K. Anderson

dec INTEROFFICE MEMORANDUM

DATE August 29, 1963

SUBJECT PDP-1-30 (SDC System)

TO Stan Olsen

FROM Don Smith

The following problems were considered when I suggested that the shipping date of the machine should be postponed. The order in which they appear is not necessarily that of importance. Every effort is being made to insure delivery at the earliest possible time.

1. The Q32 interface has not been sufficiently checked. As you probably know the machine was ready for shipping on August 23 (Friday night) as far as most involved persons at DEC were concerned. This did not include any test of the interface. Desiring to insure that problems in the interface be reduced to a minimum, I worked Saturday, August 24 and Sunday, August 25 on the machine. Problems found were logic errors, and many missing wires. At this point the interface has not yet been tested sufficiently to insure that problems that may be corrected at DEC are not present. A machine that requires rewiring in the field upon arrival, for wiring or logic errors, would not appear well from the customer's viewpoint.

2. I feel that Ben Gurley should look over the interface before shipment. Ben will return from vacation on Tuesday, Sept. 3.

3. The teletype interface has not been completed. This should be completed in the near future.

4. Customer Relations is certifying in writing that all of the 256 TTT pulses have been examined to insure proper wiring. Certification that each of the 256 break locations have been tested is also being stated. These were to have been tested at Digital by Customer Acceptance. Neither test has been completed.

5. An engineering change for typewriter logic should be completed.

6. Some mechanical prints of the machine are being prepared by visual inspection.

7. The logic prints and sepias for the customer should be shipped with the machine.

8. Maintenance spare parts and programming writeups on the machine (256 break system, additional typewriters, accumulator mixer, switch for the on-line typewriter, completion pulse traps) have not been completed. SDC has already voiced complaints to Bob Oakley for lack of information.

9. The writeup on the teletype interface has not been completed.

10. Purchase Order #B-10365-4 has not been acknowledged. This is being held due to the wording in Item 12. SDC indicated that they would change the wording to imply that interface to the 101CL Data Sets would be for data only. No control interface is to be implied.

11. The readjusted prices for the interface should be as accurate as possible. A substantial reduction in the number of modules used is in order. Additional features were requested by SDC and installed at DEC after the estimate was submitted. Change in price for the cable exits in the top of the cabinets are also in order.

Customer Relations generally does an outstanding job to prevent a machine in the above described state from leaving Digital. However, they have reversed themselves and are now applying pressure to have the machine shipped immediately, even going to the extent of suggesting that I owe them a favor and therefore should ship the machine.

I recently received Memo #1163 describing Procedures and Testing of Systems. Release for delivery must be approved by the same department that is now applying pressure to ship the machine. I do not understand what standards are being applied. Is it that Customer Relations is not responsible for the installation?

I have suggested that possibly the machine could be installed by Field Service if an immediate shipping date is required. Lack of response on their part has led me to believe that their appetite was not wetted. Perhaps Memo 1163 applies only when creampuffs are required for Field Service.

I would like to request that Customer Relations refrain from directing personnel working under my supervision. Certainly there are sufficient people in their own department that require direction without disturbing the only person I have to assist me. Perhaps if they would concern themselves with writing the acceptance test for the teletype interface I will not be required to write a memo concerning overdue programs. Such action was required for the PDP.

I am sure that some of the items mentioned above fall within the wide scope of Customer Relations.

CC: K. Olsen
H. Anderson
N. Mazzarese
R. Beckman

dec INTEROFFICE MEMORANDUM

DATE August 27, 1963

SUBJECT New PDP-1 Memories

TO K. Olsen
H. Anderson ✓
S. Olsen
N. Mazzarese
W. Hindle
D. Morse
G. Bell

FROM R. Maxcy

The following list suggests a reasonable pricing structure for the PDP-1 with 4K increments of the New memory.

PDP-1	with	4K	memory	$120,000
"	"	8K	"	140,000
"	"	12K	"	150,000
"	"	16K	"	160,000
"	"	20K	"	190,000
"	"	24K	"	200,000
"	"	28K	"	210,000
"	"	32K	"	220,000

There is an outstanding order with General Ceramics for 17 old style stacks. G. C. stacks are not compatible with the new memory, but Ferroxcube stacks are, if they are retrofited (approximate cost $150).

Disposal of G.C. Stacks & Retrofit of Ferroxcube Stacks

We have 7 Ferroxcube stacks in DEC owned machines in the Boston vicinity. These could be interchanged with 7 of the on-order G.C. stacks. This leaves 10 G.C. stacks which could be put into the next 10 PDP-4's from production.

The 7 Ferroxcube stacks plus 5 which we will take back from customers upon delivery of new 16K memories, will be returned to Ferroxcube for a retrofit. They then can be used in the new memories.

INTEROFFICE MEMORANDUM

DATE August 27, 1963

SUBJECT PDP-6 Drum System

TO E T Johnson

FROM G Bell

CC
R L Best
A Kotok
H R Morse
A Blumenthal
R Lane
N Mazzarese
H E Anderson
K H Olsen

The drum which Vermont Research Corporation is currently developing has great appeal for a bulk storage device for our computers. The VRC large drum, while not up to disc file capacity (by a factor of 10) does have flying heads, yielding fewer moving parts and no search access time.

The raw drum has the following characteristics:

1. 20 inch diameter (62.8" circumference)

2. 1000 fixed flying heads

3. 1800 rpm (33.3 ms revolution time)

4. Densities (proposed by VRC) of 500-1000 bits/inch

5. VRC price (not firm) approximately $25,000

6. Yielding capacity of 30-60 X 10^6 bits, or 1-2 X 10^6 PDP-6 words

A desirable system modus operandi might be:

1. 6 X 8192 bits/track, yielding .8 μs/6 bit character transfer time or 4.8 μs/word one way transfer time.

2. Each drum track should be sectored to provide perhaps 2^6 blocks of 2^7 (or 128) words/sector.

3. A one way transfer of 8,192 words would be 33. ms, thus a 16K core swap would take 133.3 ms and about 1/4 sec. for a 32K swap - versus 4 sec. for a 7090 drum system if all is well.

4. The above:

2^7 words/sector
2^6 sectors/track
X 2^{10} tracks
= $\frac{2^{23}}{6}$ words or 1.39×10^6 words or 50×10^6 bits

if only 6×2^7 tracks are used, this would give 1.05×10^6 words or $\approx 38.10^6$ bits.

The drum system would connect the top memory bus and be regarded as a processor from a systems standpoint. One of the other, lighter processors (central or arithmetic) would give initial conditions to the drum processor. A double buffered scheme in the drum would be used to allow a tiny bit of computation. The assembly register would read or write from 6 tracks in parallel (3 if a PDP-1) and collect 6 groups of 6.

A feature of the drum processor (synchronizer and/or controller) would be the ability to connect several drums and/or other similar devices.

GB:ASJ

dec INTEROFFICE MEMORANDUM

DATE 8/23/63

SUBJECT PDP-6 Marketing Plan and Cost Analysis.

TO Distribution

FROM R. L. Lane

Attached is an introduction to a marketing plan which is part of the effort toward arriving at the cost of PDP-6 and ultimately the selling price. The numbers and mix of Equipments are definitely open to refinement by more authoritative persons. However, if they are suitable for your purposes, please use them as a guide to arrive at PDP-6 costs.

The cost of PDP-6 has been broken down to the following 7 areas:

(1) Production and Drafting	A. Hall
(2) Development and Prototype	A. Hall
(3) Sales effort and advertising	R. Lane, J. Atwood
(4) Programming	H. Morse
(5) Customer Engineering and Diagnostic Programs	R. Beckman
(6) Overhead	R. Mills
(7) Profit	R. Mills

The names opposite each cost area are the people responsible for submitting a cost summary for that area. We are aiming at an 8-27 dead line.

The Projected Cost Summary Sheet is for your use, however, if some more suitable form is used to accumulate cost, only enter the total on this sheet and attach your substantiating information. Keep it simple, short and don't worry about minor item costs.

Distribution: Action copy	Infor. copy
A. Hall	R. Best
G. Bell	H. Anderson ✓
J. Atwood	K. Olsen
H. Morse	S. Olsen
R. Beckman	N. Mazzarese
R. Mills	W. Hindle

Prepared by: R. L. Lane
8-23-63

PDP-6
MARKETING PLAN

The following pertains to a Marketing Plan for PDP-6. The purpose of the plan is to permit sufficient information to be gathered which will allow the following tasks to be performed:

(1) Determine Equipment Manufacturing Costs.
(2) Determine Program requirements and their respective costs.
(3) Determine Customer Engineering Start up Costs (this includes training, installation, warranty, and subcontracting of maintenance programs).
(4) Determine development engineering costs per item developed.
(5) Determine prototype costs and projected usage.
(6) Project Sales effort.
(7) Project Advertising Cost and Trade Show Operating Expense.
(8) Determine Sales Price of PDP-6 based upon twelve (12) systems.
(9) Predict Cash Flow.
(10) Schedule Manufacturing Activities.

It is predicted that the PDP-6 shall have a useful life expectancy of five (5) years, however, the design of PDP-6 will be considered out-dated at the end of 1965. Consequently, all incurred costs should be recovered prior to Dec., 1965 or upon delivery of the 12th system.

The projected Sales and delivery of PDP-6 Systems shall be as follows:

Calendar Year Quarter	Orders Accepted	Deliveries Completed
4th Quarter 1963	3	0
1st " 1964	1	0
2nd " 1964	1	0
3rd " 1964	2	2
4th " 1964	2	2
1st " 1965	2	3
2nd " 1965	2	2
3rd " 1965	1	1
4th " 1965	1	1
Total	15	12

The Systems shall consist of the following equipments:

Arithmetic Processors	12
Core Memory (8K)	4
Core Memory (16K)	21
Model 33 TTY	28
Paper Tape Reader	12
Paper Tape Punch	10
Micro Tape Unit	24
Micro Tape Control Unit	12
Display System	8
Printer (300)	7
Printer (1000)	2
Card Reader	6
Card Punch	3
Tape Control Unit	4
Tape Unit	18
Drum Control Unit	3
Drum	5
Disc and Controls	1

In addition to the above number of systems, a Prototype and Sales-Programming PDP-6 will be manufactured and used for in house activities.

H. ANDERSON

PROJECTED COST SUMMARY

Prepared by _____

Description of Task

Date _____

Department _____

Direct Labor Costs (Man/Quarters)

Labor Type	1963			1964				1965				Total
Name	*	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												
9.												

* Total Man/Quarters Labor Accumulated Through _____

Material Costs (Please reference B.O.M. or attach substantiating list)

Subcontract Costs

Miscellaneous Costs (Include Items of Major Cost Only)

Travel

Living

Use of PDP-1, 4, 6

Special Tools & T.E.

Over for brief description of task.

Briefly describe the task to be performed and state any assumptions which should be made in reference to same.

Totals		Scratch Pad
Labor		
Material		
Subcontracts		
Misc.		
Other		
Other		
Other		

Total _____

Recommended Sales Price _____

MSG. NO. WC-0X 1027

TO HARLAN ANEX ANDERSON

FROM RON COLMAN

SUBJECT.. PDP-4 DEMONSTRATION PROGRAMS

SCOPE CURVE FITTING PROGRAM NOT YET COMPLETED. THE NIM GAME WHICH TYPES OUT ADVERTISING PITCHES EACH TIME THE PLAYER GOOFS, HAS BEEN SENT TO JACK SHIELDS WITH INSTRUCTIONS HOW TO PREPARE FOREIGN LANGUAGE ADVERTISING PTX PITCHES.

dec INTEROFFICE MEMORANDUM

DATE August 23, 1963

SUBJECT PDP-6 Service Center

TO H. Anderson
G. Bell
N. Mazzarese

FROM Harrison H. Morse III

I received a call today from Daniel Brown who works for Traffic Research Corporation, consultant for Boston Regional Planning Project. His purpose in calling was to determine if there would be a PDP-6 available for rental on a service center basis. His requirements were that the PDP-6 be available sometime shortly after the beguinning of the year and that FORTRAN also be available at that time which was roughly about Feb. 1. It might be worthwhile considering the establishment of the PDP-6 service center as of means of making the machine available to outside users so that they may become familiar with the machine and the programming systems available.

HRM/nbh

TO: H. Anderson
Stuart Grover
Alan Kotok
Gordon Bell
Bob Lane
Len Hantman
Programming Group

Attached is the first draft of a note which contains some random thoughts about PDP-6. These are not completely developed as yet, and the paper also lacks an intended final section.

There is certainly nothing sacred about the contents, and comments (both critical and extensional) should be freely made.

H. R. Morse III

PDP-6 Hardware Configurations, Corresponding Programming Systems and Machine Use.

1. Common Features

1.1 Hardware

1.1.1 Protect Mode

The Central Process will be able to operate in two modes: normal and protect. The protect mode permits an undebugged program to be run while the executive program is in memory with no fear of the undebugged program destroying any part of the executive. I/O commands given by the main program will be trapped so that the executive can insure none-conflicting use of I/O devices. The hardware will have two boundary registers which indicate the upper and lower core limits of the main program. When in protect mode any memory reference outside the bounded area of memory will trap to the executive program.

1.1.2 Desirable Hardware Features

It is extremely desirable to have no options in the central processor. The reasons for this from the production, checkout, design and software point of view are obvious. An additional desirable feature would be for each system to have the ability to be completely self-contained, i.e., need no support from any off-line equipment. The reasons for this are many fold, in particular it is generally true that the computer is its own best I/O Processor, if one can afford to perform I/O on-line.

1.1.2 Desirable Hardware Features (Cont'd)

Off-line equipment is by its very nature undesirable if the computer can perform the normal off-line functions in an economical way on-line.

The last reason for providing self-contained systems is that a user buying a minimum system not be required to provide off-line supporting equipment.

2.0 Minimum System

2.1 Configuration

2.1.1 Basic Equipment

Central processor, 16K memory, 1 type 33 teletype KSR, 1 dual micro-tape transport and control.

2.1.2 Peripheral Consoles

Additional consoles consisting of 1 dual micro-tape and 1 type 33 teletype. The equipment specified in 2.1.1 is sufficient for a usable computing system. The additional consoles are to replace off-line program preparation equipment.

2.2 Operation

2.2.1 Program Preparation

All program preparation will be done on-line in a simple time sharing mode. This implies that the supplied programming system will contain at least a text editor which works from micro-tape to teletype and teletype to micro-tape, and an executive program which will permit the "peripheral teletypes" to be serviced in a simple time sharing mode while the main program is running. Note particularly that the data rate of the teletypes is extremely slow compared to

2.2.1 Program Preparation (Cont'd)

the central processor speed, and the use of three or four teletypes simultaneously with the operation of main program will not significantly slow down the operation of the main program. It is this feature which makes using the central processor for tape preparation, simultaneous with the running of the main program, attractive

2,2.2 Systems

All systems program and the program library (symbolic and binary) will be stored on micro-tape. In addition all user's program will be on personal reels of micro-tape and each user may have a sufficient number of micro-tapes to contain the information he needs.

Distribution of DEC Systems will be on micro-tape rather than paper tape or punched cards.

2.3 Advantages

2.3.1 Self-contained System

The minimum system so specified is completely self-contained. That is, there is no need to have off-line peripheral gear such as key punches, teletype units, or card to tape equipment. If a printer were added to the system it would be advantageous to add it to the central processor rather than having off-line tape to printer station.

2.3.2 Program Preparation

The full capabilities of the PDP-6 are available for tape preparation. The editing function can be performed in a sophisiticated manner with the output on a device designed for rapid input to the computer.

2.3.3 Program Storage

All program texts will be on rapid access, compact and easily correctable micro-tape. One advantage of this is the elimination of the need to handle paper tape and punched cards. Another advantage is the elimination of tape (or card) readers and punches.

2.4 Disadvantages

The system must be specified, designed and programmed and workable to the customers. In this case, a computer system depends upon software, which is a somewhat touchy circumstance.

3. Large self-contained Systems

A large self-contained system could be defined as a system like that described in Section 2 with the additional feature that it may be advantageous, because of hardware configuration, to perform a program's I/O asynchronously with the operation of the program. In this case 'asynchronously' means that the final I/O operation may be performed well after the program has finished running.

The basic premise is that a computer has facilities to perform I/O more efficiently than special purpose devices, specially those which use magnetic tape for comminication. However, because of the relative speeds of magnetic tape, and devices which produce 'hard output' (line printers, card punches), it has been advantageous to record all output data on magnetic tape for later off-line processing, rather than tie up the computer waiting for a printer or card punch.

However, the actual computer time used during printing using a 1000 lpm printer on PDP-6 is less than 1 $^{o}/_{o}$. Consequently, if we could 1)stack output data, so as not to delay the main program.

2)print this later after the program has completed, still not disturbing the present main program.

3. Large self-contained Systems

then we should be able to perform I/O at least as satisfactorily as we could with magnetic tape and off-line stations.

We also have the possibility of performing I/O much better if we have a drum or disc available for output data stacking.

3.1 Configuration

The system will contain all equipment specified in Section 2.1 as well as at least one line printer and possibly large magnetic tape units. However, no off-line supporting hardware is required.

3.2 Operation

3.2.1 Program Preparation

Programs will be prepared in the same manner as the systems described in Section 2.

3.2.2 I/O Control System

The executive routine must have the ability to control and direct the I/O operations. This implies that there will be available to the programmer I/O commands such as the following:

Output data visual
Output data retrievable
Output data visual and retrievable

Associated with such commands must be a statements which specify what data, in what format, is to be output, and statements which specify how the data is to be labeled. The I/O routine would then perform the output operation. If the command were 'output visual' then the data will be printed directly on the line printer, if the printer were available. Otherwise, the data will be stacked on the active output tape (if we were using tape; a drum or disc file if we were using either of the latter) for printing when the printer becomes available.

3.2.2 I/O Control System

The executive I/O Control System would need to keep track of which tapes, drum tracks and/or disc tracks were being used for stacking the output data. It would need to switch from one to the other when the printing of one of the files was completed and that file became available for stacking output data. It would need to know that, for example, if some data were to be output in the 'visual and retrievable' mode, then it must be labeled and stored in such a way that the user could recall it at a later time, by name, and not need to know on what particular device the data were stored. There must also be commands available which allow the user to immediately print a message on-line.

4. Programming Systems

4.1 Users Needs

There are three basic types of users which will have contact with the PDP-6.

1) Systems programmers
2) Numerical problem solver
3) General problem solver

These three types of users have different needs when communicating their problem to the machine.

4.2 Systems programmer

The systems programmer usually needs to be in intimate contact with the machine, and must have available a language which accurately reflects the structure and organization of the computer.

In particular the ability to specify any machine command at any place in the program, and the ability to precisely specify the allocation of storage are necessary when building systems programs. Features which allow

4.2 (Cont'd)

such things as the placement of any "quantity" (such as (a) an octal number, (b) a decimal number, (c) the codes for a specified sequence of characters, and (d) and arbitrary part of an arbitrary "expression") in any specified part of a word are also necessary.

4.3 Numerical Problem Solver

This user requires the solution to a problem which is basically arithmetic (or algebriac) in nature. Since the computer is a tool to perform the computation, the closer the problem description (to the computer) can be to the original problem statement, the better this user is able to use the facilities available to him.

This user has no need (nor should he be so burdened) to become closely acquainted with the internal organization of the machine.

The general class of user under "numerical problem solver" can be serviced with a system such as FORTRAN. In addition, this class may be extended to include "logical problem solver", and a large portion of the class "general problem solver"by the use of a good ALGOL Compiler in place of FORTRAN.

4.4 General Problem Solver

The class includes those people who have problems which cannot be expressed well in the algebraic or algorithm languages, yet have problem which do not inherently relate the machine structure.

4.4 General Problem Solver (Cont'd)

In the past, these people have followed one of three paths:

a) Programmed in machine language, even though the detail available at that level did not necessarily facilitate the problem statement.

b) Programmed in FORTRAN, etc., even though it was sometimes excruciating to express the problem.

c) Developed special purpose languages to facilitate problem solution. Examples of this resulted in the development of COMIT, and DYNAMO, which are special purpose languages intended for research type programming in special and restricted areas.

As an aid to the user who falls in the last category, it would be to our advantage to develop a language which has the following properties:

1) There is a one-to-one correspondence between statements in the language, and machine language.

2) The language has an extensive facility to permit the user to define, and specify the meaning of symbols.

3) The commands in the language are simple to learn, use and read.

4) The processor is sophisticated enough to generate the proper instruction, as specified by the statement and the data names, and recognize any errors that arise.

5) The user has the ability to specify virtually any meaningful machine instruction.

6) Machine language is imbedded in the language.

7) The language has a fairly sophisticated I/O control facility.

8) The language has a structure which permits easy understanding of the meaning of statements in the language.

INTEROFFICE MEMORANDUM

DATE August 19, 1963

SUBJECT FALL PROJECTS - TECHNICAL PUBLICATIONS

TO K. H. Olsen
H. E. Anderson
S. C. Olsen
R. L. Best
C. G. Bell
J. R. Fadiman
N. J. Mazzarese
W. R. Hindle

FROM J. L. Atwood

The following is a list of recommended projects to be undertaken by the Technical Publications Department in the next several months. The list does not include limited-distribution operating, maintenance and programming manuals or any general information projects. It is limited to product-related projects which we feel will be necessary or helpful and which we should be able to complete in this period.

PDP-1	New F-11 brochure New F-15 handbook (already in process) New F-12 price list Application feature stories (every other month)
PDP-4	New F-41 brochure (already in process) New F-45 handbook New F-42 price list Application feature stories (every other month)
PDP-5	New F-51 brochure (already in process) F-55 handbook (already in process) Application feature stories (every other month)
PDP-6	New F-61 brochure (already in process) F-65 programming manual (already in process) New slide talk Product feature story (already in process)
Mag Tape	General brochure on product line Tape Control 57A handbooks (already in process) MICRO TAPE brochure (already in process) Tape Control 510 bulletin
Displays	CRT 34 bulletin Incremental CRT 330 bulletin Application feature stories (every other month)

Other In-Out Line Printer 64 bulletin

Analog-Digital	ADA-1 bulletin (preliminary already issued) Converter 138 bulletin Control 139 bulletin Converter 142 bulletin Product feature stories
Modules	New module catalog (or catalogs) Educational module bulletins 1 mc module bulletins (already in process) Application notes (one each month) Application feature stories (every other month)
Systems	Memory Tester 1521 brochure (already in process) Special systems specification sheets Application feature stories (every other month)

Application feature stories are shown as "every other month" on six product lines - PDP-1, PDP-4, PDP-5, displays, modules, and systems. This means that we should be able to write and place three good application stories a month, in addition to new product stories and other feature material. If we find we can do better, we will step up the pace.

