WIREMAN	TECH. WRITER	DRAFTSMAN	PROGRAMMER	METAL WORKER
TOTAL HOURS		460	440			120	160	
RATE PER HOUR		3	6.			3	4	
DIRECT LABOR		1380.- (1.7)	2640.- (1.7)			360.- (1.7)	640.- (1.7)	
OVERHEAD		1753.	3253.-			504	653	
LABOR & OVERHEAD		3133.-	5093.-			864-	1293-	

TOTAL-LABOR & OVERHEAD $ 11283-

MATERIALS - FOR ENGINEERING DEVELOPMENT ONLY

ITEM	COST	ITEM	COST

TOTAL DEVELOPMENT MATERIAL COST $ _____

MANUALS

PROGRAMMING $ _____

MAINTENANCE _____ $ _____

TOTAL ENGINEERING DEVELOPMENT COST (LABOR, OVERHEAD, MATERIALS & MANUALS) $ 11283-

IS PROTOTYPE TO BE CHARGED TO ENGINEERING DEVELOPMENT COST ? YES ___ NO ___

NUMBER OF UNITS OVER WHICH ENGINEERING DEVELOPMENT AND SALES COST IS TO BE AMORTIZED _____

SUMMARY

TOTAL ENGINEERING DEVELOPMENT COST $ 11283-

PROTO TYPE COST (IF PART OF DEVELOPMENT COST) _____

TOTAL COST TO BE AMORTIZED $ 11283-

ENGINEERING DEVELOPMENT COST PER UNIT $ 11283-

SALES COST:

ENGINEERS HOURS ___ $ _____

SALESMEN HOURS ___ _____

TRAVEL & LIVING _____

ADVERTISING _____

TOTAL SALES & ADVERTISING COST $ _____

SALES & ADVERTISING COST PER UNIT $ _____

MANUFACTURING COST ESTIMATE

LABOR AND OVERHEAD

	ASSEMBLER & WIREMAN	CHECKOUT OFF LINE	INSPECTION	CHECKOUT ON LINE	SHEET METAL MACH. SHOP	MISCELLANEOUS
TOTAL HOURS						
RATE PER HOUR						
DIRECT LABOR						
OVERHEAD						
LABOR & OVERHEAD						

TOTAL LABOR & OVERHEAD $ _____

MATERIALS

DC CATALOG ITEM	LIST PRICE	COST	ALL OTHERS	COST
			Spare parts	1000.-

TOTAL MATERIAL COST $ 1000.-

TOTAL MANUFACTURING COST (LABOR, OVERHEAD & MATERIALS) $ _____

MISCELLANEOUS COSTS

PROJECT LIAISON	$
SPECIAL CRATING & INSTALLATION	$
FIELD SERVICE	$
TRAVEL & LIVING COSTS	$
	$
TOTAL MISCELLANEOUS COSTS	$

TOTAL MANUFACTURING & MISCELLANEOUS COSTS $ 1000.-

COMPANY CONFIDENTIAL

PRICE CALCULATION

$$FP = 3(E) + [A - 0.1(3E)] + [B - 0.1(3E)]$$

$(3 \times 1000) + (2 \times 11283) = ₹ 25566.-$

Did not use formula as we are selling primarily a service.

A = ENGINEERING DEVELOPMENT COST PER UNIT
B = SALES & ADVERTISING COST PER UNIT
E = TOTAL MANUFACTURING & MISCELLANEOUS COSTS
FP = FORMULA PRICE

NOTE: POSITIVE AMOUNTS ONLY ARE TO BE USED IN DETERMINING FORMULA PRICE.

dec INTEROFFICE MEMORANDUM

DATE February 18, 1965

SUBJECT General Services Administration - Federal Supply Catalog

TO H. Anderson ✓
S. Olsen
N. Mazzarese
J. Shields
T. Johnson
T. Whalen

FROM Frank Kalwell

sent back to 5 because of bulk

I am presently gathering all pertinent information in an attempt to obtain listing in the Federal Supply Catalog (GSA). This means that the attached terms and conditions from GSA, for the most part, have to be agreed on.

Please review these terms and conditions as soon as possible so we can attempt to get listed this coming fiscal year. Once the Works Committee agrees on our being listed, I'd like to meet with the above, including Dick Testa, our company legal man, on next Wednesday, February 24th at 1:30 in Nick's office. Please contact me if this time is not convenient.

Please review the attached and make any comments.

Thank you.

dec INTEROFFICE MEMORANDUM

DATE February 19, 1965

SUBJECT Organizational Questions and Problems on PDP-6

TO H. Anderson ✓ FROM R. E. Savell

1. Confirming our recent conversation I will use A. Kotok and B. Scudney as much as possible to solve logic and circuit problems that still exist on PDP-6 so that these problems may be cleaned up as quickly as possible.

2. Do you consider that I still have total responsibility for all PDP-6 hardware including options in so far as the following items are concerned:

   Insure that all hardware design, diagnostic programming, checkout procedures, drawings, spare parts lists, maintenance manuals, acceptance test specifications, etc. as detailed by me in my memo of April 9, 1965, a copy of which is attached, are completed properly and as nearly on time as we can get them. This responsibility to apply only to those items that are designed as standard options and not those items that are designed as single shot items for a particular customer. If so, is my responsibility simply one of gathering information to report to someone else such as yourself who has the authority to attempt to solve problems?

3. What is my design review responsibility? Is it complete and absolute? In other words, am I responsible to see that the design will work or instead does this responsibility still remain with the project engineer and my responsibility remain one of insuring that a reasonable review takes place, getting together people like Alan Kotok, Len Hantman, Gordon and myself to see that a reasonable effort is made to cover all the bases?

4. Who should keep track of the financial progress of the various PDP-6 engineering projects? Sometime ago Gordon asked me if I would do this and I agreed at the time, but since I have been unable to get any assistance, such as Arthur Hall or even another technician, my work load has been such that it has been impossible for me to do anything on this.

5. Who do I report to, you or Gordon?

6. When we have my responsibilities firmly established will you expect formal status reports from me? If so, how often and what kind? If these will be reports covering the status of PDP-6 engineering projects form which I am not directly responsible will I have the authority to in turn demand and get reports from those persons who are directly responsible?

7. I believe we should have a formal procedure set up for quoting PDP-6 systems so that no deliveries are quoted without the written confirmation of the project engineer responsible for delivering the completely checked out equipment.

8. Please remember to talk to Larry White. I would like to see him keep doing the work he is presently doing for awhile and would be happy to have him do it as a part of the PDP-6 Engineering group rather than the Checkout group if need be.

9. We suffer from a continual shortage of technicians in Engineering. This is largely due to the way in which projects are planned since with few exceptions we never seem to know what the next project is going to be until we finish the one that we are presently engaged in. The result of this is that there is great pressure on most of the engineers to release whatever technicians they have as soon as their present project is completed, and not to agree to supply these engineers with any replacement technicians until the engineer knows exactly what the technician will be working on. By the time the engineer knows this, it is generally too late to get a technician to start the project and we are right back without enough help.

I presently am down to my last technician. I am being pressured to give him up to Dan Wardiman, and I am having a difficult time to drum up a replacement. Dave Adams, one of my other good technicians, is now working for Steve Lambert as a result of Steve having one of his people transferred out from under him without his consent. Bill Colburn is working on the drum project as a result of the fact that Dick Tringale has only had one technician working for him for some time.

I maintain that any engineer directly responsible for a project can keep two technicians and some times three occupied fulltime. An engineer who is responsible for supervising other engineers probably needs only one technician to assist him. I feel, therefore, that we should plan to hire enough technicians to maintain an average of two technicians per engineer at all times in the Engineering Department. Many of the projects which have suffered delays would not be as far behind as they are were there more technician help available.

10. How do we organize the design review and maintenance manual system? As a result of a number of discussions with Vericon, it would appear that a thorough design review such as Vericon performs in the process of writing our maintenance manuals is quite necessary. This can be done in one of two ways. Either someone of Vericon's caliber can do the entire job as it is being done now, or we can have our own engineering personnel do the design review portion and have technical writers then receive the data, assume that it is all correct, and write the manual. I favor the first approach if it is possible, however I am not sure we can get enough competent people who can be kept happy writing manuals.

11. The National Cash Register salesman tells me that DEC presently has two other 100 card per minute Card Readers on order. This indicates that we are selling these items without having performed a thorough evaluation of the first unit that we ordered. I don't believe that this is a good idea.

12. I would also like to talk a bit more specifically about my place in hardware development in the new organization and about my prospects for the future at Digital.

13 Let's hire a replacement for Ted Strollo and put him to work on the JOSS Consoles. The only other prospect for PDP-6 type work I have heard mentioned is Larry Seligman, but I have a feeling that he is going to be tied up for quite a while on PDP-7.

RES/mro

April 9, 1964

PDP-6 RESPONSIBILITY

This memo is an attempt to define the various jobs necessary to complete PDP-6 and to clarify, by means of the sheet attached to this memo, who is responsible for each portion of that job, when that job should be completed, and when we can expect to have it completed.

The fact that you are indicated as being responsible for a particular project or section of a project is not to be construed as an assigment of that project to you, since in many cases I have no authority to make such assignments; rather it is simply my understanding of responsibilities as they have been assigned by myself and others.

There are three copies of the assignment sheets attached, one of which you can give to your immediate superior for his information, the second which you can keep for yourself, and the third which should be checked over thoroughly and returned to me by April 17th with the expected completion dates spaces filled in. If the sheets are not returned, or are returned with blank completion dates, it will be assumed that you and your supervisor have agreed to have the designated task performed by the due dates indicated.

The due dates have been assigned, based on the attached flow sheet, with the goal in mind that all necessary documentation and test procedures will be 100% complete by the time the first production machine is ready for shipment. They have also been assigned to some extent in the order in which equipment will be required for shipment to the customer, however these dates are only to serve as guides and are subject to change due to customer pressure, etc., so they should be bettered wherever possible in order that we can wind up this initial design phase of the PDP-6 system.

A minimal amount of checking on progress will be made once the expected completion dates are agreed upon. It is each persons responsibility to let me know as soon as possible if the schedule is slipping.

Please note that if you are assigned overall project responsibility for a piece of equipment in the system that you are completely responsible for the completion of the entire project including those parts of the project, such as MAINDEC programs, which may actually be produced by someone else.

If there are any questions regarding the assignments or due dates or about the job definitions contained in this memo, please get in touch with me as soon as possible.

The due dates assume shipment of first production units to a customer as follows:

AP, PTR, PTP, TTY	July 15th
DC, Microtape	August 15th
FM, 16K 5 μsec.	September 15th
516, 521, 570, LP, CR	September 30th
Display 346	January 15, 1965

with no schedule as yet for IO Processor, CP, Drum 520, 522, 63.

DEFINITIONS

Initial Price:

A price that has been prepared on a standard DEC pricing form and submitted to the Computer Guidance Committee for approval.

Due Date:

The date on which not only the equipment is available for shipment to a customer, but on which all documentation referred to on the check list is also in its completely finished form i.e., drawings all signed off and available via routine request to the print room; maintenance manual printed in its finished form; etc.

Electrical Drawings & Mechanical Drawings:

The required drawings will be listed in another memo.

Off-Line Tester:

A quite powerful off-line tester has been designed for production testing of peripheral equipment. It should satisfy the needs of almost everyone for the checkout of controls, assuming a running tape drive, card reader, etc. Dave Pinkney is producing this tester. Please see him for details.

Off-Line Test Procedure:

Test specifications, and test data sheets. This again is somewhat self-explanatory. The documentation should be in a form adequate to be used by Computer Checkout and/or Peripheral Equipment Checkout personnel.

On-Line Test Procedures:

On-line test procedures, test specifications and data sheets. Again somewhat self-explanatory. The programs used with the on-line test procedures will probably be the MAINDEC programs. However, there may be, at the discretion of the equipment designer, other on-line test programs which are required. The test procedures should outline which programs are to be used, how long they are to be run, allowable error rates, margin range which must be met, and in general any other information necessary to instruct Computer Checkout or Customer Relations or Peripheral Equipment Checkout personnel so that they may thoroughly check out the equipment with no additional verbal instructions.

On-Line Test Program:

In most cases these programs are probably not required, the MAINDEC program serving the purpose of an on-line test program. Where applicable however, the test program must be filed in the program library by the due date along with write-ups giving complete instructions on how to use the program and with the program and with the program listing.

MAINDEC Program and Write-Up:

As with the on-line test programs, the completed program, instructions for its use, and the final printed MAINDEC booklet must be available from the Program Library by the due date. The programs alone should be available for checkout purposes as soon as possible after the prototype completion date.

Acceptance Test Specifications:

A written document must be available on the due date listing all the requirements for the running of customer acceptance tests. This includes operating instructions, programs required, duration of run, error rates, margins, etc.

Rough Maintenance Manual

This must be submitted in corrected typewritten form i.e. free from pencilled in corrections to Bob Beckman on the date specified. There is attached to this memo a guide listing the type of information required for the manuals.

Finished Maintenance Manual:

The completed manual suitable for shipment to the customer should be available on this date.

Maintenance Class Established:

A curriculum must be written and the persons responsible must teach the first class approximately on the date specified.

Preventive Maintenance Procedure:

A document apart from the Maintenance Manual and entitled Preventive Maintenance Procedures must be available listing daily, weekly, monthly, etc. preventive maintenance procedures. Where these procedures require detailed instructions which are too lengthy to be gone into on this sheet, the proper document should be referenced. This sheet should also include a list of any special tools that are required for each procedure. Field Service personnel can be of great assistance in preparation of these procedures.

Customer Parts List:

This is once again a list of items apart from the maintenance manual. It should include all items which are likely ever to require replacement such as indicator panels, toggle switches, modules, motors, belts, etc.

Recommended Spares List:

Those parts, along with quantities recommended, that a customer should stock as spares. This list should also become a part of the maintenance manual.

Programming Manual:

This document is to some extent an operator's manual and probably contains some of the same information contained in the maintenance manual. It must contain all information necessary to allow a programmer to program the piece of equipment it describes. This, of course, is not limited to in-out instructions and a status bit description, but includes many other items. For instance, the Card Reader Manual will include the list of translated codes from Hollerith to binary, a list of all invalid characters, a description of all the operating controls on the card reader's operating panel, a description of the indicator lights, a description of all error indications and why they may occur, etc. A copy of this manual is attached for reference.

Rough Installation Manual:

The information required is the physical and electrical characteristics necessary to prepare for installation of the equipment. The PDP-1 Installation Manual will provide you with a guide to the sort of information required. There are a few copies available in my office that may be borrowed. This information must be supplied to Bob Beckman by the due date.

Final Price;

The date by which the initial price should be reviewed to see whether manufactured cost, engineering cost, etc., were estimated correctly. Any adjustments necessary should be made.

Rough Sales Material:

A document showing all configurations of each piece of equipment which are available along with delivery times after receipt of order and with price information. The available configurations and prices should agree with the initial drawing in the electrical drawing format.

Finished Sales Material:

The finished collection of material described above.

50 Cycle Power Availability:

Due to the fact that we are quoting PDP-6s for round the world distribution, each piece of equipment must be able to be delivered so that it will operate with 50 cycle power input. Jon Fadiman advises that single phase 50 cycle is available everywhere with very good frequency regulation. The voltages used vary widely, however, within two ranges: 90 to 140 volts and 198 to 264 volts including tolerances. Nominal voltages are 100, 115, 127, 220, 230, and 240 volts. Suggested methods of coping with the variety of inputs are tapped transformers, variacs, or units bought especially for the particular input required. The information needed is the additional price, if any, and the delivery time for each piece of equipment. Don't forget to include all items in your investigation such as relay coils, contactor coils, fan motors, regular motors, power supply transformers, etc. Also don't forget you may have available a 50 cycle power source large enough to handle your equipment for testing.

Prototype Completion:

The date on which the prototype model is completely finished and installed on the prototype PDP-6 system, has been run with margins, is completely checked out and is available for use by programmers.

First Production Unit Completed:

The date on which we can ship out the door to a customer or deliver to Computer Checkout the first production unit. Dates given are not to be construed as an order to build, but are the earliest delivery dates that we know about today that may have to be

met.

Purchased Items:

The incoming inspection procedures and specifications and acceptance test specifications both apply primarily to peripheral equipment and are included primarily as reminders that these items must be taken care of.

Information Required For Maintenance Manuals For PDP-6

The persons using these manuals may have no familiarity whatsoever with DEC equipment or terminology so the use of undefined terminology (familiar as it may be to DEC employees) should be avoided.

If there is any doubt about the necessity of including any information it would probably be wise to include it as it will be easier for the reader to disregard it than to come back to the designer to find it.

Desirable information not mentioned in the outline should be fitted into one of the existing categories if at all possible. Where this is impossible, a special section should be added just before Tables and Drawings.

In the case that the manufacturer's manual for a major piece of incorporated purchased equipment is inadequate, confusing or nonexistent, a thorough functional explanation of this equipment should be added as a separate section.

Details listed under the sub-headings can be placed in any logical, convenient order or may be omitted where not pertinent.

If accessories to and/or modifications of the basic equipment are available as Standard Options their functioning should be described. Their status (available modification or accessory) should be noted.

TITLE PAGE:

i. Table of Contents

ii. Here should be listed the names and numbers of all pertinent documents and a mark to indicate which are included in the manual. Manufacturers manuals on purchased equipment such as power supplies, CRTs, printers, readers, etc., should be listed and whenever possible, accompanied by a note which tells how and where these manuals may be obtained.

I. General Description

A. What does this equipment do?

(eg. prints x lines a minute, 120 char. across, 8 formats, 5 available widths of paper, good carbons, etc.) Ten to twenty lines should be sufficient.

B. Physical Specifications

.Dimensions

.Weight

.Floor loading (lb./sq. ft.) (#of support points)

.Method of moving (casters, hoists, skid, lift by hand, etc.)

.Additional space required for opening doors, pulling equipment out on slides, removing filters, etc.

.Paint specifications (for touch-up)

.Cooling method(s) used and power dissipation

.Heat and humidity limitations

.Location of control logic, power supplies, controls, etc.
(This should refer to a layout included under Tables & Drawings)

.Mechanical safety requirements (written in capitals and separated from the rest of the text so that it cannot be overlooked)

.Lighting recommendations

.Vibration (caused by or affecting our equipment)

.Is the equipment primarily for seated or standing use or both?

C. Electrical Specifications

.Power requirements: (one phase, two phase, three wire, four wire; what connector; input voltage, current and frequency, starting current, how fused or breakered, frequency and transient regulation required)

.Power and logic cable mating connector information

.Maximum allowable cable lengths

.List all indicators and their significance

II Interface Signals

A. Between Computer and Control

List the polarities, length, rise time, etc., and tolerances of the signals, both level and pulse which pass between the computer and the control logic. Use the same terms which appear on the logic drawings. If abbreviations or mnemonics are used either in the text or on drawings, see that they are defined where used.

B. Between Control and Purchased Equipment

The same holds as in A above. Outline logic system used by the manufacturer and define his signal designations.

C. Timing Requirements

How soon do return pulses appear after command; how soon after one command may another be given, etc.

III Logic

A. A description of the logical functioning of the control with reference to
B. drawings included in the manual. The description should be sub-divided
C. in some logical manner to make reference easier. If you give a name to
D. a counter, gate, matrix etc., try to make it as useful as possible and in-
etc. sure that the drawing does not list a different name.

IV Special Circuitry

A. A functional description of all circuits used in the equipment which are
B. not described in easily available literature (such as a catalog)
C. Power controls, special modules, etc. would come under this definition.
etc.

V. Power

.Distribution methods

.Supplies: Number and types, capability & spare capacity, regulation, etc.

.Adjustment

.Grounding system used and motives, where pertinent

VI Maintenance

.Periodic adjustments: List tools and exact equipment required.

.Trouble-shooting - A chart showing the most common problems and solutions is frequently the most useful expedient.

.Tester: If a special purpose tester is used, describe its purpose, use and limitations.

.Periodic Maintenance: List under time-period headings the maintenance required on the equipment. Describe maintenance on DEC-made equipment completely. Refer the reader to the manufacturer's manual for details (if it is available to the customer) of maintenance on purchased equipment. (Don't forget to call for cleaning of air filters.)

.Parts list and recommended spares list.

Tables and Drawings

All logic drawings and wiring diagrams should be included. Any layout which may help a technician to find his way around the equipment should be included. Tables will be numbered from 1 up. Sketches, layouts, etc., will be identified by Figure 1 up. Drawings will use their own numbers for identification. Drawings should be reduced as much as possible while still being readable. Any drawing, table or figure which is referred to in detail in the text should be so bound that when it folds out no printed part is covered by any other page. Tables should come first, followed by Figures and then drawings. Sheets in this section should not have page numbers.

Card Reader Programming For 200 cpm Card Reader Type 421A For Ft. Meade

The Card Reader 421A will read either Hollerith or binary IBM punched cards at a rate of up to 200 cards per minute. Operation is on a card by card basis with a separate Read Card command required for each card to be moved. Once a command has been given, the reader will read the entire 80 columns of information on a card. The information is presented to the computer in a column by column fashion, hence there is no need for a "turn the corner" program to re-orient the information once it is in the computer.

Before any cards can be moved, the following conditions, indicated on the reader control panel, must be met:

1. Power on switch must have been depressed and be lighted.
2. Not ready indicator must be extinguished.

A Not Ready condition is caused by one of the following:

A. Covers not in place

B. Power Off

C. Start button has not been depressed

D. Validity check error (if validity on switch is lit)

E. Card jammed or failed to feed (Feed check indicator lit)

F. Read circuit failure (Read check indicator lit)

G. Hopper Empty

H. Stacker Full

If conditions D, E, or F above are present, they should be able to be corrected by pressing the reset push button on the control panel.

Emptying the stacker, placing cards in the hopper, and depressing the start button should extinguish the Not Ready indicator. At this point the reader is ready to accept a Read Card command.

If at any time during the card reading process the Stop button is depressed, or any of the other Not Ready conditions D through H occur, no further card moving Read Card commands will be accepted by the reader and the Not Ready level will become true.

The Validity On switch and Validity Check indicator are effective only in the Alpha-numeric mode. Every single column read in the Alpha-numeric mode is checked for validity whether or not the Validity On switch has been depressed. The invalid punch combinations are listed in Table A. If an invalid character is detected, all zeros will be presented on the information lines. If the Validity On switch has been depressed and an invalid character is detected, the Validity Check indicator will light, the Not Ready level will become true, and no further card moving Read Card commands will be accepted by the reader.

The card moving commands for the card reader are as follows:

RCA	XX40	Read Card Alpha
		Select the card reader and start a card moving.
		Information will be presented to the computer in
		alpha-numeric form.

RCB XX41 Read Card Binary

Select the card reader and start the card moving.

Information will be presented in binary form.

Remember that one of these card moving commands must be given for each card to be read. Once one of these commands is given, the reader will read all 80 columns of information.

To transfer information from the card reader to the computer, the program must respond to an interrupt which will occur each time a column of information is available by giving a Read Card Column command.

RCC XX32 Read Card Column

Read the card column information into IO bits 12-17 and clear the Read flag.

Information will be present for only 300 microseconds after the interrupt occurs; hence the RCC commands must be okay given during this interval. The interval between data interrupts is approximately 2.3 milliseconds.

When in the Alpha-numeric mode the 6 bits transferred are a conversion from the Hollerith information on the card as shown in Table C; hence only one RCC instruction per column is required. In the Binary mode all 12 bits, or rows, of each column may be obtained. The first RCC instruction will transfer the upper 6 rows (Y, X, 0, 1, 2, and 3); the second RCC instruction will transfer the lower six rows (4, 5, 6, 7, 8, and 9). The relationship between the binary information on the card and IO bits 12-17 is shown in Table B.

An interrupt will also be caused by a Card Done level and a Not Ready level. When an interrupt occurs, theprogram must perform a CKS (CheckK Status) instruction to determine which of the levels caused the interrupt. Status bits assignments are as follows:

Bit 11	Read ^{1} Column information is present
Bit 12	Card Done
Bit 13	End of File

If after an interrupt none of the above status levels are a one when the CKS command is given, it is assumed that the interrupt was caused by a Not Ready condition. Since the Not Ready level may go true at any time, the possibility exists that it may go true simultaneously with either Card Done or Read ^{1}. If this happens, the Not Ready will be undetected by the program, since it cannot be sensed by the CKS command. Should this happen, the card that is being read will continue to be read; however, the next RCA or RCB command will not be able to move a card. This condition must be detected by the operator.

Note that the Not Ready condition may be caused by at least two conditions normally encountered during operations: These are Hopper Empty and Stacker Full.

The Card Done level will go false as soon as a card moving command is given and will not go true until all 80 columns have passed the read station. This is shown on the timing chart in Table D. If a Not Ready interrupt occurs while the Card Done level is false, it should be ignored until the Card Done level is true, since in most instances it will be caused by Hopper Empty or Stacker Full. The occurrence of these conditions during the reading of a card will in no way interfere with the presentation of proper information to the computer.

Upon receipt of a Card Done interrupt the program should check to see if the Not Ready condition has already occurred. It if has not, another card may immediately be read. If it has, some sort of manual intervention is required, most commonly emptying the stacker and replenishing the supply of cards in the hopper. Once this has been accomplished and the Start button has been pressed, card moving commands will again be accepted by the reader.

If there are no further cards to be read, the End of File button should be depressed and this condition sensed by the program.

