dec INTEROFFICE MEMORANDUM

DATE October 1, 1964

SUBJECT RPI, Troy, New York

TO Harlan Anderson
Bob Lane
Nick Mazzarese
Gerry Moore

FROM Bob Maxcy for George L. Rice

The trustees have given President Folsom the go ahead to make his decision as he sees fit.

George has made an appointment with him on October 6th at 10:30.

The major competition is 100K over our price, and they haven't negotiated any better terms as of yet.

The NSF money hasn't been awarded but should be coming shortly.

dec INTEROFFICE MEMORANDUM

DATE October 1, 1964

SUBJECT

TO Stan Olsen
Bob Beckman
cc: Harlan Anderson

FROM Kenneth H. Olsen

The key part of repricing the PDP-7 and PDP-5A will be in restating the warranty. The general suggestion has been that we give warranty only on parts and that we extend it for a period of one year. This has to be very carefully spelled out and considered but it is important that we do it right away so that we are confident of our pricing.

Ken Olsen

KHO:ech

dec INTEROFFICE MEMORANDUM

DATE October 1, 1964

SUBJECT Progress Report

TO H. Anderson
L. Portner
J. Ridgeway

FROM Norman Hirst

We are engaged in the following activities:

1. Software Quality Control
2. Software Documentation and Distribution

Of these, the first is proceeding well. We are receiving documented reports, logging them in, and forwarding them to the people involved. Of the programs going out to MAC, all of the reported bugs--to date-- have been fixed except for those in MACR06.

It should be emphasized that the mechanism exists and is working to handle software trouble reports. All that remains is to be sure our customers know where to send their complaints.

The second item involves the writing of, control of, and distribution of documents. The system for control and distribution is established and working well. The details of this system will be documented in PM 1175.

The only distribution problem we have had is getting a sufficient number of copies of such things as listings for maindecs. An arrangement has been worked out with Ralph Wooldridge for getting these reduced and printed quickly and cheaply. All of these are marked preliminary and are intended to give those people who need to check out machines something to work with until the final packages are available. (However, final packages in the old sense may prove unnecessary.) We now have nine maindec programs available for distribution and three partially complete.

The most immediate problem in generating documents is the Project MAC documents. I have collected all of these into a notebook with the expectation of the I/O package write-up. Dave Gross has promised to deliver that today (October 1). I am now going through the documents and revising them vis a vis the MAC system tape.

The MAC system tape will consist of the following:

Field ∅: MACR06
Field 1: DDT/Linking Loader
Field 2: DDT/Monitor IO/Linking Loader
Field 3: For their use (Lisp?)

The tape also contains DEC Dump starting at block 1 plus a DEC tape Loader for DEC Dump format in block ∅. The four fields above begin in blocks 4, 204, 404, and 604.

The modus operandi for the system tape is to load block ∅ by the Shadow Mode Loader. The DEC Tape Loader will then load DEC Dump. The user can then load core from one of the above fields.

To go with this system, we are going to supply the following documents:

6-UP-DEC Shadow Mode Loader-6M
6 1-SC-DEC System Tape Files-6S-1
6-TP MAC-DEC Linking Loader Formats-6S-Pre 1
6-TP MAC-DEC MACR06-OM-Pre 3
6-TP MAC-DEC Linking Loader-OM-Pre 2
6-UP-DEC DECdump-UM-Pre 1
6-UP-DEC DDT6-UM-Pre 3
6-UP-DEC DEC Tape Loader-GM-Pre 1

In addition, we shall supply the non-monitor I/O write-up. This does not have a "crazy number" yet.

The above documents will be suitably printed and inserted in the PDP-6 notebooks, which I ordered and received some weeks ago, along with suitable dividers to allow for future expansion. The silk screen to say "PDP-6 Software" is now being made by the art department.

As of now, we are a couple of days behind on this project. However, it does look as if the books will be ready in time to go out by the time the machine is on the air.

One final topic--the more general and long range documents have been forced to take a back seat during the past few weeks due to the number of immediate and short range requests I have had to attend to. I now have a secretary who is able to handle almost all of the latter. Now I can get to the major documentation work, along with Dave Gross who is going to do the monitor.

NH:lt

H. Anderson

INTEROFFICE MEMORANDUM

DATE October 1, 1964

SUBJECT

TO H. Morse, L. Hantman, S. Mikulski, J. Kilduff, J. Shields, G. Bell, H. Anderson, N. Mazzarese

FROM Arthur Hall

In an analysis of PDP-6 Prototype log reports (8-17-64 through 9-20-64) for average useage time some other statistics fell out which might interest those above.

Be careful about drawing conclusions from the figures below; one person's complaint rate may be because average use is high or because more complex equipment is being used.

User	Times Used	Logged Complaints	% Complaints	Hours Used	% used of Total	Average Use (hrs)	Meantime Between Complaints (hrs)
Morse	23	15	65%	53	12%	2.3	3.5
Segal	33	3	9%	37	8%	1.1	12.3
Frazier	29	3	9%	24	5%	0.8	8.0
Samson	19	11	58%	34	7%	1.8	3.1
Piner	16	5	31%	21	5%	1.3	4.2
Watt	16	2	13%	32	7%	2.0	16.0
Hyman	10	0	0	14	3%	1.4	-
Tape Prep.	15	0	0	18	4%	1.2	-
Maint.	33	N/A	N/A	87	19%	2.6	N/A
Outside	33	3	9%	103	23%	3.1	34.3
Other	39	7	18%	33	7%	0.9	4.7
Total	266	49	19%	456		1.6	

Equipment	Complaints	Maint. Replies *
Arithmetic Processor	17	1
High Speed Printer	14	11
DECtape	13	2
Teleprinter	9	5
Other	8	5
Total	61	24

* Because maintenance replies sometimes answer more than one complaint it is difficult to determine from these figures how many complaints were not probed or how many were unanswerable (ie. "Reader loses")

AHH/mro

dec INTEROFFICE MEMORANDUM

DATE October 1, 1964

SUBJECT Progress of Applied Programming

TO Computer Guidance Committee FROM Jack Ridgeway

This memo is in response to inquiries about the new programming group by members of the September 29 Computer Guidance Committee meeting.

The Applied Programming Group was established formally by the Computer Guidance Committee about 1 August. Personnel in the group are: Norm Hirst, Martin Thomas (part time 10 hrs/week), Bill Hermistone (summer hire - has gone back to school), Henrey Burkhardt (temporary - leaves August 65), Joan Cowles, and myself.

Our first effort has been software documentation. We have rewritten the following manuals: DDT-4, Canute 4, PDP-4 Assembler and PDP-5 Fortran. We are writing PDP-5 program write-ups, PDP-5 Symbolic Tape Editor, PDP-6 users manual for the monitor, PDP-5 assembler (MACRO-5), DDT-5, PDP-4/7 write-ups and PDP-4/7 Fortran. As soon as these manuals are finished we will write or re-write PDP-6 Fortran, PDP-4/7 programming manual, DDT-6, MACOR-6, PDP-5 floating point, PDP-4/7 floating point, and software installation manuals.

Our programming efforts since 1 August have consisted of a PDP-5 master tape duplicator for the high speed reader punch, a PDP-5 demonstration package, new pulse height analysis programs and we have re-programmed the PDP-5 library in MACRO-5 format.

We have been in-house users all of the software that we have written manuals for to verify that the documents are compatible with the performance features and operating characteristics of the systems we are describing.

The sales support activities take a major percentage of my time. I am continually corresponding with the field offices helping them understand the software, explaining the sales features of the software, and working with them on their customers applications. In most cases I have to determine the number of instructions required to solve their problem and the time required for solution by doing a preliminary program design. In many instances this involves having the salesman or customer send me a description of the application and I forward my

analysis either to the salesman or directly to the customer. However for some applications I have to meet with the customer, help him define the systems requirements and work out the program specs. The most recent examples of this effort are Allied Chemical - Pilot Hybrid System, Naval ordnance Lab - Wind Tunnel Data Collection and Analysis, Friel-Hoffman - Electrical Contract Estimating, Brookhaven National Labs - film reading - data collection - filtering (least squares) - formating for 7090, Woods Hole Institute - Oceanographic Data Research, National Radio Astronomy Laboratory - Radio Antenna Directing.

Other miscellaneous activities of the group have included the August Datamation add, a PDP-5 Instruction Card, investigation of statistical analysis techniques (multiple regression, power spectrum, etc).

dec INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE October 2, 1964

SUBJECT

TO Harlan Anderson ✓
cc: Win Hindle

FROM Kenneth Olsen

Here's a list of names that I picked up when I was in Boston visiting one afternoon:

Mr. Loop, Jr. - West Virginia Pulp and Paper Company

Mr. Land - Polaroid Company

Mr. William McLane - Assistant to the President, Stephen (originally from Murk)

Montgomery Spate - President of Shell Oil

Harold Strickland - President of General Signal in New York City

Harold Lindsay - _____

Irskine White - retired from New England Telephone and Telegraph

Robert Slater - John Hancock

Milton Higgins - Norton Company

Ed Handley - Allegheny Lydlum

George Divlie

Somebody from Deer Company

Check the list of people from MIT, John Hancock, First National and the Shawmut Bank.

Note: Under lined names mean there is doubt about the spelling ...

Ken

H E Anderson

INTEROFFICE MEMORANDUM

DATE October 5, 1964

SUBJECT Miscellany

TO R. Lane
N. Mazzarese
H. E. Anderson

FROM Gordon Bell

1. If we haven't a copy of the report on IBM 360 by Auerbach, we should endeavor to obtain one. (If we have one, I'd like to read it). The report isn't too complimentary.

2. The head of the computation center at AFCRL (ask Charlton Walter of AFCRL to verify this) is shopping for a large machine. J. Gilimore told me of this, and Jack also knows his name.

GB/mro

H. Anderson

DEC INTEROFFICE MEMORANDUM

DATE October 5, 1964

SUBJECT Munich Office

TO J. Fadiman
H. Anderson
S. Olsen

FROM Gordon Bell

Gunther informed me that about 5% of his time was consumed keeping a memory exercisor sold to SEIMEN'S in operation. It had been sold with a clause that read, "Free service forever." This is a bit strange.

GB/mro

INTEROFFICE MEMORANDUM

DATE October 6, 1964

SUBJECT Spare Unit Prices

TO Works Committee FROM Don Smith

The purpose of this presentation is to determine Spare Unit Prices of devices bought from various vendors. At this time, only approval of the method is requested.

The method is as follows:

1. Obtain the Unit Cost to DEC (A).
2. Determine the mark-up to cover various charges (B).
3. Determine the Unit Price (mark-up times the Unit Cost, AxB) C.
4. Determine the Special Handling Price by totaling all modifications to the Unit so that it is self contained as a spare D.
5. Determine the Spare Unit Price (add the Special Handling Price to the Unit Price, C+D) E.
6. Determine the Option Price (add the Spare Unit Price to the Control Price, E+F) G.

Suggested Spare Unit Pricing Method

A. The DEC Unit Price contains all of the following changes for the unit only.

1. Handling
2. Ordering
3. Check-out
4. 6 month maintenance warranty
5. Standard manual and prints
6. Investigation
7. Stocking

B. The following charges are not to be included in the DEC Unit Price:

1. Any modifications
2. Write-up for modifications
3. Special adapters
4. System diagnostics
5. Special handling
6. Installation

C. Option interfacing engineering charges are to be added to interfacing hardware (Special Handling Price or Control Price) and not to the unit cost.

D. The spare unit price represents the point where the spare may be most easily interchanged with the original. This price will vary for different computers. The price includes the following charges (Special Hnadling Price):

1. Modifications to basic unit
2. Write-ups for modifications
3. Special Adapters

E. The spare unit price is determined by adding DEC Unit Price to the Special Handling Price.

F. The following equations are true:

C = DEC Unit Price
D = Special Handling Cost
E = Spare Unit Price
F = Control Price
G = Option Price

$G = E + F$ $\quad E = C + D$
$E = G - F$ $\quad C = E - D$
$F = G - E$ $\quad D = E - C$

dec INTEROFFICE MEMORANDUM

DATE October 7, 1964

SUBJECT Charlie Baker

TO H. Anderson

FROM Ted Johnson

Charlie Baker is at home, recuperating and doing quite well, I guess. His address is 707 Wildoman Ave., Pacific Palisades. Telephone: 454-9778 Greenwald, with Joe Smith and Ed Bryan, seem to be getting along. Tupac coordinates the effort.