I would appreciate your comments on this list of projects.

BBN

MASTER PROGRESS SCHEDULE, DEC ORDER NO. 05109

PDP-1D Computing System

1.	Checkout of PDP-1C with tape reader, tape punch typewriter, automatic multiply and divide, and 16 channel sequence break system completed	August 19
2.	Special Instructions wired into computer	September 16
3.	Checkout of special instructions completed	September 23
4.	Time sharing, memory renaming, and memory extension logic wired into computer	October 7
5.	Checkout of above logic completed	October 14
6.	Standard memory removed, wiring completed for new memory, memory bus modules installed	October 28
7.	16K memory with memory control connected	October 28
8.	Checkout of computer with: a. 16K memory and memory control	October 28-November 11
9.	4K memory with memory control connected	November 11
10.	32 field drum system connected	November 11
11.	Two 16-line teletype modules connected	November 11
12.	Checkout of computers with: a. 16K memory and memory contro b. 4K memory and memory control c. 32 field drum system d. Two 16-line teletype modules	November 11-November 25
13.	4K memory with memory control connected	November 25
14.	Checkout of computer with: a. 16K memory and memory control b. Two 4K memories and memory controls c. 32 field drum system d. Two 16-line teletype modules	November 25-December 9
15.	Delivery of complete PDP-1D computing system	December 9
16.	Field installation of PDP-1D computing system completed	December 23

PROGRESS SCHEDULE, EN2649

Programmed Data Processor-1

1.	Delivery of completed PDP-1 to computer checkout area	July 10
2.	Installation of 16-channel sequence break system completed	August 5
3.	Checkout of computer	August 5-August 19

PROGRESS SCHEDULE, EN2665

16 Channel Sequence Break System

1.	Delivery of 16 channel Sequence Break System	July 24
2.	Installation of 16-channel Sequence Break System	July 24-August 5

PROGRESS SCHEDULE, EN2650

16,384 Word Memory Module

1.	Order placed for core stacks	July 15
2.	Module built	July 15-September 9
3.	Core stacks received	September 9
4.	Test completed module	September 9-September 23
5.	Install module in first memory control	October 21

PROGRESS SCHEDULE, EN2651

Two 4096 Word Expandable Memory Modules

1.	Order placed for stacks	September 2
2.	Modules built	September 2-October 28
3.	Core stacks received	October 28
4.	Test completed modules	October 28-November 11
5.	Install one 4K module in second memory control	November 11
6.	Install one 4K module in third memory control	November 18

PROGRESS SCHEDULE, EN2667

Memory Extension Control, Type 15A

1.	Design time sharing, memory renaming, and memory extension logic	July 22-August 19
2.	Order all modules and other parts for above logic	August 19
3.	Wire mounting panels for above logic	August 19-September 23
4.	Wire mounting panels into central processor	September 23-October 7
5.	Receive modules	October 7
6.	Check out above logic	October 7-October 14
7.	Order memory bus driving modules	August 19
8.	Design memory bus driving logic	September 2-September 16
9.	Wire mounting panels for memory bus driving logic	September 16-October 14
10.	Wire mounting panels into central processor for memory bus logic	October 14-October 28
11.	Receive memory bus modules	October 28
12.	Connect first memory module with control	October 28

Progress Schedule EN 2668

Special Instructions for PDP-1D

1.	Design logic for the following special instructions: szi, cmi, tia, tai, tsw, lod, str, dpf, and lpf.	Aug. 19 - Sept. 2
2.	Design logic for 8 additional 18-bit input buffers for IO Register.	Aug. 19 - Sept. 2
3.	Order all modules and other required parts for above modifications.	Sept. 2
4.	Wire above modifications into central processor.	Sept. 2 - Sept. 16
5.	Receive modules for above modifications.	Sept. 16
6.	Checkout above modifications.	Sept. 16 - Sept. 23

Progress Schedule EN 2652

Three Memory Controls

1.	Order all parts that can be specified at the outset, such as modules, cabinets, etc.	Aug. 12
2.	Design system logic.	Aug. 12 - Sept. 23
3.	Wire mounting panels for first unit.	Sept. 23 - Oct. 7
4.	Wire indicator panel for first unit.	Sept. 23 - Oct. 7
5.	Assemble and wire frame for first unit.	Oct. 7 - Oct. 21
6.	Receive all modules for first unit.	Oct. 21
7.	Install 16K memory module.	Oct. 21
8.	Off line checkout of first unit.	Oct. 21 - Oct. 28
9.	Wire mounting panels for second unit.	Oct. 7 - Oct. 21
10.	Wire indicator panel for second unit.	Oct. 7 - Oct. 21
11.	Assemble and wire frame for second unit.	Oct. 21 - Nov. 4
12.	Receive all modules for second unit.	Nov. 4
13.	Off line checkout of second unit.	Nov. 4 - Nov. 11
14.	Install 4K memory module.	Nov. 11
15.	Wire mounting panels for third unit.	Oct. 21 - Nov. 4
16.	Wire indicator panels for third unit.	Oct. 21 - Nov. 4
17.	Assemble and wire frame for third unit.	Nov. 4 - Nov. 18
18.	Receive all modules for third unit.	Nov. 18
19.	Install 4K memory module.	Nov. 18
20.	Off line checkout of third unit.	Nov. 18 - Nov. 25

Progress Schedule EN 2653

32 Field Drum System

1.	Drum ordered.	July 10
2.	Design drum control.	July 10 - Sept. 2
3.	Build drum control and complete off line checkout without drum.	Sept. 2 - Oct. 14
4.	Receive drum.	Oct. 14
5.	Install drum into control.	Oct. 14 - Oct. 21
6.	Off line checkout of complete drum system.	Oct. 21 - Nov. 11

Progress Schedule EN 2654

Two 16-Line Teletype Interface Modules

1.	Order all parts that can be specified at the outset, such as the 4706 and 4707 teletype modules.	July 22
2.	Design system logic.	July 22 - Sept. 16
3.	Order remaining parts.	Sept. 16
4.	Wire mounting panels for one 16 channel module.	Sept. 16 - Oct. 7
5.	Wire indicator panel for two 16 channel modules.	Sept. 16 - Oct. 7
6.	Wire relay panel for one 16 channel module.	Sept. 16 - Oct. 7
7.	Assemble and wire frame for one 16 channel module.	Oct. 7 - Oct. 21
8.	Receive all modules for 16 channels.	Oct. 21
9.	Off line checkout of one 16 channel module.	Oct. 21 - Nov. 11
10.	Wire mounting panels for second 16 channel module.	Sept. 16 - Oct. 21
11.	Wire relay panel for second 16 channel module.	Sept. 16 - Oct. 21
12.	Wire frame for second 16 channel module (note that this work must be done while the first 16 channel module, also in this frame, is undergoing off line testing).	Oct. 21 - Nov. 4
13.	Receive all modules for 16 channels.	Nov. 4
14.	Off line checkout of two 16 channel modules.	Nov. 4 - Nov. 11

dec INTEROFFICE MEMORANDUM

DATE August 14, 1963

SUBJECT Visit to Anelex

TO K. Olsen
H. Anderson
R. Best
G. Bell
N. Mazzarese
R. Lane

FROM Robert Savell

On July 30 Bob Lane and myself visited John Griffin, Printer Sales Manager, and Sheldon Lazzaro at Anelex Corporation to discuss the present situation with respect to Series 4 printers and to see what they had available in their 300 lpm printers.

Right off the bat, Mr. Griffin surprised us by reversing completely the statement which he made at the Spring Joint Computer Conference to say that they now will sell us the 4-1000 mechanics alone if we wish to buy them that way. Most of the rest of the discussion concerned their new Series 5 printers which will be offered at both 1000 lines per minute and 300 lpm, with almost any speed in between these that you desire. They will sell these with any combination of mechanics and electronics that we would like to obtain.

The Series 5 is being designed so that they can build up any speed printer in either of two column widths, 80 or 120 column, using most of the same basic parts.

Their hammer modules look outwardly the same as those used on the Series 4, however, Anelex says that the characteristics are different so that circuits designed to work with the Series 4 will not work well with the new hammers for Series 5. In addition, the driving circuitry and hammers will be different for the low speed and high speed versions.

Availability of any of the Series 5 units is approximately six months after receipt of order. They are taking orders now. The low speed units can be obtained with either a synchronous (delay line) buffer or an asynchronous (core) buffer. The 1000 lpm can be obtained with the asynchronous buffer only. Buffer prices are approximately $4,000 for the synchronous buffer and $7,000 for the asynchronous buffer. Pricing for the low speed 300 lpm unit for the mechanics alone in quantities of 6-12 is approximately 6.5K. A unit consisting of the mechanics hammer drivers, power supplies, cabinets and frames will be approximately 13K each in quantities of 2, 12.5K in quantities of 6-12 for 120 column width. The 1000 lpm will be priced for the mechanics alone at 11.5K for two per year and 11K for six to twelve per year. The price for the print head, drivers, power supplies, cabinets and frames will be $18,000 for quantities of 6-12.

Registration tolerances on both 300 and 1000 lpm printers will be ±.010 inch for 95% of the characters on a line and ±.015 inch for the rest of the 5% of the characters.

At these rates, a 300 lpm, 120 column printer complete with buffer in quantities of two per year with delay line buffer would cost us $17,000. This is about $2,500 more than the Holley will cost us but is comparably priced to the Data Products unit.

If we are going to continue to offer both low speed and high speed printers, buying from Anelex would have the advantage that all the mechanisms would be similar. At least a portion of the circuit cards that we would have to purchase from Anelex, if we purchase their drivers and control electronics, would be similar. Anelex has been in the printer business longer than anyone I think, and, unlike Holley, so far appears to do a much more thorough job on the electronics end of their printers. All their circuit cards including their logic cards are 100% tested after assembly before being installed in their systems. All systems that have special interfaces designed for the particular customer are checkedout with a simulator which simulates the customer's interface.

One thing that is not so "red hot" is, as I said before, that they still have the same basic hammer design with two adjustments for each hammer. They have however improved the means of separating the hammers from the print wheel on this unit as well as motorizing it so that you no longer have to crank down the hammers to make an adjustment. One advantage of these individual adjustments is that the printing density can be made more uniform for large area characters (M) and small area characters (.) than it can on a unit like Holley or Data Products neither of which have individual penetration controls.

Anelex is very anxious to give us a quote, and I would say that all the above mentioned factors make Anelex another good possibility for supplying 300 lpm printers. Further discussions will be held with them concerning the buffers that they would supply and a firm price quote will be obtained from them for both 300 and 1000 lpm units.

dec INTEROFFICE MEMORANDUM

DATE August 14, 1963

SUBJECT Additional Hardware for PDP-4 Prototype

TO Bob Beckman
Harlan Anderson

FROM Dit Morse

If you will generate a purchase requisition for 1 dual micro-tape transport and control, and 1 extended arithmetic element Andy will approve it.

The purpose of adding these devices is (1) software development, and (2) to insure always having one operational in house.

HRM/nbh

dec INTEROFFICE MEMORANDUM

DATE August 12, 1963

SUBJECT

TO K. Olsen
✓H. Anderson
S. Olsen
N. Mazzarese
R. Beckman

FROM J. Smith

An Engineering Hold has once again been placed on 131-510. The unit for LRL is currently undergoing test. Below are listed outstanding orders.

510 Controls

1	AEC (Princeton)	7/30/63
1	Customer Relations	7/1/63
1	Lincoln Labs	8/1/63

Data Control 131

1	AEC (Princeton)	7/30/63
1	Customer Relations	7/1/63
2	Lincoln Labs	8/1/63
1	AEC (Harvard)	9/1/63
1	Stanford	12/1/63

INTEROFFICE MEMORANDUM

DATE August 10, 1963

SUBJECT

TO Harlan Anderson
Nick Mazzarese

FROM Kenneth H. Olsen

cc: Jack O'Connell

Late on Friday, I got a call from John Ward of MIT. He had visited Deering-Milliken Research and had spent quite a bit of time with Mr. Deering or Mr. Milliken. They are a privately owned, very large textile company and this man, who is now the head man, has set about to revolutionize their business and probably the industry. They have a four million dollar research budget but so far have done practically nothing with computers. He saw the simulation work being done at Draper Corporation and asked John to come down and tell them what they should do.

They do have a 1401 and have used some time on a 7090 and they are thinking of buying analog equipment. John told them about us and suggested that some of their problems need Digital. They are interested in process control and linear programming also, product improvement.

John flew back with this man in the company airplane and told them about us and gave the man our name. This man might call me. If I am not here when he calls, I would like you people to know about this so that you can take over.

Kenneth H. Olsen

KHO/mr

dec INTEROFFICE MEMORANDUM

DATE August 10, 1963

SUBJECT

TO Harlan Anderson ✓

FROM Kenneth H. Olsen

Check

There are a few things I would like to have you check on for me next week when I am on vacation. I asked Ed de Castro to write a letter to TRW for me telling them the price and giving the technical information on the PDP-5. He was also to tell them that he would be at the WESCON Show and would tell them how to get in touch with him. Will you check to make sure that Ed has done this.

PDP-4 still has possible problems.

Bob Savell will be back next week and I suggest that you check with him early in the week as to what we should do with the paper tape reader.

ARC Suppression last problem.

The reports on the Microtape have all been second hand for the last few days but they have been inconsistent. I suggest that you look at these early in the week too to see what you can do with them.

Kenneth H. Olsen

KHO/mr

INTEROFFICE MEMORANDUM

Subject:	PDP-6 Mnemonics	Date:	August 9, 1963
To:	Gordon Bell	From:	Norman Hirst
	PDP-6 Group		

Following is a list of mnemonics for the PDP-6:

Full Word Transmission Instructions

MOVE
MOVS
MOVM
MOVN

with modes -, I, M, S

Half Word Transmission Instructions

HMVR	HMCLR	HMSTR	HMEXR
HMVL	HMCLL	HMSTL	HMEXL
HMVRL	HMCLRL	HMSTRL	HMEXRL
HMVLR	HMCLLR	HMSTLR	HMEXLR

with modes -, I, M, S

Boolean Instructions

CL	ST	AND	IOR
XOR	STM	ANDCMM	IORCMM
EQV	STCMM	ANDCMA	IORCMA
	STA	ANDCMB	IORCMB
	STCMA		

with modes -, I, M, B

AC Bit Modification and Testing Instructions

TEST	TCL	TST	TCM
TESTI	TCLI	TSTI	TCMI
TESTS	TCLS	TSTS	TCMS
TESTIS	TCLIS	TSTIS	TCMIS

with modes -, A, E, N

AC Memory Compare Instructions

CFS
CFIS

with modes -, L, E, G, A, GE, N, LE

Memory AC Modify Instructions

JUMP
SKIP
AOJ
AOS
SOJ
SOS

with modes -, L, E, G, A, GE, N, LE

Miscellaneous Instructions

JOV
JNOV
JRPI
JSPI
XCH
XCT
BLT

I/O Instructions

DATAI	CONO
DATAO	CONI
BLTI	CONSZ
BLTO	CONSO

Shift Instructions

ASH	ASHC
ROT	ROTC
LSH	LSHC

Fixed Point Instructions

ADD	
SUB	
MUL	MULI
DIV	DIVI

with modes -, I, M, B

Floating Point Instructions

FAD	FADR
FSB	FSBR
FMP	FMPR
FDV	FDVR

Jump and Push Instructions

POP	JSR
PUSH	JSP
POPJ	JSA
PUSHJ	JRA

Float-Fix and Character Operation Instructions

FIX	CAO
FLT	LDC
FSC	LDCI
	DPC
	DPCI

NH/lal

INTEROFFICE MEMORANDUM

DATE August 9, 1963

SUBJECT

TO Stan Olsen

FROM Kenneth H. Olsen

cc: Harlan Anderson
Ed de Castro
Arthur Hall

I got a call late Thursday afternoon, August 8th, from Mr. Herbert J. Henderson who is head of marketing services of TRW Computer Division Thompson, Ramo and Wooldridge Corporation, 8433 Fallbrook Avenue, Canoga Park, California. He is interested in the possibility of offering our PDP-5 computer as part of their control line. He called our California Office but they said that the man was in Europe and they gave him my name. I suggest that you check into this situation.

They are interested in using this computer for direct digital control and also as a satellite to other computers. I told them that you would be at the WESCON Show. I also told them that before the WESCON Show you would send them a letter telling them how they can get in touch with you.

They now have two machines, their 330 all drum machine and their 340 drum core machine. They don't have a small inexpensive machine though to fill in the line.

I will send him a letter giving him the information on prices on the computer but then I would like to leave it to you or Ed de Castro to follow up on.

Kenneth H. Olsen

dec INTEROFFICE MEMORANDUM

DATE August 9, 1963

SUBJECT Financial Directory Brochures

TO H Anderson FROM J Ebner

Attached are pamphlets from (a) Dun and Bradstreet; (b) Moody's Industrials; (c) Standard and Poor's Corporation. Also a description of what Standard and Poor's "Daily News" volume (shown on back page of brochure) represents.

JHE/dhw

INTEROFFICE MEMORANDUM

DATE August 8, 1963

SUBJECT INEL-63 SHOW

TO H. E. Anderson
G. Huewe
T. Johnson
Jack Shields
Brad Towle
Stan Olsen
Jack Atwood

FROM H. O. Painter

1. LOCATION: Stand (Booth) No. 128, Hall 11
Swiss Industries Fair
Basel
(See attached Floor Plan)

2. REGISTRATION: None of the DEC attendees have been preregistered; you will need to register when you arrive. DEC is allowed 5 free registrations.

3. EXHIBIT HOURS: 9:00 a.m. to 6:00 p.m.
September 2 (Mon.) - September 7 (Sat.)

4. SET-UP: May begin on Monday, August 26
(Jack Shields is planning to arrive in Basel on Thursday, August 29)

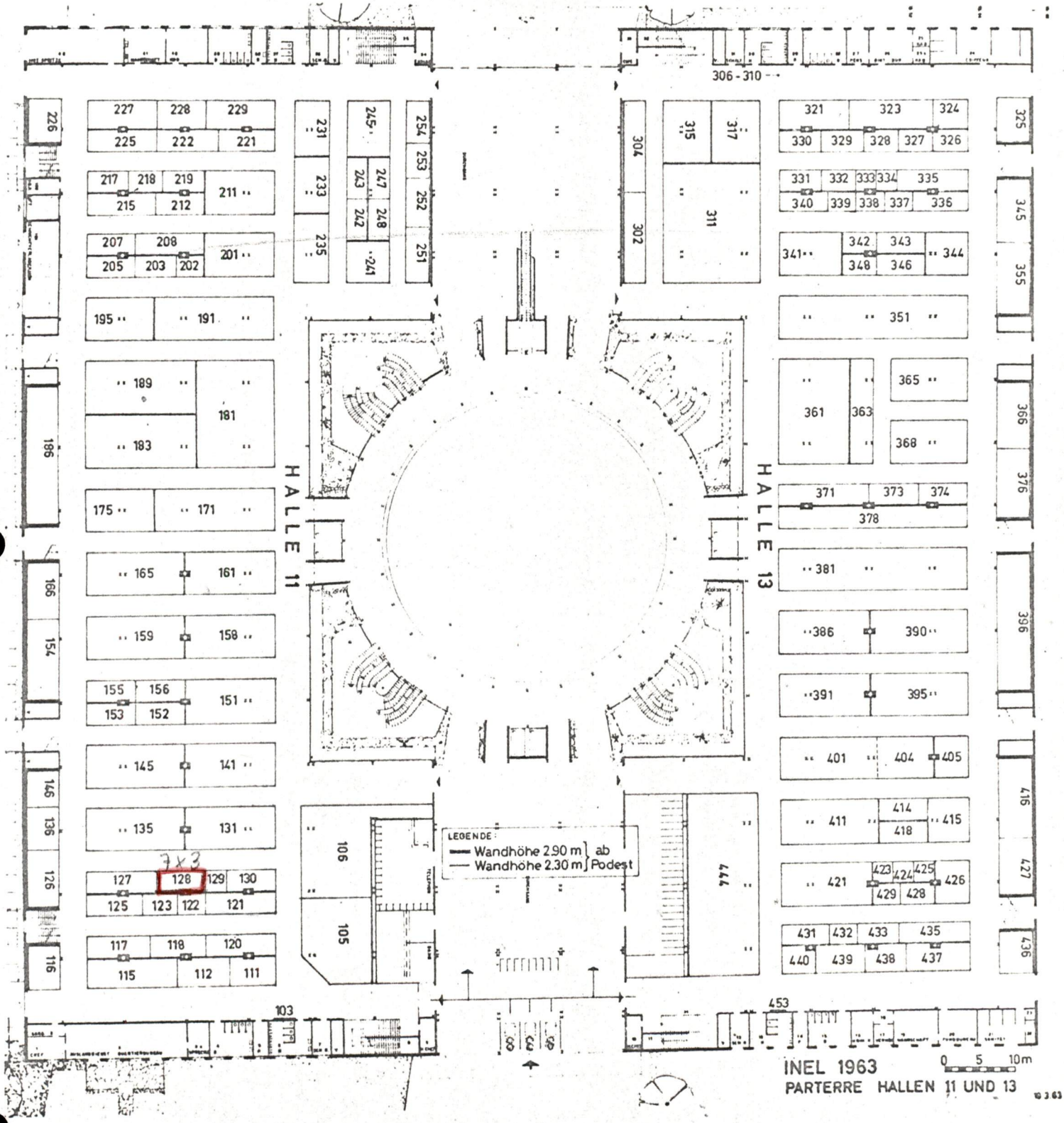
5. DISMANTLING: Must be completed by September 13.

6. ITEMS TO BE SHIPPED FROM MAYNARD:

PDP-4, Teletype, Reader and Punch
CRT-30
Spare Modules for PDP-4
Tool Kit
Literature

7. ITEMS TO BE SHIPPED FROM MUNICH:

Booth
Logic Kit
Tektronix Type 541 Scope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HALLE 13
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dec INTEROFFICE MEMORANDUM

DATE August 7, 1963

SUBJECT PDP-1C-46

TO K. Olsen
✓H. Anderson
S. Olsen
N. Mazzarese
R. Beckman

FROM J. Smith

PDP-1C-46 for Beckman Systems was delivered to Checkout today. The system is four working days behind schedule.

We feel the few days can be made up in Checkout by utilizing overtime hours.

INTEROFFICE MEMORANDUM

File

DATE August 6, 1963

SUBJECT BTL Speech Group Visit

TO N Mazzarese FROM G Bell

On Friday, August 9 at 2 P M , the following are coming:

1. Maxwell Schroeder, head of speech research group

2. Jim Flanagan (MIT doctorate in 1957 or so)

3. Peter Denes (formerly with a U.K. speech lab)

They are interested in buying a computer for on line speech research in an environment similar to that at MIT.