TABLE A

INVALID PUNCH COMBINATIONS

1 & 2	2 & 3	4 & 5
1 & 3	2 & 4	4 & 6
1 & 4	2 & 5	4 & 7
1 & 5	2 & 6	4 & 9
1 & 6	2 & 7	5 & 6
1 & 7	2 & 8	5 & 7
1 & 8	2 & 9	5 & 9
1 & 9	3 & 4	6 & 7
1 & 0 & 11	3 & 5	6 & 9
1 & 0 & 12	3 & 6	7 & 9
	3 & 7	8 & 9
	3 & 9	11 & 12

TABLE B

DATA AND STATUS BIT ASSIGNMENTS

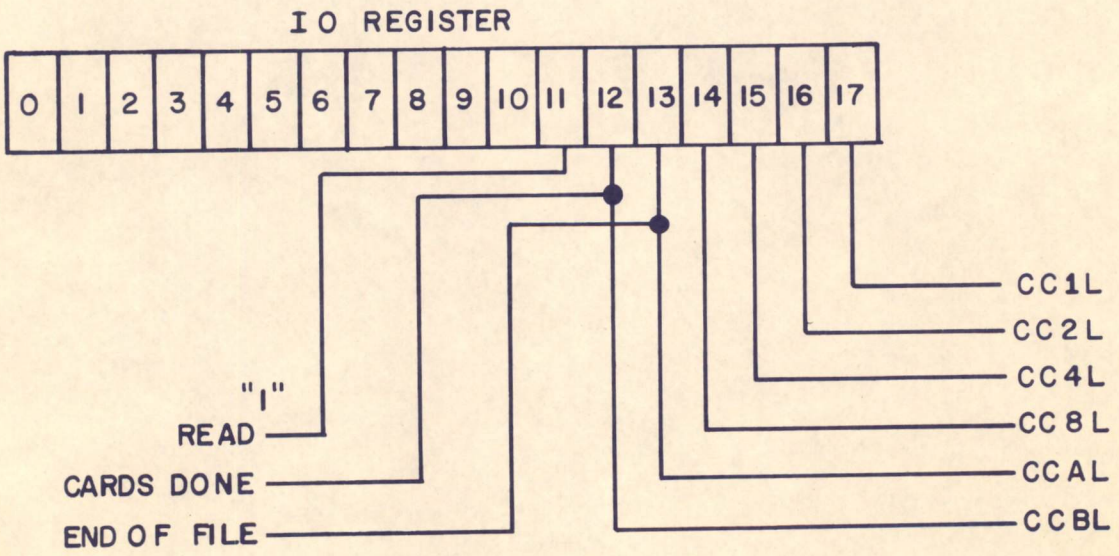


TABLE C

CARD READER CODE

A	61	Q	50	6	06
B	62	R	51	7	07
C	63	S	22	8	10
D	64	T	23	9	11
E	65	U	24	+	60
F	66	V	25	−	40
G	67	W	26	/	21
H	70	X	27	=	13
I	71	Y	30	,	33
J	41	Z	31	$	53
K	42	0	12	.	73
L	43	1	01	'	14
M	44	2	02	(	34
N	45	3	03	*	54
O	46	4	04	)	74
P	47	5	05	BLANK	20

HOLLERITH CARD CODE

DIGIT	ZONE			
	NO ZONE	12	11	0
NO PUNCH	BLANK	+[&]	−	0
1	1	A	J	/
2	2	B	K	S
3	3	C	L	T
4	4	D	M	U
5	5	E	N	V
6	6	F	O	W
7	7	G	P	X
8	8	H	Q	Y
9	9	I	R	Z
8-3	=[#]	.	$	,[%]
8-4	'[@]	)[□]	*	(

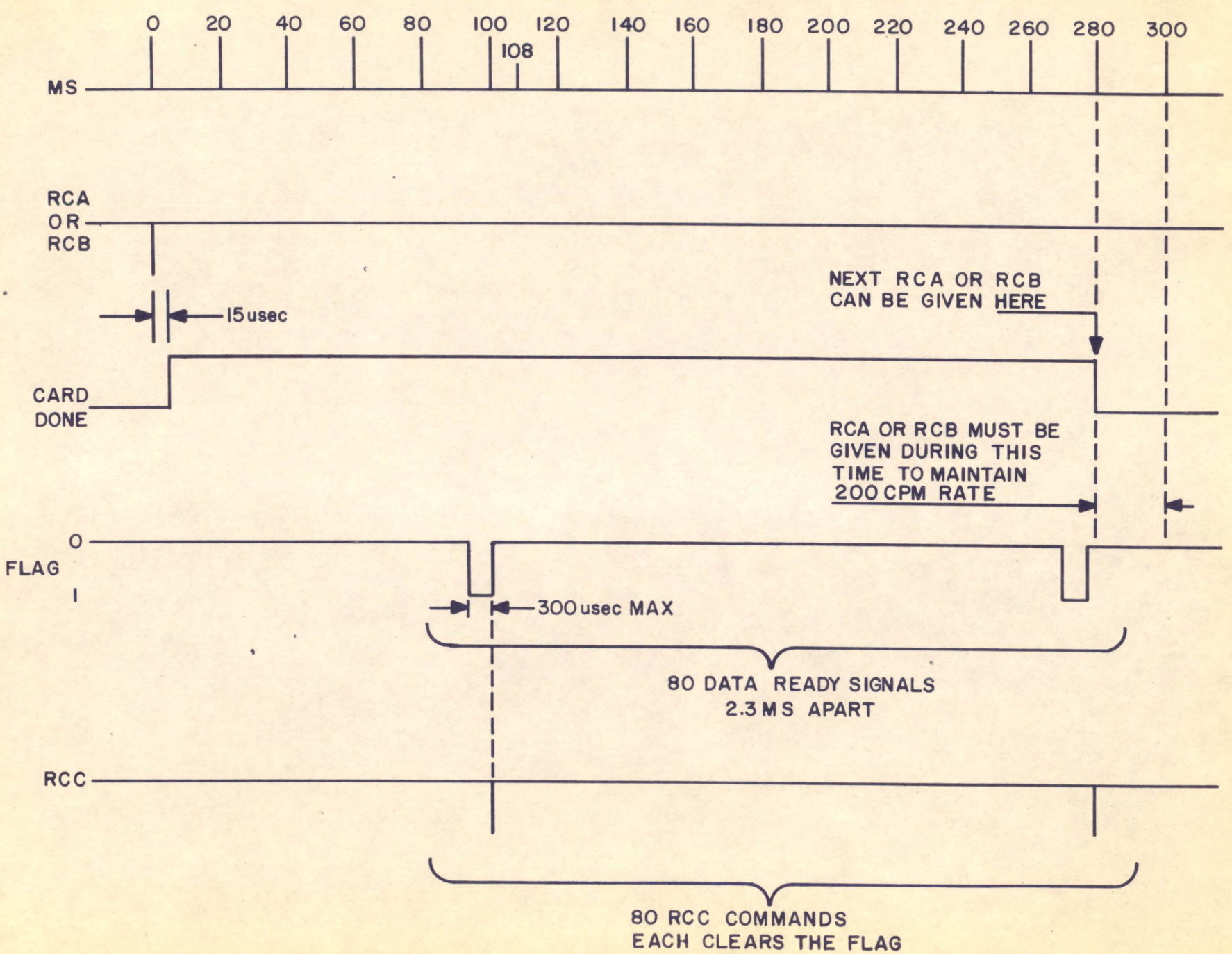
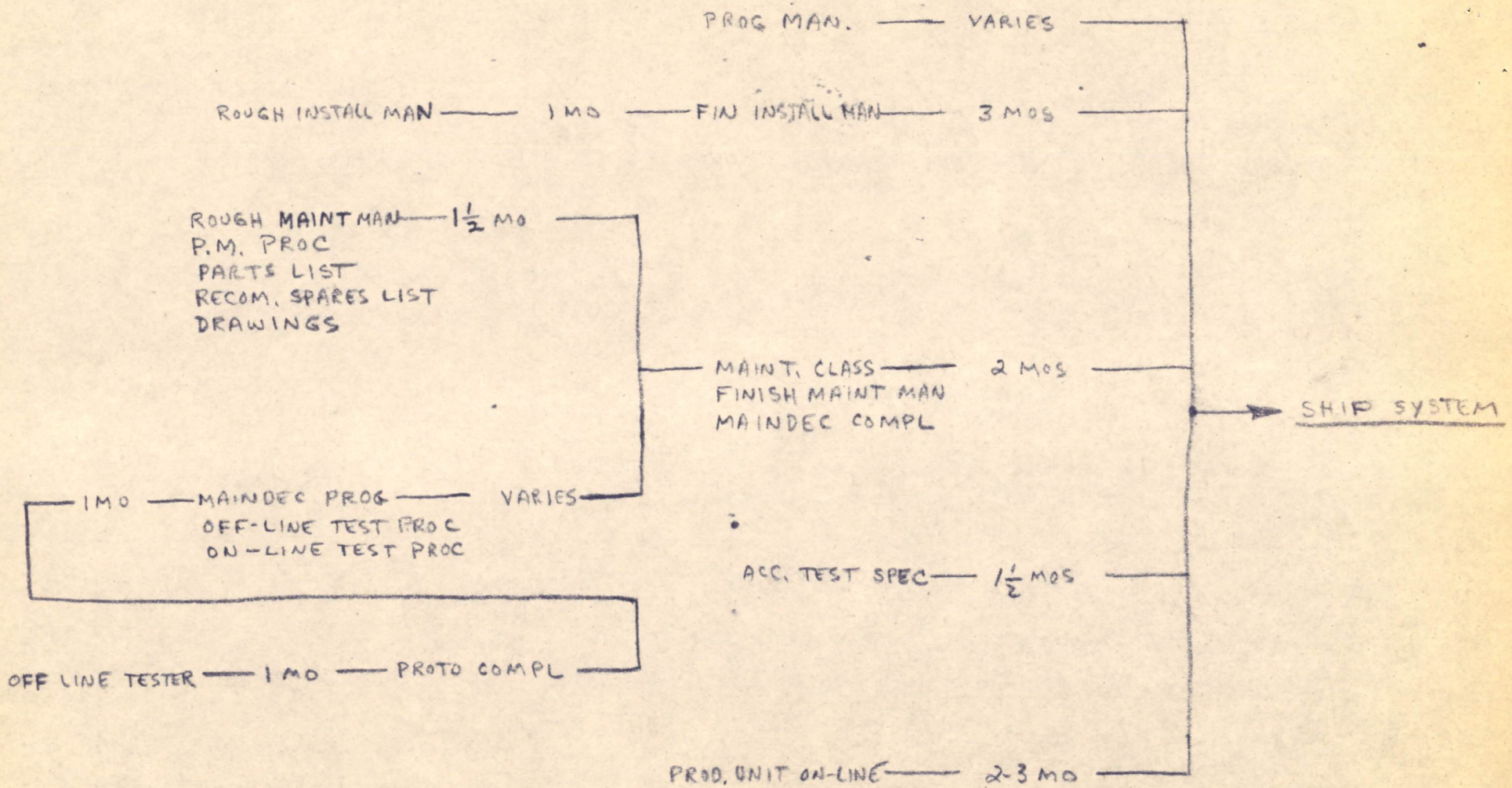


TABLE D: TIMING CHART FOR TYPE 421 CARD READER



PDP-6 Flow Sheet

RES

4/3/64

PDP-6 PROJECT

Project Engineer _____

	Person Responsible*	Due Date	Completion Date
Initial Price			
Electrical Drawings			
Mechanical Drawings			
Off-Line Tester			
Off-Line Test Procedure Specs. & Data Sheet			
On-Line Test Procedure Specs. & Data Sheet			
On-Line Test Program			
MAINDEC Program & Write-up			
Acceptance Test Specification			
Rough Maintenance Manual			
Finished Maintenance Manual			
Rough Sales Material			
Finished Sales Material			
Maintenance Class Established			
Preventive Maintenance Procedure			
Customer Parts List			
Recommended Spare Parts List			
Programming Manual			
Rough Installation Manual			
Finished Installation Manual			
Final Price			
50 Cycle Power Availability			
Prototype Completion			
First Production Completion			
Purchased Items			
Incoming Inspection Procedures Specs.			
Acceptance Test Specifications			

*Where no name is indicated under person responsible, the project engineer is assumed to be responsible.

INTEROFFICE MEMORANDUM

DATE February 19, 1965

SUBJECT User Mode IOT's

TO R. Savell
A. Kotok
Programming
R. Beckman
R. Lane
H. Anderson

FROM Gordon Bell

A modification to the 166 to help relieve some of the Real Time strain seems desirable. This would allow a program running in user mode to issue iot commands if a switch were on.

GB/mro

H Anderson

MINUTES OF MEETING ON PRODUCT DOCUMENTATION
February 18th, 1965

PRESENT: R L Best, A Hall, R Hughes, E Harwood, R Savell, M Sandler, R Melanson, C Gadzinski, Chairman.

The object of the meeting was to discuss a product documentation program. Mr Gadzinski defined a product documentation effort as those documented pieces of engineering information required to fully define the product. During the discussion it was noted that at the present Manufacturing, Engineering, Purchasing, and Drafting contributed to this effort. It was further discussed that there were some obvious gaps in the present effort.

The concensus of the meeting was that -

1. A total documentation plan should be developed and placed under a central control.

2. The gaps especially those concerning product specifications should be filled in.

Mr Gadzinski, working with Arthur Hall and Roger Melanson, will develop procedures for the implementation of these programs which will be subject to review of those present prior to any action being taken.

CG:ASJ

CC
D Packer
W Hindle
J Hastings
H Anderson
K Olsen

N. Anderson

FEB 24 1965

18th February, 1965.

Geoff Finch

John Leng

The following are PDP-6 Potentials we have visited and require following up with proposals etc.

Location	Who Visited	Potential	Require
Edinburgh Univ. Mr. Michaelson	J. Leng, Bob Lane Alan Kotok	40% * Verbal intent	Latest literature and Visit
Oxford Univ. Dr. Mulvey	J. Leng, Perry Harris J. Fadiman	90% * L.O.I.	Latest literature and Visit
London Univ. Peter Pauling	J. Leng	10%	Complete set of literature. Visit.
Imperial College Prof.Butler	G. Finch, R.Lane	40% *	Satisfactory Rental terms.Visit.
Southampton Univ. Dr. Samet	J. Leng	20%	Fortran details latest lit. Visit.
Swansea Univ. Mr. Gurr	J. Leng, J. Milton	20%	Lateet details, Fortran etc. Visit.
Road Research Lab.Datchet Mr. Chandler	J. Leng	20%	Quotation and latest lit. Visit.
AERE Harwell Mr. Curtis	J. Leng,G.Bell, Perry Harris	10%	Check on status of our proposal.Visit.
NGTE,Pyestock Mr. Nicholls	J. Leng,J. Milton	30% *	Reply to Air Ministry RFQ when it comes in.
NIRNS,Rutherford Laboratory Davd Lord	J. Leng	10%	They're looking for a large machine. Visit.
NIRNS,Daresbury Dr. Collinge	J. Leng, J. Milton	10%	Check on status of our proposal.
STC Fossey.	G. Finch	10%	Visit & Proposal.
Sheffield Univ. Dr. Evans.	J. Milton,J. Leng	20%	Proposal, Lit. Visit.
Manchester Univ. Prof. Kilburn	-	10%	They're looking for a large machine. Visit.

Queen Mary College Dr. Collins	?	10%	Visit
Reading Univ. Dr. Dresel	J. Leng	20%	Latest lit. Visit. etc.
Stadskansliet Lars Danaro	T.Wilhelm, T.Arbeus J. Leng	20%	Proposal
University of Sussex	G. Finch	?	? Visit.
University of Nottingham Dr. Pitteway	J. Milton	10%	Visit. Latest literature
University of Birmingham.	J. Leng	10%	Visit. More lit.
RAE Farnboro* Maths. Dept. D. Williams.	J. Milton	10%	Visit. More Data

* Those customers who are making an active attempt to buy our equipment.

I'd like you to prepare a plan of campaign aimed at installing or getting purchase orders for 10 PDP-6 Systems by the end of 1966. This does not seem an unreasonable number to aim at either from the potential market point of view or from the point of view of production, installation and maintenance.

We should have a meeting of all UK staff next Wednesday evening after Wally's programming class to discuss this plan and what we should all do to help achieve this target.

c.c. J. Fadiman ✓
S. Olsen
N. Mazzarese
G. Milton
W. Spittle

dec INTEROFFICE MEMORANDUM

DATE February 19, 1965

SUBJECT Grouping of Areas of Responsibility for PDP-6 and Other Computers

TO H. Anderson ✓ FROM R. E. Savell

I would like to suggest the following groupings of the areas you specified the other day:

Group One:	Software Development
Group Two:	Library and Software Documentation; Applied Science Representatives
Group Three:	Front Line Sales; Market Support and Direction
Group Four:	Hardware Development; Special Engineering
Group Five:	Checkout and Training

It is not obvious to me that Special Engineering should go with Hardware Development. It might fit as well under Checkout if, as it does today, Checkout really covers everything from contract administration to customer liaison, production planning, computer checkout, acceptance testing, and installation.

It is not obvious either that Training belongs with Checkout. I think I am biased in my judgement though, due to the fact that I believe a really competent person is required for each of these areas, not just one person to run both. Also, I feel we have never done nearly as good a job as we should in training people on those items of equipment which cause us the most trouble, namely Peripheral Equipment. Lastly, that the Field Service Department has seemed to show more interest in this sort of training than those people who are providing it at present.

Enclosed is a memo on the subject which I wrote quite some time ago.

RES/mro

File.

dec INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT Peripheral Equipment: Service, Training, and Maintenance

TO Bob Beckman

FROM Bob Savell

Due to recent troubles that have occurred on the PDP-4 in building 12 and also due to the advent of PDP-6, with what I feel will be many installations containing amounts of peripheral equipment similar to that on the 4, I have come to the conclusion that both you and I have not done all we should in the peripheral equipment area. The areas that I think need improvement are:

1. Preventive Maintenance
2. Training of personnel

I think we have been fortunate that aside from reader, punch, typewriter, and tapes there is practically no mechanical peripheral equipment in the field. PDP-6 installations, however, look as if they will have lots of it. I am firmly convinced that this equipment will not operate reliably for any length of time unless routine preventive maintenance is performed faithfully. I have visited a Burroughs installation and talked to a number of their people about this point. I am very impressed with their methods and from what the customers say it apparently pays off.

I feel that a weekly, or at the least bi-weekly, period of 1 to 1 1/2 hours per piece of equipment for P.M. is an absolute necessity. In addition, there are a few things that should be done daily. The greatest percentage of time spent on P.M. should undoubtedly be on man done mechanical things like greasing gears etc. An installation like the 4 in Bldg. 12 then would require about 6-9 hours plus whatever time reader, punch, and typewriter take.

We will, I understand, have one field service person permanently assigned to each PDP-6 installation, so the above mentioned P.M. times should present no problems.

I feel strongly that if this sort of thing is not done I can guarantee never ending troubles with the peripheral equipment.

We would provide a list of preventive maintenance procedures to follow apart from those in the maintenance manuals so people won't have to dig through the manuals, however some of the best items in a procedure list of this sort will certainly come from the people actually performing the P.M.'s, so they should be required to submit on the P. M. field service report any procedures they follow that are not on the list. These will then be added to the list.

This all leads to the second item which is training. I firmly believe that we can no longer have a Bill Newell plus assistants to handle mechanical maintenance. First, because the work load will be too great as will be the problem of transporting these guys

from installation to installation and secondly, because there just is no need for it. Any competent computer field service man is capable of becoming a competent mechanical man. They probably won't like it because it means getting their fingers greasy, but if all of them are made to do it -- like it or not -- I believe it is the most efficient way to run things since no matter how many P.M.'s we do the majority of field service troubles will probably be mechanical. They can't learn the gear the way they learn it -- what little of it there is -- today, that is by osmosis. We must have formal classes set up for readers, punches, typewriters, MAG TAPE, card reader, card punch, etc. These must not be attended on an "if available" basis but on a full time basis. Of course my people, computer checkout, and production checkout people should be included in these classes.

I think the time to begin to schedule the classes is now. Of course, I realize you can't spare anyone to attend or teach, and neither can I, but if you agree that they're necessary then between us we should set up some sort of plan and then try to convince others if more convincing is necessary. I expect that both of us would contribute, at least at the beginning, instructors and curricula.

So, those are my thoughts. I'd like to hear yours.

RES/lal

dec INTEROFFICE MEMORANDUM

DATE July 2, 1964

SUBJECT Training of Field Service Personnel on Peripheral Equipment

TO J. Shields, K. Senior, R. Beckman, H. Anderson, G. Bell

FROM Bob Savell

This is to reiterate once again my often stated feelings on training of service personnel to maintain peripheral equipment.

I feel that PDP-6 personnel must receive thorough training on all items of peripheral equipment they are expected to maintain if they are to do a good job of preventive and corrective maintenance. My estimate of the time required to perform this training is a minimum of one to two days each for Paper Tape Reader, Paper Tape Punch, and Teleprinter, and a minimum of three to five days for each of the other items of peripheral equipment.

RES/ll

INTEROFFICE MEMORANDUM

DATE February 19, 1965

SUBJECT

TO B. Scudney
L. White

FROM R. E. Savell

CC: H. Anderson
R. L. Best
R. Beckman

I received a memo recently from Larry White listing PDP-6 module problems. I have come up with a couple of questions regarding the points in the memo and also a few additional problems.

On the 6205-6615 system problems:

1. What failures occur?
2. Which failure is it that the module tester does not detect?
3. Which pulses generated by the 6205-6615 modules decreases in amplitude at lower temperatures?
4. What failures specifically have occurred under the conditions mentioned?

We have been through a number of modifications to the 6205 boards. Do all the 6205's that you are presently working on have identical circuit configurations and are component values all alike? If not, why not, and is there any correlation between differences in the boards and the troubles that are occurring?

Additional Problems:

Under 6615 problems add that only a 2 volt amplitude pulse can be observed at the input to the 6615's. This results in poor -15 volt margins of the pulse amplifiers supplying these pulses. Is this simply a termination problem? If not, what can be done to improve the amplitude and thereby increase the margins.

I didn't see any mention of 6206 problems or 6203 problems. However, on the 6203's I understand that 100 ohms series resistors must be added to all the outputs. Should these be added inside the board? If not, have they been added to the wiring diagrams via an ECO?

The 6131 output oscillates. Russ Doane has further information on this problem.

We would like to provide the 4658 with more driving capability so that more than 20 capacitor diode gates and greater than 100 feet of IO bus cable may be driven.

Frank Fortin has told me that numerous 1609 PA's produce 100 nanosecond wide pulses instead of 70 nanoseconds wide. Can anything be done to overcome this problem?

RES/mro

dec INTEROFFICE MEMORANDUM

DATE 23rd February, 1965.

SUBJECT

TO Harlan Anderson, Nick Mazzarese, Jon Fadiman.

FROM Geoff Finch GF2

We are often asked how much of the price of our equipment is for software. The answer is never "none" - if it were, we show ourselves likely to give weak software support.

Roughly what percentage do we allow in the price of the PDP-6 or are our software development costs merely taken out of profits. It seems to me we must have a policy based on the former, not the latter, if we are to offer proper software.

DEC. INQUIRY NO. 51

c.c. S. Olsen

digital MEMO

DATE 2-23-65

TO H. Anderson FROM Jack Shields

This is a copy of the Test and Inspection Record for the Desy-Hamburg PDP-5, which Guenther Huewe had so many problems with in the field.

As you notice there isn't any acceptance test signature. This is due to the fact that again we were pressed for delivery and the acceptance test procedure was over-ridden by John Fadiman.

enc.
CC; T. Johnson

TEST AND INSPECTION RECORD (Refer to Perm. Memo 1163A-12-9-63)

JN 1005-22 ITEM PDP-5 #22

EN _____ CUSTOMER DESY HAMBURG D.C.S. Hamburg

Project Engineer assigned E. Harwood Dec Tape

Intermediate QC Inspections Date 11-2-64 By B. Dawson

Checkout Completed Date 11-16-64 By A. Lee R. Defosse

Margins

Room Temp. Date 11/17/64 By A. Lee R. Defosse

Elevated Temp. at 105 °F Date 11/21/64 By E. L. Harvey R. Defosse

Final QC Inspections Date 12-3-64 By B. Dawson DOS

Released by Project Engineer Date 12/3/64 By ED HARWOOD IRM

Acceptance Test Date _____ By _____

Released to QC Date 12/4/64 By R L Berg

Final QC Approval and Release for Delivery Date 12-4-64 By R. Hughes QC Manager

Acceptance Test — Did not have time to give complete Acceptance Test. Programs Ran but only for brief periods — R.L. Berg

5.0
5C
-
5.0
5.0
5.5
6.0
>5.0
5.0
4.5
5.0

INTEROFFICE MEMORANDUM

DATE February 24, 1965

SUBJECT Reference for Mr. Bernard Haus

TO Harlan Anderson
Win Hindle

FROM Jon Fadiman

I received a letter from Mr. A. Kaufmann in answer to my request for a reference for Mr. Bernard Haus. The following is a very rough translation of this letter.

"Dear Mr. Fadiman:

I have just received your letter concerning the candidacy of Mr. Bernard Haus and I am hurrying to reply to you.

I have known Mr. Haus when General Electric and BULL were competitors in France; he was the engineer in charge of scientific utilization of computers by the clientele of General Electric. I was the scientific advisor at BULL. It is in this way as competitors that we have known each other, and I would make the greatest praise of this person who was for me an adversary particularly active but always sympathetic and loyal.

He is in my opinion one of the best engineers and mathematicians in information work that it is actually possible to find in France. His scientific and general culture is very great. He is very intelligent, active, clever, and honest in all things.