TJ/pr

INTEROFFICE MEMORANDUM

DATE October 6, 1964

SUBJECT VISIT BY BILL KEHL/UNIVERSITY OF PITTSBURGH

TO R. L. Lane FROM N. J. Mazzarese

Ray Lindsay has arranged for a visit to our facility by Bill Kehl and one of his programmers on October 19th. They will be arriving in the afternoon -- about one or two o'clock -- and plan to stay over until Tuesday.

Will you please make the necessary arrangements and act as his host while he is here.

NJM:ML
cc: H. Anderson
G. Bell
P. Harris

INTEROFFICE MEMORANDUM

DATE October 12, 1964

SUBJECT Spare Parts and Replacement Items

TO Sales, Sales Offices, Engineering and Administration

FROM Ed Simeone

Attached is an updated copy showing the selling price of spare parts and replacement items. These prices are not to be used in arriving at a total price for a system, peripheral equipment, etc.

Please destroy any existing price list you may now be using as it is obsolete. If there are items on which you desire a price and they do not appear on this list, contact me rather than use any existing price.

SPARE PARTS AND REPLACEMENT ITEMS

(These Items are not subject to Discounts or Commission)

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Connectors and Cables:			
1	34-115-115S	50 Pin Amphenol (Female)	$ 28.25
1	34-115-115S (wired)	50 Pin Amphenol (Female)	60.00
1	34-115-114P	50 Pin Amphenol (Male)	26.50
1	12-GDX-MD622S	Connector	3.90
1	12-133-022-21	Male Connector	4.00
1	12-143-022-04	Connector	2.20
1	12-143-022-12	Wire Wrap Amp Connector	2.45
1	12-900-249-2	Mtg. Panel Connector	10.50
1	12-900-309	Male Connector	3.30
1	12-900-249-1	Module Receptacle Plug	4.25
1	12-143-010-04	10 Pin Female Amp Plug	1.65
1	12-143-827-1002	Taper Pin Socket	6.50
1	12-144PCC	144 Pin Contact Connector	12.50 ~~6.00~~
1	12-7900-0049	20 Contact Connector	1.80
1	Type 1031	Connector	72.00
1	Type 1032	Connector	65.00
1	53-2012	Plug	3.00
1	34-26-4100-32S	32 Pin Amphenol Socket	5.15
1	34-S308CCT	Female Socket	2.70
1	34-P308CCT	Male Socket	2.50

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Connectors and Cables (Continued)			
1	18 Conductor	Coaxial I/O Cable w/connectors	
		Cable	$ 1.00/ft
		1031 Connector	72.00/ea
		1032 Connector	65.00/ea
		Assemble per connector	22.50
1 ft	18 Conductor	Coaxial Cable	1.00
1 ft	20 Conductor	Ribbon Cable	.18
1 ft	26 Conductor	Coaxial Cable	1.30
1 ft	50 Conductor	Cable	1.80
1	74-3357	Jumper Cable	.12
1	74-3358	Jumper Cable	.12
1	74-3401	Jumper Cable	.20
1	74-3402	Jumper Cable	.15
1	74-3403	Jumper Cable	.15
1	71-Write Cable	Write Cable	10.50
1	12-20	20' AC Power Cord	7.10
1	12-GR-274P	Cambion Banana Jack (Male)	.26
1	34-115-1391	Shell	5.00
1 ft	Sleeving	Insulating Sleeving for Strip Cable	.30
1	Clamps	Cable Clamps for Strip Cable	.08
1	12-41649	Taper Pin	.18/each
1	34-480065-6	Taper Pin Connector	5.20
1	34-3-582411-9	Taper Pin Block	9.45
1	34-581173-3	Taper Pin Block	7.90
1	53-2010	Mtg. Panel Terminal Block	11.85
1	74-2042	Lettered Terminal Strip Block	2.70/each

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Connectors and Cables (Continued)			
1	14-2041	Unlettered Terminal Block	$ 2.50/each
1	34-581342-3	Taper Pin Block	7.90/each
1	74-3289	AC Power Channel - Long	17.10
1	74-3290	Connecting Bracket for AC Power Channel (above)	2.95
1	74-3433	26 Conductor Housing	19.00
1	34-201-159-1	26 Conductor Coaxial Plug - Male	6.50
1	34-201-158-1	26 Conductor Coaxial Plug - Female	4.20
		Assemble 26 Conductor Housing & Plug	25.00
25ft	50 Conductor	50 Conductor Cable w/115/114P Connectors assembled on each end	231.00
Fans and Filters:			
1	34-X1431	Filter	2.20
1	10" X 10" X 2	EZ Kleen Filter	2.40
1	34-Rotron Fan	Rotron Fan	26.00
1	34-2R	Prop	3.50
Conversion Kits:			
1	12-M1906	Kit for conversion from Haden to Hobbs Meter	20.65
Typewriter:			
1	635C	33KSR Teletype w/o dial	900.00
1	635D	35KSR Teletype w/o dial w/sprocket feed	2,500.00
1	635E	33ASR Teletype w/o dial	1,200.00

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Connectors and Cables (Continued)			
1	635F	35ASR Teletype w/o dial w/sprocket feed	$ 4,000.00
Panels and Cabinet Accessories:			
1	852	Relay Panel	35.00
1	901	Mtg. Panel Cabinet for logic kit	112.00
1	35-3220	End Panel	45.00
1	71-3283	Indicator Panel for Type 50 Tape Unit	44.00
1	74-3217	18 Bit Indicator Panel Assy.	82.40
1	74-3229	19" Amphenol Plug Panel	12.35
1	74-2034	Plenum Door Blank 4"	3.65
1	74-2036	Plenum Door Blank 8"	6.15
1	74-2038	Plenum Door Blank 12"	9.70
1	53-100-2005	Power End Plate	23.40
1	53-100-2008	End Plates	7.25
1	53-100-2009	Short End Plate	6.75
1	53-100-2010	Terminal Block	12.00
1	53-1901-2001	Top & Bottom Set	12.60
1	53-1901-2007	Idiot Strip	2.60
1	53-1903-2001	Top & Bottom Set	16.80
1	53-1903-2007	Idiot Strip	3.10
1	53-1904-2001	Top & Bottom Set	20.40
1	53-1905-2001	Top & Bottom Set	21.60
1	53-1916-2001	Top & Bottom Set	30.05

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Panels and Cabinet Accessories (Continued)			
1	53-1916-2008	End Plates	$ 13.65
1	53-3465	Power End Plate	13.00
1	53-1935-2002	Top & Bottom Set	13.30
1	53-1935-2005	Power End Plate	26.50
1	53-1935-2009	End Plate	7.85
1	53-1935-2010	Terminal End Plate	14.75
1	74-3303	Cabinet Filler	
		Unpainted	6.80
		Painted	20.40
Power Supplies:			
1	MIKROS HV-41	Power Supply (Type 31 Display)	805.00
1	NJE S300RM	Power Supply (Type 31 Display)	630.00
1	KROHN HITE UHRT 361R	Power Supply (Type 31 Display)	1,190.00
1	NJE-P30-1	Power Supply (Type 31 Display)	139.00
1	PHR-60-5- Trygon	Power Supply	553.00
Indicators:			
1	12-1762	Indicator Light	3.30
1	12-39-28-375	Indicator Lamp	1.75
1	34-101	Pilot Light	1.95
Switches:			
1	12-7505K3	Switch	1.85
1	12-6AT1T2	Sub Miniature Toggle Switch	5.35
1	12-2112-A-5	Time Delay Relay	66.70

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Switches (Continued):			
1	12-2122-A-5	Agastat Relay Switch	$ 66.80
1	34-6AT4	Sub-Miniature Toggle Switch	4.90
1	34-16006	Telever Switch	2.70
1	34-DJE-4202-Z2P2	Mossman Switch	9.05
1	34-1PB5	Switch	3.15
Relays:			
1	12-HGS1004	Relay	17.10
1	12-HGS1009	Mercury Relay	17.25
1	12-HGSM1019	Clare Relay	13.00
1	12-HGSM5040	Relay	13.15
1	12-72AOZ 10TS-TCP	Sigma Relay	46.00
1	12-72AOZ-160TG-TCP	Sigma Relay	46.00
Relay Lines:			
1	13-C25E-330-20-1	Delay Line	14.15
1	13-C25E-330-05-1	Delay Line	14.15
1	13-C25E-330-20	Delay Line	11.35
1	13-C25E-330-05	Delay Line	11.35
1	13-DLD-2	Delay Line	168.00
Eyelets:			
1,000	459S	Eyelet	3.10/M
1,000	S-5938	Eyelet	2.85/M
1,000	A-737	Gold-plated Eyelet	6.00/M

QUANTITY	PART NUMBER	DESCRIPTION	SELLING PRICE
Eyelets (Continued):			
1,000	A-1733	Gold-plated Eyelet	$ 5.60/M
1,000	A-94	Eyelet	3.10/M
1,000	A-1527	Eyelet	2.05/M
1,000	A-721	Eyelet	3.90/M
1,000	A-1090	Eyelet	1.90/M
Miscellaneous:			
1	555	Empty Micro Tape Reel	.50
1 Reel	34-498-1/2-25 GR-IBM	Magnetic-Tape	41.30
1	145887	Teletype Grease	.92
1	145867	Grease	.92
1	KS7470	Teletype Oil	.80
1	88970	Oil	.80
1 dozen	7835	Ribbon for Teletype	16.80
1		Friden Paper Tape Gauge	7.00
1 pr	74-3375	Tape Catcher - PDP-1	225.00/pr
1 pr	74-3483	Tape Catcher - PDP-4	225.00/pr
1	53-32-1006	Light Pen Cap	12.00
1	416146	Potter Tube & Bulb Assy.	21.00
1	53-2016	Module Handle (bent)	1.25
1	53-2016	Module Handle (straight)	1.25
1	4 5/16 X 6 7/16 Copper Clad	Glass Epoxy Printer Circuit Board	2.00
1	13-20K-2W	Potentiometer	5.35
1	10-35000mfd.	Electrolyte Capacitor	17.45

QUANTITY	PART NUMBER	- DESCRIPTION	SELLING PRICE
Miscellaneous (Continued):			
1	34-1931	Fluted Instrument Knob	$ .62
1		Computer Chair	69.00
1	35-3185	PDP-1 Cabinet Door Painted Unpainted	13.50 7.50
1	74-3244	PDP-1 Typewriter Table	310.85
1	74-3532	PDP-4 Table	448.70
1	1 Bay	PDP-5 Table	135.00
1	2 Bay	PDP-5 Table	175.00
1		Aerosol Paint (Blue & Grey)	1.50
1 Gal.	Raffi & Swanson Paint	All Standard DEC Colors	6.00/gal.
1		Fanfold Tape Tray	3.30
1 Carton	#8010-015	Fanfold Paper	15.25
1 Box		Fanfold Paper Tape	3.00/1000ft
1 Case/18 boxes		Fanfold Paper Tape	40.00

dec INTEROFFICE MEMORANDUM

DATE October 12, 1964

SUBJECT ITT Visit of October 13, 1964.

TO
H. Anderson
G. Bell
A. Kotok
R. Savell
N. Mazzarese

FROM
R. Lane

Mike Lipp, Pete Jurket, and Hirsh Harrison of ITT will be visiting DEC tomorrow, 10-13, at 9:30 a.m. They wish to discuss software and hardware capabilities.

If you will not be available for this meeting, please advise me immediately.