Denes called me to make the appointment. They may come for lunch, but are visiting 3 C's in the morning. Dit might also be asked to visit with them too, since they are familiar with software needs.

GB:AJ
CC

K Olsen
H Anderson
R Best

INTEROFFICE MEMORANDUM

DATE August 6, 1963

SUBJECT Sales B riefing for PDP-6

TO R Lane

FROM G Bell

CC
S Olsen
R L Best
H E Anderson
N Mazzarese
N Hirst
H R Morse
R Beckman
A Hall

I would like to schedule a sales briefing of PDP-6 describing its instruction code, system philosophy, and programs. The meeting should be scheduled as soon as possible after the skeleton programming manual is finished (August 15).

I would like to use this opportunity to brief others too. A possible list is attached.

GHB:AJ

Engin eering:

R L Best
A Kotok
D Brown
A Blumenthal
R Boisvert
R Savell
J Sullivan
T Stockeb rand
L Hantman
B Scudney
R Doane
W Colburn
R Reed
E T Johnson
E DeCastro
A Hall
S Lambert
W Long

Programming

H R Morse
N Hurley
S Piner
G Collecelli
N Hirst
D Fellows

Field Service

R Beckman
J Shields
K Senior
S M ikulski
R Wilson

Sales

K Olsen
H E Anderson

Checkout

E Harwood
D Pinkney
D Murphy
T Leonard

Publications

S Grover
J Nangle

dec INTEROFFICE MEMORANDUM

DATE August 6, 1963

SUBJECT TRADE SHOWS

TO Ken Olsen
Harlan Anderson
Stan Olsen
Nick Mazzarese
Jack Atwood

FROM H. Painter

There will be a meeting at 2 P.M. on Wednesday, August 7, in Stan's office to discuss forthcoming trade shows.

H. Anderson

INTEROFFICE MEMORANDUM

DATE August 6, 1963

SUBJECT VISITORS REQUESTING BLUEPRINTS

TO K. Olsen
H. Anderson
R. Best
S. Olsen
M. Sandler
All Engineers

FROM Roger Melanson

Visitors, requesting blueprints from the Reproduction Department must be accompanied by a DEC employee wearing a blue badge. Telephone calls or written memos verifying the visitors print requisition will be accepted providing they are sent to and cleared by the supervisor of Reproduction (Norm Perryman is the supervisor of Reproduction.).

This procedure is necessary to insure a closer control of engineering drawings for plant security.

CUSTOMER	UNITS	CONTACT	MOS TO SELL	HAPPY?	COMPLAINTS	MAINT NEEDS	COMPUTER COMPETENCE	HAND HOLD TIME	DEC DRAIN	SOFTWARE ADEQUATE	% PRODUCTION TIME
BBN-Camb	1	Show & E.F.	3	+-	Maint.	hi	hi	long	hi	no	25%
BBN-LA	1	Previous Cust.	1	+	-	lo	hi	short	low	no	25%
Itek	1	Previous Cust.	4	0	Maint	med	med	short	hi	yes	25%
ITT	4+8	John Ackley	5	+	1973 Modules & drawings	low	hi	short	low	yes	100%
JPL	1+1	Show ?	6	+	-	low	hi	med.	low	yes	50%
LRL	1	T.J.	13	+	delivery	low	hi	long	hi	yes	75%
MIT-gift	1	-	-	+	typewriter	med	hi	short	low	-	-
MIT-Pless	1	W. Clark	1	?	?	med	med	?	?	yes	50%
Beckman	2	general knowledge	3-4	+	?	low	hi	short	hi	no	75%
Foxboro	1	personal	6	?	?	?	low	long	hi	yes	100%
SRL	1	personal	4-5	+?	design problem	low	med	med.	low	?	50%
Geotech	1	personal	7	-	program support	hi	low	long	hi	no	0
CRC	2	personal	12	-	delivery	hi	low	long	hi	no	0
OAL	1	BBN	3	+	decaf	hi	low	short	low	no	50%
Minn. Hon.	1	MIT	6	?	?	lo	hi	?	hi	no	50%

CERTAIN FEATURES OF RECENT DEC COMPUTER SALES

July 31, 1962

INTEROFFICE MEMORANDUM

DATE 7/30/63

SUBJECT Overseas Computer Marketing

TO H. Anderson

FROM N. Mazzarese

cc: S. Olsen
B. Beckman

Our major problem in overseas computer marketing will probably be customer confidence in our ability to keep them operational.

Our experience to date has shown that neither reps nor sales engineers can properly maintain PDP's.

I suggest that in your contact with potential customers and representatives in the Far East, you explore this problem in detail. Specifically, it would be interesting to examine the possibility of our supplying a roving field engineer stationed, let us say, in Melbourne and/or Tokyo who would assist reps and customers. The choice of his initial location would, of course, be dependent on our first sale.

NM/jr

INTEROFFICE MEMORANDUM

DATE July 30, 1963

SUBJECT

TO Computer Guidance Committee FROM S Lambert

The Mag Tape Control Type 57A should be considered as an option for the PDP-1. The reasons are:

1. The Type 52 MT Control can only operate the Potter Type 50 transport at 15,000 cps.

The 57A can operate Potter, Midwestern and IBM transports between 15 KC and 90 KC.

2. Potter transports, we hope, will be eliminated in the near future.

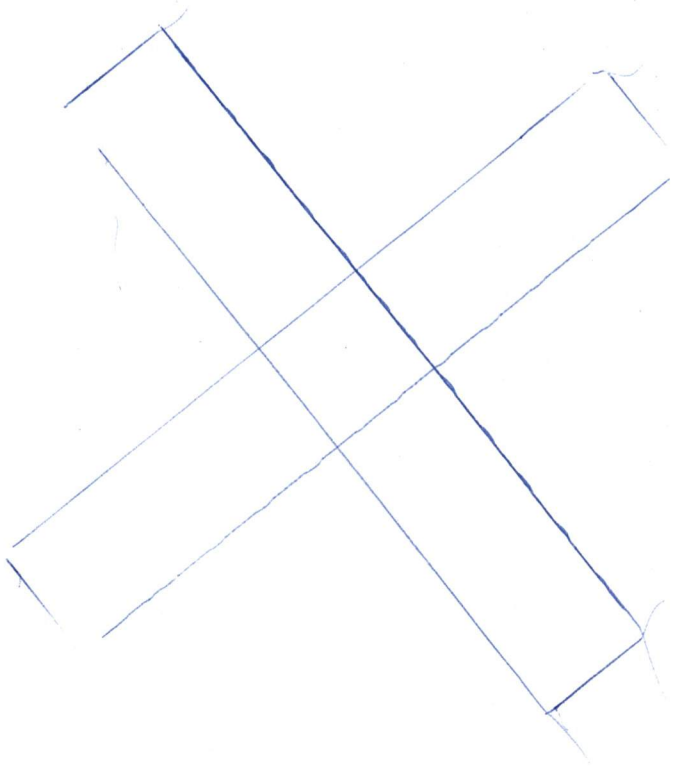
3. The price breakdown between Type 52, 57A and 510 is:

Mag Tape Control	Potter	Midwestern	IBM
Type 52	$29,000 - 52 $ 9,000 - HSC19 $38,000 - Total	None	None
Type 57A	$18,000 - 520 $ 9,000 - HSC19 $ 1,000 - IOT $28,000 - Total	$21,000 - 521 $ 9,000 - HSC19 $ 1,000 - IOT $31,000 - Total	$24,000 - 522 $ 9,000 - HSC19 $ 1,000 - IOT $34,000 - Total
Type 510	None	$21,200 - 510 $10,500 - 131 $ 9,000 - HSC19 $40,700 - Total	$21,200 - 510 $10,500 - 131 $ 9,000 - HSC19 $40,700 - Total

4. The 57A would have compatible program structure for all PDPs.

5. Due to cost factors the 57A could make the difference between sale/nosale with small limitations on programming and real time use.

SL:ASJ



digital MEMO

DATE July 20, 63

TO K. Olsen, H. Anderson, S. Olsen FROM G. Mooy

The attached letters are the result of an inquiry and a couple of telecons over the past 2 weeks. U. of Rochester is interested in a configuration something like

PDP-4 w/ 4K or 8K
card equipment
high speed printer
mag. tape (IBM compatible)
A-D
point plotter (Calcomp)

DF100-21

5M9/62

THE UNIVERSITY OF ROCHESTER
COLLEGE OF ARTS AND SCIENCE
RIVER CAMPUS STATION
ROCHESTER 20, NEW YORK

CENTER FOR BRAIN RESEARCH

RIVER CAMPUS

July 29, 1963

Mr. Gerald Moore
Digital Equipment Company
Maynard
Massachusetts

Dear Mr. Moore:

Re your conversation with Dr. Ruchkin on Friday, please find enclosed letter requesting a grant of discount of payment.

Sincerely,

E R John

E. Roy John

ERJ:sjo

THE UNIVERSITY OF ROCHESTER
COLLEGE OF ARTS AND SCIENCE
RIVER CAMPUS STATION
ROCHESTER 20, NEW YORK

CENTER FOR BRAIN RESEARCH RIVER CAMPUS

July 29, 1963

Digital Equipment Company
Maynard
Massachusetts

Dear Sirs:

We are considering the purchase of a PD-P4C computer facility. We plan to seek the funds for this purchase from the National Science Foundation and the National Institutes of Health. The facility will be used primarily for non-directed research in the areas of neurophysiology and psychophysiology. Such research will be supported mainly by grants from the National Institutes of Health.

The computer facility will be located in the Brain Research Laboratories of the Department of Psychiatry of the New York Medical College. This institution is an accredited medical school whose faculty I will join, as Research Professor of Psychiatry, in 1964. It is planned that the machine will be available to staff members and students interested in employing a computer in their research.

In the immediate future the computer will be used in our studies of changes in evoked neuroelectric potentials recorded from cats during conditioning. The results which have been obtained so far have been most encouraging, and we are anxious not only to continue with our present techniques, involving a factor analytic treatment of the average evoked potential waveforms, but also to extend our analyses to other aspects of the neuroelectric activity.

In view of the foregoing description of the situation in which the computer will be used, we request a grant of discount from the purchase price of the machine.

Sincerely yours,

E R John

E. Roy John, Ph.D.

ERJ:sjo

COMPANY CONFIDENTIAL

INTEROFFICE MEMORANDUM

DATE: 7/30/63

SUBJECT: Computer Sales Forecast

TO: K. Olsen
H. Anderson
G. O'Dea
W. Hindle
S. Olsen
D. Best
D. Mills
M. Sandler
E. Harwood
J. Koudela
B. Lane
G. Rice

FROM: N. Mazzarese

PDP-1 Computer Orders (0-3 Months)

Customer	Quantity	Value	Probability	Remarks	Sales Engineer
Michigan University	1	120K	90%	R	G. Rice
MIT	1	200K	75%	R	P. Bonner
PDP-1 Computer Orders (3-6 Months)					
Univ. of Rochester	1	150K	50%	R	G. Rice
PDP-4 Computer Orders (3-6 Months)					
Harvard University (Psychology)	1	75K	75%	NR	G. Rice
Bell Labs.	1	80K	75%	NR	D. Smith
PDP-5 Computer Orders (3-6 Months)					
Sylvania	1	27K	50%	R	N. Mazzarese
AECL	1	27K	50%	NR	D. Doyle
ERL	1	27K	50%	R	K. Larsen

PDP-1 Computer Orders - Less than 50% (3-6 Months)

Customer	Value	Remarks	Sales Engineer
Raytheon Co (Bedford, Norwood)	120K		P. Bonner
Maryland University (Physics Dept., Psychology)	120K		J. Burley
Rutgers University (Physics Dept.)	120K		D. Denniston
Wisconsin (Chemistry Physics)	120K		F. Gould
Minn-Honeywell (Brighton)	300K		J. Koudela
Tokyo University	120K	NR	H. Anderson
Yale University	200K	R	G. Rice

PDP-4 Computer Orders - Less than 50% (3-6 Months)

Litton Systems	80K		J. Burley
Northwestern Univ. (Dearborn Observatory)	253K		J. Koudela
Univ. of Illinois (Elec. Engrg. Dept.)	119K	NR	F. Gould
Washington University (Physics & Physiology)	100K	NR	G. Moore
IEC - Paramus	80K	R	G. Rice
AECL	100K	NR	G. Rice

PDP-5 Computer Orders - Less than 50% (3-6 Months)

Bell Labs. (Comp. Center)	50K		A. Titcomb
Technical Measurements Corp.	40K		H. Anderson
Photon	30K	NR	N. Mazzarese

PDP-6 Computer Orders - Less than 50% (3-6 Months)

Customer	Value	Remarks	Sales Engineer
Raytheon (Wayland)	350K	R	P. Bonner
Maryland University (Physics Dept., Psychology)	350K	R	J. Burley
Johns Hopkins Univ.	600K	NR	G. Rice
U. S. Steel	750K	NR	R. Lane
Illinois Institute of Tech. (Armour)	400K	R	R. Lane
LRL	300K	R	K. Larsen
UCLA	300K	NR	T. Johnson

Computer Option Orders (3-6 Months)

Customer	Option	Value	Probability	Remarks	Sales Engineer
Princeton	Peripheral Equipment	75K	95%	R	G. Rice
Stanford Univ.	Peripheral Equipment	100K	80%	R	N. Mazzarese
OAL	Peripheral Equipment	100K	80%	R	J. Koudela
CRL	Peripheral Equipment	100K	80%	R	R. Beckman

Orders Received

BB&N - Cambridge
Beckman Instruments
Harvard University

dec INTEROFFICE MEMORANDUM

DATE 30 July 1963

SUBJECT Loan Display for Lincoln Laboratory

TO Bob Savell FROM Bob Beckman

cc: K. Olsen
H. Anderson
S. Olsen
N. Mazzarese

A Type 30A display, which I understand is a loan, was recently shipped to Lincoln Lab. This display did not pass the established acceptance test before shipment.

The only information I have on this unit is that it is a special display that will be installed and maintained by the Engineering Department.

dec INTEROFFICE MEMORANDUM

DATE July 29, 1963

SUBJECT DECAL Rally

TO Dit Morse
Bob Beckman

H. Anderson

FROM Gordon Bell

Dick McQuillin will be here on Monday, July 29, 1963 at 2:30 p.m. to deliver the 1st installment of DECAL. We should meet with him and discuss its future and addition to the Program Library.

If there are any people other than those above, who are concemed, please call me. The meeting should be held in Dit's office.

Velma Grasseler
Sales Department
7/29/63

Marla Anderson
R L Best
R. L. Best

INDEX OF ITEMS NOT IN THE CATALOG

CATALOG ITEMS will appear in future editions of the module catalog, or on Supplementary Pages to be included in the present catalog. (See Page 13 for a list of Supplementary Pages now available.)

Those that are NOT catalog items are available to customers on a replacement basis or special order only.

Delivery dates on all items included in this list should not be quoted without first checking with Cy Kendrick, Production Department.

Model Number	Model Name	Description	Price	Catalog Item
42	ALARM PANEL	Used in Memory Tester		no
43	ALARM PANEL	Used in Memory Tester		no
44	ALARM PANEL	Same as 43, but has both a light and a buzzer.		no
75	BIAS PANEL	Resistive network used to introduce a small and variable amount of current into current driver.	$82	yes
76 +	BIAS PANEL	Electrically the same as the 75, but has only 4 circuits. Same size as a current driver.		no
722A	POWER SUPPLY	This is a 50 cps 722 Power Supply.		yes
728A	POWER SUPPLY	A 50 cps 728 Power Supply.		yes
734A	POWER SUPPLY	A 50 cps 734.		yes
735	POWER SUPPLY	For computer memories. Temperature compensated.	$455	no
735A	POWER SUPPLY	A 50 cps 735.		no
735B	POWER SUPPLY	A 735 modified for memories.		no
735C	POWER SUPPLY	A 50 cps 735B.		no
743A	POWER SUPPLY	A 50 cps 743.		yes
764	POWER SUPPLY	0 to 250 volts for test equipment. 60 milliamps.		no
769A	POWER SUPPLY	A 50 cps 769.		yes
770	POWER SUPPLY	Used in CRT Display unit. (+10K v., +250 v., -150 v.)	$410	no
770A	POWER SUPPLY	A 50 cps 770.		no

+Advertising Dept. has issued preliminary information.

Model Number	Model Name	Description	Price	Catalog Item
772A	POWER SUPPLY	A 50 cps 772.		yes
776A	POWER SUPPLY	A 50 cps 776.		yes
778 +	POWER SUPPLY	Dual -15 volt. For mounting on a plenum door.	$350	yes
778A	POWER SUPPLY	A 50 cps 778.		yes
779	POWER SUPPLY	+10, -15 and -30 volts.	$374	yes
779A	POWER SUPPLY	A 50 cps 779.		yes
780	POWER SUPPLY	Floating 12 volt, 250 milliamp. Zener regulated PS which provides the holding voltage for Type 4704 R/W Hold and Deselect module. For Memory Testers.		no
811	POWER CONTROL	Single step with power interlock.	$241	no
811A	POWER CONTROL	Modified for duplex tape.		no
811B	POWER CONTROL	Modified for Holly printer.		no
812	POWER CONTROL	Fast ON, Slow OFF for teletype punch.	$335	no
813	POWER CONTROL	2-step, 3 wire. Used in PDP-1 &-4	$675	no
814	POWER CONTROL	2-step. Used for Anelex Printer.	$555	no
814A	POWER CONTROL	Used for extra memories on PDP-1.		no
815	POWER CONTROL	Special systems only. Used to turn on AC power in machines and protect against overload. 5-1/4"x 19".		no
816	POWER CONTROL	Same as 815. 3-1/2"x 19".		no
817	POWER CONTROL	Same as 815. To be mounted on top of computer cabinet. 5-7/8"x 19-1/2		no
818	POWER CONTROL	Same as 817, only mounted on bottom of computer cabinet.		no
820	POWER CONTROL	Single step, remote ON-OFF, filters, circuit breaker.		no
821-5A	MARGINAL CHECK CONTROL PANEL	5-channel marginal check panel.		no
822	POWER CONTROL	For Tape Unit 50. Designed to allow insertion of isolation transformer or other device. Similar to 811, but with noise filters.		no

+ Advertising Department has issued preliminary information.

Model Number	Model Name	Description	Price	Catalog Item
823	SCR CONTROL	3-amp. Turns punch motor on and off		no
824	POWER CONTROL	Similar to 815, 816 and 817. Has an additional switch and outlet. 3-1/2" x 19" panel.		no
825	POWER CONTROL	2-step. Similar to 813 except it is designed to continue to operate with power off up to 100 millisecs.		no
825A	POWER CONTROL	An 825 with delayed output controlling -15 v. only.		no
826	POWER CONTROL	Used with Displays.		no
828 +	POWER CONTROL	Standard equipment on all PDP-1's and PDP-4's. Located below typewriter logic. Provides AC outlet panel for scopes, soldering iron, etc. Contains a circuit breaker and has 8 outlets. 5-1/4" x 19".		no
850	RELAY PANEL			no
851	RELAY PANEL			no
852	RELAY PANEL			no
930	TERMINATOR BOX	Plugs into current drivers.		no
931	TERMINATOR BOX	Two 930's on 3 pins.		no
960	INDICATOR PANEL	3-1/2" x 19" panel with 18 indicato lights. Has 18 banana jacks on one side of the front panel for inputs to lights from lab modules.	$175	yes
1010	DIODE MATRIX	For high speed adder and incremental scope.		no
1011 * + (numbered 1101)	DIODE	Negative AND gate with load and biasing circuitry.	$41	no
1020	MEMORY DIODE UNIT	12-pin matrix.		no
1030	TERMINATOR	Terminator for memory bus in PDP-6.		no
1031	RIGHT ANGLE CONNECTOR	Right angle 18 coax 22-pin connector.		no
1032	STRAIGHT CONNECTOR	Straight 18 coax 22-pin connector.		no
1103A	INVERTER	Interface for DCTL to DEC.		no

* Sales Dept. has issued an information sheet.

+ Advertising Dept. has issued an information sheet.

Model Name	Model Name	Description	Price	Catalog Item
1141	NEGATIVE AND-NOR GATE	General description same as 4141. Output loading same as 1105.	$61	no
1260	SUB-ROUTINE CARD	Contains 3 flip-flops and 3 pulse amplifiers.		no
1316	DELAY LINE	Contains 6 delay lines; each produces delays in steps of 50 nanosecs to a maximum of 200 nanosecs.	$117	yes
1534 +	VARIABLE SLICING RECTIFIER	Each channel clips and rectifies signal supplied from one read bus line of a digital mag tape system. Input comes directly from output of a 4550. Output drives input of a 1535.	$169	yes
1535 +	PEAK DETECTOR	Generates a 2.5-volt, 0.4 μsec Standard DEC pulse each time input signal passes through a positive amplitude peak. Is driven by the 1534.	$83	yes
1536 +	MAG TAPE SENSE AMPLIFIER	Replaces the 1549. Output drives input to a 1542.	$164	yes
1537 +	DRUM SENSE AMPLIFIER	Amplifies drum head playback, slices at predetermined threshold, strobes (time samples) and provides standard pulse amplifier output.	$132	yes
1539	PEAK DETECTOR AND SLICER	Used in tape systems to provide a logic pulse at the peak of an analog input signal. Driven from the output of a 1542.	$112	no
1542	GATABLE RECTIFIER AND SLICER	Used in NRZ tape systems to rectify amplified read head signals and slice away a variable amount for noise rejection. Is driven by output of a 1536. Drives the 1539.	$122	no
1559	LIGHT PEN AMPLIFIER	(Being redesigned)	$145	no
15591	LIGHT PEN AMPLIFIER			no
1567	DISPLAY PREAMPLIFIER		$480	no
1571	DUAL SENSE AMPLIFIER	70 nanosec strobe, 400 nanosec output.	$203	yes

+ Advertising Dept. has issued an information sheet.