For personal reasons when the alliance in France of General Electric and BULL took place he preferred not to enter into this new pool which had just been created between the two companies. For my part I regret that very strongly.

In resume I would confirm that I have for Mr. Haus the greatest esteem.

Sincerely yours,

Mr. A. Kaufmann
Scientific Advisor to BULL
General Electric"

JF:nlz

INTEROFFICE MEMORANDUM

DATE February 25, 1965

SUBJECT

TO K. Olsen
N. Mazzarese

FROM R. Belden

Points of interest from CCC:

Number of employees - 1,280 in 260,000 square feet (with new addition this year)
Present backlog - $8-10 million (includes 35-40 computers)
Next year sales - mid $20 million, profits higher but not substantially so.
EAI agreement expires June, 1965 - will not likely be renewed by mutual consent.
Microelectronic labs are now evaluating new devices. CCC will buy all production quantities from T.I.
Photo typesetting - present order of 50 special purpose from Photon. Also continued 2-3% of sales.
Internal emphasis heavily on marketing and customer orientation. Forty plus men at Framingham with 50-70 man sales force (rough).

Status

DDP-224 - First 3 production models are now on the check-out floor. There were two non-production 224's built (as with the PDP-7).

DDP-116 - Prototype is still being climbed over. None on check-out floor yet, 5 on their way, delivery in April, 20 orders to date.

New products expected before fiscal year end (October, 1965):

New Module line
A computer which, in size, will be between the 116 and 24, using new modules, I expect.

Delivery of computers seems to be a problem.

See attached application note. I hope DEC has several of these in the near future.

RB:cr

Att.

dec INTEROFFICE MEMORANDUM

DATE 25th February, 1965.

SUBJECT

TO Harlan Anderson

FROM John Leng

Have you fixed a date yet for your European visit? It would be good if you could come over at the beginning of April with Jon Fadiman. Perhaps we could then organise a European Sales Meeting at Reading at which you and Jon could bring us up to date in things at Maynard and we could discuss with you what should be done to ensure more effective support from Maynard.

In addition we need to co-ordinate our European effort so that between us we have a complete set of specialist on both maintenance and programming capability of all of our computers and peripherals.

We have programming classes scheduled on the "5" and "7" on the weeks 29 March and April 5 so how does Saturday the 3rd of April or Monday 12th April sound as a possible date?

John.

c.c. J. Fadiman
G. Huewe
J. Milton
G. Finch
W. Spittle
R. Jones

Harlan Anderson

J. Fadiman

4 copies

FEB 25 1965

COMPUTER & SYSTEMS INSTALLATION - 1965.

Item	Equipment	Customer	Date Due
1	Type 138 A to D	Dr. Poole, Harwell	Feb. 1/65
2	Type 580 Magnetic Tape	Dr. Seidman, Southampton Univ.	March 1/65
3	ASR-33 Teletype	" " "	March 1/65
4	Type 516 Tape Control	Mr. D. Lord, Rutherford Lab.	March 1/65
5	Type 570 Transport	" " "	March 1/65
6	Type 551 DECtape Control	" " "	March 1/65
7	Type 555 Dual Transport	" " "	March 1/65
8	Type 760 Paper Tape Control	" " "	March 1/65
9	Type 761 Paper Tape Reader	" " "	March 1/65
10	Type 50 Transport	Dr. Rae Harwell	March 1/65
11	PDP-7 Computer	Mr. W. S. Elliott, Cambridge	March 15/65
12	Type 340 Display	" "	March 15/65
13	Type 347 Subroutine Unit	" "	March 15/65
14	Type 341 Interface	" "	March 15/65
15	PDP-7 Computer	Professor Allen, Oxford	April 15/65
16	177 EAE	" "	April 15/65
17	172 Priority Interrupt	" "	April, 15/65
18	550A DECtape Control	" "	April 15/65
19	555 Dual Transport	" "	April 15/65
20	555 Dual Transport	" "	April 15/65
21	147 Extra 4K	" "	April 15/65
22	340 Display	" "	April 15/65

23	341 Interface	Professor Allen, Oxford	April 15/65
24	342 Character Generator	" "	April 15/65
25	350/565 Plotter	" "	April 15/65
26	PDP-7 Computer	Professor Von Hamos, Stockholm Tech. Inst.	May 1/65
27	Type 147 Extra 4K	"	May 1/65
28	Type 177 EAE	"	May 1/65
29	Type 550A Control	"	May 1/65
30	Type 555 Transport	"	May 1/65
31	Type 138 A to D	"	May 1/65
32	Type 139 Multiplexer	"	May 1/65
33	D to A Converter	"	May 1/65
34	PDP-8 Computer	Dr. Seidman, Southampton	May 15/65
35	PDP-8 Computer	Hilger and Watts	July 15/65
36	PDP-8 Computer	Dr. Orman, Harwell	July 15/65
37	Type 34 Display Control	"	July 15/65
38	PDP-8 Computer	Telare	July 15/65
39	Type 138 A to D	"	July 15/65
40	Type 139 Multiplexer	"	July 15/65
41	PDP-7 Computer	Professor Willmott	July 15/65
42	Type 147 Extra 4K	"	July 15/65

43	Type 177 EAE	Professor Willmott	July 15/65
44	Type 30 D Display	"	July 15/65
45	Type 580 Light Pen	"	July 15/65
46	Type 550A Control	"	July 15/65
47	Type 555 Dual Transport	"	July 15/65
48	Type 350/565 Plotter	"	July 15/65
49	Type 172 Priority Interrupt	"	July 15/65
50	PDP-8 Computer	Dr. J. Ellison, Manchester	August 5/65
51	PDP-8 Computer	Mr. Mather-Lees, Hawker Siddeley	August 15/65
52	PDP-8 Computer	Telare	August 15/65
53	Type 138 A to D	"	August 15/65
54	Type 139 Multiplexer	"	August 15/65
55	PDP-8 Computer	McGregor Ross S.T.C.	August 25/65
56	Type 183 Memory Control	"	August 25/65
57	Type 184 4K Module	"	August 25/65
58	Type 184 4K Module	"	August 25/65
59	Type 685 Multiplexer	"	August 25/65
60	Type 750 Tape Reader	"	August 25/65
61	Type 75A Tape Runch	"	August 25/65
62	Type 250 D Drum	"	August 25/65
63	Type 680 Communication Control	"	August 25/65
64	Real Time Clock Interrupter	"	" " "

Harlan Anderson

INTEROFFICE MEMORANDUM

DATE February 25, 1965

SUBJECT Proposed Change in Construction Requisitions

TO Nick Mazzarese FROM Jim Burley

Dear Nick:

We need to start looking into our paper work mill to be prepared for the numerous orders and shipments of equipment coming up. As near as I can tell, many of the services that the company renders are specified and performed on a rather informal basis. Now that we have an OEM policy for PDP-7 and -8 that requires taking exception to our normal policy, it will be more and more difficult to monitor and control the services we do render for as many as 200 different customers.

Rather than create new pieces of paper, I propose that we use the existing construction req. and think of it as a release of services by DEC to the customer. In addition to the hardware, the construction req. should call out which, if any, training services are to be supplied as well as which, if any, documentation must be supplied. Although this sounds a bit weighty in description, it can be abbreviated in a form legible to all parties.

With this change, of course, Bob Pate would have to be on the distribution list for the construction reqs. so that he could enter a specific order for a seat in a programming or maintenance class. I would imagine he would handle it like most products and would have a backlog of orders to be filled that in many cases would be "delivered" before delivery of the equipment itself.

Ridgeway also would become another production department in that he would or would not ship Software documentation as specified on the construction requisition.

In addition to this, the salesman would receive a copy of the construction requisition which would require his acknowledging the validity and accuracy of the construction req. by virtue of his returning a signed copy with comments and corrections if any.

There may be some pitfalls and problems with this system, but whatever system we employ should be studied shortly and incorporated before we try to memorize which of 100 customers receives or does not receive a maintenance manual on a PDP-8.

cc: Ken Olsen
Harlan Anderson
Stan Olsen
Ted Johnson
Frank Kalwell
Tom Whalen
Ed deCastro
Jon Fadiman

digital MEMO

WASHINGTON OFFICE
1430 K Street, N.W.
Washington, D.C. 20005

February 24, 1965

To: Harlan Anderson From: Howie Painter

Subject: Washington, D.C. Chapter ACM Time-Sharing Lecture Series

Dear Andy:

Here is some more background information on the lecture series:

ALEC BUMSTEAD

Date and Time - March 30th 1965, 6:30 to 8:30 P.M.
Location - Systems Development Corporation 5821
Columbia Pike, Falls Church, Va.
Approximate attendance - 50 people.

Tel: HU1 - 2220

Yours will be the fifth in a series of five lectures on time-sharing. Others giving lectures during the series will be: Mr. J. Easley of Univac, who will demonstrate an 1104, and Dr. Donald L. Shell of G.E., who will speak on Project MAC Time-Sharing System and G.E.'s 635.

The ACM Chapter is primarily interested in having your talk application oriented. Perhaps you could illustrate it with comments about some of our present and future PDP-6 installations. They also pointed out that it wouldn't do any harm for us to blow our own horn, i.e., give a good discussion on the PDP-6 and our philosophy on what a time-sharing machine should be. I think that the PDP-6 slides that we have would be very helpful in this regard. They will provide a slide projector and screen for you.

As I get more information on this lecture series, I will forward it on to you.

Best regards,

Howie

S

H. Anderson

INTEROFFICE MEMORANDUM

DATE February 25,1965

SUBJECT Letter of Intent from Oxford

TO Bob Lane

FROM Jon Fadiman

According to a Telex received from John Leng on February 17, 1965, John has received a letter of Intent from Oxford for their PDP-6 System. This information is to be kept confidential because the formal Letter of Intent and Purchase Order must come from NIRNS. Thus, no action should be taken on this Letter of Intent. The configuration is as follows:

Item	Quantity	Model	List Price	Discounted Price
1	2	2 Microsecond 16,384 Word Core Memories Type 163	$ 252,000	$ 201,600
2	1	Arithmetic Processor Type 166	146,100	116,880
3	1	Fast Memory Type 162	30,000	24,000
4	1	Data Control Type 136	10,000	8,000
5	1	Magnetic Tape Control Type 516-521	18,000	14,400
6	2	Magnetic Tape Transports Type 570	60,800	60,800
7	1	DECtape Control Unit Type 551	14,000	11,200
8	2	DECtape Dual Transport Type 555	14,800	11,840
9	1	Paper Tape Reader and Control Type 760	9,000	7,200
10	1	Paper Tape Punch and Control Type 761	5,500	4,400

11	1	Line Printer and Control Type 646, 600 lines per minute.	$ 37,500	$ 37,500
12	1	Display System Type 30 with PDP-6 Interface	17,800	14,240
13	1	Light Pen Type 370	1,625	1,300
		TOTALS	$ 607,125	$ 513,360

The following list of equipment has already been ordered by the National Institute for Research in Nuclear Science, Purchase Order Number CON/NIRNS/1C/122132, on December 10, 1964. This equipment is being constructed on Construction Requisition Number 1333 and is to be shipped to the customer on March 15, 1965.

1	1	Magnetic Tape Control Type 516-521
2	1	Magnetic Tape Transport Type 570
3	1	DECtape Control Unit Type 551
4	1	DECtape Dual Transport Type 555
5	1	Paper Tape Reader and Control Type 760
6	1	Paper Tape Punch and Control Type 761

Total Net Price: $ 84,300
Total Discounted Price: 73,520

This equipment will be installed in the field by DEC UK Ltd. when the entire system is shipped over to the University of Oxford. The customer has agreed to a 5% installation charge which amounts to an additional $4,215. Assuming that a purchase order is received from NIRNS for the entire system by March 15, delivery of the entire system will be provided on October 15, 1965.

Note: Power requirements for the entire configuration are 50 cycles, 240 volts.

JF:nlz

cc: Harlan Anderson
Gerry Moore
John Leng
Tom Whalen
Nick Mazzarese

INTEROFFICE MEMORANDUM

DATE February 26, 1965

SUBJECT

TO H. Anderson
N. Mazzarese
T. Johnson
R. Lane
J. Burley
R. Belden

FROM Arthur Hall

gave back to A.H. because of book

The attached document is for reference primarily by a Project Engineer following the receipt of an order. However sales personnel may find that some of the questions might well be asked of customers to better define an order.

Additional copies may be obtained by asking Drafting for Drawing Number DEC STD 003.

AH/mro

dec INTEROFFICE MEMORANDUM

DATE February 26, 1965

SUBJECT

TO H. Anderson

FROM R. L. Lane

(1) I requested Tom Whalen to issue a construction requisition for Rutgers 136-551-555 (DECtape System) per our discussion.

(2) I requested Tom Whalen to issue a construction requisition for Rand 551-555 (DECtape System) per Chuck Baker's request.

(3) I requested Jack Smith to order:

a) Aachen's 50 cycle card reader, 200 cpm
b) LNS card reader, 200 cpm
c) Berkeley's card reader (or EG&G)
d) Line Printer - 300 (next customer)

dec INTEROFFICE MEMORANDUM

DATE February 26, 1965

SUBJECT Don Robinson

TO H. Anderson

FROM G. Bell

I ran into Don Robinson at Litton, in L.A., and he is head of their Automated Logical Design. Don was at the U. of Illinois and knows you and your friend, Dick Johnson.
Don is another by-product of Kirksville, Missouri, and lived next door to me. At any rate, he says "hello".

GB/blk

COMPANY CONFIDENTIAL

dec INTEROFFICE MEMORANDUM

DATE February 26, 1965

SUBJECT Cost of Mfg. - 166 A.P.

TO
H. Anderson
G. Bell

FROM
R. L. Lane

I checked with Accounting to determine our current manufacturing costs on Type 166 Arithmetic Processors.

Serial # 3	(Brookhaven)	44,065
4	(Western Australia)	48,364
5	(LRL)	41,486
6	(Adams)	46,660

Serial #1 looked peculiar and systems beyond number 6 were not complete enough to consider. These costs are effective Jan. 23, 1965.

The average of the top four is: 45,144.

INTEROFFICE MEMORANDUM

DATE January 4, 1965

SUBJECT PDP-7 Production Schedule

TO K. Olsen
H. Anderson
S. Olsen
R. Belden
E. Harwood
N. Mazzarese

FROM J. Smith

Planned Production Rate:

Number	Assigned Customer	To Checkout
PDP-7-2	Stanford	1/4/65
PDP-7-5	New York University	1/8/65
PDP-7-6	Delft	1/22/65
PDP-7-7	Cambridge University	2/6/65
PDP-7-8	III	2/13/65
PDP-7-9	RPI	2/20/65
PDP-7-10	Mass. General	2/27/65
PDP-7-11	Aeronutronics Div. (Ford Company)	3/8/65
PDP-7-12	Oxford	3/15/65
PDP-7-13	Univ. of Texas	3/22/65
PDP-7-14	Royal	3/29/65

Six in April - Six in May.

Present Status:

PDP-7-2, Stanford, Due to Checkout today, January 4, 1965

C.P. and Memory completely wired. All power wiring and cabling complete.

550 Control - Undergoing off-line checkout
34 Display - Has been installed

Items unreleased to date:

E.A.E. wiring schedules
R.P.T. wiring schedules

Engineering changes on the C.P. started to come through from Ron today. He expects to have all changes in our hands by the end of the day. At that time, we will be able to determine what the delivery delay to Checkout will be. The present estimate is Thursday, January 7, 1965. We will attempt to make up some of the time lost by checking the memory while the mods to the C.P. are being installed.

DRAFT

October 18, 1964

THE AUTOMATED BIOLOGICAL LABORATORY*

by: Donald Glaser, Prof. of Physics and Molecular Biology,
University of California

John McCarthy, Computer Science Division,
Stanford University

Marvin Minsky, Department of Electrical Engineering,
Massachusetts Institute of Technology

Abstract: Our conclusion is that the first major attempt at the biological exploration of Mars should be made by a computer controlled automatic laboratory whose programs are alterable from the earth. We discuss the organization of such a laboratory and several techniques that may be used including some that require going beyond the present state of the art in computer identification of objects in pictures. We hope that these techniques can be developed in time for the 1971 opportunity, but our main conclusion about computer control holds even if they can't.

* This is the report of the subgroup on the automated biological laboratory. The subgroup is part of the summer study in exobiology sponsored by the Space Science Board of the National Academy of Sciences.

THE AUTOMATED BIOLOGICAL LABORATORY (ABL)

1. Introduction:

The state of evolution of the earth is very complex to describe, let alone to discover. Mars may be in a much simpler state, but we cannot count on it. Even if Mars is in a much simpler evolutionary state than the earth, there is much work to be done before Mars is anywhere near as well understood as our own planet.

Now we are considering what can be done with a single unmanned lander weighing several thousand pounds. Our present ability to make small scientific equipment already permits us to include a wide variety of techniques within our weight limit. The problem we shall face in this chapter is to suggest how the various devices can be co-ordinated into an automated biological laboratory that will give us a good chance of determining whether there is life on Mars, and in any case, of giving an estimate of the state of its chemical evolution.

In our opinion, the key to making the automated laboratory effective is to make it a computer with sensors and effectors rather than a collection of isolated experiments. It should be possible to use a piece of apparatus such as a TV camera or a mass spectrometer in a number of different ways in experiments aimed at answering different questions. Moreover, we want to maintain as much control from the earth of the experimental program as the 5 to 30 minute round-trip time for signals between the earth and Mars will allow. Only maintaining this control will give us much chance of getting a reasonable picture of Martian evolution from a single mission or even from a small number of missions.

Few biologists have thought much about the computer control of experiments, and there is a temptation to put the idea aside as too complicated for an early mission and settle for adapting to predicted Martian conditions a few experiments that would be simple if performed on earth. This puts a heavy burden on our ability to predict Martian conditions, and we must face the fact that many of the experiments planned would turn out to be inappropriate. A much greater chance of success is offered by a co-ordinated laboratory that can be ordered to change the experiments from the earth after the first results are returned.

1. Computer Programs for Controlling Experiments

A computer program is a sequence of instructions in the memory of the computer. The ABL computer should have room in its main memory for

(say) 50,000 instructions plus substantial secondary storage such as magnetic tape. It executes instructions one after another. Some of these instructions do arithmetic operations involved in computing the next value of the magnetic field for the mass spectrometer, some compute where to point the TV camera, or when to end a titration. Other instructions select the instructions to be executed next according to whether an experimental operation is complete or whether an iterated computation has been carried out the right number of times, or whether a signal has come from earth indicating that a new program is being transmitted. Other instructions turn on or off experimental apparatus such as the motor that rotates the camera in azimuth or the motor that extends the sample collection arm. Other instructions cause information to be transmitted to the earth after it has been edited into a compressed form that will make best use of limited transmission bandwidth.

2. Time Scales

It is important to understand the time scales involved. The computer executes an instruction every few microseconds. A simple mechanical operation involving the experimental apparatus takes between .1 and 10 seconds. The round trip time for a signal from earth is between 300 and 1500 seconds. Thus the computer can execute about 10^5 instructions in the time required for a mechanical operation, and we can perform say 2000 mechanical operations in the time required to look at the result of some complex of operations and decide what to do next. When the ABL is on the opposite side of Mars from the earth it will be on its own for 12 hours and could be shut off if we can't program a useful strategy. These times are the key to understanding the possibilities and problems of computer control of the automated biological laboratory.

First of all, 10^5 computations in a mechanical operation time means that the computer can control say 100 mechanical devices at a time and still execute an average of 1000 operations in deciding what each device is to do next. This means that the procedure for deciding what each device is to do next may be quite elaborate if this is desirable. Secondly, if we want to use our device with full effectiveness we must delegate to the computer program control of up to 2000 elementary actions of each device while we decide on the next compound action. Thus, we should program complex actions such as: a complete sequence of separation actions such as solvent extractions, titrations, and scans of the mass spectrum including the decisions about when endpoints have been reached or when the mass spectrometer has been at a given e/m long enough. More elaborately, if we can, we should program the computer to collect objects of a kind we are interested in.

3. Kinds of Experiments

Let us try to classify the experiments that might be performed in the following way:

a) Observations. Most important will be pictures on scales ranging from telescopic panoramas to microphotographs. Also there may be temperature, pressure, atmospheric chemical content, sound, and radiation measurements.

b) Analysis of samples. For example, we may use a computer controlled shovel to pick samples, grind them, dissolve them in chemicals, use solvent extraction, and chromatographic methods to concentrate fractions of high optical activity, finished off by mass spectrometer analysis of the final concentrate. The remaining concentrate may have to be stored while scientists on earth decide what further tests shall be performed.

Physical as well as chemical analyses will be made.

c) Growth experiments. A candidate for life may be put in a variety of environments and symptoms of growth or other signs of life looked for periodically.

4. Limitations of Programming

The limits of what can be programmed for the ABL are not easily set. A large class of useful operations are well within the state of the art. For example, it is not difficult to program a fractionation process to select for further analysis the fraction that shows optical activity or shows fragments at given mass numbers on the mass spectrometer. It would also be easy to program the machine to transmit only the parts of pictures that differ from previously stored pictures of the same scene.

It is still fairly easy to program a computer to make a hardness map of a mineral specimen by poking it with a needle and transmitting this together with a picture of the specimen.

It is difficult but probably possible to take pictures of a desert scene and after looking at them program the computer to transmit pictures of cacti that differ from the already classified types of cacti, as these are encountered in the ABL's travels. If the biologists are to be able to ask for this they will need the support of extensive earth based computer facilities and programming groups.

It is not now within the state of the computer art to program a computer to control the dissection of a mammal, much less to perform an operation on a mammal such as might be involved in a physiological experiment. By 1971 this situation may change if a determined effort is made, but it would be unwise to count on it. It would also be unwise to make decisions that preclude it.

When we cannot program a kind of decision the experiment is slowed up because we must send a picture of a tray of samples, or mass spectrograms of fractions to earth for decision as to what objects should be ground up or what fractions should be further treated and how. Fortunately, the automated biological laboratory can provide us with complete

flexibility in this respect. If a particular decision that has to be made on earth is slowing our progress, we can check out on earth programs for making the decision, and when we think we have them right transmit the programs to Mars.

5. Danger of Thinking too Small

We must confess to the following fear: At present, the art of programming computers to select objects of a given kind by looking at a picture of a collection of objects against a background, is in a rather primitive state. On this basis, it might be decided that although the ABL is to be provided with the ability to take pictures and transmit them to earth, the Mars computer will not be able to look at the pictures. (The computer looks at a picture by having an instruction that allows it to read the optical density at a point on the picture with given co-ordinates; programs can be written using this operation that track the light-dark boundaries and recognize objects). We believe that it is extremely important to make the ABL completely flexible. This requires that all apparatus be subject to computer control, and that all information collected by the sensors be readable by the computer. It is also important that the necessary computer programming and check-out facilities be available on earth to allow the quick changing of computer programs to meet changed experimental conditions.

If our view of what we will be able to program and the benefits of flexibility proves over-optimistic, little will be lost. The computer is still the best way to control even relatively simple processes, as industrial experience is showing. On the other hand, if through lack of imagination, a decision is made for a preprogrammed system, or even if the computer and its programming are set up in a way that makes changes difficult or risky, or if not all sense information is available to the programs, a tremendous opportunity will be lost.

6. Summary

In the succeeding sections of this chapter we shall treat the following topics: the state of the art in computer control; description of a simple automated laboratory; control of the laboratory from the earth; television systems, transmission of pictures, and the problems and uses of computer picture pattern recognition; sample collection and the computer controlled hand; the advantages and the problem of making the ABL mobile; some recommendations for research and development projects that may be undertaken now to provide support for the ABL.

The automated biological laboratory provides a marvelous focus for research and development in computer control systems. The potential technical benefits for the control of scientific experiments and other processes on earth seems as great as that for any other aspect of the space program. By itself it may repay the cost of the entire Mars exploration.

2. The State of the Art of Computer Control

The art of computer control of external devices is advancing rapidly. If this were 1955 what we propose in this report would be almost impossible, and if it were 1975, what we have to say would be regarded obvious by every scientist. We are now at the point where the tools are comfortably available, but we shall have to work fast to make good use of them.

1. Computers in airplanes and spacecraft.

Modern fighter planes contain computers for navigation and fire control. They are usually magnetic drum computers, and their programs are rarely changed. They are reliable enough for their present use and compact enough even for the Mars mission. However, they are not fast enough, they are not easily programmed, they do not have sufficiently large memories, and they are probably not sufficiently reliable for use in the ABL. The M.I.T. Instrumentation Laboratory has designed, and IBM is building a computer to be carried on the Apollo spacecraft. This computer is probably fast and reliable and small enough for the ABL, but it uses a read-only memory for programs and doesn't have enough memory. The proposed supersonic transports are to be controlled by digital computers. Several American companies have designed computers for inclusion in spacecraft, but we believe that the ABL computer can and should be more powerful than these.

2. Computer control of industrial processes.

Chemical plants, bakeries, atomic power plants, and nuclear particle accelerators have been controlled by computers. Most of these programs have been rather simple, certainly simpler than we shall want for the ABL.

3. Time-sharing.

The ABL computer must be able to manage many pieces of apparatus at the same time. This is possible because the computer is nearly 100,000 times faster than the apparatus it controls. The art of making a computer carry out a large number of separate tasks at the same time without confusion is called time-sharing. Systems that allow a computer to interact with tens of people and external devices simultaneously are in use today. They have the property that an error in one user's program cannot result in interference with the programs of any other user. This property is essential for the ABL if we are to dare to allow scientists to change programs after the machine is on Mars.