INTEROFFICE MEMORANDUM

Conference - G. Bell, J. Dennis
A. Titcomb, A. Kotok

DATE October 10, 1964

SUBJECT

TO

FROM A. Titcomb

The planning required before undertaking the construction of a multi-programming system is an essential prerequisite to the access of the project.

Programming and software must be considered as a whole and hardware must complement software. It is not sufficient for individually capable people to work independently of one another and without leadership when implementing software for a large system.

Pure procedure systems programs are required for an efficient usage of core and to reduce overhead time as user's become active. For example, without pure procedures, each person at a multiuser station might require his own copy of DDT in core or on the drum.

It is obvious that there are advantages to writing specifications for all systems programs before work is begun.

One of the concepts which project MAC expects to follow is the writing of the supervisor or monitor in MAD language. The system is much easier to understand as for those who might wish to change or improve it. (The system is much easier to document) Professor Dennis's thought here is that other groups may wish to implement similar systems and as project MAC is funded with public funds, their work will become available to everyone. Those interested parties who have written a MAD Compiler for their machines will be in the best position to quickly make use of MAC's work. (Systems programs will have to be pure procedure).

INTEROFFICE MEMORANDUM

Conference - G. Bell, J. Dennis
A. Titcomb, A. Kotok

DATE October 10, 1964

SUBJECT

TO

FROM A. Titcomb

Professor Dennis proposes that DEC offer to assist MIT, RLE in some way and thus allow Professor Zimmerman to seek funds of his own.

This system would be large - about $1,000,000.00 list price.

Professor Dennis explained that GE will deliver a temporary machine to project MAC in April. The super system will be installed in October 1965. Should we have a MAD Compiler and suitable systems programs (pure procedure), we could be running our system at RLE no later than GE at MAC. Documentation on their software will be available before October according to Dennis.

DIGITAL MAYN

DIGITAL NYO

MSG. NO. 499 10.8.64

ATTENTION...HARLAN ANDERSON

SUBJECT.....YOUR TWX3925--RE: PDP-6 INTEREST

WE HAVE BEEN IN TOUCH WITH DR. BARDON, ASSOCIATE DIRECTOR AT COLUMBIA'S NEVIS LABS RE PDP-6. DRS. TYCKO AND SEVERENS ARE ALSO INVOLVED. THE INTEREST HERE IS SERIOUS, BUT WE DON'T KNOW TO WHAT DEGREE SINCE THEY DON'T WANT TO SEE US FOR ANOTHER 2 WEEKS.

WE HAVE NO CONTACT WITH A DR. HAVENS AS MENTIONED IN YOUR TWX OF 10.7; HOWEVER, WILL RUN HIM DOWN.

DAVE DENNISTON, NYO

INTEROFFICE MEMORANDUM

DATE October 8, 1964

SUBJECT Woods Hole Oceanographic Institute

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

FROM
R. Lane

Woods Hole Oceanographic Institute is an educational institution. They qualified for a 20% educational discount on PDP-5.

The present minimum configuration which I am proposing is $407,900. It could expand to $577,242. I'm not sure if it will be a purchase, rental or "rental conversion to sale". No discounts are permitted on rentals! (G.E. currently allows them 40% on the 225 rental).

I feel that a "rental conversion to sale" is most likely. As an educational contribution, 20% is about $80,000. I am confident that I can persuade them to accept a 346 CRT Display as our contribution rather than a price reduction. As such, I would like permission to pursue this approach - either a new 346 or the MAC Type 30E when it comes back.

H. Anderson

INTEROFFICE MEMORANDUM

DATE October 12, 1964

SUBJECT Plans for Forecast, period October '64 thru September '65

TO Works Committee FROM R. Mills

This report attempts to show what I feel will be required by way of additional personnel because of the volume of business which we have forecast for the period October '64 through September '65. The Accounting and Finance areas of the company have seen a constant growth in the use of its services throughout the company. This report attempts to cover two things:

1. Additional requirements to better serve the company in areas which are well established.

2. To show the additional requirements for personnel to handle the growth in the forecast as mentioned above.

The procedure involved in preparing this report was to examine each area in detail in order that areas of operation which have grown beyond the side issue stage with an employee and requires specific assignment were considered. General comments are made under each area oriented towards:

1. Giving better service under current operating conditions.

2. Requirements due to higher volume.

Summary of Additional Personnel

Section	Requirement
Data Processing	1
General Accounting	3
Forecasting	2
Business Statistics	1
Foreign Operations	0
Accounts Payable	2
Accounts Receivable	0
Machine Tabulating	5
Cost Accounting	3
Payroll	0
Secretaries	0
Total Additional Requirement	17

A basic assumption used throughout this report is a phasing time for the use of the computer for 9 - 12 months from the present time.

Requirements by Section

Data Processing - At present we have one employee in this section and feel that another programmer is required, even though it is not requested here, hoping that this will be made available from our programming section. Fred MacLean spends a great deal of time pushing a pencil and being a filter center for our labor reporting. The clerk typist would act as a central control point for our computer operations and also clerk typist.

General Accounting - Our General Accounting function has grown substantially and we are now involved with consolidated monthly statements, detailed product line reporting, more complex general and tax accounting, and we require one junior accountant here to bring us up to strength, and one more to handle more of the general accounting work and to pick up major areas such as capital assets, inventories, and to perform some internal audit functions. The clerk typist appears to be a minimum requirement to service the volume of reports from this area.

Forecasting - The requirement is two. It would appear that in order to do an adequate job here, we need a junior accountant to become thoroughly familiar with the detail of our forecasting procedure in order that we may do more with what we are generating at present in reporting, correlation analysis, and to make more of Bob Dill's time available for me to use. The clerk typist again appears to be a minimum requirement due to the volume of reporting from this section.

Business Statistics - Addition of one. This is a relatively new area of operation for us and Jim Myers is in this slot. We now generate on a regular basis shipment, new orders, backlog, ratios, and so forth, which have proved of real value. The clerk typist requested for this area would be involved in working directly on detailed parts of this program in order to free up Jim's time for the results that we are looking for by way of analysis.

Foreign Operations - No additional. We now funnel all foreign correspondence for our area through Gerry MacDonnell and believe that this will require additional people at a later time.

Accounts Payable - Additional two. The two people requested here appear to be a minimum for the increased volume that we are expecting. We plan to be running accounts payable checks in the tab room in December and that has been considered.

Accounts Receivable - No Additional. We have one person operating this area, I believe that this is adequate for some time.

Machine Tabulating - Additional five people. This area is going through a major realignment in an effort to make more of the supervisor's time available to analyz the reports to the end of more readily usable reports with much less research on the part of the receiver. We have done some work in this area with startling results. The additional requirements in this area are due primarily to the number of additional people that appear to be called for in the forecast, slightly over 200 with the attendant, labor tickets, and normal reports for this number of people.

Cost Accounting - Additional requirements three. It would appear that we need a junior accountant here in order to pick up the extra work load which has been imposed due to our more refined costing approach. One new area which we have not done too much with is the follow on step from preparing a pricing estimate, manufacturing the goods, and then giving feedback to the individual engineer of how he made out against how he said he was going to make out. This also includes standard pricing analysis for all standard costs. Other area is project analysis which I see is a clearing house for project engineering reports issuing the forecast vs. actual comparison which has become considerably more involved to prepare due to allocations, etc. We require two clerks in this area just to pick up the extra volume in forecast business.

Payroll - No additional. This area now reports to George Breen and with such a high degree of mechanization in this area, the additional 200 people will not be that much additional machine time.

Secretaries - No additional.

Total Additional Requirements: 17

The current strength of this department is 32, and if the report is accepted, this will bring us up to a strength of 49.

Additional Equipment

We also estimate that for the increased volume due to the higher number of people, we will require one more 407 Accounting Machine, one 026 Keypunch, and one 056 Verifier, offset by the return of the 402 Accounting Machine. The 407 gives us a great deal more flexibility.

dec INTEROFFICE MEMORANDUM

DATE October 15, 1964

SUBJECT Engineering Planning

TO Harlan Anderson
Jim Hastings
Dick Best
Bob Dill
Gordon Bell

FROM Dave Packer

The process for engineering planning must be structured and routine. This memo outlines a formal planning process which could serve as the planning routine.

Step 1: Plans for existing projects

Each existing project should be planned for its lifetime. Completion of two formal requirements constitutes a complete plan:

1. A project schedule, via the existing project scheduling system.
2. A project financial plan, via the cost forecasting mechanism currently being designed. The financial plan consists of month-by-month estimates of labor, material, and overhead costs to be incurred by the project in each cost center, plus an estimate of monthly expenditures on outside contracts. Note that labor estimates come directly from the manpower estimates on the project schedule.

Before any new project is accepted, a complete plan should be available; i.e., a copy of the schedule and financial plan should be in a central file for each engineering number.

Step 2: Review of engineering plans -- detailed.

Each individual plan should be reviewed periodically. Both schedule and financial feedback will be available for review. Project engineers should review schedule and financial feedback monthly. Review by the chief engineer should be undertaken if substantial variances between actual and forecast performance (either schedule, financial, or both) exists.

Feedback will take the form of:

1. Detailed reports (Costs by cost center and type versus forecast, schedule update) monthly to project engineers.
2. Summary reports (Total cost versus forecast) for all project to the Chief Engineer.

Step 3: Review of engineering plans -- overall

Quarterly, an overall review of engineering efforts should be made. The review should include an analysis of the future load imposed by existing projects compared to engineering capacity. Such analysis can be drawn both from month by month summation of labor costs for all projects versus payroll and from manpower loads on schedules, if all projects are scheduled. It should show:

1. How much of our resources are committed to existing work.
2. Whether we are understaffed or overstaffed.
3. How current resources will become available in the future for new work.
4. How much existing work will cost over the coming months (from project summation).
5. How much total engineering will cost over the coming months, if no staffing changes are made. (From payroll analysis and materials estimates).

Basically, the review will show the resources we have for future programs and will be the basis for staffing recommendations and longer range engineering plans.

Step 4: Updating Plans

Inevitably, both schedule and financial plans will need revision. Schedules are currently updated monthly. Every six months, financial forecasts should also be updated. This should not be a major task, since it involves only adjusting the original plan to reflect the current status of the project. The original plan should be kept in the project file, however, for it contains the information used to justify the project and will allow project leaders to evaluate actual results versus their initial plans.

D. Packer

DP:ncs

HER

INTEROFFICE MEMORANDUM

DATE October 16, 1964

SUBJECT Semiconductor Price List

TO Sales, Sales Offices, Engineering and Administration

FROM Ed Simeone

Attached is an updated copy showing the selling price of transistors and diodes, as spare parts.

Please destroy any existing price list as it is obsolete.