INDEX OF ITEMS NOT IN THE CATALOG 1572 - 1706

Model Number	Model Name	Description	Price	Catalog Item
1572 +	DIFFERENCE AMPLIFIER	DC comparator like the 1547, but lower drift and higher speed.	$180	yes
1574 +	D-A CONVERTER	12-bit D-A Converter employing a binary weighted resistor ladder network.		yes
1575	SAMPLE AND HOLD	Used in Display.		no
1576	STAR	For use in Type 140 high speed ADC. Contains combination star-ladder type DAC. Intended to convert binary code which has overlapping bits into analog. (Limited production - to be made as requested)		no
1577	DEFLECTION CORRECTION GAIN CONTROL			no
1578	MULTIPLEXER SWITCH		$425	yes
15781	MULTIPLEXER SWITCH	Similar to 1578; designed for low level operation.		yes
1609	70 NANOSECOND PULSE AMPLIFIER	Six pulse amplifiers, 2-1/2 megacycle, 70 nanosecond pulse standardizers.		yes
1664	MEMORY BUS CONTROL	Quadruple size module for PDP-6.		no
1665	PULSED BUS TRANSCEIVER	Quadruple size module for PDP-6.		no
1666	ANALOG EMITTER FOLLOWER	Drives display monitors.		no
1692 +	BUS DRIVER	Similar in driving capability to the 1682.	$140	yes
1701	POWER SUPPLY CONTROL	Contains two identical circuits: one controls inhibit supply, and the other controls R/W supply.	$105	no
1704	POWER SUPPLY	-10 volt precision.	$242	yes
1705	CRT BIAS & FOCUS	Supplies voltages for the #1 and #2 grids of the 16" CRT used in DEC Type 30 Displays.	$185	no
1706	DC POWER AMPLIFIER	Unity gain amplifier used for focus correction. Will soon be replaced by the 1750.	$220	no

+ Advertising Dept. has issued an information sheet.

Model Number	Model Name	Description	Price	Catalog Item
1707 +	MULTIPLIER BIAS SUPPLY	Used with the 1706. Level shifter, places 5 volts across resistors in both directions in a 4677 single-ended bridge.	$172	no
1708	CATHODE CURRENT LIMITER	Used in Type 31 Display.		no
1710	DC VOLTAGE MONITOR	Detects reduced +10 or -15 volts before system fails.		no
1711	POWER SUPPLY CONTROL	Control for 781 Power Supply. Similar to 1701 Power Supply Control.		no
1750	OPERATIONAL AMPLIFIER	Will replace the 1706.		no
1772	CURRENT/VOLTAGE CALIBRATOR	See 72 C/V Calibrator.		no
1802 * +	RELAY	Consists of 10 Form A relay contacts energized from a single coil.	$45	no
1803 * +	RELAY	Consists of 4 Form A Dunco Reed relays, each with optional protecting circuit.	$108	yes
1804 * +	RELAY	Consists of 4 Form A Dunco Reed relays with pulse forming network in each contact circuit.	$108	yes
1924	MOUNTING PANEL	Like a 1901 except there are 4" between front panel and logic.	$150	yes
1928	SYSTEM MOUNTING PANEL	19". 25-unit taper pin mounting panel; unpainted, with marginal check switches. Like a 1914 with taper pins.	$220	yes
1929	LOUVERED MOUNTING PANEL COVER		$15	yes
1930	MOUNTING PANEL	Wire wrap; 24" wide, painted.	$250	yes
1931	MOUNTING PANEL	25-unit, quadruple size module mounting panel; unpainted. Has marginal check switches.		no
1932	MOUNTING PANEL	For 16 quadruple size modules mounted horizontally. Used in PDP-6 Memory. 10-1/2" high.		no

*Sales Dept. has issued an information sheet.
+ Advertising Dept. has issued an information sheet.

INDEX OF ITEMS NOT IN THE CATALOG 1956 - 1990

Model Number	Model Name	Description	Price	Catalog Item
1956	10-PIN PLUG ADAPTER	Provides connections from logic to rear plug of 4203 flip-flop.	$43	no
1957	BLANK SYSTEM MODULE	Double length, assembled; plain board.	$13.50	yes
1958	BLANK SYSTEM MODULE	Double length, unassembled; copper clad board.	$13.50	yes
1959	22-PIN PLUG ADAPTER	1-1/2 size module. Used in PDP-5.	$22	no
1964	BLANK SYSTEM MODULE	1-1/2 length, assembled, plain board.		yes
1965	BLANK SYSTEM MODULE	1-1/2 length, unassembled, copper clad board.		yes
1972	READ/WRITE SWITCH	Contains 4 identical switch circuits each with an AND gate input used to control the application of drive current to a memory core winding.	$153	no
1973	MEMORY DRIVER	Read and Write drivers. Provide R/W drive currents to the windings of the core array.	$130	no
1976	RESISTOR BOARD	Contains eight 50-ohm, 3-watt resistors with 1/2% tolerance.	$55	no
1978	RESISTOR BOARD	Contains eight 50-ohm, 3-watt resistors with 1/2% tolerance.	$55	no
1981	SENSE SWITCH	4 per card, designed to accept input signals of one volt amplitude. Stands back voltage of 50 volts.	$160	no
1982 +	INHIBIT DRIVER	Used to drive the inhibit windings of magnetic core memory planes. Contains 4 circuits.	$146	no
1987 +	READ/WRITE SWITCH	Used as a bipolar selection switch for address lines of a magnetic core memory. Each circuit has a 4-input diode AND circuit to decode the address register. Output lines for read and write currents are separate and can be paralleled where independence is not necessary.	$153	no
1990	READ/WRITE SWITCH	Used in drive system of Memory Testers 1516 and 1521. Switching device is low impedance silicon control rectifier. 4 switches and 4 switching circuits per module.	$200	yes

Model Number	Model Name	Description	Price	Catalog Item
4111A	DIODE	Used as a sense switch in core testers.	$58	no
4116 * +Ω6/3/63	DIODE	Three 5-input negative OR gates. Connections same as 4117.	$47	yes
4123 * +Ω6/3/63	NEG.CAPACITOR DIODE GATE	Similar to 4129. Useful as input gates for a 1 megacycle accumulator.	$59	yes
4130	POS.CAPACITOR/ DIODE GATE	Similar to 4129 except positive C/D gates with positive output.	$44	no
4143 *	DIODE	A 4141 with 2 transistors.	$56	yes
4161 * +Ω6/25/63	BCD DECODER	Same as 1161 except for transistors. Used for decoding 8421 or excess 3 to decimal.	$105	yes
4202A	FLIP-FLOP	Half of a 4202. Flip-flop B only.	$96	no
4202B	DUAL FLIP-FLOP	Same as 4202 but with shift paths bypassing flip-flop A.	$96	no
4206	TRIPLE FLIP-FLOP	For PDP-5. 1-1/2 size module with plugs on both ends. Contains one bit of the MA, MB, and AC.	$212	no
4207	FLIP-FLOP	Replaces 4203 in the newer PDP-4's.	$122	no
4219 *	QUINTUPLE FLIP-FLOP	Five flip-flops; common clear, set and jam transfer requiring two level inputs per bit.	$110	yes
4220 +	8-BIT BUFFER REGISTER	See Adv. Bulletin C-4001. 8 flip-flops with common clear and common read-in determined by conditioning of gates.	$107	yes
4221 +	6-BIT SHIFT REGISTER WITH PARALLEL READ-IN	See Adv. bulletin C-4001. 6 flip-flops. 5 have common clear, 1 has connections for either clear or set.	$109	yes
4222 +	7-BIT COUNTER WITH READ-IN GATES	See Adv. Bulletin C-4001. 7 flip-flops with a common clear and common read-in determined by conditioning of read-in gates.	$119	yes
4223 * +	10-BIT SHIFT REGISTER	10 flip-flops. 9 have common clear, 1 has either clear or set depending on jumpers on board. All flip-flops have shift gates.	$143	yes

*Sales Dept. has issued an information sheet.
+Advertising Dept. has issued an information sheet, Ω Revised (date)

Model Number	Model Name	Description	Price	Catalog Item
4224 +	9 SET-RESET FLIP-FLOP	See Adv. Bulletin C-4001.	$86	yes
4225 +	8-BIT PRESET BCD OR BINARY COUNTER	See Adv. Bulletin C-4001. There are 8 flip-flops which can either be cleared or set, depending on usage of available jumpers on the board.	$112	yes
4226	SERIAL TO PARALLEL ASSEMBLER	Used in Analog to Digital Converters.		yes
4228	3-BIT SHIFT REGISTER WITH BUFFER REGISTER	1-1/2 length board.		yes
4260	MARK TRACK DECODER	Used for microtape. 1-1/2 length.		no
4261	BLOCK FORMAT DECODER	Used for micro tape. 1-1/2 length.		no
4304 +	DELAY CONTROL	Connects to 4303 Integrating Single Shot and is used to program 6 external potentiometers for up to three 4303's. Contains 6 negative NORs similar to 4112 for logical gating.		yes
4305 +	DELAY CONTROL	Same as 4304, except no gates provided		yes
4505 +	IBM 7090(P) TO DEC CONVERTER	Handles one set of current levels; has 6 channels.	$79	yes
4514	NRZ WRITER	Used in tape systems to supply 70 ma. of current into a center tapped load.	$65	yes
4517 +	MAG TAPE READ/WRITE SWITCH	Used with 4514 and 1536 to permit reading and writing on mag tape with one head.	$77	no
4518 +Ω6/3/63	DRUM NRZ WRITER	Used for recording on a magnetic drum surface.	$72	yes
4519 +Ω6/25/63	DRUM FIELD SELECT	A 3-state device functioning to connect a group of drum magnetic heads to either read or write busses, or to bias the group to a non-selected state	$106	yes

+ Advertising Dept. has issued an information sheet Ω revised (date).

Model Number	Model Name	Description	Price	Catalog Item
4521 +	DRUM X SELECT	Used with 4522 circuits to form a two coordinate X-Y selection for drum heads operating in serial mode. The matrix may be up to 16 x 16 = 256 heads.	$84	yes
4522 +	DRUM Y SELECT	Used with 4521 circuits to form a two coordinate X-Y selection for drum heads operating in serial mode. Matrix may be up to 16 x 16 = 256 heads.	$69	yes
4524	MASTER SLICE CONTROL	Used in Core Memories with 4551.		no
4550	2-CHANNEL AMPLFIER	Mag tape 2-channel amplifier. Output drives input to 1534.		yes
4551	DUAL DC SENSE AMPLIFIER	For Core Memories.		no
4552	4-INPUT DC SENSE AMPLIFIER	For 16K Memories.		no
4605 * +	PULSE AMPLIFIER	Contains 3 pulse amplifiers which share a 6-input diode AND gate.	$76	no
4659 +	DEC TO IBM 7090(N) TRANS-MISSION LINE	Used to drive IBM 7090(N) transmission lines which are terminated with the IBM Terminating Shoe.	$42	yes
4660 +	DEC TO IBM 7090(P) TRANS-MISSION LINE	Same as 4659, except that it drives Type P lines.	$44	yes
4670 * +O6/3/63	DEC TO IBM 7090(P) CONVERTER	Similar to 4669 except that it drives Type P lines.	$97	yes
4671 * +	BCD INCANDESCENT LIGHT DRIVER	Same as 1671 except it will decode 8421 and excess 3 codes.	$96	yes
4673 * +O6/3/63	BCD NEON DRIVER	Used to provide visual indication of the contents of a decimal counter. Decodes 8421 as well as excess 3 code.	$85	yes
4678 +	LEVEL AMPLIFIER	Contains 5 level amplifiers to drive D to A ladder network.	$78	yes

* Sales Dept. has issued an information sheet.
+ Advertising Dept. has issued information. O (revision date)

Model Number	Model Name	Description	Price	Catalog Item
4679	LEVEL AMPLIFIER	Contains 4 level amplifiers to drive D to A ladder network.	$77	yes
4700 +	PRINTER BUFFER DRIVER	Double length board. Used to drive Anelex printer hammer. Contains 6 flip-flops with individual complement inputs and a common clear input.	$168	no
4702 * +	TELETYPE RECEIVER	A serial to parallel converter. (See also Adv. Brochure C-4001.)	$200	yes
4703 +	TELETYPE TRANSMITTER	A parallel to serial converter. (See also Adv. Brochure C-4001.)	$250	yes
4704	HOLD AND DESELECT	Used in Memory Testers in conjunction with the 1990 R/W switch.		no
4705	DESELECT CURRENT DRIVERS	Used in Memory Testers in conjunction with the 1990 R/W switch.		no
4706 *	TELETYPE RECEIVER	A serial to parallel converter. Data consisting of 10 elements is received in serial form.	$270	yes
4707 *	TELETYPE TRANSMITTER	A parallel to serial converter. Data consisting of 10 elements is transmitted in serial form.	$310	yes
4900	BUTTON PUSHER		$45	no
6102 * +	9 INVERTERS	For general use. Logic diagram is same as 4102. Output fall and rise times same as 6105.	$77	yes
61020	9 INVERTERS	Same as 6102 except overdrive capacitor is 27 pf instead of 56 pf.	$77	yes
6104 * +	INVERTERS	General purpose. 10 mc.; contains 4 inverters and 4 clamped loads.	$48	yes
61040	INVERTERS	Same as 6104 except overdrive capacitor is 27 pf instead of 56 pf.	$48	yes
61050	INVERTERS	Same as 6105 except overdrive capacitor is 27 pf instead of 56 pf.	$52	yes
61060	INVERTERS	Same as 6106 except overdrive capacitor is 27 pf instead of 56 pf.	$67	yes
61090	INVERTERS	Contains 10 inverters.		yes

* Sales Dept. has issued an information sheet.
+ Advertising Dept. has issued an information sheet.

INDEX OF MODULES NOT IN THE CATALOG 6110 - 8201

Model Number	Model Name	Description	Price	Catalog Item
6110	DIODE	Similar to 4110 (board).		yes
6111 * +	DIODE	Same as 1111 and 4111, but will operate to 10 mc. Do Not use for 10 mc pulses.	$52	yes
6113 * +	DIODE	Same as 1113 and 4113, but will operate to 10 mc. Do Not use for 10 mc pulses.	$80	yes
6115 * +	DIODE	Same as 1115 and 4115, but will operate to 10 mc. Do Not use for 10 mc pulses.	$69	yes
6116	DIODE	Similar to 4116.		yes
6117 *	DIODE	Same as 1117 and 4117, but will operate to 10 mc. Do Not use for 10 mc pulses.	$64	yes
6118	DIODE GATE	Similar to 4116. Two 8-input negative NORs.		yes
6119	DIODE	Two 8-input positive NORs.		yes
61220	INVERTERS	Contains 12 inverters and is the logical equivalent of the 4112.		yes
61230	INVERTERS	Contains 12 inverters and is the logical equivalent of the 6113.		yes
61240	INVERTERS	Contains 14 inverters and is the logical equivalent of the 4114.		yes
6141	DIODE	High speed equivalent of the 4141.		yes
6143	DIODE	High speed equivalent of the 4143.		yes
6155	TWO 2-BIT DECODERS	Selected lines are ground. Each decoder has an extra enable input.		yes
6227	8 UNBUFFERED FLIP-FLOPS	Two clear inputs which may be jumpered.	$150	yes
6684	BUS DRIVER	Similar to 1684 except faster and non-inverting.		yes
8103	VHF LOGIC MODULE	See Adv. Brochure C-8000P.		no
8110	VHF TWO 6-INPUT NOR			no
8201	VHF FLIP-FLOP	See Adv. Brochure C-8000P.		no

* Sales Dept. has issued an information sheet.
+ Advertising Dept. has issued an information sheet.

INDEX OF ITEMS NOT IN THE CATALOG

SUPPLEMENTARY PAGES in Catalog form are available on the following. These pages are now included in an envelope inside the back cover of all Catalogs being distributed by the Advertising Department.

The first ten items below appear on the latest price list dated April 1, 1963.

Model Number	Model Name	Description	Price	Catalog Item
53	CURRENT DRIVER		$760	yes
63	CURRENT DRIVER		$760	yes
72	CURRENT VOLTAGE CALIBRATOR		$950	yes
1161	BCD-TO-DECIMAL DECODER		$160	yes
1538	SENSE AMPLIFIER		$203	yes
4205	DUAL FLIP-FLOP		$100	yes
4217	FOUR-BIT COUNTER		$96	yes
4506	7090(N)-TO-DEC CONVERTER		$62	yes
4606	PULSE AMPLIFIER		$122	yes
4669	DEC-TO-7090(N) CONVERTER		$114	yes

31	ULTRA PRECISION CRT DISPLAY		yes
40-523	CARD PUNCH CONTROL		yes
41	CARD READER AND CONTROL		yes

H Anderson

INTEROFFICE MEMORANDUM

DATE July 29, 1963

SUBJECT Germanium Diodes

TO M Sandler

FROM R L Best
R Hughes
H Crouse
D White

In less than one month our supply of D001 diodes will be depleted. The latest quotes on 003 diodes indicate that the difference in price between 001 and 003 will be too small to justify two diode types.

When the present supply of D001's is exhausted, we will use D003 in its place . Circuit schematics will be changed gradually in conjunction with other engineering changes.

ASJ
CC
Distribution List D

DISTRIBUTION LIST

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J Myers
K Olsen
R Savell

A Blumenthal
D Brown
E Chevrier
D Chin
B Colburn
J Cudmore
R Doane
K Doering
A Falco
C Fuller
G Gerelds
J Hamilton
E Johnson
F Kalwell
C Kendrick
W Long
J McKalip
R Melanson
G Perazzo
R Reed
M Sandler
B Scudney
J Shields
J Smith
B Stephenson
T Stockebrand
R Tringale
K Wakeen
D Wardimon
L White

dec INTEROFFICE MEMORANDUM

DATE July 26, 1963

SUBJECT MEMORY MODULE TYPE 12 FOR SALES

TO Ken Olsen
H. Anderson
S. Olsen
N. Mazzarese
M. Sandler
J. Smith
R. Beckman
J. Shields

FROM G. Moore

Shelley Boilen of BB&N called me on July 19 to ask if they (BB&N) could borrow a 4K memory module for use with their PDP-1 for a period of two months. It was decided in consultation with Nick that we would loan them the module. The module will be mounted in a single bay cabinet and will be installed by us. It will be built for the Sales Department under EN 2707.

vg

dec INTEROFFICE MEMORANDUM

DATE July 25, 1963

SUBJECT

TO Ken Olsen
Harlan Anderson
George O'Dea

FROM Win Hindle

Mr. Charles E. Cotting and Mr. Henry S. Rogerson of Lee Higginson visited and I had a pleasant conversation with them. They merely wanted to keep in touch with us to be sure they were considered the minute we started to think seriously about a public offer of stock.

Win Hindle

WRH/mr

dec INTEROFFICE MEMORANDUM

DATE 25 July 1963

SUBJECT Computer Scheduling

TO All Computer Users

FROM Bob Beckman

In an effort to promote greater computer utilization and to allow more frequent access to the computers, the following rules for allocation of computer time have been established:

1) On Friday of each week a schedule for the following week will be posted near the computers. Time reserved for production runs, demonstrations, customer use and scheduled maintenance will have been previously blocked out.

2) Any user may sign up for any one free block of time (up to 1 hour) he desires; however, he cannot sign up for additional time until the previously requested time has passed. This applies to the time between 8 a.m. and 5 p.m., Monday through Friday. For the present, night and weekend time will not be limited and can be scheduled in advance through Sandy Moore. When scheduling time on the PDP-4 Prototype (located in Bldg. 12) users must notify Sandy Moore (ext. 362) so that she can properly handle the scheduling of users from outside the plant.

3) If, for any reason, the machine cannot be used during any period of time (i.e., unscheduled maintenance, etc.) the time shall be considered lost, and no change will be made in the schedule.

4) After time has been requested, swapping of time between individuals is permitted for personal reasons, or if particular pieces of in-out equipment are temporarily not available, etc.

5) Sandy Moore will be responsible for posting of the schedules with the proper times blocked out, and for notifying individuals if the machine is not available, or if schedule changes must be made.

6) Questions or scheduling conflicts that cannot be resolved between the users involved should be referred to Bob Beckman.

INTEROFFICE MEMORANDUM

DATE July 25, 1963

SUBJECT PDP-6 - U. S. Steel

TO H. Anderson
S. Olsen
N. Mazzarese
G. Bell
D. Morse

FROM R. L. Lane RLL

In a telephone conversation with D. Macoy of U. S. Steel on 7-24-63, he advised me that they were no longer considering the PDP-6 for Linear Programming.

However, he further advised me that within 2-3 weeks, he and scores of accounting type people and message planners would be descending upon DEC to discuss PDP-6 for use in Message Switching, Real Time Applications and Inventory Control.

He will advise me in sufficient time so that we can prepare for this visit or visits.

H. Anderson

dec INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT Raytheon PDP-6

RLL

TO

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

FROM R. L. Lane

Mr. Fred MacMillan and Jim Misho, in separate telephone calls to Pete Bonner and myself, advised us of Raytheon's decision to wait one (1) year before obtaining a computer for use within their Wayland facilities. They feel that if the current downward trend in computer prices continues as it has during the past year that they will be able to obtain a card machine next year for what they would have to pay for a paper tape machine now. He further indicated that the separate departments which together were justifying a PDP-6 would have to individually survive the best they could.

I feel the following names are worthy of recording here for future reference:

Hall - Corporate Consultant who will make the decision as to which computer and when.

Merrill - Responsible for funding decisions.

Tom Silverman - ADL (Advanced Development Laboratory) head.

He rb Groginsky - Head of Analytic Techniques (Jim's Boss).

dec INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT

TO George O'Dea

FROM Kenneth H. Olsen

cc: Harlan Anderson

Very early in the formation of the company, when Horace Ford was Chairman of the Board of Directors, we gave options to each of the Directors. Horace Ford became quite ill after that and resigned as Director and has not been very active. All of the Directors have exercised their options by now except Horace Ford and his option is about due. Because the price was so low we have an obligation to tell him about this and to suggest that he exercise it. Before we do this, Jay Forrester is going to check into the present status of Mr. Ford's health. Jack Barnard also has a question with the SEC which he expects a favorable answer on but he does not want us to go ahead without getting an answer. He is concerned over the propriety of Horace Ford as a member of ARD Board receiving compensation from one of the ARD holdings. We also have to find out by reading the option letter if he had to still be an employee of DEC in order to exercise the option. I don't think that this was part of the option.

Although Mr. Ford has been active in financial organizations for many years, he never personally took part in them and so we understand he has to watch his finances closely right now. He may be somewhat reluctant to exercise the option if there is no chance to take advantage of it in the immediate future. He is well into his eighties now. There are several things we may do. We may pay the price of the option if he, in return, promises not to sell the stock for a certain number of years. We may also prearrange a sale of the stock to the present stockholders or to DEC so that he can make money.

Will you take the responsibility for the company to follow up on this and after a couple of months, check into it again and then make sure that we take whatever action is necessary.

Kenneth H. Olsen

KHO/mr

INTEROFFICE MEMORANDUM

DATE 24 July 1963

SUBJECT Computer Room Cleanliness

TO Dit Morse

FROM Bob Beckman

cc: K. Olsen
H. Anderson

There is nothing that makes a computer installation look worse than having tapes, print-outs, scribled notes, etc., laying around all the time. The prototype PDP-4 has more than adequate provision for neat, clean storage of console tapes. I will welcome any helpful suggestions concerning facilities and procedures to aid the users of the machine, but I see no reason to relax the present rules about cleanliness, and they will continue in force.