4. Picture recognition.

Some work has been done on programming computers to classify pictures into a number of categories. These programs even learn the categories from examples. The number of categories and their complexity is quite limited so far. Other work has concentrated on the more relevant problem of picking out objects of given categories from a background and measuirng their positions and dimensions. The work in recognizing nuclear events

in bubble chamber and spark chamber pictures is relatively advanced. The apparatus for this recognition work is just becoming available, and rapid advances may be expected because the problem is being pursued energetically.

5. Artificial intelligence.

This is the problem of making computers perform tasks which, when performed by people, are considered to require intelligence. Modest successes have been achieved, but progress is likely to be slow. This work has led to an ability to identify those tasks which are readily assigned to a computer and those which still require human intervention.

6. Computer performance.

In our opinion the ABL can use profitably a large scale computer by present standards. Great advances are being made in minaturizing computers. However, we do not yet know whether a large scale computer (with say 2^{16} words of one microsecond memory) can be reduced to 200 lbs. in time, or whether we will have to compromise in this area. The result of a compromise would be to reduce the complexity and number of processes that can be controlled simultaneously and to increase the time required to change the course of the experiments.

3. A Simple Automated Laboratory

In order to clarify the problem of automating a biological laboratory , we shall consider a simple one. We mention specific apparatus not to express an opinion about what should be included - much more can be included than is listed here - but merely to make the control problem concrete.

Let us assume the following equipment:

1. A television camera and a storage tube. The camera has a variety of lenses for magnifications from telescopic to microscopic. An arm permits the camera many positions: on a tower for looking at the landscape; attached to a microscope for looking at slides; overlooking the immediate foreground for controlling an arm used for picking up samples or for controlling the motion of the ABL over the ground; and a position that allows the camera to look inside the ABL in order to see the positions of movable parts. Several cameras may be taken if the workload or reliability requires it. The computer can transfer information from the storage tube into its memory either en masse or point by point. Computer programs compress picture information for digital transmission and also use the information to make decisions.

2. One or more mechanical arms like those used for handling radioactive materials are under the control of the computer. They can be positioned to computed positions when the computer knows the precise sequence of motions desired, or can be controlled via the picture information by the computer when a servo-mechanism type of operation is

required. The arms can use tools such as shovels, coring drills, and a variety of clamps for holding objects of various shapes.

3. A wet chemical laboratory. Reagents may be added to samples, and operations such as titration, centrifuging, filtration may be performed.

4. Optical spectrometry.

5. Mass spectrometry.

4. Control from the Earth

The ABL will be carrying out simultaneously a wide variety of experiments in a number of different fields. Many of these experiments are of kinds that on earth involve continuous supervision by the experimenter. The round trip signal time precludes continuous supervision and so we have emphasized computer control. Nevertheless, we want to make human supervision as effective as possible and this requires very sophisticated earth-control.

We envisage the following kind of system:

1. There are a number of groups of scientists, each pursuing its own line of investigations.

2. Each group has consoles for the display of information coming from Mars and transmitting instructions to that part of the computer program on Mars carrying out the group's investigations. They have computer facilities on earth for analyzing data and for debugging new programs to be sent to Mars.

3. The consoles are attached to a computer on earth which coordinates their communication with the experiment on Mars.

The allocation of resources among the groups is decided by directorate and administered by programs in the earth computer and to a lesser degree in the Mars computer. These decisions include:

a. The rate at which each group can get pictures and other data back from Mars.

b. Allocation of expendable supplies.

c. Decisions about when and where the lander will move.

d. Allocation of the services of the arm, the chemical analyzer, and the cameras.

One might argue that usually it would be better to do one experiment at a time, and this might be true if we could program all decisions for the Mars computer. However, if a particular experiment has to be carried out in a mode where a short operations is carried out and the result sent to earth for decisions, there will be much time wasted if only one experiment is done at a time.

4. Each group will strive to program the decisions needed to carry out its experiments. For example, suppose an experiment requires the selection of objects from a shovelful for subsequent chemical analysis. At first, it may be necessary to have a TV picture of the shovel returned to earth in order to select the objects. However, the experiment will go faster once the selection criterion can be programmed for the Mars computer. The programs to do this will be checked out on earth-bound copies of the Mars computer operating earth-bound copies of the ABL.

5. Because of the limited time the lander will operate, the results obtained up to a given time should be available in raw form to the whole scientific community. This will enable suggestions to be made and even new groups to start new research programs using the ABL if their proposals seem to warrant it.

5. The Chemical Laboratory

It is too soon to say what the chemical analysis facilities should be in detail. However, some general remarks can be made. A chemical analysis procedure is a strategy involving the following kinds of operations.

1. Physical preparation of the sample. Grinding, etc.

2. Mixing reagents with the sample.

3. Controlling the physical environment: temperature, pressure, illumination.

4. Separation. Filtration, centrifuging, solvent extraction, chromatography.

5. Physical measurements. Presence (e.g. did anything precipitate), weight, color, reflection spectrum, form,(flocculent precipitate; if we want the criterion we need a computer program to recognize it); spectrum; mass spectrometry; optical activity; density; viscosity.

6. Storage. Some fractions may be put aside for later use.

In general, the results of the physical measurements determine what mixing and separation operations will be performed next and what fractions will be put aside or discarded. Besides reliability the following considerations should determine the methods made available:

1. Generality. As few assumptions as possible about the chemical environment of Mars should be made. Some long shot guesses can be accomodated by including special reagents.

2. Economy. The consumption of expendable supplies per experiment should be very low.

3. Speed. Automated mechanical movements can be very fast; five operations per second are readily achieved. This means 3×10^8 elementary chemical operations may be performed in the life of the ABL. If one milligram of supplies is consumed per operation we will need 300 kg of supplies. The above figures represent our guess as to the order of magnitude of the quantities involved, and perhaps they suggest that expendable supplies will be the limiting factor on how much chemistry can be done. Much present chemistry depends on having large excesses of certain reagents, especially water. Perhaps, in order to get by with milligram amounts of reagents one should use microgram amounts of sample. It should be pointed out that the mechanical movements can be sped up to 100 per second if small enough masses have to be moved.

One may ask whether there would be any use for 3×10^8 chemical events. Wouldn't some smaller number, say 3×10^4, do? We believe that the larger number is really likely to be wanted because the reactions will be combined into procedures, and each procedure may involve hundreds of chemical events.

The reactions themselves should usually proceed on the 1/10 second time scale although one second reaction times can be tolerated if one vessel can be put aside to react while others are manipulated.

The problem of cleanliness is a large one. Perhaps disposable liners for the reaction vessels will solve the problem. Difficult-to-clean vessels like stills and perhaps continuous processes generally may turn out to be impractical.

6. Pictures and Visual Control of Experiments.

In discussions of research techniques one takes vision for granted. However, the beginner in biology is often bewildered by the expert's sure identification of the important object in what appears to be a very complicated or indistinct picture. We are all beginners as far as Mars is concerned, but we would like to become experts.

In this section we deal with two topics:

1. Getting pictures back to earth to develop our understanding of what things on Mars look like.

2. Programming the identification of objects by the ABL computer so that it can avoid obstacles, select samples of desired kinds for analysis, send back pictures of previously unseen objects, etc.

What is there to look at?

Much more of Mars will be visible from the ABL than can be inspected with any other sense. A camera boom on the ABL and the ability to move the ABL to scenic lookouts will increase what can be seen. What can be seen may be divided into topography and objects.

Some general information about topography will already be available from the environmental flights required to assure the safe landing of the ABL. The additional topographical information obtained by the ABL will be useful if correlated with the objects.

The possible varieties of objects are too numerous to catalog. They include craters, vegetation, mineral outcroppings and many objects that may be difficult to classify when first seen.

In order to extract the maximum information from distant objects the ABL needs telescopes of various magnifications with emphasis on the maximum usable magnification. Color information may provide useful clues about the composition of the surfaces seen. This suggests that we include the ability to photograph a scene through an arbitrary spectral window and that we develop the ability to infer composition from such reflection spectra.

The near scene also requires photography at various magnifications.

Next we come to photography of objects that we can manipulate. Here are some examples:

1. Lichen on a rock.

2. Objects under an over-turned rock and the bottom of the rock.

3. The stratification of a hole we have made.

4. Fragments of a smashed or smashable object.

5. Sections of a sectionable object.

6. A precipitate or polymer resulting from a chemical process.

The picture handling system should include the following:

1. Optical instruments - telescopes, microscopes.

2. A TV camera with a storage tube.

3. A picture storage system, e.g. video tape in the ABL .

4. The ability for the computer to look at points in pictures on the storage tubes.

5. Computer programs for digitizing and compressing picture information.

6. Computer programs for recognizing objects of various kinds.

7. Transmission facilities for sending the pictures to earth. Pictures are likely to require more bandwidth than any other information transmitted.

Programming Computers to Recognize and Handle Objects:

First we shall list the relevant research.

1. H. A. Ernst programmed the TX-0 computer to control a mechanical hand to pick up blocks and stack them. (1961 M.I.T. Sc.D Thesis in Electrical Engineering).

2. L. Hodes and T. Evans at M.I.T., while working under Minsky, programmed the IBM 7090 to find geometrical objects when partially overlaid with other objects.

3. A number of physics groups have programmed computers to find events of given sorts in pictures of spark chambers. The group at Argonne National Laboratories has used their system to count the number of chromosomes of each of several types occurring in a picture.

4. A programmable film reader that reads radar traces and graphs from film and writes magnetic tapes with the information in digital form is marketed by Information International.

5. A large amount of work has gone into the classification of whole pictures. This is not very relevant for the present purpose that requires the identification of objects in a picture in a manner that will allow the manipulation of the objects.

6. A system called FIDAC has been developed by R. S. Ledley (Science, Oct. 9, 1964) that scans pictures and reads about 10^6 bits of information into the memory of an IBM 7090 computer for analysis. They have also developed a programming system for picture analysis which is being used to classify chromosome pictures.

Much of the work on picture recognition uses the following technique: The computer controls the position of a spot on the face of a cathode ray tube (CRT) i.e. there is a computer instruction that says position point of light at image coordinates (x,y). An optical system projects the light point through a photographic transparency and onto a

photomultiplier cathode. An analog-to-digital converter makes the photomultiplier cathode current, which is proportional to the transparency of the photograph, available to the computer. Thus the basic computer instruction is to determine the optical density at a point on the film with given co-ordinates.

A number of variants of this hardware have been used or proposed to increase the speed of various recognition schemes. The PEPR apparatus for measuirng bubble chamber pictures displays a bar whose length and orientation as well as postion are controlled by the computer. This is useful for detecting tracks of particles. The Argonne apparatus scans a rectangle chosen by the computer and returns the co-ordinates of all points where a change in density from one level to another occurs. (They have 64 levels).

Given this basic facility the computer can be programmed to find objects of various kinds, for example by tracing their outlines. The apparatus is only beginning to be available and all the present facilities are dedicated to very specific applications.

Besides the above-mentioned work, much attention has been given to apparatus and programs that classify pictures as a whole, e.g. this is a picture of an A. It is difficult to see how these methods can help with the present problem, but the advocates of perceptions, and adelines etc. will speak for themselves when the time comes.

All the above-mentioned work except Ernst's, which used photocells and mechanical sensors, has been concerned with photographs. Direct recognition of objects requires a TV system in which the computer can ask for the intensity at a given point on an electrical image of the scene. Systems of this kind have been designed but are not yet built. A number of additional techniques have been proposed, such as using the magnitude of the high frequency component of the intensity in a scan as a measure of whether the camera is in focus and using focus to measure distance.

We believe that a useful capability for recognizing and manipulating objects can be available in time for the ABL if a prompt and serious effort is made.

Mechanical Manipulation

We believe it is reasonable to consider basing much of the ABL's mechanical activities upon a set of general purpose computer-controlled manipulators.

Each manipulator would consist of a fast, firm positioner, with several degrees of freedom, and an attachment interface that can hold a variety of special tools, graspers, or sensors. Interchangeability would mean much more flexibility and capability than could be obtained by the same number of actuators installed in particular experiments for fixed purposes.

The most straightforward design would have motions of the positioner based on a fixed coordinate system relative to some points on the ABL vehicle. We should also study the possibility of making the manipulator along the general lines of the human arm and hand. With computer control and visual monitoring (by computer) this may be practical.

Computer-controlled manipulation exists today chiefly in the form of automatic machine-tool control systems. Visual control of manipulators has not been developed, but we believe the state of the art is just ready for such a development. The computer-controlled, human-like arm, developed by H. A. Ernst, used only simple tacticle sensors, but it could find a number of scattered blocks, stack them up in a tower, and then put them in a box that it had to find.

The advantages of general-purpose manipulators include:

Reduction in weight as compared to many special activators.
Great flexibility in programming sample-collection and material transfers.
Adjustment of physical layouts of experiments.
Assembly of parts into many configurations.
Adjusting parameters of experiments.
Some possibilities of repairs on site, or at least replacement of parts.

In particular, a manipulator could serve to control TV cameras, outside and within the space-craft. It might be feasible to use it to lay out and phase a large efficient outside antenna. It could operate micro tools, through a reduction interface.

It is possible that basing operations on a few reliable manipulators could yield a substantial gain in overall reliability since it would be possible then to simplify most experiments. It may be preferable to adjust the mechanical parameters of an experiment by moving a simple stud or tab, instead of installing and depending on a special motor or actuator for that task. It is not possible to say now which system would be most reliable and compact.

We shall want arms of several sizes. Very small arms can move very fast.

7. Mobility

We believe that the effectiveness of the ABL can be greatly enhanced by making it mobile. There is a substantial chance that it will land in an unsuitable place such as a small crater, and there may be very little to observe. A negative conclusion about the existence of life would be quite suspect if based on a single site or even a few sites.

The problem of providing mobility has two aspects:

1. The power available will be quite small. For example, the Beagle study estimates that a total 300 watts will be available for all activities of a 5000 lb. package. Other studies estimate up to 2 kilowatts.

2. The terrain is unknown.

3. Step-by-step control from the earth is hampered by the signal round-trip time.

The answer to the power problem is to go slowly. A velocity of one meter per second, the maximum that could be hoped for would permit covering 60,000 km in two years. This amounts to two circumnavigations of Mars. Even one cm/sec would permit 600 km of travel. If the ABL could find vantage points along its route permitting 10 km of side visibility, this allows the exploration of 12,000 square kilometers in the sense that a number of visually interesting objects could be approached and examined in detail.

A one meter/second velocity means that the ABL would cover about one kilometer in a round trip signal time. This precludes detailed earth control and requires a computer program that can use TV information to steer a course. On the other hand the one cm/second rate permits only 10 meters to be covered so that instructions to the vehicle can be based on a human look at the terrain to be covered.

The decision on what mobility system is best is a complicated one. In this chapter we shall only mention two complementary systems that suit the low power available.

The first system is to have a long arm that can extend a drill that can make a hole and that can attach an anchor. A winch is then used to haul the ABL with whatever power can be spared. Three cable-anchor combinations are needed. This system can deal with almost any solid terrain, including cliffs.

More suitable for flat ground with unavoidable obstacles not more than one meter high is a system of eight legs, four at each corner. One set of legs is lifted, advanced and set down, the second is lifted, advanced and set down, and finally the body of the ABL moves forward. The legs can extend to different lengths and are as light as possible. We minimize up-and-down motion of the ABL in order to reduce the power used.

8. Research and Development Projects:

The purpose of this section is to identify some research and development projects that should be started soon if the ABL is to be maximally effective.

1. Identification of substances by reflection spectra. The ABL will be able to see much more than it can touch.

2. Computer recognition and manipulation of objects.

3. Computer controlled wet chemistry on as small a scale as possible.

4. Computer control of a vehicle. One should work towards systems that have at least the human ability to tolerate variations in terrain.

dec INTEROFFICE MEMORANDUM

DATE January 4, 1965

SUBJECT NOTES ON COMPUTER EQUIPMENT FOR EXPLORATION OF MARS

TO HARLAN ANDERSON

FROM KEN LARSEN
PALO ALTO

Attached are a couple of notes that I received from John McCarthy at Stanford. The first, entitled "Computer Control of a Machine for Exploring Mars" is the N.A.S.A. Life Sciences Project that is being directed by the Nobel Laureate, Dr. Joshua Lederberg at Stanford Medical Center. As you may recall, we discussed previously that John would like to lease a machine until N.A.S.A. Life Sciences has enough money to purchase one. The request for funding was made based on lease information that I gave him some time ago.

The other memo, "The Automated Biological Laboratory" relates to the work being directed by Dr. Donald Glaser of the University of California. You may remember that we discussed Dr. Glaser's Project with Dr. Wattenburg during your visit here for the FJCC. Professor Wattenburg and Jerry Russell are also key people on this project, although John McCarthy does not mention them. Some of the techniques perfected by Professor Wattenburg for pattern recognition will be used in the automated biological laboratory described by John McCarthy.

K. L.

STANFORD ARTIFICIAL INTELLIGENCE PROJECT
Memo No. 14

June 15, 1964

COMPUTER CONTROL OF A MACHINE FOR EXPLORING MARS

by John McCarthy
Computer Science Division
Stanford University

Abstract: Landing a 5000 pound package on Mars that would spend a year looking for life and making other measurements has been proposed. We believe that this machine should be a stored program computer with sense and motor organs, and that the machine should be mobile. We discuss the following points:

1. Advantages of a computer controlled system.

2. What the computer should be like.

3. What we can feasibly program the machine to do given the present state of work on artificial intelligence.

4. A plan for carrying out research in computer controlled experiments that will make the Mars machine as effective as possible.

The preparation of this memo has benefited from discussion with E. Fredkin, J. Lederberg and M. L. Minsky.

The research reported here was supported in part by the Advanced Research Projects Agency of the Office of the Secretary of Defense (SD-183)

COMPUTER CONTROL OF A MACHINE FOR EXPLORING MARS

by John McCarthy
Computer Science Division
Stanford University

In 1969 or 1971 we can land 5000 pounds on Mars. The machine we land can have 300 watts of power, can communicate from 10,000 to 100,000 bits per second back to earth according to the distance between earth and Mars. The machine should be able to operate for a year. These facts were taken from a General Electric study called Beagle after the ship that took Darwin around the world. The Beagle study does not discuss the possibility of making the machine mobile, but we believe this can and should be done even if the power limitation makes it go very slowly. We shall follow G. E.'s lead and call the machine the Beagle.

The Beagle should obtain as much information as it can about Mars and radio it back to earth. Naturally, the most interesting question is whether there is life on Mars and if so what it is like. Therefore, we can set forth three goals.

1. To carry out as thorough a search for life as possible, i.e., to maximize the probability that if life exists on Mars, Beagle will find it.

2. If life exists to find out as much as possible about its chemistry, physiology, and ecology. Chemistry will be emphasized because the same means that detect life may also be used to study its chemistry.

3. To find out anything about the environment of Mars that will help future exploration, especially manned exploration.

Why Computer Control of the Beagle:

Up to now space probes have consisted of a collection of separate experiments sharing propulsion power supply and telemetering. We believe that Beagle will be much more effective if it is a computer with sense organs and motor organs and the experiments are represented by computer programs each of which uses the sense and motor organs in a co-ordinated way. Beagle differs from previous space experiments in a number of ways that are relevant to this preference.

1. A large number of sense and motor organs can be included in a 5000 pound machine.

2. Many of the experiments can use common facilities of manipulation, picture recognition, etc.

3. If Beagle works for a year the results of the early experiments will make changes desirable in later ones.

These needs of the Beagle mission can best be met by a computer controlled system. A brief statement of the reasons follows:

1. The control circuitry of each sensory or motor device can be reduced to a minimum if the whole system is computer controlled.

2. The strategy of each experiment can be chosen freely by writing suitable programs even after the hardware decisions have been made.

3. New programs can be written and transmitted from the earth even after Beagle is on Mars.

The Computer and Its Programming:

In this section we shall discuss the features that the Beagle computer should have.

1. It should be light, compact, fast, have a large memory, and be reliable. We shall not discuss how these features can be achieved in this paper, but many companies are working on the problems involved, and we are quite sure a suitable computer will be available.* Suitable parameters might be

1.1 weight - 100 lbs.
1.2 volume - 2 cu. feet.
1.3 memory cycle 1 μ sec - add instruction 2 μ sec - floating multiply - 10 μ sec.
1.4 power consumption - 40 watts.
1.5 memory 130,144 - 48 bit words.

If these goals are too hard to meet, some compromises are possible, but even higher performance might be helpful.

2. If possible, the system should not use mechanical secondary storage, e.g. tapes or drums. They make reliability difficult.

3. The system must be able to recover from programming errors in programs that carry out particular experiments. Otherwise, it will be impossible to allow the wide variety of programs necessary to make use of the flexibility of a computer based system. In particular, it would be difficult to allow the revision of programs from the earth on the basis of preliminary experimental results if an error in such a revision could cripple the whole machine.

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* I don't want to suggest that reliability will come automatically, only that I don't have anything important to say about it.

The ability to recover from programming errors can be achieved by the same devices as one beginning to be used to make time-sharing monitor systems proof against user errors. The necessary features are available on the Digital Equipment PDP-1 and PDP-6 computers, on the IBM 360 computer and partially on the IBM 7090 and 7030 computers. In fact, the Beagle computer should be operated with a time-sharing system, although the Beagle monitor must differ substantially from time-sharing systmes oriented towards computation centers. The important features of time-sharing systems are the following:

1. The system has a user mode and an executive mode. When in user mode the use of input-output instructions is inhibited and attempts to change memory outside an area reserved to a particular program leads to interrupts to the executive program.

2. A clock leads to an interrupt of the executive every so often anyway. (Say, every millisecond). The executive then decides what program should be executed next for a quantum of time.

3. Input or output devices generate interrupts to an appropriate part of the executive program whenever input becomes available or an output device is ready for more.

The core of the executive program must be absolutely debugged, but protection can be provided against errors in large parts of the executive (e.g., the programs that handle input-output devices) by allowing earth generated interrupts to a part of the executive that can be instructed to make changes in the rest of it.

We envisage the program to be divided into four parts.

1. The time-sharing executive - divides the time among the application programs.

2. Housekeeping programs. Handle communication with earth, temperature control management of the energy and supply, control of the motion of the machine.

3. Programs for operating devices. Used as subroutines by the programs that run experiments. Normally contain checks to make sure the devices are not damaged.

4. Programs for running experiments. These are written under the supervision of the experts in the field in which the experiment is performed. The time-sharing system permits them to be written independently of each other.

Mobility:

The effectiveness of the Beagle will be greatly enhanced by mobility. There are two difficulties. First, an average power of 250 watts will not

move a 5000 lb. vehicle very fast, and not all the power is available for that purpose. Second, the motion cannot be directly controlled from the earth because the response delay varies from a little over six minutes to almost 25 minutes.

The first difficulty can be overcome by accepting very slow progress (e.g., 10 cm/sec to 100 cm/sec depending on terrain) at times when the experiments and information transmission require very little energy. The second problem must be solved by developing computer programs capable of steering the vehicle past obstacles over different terrains.

Mobility is important for the following reasons:

1. Beagle might land in an unsuitable place, e.g. on bare rock or in a ditch.

2. Beagle should be able to look for high points from which to transmit pictures of the landscape.

3. Features that looked interesting in pictures could be examined at close range.

4. The search for life will be more effective if Beagle can go look for it.

Artificial Intelligence:

Research labelled artificial intelligence is aimed at making computers perform tasks that require intelligence when performed by humans. The exploration of Mars involves many such tasks. If the artificial intelligence problem were completely solved we could expect to send a computer to Mars with no control from earth and have it send back all the information that could be acquired by a large manned expedition. In fact, it is very unlikely that results comparable to manned exploration will be achievable by computer controlled machines within the next twenty years. However, many of the subsidiary tasks are within or near the present state of the programming art especially if the machine can be instructed from the earth if it gets stuck.

Some of the tasks are:

1. Controlling the telemetering so as to submit information at the maximum rate compatible with the orientation of Mars and the distance from Mars to earth. Information of lower priority can be saved for later transmission at times when high priority messages have to be sent.

2. Compression of information. Sending only deviations of an instrument reading from its expected value based on previous readings. Picture compression is more difficult but some results have been achieved.

3. Picture recognition. In various forms, picture recognition is required for a number of Beagle's tasks. Some of these are:

3.1 Recognizing types of terrain and obstacles so that Beagle can obey orders to move.

3.2 Recognizing the lands of materials it has been ordered to collect for analysis.

3.3 Co-ordinating the devices that pick up samples and subject them to analysis.

4. Motor co-ordination, co-ordination of the "hands" and wheels and "legs".

5. Other experimental strategies.

The assumption that the computer can be programmed to achieve the above goals relies heavily on the ability to reprogram it from the earth when unexpected conditions are encountered. We do not expect the state of work in artificial intelligence by 1970 to make the following feasible.

1. To put in the program our concepts of what is interesting.

2. To define life well enough so that the machine would recognize any form of it.

3. To make the program adaptable to any terrain without further instruction. e.g., swamps or mountains.

Projects:

The problem of making good use of a 5000 pound payload is very difficult. A number of investigations should be started right away if the Saturn V rocket is to be used when it becomes available. Some of these projects are:

1. Design of a suitable computer. We assume that the work on small, light, reliable and fast computers with low power consumptions is proceeding. We are less confident that the computer companies will come up with system designs suitable for the sophisticated programming that would be required. The Stanford Computer Science Division would be interested in helping with the order code, input-out structure, and system program design for such a computer.

2. Artificial Intelligence. Anything that can be learned about how to make machines behave intelligently will eventually be of use in unmanned planetary exploration. The most critical problem for Beagle, however, is the visual pattern recognition necessary for selecting and picking up samples and for steering a vehicle past obstacles to a goal. The more we can achieve in general purpose manipulation the less it is necessary to rely on Rube Goldberg contraptions for raising antennas, picking up samples, righting the machine after landing, etc.