SEMICONDUCTOR PRICE LIST

TRANSISTORS

PART NUMBER	SELLING PRICE
15- 2N167	$ 4.65
15- 2N215	2.60
15- 2N398A	2.24
15- 2N456A	2.70
15- 2N457A	3.98
15- 2N522A	2.03
15- 2N598A	3.83
15- 2N656	6.15
15- 2N708	3.09
15- 2N709	11.55
15- 2N711A	2.18
15- 2N744	10.50
15- 2N813	9.62
15- 2N835	4.05
15- 2N979	2.10
15- 2N995	8.19
15- 2N1065	3.38
15- 2N1132	9.45
15- 2N1184	6.20
15- 2N1184B	10.40
15- 2N1204	8.93
15- 2N1304	1.22

Transistors (Continued)

PART NUMBER	SELLING PRICE
15- 2N1305	$ 1.22
15- 2N1308	1.68
15- 2N1309	1.68
15- 2N1310	6.77
15- 2N1472	17.01
15- 2N1494	9.56
15- 2N1495	10.29
15- 2N1754	2.03
15- 2N1998	3.83
15- 2N2099	7.98
15- 2N2100	11.97
15- 2N2387	16.17
15- 2N2475	8.75
15- 2N2480	32.90
15- 2N2714	2.48
15- 2N2801	18.34
15- 2N2804	35.70
15- 2N2904	14.35
15- 2N2904A	21.42
15- 2N3110	8.40
15- 3N76	29.40
15- DEC1008	16.80
15- DEC1009	25.20

PART NUMBER	SELLING PRICE
15- DEC2219	$ 8.19
15- DEC2219 2	8.19
15- DEC2894	11.55
15- DEC2894 1	11.55
15- DEC2894 2	11.55
15- DEC2894 3	11.55
15- DEC2894 4	11.55
15- DEC2894 5	11.55
15- DEC3009	1.18
15- FSP24	49.56
15- GA212	5.18
15- MA89	7.28
15- MA90	7.28
15- MD93	7.28
15- MD94	4.43
15- MD95	5.48
15- MD109	5.48
15- MF114	2.03
15- MM999	7.05
15- NS3033 1	36.40
15- NS3033 2	30.80
15- NS3033 3	22.40
15- NS3033 4	32.76

Transistors (Continued)

PART NUMBER	SELLING PRICE
15- NS3033 5	$ 27.72
15- NS3033 6	20.16
15- NS3033 7	20.16
15- NS3033 8	18.14
15- NS3033 9	8.40
15- SDA4	8.82
15- SDA5	6.90
15- SDA6	6.38
15- SDA7	12.60
15- SDA8	8.75
15- SF2506	16.80
15- SF2507	22.40
15- SJ1071	16.38
15- TI 796	7.32
15- 4JXIC741	2.87
15- 16JI	1.80

E. Simeone - October 1964

DIODES

PART NUMBER	SELLING PRICE
11- IN67A	$ 1.20
11- IN91	1.70
11- IN270	.70
11- IN429	7.63
11- IN456A	2.70
11- IN469	5.63
11- IN469A	7.13
11- IN648	2.93
11- IN748	3.00
11- IN748A	4.20
11- IN750	3.00
11- IN750A	4.20
11- IN753A	4.13
11- IN756A	4.13
11- IN758A	4.20
11- IN764	3.15
11- IN825	11.13
11- IN964A	3.53
11- IN987B	5.18
11- IN1217	1.36
11- IN1220	1.86
11- IN1227	1.76
11- IN1315	4.88

Diodes (Continued)

PART NUMBER	SELLING PRICE
11- IN1341	$ 1.68
11- IN1875	5.25
11- IN1971B	10.22
11- IN1982	11.09
11- IN1998	4.88
11- IN2175	16.10
11- IN2970B	10.22
11- IN2974B	10.22
11- IN2976B	10.22
11- IN3030B	7.14
11- IN3031B	7.14
11- IN3156	16.38
11- IN3208	1.73
11- IN3209	1.95
11- IN3210	2.63
11- IN3316	8.47
11- IN3499	26.60
11- 2N1600	7.98
11- D001	1.28
11- D003	2.63
11- D007	1.08
11- D662	2.10
11- D664	4.35

Diodes (Continued)

PART NUMBER	SELLING PRICE
11- D666	$ 3.15
11- D668	3.00
11- D669	4.20
11- D670	2.25
11- G688	2.63
11- L S 400	18.90
11- SV6	3.00
11- SW1250 3	2.99
11- 1/4M 2.4 AZ5	3.15
11- 1/4M 68 AZ5	6.00
11- 1/4M 82 Z5	6.00
11- .50M 100 SZ10	11.20
11- 10M 100Z 10	8.19
11- 20 SP484	1.55

E. Simeone - October 1964

INTEROFFICE MEMORANDUM

Conference - A. Titcomb, J. Dennis

DATE October 20, 1964

SUBJECT A Meeting to Discuss Segmentation and our Quote to BTL.

TO

FROM A. Titcomb

Our system, as outlined in the BTL proposal, is unworkable as memory protection is not provided for.

In discussing this subject with Professor Dennis, I feel, needless to say, at some disadvantage. However, it is clear that about the best we can get is a discussion of the problems (many) and the possible solutions (many and interacting).

It isn't impossible to arrive at a system which will work, but to arrive at the perfect system requires regular and constant effort by DEC.

Our system could be improved by creating the instruction "attach". Attach loads the left half of an index register with a Segment Name. In addition, it would specify that all further use of this index register would take the user to the memory mapping table from which the ultimate effective address would be extracted. (As the fast look-behind registers are not essential to the system but serve to speed it up, reference to them is omitted from this discussion.)

To return the usage of the index register to normal, it would be necessary to give say a MOVEM, (E) where E =index register. (This may be incorrect but it conveys the thought that an instruction would be able to return the usage to normal.

When the "attach" instruction is given, a table must be consulted which would determine whether the segment being loaded is a legal one for the user.

It can be seen that as user's become active, the hash-coded memory mapping table must be reloaded with our present system. This is an overhead item and not desireable. One alternative would be to provide separate tables for each user. Whatever it is that takes one to the proper core location to find the table, would have to be modified by the monitor as each user became active.

Another alternative which Professor Dennis seemed to like is the enlargement of the hash-coded table to 512 locations. By this means, all user segments would be mapped at one time and the table would never be more than 50% full (262K is full core) (512x 1024=2x full core) Keeping the population in the table low reduces the chances of having two separate segment-name-block combinations hash-coded to the same table entry.

One problem which I have not heard much discussion of is the mechanism of changing the "current segment." Probably this would be done by a jump through an index register in which a segment has previously been loaded by an "attach" instruction. The "current segment" would be the one from which instructions are being taken. In addition, there might be a "current segment" for data. Note that subroutines, Fortran, etc. would exist as pure procedures and therefore require that temporary storage be allocated in a user segment for data. The current data segment scheme is not without problems, however. At this point, I felt that I had had enough and I so pleaded.

I have omitted some items discussed however they probably will not affect our SDC quote.

Overall, Jack said that our BTL proposal was superior to most originating at DEC and he would like to have his copy returned after I have finished with it.

Could the notation which we have included citing proprietary information be in any way disregarded? I think he would like to show others our work.

dec INTEROFFICE MEMORANDUM

DATE October 20, 1964

SUBJECT

TO Bob Lassen

FROM D. J. Doyle

cc for Stan Olsen
Ted Johnson
Ken Olsen ✓

We have had quite a number of personnel changes up here, and the purpose of this memo is to bring you up to date and to recommend action on your part where necessary.

The major changes are that we have acquired a second field service technician, Mr. Claude Payette, and we will be hiring a Mr. Fred Welton as accountant to replace Mrs. Johansen, effective November 1, 1964. Mrs. Lorna Wright is a temporary employee at the moment, but it looks like she may be necessary and I have asked her to complete an application form. She is handling all customs work and the shipping and receiving of goods including invoicing.

I am also asking you to look up Barbara Angell's background. She has been doing the assembly work for Bill, and we have given her work on a very non-continuous basis. She has wired up a total of three systems, which totalled approximately $40,000 in sales. We talked on the phone about her.

You will notice that we have nine people on staff, three of whom are engaged in the handling of goods. Our warehousing operations are therefore using up personnel, but it is returning real dividends in extra sales. Our warehouse not only speeds up delivery, but relieves the customer from doing his own clearance through customs. Some customers have phoned in an order and received it the same day.

As for production, I plan on resting on our oars for a month or so until our new field service man gets some training. We have delivered three systems which were assembled up here; one has proven itself, and I want to wait and see how the others make out. Shortly after the new year, I would like to take on about $20,000 per month in special systems work, and this will mean hiring additional people.

In conclusion,Bob, I want you to look up Barbara Angell's background and see that all of these other people get put on your records. John Mutzeneek and Bill MacGregor are really doing excellent work. The future looks very good up here as I have a good choice of contracts lined up as far as a year in advance. Canadian Westinghouse want us to assemble a system for delivery in June, costing about

INTEROFFICE MEMORANDUM

DATE October 20, 1966

SUBJECT

TO Bob Lassen

FROM D. J. Doyle

cc for Stan Olsen
Ted Johnson
Ken Olsen

$40,000. I plan on starting it early in the new year. There is a strong requirement for Canadian content and if we didn't do it for them, it is doubtful if we would even sell them the modules. Westinghouse up here shows real good potential as a customer.

NAME	DATE EMPLOYED	CURRENT SALARY	DATE OF LAST INCREASE	POSITION	ACTION REQUIRED
D. J. DOYLE	15/3/63	$11,000/YR.			
W. C. MACGREGOR	2/2/64	$6,700/YR	NONE	SHIPPING, RECEIVING, PRODUCTION.	INCREASE OF $550/YR HIGHLY RECOMMENDED
JOHN MUYZENEER	2/2/64.	$5,600/YR	1/6/64.	FLD. SERVICE	NORMAL REVIEW ACTION. VERY SATISFACTORY PERFORMANCE
JOHN RICHARDSON.	1/9/64.	$7,800/YR	1/9/64.	SALES	NORMAL REVIEW.
PATRICK AMYOTTE	1/6/64.	$1.60/HR.	1/10/64.	SHIPPING, RECEIVING & MAINTENANCE	NORMAL REVIEW
CLAUDE PAYETTE.	12/10/64	$4800/YR	NONE.	FLD. SERVICE	NORMAL REVIEW.
MRS. ELEANOR GARDINER	1/10/64	$55/WK.	NONE.	SALES SECTRY	"
MRS. LORNA WRIGHT	TEMP.	$55/WK.	NONE.	SHIPPING, RECEIVING, CUSTOMS, & INVOICING.	"
MR. FRED WELTON.	1/11/64	$90/WK.	N/A.	ACCOUNTANT.	"

INTEROFFICE MEMORANDUM

DATE October 21, 1964

SUBJECT

TO K. Olsen
H. Anderson ←
S. Olsen
M. Sandler
G. Bell

FROM J. Smith

Let's try it!
H.E.A.

What are your feelings on the below?

In the past, there has been a great deal of misunderstanding as to the status of options in process. Most of these misunderstandings arise at Computer Guidance Committee or special status meetings. In order to help clarify this situation, I intend to generate a weekly Status Report on options in process. It is my feeling that this report should be issued to the Computer Guidance Committee on a weekly basis for review. At that time, it should be determined what affect delays have on delivery to customers and what corrective steps should be initiated.

I hope, in most cases, this review will take only a few minutes at each meeting. Indeed, in some cases if there is no controversy or problems, it could be cancelled for that session. I feel that the report should be of the "exception" type, listing only those items that we are having problems with. This should help to cut down on the review time.

What I hope to gain by this report and review is a better understanding of where the true bottle-neck lies. In some cases, this is not always obvious. By reviewing a report of this type at the Computer Guidance Committee, which has a cross section of DEC departments, bottle-necks can be isolated and the necessary action generated.

It would also help expedite matters if a representative of Production is present when special-scheduling meetings are held that involve equipment for which Production is responsible.

I hope the proposed report will be of sufficient detail as to minimize the need of special status report meetings.

(Swe)

INTEROFFICE MEMORANDUM

DATE October 21, 1964

SUBJECT

TO H. Anderson
S. Olsen
N. Mazzarese
R. Best
G. Bell
H. Crouse
J. Smith

FROM D. Kuyamjian

Attached are the particulars of all outstanding major contracts. Schedule dates prior to which actual requirement and specifications for equipment must be established to avoid cancellation charge are indicated.

The delivery cycle noted is the notification the manufacturer requires before delivery of a unit can be made; all are given as worst case. This time period must be kept in mind as the expiration date of the contract approaches.

The cancellation clause and incremental price schedule for each contract are also included.

Delivery of equipment is to be accomplished over an approximate twelve month period commencing from date of delivery of the first printer or eighteen months after inception of this order, whichever occurs first. Delivery of each unit is to be made only upon a written formal release issued by DEC Purchasing Department.

Anelex agrees to make machines available for delivery within a five month period after release by DEC should DEC require such delivery. Deliveries are contingent upon not only the receipt of this order, but the establishment of firm specifications for the equipment to be delivered. Any unusual amount of time required to resolve specifications after receipt of release shall be cause for extended delivery dates.