For the past several weeks I have made it a point to inspect the area in the morning and in the evening. In an effort to ease your transition from pig-pen to parlor I have on many occasions rescued tapes and other materials that had been left out. The "console copies" of the 8-K Assembler have, time and time again, been placed in one of the tape trays provided under the apparently naive assumption that you would eventually get the idea and do it yourself. On Monday night I found several tapes, including the assembler copies, on top of the reader and decided to stop wasting my time trying to protect you. These tapes were placed in the trash can where you later found them.

It is unfortunate if the retrieved tapes were unusable. The clean-up man has been instructed to be careful about not crushing things down in these trash cans. In fact, on Tuesday morning I was there at the time he cleaned the area up and moved the trash can into the back row, and I know that he did not do anything of this nature.

Two copies of the assembler were found on top of the reader again this morning. I retrieved them and will turn them over to you, but this is the last time I'm going to waste my time cleaning up after you.

INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT

TO Harlan Anderson

FROM Kenneth H. Olsen

cc: Jack Atwood
Nick Mazzarese

The Adams computer chart now have several computers in it which have not as yet been built. With these ground rules, we should be sure that our PDP-6 is also included. Will you take care of this or else pass it on to someone.

INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT

TO George O'Dea
Dick Mills
Win Hindle
Dick Best
Harlan Anderson

FROM Kenneth H. Olsen

At the last Board of Directors Meeting, Arnaud de Vitry asked that we have a report at one of the next meetings on profitability of several of our projects. We prepared this a month or two ago and I told him that we would write it up and bring it to the next Board Meeting. They would also like to see some estimate of interest charges on each of these projects so that it will be a more realistic measure of profitability. Some arbitrary decisions will have to be made in order to do this calculation but I think we should plan on having it for the September meeting.

Kenneth H. Olsen

INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT

TO Jim Sullivan
Arthur Hall
Henry Crouse
Computer Guidance Committee

FROM Bob Savell

The Computer Guidance Committee has decided that we should not do any engineering on the Burroughs BC-303 100 cpm Card Punch and Control until we get a customer order. Please remove it from the prototype PDP-6 schedule and cancel the purchase order.

The Committee agreed that should a customer order one, sufficient time will be allowed after receipt of a unit from Burroughs to allow an orderly integration of the unit into the PDP-6 system and to allow proper training of maintenance personnel.

RES/lal

TEROFFICE
MORANDUM

DATE July 23, 1963

SUBJE Cleanliness of PDP-4 Installation

TO Bob Beckman

FROM Dit Morse

In the past, tapes which were obviously console copies of program (obvious because they had "Console Copy Do Not Remove" written on them in large letters) have been discarded when they were inadvertently left on the console.

While I agree that a clean computer room is a desirable thing, I don't believe tapes left on top of the reader at night are a valid reason to delay operations one hour the next day. (The only two console copies of the PDP-4 8K Assembler would not read in after being retrieved from the trash barrel). Luckily, a copy of 8K Assembler had been given to Sandy Moore last week, or there would be NO 8K Assembler available now.

It would be appreciated in the future if tapes which have written on them in large legible letters, CONSOLE COPY, are not discarded as trash. Computer users will continue to make an effort to restore console tapes to the console tape trays.

cc: K. Olsen
H. Anderson

HRM/nbh

July 22, 1963

PERSONNEL FORECASTING--HOURLY TECHNICAL PEOPLE

Works Committee

R. Lassen

Attached for your review is a forecast of our hourly technical personnel requirements for the next 12 months. The forecast is a compilation of individual departmental projections. It has been reviewed by the Personnel Planning Committee.

The forecast indicates that we should immediately begin hiring additional hourly technical people. As a point of information, 20 men in this category (mostly 2-year electronic vocational school graduates) have been hired since April 1st of this year.

Because of the lead time necessary to prepare new technicians for the projected responsibilities, it will be necessary to start recruiting and training activities immediately. The Personnel Planning Committee has been actively working out more comprehensive training measures through accelerated company training classes and logical job progressions.

Of course, we plan to fill as many of the projected openings from within the company as possible; however, it is apparent that we must hire some experienced people from the outside particularly for field service work.

HOURLY TECHNICAL PERSONNEL FORECAST--JULY, 1963

Technical Level		Immediate Requirements		6-Month Projection		12-Month Projection
Wiremen	(3)	1 - Beckman 1 - Fadiman 1 - Harwood	(4)	1 - Fadiman 2 - Beckman 1 - Gerelds	(2)	2 - Beckman
Technicians (Module Test)	(4)	1 - Stockebrand 2 - Gerelds 1 - Wakeen	(1)	1 - Gerelds	(2)	1 - Fadiman 1 - Gerelds
Technicians (Peripheral C.O.)	(3)	3 - Harwood	(3)	3 - Harwood		- - - - -
Technicians (Computer C.O.)	(4)	4 - Beckman	(5)	3 - Beckman 2 - Savell	(6)	4 - Beckman 2 - Savell
Senior Tech. (Computer C.O.)	(5)	3 - Beckman 1 - Blumenthal 1 - Hughes (T.E.)	(7)	2 - Boisvert 1 - Stockebrand 4 - Beckman	(5)	4 - Beckman 1 - Bell
Project Tech.	(3)	2 - Beckman 1 - Bell	(3)	3 - Beckman	(6)	5 - Beckman 1 - Bell
TOTALS	21		23		21	37 Beckman

21
23
21

65

Cost feed back related to personnel needs.

HOURLY TECHNICAL EMPLOYEES - 7/24/63

(Wiremen - Project Tech.)

Cost Center	Number	Supervisor
Final Test	12	Sandler
Sub-Assembly	28	Sandler
Model Shop	9	Gerelds
Quality Control	8	Hughes
Test Equipment	2	Hughes
PDP-1	11	Harwood
In-out	5	Savell
PDP-4	4	Bell
Module Engineering	4	Best
Mag. Tape	1	Boisvert
Systems	10	Fadiman
PDP-N	2	Blumenthal
Customer Relations	9	Beckman
	105	Total number of hourly technical employees (wiremen thru Project Tech) employed as of 7/24/63.

Works Comm.

INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT

TO George O'Dea
Dick Mills
Win Hindle
Dick Best
Harlan Anderson

FROM Kenneth H. Olsen

At the last Board of Directors Meeting, Arnaud de Vitry asked that we have a report at one of the next meetings on profitability of several of our projects. We prepared this a month or two ago and I told him that we would write it up and bring it to the next Board Meeting. They would also like to see some estimate of interest charges on each of these projects so that it will be a more realistic measure of profitability. Some arbitrary decisions will have to be made in order to do this calculation but I think we should plan on having it for the September meeting.

Kenneth H. Olsen

9/10/63

dec INTEROFFICE MEMORANDUM

DATE July 24, 1963

SUBJECT Visit to Bell Labs, Murray Hill, New Jersey

TO H. Anderson
R. Beckman
D. Denniston
N. Mazzarese
K. Olsen
S. Olsen
D. Smith

FROM S. Mikulski

I spent 3 days at Bell Labs in Murray Hill teaching Mr. Peter Rosenfeld the ins and outs of a PDP-4 computer, specifically dealing with programming of his problem. He will be tying a PDP-4 computer into an automatic scanning device for active or passive networks. The device, in turn, will process db loss (to 80 db) and phase shift (±180°). It has the ability to have an active circuit mode and a delay measurement mode. It utilizes a frequency range of 20 cps to 250 MC.

Mr. Rosenfeld originally worked on the device (presently analog) and realizes the potential of a digital system for calculations. Only one complete unit has been constructed at a cost of approximately $300K. The present system performs measurements in a fixed sequence which is not ideal for all jobs. Mr. Rosenfeld feels that one way to gain desired flexibility is by using a general purpose digital computer as the controller. The control sequence could be stored and modified easily with new programs. Optimum programs could be written for different networks.

Much of the equipment used at present (frequency synthesizers, readouts, etc.) use a bcd code and could easily be controlled by a computer.

In Mr. Rosenfeld's inquiries from Adams in reference to computers to do the job, a PDP-4 and a 1620 were suggested. The time requirements prevented the use of a 1620 but the coding system was attractive. In an inquiry to DEC at that time this question was asked: "How long does it take a PDP-4 to calculate a $\log_{10}$ to 4 decimal digits?" The answer: "Approximately 900μs." No reference was made to the automatic multiply features. Costing and time for the project were estimated and the costing did not include the extra $6.3K for an extended arithmetic element. A proposal was submitted for the interface and a 4K machine.

During my talks the question of time arose and in laying out a time chart we discovered that a single precision multiplication requires 2.6msec (more than his 1msec requirement) and that a log calculation requires a few of these multiplications.

The problem does not bother him too much because he will design the read-out amplifier which feeds the A/D equipment (their own) and he can design it either linear or logrithmic. The point to emphasize is why did it take so long to discover this misunderstanding? These problems could have been discussed and resolved during initial sales contacts, either in person or through inquiries.

The remainder of his programming problems can be handled easily with standard packages available from the PDP-4 library (Double precision Integer Package, Assembler, etc.)

Mr. Rosenfeld is sold on a PDP-4 system at this time, but did not realize about the timing problem. This, by the way, is one of the reasons the PDP-4 won over the 1620; the ability to take a log that fast.

The original estimate for a 1620 ran as follows:

	Monthly Rental	Purchase Price
tape system	$1590	$74,050
card system	$2000	$94,500

Interface estimate is $20,000.

A PDP-4 system was approximately $72K including interface.

In reference to a memo by D. Denniston (4/29/63): In a sales followup, at that time a 1620 was selected because of availability of service (local staff at Murray Hill) rather than speed and ease of programming. Since then it looks like a PDP-4 is being strongly considered because of speed and ease of programming.

The people who will be programming there are not programmers and have had no experience. I left them with the impression that the problem was not too difficult, could be placed in 4K of memory with no difficulty, and that they can get technical assistance by attending a course here at DEC.

Mr. Rosenfeld will produce detailed flow charts in the next few weeks and send them to me for comments.

I believe the system can be programmed in a short time; time requirements for their projects are years (sigh) not months.

The system's future is as follows:

1. Initially 3 systems - first at Andover, Mass.
2. Prospects for 2 more (all built by Bell Labs)
3. Turn over to Western Electric for potential sales.

DIGITAL EQPA

MSG NO. SFO-55

DEC PALO ALTO TO DEC MAYNARD 7-22-63 5-20 PM

ATTN..... HARLAN ANDERSON AND GORDON BELL

NORMAN HARDY OF THE LAWRENCE RADIATION LABORATORY IN LIVERMORE IS AT THE MIT PROJECT MAC SEMINAR.

IF IT IS POSSIBLE PLS INVITE HIM TO MAYNARD FOR A CONSULTING SESSION ON THE PDP-6. HE IS WILLING TO BE HELPFUL HAS A GREAT MANY GOOD IDEAS AND LOTS OF EXPERIENCE

KEN LARSEN

B SWEDENBORG

END O 9

dec INTEROFFICE MEMORANDUM

DATE 7/23/63

SUBJECT PDP-5 FORTRAN

TO Harlan Anderson
Nick Mazzarese
Dit Morse

FROM Ted Johnson

I understand that the decision has been made to attempt to find programming personnel who would be able to take on the load of doing PDP-5 FORTRAN.

I have been discussing a FORTRAN contract with a number of people here and am sending a collection of brochures and notes on these various discussions. It is my opinion that we would do well to assure that the FORTRAN system for the PDP-5 is done as soon as possible, to enable us to begin marketing the PDP-5 to as broad a market as we can. Several of these contractors could accomplish this at what would appear to be a reasonable cost in a five to six month period. I would urge you to consider that the advantages of having somebody like Systems Programming Corp. (Mesa Scientific) do this job would probably result in having more complete documentation in a very short time, which would give our sales people a good feeling for the features and workings of the compiler system. Although there are advantages in having our own programming people be intimately familiar with the system, I feel it is just as important, if not more important, to have all of the people who will be attempting to sell PDP-5 equipped with sufficient sales tools and knowledge. I suspect that SPC would do a good job of providing the detailed information on the system to our top programming people, in addition to supplying good sales literature ahead of any schedule we could expect from an in-house group.

Pete Warkenton, of SPC, will be visiting the plant next week to discuss this. He was formerly sales manager for Autonetics Recomp division, and is the marketing manager for SPC. I believe that you should direct any questions you have toward him at that time, keeping in mind, however, that he is not as familiar with details as other representatives of their firm might be. He will also want to discuss applications ideas, particularly in the automatic type setting area, as outlined in their letter to me. Their analysis of PDP-5 for this job has led them to some other questions on possible memory expansion, etcetera.

Although I am certainly in favor of expanding our in-house capabilities to provide a complete product package, I feel that in this case the advantage of working with a professional and experienced compiler organization (the investment as compared to costs of bringing in new

people and the freeing of our people for other areas such as PDP-6) might justify establishing a relationship with SPC. In addition, I feel that we are very likely to gain additional marketing benefits and a possible customer in Mesa Scientific, or possibly one of the other firms in this area.

Ted

SYSTEMS PROGRAMMING CORPORATION

1833 EAST 17TH STREET, SANTA ANA, CALIFORNIA

KImberly 7-0069

July 15, 1963

Mr. Ted Johnson
Digital Equipment Corporation
8820 Sepulveda
Los Angeles, California

Dear Mr. Johnson:

This letter is to summarize some of the discussions we have had over the past week. When we receive your FORTRAN specification on Wednesday, we can give you a precise estimate of price and schedule for the development of PDP-5 FORTRAN; until then, the best we can do, as we have discussed, is quote a price somewhere in the $35,000 to $45,000 range and a delivery of six months. This assumes a 4K PDP-5 with microtape as the basic machine configuration. In order to help your sales effort, we propose a schedule of milestones so that useful material will be available to you before six months have elapsed:

Preliminary User's Manual	6 weeks after start of contract
Basic FORTRAN suitable for demonstration	4 months after start of contract
Complete FORTRAN	6 months after start of contract

These schedules and prices are, of course, contingent on availability of PDP-5 machine time and PDP-5 software (such as assembly program, memory dump, program loader, machine diagnostics, etc.) We will be glad to discuss a software package which includes these items if you wish.

In addition to FORTRAN, we are discussing various approaches to the automatic typesetting application and are intrigued by your suggested approach. It would help us in our discussions if you could give us a rough idea as to what type of delivery schedule and pricing DEC would be able to propose for 100 computers (PDP-4 and PDP-5) over a two-year period.

We would also like to pursue our discussions on other computer application areas which have previously resulted in large-scale placements in both the military and the non-military fields. One of these is "Automatic Circuit Design and Analysis," which resulted in the placement of obsolescent RECOMP II computers throughout the aerospace industry and which were developed or applied by present SPC staff members. We feel that Systems Programming Corporation can make a major contribution to the marketing results of DEC, resulting in increased placements of DEC computers.

We are looking forward to working with you; I think you will find the depth and breadth of experience available in SPC and Mesa unmatched by any other programming firm. As you know, our staff includes a large number of people who have had extensive compiler development experience with such systems as 3C FORTRAN II, RECOMP FORTRAN II, 7090/94 IBMAP (FORTRAN IV), 7090 Commercial Translator, 1105 COBOL, Hughes VATE Compiler, Automatic Test Language Compiler (924A), and many others.

As you are also aware, SPC personnel have extensive experience on your PDP-1 and PDP-4 computers. This experience arose out of our subcontract relationship with the Jet Propulsion Laboratory at Pasadena.

Very truly yours,

SYSTEMS PROGRAMMING CORPORATION

Peter Warkenton

Peter Warkenton
Marketing Manager

PW:cb

H. Anderson

July 22, 1963

PERSONNEL FORECASTING--HOURLY TECHNICAL PEOPLE

Works Committee **R. Lassen**

Attached for your review is a forecast of our hourly technical personnel requirements for the next 12 months. The forecast is a compilation of individual departmental projections. It has been reviewed by the Personnel Planning Committee.

The forecast indicates that we should immediately begin hiring additional hourly technical people. As a point of information, 20 men in this category (mostly 2-year electronic vocational school graduates) have been hired since April 1st of this year.

Because of the lead time necessary to prepare new technicians for the projected responsibilities, it will be necessary to start recruiting and training activities immediately. The Personnel Planning Committee has been actively working out more comprehensive training measures through accelerated company training classes and logical job progressions.

Of course, we plan to fill as many of the projected openings as possible from within the company; however, it is apparent that we must hire some experienced people from the outside, particularly for field service work.

HOURLY TECHNICAL PERSONNEL FORECAST--JULY, 1963

Technical Level		Immediate Requirements		6-Month Projection		12-Month Projection
Wiremen	(3)	1 - Beckman 1 - Fadiman 1 - Harwood	(4)	1 - Fadiman 2 - Beckman 1 - Gerelds	(2)	2 - Beckman
Technicians (Module Test)	(4)	1 - Stockebrand 2 - Gerelds 1 - Wakeen	(1)	1 - Gerelds	(2)	1 - Fadiman 1 - Gerelds
Technicians (Peripheral C.O.)	(3)	3 - Harwood	(3)	3 - Harwood		- - - - -
Technicians (Computer C.O.)	(4)	4 - Beckman	(5)	3 - Beckman 2 - Savell	(6)	4 - Beckman 2 - Savell
Senior Tech. (Computer C.O.)	(5)	3 - Beckman 1 - Blumenthal 1 - Hughes (T.E.)	(7)	2 - Boisvert 1 - Stockebrand 4 - Beckman	(5)	4 - Beckman 1 - Bell
Project Tech.	(3)	2 - Beckman 1 - Bell	(3)	3 - Beckman	(6)	5 - Beckman 1 - Bell
TOTALS	21		23		21	

H. Anderson

INTEROFFICE MEMORANDUM

DATE July 19, 1963

SUBJECT Tape Control for PDP-6

TO Eng. Projects Committee

FROM Roland Boisvert

Dit Morse
Alan Kotok
Steve Lambert

My purpose for putting the tape control for the PDP-6 on the agenda of the July 29th meeting of the Engineers Projects Committee is to consider exactly what this control should do if anything over and above the normal read, write, space, and rewind operations being performed by our present controls.

Discussion Topics:

A. Sharing of Data Buffers

Design of the Data Buffering section should be such that these buffers can be used by both the IBM compatible Control and the Micro Tape Control.

B. Read Backward

Several companies are presently reading backwards with a high degree of success. The inherent problems here are skew and reshuffling of the data. The read back skew problem could be taken care of on our own units by the addition of read skew delays in the read amplifiers. The setting of skew procedure would then be something like the following:

a. Set read amplifiers skew with master skew tape

b. Set write deskew

c. Reset read amplifier with master skew tape in the reverse direction.

Since the PDP-6 has all the Data Reshuffling facilities, the responsibility for doing this is best left with the programmer.

C. Error Cycles

Two possible error cycles which bear consideration are listed below. Any additional ideas in this area should be brought out.

a. Parity Error During Write:

The transport would be spaced back over the record, the current address and word count re-established and the record written.

b. Parity Error During Read:

The transport would be spaced back over the record, the current address and word count re-established, change to low slice level read, and re-read the record.

D. Read Check Against Core

This function has been done only on a word basis in the past. I strongly recommend that this be done on a character basis in this control.

E. Search Plus Read

The present design of the logical read/write section of the 570 Transport allows the read circuitry to be duplex. That is the read signals can come out on either read buss A or read buss B. The buss is selected by the control. It would be possible to tell tape unit 1 to search, that is just keep the tape unit in motion reading, and to tell tape unit 2 to read. Thus by clever programming a programmer could read consecutive records of different drives and by -pass the delays for start/stop motion control. This feature could be augmented such that the tape unit in the search mode would position itself for read in by virtue of a successful read check on a character or word basis.

F. Search

Successful readcheck of 6 characters would cycle the transport to read that record in to core.

G. Store Initial Instructions

After instructing a transport to rewind a new operation could be loaded

into the function register and store program in the Tape Control would wait until the rewind is complete and perform insued function (like skip if busy instruction in programming with jump to itself).

RB/II

Harlan Anderson

INTEROFFICE MEMORANDUM

DATE July 19, 1963

SUBJECT PDP-5 Software

TO Computer Guidance Committee FROM Dit Morse

Enclosed are copies of pertinent information from consultants concerning PDP-5 programming systems. The decision should be made Monday at 1:00 p.m. whether to do it in-house or not. My arguments are listed on the previous PDP-5 Software memo.

NEW DIRECTIONS IN APPLICATIONS AND RESEARCH

FOX COMPUTER SERVICES, INC.

38 WEST 48th STREET, NEW YORK 36, N.Y.

LT 1-3760

July 2, 1963

Mr. Harrison R. Morse III
Supervisor, Programming Group
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts

Dear Dit:

I would like to thank you for the opportunity to see the DEC plant last week and for the introductions you provided. I never did get to see Bob Beckman, so I am enclosing an extra copy of our brochure which you might like to pass on to him.

As you suggested, we have put some thought into the requirements of a software package for the PDP-5. This has taken the form of looking at specific requirements peculiar to the PDP-5 and not of trying to define overall specifications. This letter contains some of our thoughts and suggestions.

The addressing structure of the PDP-5 places unique requirements on programming conventions. The first goal of the software should be to aid the programmer in meeting these requirements. To this end we suggest the memory usage conventions depicted in Figure 1.

It is seen that page zero is used exclusively for generally accessed data and contains none of the program itself. The specific usage of each of these areas and the means of constructing them are discussed in connection with relevant assembler features.

Common temporary storage locations - generally used for storing intermediate results, transient indirect addressing, subroutine communication, loop counters, switches, flags, etc.

octal address	usage
0000	program counter
0001	common temporary storage locations
0007	
0010	index registers
0017	
0020	common constants
0177	data table pointers
0200	program
7777	data tables

Figure 1

PDP-5 Memory Usage Conventions

Index registers - used for indirectly accessing and looping through data tables or program tables.

Common constants - constants or short data tables used frequently throughout the pages of a program. The assembler will contain a "constant location counter", which is initially set at $20)_8$. The occurrence of the pseudo-operation CON will cause subsequent coding to be generated in the constant area and the constant location counter to be advanced.

Data table pointers and data tables - the data tables contain the general working data of the object program and the data table pointers are, for each table, a word containing the address of the origin of the table minus one. The data table pointers will be used by the programmer for initializing index registers to access the data tables. The assembler will contain two location counters for maintaining these areas. The "data location counter" is originally set at $7777)_8$ and the "data pointer counter" is originally set at $177)_8$. The pseudo-operation

TABLE, DTA n

will cause n (the length of the table) to be subtracted from the data location counter. Then the symbol TABLE will be assigned the current value of the data pointer counter, and at this location will be generated a word containing the new value of the data location counter. Subsequently, the data pointer counter is decremented by one. Consideration may also be given to means for independently adjusting these two counters.