3. A sample collector. The mechanical engineering of a device for picking up and breaking and crushing samples should be undertaken soon.

4. A vehicle. The low power that is likely to be available calls for a special vehicle design. For example, a crab that uses the same organs for mobility and for picking up things may be appropriate.

We believe that work aimed at a prototype Beagle that can be tried out on earth should be started as soon as possible. We are eager to help with this.

DEC INTEROFFICE MEMORANDUM

DATE January 4, 1965

SUBJECT Summary of EXEC System progress from DEC 27.

TO G. Bell

cc: H. Anderson per G. Bell

FROM Harrison R. Morse III

12-27,28 (early morning) Debugging, discovered and fixed bugs in CTYSER, IOXC$: OUTS, DTSER1. Expanded and completed error handling. Left tapes for editing and assembly.

12-28 (4 PM) Received assembled tapes, attempted to load system and lost. Finally tracked down trouble to channel 8 not punched in 3 or 4 tapes assembled (push down). Corrected 3 errors still remaining after above editing, and reassembled. Lost due to punch dropping channel 2 on part of one tape during editing. Re-edited, reassembled, had to get off (6:30 PM) back to same place I should have been at 4 o'clock.

12-28 (late-late) Watched Gross debug, and discovered errors in DECtape Releas, CLOSE, and OUTS Latter was an editing oversight. Edited and reassembled three tapes. Couldn't load because tapes ripped in either punch or reader.

12-29 In attempting to load, discovered other tape assembled 12-28 was also bad (lost 1 hour) (first glance did not so indicate). Reassembled, reload. Lost because of DECtape twice "deselecting". Finally DECtape B (System Library) ran off the front of the reel (loose hub). Remounted system library tape, loaded successfully!

12-30 Checkout of system loaded 12-29. System went up immediately, discovered two minor errors in PTRSER, CDRSER. Completely checked out error routines which now handle PDL OV, NON EX MEM, ILL MEM, Halt's and IOT's, improper INPUT and OUTPUT commands and certain system errors. All messages include either the address in the user's program of the offending command, or the address of the last call to the system. Routines also type on the console if no other

12-30 (cont.) teletype connected, and leave the console tty so it can be used by DDT.

A productive evening.

1-2 Spent the evening loading and checking out Witcraft's new version of the system tapes. Lost two hours because of a prematurely terminated assembly (I know not how or why), which caused the block contained the program break not to be punched, which caused the loader to load the next program over the last, which hung the loader in an infinite loop, probably trying to resolve a global. Reassembled, loaded and tried to block transfer the system down and run exec DDT. Lost (1 hour) because a symbol was arbitrarily multiply defined (as a global), which was erroneously linked while loading the first location of DDT changing it to a JSR into the middle of the system.

Eliminated the global, reassembled, loaded successfully, and ran. System went up quickly (only bugs discovered initially were errors in global definition (expected in new tapes) and a "1" and "," dropped in crucial places. All in all, a productive evening.

1-3 Lost an evening because of 80° temperature in Bldg. 12, air conditioning down, waited until midnight for Australia, discovered Australia-System combination unreliable for system checkout - with inconsistent failures.

Total score from 12-27 to 1-3

Total days worked	7	
days lost	2	
Productive days	3	(12-27, 12-30, 1-2)
Futile days	2	

This is a large part of the reason my schedule stretches. I should multiply 2.33 to include the sort of messing around necessary to get at and on a machine.

Note that only TWO of the above 7 days were spent in actual debugging (12-30, 1-2) and both were very productive.

HRM:tw

INTEROFFICE MEMORANDUM

DATE January 4, 1965

SUBJECT PDP-7 Production Schedule

TO K. Olsen
H. Anderson
S. Olsen
R. Belden
E. Harwood
W. Hindle
N. Mazzarese

FROM J. Smith

Three weeks ago at a meeting with Ken, it was agreed that Production should undertake a "crash program" on the construction of PDP-7 basic computers.

At that time, the J.P.L. and Bell Laboratories systems were undergoing checkout. These machines were constructed in conjunction with the prototype and therefore, were in reality prototypes themselves. Extensive modifications were being generated on a daily basis. Stanford and all subsequent machines were virtually non-existent, due to the status of the machines under test. It was agreed that Production should strive to construct one machine per week starting January 4, 1965. We were informed that extensive modifications to the central processor, reader, punch and E.A.E. were in the process of being generated, but it was decided to go with what we had. We agreed on the attached schedule.

The attached status memo will give you an idea of what has transpired since that time; and also, what remains to be accomplished. A great deal has been accomplished, which can be readily witnessed by the number of PDP-7's in advanced stages of construction on the production floor. Conditions seem very favorable, and all schedule dates beyond machine number five should be met if modifications can be held within reasonable limits.

Planned Production Rate:

Number	Assigned Customer	To Checkout
PDP-7-2	Stanford	1/4/65
PDP-7-5	New York University	1/8/65
PDP-7-6	Delft	1/22/65
PDP-7-7	Cambridge University	2/6/65
PDP-7-8	III	2/13/65
PDP-7-9	RPI	2/20/65
PDP-7-10	Mass. General	2/27/65
PDP-7-11	Aeronutronics Div. (Ford Company)	3/8/65
PDP-7-12	Oxford	3/15/65
PDP-7-13	Univ. of Texas	3/22/65
PDP-7-14	Royal	3/29/65

Six in April - Six in May..

Present Status:

PDP-7-2, Stanford, Due to Checkout today, January 4, 1965

C.P. and Memory completely wired. All power wiring and cabling complete.

550 Control - Undergoing off-line checkout.
34 Display - Has been installed.

Items unreleased to date:

E.A.E. wiring schedules
R.P.T. wiring schedules

Engineering changes on the C.P. started to come through from Ron today. He expects to have all changes in our hands by the end of the day. At that time, we will be able to determine what the delivery delay to Checkout will be. The present estimate is Thursday, January 7, 1965. We will attempt to make up some of the time lost by checking the memory while the mods to the C.P. are being installed.

INTEROFFICE MEMORANDUM

DATE 5 January 1965

SUBJECT Schedule for Western Australia PDP-6 Shipment

TO R. Beckman
FROM Gordon Bell

cc: A. Kotok, H. R. Morse, L. Portner, K. Senior, H. Anderson, J. Stenberg, J. Shields, R. Savell, J. Fadiman

Jan. 5 - 10	Finish checkout, fast memory. Procure paper tape temporary punch logic for checkout, and attach. Make available for some Systems Programming testing.
Jan. 11	Run acceptance (F.S. & Checkout).
Jan. 12	8:30 a.m. turn over to Field Service, L. Portner.
Jan. 12 - Feb. 8	Run as user's installation for Systems Programming.
Feb. 1 - 5	Maynard - Hardware/Software acceptance.
Feb. 8	8:00 a.m. begin crate
Feb. 11	5:00 p.m. to airport
Feb. 12	2:00 a.m. Plane takeoff
Feb. 15	Arrive Perth
Feb. 17- March 30	Acceptance - Software/Hardware
April 1	If Feb. 17 - March 30 events do not occur, pack machine for return to Maynard.

GB:tw

dec INTEROFFICE MEMORANDUM

DATE January 6, 1965

SUBJECT NEW PERSONNEL AUTOMOBILE POLICY

TO All field offices FROM Ted Johnson

Attached is a copy of the new mileage allowance policy. This is effective as of January 15, 1965.

Please outline and discuss this policy with your regional salesmen and field service personnel. Send me a memo listing present or planned automobiles and those who wish to take advantage of the $30.00 monthly fee.

A memo outlining the personal income tax aspects of this mileage policy will follow.

We believe this to be a good policy. I'd be happy to discuss this with you if you have questions.

TJ/pr

cc;
N. Mazzarese
Jack Atwood
Ken Olsen
Winn Hindle
✓ Harlan Anderson

Ted

DEC AUTOMOBILE MILEAGE ALLOWANCE POLICY

It is DEC's policy to reimburse employees required to use their personal automobile for business purposes.

A DEC employee to be reimbursed for mileage falls within one of two schedule categories, depending on whether he is a field office assigned employee (either sales or field service) or assigned to Maynard.

Field Office Sales and Service personnel will receive 9 cents per mile plus a fixed amount of $30.00 per month, the latter conditional upon the employee's automobile being qualified by committee through the Field Sales Manager.

The fixed fee reimbursement is done on a monthly basis. Employees are required to submit their travel figures on expense reports and to keep their own records for tax purposes. The fixed fee reimbursement will be made at the beginning of each month, separate from the salary payment and paid automatically to persons who qualify. Per mile allowances will be paid upon receipt of travel vouchers.

The general qualification of the field employee's automobile is that the car be 2 years old or less (rated January 15 of each year) and comfortably seat 5 persons. The class B automobile is the recommended standard. (A full size Chevrolet or Ford.) High standard compacts will be qualified at the discretion of the Field Sales Manager. If the automobiles do not qualify, the $30.00 rate is forfeited and only the 9 cents per mile rate applies.

It is to be stressed that qualification for the $30.00 allowance is dependent upon the employee's primary responsibility being customer work requiring extensive use of his automobile in his locally assigned region. Should the employee's job classification change, the qualification will be reviewed and revised at the discretion of the field sales manager.

Other DEC employees will be reimbursed at a rate of 9 cents per mile.

Field Sales and Service people assigned to the home plant (training, in-plant service, etc.) do not qualify for the Field Office reimbursement plan.

Qualificants as of December 22, 1964

FIELD SERVICE (Field Only)

John Mutzeneek
Claude Payette
Frank Hibberd
Jim McPherson
Bob Brackett
Gene Henton
Charles Surbur
Al Roberts
Lloyd Murray

FIELD OFFICE SALESMEN

Denny Doyle
Jack Richardson
Tom Quinn
Bob Stiver
Jerry Murphy
Dave Denniston
John Jorgenson
Ken Larsen
Ken Weir
Ray Lindsay
Howie Painter
Don Henderson
Jack O'Connell
Don Barker
Dick Musson
Ken Brown
George Rice
Charlie Kosaftis
Bob Maxcy
Fred Gould
Barbera Stephenson
Bob Oakley

INTEROFFICE MEMORANDUM

DATE January 6, 1965

SUBJECT

TO Computer Guidance Committee FROM J. Smith

cc: D. Smith

Attached you will find a copy of a memo and a status report dated December 3, 1964. Code (X) will give you an idea of what has transpired since that time. All systems with the exception of Adams are either under test or in the final stage of construction.

Remaining to be Released:

Special Switch	for MIT (AEC)	R. Beckman
635B-4	for Adams	D. Smith
635B-5	for Adams	D. Smith

Distribution:

K. Olsen
H. Anderson
S. Olsen
R. Beckman
G. Bell
R. Best
W. Hindle
N. Mazzarese
H. Morse
D. Packer
D. Smith

INTEROFFICE MEMORANDUM

DATE December 3, 1964

SUBJECT

TO Computer Guidance Committee FROM J. Smith

cc: D. Smith

Tuesday I met with D. Smith to discuss the integration of the 630 Data Communication System into Production. Also, of what immediate assistance we could be in helping him to meet existing customer commitments.

Attached, you will find a sheet I have constructed noting the status of all open orders for 630 Data Communication Systems. As can readily be seen, there are a number of items still not released. I feel some thought should be given as to the priority Don should follow for the remaining unreleased units. For example, with the release of the 631B, two customer orders could be completed - Dupont and Fischer & Porter. The 631B is a relatively short job and should not take too much time away from the Adams systems, which it would seem should have top priority, if we consider only delivery dates.

I intend to issue a weekly report to this Committee on the progress of the shifting of responsibilities from Don to Production. The construction of the released units has been given top construction priority, and we should see some very tangible results within the next couple of weeks.

We have, at this time, assumed all construction and checkout responsibilities for all released units and will work very closely with Don to see that the remaining unreleased units become available.

	Design Complete	Wiring Diagram Released	Power Wiring Released	Cabinet Layout Released	Manufacturing Order Issued	Modules and Power Supplies Ordered	Cabinets Ordered	Cabinets Received	Wiring Complete	Final Construction	Test
New York University 630-12											
634E-1	X	X			X	X			X		
632C-5	X	X			X	X			X		
631B-5	X	X			X	X			X		
Adams 630-14			X	X			X				
635A-5	X	X			X	X					
632F-1	X	X			X	X			X		
632F-2	X	X			X	X			X		
633R-1	X	X									
631A-15	X	X			X	X			X		
631A-16	X	X			X	X			X		
635B-4											
635B-5											
MIT (AEC) 630-15							X				
633B-3	X	X			X	X			X		
632B-8	X	X			X	X			X		
635A-6	X	X			X	X			X		
631A-17	X	X			X	X			X		
Special Switch											
Dupont 630-16											
632C-6	X	X			X	X			X		
634C-2	X	X			X	X			X		
631B-6	X	X			X	X			X		
Fischer and Porter											
634C-3	X	X			X	X			X	X	X
632C-7	X	X			X	X			X		
631B-7	X	X							X		
SDC 630-2											
631A-18	X	X			X	X			X		
632A-6	X	X			X	X					

dec INTEROFFICE MEMORANDUM

DATE 6th January, 1965.

SUBJECT

TO Jon Fadiman, S. Olsen, N. Mazzarese, R. Scudney, T. Johnson, R. Beckman, H. Anderson, D. Doyle, K. Olsen, G. Huwe, J. Milton, G. Finch, W. Spittle, P. Greene, R. Mills

FROM John Leng

A number of P.O's were received this month following previous LOI's. These are as follows:-

Type 50 Transport for Harwell.
Type 33 Character Generator for Harwell.
Type 570 Transport for NIRNS.
Type 516-521 Control for NIRNS.
Type 555 Dual Transport for NIRNS.
Type 951 Control for NIRNS.
Type 760 Reader for NIRNS.
Type 761 Punch for NIRNS.
PDP-8 for Hilger & Watts.

LOI's were received as follows:-

PDP-8 for Harwell.
PDP-8 for S.T.C.
PDP-8 for Manchester University.

There are 12 additional PDP-8's, 4 additional PDP-7's and a PDP-6, at the 50% level or greater, for which P.O's or LOI's may materialize within the next 6 months.

MONTHLY SALES POTENTIAL CENSUS

READING OFFICE

CUSTOMER	CONTACT	EQUIPMENT	DOLLAR VALUE	DELIVERY	POTENTIAL NOVEMBER	POTENTIAL DECEMBER
Edinburgh Univ.	Michaelson	PDP-6	500K	Dec.'65	40	40
	"	PDP-8	25K	Aug.'65	30	30
	Oldfield	PDP-7	80K	Dec.'65	40	40
	Royles	PDP-7/8	50K	-	10	10
Glasgow Univ.	Drever	PDP-7	100K	Dec.'65	20	20
Manchester Univ.	Lisle	PDP-7	85K	June '65	70	70
	Ellison	PDP-8	20K	Aug.'65	50	90
Liverpool Univ.	Collinge	PDP-7	70K	Dec.'65	20	20
Oxford Univ.	Mulvey	PDP-6	400K	July'65	70	70
	Allen	PDP-7	140K	March'65	90	90
	Wilkinson	PDP-8	20K	Aug. '65	40	40
Southampton Uni.	Samet	PDP-6	500K	Jan. '65	30	30
	Seidman	PDP-8	25K	May '65	100	100
Swansea Univ.	Gurr	PDP-6	500K	Jan. '66	30	30
	Griffin	PDP-8	20K	Sept.'65	30	30
Univ.Coll.London	Pauling	PDP-8	40K	Sept.'65	50	50
Woolwich Poly.	Seftan	PDP-7	70K	June '66	30	30
A.E.R.E. HARWELL	Rae	Type 50	18K	March '65	90	100
	"	Type 33	5K	-	-	100
	"	Loan equipment	10K	Jan. '65	70	70
	Poole	A to D	5K	Feb. '65	100	100
	Hooton	PDP-8	22K	July '65	90	90
	Orman	Modules	2K	Jan. '65	30	30
	Ferguson	PDP-7	70K	Dec. '65	40	40
	"	PDP-8	30K	Dec. '65	50	50
	"	PDP-8	30K	Dec. '65	50	50
	"	PDP-8	30K	Dec. '65	50	50
	"	PDP-8	30K	Dec. '65	50	50
	Curtis	PDP-6	1700K	Dec. '65	30	30
	Hall	PDP-8	70K	Dec. '65	70	70
	Wells	PDP-8	20K	Dec. '65	50	50
	Baker	PDP-8	20K	Jan. '66	-	20
	Wade	PDP-8	30K	Dec. '65	-	20
N.G.T.E.Pystock	Millington	PDP-7	80K	May '65	70	70
	Nicholls	PDP-6	350K	Dec. '65	40	40
Satra	Manning	PDP-7	80K	May '65	60	60
NIRNS	Lord	PDP-6PERIPH.	70K	March '65	90	100

NIRNS, Daresbury	Collinge	PDP-6	1000K	Dec. '65	30	30
	"	PDP-7/8	400K	Dec. '65	30	30
	Gregory	PDP-8	60K	June '65	60	60
NIRNS, Rutherford	Lord	30 Display	15K	March '65	30	30
	"	Flip-Chips	1K	Jan. '65	100	100
	Wilde	PDP-8	20K	Aug. '65	40	50
	Thresher	PDP-5/8	20K	Aug. '65	-	10
CERL, Leatherhead	Walker	PDP-7	280K	Dec. '65	60	60
	James	PDP-8	20K	June '65	30	30
Electronic Assoc.	Grew	PDP-8	20K	June '65	30	30
S.T.C.	Elton and	PDP-5	Rental	Jan. '65	40	50
	MacG. Ross	PDP-8 with drum	80K	Jan. '65	50	70
S.T.L.	Fossey	PDP-8/5	20K	Sept. '65	10	10
	"	PDP-6	300K	-	-	10
Solartron	Stockham8	PDP-8	20K	June '65	30	40
	Haxby	PDP-7	70K	June '65	30	40
Univ. of E. Anglia	Osborne	PDP-8	30K	Dec. '65	10	10
AWRE, Aldermaston	Tomkins	PDP-8	20K	Aug. '65	30	30
	Yates	PDP-7	70K	Dec. '65	30	30
Sheffield Univ.	Moray	PDP-8	26K	Sept. '65	30	30
	Mason	PDP-8	40K	Sept. '65	50	50
	Evans	PDP-6	500K	Jan. '66	30	30
Lanchester Univ.	Michaelson(Edin)	PDP-7	70K	Jan. '66	10	10
Manchester Coll.	Hoffman	Modules	3K	Sept. '65	20	20
of Technology	Gill	PDP-8	20K	Jan. '66	20	20
R[illegible]s Res. Lab.	Chandler	PDP-6	500K	Jan. '66	20	20
Hydraulics Lab.	Shaw	PDP-8	20K	Sept. '65	40	40
	"	PDP-7	70K	Jan. '66	30	30
Ampex, Reading	Silvie	PDP-8	20K	Dec. '65	10	20
UKAEA, Risley	Grant	PDP-8	60K	Aug. '65	40	40
Hilger & Watts	Stansfield	PDP-8	20K	Aug. '65	70	100
	Skinner	PDP-8	20K	Dec. '65	-	30
Whitwell Elect.	Whitewell	Hybrid PDP-8	20K	March '65	50	50
Rank Organ.	Hanney	PDP-8	20K	Aug. '65	30	30
ICI Res. Lab.	Owston	PDP-8	40K	Aug. '65	30	30
HOC Division	Weir	PDP-8	30K	Aug. '65	30	30
Reading, Berks.	Gray	PDP-8	20K	Sept. '65	30	30
Mullard Res. Lab.	Tweedale	PDP-8	20K	Sept. '65	10	10
Queen Mary Col.	Murgatroyd	PDP-8	20K	Sept. '65	10	10
	Collins	PDP-6	700K	Oct. '65	30	30
G.E.C.	Ellicot	PDP-8	20K	Sept. '65	20	40
Cambridge Univ.	Kennard	PDP-8	40K	Sept. '65	40	40
	Elliott	PDP-7	60K	March '65	90	90
MRC, Cambridge	Lennard	PDP-8	20K	Jan. '66	20	20
Imperial Coll.	Edmonds	PDP-6	250K	June '65	30	40
	"	Modules	2K	April '65	10	10
Ameys	Charlton	PDP-8	70K	Dec. '65	50	50

GCHQ, Cheltenham	Willoughby	PDP-8	40K	Aug. '65	20	20
Cambridge Eng. Lab.	Pascoe	Modules	5K	May '65	20	20
Cambridge Molec. Biology Lab.	Blow	PDP-8	20K	Sept. '66	10	10
	"	Modules	2K	April '65	20	20
Institute of Cancer Research	Bentley	PDP-8	25K	Sept. '65	30	30
Royal Liberty --Grammar School	Broderick	PDP-8	20K	Aug. '65	30	20
Bolton Tech.	Normington	PDP-8	20K	-	10	10
Birmingham Univ.	Colley	PDP-7	70K	Aug. '65	10	10
Brighton Tech.	Summerbee	PDP-8	20K	-	10	10
Hawker Siddeley	Champney	PDP-8	20K	Aug. '65	50	70
	Ballard	PDP-5	Rental	-	-	10
	Wheable	Modules	4K	June '65	-	10
Reading Univ.	Dresel	PDP-6	500K	Jan. '66	30	30
Short Bros. & H.	Miller	PDP-8	20K	-	-	10
Behnson-Lehner	Heyes	PDP-8	20K	-	-	10
UKAEA, Culham	Morton	PDP-7	100K	July '65	-	30
Kearney & Treeker	Dinnage	PDP-8	20K	-	-	20
Nottingham Univ.	Pitteway	PDP-6	600K	Sept. '65	-	30
Univ. Copenhagen	Guld	PDP-8/7	50K	Jan. '66	-	30
Elliott Marine	Martin	PDP-8	20K	-	-	10
Distillers Co.	Little	PDP-8	20K	-	-	10

INTEROFFICE MEMORANDUM

DATE January 8, 1965

SUBJECT

TO H. Crouse
H. Anderson ✓
S. Olsen
N. Mazzarese
R. Savell

FROM D. Kuyamjian

I had a little chat today with Bill Collins, Sales Manager of Data Products, about the new commercial sales division they have set up to service computing equipment users.

The new division consists of three people and is primarily concerned with selling or leasing their high speed printers for off-line use with magnetic tape transports or for use with an IBM 1620 for which Data Products offers a standard interface.

They claim this division has no definite marketing plans for the discfile, only the printers. Should requests from end-users materialize, the discfiles would be sold rather than leased because of the peculiarities of interface required by the different computing systems on the market, even within Data Products "standard" interface.

Collins has categorically stated that Data Products will discourage the purchase of their discfiles by end-users of their customer's equipment. Though pricing for the discfile would be the same as to OEM people, assuming identical quantity, "pricing on the interface would probably be higher and would be the discouraging factor."

We purchased the Model 5022 for about 70K instead of the 5024. The 5024, which is the same unit, but

available with modifications and special interface at no extra charge, sells for about 85K for the initial purchase, but drops considerably below 70K after several purchases. There is no quantity pricing on the 5022 and this would be the route an end-user would go for a one-time purchase with standard interface.

Essentially our position is that anyone can purchase the discfile for the same price as we paid providing there is no special interface requirements. DEC equipment does not require substantially specialized interface. Special interface requires the purchase of a 5024 which is considerably more expensive for an initial or one-time purchase.

I think they're going to play it by ear depending upon whose toes they might be stepping on, but of course will have to avoid "restraint of trade" situations.

H Anderson

INTEROFFICE MEMORANDUM

DATE January 8, 1965

SUBJECT Solid State DECtape Transport

TO Computer Guidance Committee FROM Dan Wardimon

The purpose of this memo is to evaluate briefly the solid state transport and to compare it with the existing relay transport and, to some extent, the Linc transport. The following points deserve our main attention. Their merit and importance should by no means be regarded solely by the order in which they are presented here.

1. Cost
2. Performance
3. Maintenance
4. Appearance

Cost

At present our relay manufacturing cost is approximately $1650 (read write heads alone cost $600).

The subcontracted Linc transport cost to DEC is $1750.

The solid state DECtape, which has an additional $170 of modules and $70 of brakes less $80 of relays, should cost roughly the same as the relay and Linc transports. Although labor (wiring and checkout time) is believed to be less than in the relay transport, wiring could be automated in the solid state if desired. (5 FLIP CHIP blocks are required).

Performance

Performance should be much the same in all cases. Stop time will probably be somewhat improved over the relay type. Also the creeping problem that exists in the latter will be eliminated. Faster selection and commands speed of the solid state is probably of secondary importance.

The Linc motors are not as satisfactory as those in the solid state or relay transports (mainly starting torque) but this is probably of secondary importance as most customers won't feel very strongly about this point.

Maintenance

The solid state transport is much superior to the other types. In case of a faulty circuit a changeover to another plug-in card is far better, faster, less involved and less expensive; a boon to Field Service. This is probably one of the main deficiencies of the existing relay transport. Also the follow up time for analyzing an error will be enhanced by the solid state type.

Appearance

There is no need to elaborate on the looks of the SS transport versus the hand wired relay type which does indeed resemble a TV chassis.

To conclude I want to add that considerable work has been done and money spent on this project (probably beyond the half way point). It might be well worth putting a model together and giving it a test. At least a lot of pro and con arguments would be solved.