VIII. Cancellation: In the event only a partial of this order is filled due to the termination at the convenience of DEC, the full extent of DEC's liability will be computed on the basis of a) procurement of parts by Anelex and b) labor effort directed to the assembly of the equipment.

a) Procurement of Parts: Those parts peculiar to DEC's equipment and procured by Anelex at point of termination of the order, or of a particular release, by DEC will be subject to a cancellation charge of 100% of Anelex's procurement costs with the following exceptions:

Should DEC cancel and/or change specifications for a released unit four months prior to the delivery date scheduled by DEC's release, there will be no parts subject to a cancellation charge. Should the speed requirement (300, 600, or 1250 lpm) of a released unit be changed less than four months prior to DEC's scheduled delivery date, cancellation charges for those parts affecting the speed of the unit will apply.

In the event the character set of a released unit is changed greater than seven weeks prior to DEC's scheduled delivery date, there will be no cancellation charges for this change. Should the character set of a released unit be changed less than seven weeks prior to DEC's scheduled delivery date, cancellation charges for the character drum will apply.

Title for those parts against which a cancellation charge is applied will pass to DEC and the parts may be incorporated into equipment to be released at a later date against this order. Should the order be terminated and no subsequent machines released within the specified time duration of this order, DEC will be liable for these parts.

Signed by _____
Anelex Corporation

Signed by _____
Digital Equipment Corporation

b) Labor: Since labor effort directed to the assembly of the equipment by Anelex Corporation is generally confined to the thirty days immediately prior ot the scheduled delivery date for the equipment there will be no labor cancellation charges applicable if point of termination of the order, or particular release, occurs thirty days prior to the scheduled delivery date.

If the order is terminated by Digital Equipment Corporation less than thirty days prior to the scheduled delivery date, cancellation charges for the labor effort will be negotiated by Anelex Corporation and Digital Equipment Corporation, and if demanded by one or both parties, arbitrated by an impartial party mutually agreed upon. In any event, cancellation charges will be commeasurate with the amount of labor effort expended by Anelex Corporation.

IX. Changes, Additions, and Deletions: No changes to this order are authorized unless made by the cognizant buyer or his supervisors and substantiated by a formal, written change notice. However, although this purchase agreement calls for the Anelex Series 5-600 Line Printer, Buffer, and DEC Interface, DEC may substitute a series 5-300 or 5-1250 Line Printer for the former type in any quantity not to exceed the total quantity of this order in any combination of types.

DEC will not pay for additional work or extras unless such additional work or extras have been ordered in writing and the price therefore agreed upon. Anelex shall not substitute other materials or accessories or revise specifications for those specified in the order without written consent of DEC. Changes made by Anelex without an authorized change notice shall be made at the sole risk of Anelex, there being no financial recourse against DEC.

X. Pricing: Equipment delivered to DEC against this order is subject to the price schedule below regardless of the total quantity of units or the speed of the units delivered.

Signed by _____
Anelex Corporation

Signed by _____
Digital Equipment Corporation

	Series 5 300 lpm	Series 5 600 lpm	Series 5 1250 lpm
Printer	$10,500.00	$12,500.00	$18,750.00
Buffer	$ 4,675.00	$ 5,050.00	$ 6,085.00
Interface	$ 425.00	$ 425.00	$ 425.00

XI. Replacement Parts: Anelex reserves the right to discontinue its products without notice and make modifications in design at any time without incurring any obligation to make such modifications to products previously supplied. Anelex does, however, guarantee to supply replacement parts at then current prices for a period of at least five years from date of shipment for any standard products.

A complete set of finished Operation and Maintenance manuals must be delivered, at no charge, within thirty days of delivery of each printer. Additional manuals are to be made available upon request for a charge of $15.00 a set.

XII. Patent-Copyright Indemnity: Anelex agrees to defend and hold harmless DEC, its customers, and those for whom DEC may act as agent, from all claims, liability, loss, damage, or expense, including counseling fees, arising from or by reason of any actual or claimed trademark, patent, or copyright infringements, or any litigation based thereupon, with respect to the articles or services furnished hereupon, whether by reason of their sale or use, except those for which DEC furnishes complete specifications. Such obligation of Anelex shall survive acceptance of goods and services and payments therefor by DEC.

XIII. Proprietary Information: Anelex agrees that the proprietary interest of DEC in the material it supplies will be respected. All information is transmitted in confidence and may not be disclosed to unauthorized individuals. Any information pertaining to this order which Anelex wishes to release for publication must first be submitted to DEC for approval.

Signed by _____
Anelex Corporation

Signed by _____
Digital Equipment Corporation

PURCHASE ORDER

CHANGE ORDER NOTICE # 1
PURCHASE ORDER NO. 37039

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

Digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

DATE: October 2, 1964

• Magne-Head Division
General Instrument Corp.
c/o T. W. Garrettson Co.
P. O. Box 343
W. Medway, Mass.
• Attention: Mr. J. Gallagher •

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 5r Room 20
Maynard, Mass.

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
See Below	See Below	See Below	Hawthorne, Calif.	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		X. Cancellation: In the event only a partial of this order is filled due to the termination at the convenience of DEC, the full extent of DEC's liability will be computed on the basis of a) incremental price increase, b) labor effort directed to the assembly of the equipment, and c) procurement of parts by Magne-Head. a) Incremental Price Increase: Should a portion of the order be terminated, the unit price of each machine shipped against the order will revert to the appropriate quantity price as determined by the incremental price schedule: Incremental Price Schedule Quantity — Price First or single unit — $29,500.00 1 additional — $29,000.00 2 additional — $28,500.00 3 additional — $27,750.00		

0005 D 1314		24					20

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

PURCHASING

DF 178 REVISED

PURCHASE ORDER

CHANGE ORDER NOTICE #1
PURCHASE ORDER NO. 37039

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

Digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

DATE: October 2, 1964

Magne-Head Division
General Instrument Corp.
c/o T. W. Garrettson Company
P. O. Box 3434
W. Medway, Massachusetts
Attention: Mr. J. Gallagher

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 5 Room 20
Maynard, Mass.

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
See Below	See Below	See Below	Hawthorne, Calif.	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		b) Labor Effort: Should all or a pnotion of the order be terminated there will be no labor cancellation charges applicable if point of termination of the order, or a particular release, occurs ninety days prior to the scheduled delivery date as established by DEC. Should delivery of a released unit be rescheduled to a later date, and notice of the rescheduled date occur at a point less than ninety but more than sixty days prior to the scheduled delivery date per DEC's release, there will be no charges incurred. In the event delivery of a unit is rescheduled less than sixty days prior to the original delivery date established by DEC's release, the accounting charges, according to customary industry practice, will be agreed upon by DEC and Magne-Head. Should this unit be subsequently cancelled, cancellation charges as outlined will apply. In the event all or a partial of this order is cancelled, cancellation charges for those units cancelled less than ninety days prior to the scheduled delivery date as established by DEC's release, will		(05)
0005 D 1314		24		20

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION
By Henry J. Cuccia
PURCHASING AGENT

PURCHASING

DF 176 REVISED

PURCHASE ORDER

CHANGE ORDER NOTICE # 1

PURCHASE ORDER NO. 37039

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

Digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

DATE: October 2, 1964

• Magne-Head Division
General Instrument Corp.
c/o T. W. Garrettson Co.
P. O. Box 343
W. Medway, Mass.
• Attention: Mr. J. Gallagher

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 5 Room 20
Maynard, Mass.

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
See Below	See Below	See Below	Hawthorne, Calif.	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		be computed on the basis of labor effort expended against the order and will be negotiated by Magne-Head and DEC, and if demanded by one or both parties, arbitrated by an impartial party mutually agreed upon. In any event, cancellation charges will be commeasurate with the amount of labor effort expended by Magne-Head. Magne-Head shall maintain adequate records pertaining to the costs of performing this order. Such records shall be subject to audit by DEC in the event of cancellation for which the charges are based on time and materials. In the absence of such records, DEC shall be under no obligation to pay cancellation charges to which Magne-Head might otherwise be entitled. c) Procurement of Parts: A cancellation charge of 100% of Magne-Head's procurement cost will apply to only those parts peculiar to DEC's equipment and procured by Magne-Head at point of termination		(05)
0005 D 1314		24		20

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

PURCHASING

DF 178 REVISED

PURCHASE ORDER

CHANGE ORDER NOTICE #1

PURCHASE ORDER NO. 37039

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

Digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

DATE: October 2, 1964

Magne-Head Division
General Instrument Corp.
c/o T. W. Garrettson Company
P. O. Box 343
W. Medway, Massachusetts
Attention: Mr. J. Gallagher

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 5 Room 20
Maynard, Mass.

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
See Below	See Below	See Below	Hawthorne, Calif.	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		of the order, or a particular release, by DEC. Title of the parts will then pass to DEC and the parts may be incorporated into equipment to be released at a later date against this order. Should the order be terminated and no subsequent machines released within the specified time duration of this order, DEC will become liable for these parts and title will pass to DEC. DEC may cancel this order in whole or in part at any time by written or telegraphic notice whenever Magne-Head shall default in performance or shall so fail to make progress so as to endanger performance and provided Magne-Head shall not remedy such default within ten days after written notice by DEC. After receipt of notice of termination for such default, Magne-Head may transfer title and deliver to DEC satisfactorily completed work, and such work in process as may be directed by DEC. In the event DEC terminates this order in whole or in part as provided herein, it may procure in such manner as it may deem appropriate, the required supplies or		(05)
0005-D-1314		24		20

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

PURCHASING

DF 176 REVISED

PURCHASE ORDER

digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

PURCHASE ORDER NO. 37039

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

DATE: October 2, 1964

Magno-Head Division
General Instrument Corp.
c/o T. W. Garrettson Company
P. O. Box 343
W. Medway, Mass.
Attention: Mr. J. Gallagher

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 5 Room 20
Maynard, Massachusetts

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
See Below	See Below	See Below	Hawthorne, Calif.	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		services and Magne-Head shall not be liable for any excess costs if the failure to perform arises out of causes beyond the control and without the fault or negligence of Magne-Head and its subcontractor, if the failure to perform is caused by the default of the subcontractor, unless the articles to be furnished by this subcontractor were obtainable from other sources in sufficient time to comply with the order. DEC may cancel this order by written or telegraphic notice if Magne-Head becomes insolvent or makes a general assignment for the benefit of creditors, or if a petition under chapters X or XI of the Bankruptcy Act is filed by or against Magne-Head. M. Patent-Copyright Indemnity: Magne-Head agrees to defend and hold harmless DEC, its customers, and those for whom DEC may act as agent, from all claims, liability, loss, damage, or expense, including counseling fees, arising from or by reason of any actual or claimed trademark, patent, or copyright infringements, or any litigation based thereupon, with		
0005 D 1314		24		20

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

PURCHASING

DF 178 REVISED

PURCHASE ORDER

(PAGE 2)

BLANKET ORDER

digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

PURCHASE ORDER NO. 25422

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

DATE: May 29, 1964

Vermont Research Corporation
P.O. Box 493
Springfield, Vermont
Attn: Mr. Prentiss Smith

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 5, Room 148
Maynard, Mass.

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		10" Memory Drum Systems		

In the event of cancellation due to termination at the convenience of Digital Equipment Corporation, the unit price for those units received will increase per the incremental price schedule below. This is the extent of Digital Equipment Corporation's liability in the event of cancellation.

INCREMENTAL PRICE SCHEDULE
FOR DRUM MEMORY SYSTEM

1-4	$4500.00	$ 4500.00
5-9	3850.00	3850.00
10 plus	3300.00	3300.00

NOTE:

Delivery is of primary importance to Digital Equipment Corporation. Digital Equipment Corporation may depend upon delivery of a memory drum typically within six weeks of receipt of a written release by Vermont Research Corporation.