Program - the assembler will contain a "program location counter" which is initially set at $200)_8$. The occurence of the pseudo-operation PRG will cause subsequent coding to be generated in the program area and the program location counter to be advanced. If the program location counter ever meets with the data location counter (or the constant location counter with the data pointer counter) an error will be flagged.

The most bothersome problem the programmer will face is the handling of extra-page references (references to pages other than the current page) within the program. Since these references must be indirectly addressed either through the current page or page zero, the programmer would normally have to be quite aware of the segmenting of his program into pages. Thus the assembler should provide an aid to segmenting and inserting indirect addresses. To this end, assume that all coding is done without regard to extra-page references (direct addressing of all references to within the program). Before assembling his program the programmer can roughly estimate the page segmentation and somewhere near the end of each page insert the pseudo-operation PGE. On the first pass this pseudo-operation causes the program location counter to re-origin at the beginning of the next page, leaving an unused space at the end of the current page.

On the second pass, this space is used to generate indirect addressing registers for extra-page references, and the instructions making these references are made indirect through the appropriate register. If the space left on the current page is inadequate, the overflow may be generated in the space remaining on page zero between the final values of the constant location counter and the data pointer counter.

Since PGE may cause a break in the object program, the programmer must exercise discretion only to insert the paging at a proper logical break in the program flow. For example, paging may not occur in the middle of a sequence of forward program flow, or after a jump to an address of the form .+n. In FORTRAN the compiler will be much more aware of program logic, and paging can be even more automatic.

As for contractor communication and documentation, we have found that a multi-phase project structure lends itself to smooth flow. This can take the form of a Design phase, a Programming and Debugging phase and a Field test phase. During all phases, informal regular progress letters can be used to keep you informed, and briefings by technical personnel on the project can be arranged. Formal documentation and presentations may be made at the end of each phase.

While this letter has grown larger than I expected, I did want to supply enough detail to get the ideas across and to suggest an approach which can grow from specific PDP-5 requirements to general software requirements. I would like to invite you to visit our facility next time you are in the New York area.

Sincerely yours,

Jim

James Enterline

JE:ek
encl.

INTEROFFICE MEMORANDUM

DATE: July 19, 1963

SUBJECT: Progress of Second Lot of 555 Units

TO: K. Olsen
H. Anderson
S. Olsen
N. Mazzarese
B. Beckman
R. Maxey
E. Harwood
T. Stockebrand

FROM: J. Smith

Motors will not be available for this lot of 10 units until 8/18/63. Purchasing has been expediting delivery the past week but have met with little success. All units will be constructed awaiting motor delivery. Units will be available from checkout three days following delivery of motors.

Three units from the first lot are still available for assignment to customer order. The units are physically located in Mag. Tape Checkout.

H. Anderson Reminder File

8/19/63

INTEROFFICE MEMORANDUM

DATE July 18, 1963

SUBJECT PDP-5 Software

TO Computer Guidance Committee FROM Dit Morse

Enclosed is a rough specification of a PDP-5 Programming System.

The decision should be made very soon (Friday, if possible) whether to do it in house or not. Some of the arguments are as follows:

OUT-HOUSE

Advantages:

1) There are numerous competent consultants available and anxious to do the work.

2) The price will probably compare to what it would cost DEC to do it internally.

3) We might encoutage a consultant to "favor" our machine by offering a trade, loan of a computer in house, etc.

4) Documentation will probably be more satisfactory.

Disadvantages:

1) We would lose some level of control over the design of the system.

2) No-one at DEC is closely acquainted with the inner workings of the system.

IN-HOUSE

Advantages:

1) We can design the system exactly as we want.

2) We will have in house knowledge of the system.

Disadvantages:

1) We have no-one at DEC both competent enough and available presently.

The same person (or group) should do ALL the software, to insure the system is both integrated and optional.

If we decide to do it in-house, then we should immediately hire someone capable of handling the job.

This will probably take a month. Otherwise we should hire a consultant and get a final specification, delivery date and cost basis. This will probably take two weeks to a month.

In either case, a definite schedule consisting of the following should be established.

1) final system specification
2) Assembler and tape editor completed
3) Arithmetic Package
4) FORTRAN
5) Rough draft documentation
6) final documentation

If done internally, two people should work on the programming, with some technical writing help for documentation.

The time estimates in-house, assuming two people, 1 excellent, 1 capable are,

FOR	EFFORT
specification and design	4mm
programming	1my
documentation	3mm

HRM/nbh

SPECIFICATION OF THE PDP-5 PROGRAMMING SYSTEM

This document describes the proposed programming system for PDP-5 Computer.

The minimum configuration will be:

PDP-5 with 4K memory
1 dual micro-tape transport and control
1 teletype Model 33 ASR

NORMAL OPERATING PROCEDURE:

The PDP-5 Computer is intended to be a self-contained device not requiring support from off-line equipment. Consequently, the system will use micro-tape as primary I/O device, with the keyboard-printer used for control and secondary I/O.

The normal procedure will be to use the computer on-line for program preparation, keeping symbolic programs stored on micro-tape.

The assembler and compiler will perform their processing from micro-tape to micro-tape leaving the resulting binary program to be loaded from micro-tape and executed.

The following programs constitute the minimal generally useful programming system:

1. Tape editor: micro-tape to micro-tape for program preparation and editing.
2. Assembler of the PDP-4 flavor, which should include features to ease the addressing problem.
3. Compiler: A subset of FORTRAN for PDP-4. Output will be in symbolic machine language or an interpretive language, which ever is more feasible (probably the latter).

4. Arithmetic Package:
   a) fixed point multiply and divide
   b) floating point add, subtract, multiply and divide.
   c) functions - sin, cos, e^x, x^y, $\log_{2,10,e}$, arctan, sgrt.
   d) floating point interpreter.
   e) floating point I/O.
   f) fixed point I/O.
5. Debugging routine: Probably a simple debugger including octal I/O, break points, searching features, the ability to dump core on micro-tape, and make corrections to the program while on micro-tape is sufficient.
6. Utility routines:
   a) micro-tape read-write-search package.
   b) micro-tape to punch dump.
   c) reader to micro-tape loader.

COMMENTS:

1. Micro-tape should be an integral part of the system.
2. The possibility of FORTRAN programs too large to fit into core with the subroutines necessary to support them should be provided for.
3. The debugging routine should work on a program which overlays it.
4. All system programs should inter-communicate - in the same format. (For example, the symbols defined during assembly should be directly accessible to the debugging routine.)
5. The programs must be modular enough so that changes to the system can be safely made a non-author of the system. In particular, adapting the system for different I/O configuration should be easily accomplished.
6. The system should take advantage of larger equipment configurations.

GENERAL AIMS:

The Assembler should have features which allow subroutines to be assembled with main programs without symbol conflicts. This merely means a feature which allows the subroutine writer to indicate to the assembler which symbolsare to be saved after assembly of the subroutine, and which are to be discarded. (PDP-4 FORTRAN does this automatically). This eliminates the general problem of linking and relocating binary programs. In addition there are many advantages to keeping library programs in symbolic rather than binary form, such as the ability to look at a subroutine and easily modify it. The assembly process should be efficient enough so that there is normally no reason to keep binary versions of programs other than the system programs.

Since every PDP-5 Computer sold will have micro-tape, we should go to some lengths to take advantage of it in our system programs. There should always be available (in core) a set of micro-tape read-write-search routines, which will used by the Assembler, Compiler, editor, debugging routines, and user's programs, if desired.

It is advantageous to dump some of core on tape and overlay that core with the debugging routine when interrogating a program. This means only enough of the debugging program to handle traps and dump core necessarily be in core when the program is running.

Since program are almost relocatable now (on page basis), it appears fairly trivial to make them completely so. This possibility may make it very feasible for the subroutines needed by compiled programs to be quite elaborate yet occupy a small portion of core, with sections of program being brought into core as needed. For example, only one or two pages need be allocated for all function generators. The desired one is brought in when needed, overlaying the previous one.

The preceding paragraph points out one predominate problem in constructing a satisfactory programming system for the PDP-5. That is the problem of limited memory capacity. It is desired that this problem be alleviated by the use of micro-tape as a large backing store. To this end, the programming system should be designed to expect programs which will exceed the memory capacity of the machine, and to properly handle such programs.

This does not mean that the general storage allocation problem (choke!) need be solved on PDP-5. However, the programs which make the system up must be designed to operate in a small amount of core if necessary. In particular, the subroutines necessary to support a FORTRAN program are large in number, and may leave only a very small portion of core for user's programs if all subroutines are in core at once. However, only a few subroutines need be in core at any one time. Certain subroutines may be able to perform their functions in two or more passes, with a new section of program being loaded at each stage ot minimize the storage used by the subroutine.

Features to permit such storage overlay should be included in the system.

H. R. Morse III
July 18, 1963

P.S. The main purpose of the preceding discussion is to explain our general aims, rather than precisely specify the system.

INTEROFFICE MEMORANDUM

DATE July 18, 1963

SUBJECT Consultants for PDP-5 Software

TO S. Olsen
H. Anderson

FROM Dit Morse

Enclosed are copies of documents I have received directly concerning PDP-5 Software.

Encls.

HRM/nbh

dec INTEROFFICE MEMORANDUM

SUBJECT: Automatic Type Setting Computer Application, Discussion with Systems Programming Corp. (Mesa)

DATE: 7-12-63

TO: N. Mazzarese
Dit Morse

FROM: Ted Johnson

Several people at Systems Programming Corporation, including their marketing manager and assistant manager, are highly interested in the field of automatic type setting for small-medium sized newspaper publishers. They explored this market while with NAA Autonetics and have apparently devoted a considerable amount of time and effort to develop an approach to the problem of hyphenating words in newspaper articles so as to automate the process of going from paper tape inputs representing newspaper articles (received from news services and/or produced internally) to paper tape outputs to be fed to linotype machines which have been properly formatted to fit within the determined column widths and lengths.

To date, IBM and RCA have been cultivating this market. A recent sale was made to the Wall Street Journal of an IBM 1620 for this purpose. Systems Programming Corp. feels they have developed a means of accurately determining where to hyphenate words which requires considerably less memory and less cost. They are visualizing a computer software package for the newspaper industry which would run about 60 to 70K. They are interested in the PDP-5 for this application, if it has sufficient capability, particularly in through-put rate. They seem to know what they are talking about. They also visualize a very sizable market (100 or more computer systems) and feel that their approach is sufficiently proprietary that they would like to find a way to capitalize on it. It might be that their interest could affect our negotiations for a FORTRAN system. If they indicate a high degree of follow-through, motivation and sound judgment, it might very well be that they would provide a program package where their payment would be geared to sales. I opened the possibility that they themselves could represent our customer in this program and by ordering quantities of PDP-5's could realize additional profits while the advantage to us would be that they would assume full responsibility for marketing these systems in a big hurry and would be directly motivated to do a superlative job in developing this system.

A factor of concern is the reliability of microtape in the printing room environment, another is our interest in gearing up to meet the demand that they visualize.

I understand that we are concurrently exploring this area but do not know if it is in exactly this application. I would suggest serious

consideration being given to this venture since it represents a market which is traditionally a buyer market and non-renegotiable.

Please let me know if I am way out in left field on this idea. If not, I would appreciate your comments and would like to follow this up.

SYSTEMS PROGRAMMING CORPORATION

1833 EAST 17TH STREET, SANTA ANA, CALIFORNIA

KImberly 7-0069

July 15, 1963

Mr. Ted Johnson
Digital Equipment Corporation
8820 Sepulveda
Los Angeles, California

Dear Mr. Johnson:

This letter is to summarize some of the discussions we have had over the past week. When we receive your FORTRAN specification on Wednesday, we can give you a precise estimate of price and schedule for the development of PDP-5 FORTRAN; until then, the best we can do, as we have discussed, is quote a price somewhere in the $35,000 to $45,000 range and a delivery of six months. This assumes a 4K PDP-5 with microtape as the basic machine configuration. In order to help your sales effort, we propose a schedule of milestones so that useful material will be available to you before six months have elapsed:

Preliminary User's Manual	6 weeks after start of contract
Basic FORTRAN suitable for demonstration	4 months after start of contract
Complete FORTRAN	6 months after start of contract

These schedules and prices are, of course, contingent on availability of PDP-5 machine time and PDP-5 software (such as assembly program, memory dump, program loader, machine diagnostics, etc.) We will be glad to discuss a software package which includes these items if you wish.

In addition to FORTRAN, we are discussing various approaches to the automatic typesetting application and are intrigued by your suggested approach. It would help us in our discussions if you could give us a rough idea as to what type of delivery schedule and pricing DEC would be able to propose for 100 computers (PDP-4 and PDP-5) over a two-year period.

We would also like to pursue our discussions on other computer application areas which have previously resulted in large-scale placements in both the military and the non-military fields. One of these is "Automatic Circuit Design and Analysis," which resulted in the placement of obsolescent RECOMP II computers throughout the aerospace industry and which were developed or applied by present SPC staff members. We feel that Systems Programming Corporation can make a major contribution to the marketing results of DEC, resulting in increased placements of DEC computers.

We are looking forward to working with you; I think you will find the depth and breadth of experience available in SPC and Mesa unmatched by any other programming firm. As you know, our staff includes a large number of people who have had extensive compiler development experience with such systems as 3C FORTRAN II, RECOMP FORTRAN II, 7090/94 IBMAP (FORTRAN IV), 7090 Commercial Translator, 1105 COBOL, Hughes VATE Compiler, Automatic Test Language Compiler (924A), and many others.

As you are also aware, SPC personnel have extensive experience on your PDP-1 and PDP-4 computers. This experience arose out of our subcontract relationship with the Jet Propulsion Laboratory at Pasadena.

Very truly yours,

SYSTEMS PROGRAMMING CORPORATION

Peter Warkenton

Peter Warkenton
Marketing Manager

PW:cb

NEW DIRECTIONS IN APPLICATIONS AND RESEARCH

FOX COMPUTER SERVICES, INC.

38 WEST 48th STREET, NEW YORK 36, N.Y.

LT 1-3760

July 2, 1963

Mr. Harrison R. Morse III
Supervisor, Programming Group
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts

Dear Dit:

I would like to thank you for the opportunity to see the DEC plant last week and for the introductions you provided. I never did get to see Bob Beckman, so I am enclosing an extra copy of our brochure which you might like to pass on to him.

As you suggested, we have put some thought into the requirements of a software package for the PDP-5. This has taken the form of looking at specific requirements peculiar to the PDP-5 and not of trying to define overall specifications. This letter contains some of our thoughts and suggestions.

The addressing structure of the PDP-5 places unique requirements on programming conventions. The first goal of the software should be to aid the programmer in meeting these requirements. To this end we suggest the memory usage conventions depicted in Figure 1.

It is seen that page zero is used exclusively for generally accessed data and contains none of the program itself. The specific usage of each of these areas and the means of constructing them are discussed in connection with relevant assembler features.

Common temporary storage locations - generally used for storing intermediate results, transient indirect addressing, subroutine communication, loop counters, switches, flags, etc.

octal address	usage
0000	program counter
0001	common temporary storage locations
0007	
0010	index registers
0017	
0020	common constants
0177	data table pointers
0200	program
7777	data tables

Figure 1

PDP-5 Memory Usage Conventions

Index registers - used for indirectly accessing and looping through data tables or program tables.

Common constants - constants or short data tables used frequently throughout the pages of a program. The assembler will contain a "constant location counter", which is initially set at $20)_8$. The occurrence of the pseudo-operation CON will cause subsequent coding to be generated in the constant area and the constant location counter to be advanced.

Data table pointers and data tables - the data tables contain the general working data of the object program and the data table pointers are, for each table, a word containing the address of the origin of the table minus one. The data table pointers will be used by the programmer for initializing index registers to access the data tables. The assembler will contain two location counters for maintaining these areas. The "data location counter" is originally set at $7777)_8$ and the "data pointer counter" is originally set at $177)_8$. The pseudo-operation

TABLE, DTA n

will cause n (the length of the table) to be subtracted from the data location counter. Then the symbol TABLE will be assigned the current value of the data pointer counter, and at this location will be generated a word containing the new value of the data location counter. Subsequently, the data pointer counter is decremented by one. Consideration may also be given to means for independently adjusting these two counters.

Program - the assembler will contain a "program location counter" which is initially set at $200)_8$. The occurence of the pseudo-operation PRG will cause subsequent coding to be generated in the program area and the program location counter to be advanced. If the program location counter ever meets with the data location counter (or the constant location counter with the data pointer counter) an error will be flagged.

The most bothersome problem the programmer will face is the handling of extra-page references (references to pages other than the current page) within the program. Since these references must be indirectly addressed either through the current page or page zero, the programmer would normally have to be quite aware of the segmenting of his program into pages. Thus the assembler should provide an aid to segmenting and inserting indirect addresses. To this end, assume that all coding is done without regard to extra-page references (direct addressing of all references to within the program). Before assembling his program the programmer can roughly estimate the page segmentation and somewhere near the end of each page insert the pseudo-operation PGE. On the first pass this pseudo-operation causes the program location counter to re-origin at the beginning of the next page, leaving an unused space at the end of the current page.

On the second pass, this space is used to generate indirect addressing registers for extra-page references, and the instructions making these references are made indirect through the appropriate register. If the space left on the current page is inadequate, the overflow may be generated in the space remaining on page zero between the final values of the constant location counter and the data pointer counter.

Since PGE may cause a break in the object program, the programmer must exercise discretion only to insert the paging at a proper logical break in the program flow. For example, paging may not occur in the middle of a sequence of forward program flow, or after a jump to an address of the form . +n. In FORTRAN the compiler will be much more aware of program logic, and paging can be even more automatic.

As for contractor communication and documentation, we have found that a multi-phase project structure lends itself to smooth flow. This can take the form of a Design phase, a Programming and Debugging phase and a Field test phase. During all phases, informal regular progress letters can be used to keep you informed, and briefings by technical personnel on the project can be arranged. Formal documentation and presentations may be made at the end of each phase.

While this letter has grown larger than I expected, I did want to supply enough detail to get the ideas across and to suggest an approach which can grow from specific PDP-5 requirements to general software requirements. I would like to invite you to visit our facility next time you are in the New York area.

Sincerely yours,

Jim

James Enterline

JE:ek
encl.

INTEROFFICE MEMORANDUM

DATE July 18, 1963

SUBJECT

TO G. Bell
A. Hall
Computer Guidance Committee

FROM E. T. Johnson

Evidence has been presented that Vermont Research Corporation has a reliable flying head drum. Vermont Research will sell us flying head units equivalent to the fixed head drum we presently use in our Type 24 drum for the same cost.

A suggested format would use a 10" diameter drum at 1800 rpm. Keeping the present system clocking rate (285kc) would double the bits per track and give transfers of 512 words instead of the present 256 words. Total storage would double the Type 24 drum system to 32K, 65K, and 130K words. Price could (but need not) remain as at present, as I estimate engineering time to be trivial for this change.

ETJ/lal

dec INTEROFFICE MEMORANDUM

DATE July 17, 1963

SUBJECT TECHNICAL PUBLICATIONS CONTACT PERSONNEL

TO Lists A, B, C and D

FROM Jack Atwood

Recent changes in personnel and assignments in our department should be brought to your attention so you will know whom to call on for information and/or assistance in different areas. This listing includes only the people you are most likely to contact and only that portion of their duties which would be expected to affect you directly.

Ralph Wooldridge replaces Helene Shebak as production manager. He schedules jobs to be produced in finished form inside or outside the shop, orders any necessary materials and services, and steers the jobs through the various production steps. He is the person to contact for printing, art work, photography, silk screening, collating, binding, and other graphic arts services.

Linda Marshall is now production control clerk. She assists Ralph and also keeps track of requisitions, receiving slips, invoices, inventory records, etc.

Jennifer Johnsen is acting copy editor. She reviews technical and promotional copy, makes sure that manuals and proposals are complete and properly organized, and oversees proofreading and reproduction typing.

Bob Graham handles "sales service" - including show literature, materials for the sales offices and special requests from customers. He also maintains the job schedule on advertising, public relations, sales promotion, and technical information projects.

Gertrude Loynd (Ext. 370) runs our direct mail operation. She gathers the ingredients for general and special mailings, maintains the mailing list and services literature requests from customers and prospects.

ALSO

Jack Atwood directly supervises advertising, sales promotion and public relations projects. He is also the person to contact when you have any questions about Tech Pubs services - or the lack thereof.

Stuart Grover supervises the preparation of manuals, proposals, application notes, and other technical information pieces. He also assists people who are preparing technical papers, talks and articles. He is the person to contact about Tech Pubs services when you can't contact Jack Atwood.

Joe Nangle has joined the department in the capacity of senior writer. He will be working on various sales promotion and public relations projects, including feature stories on new equipment and applications, promotional brochures, annual reports, etc.

Alex Stephens handles a wide range of advertising assignments - from new product brochures to employment advertising.

Don Watson specializes in publicity and public relations projects, such as trade show publicity, employee materials and releases on new products, new applications and new literature.

Florence Dudzinski (Ext. 224) can usually locate Jack Atwood, Joe Nangle, Alex Stephens, Don Watson, Bob Graham, and Gertrude Loynd.

Eleanor Norton (Ext. 225) knows where to find Stu Grover, Jenn Johnsen and Technical Writers Bob Buyer, Bob Clark and Paul Barber.

dec INTEROFFICE MEMORANDUM

DATE 17 July 1963

SUBJECT

TO Dit Morse

FROM Bob Beckman

cc: Ken Olsen
Harlan Anderson
Stan Olsen
Nick Mazzarese
Gordon Bell

Please note the last paragraph of the attached letter.

This is the kind of thing that I have several times complained to you about. Sooner or later our customers are going to run out of stubborn pride.

HARVARD UNIVERSITY
CENTER FOR COGNITIVE STUDIES

61 KIRKLAND STREET
CAMBRIDGE 38, MASSACHUSETTS

July 11, 1963

Mr. Stefan S. Mikulski
Digital Equipment Corporation
146 Main Street
Maynard, Mass.

Dear Mr. Mikulski:

Now that we've had our computer for a month, we're in a better position to give you our reactions to your course.

We all agreed that the first day of your course could be packed with much more material than it was. Though the pace picked up after that, even those with no programming experience found the first day rather slow.

Other than that, we were generally satisfied with the course, and have been able to push ahead with our own programs on the basis of what you taught us. Especially useful have been the explanations, included in your workbook, of the various programs included in the program library. Without exception your explanations have been easier to understand than those provided with the programs. It would be very helpful if these explanations were expanded and more of them provided. There are, as you know, a number of typos in the text of your manual, and some bugs in the programs -- we assume you will catch these before you use it again.