DW:ASJ
CC
J McKalip

INTEROFFICE MEMORANDUM

DATE January 11, 1965

SUBJECT 44th Meeting of the Test Equipment Committee

TO Richard L. Best

FROM Russell Doane

Members of the Committee:

Robert Hughes, Chairman
Russell Doane, Secretary
Win Hindle
George Gerelds
Jim Cudmore
Steve Lambert
Larry White
Ed Harwood
Jack Shields
Bill Titelbaum

1. Bill Titelbaum has received from Tektronix an estimate by them of the fair market value of our two do-nothing 'scopes types 321 and 515. Bill will write an ad for Tek Topics, offering the 321 at the suggested price of $600. He will include serial number and some indication of their condition. The 515 will not be sold at this time, since the expansion of power supply production soon may demand its use. The asking price would have been $400 on this 'scope.

2. Our eventual need for a Wattmeter was put off again, since cash is still scarce.

3. Win Hindle is a new member on the committee.

4. The Works Committee expects a written report on equipment loss every month. Bill Titelbaum will continue to write this, and make sure Ken Olsen is on the list to get it.

The next meeting will be February 15, 1965 at 1:30 p.m. in Bob Hughes' office.

dec INTEROFFICE MEMORANDUM

DATE January 11, 1965

SUBJECT

TO Harlan Anderson
Win Hindle

FROM Kenneth H. Olsen

Ted Johnson has proposed that we give out playing cards with DEC module symbols on the back. This might be a clever advertising stunt but I am a little concerned about the image. I would like to hear what you think about this.

Society has a dual standard on many things. We often take part in things freely but are still very doubtful of those who propagate the activities. They might drink but they are very doubtful of liquor dealers. They might play pool but they are sure that pool halls are very evil places for anyone else. Is this true of cards also?

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE January 12, 1965

SUBJECT Status - PDP-7 Production

TO K. Olsen
H. Anderson ←
S. Olsen
R. Belden
E. Harwood
W. Hindle
N. Mazzarese

FROM J. Smith

PDP-7-2, Stanford

Modifications to the central processor were completed Thursday, January 7, 1965. The machine is presently undergoing checkout. The machine was delivered to Checkout with all modules and modifications installed.

Options

34 display has been installed.
550 tape control undergoing off-line checkout; will be available for installation the end of the week.

Problem Areas

Extended arithmetic element and reader, punch - unless wiring schedules are received on these items by Friday, January 15, 1965, checkout will be greatly hindered.

Shipping date to customer - February 23, 1965

PDP-7-5, New York University

Modifications to the central processor were completed Monday, January 11, 1965. Checkout commenced Tuesday, January 12, 1965. The data communication system has been installed in conjunction with the central processor modifications to help expedite matters at a future date.

Options

340 system - undergoing off-line checkout. Will be available for "tie-on" the end of the week.

630-12 data communication system - has completed construction and has been installed. D. Smith has agreed to help with on-line testing.

Problem Areas

Once again, the extended arithmetic element and reader, punch are not released.

Shipping date to customer - February 15, 1965

PDP-7-6, Delft

Schedule date to Checkout - January 22, 1965

Central processor logic has been received and is currently being modified. Memory logic is undergoing ring out. Device select and manual function logic is being constructed.

System will be delivered to Checkout on schedule.

Shipping date to customer - March 5, 1965

INTEROFFICE MEMORANDUM

DATE January 12, 1965

SUBJECT PDP-7 Production Construction

TO Computer Guidance Committee FROM J. Smith

cc: R. Belden
J. Hastings
R. Wilson

Our present production schedule requires the delivery of one (1) PDP-7 basic computer to Checkout per week through March. During April and May, we will move to a six-per-month schedule.

At this time, we should consider the integration of the new model (Inverted) PDP-7 into our production schedule. By taking time now to schedule the prototype and first production machine, we can insure a smooth transition from the old to the new model without effecting schedule dates. This schedule falls into the realm of Engineering Project scheduling, but I would like to work with Ron and Jim to become familiar with the critical interim dates.

We are presently committed to our present design through machine number 10, which has a delivery-to-Checkout date of February 27, 1965. A five-week cycle time will be required from receipt of wiring cards to integrate the new model into the flow of our present production schedule.

Production starts of our present design are currently being generated at a rate of one (1) per week. Each week that passes, without release of the new design, an additional PDP-7 of our present design is committed.

Starting February 26, 1965, two (2) production starts per week will be required to maintain our construction schedule.

Production starts of our present design will continue to be issued at a rate required to meet schedule dates. The economics of the new design, of which I am not familiar, should determine what priority should be assigned to its integration into our schedule.

INTEROFFICE MEMORANDUM

DATE January 12, 1965

SUBJECT

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

FROM J. Smith

Per our agreed schedule on PDP-5 construction, this week we have moved from a one (1) to a two (2) per week delivery to Checkout schedule.

Machine number 83 was delivered to Checkout yesterday. Machine number 84 will be delivered to Checkout today. We will continue delivering machines to Checkout at a rate of two (2) per week through machine number 102.

Our present schedule will terminate the delivery of machines to Checkout on March 1, 1965. If you wish to continue this schedule beyond March 1, 1965, please contact me on or before February 1, 1965.

CONFERENCE REPORT

PRESENT FOR CLIENT

J. Atwood
J. Nangle ✓
J. Burley , Manager of PDP-8 Marketing (part time).

PRESENT FOR AGENCY

F. B. Lynch

CLIENT Digital Equipment Corporation

DATE January 13, 1965

PLACE Maynard

SUBJECT Discuss Public Relations Activities

ROUTE TO

J. Atwood
J. Nangle
T. Howard
D. Moffitt
R. Todd
F. Brill

Purpose of this session was to chart PR activity over the next few months. Areas of emphasis will include:

I. PDP-8 Introduction:

The prototype will be shown first at the IEEE Show in New York's Coliseum, March 22-25. It will probably be demonstrated in connection with a fibre tensile test device, similar to that used by DuPont (At Spruance, Virginia, plant) in an early commercial installation of the PDP-8.

A press showing of the PDP-8 has been tentatively slated for 4 p.m., Thursday, March 18, in a public room of the New York Hilton. The computer will be operational there.

To be invited are editors of electronics and other relevant trade papers in the New York area, business news editors of major New York dailies and wire services. Representatives of ~~ELECTROMECHANICAL DESIGN, COMPUTER DESIGN~~ and the BOSTON GLOBE and HERALD-TRAVELER are to be invited from the Boston area, flown to New York and picked up by limousine and brought to the conference. Digital's New York area sales office is expected to bring a selected group of customers and prospects. ARD may be asked to invite guests from financial circles. Messrs. Olson and Anderson are expected to participate in the presentation of the new product. Cocktails will be served following the demonstration.

Rumrill will:

1. Investigate logistics and cost of the press reception.

2. Work with Joe Nangle on development of press kit and photographs and possibly a film clip for television.

3. Investigate with DuPont possibility of obtaining an illustrated application story on their PDP-8 before the press conference.

NOTES

Or similar demonstration
DA

Obviously tentative
DA

?
Electronic News, Electronics and others with New England editors only
DA

also contact ELECTRONICS in N.Y. about PDP-8 Color photo for possible use on 3/8 show preview Cover. JN to submit proof to ELECTRONICS Boston

CONFERENCE REPORT

II. Flip Chip Modules:

1. A new module handbook will be available at IEEE and will be publicized.

2. The new module production facilities in Maynard will be covered in text and pictures and placed editorially.

3. Agency and Joe Nangle will investigate sources of short illustrated application stories which demonstrate Digital capability and leadership in modules.

4. Digital's policy and methods of marketing modules will be investigated and may form substance of and article for a general business magazine.

Qualified applications engineers AS

5. The module tester is related to module promotion and a story on this, as a product for other manufacturers as well as on its role in the new module production facilities at Maynard, will be obtained. Chuck Stein is the contact.

III. The Digital Trainer:

Alan Ross to set date AS

This product is ready for market (a complete logic training device for about $500).

Jack Atwood is to provide name of a contact at RCA Institute, New York, and agency is to arrange for short term loan of a trainer for classroom use and obtain a story on this. Dave Denniston of Digital-New York could demonstrate the trainer to students.

IV. PDP-6:

After one false start, the van-mounted computer arrived at Brookhaven on Wednesday, January 13. By way of report:

Understand we lost CBS News among others due to delay AS

Don Moffitt of Rumrill alerted New York area press and prepared and distributed a news release and photographs on the arrival. These were distributed, as well, to Boston papers. Reporters and photographers from NEWSDAY and the LONG ISLAND PRESS covered the arrival at Brookhaven, as well as a reporter from the NEW YORK TIMES. They and Don held lengthy interviews with Brookhaven personnel. An additional story is being prepared by Rumrill for trade press.

The computer for the University of Western Australia will be shipped from Logan Airport about February 12. Agency will suggest areas of press coverage. Chances of Papal blessing in Rome are remote.

CONFERENCE REPORT

V. LINC:

There are three major Digital installations of LINC:

--two at Stanford, used in pharmacology and neurology.

--one at Worcester Foundation, testing animal responses to various stimuli.

--one at American Cyanamid-Lederle Laboratories, working with new drug tests on rats.

It may be possible to obtain case histories on each or all of these. At the same time, it should be noted that the PDP-8 may have greater future application for Digital in biomedical research.

More important to have instance when LINC serves several users on varied applications — as discussed

VI. Corporate story:

The agency will attempt to tie the PDP-8 press introduction into the Digital corporate story. Major start: obtain a NEW YORK TIMES profile article.

Agency to provide advice and implementation materials for the ARD annual meeting, March 4, in Dorothy Quincy Suite of John Hancock Building, Boston.

VII. Addenda:

Agency to produce in-depth coverage and pictures on computer installation aboard Woods Hole Oceanographic Institute's exploration vessel, the Atlantis, which sails on January 20 for 10 months study of monsoon currents in the Indian Ocean and their relation to future food from the sea for Asia.

N.B., we have talked with Bud Palmer, PR man for Woods Hole, and Don Moffitt and photographer will visit there on Monday, January 18. They are promised some interview time with Arthur R. "Rocky" Miller, leader of the expedition.

Agency to investigate story possibilities in abstracts of papers presented by Decus group. A spring meeting of this group will be held at Harvard in May.

Agency to ascertain interest of CONTROL ENGINEERING in material from Digital for forthcoming article surveying small computer field and to find out when it will be published.

CONFERENCE REPORT

VII. Addenda: (continued)

Agency to ascertain information leading to application story on Western Electric-Bell Laboratories use of PDP-7 at Merrimack River plant, Andover.

N.B., we have contacted Bell Labs PR and should have information shortly.

#

dec INTEROFFICE MEMORANDUM

DATE January 13, 1964

SUBJECT Rand letter of intent

TO H. Anderson

FROM G. Moore

I have discussed the question of a July 15 delivery of a drum PDP-6 system with Bob Beckman. He feels that such a delivery date is possible, but extremely tight. He would feel much more comfortable with an August 15 delivery. The controlling factor will very likely be drum ordering and drum delivery.

At the present time we are evaluating a Vermont Research drum. This drum was quoted for 4 month delivery and was actually received closer to 5½ months after order. We also have a General Instrument drum on order. It is now overdue and there is no good indication as to when it will be delivered. The Vermont Research drum was purchased for evaluation only. It has only a fraction of the number of heads required by a 1 million word drum. Hence it would have to be modified to be sold to a customer. The General Instrument drum, therefore, will have to go on the Adams system.

We will have to order another drum for Rand. Assuming faster (say 4 months) delivery of a 2nd model, we could hope to follow the following schedule:

order drum	-	January 15
receive drum	-	May 15
complete off-line test	-	June 1
complete on-line test	-	June 15
complete margins, crating and ship	-	July 1

If we order a drum on January 15, we will not have had an opportunity to make a full and careful comparison between the VR drum and the GI drum.

The JOSS consoles do not pose any problem as far as delivery goes. Steve Lambert says that development of the logic and production of one prototype electronics requires 3 months and contributes $15,000 to the selling price. No one is available who can tell me anything about the cost of mechanical development, so I have assumed it, also, to be $15,000.

I would suggest that we start JOSS console development by February 15. On May 1 development should be far enough advanced so that we could commence producing the consoles.

The following terms seem fair:

1. Letter of intent by this Friday, Jan. 15.

2. No cancellation charges for 30 days. Delivery held firm.

3. Decision by Rand on February 15 to continue letter of intent. JOSS console development now starts and cancellation charges start to accrue at $1,000 every three days for 90 days.

4. Joss console production starts on May 1 and additional cancellation charges accrue over the eight week production period. Cancellation should be $3,500 per unit with some way of computing fractions of a unit (work in progress).

N. Anderson

dec INTEROFFICE MEMORANDUM

DATE January 14, 1965

SUBJECT PDP-7 Installations and Confirmed Orders

TO Field Salesmen FROM Rod Belden

Installation	Application
Bell Labs	Computer Controlled Measurement System
Jet Propulsion Labs	-
New York University	Computer Science Laboratory
Stanford University	SCANS System (Stanford Computer for Analysis of Nuclear Structure)
Delft University (Netherlands)	Control Engineering Laboratory
Rensselear Polytech Inst.	Nuclear Experiment Data Recorder
Mass. General Hospital	Medical research and patient record storage
Aeroneutronics Corp.	Automatic film reader
Foxboro Company	Process Control

RB:cr

CONFERENCE REPORT

PRESENT FOR CLIENT		ROUTE TO
Mr. J. L. Atwood	CLIENT DIGITAL EQUIPMENT CORP. DATE January 14, 1965 PLACE New York SUBJECT	B. W. Jones J. E. Rodwell W. Mostad C. J. Raines G. Pinto P. S. Monti N. Lamb G. M. Papazian
PRESENT FOR AGENCY Mr. T. P. Howard Mr. R. V. W. Todd Mrs. R. Venn		

NOTES

1. The purpose of this meeting was to discuss media to be considered for DEC's 1965 advertising program. The agency will prepare a space program recommendation, complete with analyses of recommended media. Upon completion of the media proposal, the agency will present it to JLA (probably in Maynard) for reviewing.

RV to follow up

2. It is still not certain what issue of DATAMATION the 2-page, b/w ad "The PDP-8 is a powerful (7228-5-0002A)" will be scheduled to appear in. The agency will be instructed -- on January 15, if possible -- in regard to the scheduling of this ad.

JLA to apprise agency

Specific books and markets discussed included:

1) Scientific research and education — SCIENTIFIC AMERICAN, INDUSTRIAL RESEARCH, SCIENCE, PHYSICS TODAY
2) Education - ELECTRONICS, SPECTRUM, educational edition of TIME*
3) Scientific and technical management — INTERNATIONAL SCIENCE & TECHNOLOGY
4) Technical management - ELECTRONIC NEWS
5) Computers - DATAMATION, COMPUTERS & AUTOMATION, COMMUNICATIONS OF ACM
6) Modules - COMPUTER DESIGN, ELECTRO-TECHNOLOGY, also ELECTRONIC DESIGN, EDN, EEE, and ELECTRO-MECHANICAL DESIGN
7) Regional - WESTERN ELECTRONIC NEWS

RA

*A very attractive possibility suggested by Rita Venn.

INTEROFFICE MEMORANDUM

DATE January 15, 1965

SUBJECT

TO Harlan Anderson
Bob Lane

FROM Nick Mazzarese

I just received a telephone call from Alice Hobnet of AEC. She indicated that the Rand people are coming in to visit her on Monday, the 18th. The reason she called was to find out if we were willing to accept an order directly from Rand and count it towards the AEC contract, rather than go through the red tape of having a transfer of funds made. She felt that,in this case, transfer of funds might go as far as the Pentagon and, being a circular building, might go round and round. She also mentioned that it was not clear to her what AEC's interest was in this particular computer and it was her understanding that they were not providing any of the funding for the purchase of the computer. She felt that this further complicated it. She indicated that she would be calling me back on Monday, after the Rand people have visited her, to discuss the matter further with me. We should perhaps get together and discuss this problem sometime early Monday.

dec INTEROFFICE MEMORANDUM

DATE January 15, 1965

SUBJECT

TO S. Olsen
H. Anderson ✓
N. Mazzarese
J. Fadiman
R. Lane
R. Beckman
H. Crouse

FROM D. Kuyamjian

Attached is the revised schedule of Anelex printers.

CONTRACT	RELEASES	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN
Anelex Corporation Series 5 Line Printer Qty: 10 Contract: 11-64/3-66 Dlvy. Cycle: 5 months	Release #1-ten units			#2 300 lpm 120 col 50~220V 15,500 BONN	#3 300 lpm 120 col 50~220V 15,500 AACHEN	#4	#5 1250 lpm 132 col 60~115V 25,910 WASH S.U.	#6	#7	#8	#9	#10	
SPEED, INPUT REQUIREMENTS CHARACTER SET NUMBER OF COLUMNS CANNOT BE CHANGED AFTER THESE DATES WITHOUT CANCELLATION CHARGES AND/OR EXTENSION OF DELIVERY DATES.					#1 300 lpm 120 col 60~115V 15,500								
—— EQUIPMENT MAY BE CANCELLED PRIOR TO THIS DATE WITHOUT INCURRING CANCELLATION CHARGES		1st ——			14th								
/ EQUIPMENT CANCELLED PRIOR TO THIS DATE MAY INCUR CHARGES FOR PARTS BUT NOT LABOR.				NOTE: Unit #3 Character Drum to be supplied with zero (0) and letter (O) not slashed.									

25th / —— 15th
15th —— 26th / —— 14th
15th —— 15th —— 27th / —— 15th
15th —— 15th —— 28th / —— 15th
15th —— 15th —— 14th —— 28th / —— 15th
15th —— 15th —— 28th / —— 15th
15th —— 15th —— 27th / —— 15th
15th —— 15th —— 27th / —— 15th
15th —— 15th —— 27th / —— 15th

dec INTEROFFICE MEMORANDUM

DATE January 18, 1965

SUBJECT New Computer Cabinet

TO Loren Prentice
Ron Cajolet
Gordon Bell
Alan Kotok

FROM Kenneth H. Olsen

I am thinking of a new computer cabinet which is designed to take advantage of the techniques we have learned in making the PDP-8 and to take best advantage of the Gardner-Denver automatic wire wrapping machine. I feel that we should continue our standard type construction with swinging doors, hung on end panels, and I also feel it should be the same height and width so that we can continue to add on our standard cabinets and equipment. However, they should be wider because the Gardner-Denver machine will wire panels which are 22" x 44" and it is very wasteful if we can't wire full width. In addition, the console front which we are making for the PDP-8 promises to be tremendously less expensive but it does take somewhat more width than our standard panels. I think it is clear that our wiring should be 22" wide and either 44" or 54" in length. If we can get 54" we should, of course,do that; otherwise, we might as well standardize them 44". The big question we should decide is whether or not this wiring panel should be on the plenum door. It does have advantages to have it on the plenum door because one has ready access to it. The plenum door is only 46" high and this allows us 20" underneath for power supply and the fans. We will use too many psychologics from now on and so we'll need very little power conveyed into one standardized unit such as we use in the PDP-8. In those cabinets which have a lot of logic and no console front, we can have a plenum door arrangement on both front and back. Perhaps we should move it down 5 1/4" so that we could have a PDP-6 type indicator panel at the top.

The cabinet would then be 22 + 2 1/2 + 2 1/2, or 27" wide. Our standard construction would be plenty strong for this larger plenum door. The amount which we can hold in one of our glass console fronts is limited by the center distance of the switches which is 9/16". This comes out to be 20.2" for 36 bits and 13.5" for 24 bits, which means it would fit quite comfortably in a 27" panel. An area 22 x 44 would hold 44 x 16 or 705 modules.

We expect practically no assembly time on the PDP-8 because all the different parts get patched together with cables. Because each of the individual parts would be tested separately, the machine ought to work immediately after being cabled together. I heard that this cabling system did not work out on the PDP-7 but, in questioning people more closely, I believe they say that it didn't work out because they ran out of space and had to use those sockets for modules.

Another possible way of constructing the cabinet would be to fasten the modules in the front of the cabinet like we do now which would make the cabinet only about 24" wide. We could then put the console on the plenum door. The plenum door could then be the same width as the cabinet and mounted outside of the cabinet because there would be no doors

outside of the plenum door.

There could be mounted inside the cabinet and close to the top surface of the modules, a vertical sheet which would keep the air being blown up from inside the modules from floating out into the cabinet and take care of the cooling of the full 44". When the plenum door is open, the modules would be hanging free and would get the cooling from normal conduction. The power supply in the very bottom could take care of the fan and the filtering.

Because of the shallow depth taken up by the modules, the paper tape reader and paper tape punch could be mounted above the console like we now have on the PDP-1. As we're re-doing solid state microtape, we perhaps should make sure it is shallow enough so that two could fit in and still leave room for modules.

After the PDP-8 mechanical problems are solved, I would like to see us build one of these type cabinets so that we can have the confidence to go ahead and commit ourselves to the computer using them.

Ken Olsen

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE January 18, 1965

SUBJECT Progress and Status Report on Computer-Aided Design

TO Works Committee FROM C. Stein

1) The following work has been done in the area of Computer-Aided Design:

A. A first attempt at a system called DECADE is now being implemented. This system is described in an accompanying document. I am spending about 60 per cent of my time and John Rodenhiser is spending full time on this project.

B. The Hardware required is:

1. 8K PDP-4/7
2. 3 - 555 Dual DECtape Transports
3. 550 DECtape Control
4. 340 Display
5. 370 Light Pen
6. 347 Subroutining Interface
7. 31 Precision Display with PDP-4/7 Interface
8. Microfilm Equipment
9. Card Punch and Interface

The list price of this equipment, excluding the microfilm equipment and card punch is $167,383.00.

C. The microfilm equipment would include a camera, film processor and dryer, and a viewer. With this equipment, we would not need a line printer. Instead, we would use the 31 display to project characters on the film, develop, and process with our existing Caps-Geoffry microfilm to hard copy machine. In this manner, we would achieve about 900 lines per minute. The viewer would permit instant viewing of the drawing or printing.

I have discussed this equipment with Photomechanisms, Inc. in Long Island, New York. They have all the necessary modules to make such a system and have given me a ball-park figure of 10 - 15K. I would propose that we issue a "Request for Quotation" for such equipment.

Adding $15,000 to the list price of the equipment gives a total of $182,383.00 exclusive of the card punch.

2) It is my belief that this is a good product line for DEC to pursue. I have discussed this system with Vitro Labs. in Washington, D.C. and have opportunities to discuss it with other firms. They are:

A. RCA, Indianapolis, Indiana. Mr. Troy, their head of Manufacturing processes believes he could use this system for TV design.

B. Northern Electric, Toronto. I have talked with a Mr. Turnbull who would like to continue discussions by visiting DEC. They feel that this system would be useful in telephone communications systems design.

C. Boeing, Seattle and Lockheed, Sunnyvale. Mike Ford has talked to both of these companies regarding this system's use.

At this moment, IBM is the only other company in this area. They are not competitors, however, since their system cost in the neighborhood of 3.2 million dollars. Presumably, our system would sell for around $200,000. However, DEC will not be alone in this area for very long. CDC and CCC are both interested in this area, and Honeywell is considering the idea. Thus, the decision should be made soon. I would propose that we attempt to demonstrate at the Spring Joint Computer Conference.

3) My guess is that we would sell from 10 to 20 of these systems in Fiscal Year 65 - 66. This is based on:

A. The early interest of AVCO, Sylvania, and Raytheon.

B. The present interest by the four mentioned firms.

C. The interest of B. K. Elliott Company, a drafting supply manufacturer.

4) The included document describes the operation of the system. For our use, it will be coupled with a wire list generator (from the drawing's tables), and a wire-wrap computer (completed). Roger Melanson and I have concluded that this system will do most of the work of the present electrical drafting section.

5) The initial system will be operating on 1 April, 1965. Any systems sold should be deliverable by 1 September, 1965.

DECADE-Digital Equipment Automatic DEsign System

ABSTRACT: This paper describes a preliminary version of the DECADE* System. As the system is used, various other abilities will be implemented to make DECADE more powerful. DECADE is the first attempt to produce a low-cost drafting and analysis system. It is a schematic (drawings consisting of standard type elements, text information, and lines, to indicate connections), drawing system. DECADE generates a description file, which contains information about the "appearance" of the drawing, and the interconnections between standard elements.

*DECADE is a trademark of Digital Equipment Corporation

DESCRIPTION

The paragraphs that follow, describe the operation, requirements, and use of DECADE.

The following hardware is necessary for DECADE.