To be established		EA					145

220017

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

FOLLOW-UP

DF 178 REVISED

PURCHASE ORDER

digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

PURCHASE ORDER NO. 35658

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

DATE: July 22, 1964

Vermont Research Corporation
P. O. Box 498
N. Springfield, Vermont

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 45 Room 140
Maynard, Massachusetts

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		20" Memory Drum Systems cost of the Drum. Delivery Schedule: The five memory drums will be scheduled for delivery over an approximate twelve month period at the convenience of Digital Equipment Corporation. Shipments are to be made only against written releases as issued by Digital Equipment Corporation. In the event of cancellation due to termination at the convenience of Digital Equipment Corporation then unit price for those units received will increase per the incremental price schedule below. This is the extent of Digital Equipment Corporation's liability in the event of cancellation. The Delivery is of primary importance to Digital Equipment Corporation. Digital Equip-		

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

FOLLOW-UP

DF 17B REVISED

PURCHASE ORDER

Digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

PURCHASE ORDER NO. 25453

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

DATE: July 22, 1964

Vermont Research Corporation
P. O. Box 429
E. Springfield, Vermont

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building 65 Room 148
Maynard, Massachusetts

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		20" Memory Drum Systems ment Corporation may depend upon delivery of a memory drum typically within ten weeks of receipt of a written release by Vermont Research Corporation. Incremental Price Schedule: For Basic Memory Drum 1 - 4 $2,000.00 5 - 9 7,500.00		(05)

IMPORTANT

PLEASE SEND INVOICE IN TRIPLICATE TO
ACCOUNTS PAYABLE DEPARTMENT

DIGITAL EQUIPMENT CORPORATION

By _____
PURCHASING AGENT

FOLLOW-UP

ADDITIONAL ARTICLES OF CONTRACT

APPROVED BY DEC _____
ACCEPTED BY MI _____

E. TERMINATION

Digital reserves the right to terminate this order at Digital's convenience, provided, however, that Digital shall, notwithstanding any exercise of such right of termination, accept delivery of all units scheduled for delivery during the succeeding three months and forecast for the fourth and fifth months, as such deliveries are scheduled and forecast, pursuant to the provisions of the following Paragraph F of this attachment to the order.

Digital may, however, in the event of the exercise of such right of termination, reschedule deliveries for the units previously forecasted for the fourth and fifth months, so as to provide for the delivery of the aggregate number of units forecasted for said fourth and fifth months during the period ending ninety (90) days beyond said fifth month. Such rescheduling, in the event of such termination, shall be made in the Notice of Termination, which notice shall be in writing and the effective date of such termination shall be the date of receipt by Midwestern. If Digital does not elect to exercise the privilege of such rescheduling for the fourth and fifth months, then and in such event the previous forecast for said months shall then be considered as a firm delivery schedule.

In the event of a termination at the convenience of Digital, the price per unit under this order shall then be the increment price of the total quantity ultimately delivered under this order, in accordance with the prices set forth in attachment 2 hereof. Responsibility for finished goods in process and raw materials purchased by Midwestern and specifically assigned to this order

APPROVED BY DEC _____
ACCEPTED BY MI DRM.

and qualified as unique to this order, shall be negotiated by the parties hereto upon such termination and if agreement for the payment of said items cannot be arrived at by mutual agreement between the parties, then the parties agree to submit the same to arbitration.

ATTACHMENT 2
DEC PURCHASE ORDER 29318
Page 1 of 1
PRICING

APPROVED BY DEC _____
ACCEPTED BY MI _____

	NET
1 - 9	$11,500
10 - 14	$10,245
15 - 19	$ 9,875
20 - 24	$ 9,450
25 - 29	$ 9,100
30 - 39	$ 8,850
40 - 49	$ 8,450
50 - 99	$ 8,312
100	$ 7,930

In addition, the prices in the above table shall not vary over the life of the purchase order. However, in the event of a change in specifications or design, which are mutually agreed upon by both Midwestern and Digital, then consideration shall be given to repricing.

Midwestern Instruments Contract
M 3000 Tape Transport

PURCHASE ORDER

EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

PURCHASE ORDER NO. 37611

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

DATE:
August 24, 1964

Digitronics Corporation
1 Albertson Avenue
Albertson Long Island New York

Attention: Mr. Karlson

SHIP TO
DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building #5 Room 12
Maynard, Massachusetts

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
N/A	N/A	N/30	Albertson	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
1	35	Model 2500 Paper Tape Readers with rack adapters (primed only)	$714.00	$24990.00

Terms and conditions

Delivery is to be accomplished over an approximate twelve month period. Shipments are to be made by Digitronics Corporation only upon receipt of a written formal release issued against this purchase order by Digital Equipment Corporation's Purchasing Department. Shipments are to be made according to the delivery schedule indicated on each release.

In the event Digital Equipment Corporation releases only a partial of this order due to termination at the convenience of Digital Equipment Corporation; theunit price for those units received will revert to the appropriate quantity price per the Incremental Price Schedule below. This is the extent of Digital Equipment Corporation's liability.

ACKNOWLEDGMENT

(05)

WE ACKNOWLEDGE RECEIPT OF AND ACCEPT THIS ORDER SUBJECT TO TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE HEREOF. SIGN AND RETURN TO ATTENTION OF PURCHASING DEPARTMENT.

WILL SHIP ON _____

SELLER'S ORDER NO. _____

_____
DATE

_____
SELLER'S NAME

_____
SIGNATURE OF AUTHORIZED OFFICER OR EMPLOYEE

178 REVISED

PURCHASE ORDER

Digital EQUIPMENT CORPORATION
MAYNARD·MASSACHUSETTS

AREA CODE 617 • TWINOAKS 7-8822 • TWINBROOK 9-0510 • TWX MAYN 753 UX

PURCHASE ORDER NO. 37611

OUR PURCHASE ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKING SLIPS AND SHIPPING DOCUMENTS.

DATE: August 24, 1964

Digitronics Corporation
1 Albertson Avenue
Albertson, Long Island, New York
Attention: Mr. Karlson

SHIP TO

DIGITAL EQUIPMENT CORPORATION
Thompson Street
Building #5 Room 12
Maynard, Massachusetts

TO BE DELIVERED BY	SHIP VIA	TERMS	F.O.B.	GOV'T CONTRACT NO.
N/A	N/A	N/30	Albertson	N/A

PLEASE SHIP SUBJECT TO THE CONDITIONS ON THE FACE AND BACK HEREOF THE FOLLOWING:

ITEM	QUANTITY	STOCK NO./DESCRIPTION	UNIT PRICE	AMOUNT
		Incremental Price Schedule 1 - 9 $779.80 10 - 19 $764.80 20 - 34 $749.80 35 $714.80 ACKNOWLEDGMENT		(03)
1730		32		12

WE ACKNOWLEDGE RECEIPT OF AND ACCEPT THIS ORDER SUBJECT TO TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE HEREOF. SIGN AND RETURN TO ATTENTION OF PURCHASING DEPARTMENT.

WILL SHIP ON _____

SELLER'S ORDER NO. _____

_____ DATE

_____ SELLER'S NAME

_____ SIGNATURE OF AUTHORIZED OFFICER OR EMPLOYEE

DF 170 REVISED

Delivery of equipment is to be accomplished over an approximate eighteen month period commencing from inception of this order. Delivery of each unit and labor and materials expended against its delivery is to be made only upon a written formal release issued by DEC Purchasing Department.

IX. Inventory Agreement: At any point in this contract, DEC has the option to release any portion of the outstanding quantity of Transports for manufacture and finished goods inventory by Datamec. This may take the form on one specific quantity or a monthly production quantity. Datamec will produce so as to place released units in finished goods inventory within ninety days of release. DEC may revise the quantity or production rate at any time provided Datamec is given ninety days notice on the finished goods schedule requirement. As units are completed and added to finished goods, Datamec will furnish certification of same to DEC.

X. Terms of Payment: Invoices for performance against this order may be submitted to DEC for payment upon shipment of system(s) specified. Payment is due thirty days from date of acceptance of equipment by DEC with a 1/2% discount applicable if payment is made within ten days of acceptance of equipment. DEC will accept or reject equipment within three weeks of receival, typically within ten days. F. O. B. Point is Mountain View, California.

In the event DEC exercises the Inventory Agreement option, Datamec may submit billing of 50% of the unit contracted price for each unit completed together with certificate of completion of equipment. Invoices of this instance are due within thirty days of date of invoice and are subject to a 1/2% discount if paid within ten days of date of invoice. Billing for the final 50% of the unit price may be submitted to DEC upon shipment of the equipment and will be due for payment within thirty days of date of invoice.

XI. Cancellation: In the event only a partial of this order is filled due to the termination at the convenience of DEC, the unit price will revert to the appropriate quantity price according to the Incremental Price Schedule. This is the full extent of DEC's liability except for those units, released or built against the Inventory Agreement option, against which Datamec has expended labor effort and/or materials if those units were scheduled by DEC for delivery or completion less than ninety days of notification of cancellation.

Signed by _____
Datamec Corporation

Date _____

Signed by _____
Digital Equipment Corporation

Date _____

In this event, Datamec will be entitled to cancellation charges equal to the total production costs expended on the cancelled unit up to a maximum of $1,953.00

DEC may cancel this order in whole or in part at any time by written or telegraphic notice whenever Datamec shall default in performance or shall so fail to make progress so as to endanger performance and provided Datamec shall not remedy such default within ten days after written notice by DEC. After receipt of notice of termination for such default, Datamec may transfer title and deliver to DEC satisfactorily completed work, and such work in process as may be directed by DEC. In the event DEC terminates this order in whole or in part as provided herein, it may procure in such manner as it may deem appropriate, the required supplies or services and Datamec shall not be liable for any excess costs if the failure to perform is caused by the default of the subcontractor, unless the articles to be furnished by the subcontractor were obtainable from other sources in sufficient time to comply with the order. DEC may cancel this order by written or telegraphic notice if Datamec becomes insolvent or makes a general assignment for the benefit of creditors, or if a petition under Chapters X or XI of the Bankruptcy Act is filed by or against Datamec.

Signed by _____
Datamec Corporation

Date _____

Signed by _____
Digital Equipment Corporation

Date _____

XII. Pricing: Pricing is subject according to the following:

Incremental Price Schedule

Description of D2020, 800 BPI	Quantity & Price 1-7	8-19	20-30	31-50	51-100
30 ips triple density with triple density head	$4,340.00	$4,253.00	$4,123.00	$3,906.00	$3,689.00
30 ips dual density with triple density head	$4,240.00	$4,155.00	$4,028.00	$3,816.00	$3,604.00
30 ips dual density with dual density head	$4,125.00	$4,131.00	$3,919.00	$3,713.00	$3,506.00
45 ips triple density with triple density head	$4,640.00	$4,547.00	$4,408.00	$4,176.00	$3,944.00
45 ips dual density with triple density head	$4,540.00	$4,449.00	$4,313.00	$4,086.00	$3,859.00
45 ips dual density with dual density head	$4,415.00	$4,327.00	$4,194.00	$3,973.00	$3,753.00

Signed by _____
Datamec Corporation

Date _____

Signed by _____
Digital Equipment Corporation

Date _____

DEC may release any combination of Transports with varying transfer rates, bit packing densities, power requirements, tape speeds and paint schedules. Prices for transports other than those with a transfer rate of 36,000 cps, 800 BPI, 24 ips tape speed, and 60 cycle power will be as specified by Datamec.

XIII. Communication of Technical Information: The above pricing includes an Instruction and Maintenance Manual furnished with each Transport, a Recommended Spare Parts List, and operation and maintenance instruction classes for DEC personnel. These classes will be free of charge if conducted at Datamec's facilities in Mountain View, California or if conducted at DEC by Instrument Dynamics, Inc. personnel.

XIV. Patent-Copyright Indemnity: Datamec agrees to defend and hold harmless DEC, its customers, and those for whom DEC may act as agent, from all claims, liability, loss, damage, or expense, including counseling fees, arising from or by reason of any actual or claimed trademark, patent, or copyright infringements, or any litigation based thereupon, with respect to the articles or services furnished hereunder, whether by reason of their sale or use, except those for which DEC furnishes complete specifications. Such obligation of Datamec shall survive acceptance of goods and services and payments therefor by DEC.