It would also be helpful if more explicit instruction were given in the use of DDT and a few of the more esoteric instructions on both the assembler and Edmund.

We're enclosing a very short program which Don Norman wrote to get material packed using the text mode out again. It may prove to be a useful exercise for future classes. When all you have for output is the teleprinter, the teletype output package becomes pretty important to know about.

We have several times been on the verge of calling you to ask about some detail or other (like what the hell are we doing wrong when a change or delete order to Edmund cleans out the entire memory, loader included), but so far stubborn pride has prevented us and we have either solved or learned to live with most of our problems. We are saving you, in other words, until we are <u>really</u> stuck.

Sincerely yours.

George Miller

George A. Miller
Don Norman
Al Bregman
Mike Stein

GAM:jj

enc.

Subroutine "Prose" to type text packed in the text mode

/Needs teletype output package

```
Prose,      0
            dac aaa'
            lac i aaa
            ty3
            lac i aaa
            and (77
            sna
            jmp i prose
            isz aaa
            jmp .-7
```

This subroutine will type out any prose which is packed in the text mode (3 characters per word in concise code) beginning in location "story."

The calling sequance is:

```
lac (story
jms prose
```

TAPE CONTROL 54
PROGRAM DESCRIPTION

Digital Equipment Corporation
July 16, 1963
By: Leo Gossel

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1.0 INTRODUCTION

TC-54 is a control program for the 54 tape control. The program allows the operator to perform the following functions:

a. read
b. write
c. space N records
d. space to end of file
e. write an end of file mark
f. erase 6 inches of tape
g. rewind

The program also allows the operator his choice of the following:

a. unit
b. parity
c. start address
d. stop address

* * *

The read, space and space to end of file use the PDP-4 interupt.

IT IS THE PROGRAMMER'S RESPONSIBILITY TO INSURE THAT NO DEVICES CAUSE AN INTERUPT WHEN THE TAPE PROGRAM IS READING OR SPACING.

Computing time is available when spacing records. When spacing to an end of file, computing time is available after a record has been examined for a possible end of file.

When calling a tape routine, if the interupt is active the program waits until it becomes inactive. When the routine is entered, if the interupt is used by the tape all of the standard interupt flags are cleared. Devices that can cause an interupt other than those listed at register (INT) should be cleared. There are two NOP instructions provided which may be changed to the appropriate IOT instructions.

When calling a tape routine, the program waits for unit ready. Possible causes of the unit not being ready are: the unit selection is wrong or the tape is rewinding.

2.0 CALLING SEQUENCES

Rewind

In rewind, the instruction preceding the (JMS) must be a LAW 600 + the unit number.

The return is always +4. The three words following the (JMS) may be used for constants.

Calling Sequence -

```
LAW 60X
JMS A54
X
X
X
return to program
```

Write

When calling the write routine, the AC must contain LAW + 100 +unit + a parity bit 15 if odd parity is desired.
(JMS) + 1 is the starting address of the block that is to be written.
(JMS) + 2 is the final address of the block to be written. The start address must be equal to or less than the stop address.
(JMS) + 3 is the return if end point is present. Also, the routine will not be executed if end point is present.

Calling Sequence -

```
LAW 10X
JMS A54
start address
stop address
return if end point
return
```

Write EOF

When calling EOF, the AC must contain LAW 700 + the unit number. The two words following the (JMS) are not used by the program and may be used as constants by the programmer.
(JMS) + 3 is the return if end point is present. Also, the routine

is not executed if end point is present.
(JMS) + 4 is the normal return.

The routine writes a gap, followed by a (17) even parity, 300 us later an EOB mark, then the remaining gap.

Calling Sequence -

```
LAW 70X
JMS A54
X
X
end point return
return
```

Clean Tape

To clean 6 inches of tape, the AC must contain LAW + 1100 + unit. The following three words are not used by the program and the return is always +4.

The routine is useful when difficulty in writing on a particular area of tape is encountered.

Writing even parity zeros will eliminate errors when the tape is read back.

Calling Sequence -

```
LAW 110X
JMS A54
X
X
X
return
```

Read

When calling the read routine, the AC must contain LAW + 200 + unit + a bit 14 if odd parity is desired.
(JMS) + 1 is the start address of where the block is to go. The start address must not be greater than the stop address.
(JMS) + 2 is the address + 1 of the last word desired from the tape.

The program always reads to the end of the record; however, when the stop address is reached, no more words are stored in memory. If the start and stop addresses are equal, the effect is a space forward one record. This function differs from the forward space instruction in that parity is checked.

(JMS) + 3 is the return in the event of error. The tape status register is in the AC.

(JMS) + 4 is the normal return, with no parity error. The end of block mark is in the register EOB Bits 0-5. The status register is in the AC. The end of block mark is not valid in cases where it is a mark of even parity zeros.

Calling Sequence -

```
LAW 2XX
JMS A54
start address
stop address + 1
error return
normal return
```

Space Forward

When calling the forward space routine, the AC must contain LAW + 400 + unit. The number of records spaced is equal to the difference + 1, between A and B.

Spacing to end of file or to the end of a record always leaves the read/write head in the gap following the file mark or record. (JMS) + 3 is the return.

Calling Sequence -

```
LAW 40X
JMS A54
A
B
return
```

Space Backward

When calling the back space routine, the AC must contain LAW +

500 + unit.

The number of records spaced is equal to the difference + 1 between A and B.

(JMS) + 3 is the normal return.

Calling Sequence -

```
LAW 50X
JMS A54
A
B
return
```

Forward Space EOF

When calling the space forward to an end of file routine, the AC must contain LAW + 1400 + unit.

The tape moves forward until an end of file is seen.

The return is always + 3.

Calling Sequence -

```
LAW 140X
JMS A54
A
B
return
```

Back Space EOF

When calling the space backward end of file routine, the AC must contain LAW 1500 + unit.

The tape moves backward until an end of file is seen. Upon moving forward, the first information encountered is the end of file mark.

Calling Sequence -

```
LAW 150X
JMS A54
A
B
return
```

3.0 TIMING FUNCTIONS

Write timing

Start motion

5.8 MS writes first character

Write pulses occur at 70 us intervals

Last write pulse +296 us write EOB

EOB + 6.440 us stop transport

12 MS transport recovery

Return to programmer

Read timing

Start motion

+152 us select interupt

+184 us look for first character

Skew delay min. 24 us max. 32 us

Max. time for house keeping between characters 24 us

Last character +1698 us stop transport

12 MS transport recovery delay

Return to programmer

Forward Space timing

Start motion

+120 us turn on interupt

+208 return to programmer

Time in the interupt if not last record to be spaced 112 MS

Last character +1706 us stop tape

12 MS transport recovery

Return to programmer

Space Forward to EOF: timing

Start motion

+176 turn on interupt

+312 look for 1st character

Second character +224 us Return to programmer

Interupt time not an end of file, from EOR flag to second character of next record

EOF mark 1728 us stop transport

12 MS transport recovery delay

Return to programmer

Back Space timing

Start motion

+160 turn on interupt

+246 return to programmer

Interupt time when not last record 112 us

Last character +4,914 stop transport

12 MS transport recovery delay

Return to programmer

Back Space EOF timing

Start motion

+176 us turn on interupt

+312 us look for lst character

Second character read +224 us Return to programmer

Interupt time when not an EOF mark, EOR flag to second character of next record

EOF mark +4,908 us stop transport

12 MS transport recovery

Return to programmer

PDP-6 Programming Manual
Outline

July 15

Norm Hurst

Preface:

A. New Concepts

1. Fast Memory

2. Multiple Accumulators

Introduction:

A. General System Features

1. Design Rationale

2. Organization of System

a. Standard

b. Optional

3. Special Features

a. Fast Memory

b. Number of Accumulators

c. Large Main Memory

d. Characters, List and all Boolean Instructions

e. Indexing

f. Built in Floating Point

4. Organization of Manual

Chapter I System Organization

A. Central Processor

1. Logical Organization

a. Information Flow Diagram

b. Explanation

2. Fast Memory

a. Accumulators

b. Index Registers

3. Asynchronous Features

B. Memory

1. Module Sizes

2. Timing

a. Overlapping

3. Processor Connections

C. I/O

1. General I/O Rationale

2. Channels, etc.

3. Program Interrupt

D. Internal Representation

1. Word Format

a. Instruction Words

b. 2's complement binary fractions

c. Floating point

Chapter II Computer Instructions:

A. Explanation of general features

1. Repeat instruction format

2. All instructions use bits 13-35 in the same way

3. All instructions calculate an effective address

4. Explanation of indexing scheme

5. Indirect addressing and clearing features

6. Combinations of indexing and indirect addressing

7. Discussion of timing considerations

B. Two general classes of instruction

1. I/O prefix 7_8

a. No AC reference

b. Give format

2. All other instructions

a. All reference any of 16 Accumulators

b. Give format

c. List subchassis → classis

d. Explain modes

C. Detailed listing of instructions giving order code, mnemonics, effect, and timing. Also, we might consider giving a brief explanation of the intent of some instructions - set off so they do not bog down someone using the list for reference.

Chapter III I/O and Optional Equipment

A. Complete Discussion of Common Features

1. Several I/O schemes

2. Memory Bus (Data Channels)

3. Sequence Break

4. I/O Processor

B. Complete description of standard I/O Equipment

For Example:

1. Model 33 Teletype

a. Character Codes

2. Micro Tape

a. General description

b. Format of information on Tape

C. Description of Optional Equipment

Chapter IV Programming

The general idea of this chapter will be to discuss the use of unusual features, instructions, etc., of this machine. However, I feel that this chapter rates a fairly low priority until the first three are well under control.

Appendices:

The usual, i.e., instruction lists arranged alphabetically, numerically, etc.; number system conversions, powers of two, etc.

7/15/63

PDP-6 SCHEDULE

The attached is a schedule predicated on the requirement that a working PDP-6 of as complete a configuration as possible be available for the Fall Joint Computer Conference on November 12-14.

Because it is rarely possible to predict the degree of delay that will be caused by design errors, personnel sickness, lack of priority, etc. these delays will be ignored to yield a schedule which depicts the minimum time required to accomplish the tasks listed.

As it is apparently impossible to have all the desired IO equipment and programs available and debugged by November 1, I have listed the estimated time required to complete each increment. When the Central Processor and IO Interface are completed and checked out, the remaining time (if any) before the show can be used to check out desired programs or equipment.

If delivery of the computer is to be at all possible at the date desired the new modules developed especially for PDP-6 will have to be tested manually and the testers built later.

Operator console delivery date is contingent on a final design decision (on the number of lights required) which will not increase the height of the panels.

This schedule reveals that it is within the realm of possibility to have a working computer in time for the FJCC if PDP-6 has absolute priority over all other work, if shortcuts are taken in module test and if no major circuit or logic design or checkout problems arise.

Quality Control Inspection

Intermediate and Final combined -- Inspection and repair — 40 work hours

Heat Test

Test, trouble diagnosis and repair — 24 work hours

Testers

Design, build and test one module tester — 35 man hours

Modules

The following new modules are required for the Central Processor:

1250	6110	6143	6684
1260	6116	6155	61090
1316	6118	6205	61220
1609	6119	6206	61240
1664	6123	6227	1030
1665	6141	6609	

A

3/4 are Trivial

PDP-6 Programs for FJCC

PROGRAM	Elapsed on-line time required on computer	Actual on-line computer time
Assembler	160 hrs.	96 hrs.
Micro Tape Editor	120 hrs.	36 hrs.
Simple Executive Routine	32 hrs.	10 hrs.
Pen-Follow Routine	16 hrs.	5 hrs.
Teleprinter to Display	16 hrs.	4 hrs.
Display to Micro Tape	8 hrs.	2 hrs.
Micro Tape To Line Printer	8 hrs.	3 hrs.

(estimated per H. Morse)

Notes: Add 10% to total to account for inefficiency in use of computer time.
Reserve nights and weekends as time to make up miscalculations in schedule.

Crating 16 hrs. will be required to crate PDP-6 System for show. (K. FitzGerald)

Shipping 1 calender week should be allowed between arrival of the shipper and the first day of the show for shipping (by air) and for set-up. (N. Mazzarese)

Peripheral Equipment On-Line Checkout

EQUIPMENT	Elapsed on-line computer time	Actual on-line computer time
CRT Display	176 hrs.	88 hrs.
Micro Tape	80 hrs.	20 hrs.
Teleprinter	80 hrs.	40 hrs.
Paper Tape Reader	80 hrs.	40 hrs.
Paper Tape Punch	80 hrs.	40 hrs.
300 lpm Printer	176 hrs.	44 hrs.
200 cpm Card Reader	176 hrs.	44 hrs.
Card Punch	176 hrs.	88 hrs.

Notes: Add 10% to total of actual time to allow for inefficiency in computer time use.
Reserve nights and weekends to make up lost time.

PDP-6 AREAS OF RESPONSIBILITY

Logic Design of Central Processor and IO Interface	Gordon Bell Alan Kotok
Logic Design of Fast Memory and Control	David Brown
PDP-6 Core Memories	Al Blumenthal
Memory Control Implementation	Bob Reed Bill Colburn
New Module and Tester Design	Burt Scudney Emile Chevrier
PDP-6 Operator Console	Ken FitzGerald
Mtg. Panel for Horizontal Mounting Modules	Ron Cajolet
Display, Reader, Punch, Teleprinter, Card Reader, Card Punch, High Speed Printer	Bob Savell
Magnetic Tape Transport and Control	Roland Boisvert
Micro Tape and Control	Tom Stockebrand
Programming Manual	Norman Hirst
Maintenance Manual	Bob Beckman
Programs	Dit Morse
Project Coordination	Arthur Hall

****

AHH/lal

dec INTEROFFICE MEMORANDUM

SUBJECT: Automatic Type Setting Computer Application, Discussion with Systems Programming Corp. (Mesa)

DATE: 7-12-63

TO: N. Mazzarese
Dit Morse

FROM: Ted Johnson

Several people at Systems Programming Corporation, including their marketing manager and assistant manager, are highly interested in the field of automatic type setting for small-medium sized newspaper publishers. They explored this market while with NAA Autonetics and have apparently devoted a considerable amount of time and effort to develop an approach to the problem of hyphenating words in newspaper articles so as to automate the process of going from paper tape inputs representing newspaper articles (received from news services and/or produced internally) to paper tape outputs to be fed to linotype machines which have been properly formatted to fit within the determined column widths and lengths.

To date, IBM and RCA have been cultivating this market. A recent sale was made to the Wall Street Journal of an IBM 1620 for this purpose. Systems Programming Corp. feels they have developed a means of accurately determining where to hyphenate words which requires considerably less memory and less cost. They are visualizing a computer software package for the newspaper industry which would run about 60 to 70K. They are interested in the PDP-5 for this application, if it has sufficient capability, particularly in through-put rate. They seem to know what they are talking about. They also visualize a very sizable market (100 or more computer systems) and feel that their approach is sufficiently proprietary that they would like to find a way to capitalize on it. It might be that their interest could affect our negotiations for a FORTRAN system. If they indicate a high degree of follow-through, motivation and sound judgment, it might very well be that they would provide a program package where their payment would be geared to sales. I opened the possibility that they themselves could represent our customer in this program and by ordering quantities of PDP-5's could realize additional profits while the advantage to us would be that they would assume full responsibility for marketing these systems in a big hurry and would be directly motivated to do a superlative job in developing this system.

A factor of concern is the reliability of microtape in the printing room environment, another is our interest in gearing up to meet the demand that they visualize.

I understand that we are concurrently exploring this area but do not know if it is in exactly this application. I would suggest serious

consideration being given to this venture since it represents a market which is traditionally a buyer market and non-renegotiable.

Please let me know if I am way out in left field on this idea. If not, I would appreciate your comments and would like to follow this up.

dec INTEROFFICE MEMORANDUM

DATE July 12, 1963

SUBJECT Sales Information From High Voltage Engineering

TO Harlan Anderson FROM John Jones

cc: Stan Olsen
Nick Mazzarese

One of the areas of experimental physics that could be very important to us in terms of computer and module sales depends on accelerators as a source of particles. It is fairly easy to keep track of who buys the monster machines, but there is another class that represents a far greater number of units - the Van deGraaff generator. Minimum instrumentation for a V de G includes a pulse height analyzer and many are used with detection chambers that require core or PEPR type data analysis.

At this time nearly all V de G machines come from High Voltage Engineering which leads me to conclude that knowledge of their sales and contacts would be invaluable to us in our search for new business. How can we get this information?

I'm not sure we can offer a great deal to them in exchange because we usually get our customers <u>after</u> they have committed themselves to such basic equipment as H.V. provides. (Perhaps I'm wrong in this assumption.) On the other hand, I don't think giving us this sales information, in confidence, would in any way jeopardize their market position.

Are there people within H.V., that we already know, with whom we might discuss the possibility of an information exchange? If not, could we talk about the pros and cons of my contacting H.V. to seek their cooperation in getting this information.

JJ:vg

INTEROFFICE MEMORANDUM

SUBJECT: JOB ALLOCATION, MECHANICAL DESIGN DATE: July 12, 1963

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

FROM: Loren Prentice

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

ENGINEER	JOB NUMBER OR EN NUMBER	DESCRIPTION	% COMPLETE
Ron Cajolet	1169	Display 30 interface	95%
	1199	Type 580 tape transport	10%
	1178	PDP-6 Development	30%
	1177	PDP-5 Development	95%
	1064	Display 31	95%
	1016	Core Memory Development	90%
	1023	Special Mounting Panel	-
	1161	PDP-4 type 57 mag tape	95%
	1027	Microscope holder	15%
il Backholm	1196	M3000 tape transport Prototype type 570	25%

ENGINEER	JOB NUMBER OR EN NUMBER	DESCRIPTION	% COMPLETE
Scott Miller	1177	Basic PDP-5	90%
		Standard Special Systems bay for PDP-5	10%
		Standard computer bay for PDP-5 (2 models)	50%-75%
	1178	PDP-6	90%
	1196	Tape transport 570	95%
	1209	30 Display (cabinet model)	25%
	2623	F.A.A. - memory typewriter buffer	30%
	----	Product Identification	-
Loren Prentice	1136	555 Tape Unit E.C.O.'s	-
	1097	Mod. development	75%
	1065	Large Display	10%
	1177	PDP-3 computer (24-36 bit)	30%
	1184	Variable field light pen First three units	95%
	1179	Display 30 cost reduction survey	95%
	1000	Building layout	75%
	1196	Tape transport type 570	10%
	1000	Quotation - plastic parts	-
	1000	Engineering standards	0.5%

ENGINEER	JOB NUMBER OR EN NUMBER	DESCRIPTION	% COMPLETE
Ken FitzGerald	1023	Additional assembly jig for 1914 mounting panels	75%
	1000	Paint adhesion on steel components	30%
	1053	Welding jigs for standard computer cabinets	90%
	1000	Sheet metal, machine, cabinet assembly and carpenter shop supervision and administration	-
	1178	PDP-6 console mechanical design and prototype fabrication	45%
	1208	DEC paper tape reader (Stepping motor drive)	15%
	1000	"Plastic" doors and end panel research	0%
	1000	Programing tape controlled milling machine	-

JOBS PENDING - UNASSIGNED		ASSIGNED ELECTRONIC ENG.
1151	Large Tape Storage - Hold	T. Stockebrand
1165	Projection display	R. Savell
1180	Camera equipment for 30 display	R. Savell
1181	Camera equipment for 31 display	R. Savell
1182	Electrostatic display development	R. Savell
1086	Holley printer	R. Savell
1064	Eye-ball unit	R. Savell

INTEROFFICE MEMORANDUM

DATE July 10, 1963

SUBJECT Regarding Reader/Spooler Memo Of July 9th.

TO Bob Beckman

FROM Bob Savell

cc: Ken Olsen
Harlan Anderson
Stan Olsen
Nick Mazzarese

I wish to clarify one point. The spooler problems were not uncovered by the final acceptance tests, but were uncovered by the Peripheral Equipment Department during the course of our normal equipment checkout prior to acceptance testing.

RES/lal

H. Anderson

INTEROFFICE MEMORANDUM

DATE July 10, 1963

SUBJECT Card Equipment For PDP-6

TO Computer Guidance Committee

FROM Robert Savell

cc: Bob Lane
Bob Beckman
Jack Shields
Ed Harwood

After visiting a local Burroughs installation to see their 800 cpm card reader and 300 cpm punch in operation, I am even more enthused about their equipment. The customer and two separate field personnel all gave essentially the same answers to the same questions dealing with numbers and kinds of troubles asked to them individually. All say the units are practically trouble free.

Burroughs stresses preventive maintenance and spends about 1-1 1/2 hours per week per unit on weekly maintenance as well as about 15 minutes per day or less cleaning read heads etc. If we are to expect the units to run reliably, we must expect to spend similar amounts of time. More detail on preventive maintenance is coming from Burroughs.

If the decision is made to use this equipment I feel that at least two of my people, two checkout people, and two field service people must initially learn this equipment -- and I don't simply mean read the maintenance manual. They should receive thorough formal instruction on each piece of equipment mechanical as well as electrical operation (in fact mechanical is probably the more important) - before it arrives at our plant. Burroughs has formal training courses set up which our people can attend for about $20 per day per person. Those attending should then be responsible for setting up a duplicate training program of our own so that every field service man knows all of the standard items of equipment thoroughly that are included in installations for which he is responsible.

Price to us and delivery as of June 15 is as follows. Number of units already in the field is shown also.

Burroughs Model	Type	Cost	Delivery	Units in Field
BC-122	200 cpm Reader	6.5K	2 months	250
BC-124	800 cpm Reader	13.5K	2-4 months	60-100
BC-303	100 cpm punch	15K	6-8 months	15-20
BC-304	300 cpm punch	25K	6-12 months	50

The mechanical portion of the BC-304 is made by Bull, and under Burroughs agreement with them cannot be sold to OEM's. Burroughs will sell it directly to our customers however. Does this present any problems to us legal or otherwise?

Gordon and I have decided that we should immediately order the 100 cpm punch. Work will begin immediately on integrating it into PDP-6. Further investigation will be continued to verify that this decision is a good one, consisting of a detailed perusal of Burroughs technical manuals, visits to Burroughs plants, and visits and/or discussions with more Burroughs customers.

A subsequent memo will detail the schedule for incorporating this equipment into PDP-6.

RES/lal

INTEROFFICE MEMORANDUM

DATE 9 July 1963

SUBJECT Reader/Spooler for MIT

TO Bob Savell

FROM Bob Beckman

cc: Ken Olsen
Harlan Anderson
Stan Olsen
Nick Mazzarese

Final acceptance testing of the reader/spooler unit uncovered some serious problems and it was agreed by all concerned that the spooler should be replaced before the unit was delivered to the customer. The customer, however, insisted on having the equipment even though its operation would not be entirely satisfactory. As a result, the unit has been delivered and is presently being installed.