1. PDP-7, 8192 Words Core Storage
2. 340 Incremental Display
3. 370 Light Pen
4. 550 DECtape Control
5. (3) 555 DECtape Dual Transports
6. Output device consisting of either of the following:

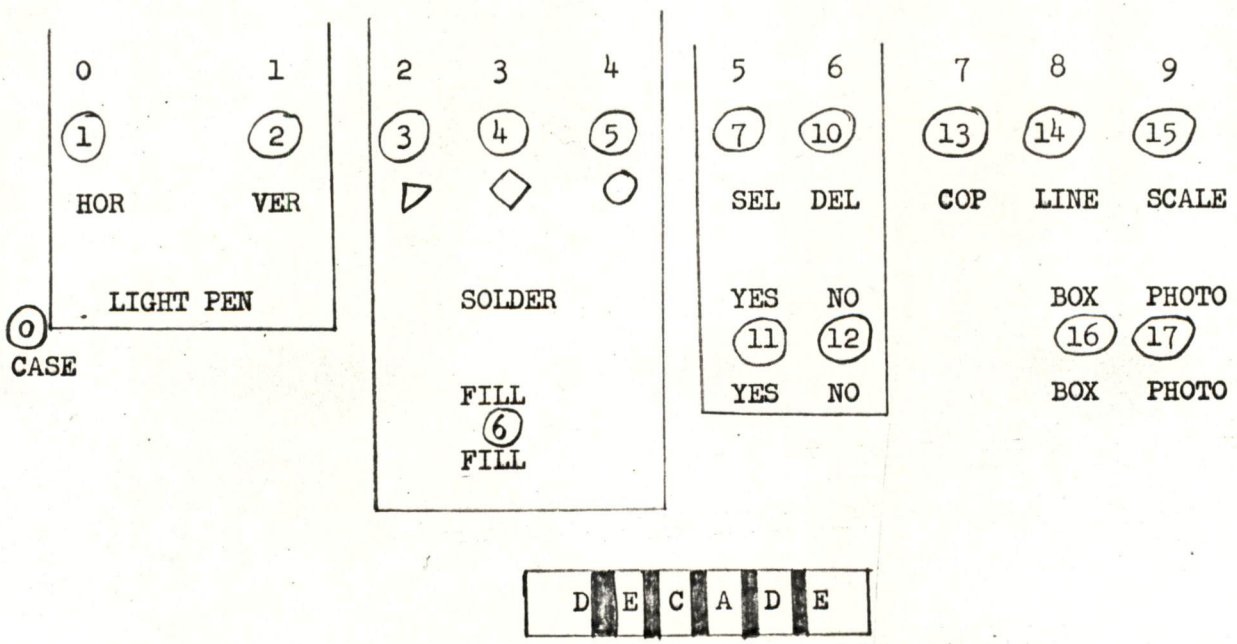
    A. 31 Precision Display with Camera Attachment - Or -
    B. 300 Line/Minute Printer and a Printer Plotting Device

With option 6A, the precision display would be used as a precision plotter and a line printer. Some sort of microfilm to hard copy equipment would be necessary (Caps, Photomechanisms, Xerox, etc.).

The cost of hardware and programs would be in the neighborhood of $200,000.

A special push-button console comes with the DECADE System. Figure 1 is a sketch of this console. The buttons have two values, set by the CASE push button. When CASE is held down, the buttons are in the upper case, when left up, in the lower case.

FIGURE 1



DECADE CONSOLE

For the purposes of this discussion, we will assume that there is in existance a standard element tape and corresponding hard copy showing:

A) Picture of the standard elements
B) Name or "Tag" of the standard elements
C) Hot points

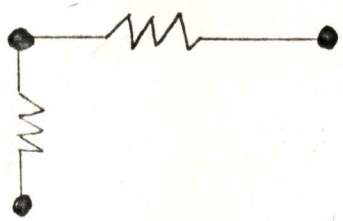
From this documentation, we could see that:

A) There is a standard element that looks like

B) Called RESTR
C) Having hot points at each end.

Hot points are the points at which connections can be made. Thus, this resistor could be connected to things at either end, but not in the middle.

EXAMPLE:



All standard elements are contained on this drawing.

When we are drawing, there are two scales, or views of the schematic. Scale Zero looks at the entire D-Size page. However, the screen is too small to draw effectively at that scale. Thus, scale one shows a small section of the D-Size page. This section is a 9 inch square on the large page and can be thought of as a window, which slides over the drawing. At any time, the "window" is isolated, and magnified.

When in scale 0, a box $2\frac{1}{4}$ x $2\frac{1}{4}$ can be shown by depressing the Box pushbutton. This box can be positioned by placing the pen on the screen in the area desired and depressing BOX.

Displayed at all times on the screen is a small cross. This is where the computer last saw light from the light pen. This cross can be moved over the screen, by placing the pen over it, and then moving the pen. Above and to the left of this cross is a dot. This serves as a pointer. Thus to point at something on the drawing, we place this dot over the object and push the appropriate button. Coinciding with this dot is another dot, which is the writing point of the pen. When we are in the line drawing mode, a line will "flow" from this dot. The writing dot can be constrained by two push buttons. They are:

1) VER- While this button is held down (lower case) the writing point of the pen will only move in the vertical direction. The horizontal coordinate will stay the same. This is used to draw vertical lines and to vertically align.

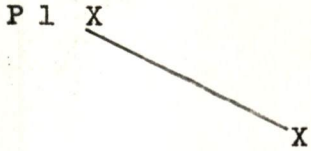
2) HOR- This button works in the same manner as the VER button. While this button is held down the writing point of the pen will only move in the horizontal direction. The vertical coordinate will stay constant.

When these constraints are applied, the pen and pointer will stay with the light pen.

There is also a LINE button which, when first depressed, causes the coordinates of the present pen position to be saved. While the button is depressed, a line will be drawn from that point to the writing point of the pen.

EXAMPLE:

A) Draw the following line

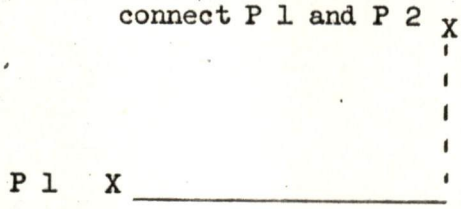


1) Place the pen's writing point at P 1
2) Depress LINE
3) While holding LINE down, move the writing point to P 2
4) Release LINE

B) Draw the following horizontal line

1) Place the pen's writing point at P 1
2) Depress HOR and LINE
3) While holding both HOR and LINE down, move the writing point to P 2
4) Release both HOR and LINE

C) Draw a horizontal and a vertical line to connect P 1 and P 2



1) Place the pen's writing point on P 1
2) Depress HOR and LINE
3) While holding HOR and LINE down, move the pen pointer to P 2. The solid line will be drawn
4) Release LINE, leaving HOR down
5) Depress LINE (the dotted line will be drawn)

To connect lines to standard elements or other lines, the three SOLDER buttons are provided. These buttons provide different ways to connect. For example, in the area of Logic Schematics those three could be a diamond, an arrow, or a small circle *. The FILL push-button satisfies DEC's requirements for positive or negative levels. It is a very simple matter to change the symbols generated and/or the meaning of these four buttons. However, for the purposes of this discussion, we shall assume that these symbols are acceptable. The SOLDER buttons generate the specified symbol, then enter the LINE mode. The best way to describe this operation is through examples.

EXAMPLE:

Connect the two standard symbols below at points A and B

1) Place the pen's writing point at A
2) Depress SOLDER (◇), release (Place a diamond at P A)
3) Depress FILL, release (Fills in the diamond)
4) Depress VER, move the pen to P 1
5) Depress LINE, HOR
6) Place the pen at B

*DEC Notation

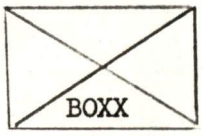
7) Release LINE, leave HOR down
8) Depress LINE, release HOR
9) Depress SOLDER (O) (Places a circle at B)
10) Release all buttons

When a standard element is placed in the picture by typing G, tab, and the Name of the element, it appears on the lower left of the drawing. To place it somewhere else, the POS (position) button is depressed. The element will now be placed with its upper left corner at the writing point. If the POS button is held down, and the pen moved, the element will follow the pen over the screen.

EXAMPLE:

A) Suppose there is a standard element called BOXX as shown below. It is desired to place BOXX in the middle of the drawing.

1) Type "G, tab, BOXX, carriage return"
2) Move the pen to the center of the drawing
3) Depress POS



B) It is desirable to align BOXX vertically with a currently existing element

1) Type "G, BOXX, carriage return"
2) Place the pen on the part of the existing element to be aligned with BOXX
3) Depress VER
4) Move the pen to the vertical position desired for BOXX
5) Depress POS

Thus, we can position elements immediately after they have been placed on the screen. However, suppose we desire to re-position some element. How do we refer to elements already placed on the drawing? To solve this problem, we have included a button called SEL (select). When we type a name in and get a standard element, it becomes "LIVE". However, if we should desire that another element become LIVE, we point at it with the pen (place the pen over it) and depress SEL. When this has been done, the element will become brighter than the rest of the picture.

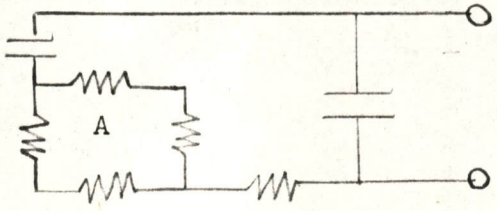
To delete part of a picture, the DEL button is used, in conjunction with the SEL button. To delete an element:

1) SELect the element (or elements)
2) Depress DEL
3) If you made a mistake, depress NO and the element will reappear. If you wish to delete the element finally, depress YES.

After the DEL button has been depressed, all other buttons are disabled until either YES or NO has been depressed. The SEL button is used for one other function. At times, it is desirable to construct a standard element from other elements. For example: It might be desirable to define a three bit register made out of flip flops. Then every time we typed the name of this register, we would get three flip flops connected together.

EXAMPLE:

Make a Wheatstone bridge out of four resistors and rename it WHTSBR. The current drawing looks like:

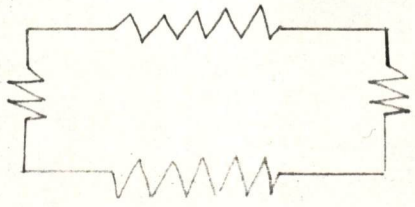


The four resistors we will use are the left-most four (Letter A)

1) Place the pen over one resistor and depress SEL
2) Repeat this for the other three
3) Type "R tab WHTSBR carriage return"

The R is the Rename command.

Henceforth, the symbol:



Will appear when WHTSBR is typed.

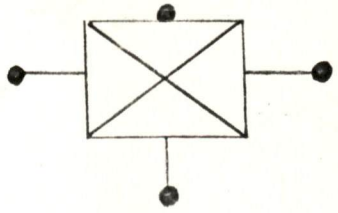
The last button we will discuss is COP (copy). This button allows the user to copy the live element N times. To use it:

1) Select the element to be copied with SEL
2) Using the upper case, place N into the count register (See Below)
3) Move the pen to where the adjacent element should appear
4) Depress COP

N evenly spaced elements will be drawn. The number N is placed in the count register. This is done with the number buttons in the upper case. Thus to place the number 1792 in the count register, depress CASE then 1, 7, 9 and 2. If a mistake is made, depress NO and the entire number will be cleared.

EXAMPLE:

Copy the symbol below 4 times, aligning them vertically:



1) Place the pen on the symbol. Depress SEL
2) Depress VER, move the pen below the element to the proper spacing
3) Release VER. Depress CASE then 4
4) Depress COP

Review of Buttons:

1) VER - Constrain the pen's writing point in such a way that it will only move in the horizontal axis.

2) HOR - Constrain the pen's writing point in such a way that it will only move in the vertical axis.

3) LINE - Save the present writing point position the first time depressed. Thereafter, generate a line from that point to the current writing point.

4) SOLDER - Consists of three buttons to generate different connection symbols. When depressed initially generate that symbol and enter line mode.

5) FILL - After Solder, cause the symbol generated to be filled with bright cross batch. Otherwise, ignore.

6) POS - Cause the Live Element to be positioned at the current pen writing point.

7) SEL - Make the element over which the pen is pointed to the Live Element. Increase the intensity of this element to make it appear brighter.

8) DEL - Delete the Live Element.

9) YES - Used in conjunction with SEL and DEL. Completes the SEL and DEL functions.

10) NO - Used in conjunction with SEL and DEL. Negates the SEL and DEL functions.

11) COP - Copy the Live Element N times. N is set with the Number push buttons.

12) BOXX - Ignored in Scale one. In Scale 0 position the window over the pen's pointing point.

dec INTEROFFICE MEMORANDUM

DATE January 18, 1965

SUBJECT Magnetic Tape Selectric Typewriter

TO K. Olsen
H. Anderson
S. Olsen
R. Best
M. Sandler
R. Mills
G. Bell
N. Mazzarese
W. Hindle

FROM J. Atwood

The attached brochure describes the new IBM Magnetic Tape Selectric Typewriter which I mentioned at last week's Works Committee meeting.

I would like to lease a Model IV MTST (two tape stations with search and adjust) to perform repetitive typing tasks for our own and other departments. For example:

Sales	Customer, prospect and DECUS mailings Proposals and acknowledgments Price lists and status reports
Engineering	EN and option number lists Project schedules Technical reports
Production	Production schedules Parts lists
Accounting	Financial statements Statistical reports
Purchasing	Vendor lists and mailings Requests for quotation Detailed purchase orders
Personnel	Form letters Insurance reports
Programming	Program write-ups

Tech Pubs	Employee mailings
	Job lists
	Publication drafts
	Request for quotation
	Personalized invitations

These are typical instances where automated typing can reduce costs, save work time, improve the end product, or perform necessary operations which might otherwise not be done because of a shortage of qualified typists.

The Model IV leases for $233.00 a month. The purchase price is $9,535.00, but I would not recommend that we consider purchasing until there has been more opportunity for product improvement or price reduction.

J.L.A.

fd

K. Anderson

INTEROFFICE MEMORANDUM

DATE January 18, 1965

SUBJECT

TO E. Harwood
N. Mazzarese

FROM J. Smith

The B210 accumulator module for the PDP-7 is currently on Engineering Hold. I have contacted R. Doane and made him aware of our current PDP-7 schedule.

Machine number 6 is due up to Checkout this Friday, and it requires 19 of this module type. He feels he can have the model for us first thing tomorrow morning. If so, we should meet the schedule date. Each day delay thereafter will directly effect the delivery of machine number 6 to Checkout.

I will keep you aware of the situation.

INTEROFFICE MEMORANDUM

DATE January 18, 1965

SUBJECT Inventory Analysis and Proposal

TO Works Committee FROM M. Sandler

The attached Inventory Analysis is a summary of all parts in Raw Material and WIP Stock which have not been used during this current fiscal year and which could have been written off in fiscal 1964.

The Remarks Column holds data which is of interest.

1. The Type 12 Memory accounted for $2670. involved in the 1538 Sense Amplifier.

2. Tube Current Drivers accounted for $5107. of non-usage.

3. Germanium transistors accounted for $8850.

4. Indiana General stocks accounted for $25,699.

5. Sheet Metal Parts accounted for $14,836.

6. It is interesting to note that Tube Current Drivers are still in our catalogue and that we still sell Type 12 Memories.

7. The 146 "other types" of resistors and potentiometers average $64. per item.

8. The 53 "other types" of Class 34 Mechanical Components average $54. per type.

9. The 78 "other types" of Class 53 Sheet Metal Parts average $58. per type.

10. The 75 "other types" of Class 74 Fabricated Metal average $69. per type.

Proposal:

That a committee comprised of Engineering, Sales, and Production determine the disposition of the large items listed. We must either use this material or take a write-off.

INVENTORY ANALYSIS

Raw Material not used in Current Fiscal Year

Class	Name	Amount	Remarks
10	Capacitors	$ 1,940.	1000mfd-15V replaced by 1500mfd in 710, 735, 721 - $583.; 6000mfd-150V and 6750mfd-150V purchased for 2 Usec. Memory Power Supply, but not used - $716.
11	Diodes	3,338.	SW1250 used in 1986 M.T. Read-Write Switch, obsolete - $956.
12	Hardware	3,829.	1906 Mounting Panel Circuit, not yet used - $843.: Current Driver Tubes - $466.
13	Resistors, Pots, Etc.	15,637.	25Ω-25W - Used in 721 - $2285.; 100Ω CTS Pot - Used in 1538 Sense Amp. for Type 12 Memory - $1410.; 220Ω-¼W-1% for 2 Usec. Memory - Not used - $1320.; 250Ω-2W-Pot - For 1538 Sense Amp. - $1260.; 146 other types designed out.
14	Boards	170.	
15	Transistors	14,946.	2N167; Used in 1547 and 1706 Now obsolete - $1073.; 2N2100, designed out of 1989, $841.; 2N2801, used in 15591 Light Pen No Longer Used, - $804.; MD93 germanium - $8850.

16	Transformers	4,258.	1012 and 1020 used in Tube Current Drivers - $3978.
19	Cera-Circuits	2,902.	B27 and F27 designed out - $2902.
	Total Module R.M. -	$47,020.	
30	Peripheral	$ 1,919.	12 "Computerwriter" - $1860.
31	Magnetic Tape	220.	
33	Display	722.	EQ R60-6 P.S. - $530.
34	Mechanical	5,268.	1 KC Oscillator - $885., 115-114S-432 Taper Pin Receptacle, $1488.; 53 other types.
36	Miscellaneous	330.	
	Total Computer R.M. -	$8,459.	

Work-In-Process Not used in Current Fiscal Year

Class	Name	Amount	Remarks
50	Etched Boards	$ 2,222.	3102, 3112 Boards - $574.
51	Panels	506.	
52	Pulse Transformers	740.	
53	Sheet Metal Parts	7,232.	40 Alarm Panel - $498.; 813 Chassis - $718.; 1903 Stop Strip - $821.; Tube Current Driver - $663.; 78 Other Types
	Total WIP Module	$10,700.	
70	Sub-Assembly, Wired	8,728.	PDP-1
71	Magnetic Tape	1,751.	
72	Display	1,525.	30D Logic - $438.
73	Memories	25,699.	Indiana General Stocks - Seven.
74	Fabricated Metal	7,604.	Switch Brackets - $831.; Buffer Cabinet Assembly - $1555.; 75 Other Types
	Total Computer WIP	$45,307.	

SUMMARY

Module R.M. Classes	$47,020.	
Module WIP Classes	10,700.	
Total Modules		$57,720.
Computer R.M. Classes	$ 8,459.	
Computer WIP Classes (25,000 Stacks)	45,307.	
Total Computers		$53,766.
Total		$111,486.

INTEROFFICE MEMORANDUM

DATE January 19, 1965

SUBJECT CANADIAN OPERATION

TO K. H. Olsen
H. E. Anderson

FROM J. L. Atwood

I see two choices with respect to our Canadian operation.

1. By handling it as a U.S. regional office, we stand to upgrade our sales in Canada rather quickly since Ted appears to have better rapport than Jono with the majority of the Home Office sales staff.

2. By handling it as a foreign subsidiary, we stand to upgrade our entire international marketing effort since Jono would be influenced to solve the many problems that are or will be common to all of our operations outside the U.S.

Neither alternative would appear to offer any particular advantage in the current fiscal year. Consequently, the problem should be viewed in terms of our long-range objectives. And it should also be viewed with minimum emphasis on the individuals presently concerned. Ted, Jono, Denny, John Leng - any or all might have completely different assignments six months or a year from now.

My considered opinion is that we have far more to gain by using DECAN to help support and guide the establishment of an effective international marketing operation than by extending our U.S. sales operation into Canada.

J.L.A.

fd

dec INTEROFFICE MEMORANDUM

DATE JANUARY 19, 1965

SUBJECT DEC TECHNICAL IN-HOUSE TRAINING

TO DISTRIBUTION FROM BOB BECKMAN

DISTRIBUTION:

K. Olsen
H. Anderson ✓
S. Olsen
W. Hindle
W. Mazzarese
H. Morse
G. Bell
J. Hastings
R. Best
R. Lassen
M. Sandler
D. Packer
E. Harwood
R. Hughes
J. Smith
J. Shields
R. Mills
J. Atwood

The first DEC Technical In-House Training course has been completed. It consisted of 11 students and one instructor in training. The class was assigned to various parts of the company as follows:

Engineering	1
Computer Checkout	3
Module Test	3
Field Service	4

Technician training until now has been on-the-job type training. This is partially satisfactory for a small company with limited production. Such training has become unsatisfactory for a company that has expanded to the size of DEC with its many and diversified fields of operation.

On-the-job training limits the individual in his overall usefulness to the Company because he is trained for and understands only one facet of the entire operation. His growth potential is limited with no real understanding of the relation between his particular job and the end product. Without such an understanding, the individual would tend to view his present position as "just another job," with no real purpose or chance for advancement.

The demand for trained technicians far outweighs the supply. This leaves the Company with two alternatives, either continue an expanded OJT program or conduct formal training courses which cover all facets of DEC's operation.

The time required to make available a technician, familiar with all of DEC's operations and procedures via on-the-job training, can run from 12 to 15 months. The In-House Training Course can make available a trained technician in approximately 8 weeks. After completion of the course, and with a limited amount of supervision, the technician can assume responsibility faster and be productive.

At this time it is a little premature to make an evaluation of these people. After a resonable length of time and evaluation by their supervisors, areas that may have been weak in the pilot course will be covered more thoroughly. Future plans for the course are that the courses be run on a four-a-year basis. The length of the course will be approximately 8 weeks. Our next class will convene in February.

The following is a list of the subjects covered in the Technician Training Program:

CIRCUITS COURSE

1. Review of electronics fundamentals and discussion of components, to include: Resistors, Capacitors, R-C Time Constants, and Thevenin's Theorem.
2. Semiconductor Theory
3. P-N Junctions (Diodes)
4. Junction Transistors
5. Transistor Types
6. Resonant Transformer Power Supplies
7. Inverters
8. Unbuffered Flip-flops
9. Buffered Flip-flops
10. C-D Gates
11. D-C-D Gates
12. Diode AND, OR, NAND, NOR Gates
13. Pulse Amplifiers
14. Pulse Generators
15. Delays
16. Clocks

MATH (General Logic)

1. Binary Math - Addition, Subtraction, Multiplication, Division, Fractions.
2. Octal Math - Addition, Subtraction, Multiplication, Division, Fractions, Binary to Octal, Octal to Binary.
3. Coded Numbers - Gray Code and Binary Coded Decimal, Gray to Binary, B-C-D to Binary.
4. Boolean Algebra- Basic algebra review, Laws of Boolean, Venn Diagrams, Conversion of Boolean expressions into logic circuit diagrams, Conversion of logic circuit diagrams into Boolean expressions.

D-E-C Logic and Symbology

1. Inverters
2. Flip-flops
3. And Gates
4. Or Gates
5. C-D Gates
6. D-C-D Gates
7. Clocks
8. Pulse Amplifiers
9. Pulse Generators
10. Delays

TEST EQUIPMENT

1. Oscilloscopes
    a. Tektronix
    b. Hewlett-Packard
2. Triplett Volt - Ohm - Milliammeter

LAB

During these sessions, the students:

1. Practiced operating oscilloscopes.
2. Viewed circuit waveforms.
3. Measured circuit waveforms for width, amplitude, and frequency.
4. Built and checked various circuits taken from the system modules catalog, including counters, shift registers, jam transfer gates, and gates, or gates.
5. Designed and built a counter that would count to fifteen, and hold that count, and stop.
6. Built binary to octal decoders.
7. Built A to D converters.
8. In general, familiarized themselves with the function and use of DEC circuitry.

PRACTICAL APPLICATIONS

PDP-5 or Equivalent Machine, i.e., PDP-8

1. Flow Diagrams
2. Reading Schematics
3. Simple Programming
4. Theoretical Troubleshooting
5. Actual debugging and programming of computer.

PERIPHERAL GEAR (General)

1. Mag. Tapes
2. Mag. Drum
3. Mag. Disc
4. Displays
5. Typewriters
6. Lineprinters

INTEROFFICE MEMORANDUM

DATE January 19, 1965

SUBJECT Production Schedule of PDP-8 Basic Computers

TO See Distribution List FROM J. Smith

Machine Number	Delivered to Checkout
1 - 10	3/8/65
10 - 30	(20) in April Approximately 1 per Day
30 - 50	(20) in May
50 - 70	(20) in June
70 - 90	(20) in July
90 - 110	(20) in August

Distribution:

K. Olsen
H. Anderson ←
S. Olsen
W. Brackett
R. Cajolet
H. Godfrey
E. Harwood
D. Kicilinski
R. King
R. Maroney
N. Mazzarese
L. Prentice
M. Sandler

INTEROFFICE MEMORANDUM

DATE January 19, 1965

SUBJECT PDP-7 Status

TO K. Olsen
H. Anderson
S. Olsen
R. Belden
E. Harwood
W. Hindle
N. Mazzarese
D. Vonada

FROM J. Smith

PDP-7-2, Stanford

Reader and punch wiring diagrams were released late Friday, January 15, 1965. We are presently rushing two (2) through wiring. Should be available for Checkout Thursday, January 21, 1965.

Card deck for the extended arithmetic element will be available Wednesday, January 20, 1965. Completed panels should be available from RCA January 26, 1965.

Wiring for the 172 priority interrupt has not been released.

PDP-7-5, New York University

Reader and punch logic - see above - two (2) panels are in process.

PDP-7-6, Delft

Central processor is on schedule. All wiring will be complete and all modules available with the exception of the B210's which are on Engineering Hold. Reference previous B210 status memo.

PDP-7-7, Cambridge

Due to Checkout February 6, 1965. Central processor has been received from RCA - being reworked and updated. Memory logic is being constructed. Will be delivered on schedule, if the B210 problem is resolved.

copy to
H. Anderson

INTEROFFICE MEMORANDUM

DATE 20 January 1965

SUBJECT PDP-6 and DEC Missionary Work

TO Nick Mazzarese, Maynard
Jack O'Connell, Orlando

FROM Bob Stiver, Los Angeles

I have just been informed by one of our systems houses that a PCP-6 and -7 telemetry data acquisition and processing system proposal has been eliminated from contention in favor of one of the Big 3, namely, IBM, Univac, and CDC. This systems house was somewhat amazed as they feel there is quite a good reputation for DEC throughout the country, although the customer, the US Air Force and their systems operation group, called "Pan Am" has claim to not having heard of DEC.

The other impression conveyed is somewhat more plausible in that they feel standardization of general computing equipment in the Cape Kennedy area is fairly wise. I think we will go along with that, especially if they standardize on our equipment. The name of my informant must remain anonymous. However, he did give me some names of people to contact and I suggest if this contact is made it be done in a general manner, rather than on any specific subject, as this particular program is pretty much lost. The name of the installation is Bio-Astronomical Support Unit. The two Air Force officers involved are Capt. R.A. Davison, and Lt. W.F. Stinson. The Pan Am representatives were M.M. Lawrence and Paul J. Nied. For general background, remember that JPL is using several PDP-4's, which will shortly by PDP-7's for just the telemetry reduction application that is described here.