XV. Proprietary Information: Datamec agrees that the proprietary interest of DEC in the material it supplies will be respected. All information is transmitted in confidence and may not be disclosed to unathorized individuals. Any information pertaining to this order which Datamec wishes to release for publication must first be submitted to DEC for approval.

XVI. Compliance with Laws: Datamec warrants that in performance of work under this order, it has complied with or will comply with all applicable Federal, State and local laws and ordinances, and all lawfull orders, rules, and regulations thereunder. At the request of DEC, Datamec will furnish certificates to the effect that it has complied with the same.

Signed by _____
Datamec Corporation
Date _____

Signed by _____
Digital Equipment Corporation
Date _____

Description	Releases	November	December	January	February	March	April	May	June	July	August
Magne-Head Div. Memory Drum D-5000 Qty. Ordered: 4 Duration of Contract 12 mos. after receipt of first unit. Price: 1st unit - $29,500.00; 3 units $27,750.00.	Release #1 - one unit, 512 data tracks, 1 clock track, 15 spare tracks. Balance not yet released. Delivery Cycle: 4 months		1 st								
Anelex Corp. Line Printer 5-600 Qty. Ordered: 10 Duration of Contract 12 mos. after receipt of first unit. Price: $17,975.00 Delivery Cycle: 5 months	Release #1 - ten units, 600 lpm, ASCII code.					15th	15th	15th	15th	15th	15th
Vermont Research Memory Drum 20" Qty. Ordered: 5 Duration of Contract 7/7/64 to 7/7/65 Price: depends on quantity of heads. Delivery Cycle: 4 months	Release #1 - 96 data tracks, 1 clock track $10,910.00 Balanced not yet released	30th							7th Contract Expires		

SPEED AND CHARACTER SET CANNOT BE CHANGED AFTER THESE DATES WITHOUT CANCELLATION CHARGES.

Description	Releases	November	December	January	February	March	April	May	June	July	August
Vermont Research Memory Drum 10" Qty. Ordered: 10 Duration of Contract 5/28/64 to 5/28/65 Price: depends on quantity of heads. Delivery Cycle: 3 mos.	None Released							28th Contract Expires			
Midwestern Insts. Tape Transport M 3000 Qty. Ordered: 50 Duration of Contract 11/8/63 to 5/8/65 Price: $8,312.00 Delivery Cycle: 3 mos.	Release #1 - ten units received. Release #2 - ten units. Balance not yet released.	2 units	4 units	4 units				8th Contract Expires			
Teletype Corp. 33 ASR Qty. Ordered: 150 Price: $652.00 33 KSR Qty. Ordered: 120 Price: $460.00 Delivery Cycle: 6 mos.	Release #1 - 150 units Release #1 - 120 units		50 units 30 units	10 units 10 units	10 units 10 units	20 units 20 units	20 units 20 units	20 units 20 units	20 units 10 units		

NO SPECIFIED DURATION OF CONTRACT. UNITS MAY BE CANCELLED WITHOUT CHARGE ANYTIME PRIOR TO SHIPMENT.

Description	Releases	November	December	January	February	March	April	May	June	July	August
Teletype Corp. 35 ASR Qty. ordered: 6 Price: $2,313.00 35 KSR Qty.ordered: 5 Price: $1,476.00 Delivery Cycle: 7-8 mos. NO SPECIFIED DURATION OF CONTRACT. UNITS MAY BE CANCELLED WITHOUT CHARGE ANYTIME PRIOR TO SHIPMENT.	Release # 1 - six units Release # 1 - five units			6 units 5 units							
Digitronics Corp. 2500 Reader Qty. Ordered: 35 Duration of Contract 8/24/64 to 8/24/65 Price: $714.00 Delivery Cycle: 6 weeks	Release #1 - twenty units; five received	4 units	4 units	4 units	3 units						24th Contract Expires
Datamec Corp. Tape Transport D2020 Quantity: 51 Price: $3,689.00 Duration of Contract 18 mos. after inception of order. Delivery Cycle: 3 mos.					A FIRM COMMITTMENT HAS NOT YET BEEN MADE						

INTEROFFICE MEMORANDUM

DATE 22 October 1964

SUBJECT PDP-5 Programming Course

TO All Sales Personnel
All District Offices
Receptionist Bldg. 12
K. Olsen
H. Anderson
S. Olsen
N. Mazzarese
R. Beckman
T. Johnson
A. Hall

FROM E. Steinberger

The following individuals are scheduled to attend a one-week PDP-5 Programming Course convening 2 November 1964:

Consolidated Systems Corporation	Mr. H. Hallmark
Digital Equipment Corporation	Mr. F. Hibberd
Digital Equipment Corporation	Mr. S. Maminski
DECAN	Mr. C. Payette
Dow-Jones & Co., Inc.	Mr. A. L. Paulding
Eastman Kodak	Mr. G. Kittleson
Foxboro Company	Mr. R. Davisson
Transdata	-----
Transdata	-----

INTEROFFICE MEMORANDUM

DATE October 22, 1964

SUBJECT Engineering Programming Committments

TO K Olsen
G Bell
W Hindle
H Anderson
R Beckman
J Shields
J Hastings

FROM L Hantman

I. Things to be done.

PDP-6

1. Changes to card reader test to allow variable rate reading.

2. Console switch and register test.

3. 630 Full Duplex System.

4. 516 Tape Specification Test.

5. Drum Test.

6. 340 Interface and Data Test.

7. DECtog probably should be re-written for the following reasons:

   a. It was never fully debugged.

   b. Additional tests must be added.

   c. Changes to existing tests must be made.

   d. Changes must be made for compatibility reasons.

8. Additions to Memory Tests for dynamic testing (timing, etc.)

PDP-1

1. Changes must be made to the DECtape routines for compatibility purposes.

2. 57A test must be completed.

PDP-4

1. DECtape routines must be revised for compatibility changes.

2. Sort must be completed allowing typed input.

PDP-5

1. Engineering tests for Stockebrand's module line. Both on-line testing, and calculating programs are necessary.

PDP-7

1. Work should begin on analysis of proposed PDP-7 assembler.

2. Outline of PDP-7 job handling system with possible use for PDP-8.

GENERAL

1. Completion of routines necessary for existing equipment as per J Shields. This includes a great many programs for various pieces of peripheral equipment on all computers.

II. Present Allocation of Manpower

1. L Hantman.

a. Overall supervision of all Engineering Programming requirements including PDP-7 system, Bus-Pak, and flexowriter operations.

b. Completion of PDP-6 time-shared DECtape routines.

c. Completion of 570 acceptance tests and 57A compiler on PDP-4.

d. Completion of Sort

e. Completion of 57A compiler for PDP-1.

2. Leo Gossel.

    a. Updating of instruction test on PDP-6.

    b. Instruction test for LINC.

    c. PDP-5 Drum Test.

    d. PDP-4 Plotter Test.

    e. 580 Tape System on PDP-5.

    f. Automatic Program Priority Interrupt on PDP-4.

3. R Winslow.

    a. Supervision of PDP-5 systems programming.

    b. DECtape routines for PDP-5.

    c. Liaison with J Pitts on Module Tester.

4. D Brown.

    a. Memory tests for PDP-6.

    b. 516 tests for PDP-6.

    c. 340 tests for PDP-6.

5. D Fellows.

    a. Revisions and testing of PDP-4 programs with ASR 33.

    b. Magnetic and DECtape system for Assembler and FORTRAN.

    c. Teaching necessary for NYU PDP-7 (4).

    d. FORTRAN hand-holding for Columbia University.

    e. Specifications of PDP-7 system.

6. G Colicelli.

a. Completion of testing and documentation of the Bus-Pak program.

b. Magnetic and DECtape system ability.

c. Job analysis program.

d. Infotrieve.

e. Generalized report writer.

III. Immediate consideration should be given to how we are to get the work done considering present conditions - but what then?

DEC is no longer the small, homey company it was even two years ago. As our product line expands, as sales grow and especially as we become more software oriented (both from an engineering and systems standpoint) we have got to make some long range plans. Such plans should have been made a long time ago, but instead of worrying about the past (or even the present) let's think about the future.

The easy answer is: "Get more programmers". While necessary, this is hardly the complete solution. How many do we need? What will they be doing? When will they be doing it? Who will they be responsible to? etc., etc. Obviously, none of these questions can be answered until we take the time to estimate and control our future committments. First, we need someone to take full responsibility for programming. That person must have the responsibility and facilities for estimating company requirements in all areas, engineering, systems, production, sales, applications, etc. Above all he must have the ability to get (or at least try to get) the people necessary for the job and be able to define the specific areas of responsibilities of the different programming groups. The individuals responsible for each of the groups must be absolutely sure that they will know just what programs are needed, who they will have available to do it and when the programs must be done. While the shifting of programmers from area to area provides a flexible method of solving instant crises (and no doubt it will always have to be done) it should be kept to a minimum so that some possibility remains for estimating work loads and capabilities. As things stand now, none of the groups (and possibly, especially, the Engineering Programming Group) have been able to fulfill their primary functions in anything like a reasonable manner. For example, one of my primary functions was to provide programming help for projects like Stockebrand's new module line. As a matter of fact, I was hired to do exactly that. However, at this moment, when Tom asks for help, my answer is: "It's impossible." WHY? Equipment is being shipped almost daily without adequate programs. WHY? Changes must be made to existing programs and new programs are needed, but no one is available to do them. WHY? The list can go on for quite awhile.

The answer is simple. In the last analysis it is simply that the company has let me (us) down, not knowingly or willingly, but because no one has taken the time to think of DEC's responsibilities to our customers and our own in-house engineers. They need help, and we're providing hand-to-mouth assistance. It may have worked when we were small but it will not work now. DEC is expanding and to remain competitive our software capability (which in spite of everything is darned good) must expand with it. I think it is about time that we took the time to make time for the future.

In addition, DEC must determine, realistically, the cost of its programming. Compared to other companies, we get our programs comparatively cheap but we still don't know what it costs us. I'm pretty sure faulty estimates are being made as to the cost of programming necessary for computer revisions or additions mainly because, except in rare instances, NOBODY HAS EVER ASKED ME FOR ONE. Construction requisitions come in and in some cases the machine is almost ready to be shipped before any concern for programming is heard. Accounting still does not give me a report concerning the money (hours) charged to EN numbers by members of my group. How can the Project Engineers possibly know what programming is costing them?

Obviously the time has come for a serious re-appraisal of our programming abilities, and I seriously recommend that it not be put off until "later".

LH:ASJ

H. Anderson

dec INTEROFFICE MEMORANDUM

DATE October 23, 1964

SUBJECT New PDP-6 Instruction

TO Extended PDP-6 List

FROM D. A. Witcraft

The following instruction is recommended for incorporation in the new PDP-6.

XCTR Execute relocated. Compute the effective address as normal to obtain the object instruction. Activate memory protection and relocation during execution of object instruction.

In the User Mode this instruction is identical to XCT. In the Executive Mode this instruction allows very convenient access to the user's area. The operation code of XCT is 256 and code 257 is currently not in use.

DAW:tw

dec INTEROFFICE MEMORANDUM

DATE 26 October 1964

SUBJECT PDP-6 Maintenance Course Convening 2 November 1964

TO K. Olsen
H. Anderson
S. Olsen
N. Mazzarese
R. Beckman
T. Johnson
Receptionist, Bldg. 12
All Sales Personnel
All District Offices

FROM R. Bernier

The following individuals are scheduled to attend a four-week PDP-6 Maintenance and Familiarization Course convening Monday, 2 November 1964:

Mr. J. Moore	Lawrence Radiation Laboratory, Livermore
Mr. J. Noonan	Lawrence Radiation Laboratory, Livermore
Mr. Weiss	Brookhaven National Laboratory
Mr. Yonda	Brookhaven National Laboratory

**

dec INTEROFFICE MEMORANDUM

DATE October 28, 1964

SUBJECT New Technician Training Course - Starting Monday, November 2, 1964

TO

FROM Bob Lassen

cc: K. H. Olsen
✓ H. E. Anderson
R. Best
W. Hindle

Because of the critical company-wide need to step up the training of our new and inexperienced technicians, DEC has established a full time accelerated training course.