Under the circumstances I feel that correction of the problems and interim operation of the unit is an engineering responsibility, not a field service responsibility. Field Service will, of course, assist in every way possible, but cannot accept maintenance responsibility for the unit until the troubles detected during acceptance testing have been corrected.

DIGITAL MAYNAD

DIGITL EQ LA

MSG. NOM WCO 912

FROM JEAN WARREN

TO MARY ELLEN

RE. MMM..... DESK.

BELIEVE IT WAS AN QUOTE EASTERN NO. 1260-78 WALNT DSK

PURCHASED FROM DON CAMERON COMPANY IN LOS ANGELES

HAVE A DATE HERE OF JULY 27 1959

THE PRICE AT THAT TIME WAS 98.40.

$3\frac{7}{8}$$ END OR GA

JEAN YOU DONT HAPPEN TO KNOW IF THEY HAVE A REP IN THIS AREA GA

DONT KNOW, BUT CAN PHONE AND FIND OUT IF YOU LIKE.

&- GA

OK JUST TWX ME IF THEY DO END OR GA MARY ELLEN

END JEAN

INTEROFFICE MEMORANDUM

DATE July 3, 1963

SUBJECT Library Bulletin

TO Judy Ebner
Dick Best
Jack Atwood
Harlan Anderson
Stan Olsen

FROM Kenneth H. Olsen

I have been reading over the latest Library Bulletin and I would like to propose that we discontinue it. Although this might be of interest to some people in the company, I do not think it is worth expending the limited amount of manpower that we have in the library on this bulletin.

I asked Dick Mills to estimate the cost of printing this bulletin and he says it is approximately $120.00. There are only twenty-one new books reported in this issue which indicates that it costs about $6.00 per book to let people know about them. Some books didn't even cost that much to buy. Many of the books have very limited interest within the company and so are not worth even taking space in the Library Bulletin.

The paragraph that accompanies each description apparently comes from the book jacket. Because they are so badly "over-selling", these paragraphs are almost useless. I would suggest that we limit the Library Bulletin to a single page which lists nothing more than the title, the author, and the publishing date. As far as I am concerned, the title of the book gives more information than this paragraph which was written by a publicity agent who did not even read the book.

If we limit the Library Bulletin to one page of titles, it should relieve the shortage of manpower in the library. If it is done on the ditto machine, the cost should be very low. If there is no overwhelming reason why we should not do this I will assume that we will go ahead this way.

Kenneth H. Olsen

Harlan Anderson

Reminder File for July 22

dec INTEROFFICE MEMORANDUM

DATE July 3, 1963

SUBJECT

TO Stan Olsen
Gerry Moore
Nick Mazzarese
Ken Larsen
Ted Johnson
Ken Olsen
Harlan Anderson

FROM Mort Ruderman

The MIT order for the 20 LINC's is approximately 95% complete as of July 1, 1963. The order for the remaining 6 LINC computers that Wes Clarke is going to build, exclusive of the 4102 units will be placed sometime within the next couple of weeks. The present status of the LINC computer is that 1) 99% of the unit has been debugged and checked out and 2) the overall design is complete and firm.

The significance of the overall design of the LINC being complete is that now all information concerning the LINC is public information. This allows any individual or concern to obtain all specifications and prints. Thus, logic prints, circuit schematics, wiring diagrams, mechanical prints and overall system drawings are available to anybody for simply the cost of reproducing the drawings. I feel it is extremely important that DEC should be fully aware of this situation for a number of reasons. 1) The present LINC is designed with 90% of the plug-in modules being DEC units and the other 10% being special circuits that were designed by the LINC staff but built and tested by Electro-Pac. Now this places DEC at a distinct advantage when any subsequent users of the LINC computer decide to build (or have built) a unit identical to the present one. This would mean just ordering off-the-shelf units both DEC Modules and all other units that make up a complete LINC. However, reason no. 2) Electro-Pac, a fully owned subsidiary of Computer Control Corporation, is presently in the process of procuring all prints, layouts and literature concerning the LINC system. Their plans, from what I am told by the people at MIT, are to try and market the LINC computer and to have the capability of building a complete LINC computer for any future user. They are underwriting the cost of redesigning the LINC system using their logic and modules. This means conversion of DEC logic to their logic, new power requirements, new logic

levels, new wiring and new system layout. They are, as MIT puts it, getting their foot in the door and really persuing the issue.

DEC's decision to either market the LINC computer as a unit or to supply future builders of LINC's with the plug-in modules is one that should be made in the very near future. The position of supplying future users of LINC's with the modules would be an enviable position. The cost of DEC Modules per system (approximately 300 units) is $23,000 before discount. MIT has approximately $650,000 for 19 LINC units. This, therefore, estimates the cost of materials and assembly to be $34,000 per system.

If the decision to market the LINC computer were to be made by DEC, here are some of the pertinent facts to date. MIT received approximately 75 proposals for the LINC's. Of these, approximately 16 are to go to various installations and MIT themselves will keep 10 at their computer complex. There are also four independent groups building LINC's: NIH, CID, AFCRL and Lincoln Lab. Therefore, there are presently 60 initial requests for LINC's unfulfilled plus many requests after the initial proposals: CID is now planning to build two more LINC's after January 1, 1964 and RLE is hopeful of maybe building one next year. In general there appears to be a growing market.

H. ANDERSON

INTEROFFICE MEMORANDUM

DATE July 2, 1963

SUBJECT 16K memory delivery

TO K. Olsen
H. Anderson
S. Olsen
N. Mazzarese
A. Blumenthal
J. Smith
R. Beckman
J. Shields
E. Harwood
H. Crouse
W. Hindle

FROM Robert Maxey

The attached schedule indicates times for placement of stack orders, lead time for delivery, and times for checkout and installation. Those customers indicated are the ones for which firm orders or verbal orders for 16K memories have been received to date. This schedule depends on several key assumptions:

1. Al Blumenthal will deliver a prototype (for Lincoln Labs) by 9/1/63.

2. Two memory testers and two test technicians, to be in operation by 10/1/63.

3. First stack must be delivered by 7/15/63. Subsequent stacks must have a less than 8 week lead time.

This schedule implies that all PDP-1's from Nov., 1963 on .... will have 4K expandable memories.

CUSTOMER

LINCOLN LABS

7/1 — FIRST STACK MUST BE DEL. — 8/1 — 9/1 — PROTOTYPE FOR DEL. LINC — 10/1 — 11/1 — 12/1

DATE OF ORDER

PRINCETON — 32K ORDERED THIS MONTH BY 6/24 — 16K

YALE — 16K

BBN — 16K — ASSUMES 2 TESTERS

STANFORD — 16K

MIT — 32K ORDERED THIS MONTH — X — 32K ORDERED THIS MONTH

STD. PROD. PDP-1's (4K PERMACHINE)

4K — 16K ORDERED THIS MONTH (8K SPARE)

4K — 16K ORDERED THIS MONTH (8K SPARE)

16K ORDERED THIS MONTH (8K SPARE)

dec INTEROFFICE MEMORANDUM

Andy

DATE July 1, 1963

SUBJECT PDP-1 Installations: Yale, Princeton, Rutgers

TO R. Beckman FROM S. Mikulski

Yale: 24-25 June 63

Monday at Yale: Loading difficulties at Maynard delayed delivery time 3 hours (Bekins van was prefilled with household goods). Moving difficulties experienced due to lack of means of taking PDP-1 and Type 50 off shipping skids. Removed skids and installed machine. Reader margins adjusted. Bad package replaced (flag 2 not set by tape control unit). Adjusted upper arm servo on Type 50.

Tuesday at Yale: Acceptance tests run and completed. After tests, reader began dropping a line. Finally traced to broken wire on reader power relay which was momentarily turning off reader power during read, and dropping a line; power not off long enough to cause power to shut off, just bad character. Mag tape arrived 1 knob short. Mag tape servo amplifier drifting. Secured mag tape - made arrangements for shipment of module and indicated to Dr. Taft that we would return the end of the week to repair tape. At this time I will mention that the room temperature these 2 days was 103°, it will become significant later in this report.

Princeton: 26-27 June 63

Wednesday at Princeton: Arrived early A.M. to check out loan machine and prepare for movement to Rutgers. Machine checked out perfectly. Bekins arrived at scheduled time. Experienced great difficulty in getting machine out of truck, up ramp to loading dock. No fork lift available. Installed machine and left for Rutgers with second machine. Rutgers delivery smooth; required removal of console table to enter elevator. Rutgers machine checked out OK.

Thursday at Princeton: Ran acceptance tests. Few loose modules due to drops during delivery. All test ran. Princeton indicated that they wanted to use Type 30 loaner until their display arrived. Tied Type 30 into machine and power would not come on. Memory was dropping bit #13 at this time too. Found loose sense amp in memory and dirty fan filters in Type 30. Cleaned filters, display checked out OK. Princeton CP was delivered with 4 console switch knobs wrong size. Cannibalized knobs from Rutgers machine.

To: R. Beckman
From: S. Mikulski

Rutgers: 27-28 June 63

Thursday at Rutgers: Began wiring IOT area for special equipment.

Friday at Rutgers: Completed wiring of IOT area, (2-50 pin connectors and 1 rack of logic). Began static tests and were plagued with wrong levels or no wires in IOT area. IO manual indicates AC bits 0-11 available and only 0-9 are wired. PF o's were brought out instead of PF 1's. Spare logic rack in IO section was 1/16" narrower than logic modules. Very difficult to insert. Plus many other wiring errors, etc. Statically checked equipment then dynamically tested with Dr. Plano's equipment. All checkout satisfactory. Replaced cannibalized console knobs with Rutger's spare knobs.

Yale: 29 June 63

Saturday at Yale: Air conditioning equipment installed. Room temperature of 75 required readjustment of reader. DEC library tapes would not read in. Scope indicated that feed hole, when reading, was as low as 450μsec vice 1000μs of normal tapes. Returned bad tapes to DEC. Replaced mag tape servo amplifier, mag tape tested OK.

Summary: All 3 installations were reasonably satisfactory from my point of view but too much time spent in unloading machines due to lack of proper equipment. Rutgers machine has been in the field since November, 1962 and understandably, with all the changes made by EAI and Princeton it was not up to date with the prints. Bad library tapes tested on Customer Relations PDP-1 and all read in. Feed hole measured 800-900μsec which is a bit light but not objectionable. I will measure the replacement tapes that I send to Yale. This might be an indication of future reader problems at Yale.

Recommendations:

1. Supply a skid-floor ramp with each installation.
2. Supply a fork lift truck with each installation. (These items can be returned by the mover.)
3. Incorporate additions to in-house acceptance tests to look for thin mounting panels and proper knobs, etc.

CC: S. Olsen, E. Harwood, J. Shields
nh

INTEROFFICE MEMORANDUM

DATE July 1, 1963

SUBJECT Power Conversion System for Computers Going Over-seas

TO H. Anderson FROM Ed Harwood

Jon Fadiman and I have discussed this problem and we have come up with two systems for handling the power conversion. The first system calls for handling the 230 volts, 50 cycle AC, at all the individual power supplies in the computer by having tapped power supplies. This would necessitate ordering special motors, 230 volt variety, for the Reader, Punch and Typewriter. The other system calls for using an auto transformer and transforming the 230 volts, 50 cycle power down to 115 volt, 50 cycle power and distributing this throughout the computer. This also requires the use of the tapped 50 cycle transformers. We would have to supply every computer going over-seas with a 30 amp. auto transformer to handle the 230 volt, 50 cycle power conversion. I propose handling all the computer systems in this fashion.

Any time any in-out equipment such as mag tape, is added to the computer, I suggest that we contact the manufacturers of this equipment and see if they supply special motors which run at 230 volts, 50 cycles, or 115 volts, 50 cycles. If we are to handle any volume of computers going over-seas, it will necessitate buying another motor-generator setup similiar to the one Jon presently has in his area.

Jon Fadiman has been in touch with the Acme Transformer people and they are presently manufacturing two of our types of transformers, in the tapped 50 cycle version. I propose that we have Acme assign nembers for replacement transformers (230 volt, 50 cycle), for all our

standard power supply transformers.

Delivery of these transformers runs approximately 1 to 2 months, so we would have to know at least that much in advance of any system which needs this power conversion. Based on these delivery dates, it looks like we will have quite a problem getting the PDP-4 ready for the INEL show. Howie Painter has requested this computer to be shipped on August 15.

INTEROFFICE MEMORANDUM

DATE July 1, 1963

SUBJECT PDP-1 Installations: Yale, Princeton, Rutgers

TO R. Beckman FROM S. Mikulski

Yale: 24-25 June 63

Monday at Yale: Loading difficulties at Maynard delayed delivery time 3 hours (Bekins van was prefilled with household goods). Moving difficulties experienced due to lack of means of taking PDP-1 and Type 50 off shipping skids. Removed skids and installed machine. Reader margins adjusted. Bad package replaced (flag 2 not set by tape control unit). Adjusted upper arm servo on Type 50.

Tuesday at Yale: Acceptance tests run and completed. After tests, reader began dropping a line. Finally traced to broken wire on reader power relay which was momentarily turning off reader power during read, and dropping a line; power not off long enough to cause power to shut off, just bad character. Mag tape arrived 1 knob short. Mag tape servo amplifier drifting. Secured mag tape - made arrangements for shipment of module and indicated to Dr. Taft that we would return the end of the week to repair tape. At this time I will mention that the room temperature these 2 days was 103°, it will become significant later in this report.

Princeton: 26-27 June 63

Wednesday at Princeton: Arrived early A.M. to check out loan machine and prepare for movement to Rutgers. Machine checked out perfectly. Bekins arrived at scheduled time. Experienced great difficulty in getting machine out of truck, up ramp to loading dock. No fork lift available. Installed machine and left for Rutgers with second machine. Rutgers delivery smooth; required removal of console table to enter elevator. Rutgers machine checked out OK.

Thursday at Princeton: Ran acceptance tests. Few loose modules due to drops during delivery. All test ran. Princeton indicated that they wanted to use Type 30 loaner until their display arrived. Tied Type 30 into machine and power would not come on. Memory was dropping bit #13 at this time too. Found loose sense amp in memory and dirty fan filters in Type 30. Cleaned filters, display checked out OK. Princeton CP was delivered with 4 console switch knobs wrong size. Cannibalized knobs from Rutgers machine.

To: R. Beckman
From: S. Mikulski

Rutgers: 27-28 June 63

Thursday at Rutgers: Began wiring IOT area for special equipment.

Friday at Rutgers: Completed wiring of IOT area, (2-50 pin connectors and 1 rack of logic). Began static tests and were plagued with wrong levels or no wires in IOT area. IO manual indicates AC bits 0-11 available and only 0-9 are wired. PF o's were brought out instead of PF 1's. Spare logic rack in IO section was 1/16" narrower than logic modules. Very difficult to insert. Plus many other wiring errors, etc. Statically checked equipment then dynamically tested with Dr. Plano's equipment. All checkout satisfactory. Replaced cannibalized console knobs with Rutger's spare knobs.

Yale: 29 June 63

Saturday at Yale: Air conditioning equipment installed. Room temperature of 75 required readjustment of reader. DEC library tapes would not read in. Scope indicated that feed hole, when reading, was as low as 450μsec vice 1000μs of normal tapes. Returned bad tapes to DEC. Replaced mag tape servo amplifier, mag tape tested OK.

Summary: All 3 installations were reasonably satisfactory from my point of view but too much time spent in unloading machines due to lack of proper equipment. Rutgers machine has been in the field since November, 1962 and understandably, with all the changes made by EAI and Princeton it was not up to date with the prints. Bad library tapes tested on Customer Relations PDP-1 and all read in. Feed hole measured 800-900μsec which is a bit light but not objectionable. I will measure the replacement tapes that I send to Yale. This might be an indication of future reader problems at Yale.

Recommendations:

1. Supply a skid-floor ramp with each installation.
2. Supply a fork lift truck with each installation. (These items can be returned by the mover.)
3. Incorporate additions to in-house acceptance tests to look for thin mounting panels and proper knobs, etc.

CC: S. Olsen, E. Harwood, J. Shields
nh

INTEROFFICE MEMORANDUM

DATE July 1, 1963

SUBJECT

TO
K. Olsen
H. Anderson
S. Olsen
N. Mazzarese
J. Koudela
R. Lane
R. L. Best
G. Bell
A. Kotok
D. Brown
D. White
R. Hughes
H. Morse

FROM Arthur Hall

If you have not already read it, you may be interested in the attached comments (from Business Week) on B. W.'s (& apparently G.E.'s) ideas about silicon computer transistors and process control computers.

AHH/ll

Production briefs

BW

Motorola takes another crack at color TV with set that features its own tube

Motorola, Inc., which lost $1.5-million in trying to sell color television sets in the mid-1950s, announced this week that it is back in color set production.

In its 1964 line of TV sets, eight models ranging from $650 to $1,650 will feature **the 23-in., 92-deg. rectangular tube that Motorola developed two years ago** [BW Aug.5'61,p47] and that National Video Corp. is producing exclusively for the set maker. At the low-priced end of the line, three color sets ranging from $449.95 to $529.95 use RCA's 21-in., 70-deg. round tube.

The rectangular tube permits a noticeably smaller cabinet, is 5½ in. shorter than the round tube, yet it offers a picture of 274 sq. in., compared with 265 sq. in. for the RCA tube.

Motorola's square tube design was "offered to every tube manufacturer, but we had no takers," according to Executive Vice-Pres. Edward H. Taylor. Convinced that a shorter, more compact tube was necessary to appeal to color TV customers, Motorola financed National Video's tooling and production equipment—a move that raised Motorola's investment in the tube to $4-million. Taylor says production yields of the tube are increasing daily and expects "several tens of thousands" of tubes to come off the line by yearend.

Taylor joins in predicting a big year for TV, with continued gains for color. "We forecast," he says, "that total TV unit sales for the 1964 model year will reach 7.5-million, with something like 550,000 to 700,000 being color sets." He estimates dollar volume, at wholesale prices, of around $1.3-billion.

GE shows $50,000 process control computer, hoping it's answer to high-cost barrier

General Electric Co. has launched a major campaign to broaden the market for process control computers. The company introduced a new line of smaller computer systems, priced from $50,000, and hopes **it will break the high-cost barrier that has scared many firms away from using computers for control applications.**

The new computer series, called the GEPAC 4000, uses silicon transistors, a highly reliable component that has dropped significantly in cost during the past year. Minneapolis-Honeywell's Systems Div. switched to an all silicon computer for process control earlier this year, and it is likely that other firms will follow.

Industry observers believe that as computers get more reliable, a large proportion of standard indicators and controllers, needed for manual control and emergency backup, will be eliminated. That could reduce over-all costs significantly. But before computers take over process control to that extent, they'll have to log a lot of operating history to prove themselves.

Few in the industry expect that lowering the cost of equipment will have a radical effect on sales of control computers. Setting up mathematical models and programming a system for the first time often runs a bill higher than that for the equipment. But computer makers are convinced that as more and more companies build up internal skills in these new areas, the cost of programming will follow equipment costs down sharply.

Hunt for ways to inspire researchers draws diverse answers, some of them conflicting

Inquiry into ways to measure inventiveness of company researchers has found that it's well-nigh impossible to gauge such creativity. Nevertheless, the annual conference of George Washington University's Patent, Trademark, & Copyright Foundation last week set out to find how companies can spur their inventors to greater effort.

The gathering came up with a potpourri of answers, some of them conflicting. For example, research departments should be kept small, said some at the meeting, for they decrease in inventiveness as they increase in size. On the other hand, greater inventiveness can spring from big research departments, others held, because of the cross-currents of ideas and problems flowing through the larger organization.

Not all proposed solutions were so broad in scope and many dealt with rewards for the individual. These included setting up a system of monetary awards for patentable inventions, a proposal that has captured the attention of many companies in recent years [BW Mar.23'63,p133]; and giving researchers shares in the company, especially smaller concerns where profits can be traced to an individual's invention.

Foundation officials and industry representatives alike saw an acute need to solve the problem. With a "back-to-the-drawing board" attitude, **they called for increased efforts to find a scientific basis to the question of why some companies and individuals come up with the goods more often than others.**

Major maker of periscopes expands into line of precision optical alignment instruments

Kollmorgen Corp., a Northampton (Mass.) company that makes most of the periscopes for U. S. submarines, has announced that it is now producing a line of precision optical alignment instruments. These devices—autocollimators, alignment telescopes, and pointing interferometers—give the critical alignment necessary when building and inspecting missiles, airframes, ships, machinery, and special tooling.

The market for this type of equipment is growing steadily, according to Kollmorgen spokesmen, and should reach $12-million by 1966. And **Pres. Richard Rachals predicts that his company, with nearly $13-million in sales last year, will penetrate this market because it will be offering a complete line of optical tooling.** This also marks the first major product line developed under the company's diversification program.

INTEROFFICE MEMORANDUM

DATE July 1, 1963

SUBJECT

TO ✓H. Anderson
J. Atwood
S. Olsen
N. Mazzarese
J. Koudela
P. Bonner
R. Maxcy (5 copies)
R. Beckman
J. Shields

FROM Arthur Hall

Attached for your information is a copy of a letter detailing drum prices which are the result of a recent Computer Guidance Committee and further consultation with Harlan Anderson.

These prices supersede previous #24 drum prices.

AH/ll

digital equipment corporation
MAYNARD, MASSACHUSETTS
TWinoaks 7-8822 TWX MAYN 816

July 1, 1963

Mr. Roy Fine
Manager of Operations
Foxboro Company
21 Strathmore Road
Natick, Massachusetts

Dear Mr. Fine:

Pursuant to our conversation of June 26th concerning a DEC Parity Checking option; there will be no change in delivery time for a computer so equipped. There exists, however, the distinct possibility that we may not be able to beat the promised delivery time by as much as we would like.

The new drum configurations and prices that I mentioned are as follows:

Three drum configurations available:

16K	$36,200
32K	$38,680
64K	$43,400

The 16K and 32K drums may be field-retrofitted up to 64K (without removing the drum) at the following expense;

16K to 32K	$2288 plus about 25 hrs. of labor*
32K to 64K	$4576 plus about 40 hrs. of labor*
16K to 64K	$6864 plus about 60 hrs. of labor*

*Labor to be charged at DEC Maintenance rates.

If, for any reason, Foxboro would prefer the 16K or 32K configurations in a 32K size drum, subtract $2,600 from the prices.

A 16K size drum is no longer available.

Yours truly,

DIGITAL EQUIPMENT CORPORATION

Arthur H. Hall III

Arthur H. Hall III
Computer Design Engineer

AHH/lal