INTEROFFICE MEMORANDUM

DATE January 20, 1965

SUBJECT

TO H. Anderson ✓
R. Best
R. Beckman
R. Tringale
R. Savell
H. Crouse

FROM D. Kuyamjian

The General Instrument memory drum is being re-coated for the fifth time.

According to S. Intagliata, G.I.'s chief engineer, the problem is with the silver substrate which lies between the magnesium casting and the magnetic material. Accordingly, they have stripped the drum down, this time right to the magnesium, and will apply the required layers - silver substrate, nickel cobalt and protective overlay. Again, due to flaking, the heads must be re-lapped.

The success of this attempt will be determined by January 27, 1965.

INTEROFFICE MEMORANDUM

DATE January 20, 1965

SUBJECT

TO H. Anderson
R. Beckman
L. Portner
R. Lane
R. Savell
H. R. Morse
A. Kotok

FROM G. Bell

There will be a PDP-6 Project meeting at 1:00 p.m. today in H. Anderson's office with H. Anderson, R. Beckman, L. Portner, G. Bell, R. Lane, R. Savell, H. Morse, and A. Kotok.

The items to cover are:

1:00	Fortran 4 Schedule - W. Segal, J. Ridgeway
1:15	Fortran Manuals and Manual Philosophy - N. Hirst, J. Ridgeway
1:25	Macro Manuals - J. Ridgeway, S. Piner
1:35	Operating System Manual - J. Ridgeway, D. Gross, H. R. Morse
2:00	The PDP-6 Prototype, Past, Present, and Future - J. Shields
2:20	The Schedule this week for next week - L. Portner
2:30	The W. A. Machine - its future
2:45	Software commitments - people loading

GB/mro

CC: W. Segal
J. Ridgeway
N. Hirst
S. Piner
D. Gross
J. Shields

D A White - January 20, 1965

RED HOT	MEDIUM HOT	SORTA HOT	
A 601 - EC4418 A 604 - EC4416 A 605 - EC4417			In Drafting
	G 080 - PR4334 W 800 - PR4400 A 201 - EC4365 W 640 - PR 4115 EC4378 4129 - EC4399 6207 - EC4377	B 401 - PR4367 R 131 - PR4042	In Model Shop
R 405	PR4330		Engineering Has

8:39

Completed:

W102	PR4188	835B	PR4106
B201*	EC4311	B301	EC4253
B301*	EC4323	R203	EC4337
B620	EC4316	835B	EC4361
R302*	EC4329, EC4414	1938	EC4231
6303*	EC4321	6102	EC4338
6304*	EC4322	6205	EC4319
B130	PR4313	6303	EC4254
B681	PR4286	6304	EC4255
W024	PR4340		
W992	PR4343		
738	PR4249		
738A	PR4250		

Scrapped:

58	EC4328

INTEROFFICE MEMORANDUM

H. Anderson

TO: M. Dill, D. Kicilinski, D. Kuyamjian, N. Mazzarese, J. McKalip, N. Perryman, R. Savell, K. Senior, D. Smith, T. Whalen, J. Smith, M. Sandler, D. Bevins

DATE: 1/20/65

FROM: R. Beckman

SUBJECT: LNS MIT SYSTEM SCHEDULE

Attached is a copy of the LNS System Schedule. The heavy vertical line indicates the day of the report. (19 Jan.) The progress of the various jobs is also indicated by a heavy line. Explaination for those short are:

1. 516/520 Construction complete awaiting modules so it can be off line tested.

2. Card Reader complete requires QC.

3. Central processor under going an abreviated rerun of Phase 1 & 2 due to installation of ECO 73 & 76. The time that it is short can be made up.

4. Memory late due to stack delivery. Stack is due in 22 January.

CODE	DRWG. NO.	REV. LTR.

NOVEMBER 9 13/16 20/23 25 30 — DECEMBER 4 7 11/14 18/21 23/28 — JANUARY 31/4 8/11 15/18 22/25 29/1 — FEB 5/8 12/15 19/22 26/1

1 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

516/520 OFF LINE TEST

CARD READER OFF LINE TEST

166 DELIVERY — PHASE 1 — PHASE 2 — PHASE 3 — CRD RDR ON LINE — DECTAPE SYSTEM ON LINE — 516 ON LINE — 2 USEC MEMORY ON LINE — 630 ON LINE — DISPLAY INTFCE ON LINE — INSPECTION & REWORK — SYSTEM MARGINS — ACCEPTANCE

136 / 555 / 551 OFF LINE TEST

MEMORY LOGIC CONSTRUCTION — MEMORY OFF LINE TEST

MATING

STACK DELIVERY

630 OFF LINE TEST

DISPLAY INTERFACE DESIGN & CONSTRUCTION (OFF LINE TEST)

REV LTR	ECO NO.	DATE	ENG

REVISIONS

DRAWN	SSM	DATE	12-9-64
CHECKED		DATE	
ENG		DATE	
PROJ ENG		DATE	
PROD		DATE	

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

ASSY NO

SHEET OF

TITLE: SYSTEM SCHEDULE

FOR: LNS MIT

CODE	DRWG. NO.	REV. LTR.

DIST

dec INTEROFFICE MEMORANDUM

DATE January 21, 1965

SUBJECT RUMRILL MEETING

TO K. H. Olsen
H. E. Anderson
S. C. Olsen
N. J. Mazzarese

FROM J. L. Atwood

Charlie Rumrill, president, and Don Miller, executive vice president, will be here next Wednesday, January 27, from The Rumrill Agency. I would like to schedule a meeting with them around lunchtime.

Rip Todd, our account executive at Rumrill, and Rita Venn, their New York media manager, will also be on hand to present the agency's proposal for a media schedule. Once this has been approved, we can get on with the writing of ads for specific marketing objectives.

J.L.A.

fd

INTEROFFICE MEMORANDUM

DATE January 22, 1965

SUBJECT

TO Harlan Anderson
Stan Olsen
Ted Johnson
Rod Belden
Ron Wilson

FROM Nick Mazzarese

I had a telephone conversation yesterday with Mark Connelly of MIT. We discussed the possibility of including an index register in the PDP-7 Computer. The application involved an aircraft simulation system. The requirement would be for a total of nine PDP-7's. The contract was to be let to a West Coast aircraft manufacturer, wo do not know the name of the manufacturer and Mark was reluctant to tell me who it was.

The plan we settled on for an index register was approximately as follows:

One bit of the memory field would be assigned as an index register, therefore, only 4K would be directly addressable in a PDP-7 with an index register. The operation of this register could be implemented in one of two ways:

1. The index register could be decoded as a distinct memory address, therefore, it would be possible to perform all instructions on the contents of the index register.

2. The index register would be a separate register which was loaded by IOT's from the accumulator. There would also be IOT's for incrementing, decrementing, and testing.

A quick check on the programming implications indicate that some modification of our existing software would be necessary to run on this machine with an index register, however, supprisingly, a great deal of modification would not be necessary.

Mark indicated an interest in knowing what the approximate price of such an index register would be, and I told him approximately $5,000. He felt that with our other advantages, we could easily meet the competition of the 930 which is the alternative for the manufacturer.

dec INTEROFFICE MEMORANDUM

DATE January 25, 1965

SUBJECT PDP-6 Schedule

TO R. Beckman

FROM R. Lane

This is the suggested schedule for PDP-6 Systems:

Serial No.	Customer	Date for Processor Checkout Completion
7	DEC(Syst. Prog., Sales)	Feb. 15
8	Rutgers	March 15
9	Rand	April 1
10	Bonn	May 15
11	DEC(Syst. Prog.)	April 15(Refurbished Prototype)
12	Aachen	June 15
13	LMS	July 1
14	Berkeley	August 15
15		

Please confirm ASAP.

CC: H. Anderson
J. Smith
G. Bell
S. Mikulski
R. Pate

INTEROFFICE MEMORANDUM

DATE January 25, 1965

SUBJECT MIT - MAC

TO
H. Anderson
G. Bell
R. Beckman
J. Smith
J. Shields
T. Whalen

FROM R. Lane RHL

The following customer commitment has been made:

Delivery of Character Generator	February 10
Delivery of 2µsec, Type 163C Memory	February 15-20
Delivery of .4 µsec, Type 162 Fast Memory	February 15-20

This delivery is based upon best available information on January 21, 1965. Please advise any change to the above schedule immediately.

R. LANE

dec INTEROFFICE MEMORANDUM

DATE January 25, 1965

SUBJECT PDP-6 Schedule

TO R. Beckman

FROM R. Lane

This is the suggested schedule for PDP-6 Systems:

Serial No.	Customer	Date for Processor Checkout Completion
7	DEC(Syst. Prog., Sales)	Feb. 15
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9	Rand	April 1
10	Bonn	May 15
11	DEC(Syst. Prog.)	April 15(Refurbished Prototype)
12	Aachen	June 15
13	LMS	July 1
14	Berkeley	August 15
15		

Please confirm ASAP.

CC: H. Anderson
J. Smith
G. Bell
S. Mikulski
R. Pate

INTEROFFICE MEMORANDUM

DATE January 25, 1965

SUBJECT Teletype 33 Reliability Investigation

TO K. H. Olsen
H. Anderson
S. Olsen
N. Mazzarese
T. Johnson
J. Shields
P. Gadaire
W. Newell
D. Dubay
J. Smith
B. Dill
J. Hagerty
E. Harwood
R. Mangsen
R. L. Best
G. Bell
R. Savell
D. Adams
E. De Castro
J. Burley
R. Wilson
R. Belden

FROM Arthur Hall

The project assigned me to investigate the means of improving the reliability of Type 33 Teleprinters is, for all practical purposes, complete.

My findings and recommendations are as follows:

1. Teletype claims that the Type 33 may be operated continuously (except for preventative maintenance every 500 hrs) for its estimated service life of 4500 hours. They say that the reliability should be as good as that of the Type 35 (which has a longer operating life). I have found no conclusive evidence to dispute this claim.

2. My estimate of the reasons for the large number of complaints about and troubles with the Type 33 are, in order of importance:

   a. The relative inexperience and lack of training of most of the persons responsible for repair of the Type 33, the difference between the familiar Type 28 and Type 33 and the conviction of most of these people that regardless of their efforts, the Type 33 was not going to work properly.

   b. Improper and inadequate packing for shipping of the Type 33 by both Teletype and DEC.

   c. Marginal design of early units and too many difficult-to-make adjustments in early and current units.

3. Analysis of Type 33 troubles has been difficult not only because of the somewhat emotional atmosphere surrounding the situation but because of the very wide variety of troubles encountered. For instance the part which caused trouble most frequently caused less than 8% of the total complaints; 50% of the complaints involved parts

failing five times or less; less than 5% of the complaints were due to broken parts and of these 1/3 were broken in shipment and 1/3 involved the reader feed wheel (for which Teletype has a fix).

4. Complaints and suggestions about troubles which have formed a relatively high proportion of reports have been passed along to Teletype. They have a modification to eliminate breaking of pins on the reader feed wheel and we hope they will release this mod soon so we may retrofit units in the field. I have written twice and talked to Teletype once about the loose screws attaching the unit to the mounting board and about the poor labelling which offers the shipper an excuse for sloppy handling of the cartons. A comprehensive, detailed analysis of all troubles reported to 12-7-64 will be mailed to Teletype by 1-29-65.

Improvement of Reliability

5. Teletype feels that Teleprinters manufactured after serial #19090 are, because of changes made at that point, more reliable than earlier units. My analysis does not bear this out but then my statistics are incomplete. Modification kits to retrofit Teleprinters made before Serial # 19090 are in house and available for any one at DEC or in the field. As the worth of this modification is not proven and as it requires a lengthy re-building of the unit by an experienced technician I would not suggest the installation of these kits unless a unit is having serious troubles.

6. Training by Teletype or in Dave Dubay's class (given by Field Service on occasion) and as much repair experience as possible are the prerequisites for the development of sufficient skill to properly adjust and repair Type 33 Teleprinters. Attempts by overconfident amateurs have caused more troubles than they solved. A continued reluctance to sacrifice the time and money necessary to give repairmen this training will prolong the troubles we are having with Type 33's.

On 11-11-64 I sent out a memo requesting information from our field offices on the capabilities of these offices to handle Teletype Type 33 troubles. There were 7 replies. Only 1 office had a trained man (he took a 2-day DEC course). Two offices had repaired or adjusted 33's, one of them two times, the other 3 times. Only 1 office knew of available outside assistance and only 1 had definite plans to send a man to school for 33's.

It does not sound to me as if we were prepared to deal with the adjustment and repair of the numbers of PDP-8 attached Teleprinters which we expect to ship in the near future.

A method we might employ to avoid the expense and time of training is to equip our field offices with spare Teleprinters for replacement and to ship faulty units to DEC for repair or replacement. (We would have to make better shipping crates than are presently available.) How to deal with the coming Type 33 maintenance problems should be considered by Customer Relations.

7. Regular maintenance should be performed on a Type 33 Teleprinter every 500 hours of running time. Very few Teleprinters have running time meters and so we have little way of knowing which units are due for or past preventative maintenance. Lack of these meters also makes any analysis of Mean Time Between Failure or total life of Teleprinters impossible.

These meters are available at DEC and the modification is a simple one. These meters should be installed in every Type 33 in house and in the field at the earliest possible opportunity. Jack Shields should see that Field Service personnel carry one of these mod kits with them on any visit to any unmodified PDP-5.

Who ever installs a meter should send a note to Bud Dill (in Peripheral Equipment Checkout) giving the best estimate possible of the time that the Teleprinter has run before the meter was installed (the computer elapsed time meter and a % use estimate from the operating personnel should give a fair answer). No Type 33 must be allowed to leave the Peripheral Equipment Checkout area for any reason without a meter. This may involve a manpower problem which Jack Smith and Bud Dill will have to solve.

8. I have devised a Trouble Reporting Code and reporting forms to use for statistical analysis of Teletype troubles (it is easily adaptable to other equipment if needed without altering present data). The data is coded by a knowledgable technician, transcribed to cards and various analyses run off by the Tab Department. All Type 33 reports dated from 9-6-63 through 12-7-64 which were available on 12-11-64 are on cards and have been analysed for trends in trouble types, part failures, etc. An interpreted report will be available 1-29-65.

This analysis has been useful and should be continued. When running time meters are installed, the meter indication should be recorded on the Field Service Report and on the tabulating cards. This will enable us to make a determination of MTBF.

Analysis work has been hindered by a lack of knowledge about how many Teleprinters have entered DEC, to which computer they are attached and what the serial numbers of those computers are. Paperwork involving the transfer of Teleprinters from one area or jurisdiction to another should record the serial number (this number is easily seen without any disassembly). The fact of the entry of any Teleprinter into the Peripheral Equipment Checkout area from any source for any reason should be recorded together with the serial number so that we can keep records up to date and catch previously unrecorded units if they pass through.

9. To avoid giving customers used Teleprinters and so that we may have a control lot to watch carefully, the Teleprinters used in Checkout will remain in Checkout. Teleprinters to be shipped with the system will be attached only far enough ahead of final checkout to assure that they are working properly.

10. A careful analysis of the trouble we have with parts should be the basis of a comprehensive stock of parts both for use at DEC and in the field. The cost of the parts themselves is trivial compared to the expense of system downtime.

AH/mro

INTEROFFICE MEMORANDUM

DATE January 26, 1965

SUBJECT Trip to Brookhaven PDP-6 Installation

TO H Anderson FROM J McKalip

J McKalip, R Boisvert, S Lambert and D Brown of the Engineering Department were on hand at the Brookhaven Installation on the 19th, 20th and 21st of this month to correct the problems with the mag tape system.

The primary problem is excessive skew in the reverse direction on all three Type 570 transports. Our present specification on skew (forward or reverse) requires total character time to be less than 2.5 microseconds. A transport becomes inoperable at 800 BPI whenever skew exceeds 5.5 microseconds. Skew on all three of the Brookhaven 570's exceeded 6 microseconds.

Local adjustment of one transport reduced reverse skew to 3.5 microseconds. This value is not within specification but is within usable limits. Following this adjustment, the transport had an error rate signifigantly improved over previous tests, thus confirming that skew is the main problem. The adjustments that were made to the transport held for two hours and then drifted out beyond 6 microseconds. This indicates that the skew problem is the result of a mechanical malfunction rather than an error in transport setup procedure. The tape guidance system vendor has been called in on the problem and results should be forthcoming shortly.

Unfortunately, the 6 hours of effort outlined above required approximately 22 hours to accomplish. Shortly after our arrival, the IO Bus began to malfunction. Since no DEC personnel other than the four engineers listed above were present, we were forced to fix the computer in a somewhat less than expert fashion.

The following specific problems were found:

a. 42 unsoldered wires in the IO Bus coaxial cable connector modules.

b. 1 short circuit between 2 coaxial lines on a cable terminator module caused by a solder splash.

c. 7 unsoldered wires on the IO Bus connectors under the console table in the Central Processor.

d. 4 possible shorts between connector pins caused by excessive solder on the IO Bus connectors in the C.P.

In addition, we found DECtape to be only partly functional, (5-6 passes required to read in), a malfunctioning console typewriter and sporadic paper tape reader problems. These problems could all be caused by the IO Bus.

Our attempts at correcting the IO Bus problems were not too successful. We were, however, able to obtain sufficient data on the mag tape problem to proceed with corrective action.

It should be noted that the gross problems with the skew may be masking some minor problems that won't appear until things are operating more reliably.

JMcK:ASJ
CC
R Beckman
G Bell
R L Best
L Hantman
K Olsen

dec INTEROFFICE MEMORANDUM

DATE January 26, 1965

SUBJECT PDP-7 Status

TO K. Olsen
H. Anderson
S. Olsen
R. Belden
E. Harwood
W. Hindle
N. Mazzarese
D. Vonada

FROM J. Smith

PDP-7-2, Stanford:

The 550 has completed off-line checkout. It is currently being on-line checked on the Engineering PDP-4. Should be delivered to the "7" upstairs tomorrow.

Reader, punch logic has been installed.

Extended arithmetic element due back from RCA tomorrow. This has been confirmed with RCA.

Problem Areas:

The 172 priority interrupt has not been released. This is the one remaining piece of equipment to go on the machine. We should have a short meeting to insure that this system is shipped by February 15, 1965. By the end of this week, all hardware should be available.

PDP-7-5, New York University:

Data communication system has been constructed and installed.

Display control and slave have undergone off-line checkout. Bill Long supplied interface wiring schedules yesterday. Currently being wired in. Complete display system should be ready to go on the "7" Friday, January 29, 1965.

Problem Areas:

The character generator draw and control logic has been constructed and is awaiting test. At the present time, Alan Titcomb is having some marginal check problems with Western Australia. As soon as the problems on the Western Australia are resolved, checkout will start or the New York University can be completed.

PDP-7-6, Delft:

Central processor and memory have completed construction. Having problems with the new design of the B210. The central processor should be delivered to Checkout Thursday, January 28, 1965.

Memory for this system will be checked off-line on a tester before being installed.

The extended arithmetic element is due in from RCA tomorrow.

PDP-7-7, Cambridge, Due to Checkout February 6, 1965:

The central processor has been received from RCA and is currently being modified and brought up to date. Memory has completed construction. Should make schedule date, if the B210's work out.

dec INTEROFFICE MEMORANDUM

DATE January 27, 1965

SUBJECT QUALITY OF THE PDP-6-3
(BROOKHAVEN)

TO
Ken Olsen
Harlan Anderson

FROM Klaus Doering

The system was sent to the customer without adequate assurance of quality. The efforts of the Quality Control Department were unsuccessful because the PDP-6-3 was shipped without our knowledge in complete ignorance of long established and well known procedures. (See permanent memorandum #M 1163 from August 1963 by R. Best and R. Beckman, approved by H. Anderson).

The responsible person for PDP-6 systems is Bob Beckman.

The last time any Q.C. inspection had been performed was on Dec. 17. The system left on Jan. 12. Though extensive rework had been done to it during this period of almost 4 weeks

a) no further inspection had ever been requested.
b) a list of rework cannot be located.

SUMMARY OF DEFICIENCIES:

1. Intermediate inspections are missing on the
16K Memory and
Fast Memory
for solder joints

Interface
136 Data Control
646 Line Printer Control
626 Typewriter Logic
Line Printers
for mech. assembly

Final inspections are missing on the
136 Data Control
570-8 Tape Transport
626 Typewriter Logic
for solder joints

Interface
136 Data Control
570-8 Tape Transport
551 Micro Tape Control

646 Line Printer Control
626 Typewriter Logic
for mech. assembly

2. The inspection signature of M. Doucette was falsified on the 136 data control, 551 microtape control and the 646 line printer control (intermediate solder joint insp.) and on the 570-8 Tape Transport and 551 Microtape Control (intermediate mech. insp.)

   False inspection signatures were found for the following final inspections: 570-6 Tape Transport for mech. assembly and solder joint insp. and on the PDP-6-3 for mech. insp.

3. There were no requests for waivers though provided for in the policy.

4. The system was not released by the project engineer.

5. The system was not released by R. Best nor B. Beckman.

6. The system left on 1-12-65 at 10 A.M. without final Q.C. approval.

Conclusion: The bad quality of this system is especially regretful because we in Quality Control had worked late hours on it and had offered to do so again if needed, in order to get it to the customer in time.

cc: R. Hughes
R. Beckman
G. Bell

KD/kmk

dec INTEROFFICE MEMORANDUM

DATE January 28, 1965

SUBJECT INSPECTION REPORT OF THE PDP-6-3 (at Brookhaven)

TO Ken Olsen
Harlan Anderson

FROM Don Bevins

1. The first inspection I performed was that of all I-O buss connectors and buss cables because this was where the trouble seemed to be. The solder joints reworked at Brookhaven were of poor condition. Upon inspection, I found three wires broken and a number of cold solder joints and poor wire wraps on the central processor. All faulty solder joints were reworked, reinspected and accepted.

   We found that the module on 2L20 had one wire shorted to pin C and the module on 2N25 has pins M and N shorted. All I-O buss cables were removed and inspected on the entire computer and reworked where needed and replaced. Typical faults found, were long wires on back side of modules. The leads between the Amphenol connector and the module board were shorted in various places.

2. Then I inspected the entire computer. All faulty solder joints were reworked, reinspected and accepted. The elapsed time meter on the fast memory was disconnected. The identification labels on all mounting panels on the 516/136 converter were missing. I wrote the numbers in with ink.

3. All three 570 Tape Transports had been reworked. Solder joints were bad and components added on logics were poorly wrapped and most had no sleeving. One wire was broken on connector 1C11V on 570 #8 transport. All discrepancies were reworked, reinspected and accepted. Note: The 570-1 (prototype) had left for Brookhaven without any inspection.

   The left vacuum columns on transport #6 and #8 were causing the tapes to bind and twist. Columns were losing vacuum. The back plate in the column had bowed out. The heat in the trailer was turned off Sunday night and it was approximately 25°F inside the trailer at 8:30 A.M. the next morning. The back plate may have been bowed originally or the sudden temperature change may have caused it to bow.

Roland Boisvert and I removed all four vacuum columns on transports #6 and #8. They were to be replaced by new ones arriving on Wed. 1-27-65 from DEC.

Conclusion: When I left, everything except the 570-6 and 570-8 (because of the vacuum columns) was running again. The inspection reports will be furnished upon request.

cc: R. Hughes
K. Doering
R. Beckman
G. Bell

DB/kmk

Andy

AGANT 015 1251
DIGITAL MAYN

DIGITAL READING
28.1.65.
MSG NO 30

TO JON FADIMAN
FROM JOHN LONG

LOI IN POST FROM MANCHESTER UNIV FOR FOLLOWING CONFIGURATION:

1. PDP-1. - 45,000
2. EXTRA 4K. 12,000
3. TYPE 30 DISPLAY. — 13,200
4. LIGHT PEN. 1,625
5. EXTENDED ARITHMETIC. 6,300
6. DECTAPE CONTROL. — 7,800
7. DUAL DEC TAPE — 7,400
8. 350/505 PLOTTER. — 8,400
9. PRIORITY INTERRUPT. — 7,000

→ 78,325

→ 31,100

109,425

ITEMS 1 TO 5 PURCHASE
ITEMS 6 TO 9 LOAN FOR 12 MONTHS AT ONE HALF PERCENT PER MONTH INTEREST.

DELIVERY REQUIRED FIRST WEEK IN JULY OR BETTER.

PLEASE ACKNOWLEDGE

END OF GA PLS

H. Anderson

dec INTEROFFICE MEMORANDUM

DATE 29 January 1965

SUBJECT Software Trouble Reports

TO PDP-6 List 1 & 2

FROM L. Portner

Please use the software trouble reports which can be found near all PDP-6 consoles. Forward them to Terry Wilkins who will enter them in a log and send them to the proper programmer for action. Notations of corrective action should be made as these will also be logged, and then the trouble report will be returned to author.

cc Harlan Anderson

INTEROFFICE MEMORANDUM

DATE 1-29-65

SUBJECT

TO Mort

FROM Jack O'Connell

Visited with Communications Research Institute and found out the following information: Spear Inc. is re-designing LINC with microcircuits. They sent out a letter dated Jan. 22 to those already having LINC's. They have invested over $100,000 to developing the LINC. The first machine is going to be installed at Boston College around May 1. Production units are scheduled for delivery beginning July '65. Price $49,500 with discount $39,500.