The purpose of the course is to prepare inexperienced technicians, who have the equivalent of 2 years advanced electronic schooling, for production job assignments throughout the company as quickly and as effectively as possible. The course is designed primarily for newly hired people. However, qualified and deserving technicians may be selected from within, provided they have the necessary technical qualifications and provided they have not already had equivalent digital electronic training. Employees will be selected from within only after they have been tested and interviewed.

Classes will be held in the training area in building 3 on Monday through Friday from 8:15 A.M. to 5:00 P.M., and will continue on a full time basis for approximately two months.

The first class will start on Monday, November 2, 1964.

This is our first comprehensive technical training effort and if the "pilot course" proves to be productive, we will conduct these classes four times a year. Course standards will be high and each student will be expected to maintain these standards.

If you wish to recommend a technician whom you feel meets the necessary pre-requisites, please contact me and I will arrange for their technical interview and testing.

NEW TECHNICIAN TRAINING COURSE OUTLINE

Circuits

Numbering Systems

Logic (Boolean)

Test Equipment

DEC Symbols and Prints

Gating

Flip-Flops

Registers

Timing and Synchronization

Counters

Arithmetic Operations

Core Memory

Drums and Disks

A/D and D/A

Card Readers

Displays

Line Printers and Plotters

H Anderson

INTEROFFICE MEMORANDUM

DATE October 28, 1964

SUBJECT

TO G. Rice
H. Anderson
N. Mazzarese
R. Lane
F. Fortin

FROM Arthur Hall

On 10-23-64 and 10-24-64 DEC made a very rough test of a PDP-6 at Acton Labs. in order to estimate whether or not the computer will meet the specifications of MIL-I-6181D, a radio frequency interference specification.

CONCLUSION: The PDP-6 almost certainly meets the requirements of MIL-I-6181D/ MIL-I-26600.

Before the test was started it was known that certification of success or failure was not possible because:

1) The computer selected for test was not functioning properly and did not have a paper tape punch installed. (Therefore all modes of operation could not be tested.)

2) Equipment available at Acton Labs. closely approaches but does not quite reach the top frequency required in the specification.

It was also understood at the time of the test that there would not be time to complete all the tests.

There are 4 major equipment classifications mentioned in these mil. specs. From the language used in the Class descriptions it is not clear whether or not the PDP-6's Saunders Assoc. are interested in fall under Class I or Class II. Class I provides for radiated RFI to be measured at 1 ft. while Class II provides for measurement at 25 ft.

The PDP-1 and PDP-4 tested previously as well as the PDP-6 just tested fail to meet the provisions of Class I. It is not possible to administer the Class II tests because the screen room is not large enough to put an antenna more than about 2 ft. from the computer.

On the basis of interpolation from preliminary data I believe that all the computers tested up to now will meet the requirements of MIL-I-6181D/MIL-I-26600 if the equipment is judged to belong in Class II. (I will have better, but not conclusive data early next week.)

AH/mro

INTEROFFICE MEMORANDUM

DATE October 29, 1964

SUBJECT

TO K. H. Olsen
H. Anderson
N. Mazzarese
G. Rice
E. De Castro
J. Fadiman
R. Wilson
R. Lane
G. Belden
G. Bell
R. L. Best
R. Hughes

FROM Arthur Hall

Recent general interest in Radio Frequency Interference testing prompts this memo which gives an idea of the general labor and dollar outlay necessary if DEC were to undertake this testing.

Provisions for Testing Computer Equipment per MIL-I-26600

Below are some notes on equipment and measures necessary to qualify equipment under MIL-I-26600. (The number before each paragraph is the MIL-I-26600 paragraph reference.)

4.1.3	"A test report conforming to MIL-T-9107 shall be submitted to the procuring activity prior to submission of the preproduction model for acceptance."
4.1.4.1	Interference measuring equipment will be calibrated periodically with laboratory generators.
4.1.7	"A minimum of three measurements shall be made in each frequency octave."
4.1.9	A power line stabilization network shall be inserted in each ungrounded power supply lead.
4.2.1	Ambient interference level during testing should be at least 6 db below the allowable specified interference limit.
4.2.2	Equipment to be tested must be on a copper or brass ground plane and must, if it is not in a screen room, rest on a large metal support plane.
4.2.5.2	Power cables from the equipment under test shall be 24 ± 1 inch between the equipment bay and the line stabilization network.
4.2.5.2.1	Interconnecting leads between bays not connected together will be 3.5 ± 1.5 ft. long.
4.2.8	"The equipment under test shall be loaded with the full mechanical and electrical, or equivalent load, for which it is designed."
4.3.2	"Radiated interference fields in excess of the values given in figures 6, 7, 8 and 9 shall not radiate from any unit, cable, ..., or interconnecting wiring over the frequency range of 150 KC to 10 gc for CW and pulsed CW interference and 150 KC to 400 MC for broadband inpulsive interference."

Xerox copies of MIL-I-6181D (which refers only to electronic equipment intended for installation in manned aircraft) and MIL-I-26600 are available from Arthur Hall.

Subject: RFI Testing

RFI testing is generally accomplished in a screen room however it can be done in quiet areas away from flourescent lights, rotating electrical machinery, relay equipment or fast rise-time logic.

A quick survey revealed that we could not test at DEC (without a screen room) except probably in the center of Building 3 after DEC working hours.

Equipment costs known this date are shown on the following pages. The only three companies manufacturing wide range noise testing equipment (to the knowledge of a local testing lab.) are Empire Devices, Stoddart and Polarad. Polarad has declined to quote on equipment due to "prior committment."

Screen room or not, a large metal support for the equipment topped by a 12 sq. ft. copper or brass ground plane is required. Also necessary are the 50A power line stabilization network.

Test results are subject to a great deal of interpretation and it usually takes an experienced person to run the tests properly. (So said a representative of Empire Devices.)

Cost of Equipment to Test per MIL-I-26600

Empire Devices Equipment

A.	Frequency range 150kc to 1gc			
	Basic Instrument	BA-105		$1,980
	Tuners for various consec.	TA		1,500
	frequency ranges	T1		980
		T2		1,160
		T3		1,700
	Antenna kit 150kc to 30mc.	LM-105		335
	Antenna kit 20mc to 1gc.			720
	Switching unit			60
B.	Frequency range 1gc to 10gc.			
	Basic Instrument	BA-112		3,790
	Tuners for various consec.	T1	(1gc to 2gc)	2,790
	frequency ranges	T2	(2gc to 4gc)	2,790
		T3	(4gc to 7gc)	2,790
		T4	(7gc to 10gc)	2,790
			TOTAL	$23,385

Equipment can be rented for 20% of cost (1st month)
85% of rental may be applied to cost if purchased.

AH/mro

INTEROFFICE MEMORANDUM

DATE October 31, 1963

SUBJECT

TO K. Olsen
H. Anderson
N. Mazzarese
G. Rice
J. Koudela
R. L. Best
G. Bell
R. Maxcy
E.T. Johnson
E. DeCastro

FROM Arthur H. Hall

The following letter represents the formalization of decisions by persons mentioned above in either their private or committee capacities. It is to insure that there is general agreement on prices and specifications before formal quotation that this letter be circulated.

This letter will be mailed Wednesday, November 6th.

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

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

Dear Mr. Fine:

The current situation on magnetic drums is as follows:

Available as standard items:

Type 24E	(1800 rpm)	32,768 words	$36,200
Type 24F	(1800 rpm)	64,536 words	$38,680
Type 24G	(1800 rpm)	131,072 words	$43,400

Type 24E may be expanded in the field to #24F or #24G. Number 24F may be expanded in the field to #24G. Prices and approximate times below apply.

#24E field conversion to #24F	$2,288 plus about 25 hours*
#24E field conversion to #24G	$6,864 plus about 60 hours*
#24F field conversion to #24G	$4,576 plus about 40 hours*

Field installation charges may be applied at the discretion of DEC for in-house drum configuration changes due to changes by Foxboro in the purchase order.

Type 24E and #24F drums may be obtained in a smaller physical size allowing expansion only to 65,536 words maximum at the following prices.

Type 24E	(1800 rpm)	32,768 words	$33,600
Type 24F	(1800 rpm)	65,536 words	$36,280

#24E field conversion to #24F	$2,288 plus about 25 hours*

All drums mentioned above are available at no extra charge with a 3600 rpm motor. Drums above equipped with this motor would have one half of the word storage and the average access time would be divided by two.

All drums above are available in 18-bit configuration for PDP-4 and 11-bit configuration for PDP-5.

A new DEC offering is the Type 250 Drum for PDP-5. These drums are equivalent in features, access time, buffering, instruction etc. to the #24 except that they are in an 11-bit, 32,768 word maximum size.

Type 250A	(1800 rpm)	8,192 words	$18,800
Type 250B	(1800 rpm)	16,384 words	$19,500
Type 250C	(1800 rpm)	32,768 words	$21,500

#250A field conversion to #250B	$ 530 plus about 16 hours*
#250A field conversion to #250C	$1,674 plus about 18 hours*
#250B field conversion to #250C	$1,144 plus about 20 hours*

Discounts are available on #250 drums on exactly the same basis as for the #24 drum.

To confirm our telephone conversation, the estimated hours to install additional core memory modules (in the field) on PDP-4 computers ordered from now on are as follows:

First additional 4K	10 hours
Next additional 4K (incl. memory extension control)	20 hours**
Each additional 4K	10 hours

The details of the order numbers for PDP-4 Teleprinters (asked for by your office) are as follows:

Model 28KSR	Page Printer
Typing Unit	LP87RX/AGY
Keyboard	LK16ARK
Type Box	151930
Motor	LMU3
Console	LAC 203AB238
Gears	161295

Also offered at this time is the #141 Parity Checking Option for PDP-4 priced at $3,200 for the first 4K. This option may be included in the regular PDP-4 discount. The $3,200 price holds only if the option is included in the original computer order. Field installation is impractical and would be prohibitively expensive in both money and downtime. Price to include addition memory is $650 per each additional 4K.

The #141 Parity Checking Option adds parity bits as necessary on every memory store operation and checks parity on every memory retrieval operation. Odd parity is used. Parity errors would be indicated by a light on the operator console. The parity error flag (which turns the light on) is cleared by a "Begin" pulse or by an IOT. A parity error would cause an interrupt or not under control of a "Parity" switch on the Operator Console.

If you should require more details concerning the subjects mentioned above or about any other matters, I will be glad to help you.

Yours truly,

DIGITAL EQUIPMENT CORPORATION

Arthur H. Hall III
Computer Design Engineer

AHH/lal

* To be charged at DEC Maintenance Prices
** Presuming that the additional memory and extension control are mounted in a new bay and checked out at DEC before installation.

dec INTEROFFICE MEMORANDUM

DATE September 4, 1964

SUBJECT Notes on Production Goals for New Modules

TO Maynard Sandler
Harlan Anderson
Stan Olsen
Dick Best
Loren Prentice
Bob Hughes
Tom Stockebrand
Phil Backholm

FROM Kenneth H. Olsen

We have set some approximate production goals which we would like to achieve one or two years from now. This is so that when we purchase equipment and lay out space we'll have some basis to work from. We're not purchasing excessive equipment that will now produce these rates but when we can spend a little more money to obtain these rates we do it. While we're laying out space, we lay it out assuming that we'll later fill in the equipment to accomplish this.

We assume that at that time the modules will be paying about $10.00 a piece and to make the big effort worthwhile we should sell a million dollars a month. This will make 100,000 modules per month or, on a 20 day month, it will be 5,000 per day. If we assume 6 ceramic chips per module it is 30,000 per day, and if there are 20 diodes per module it is 100,000 diodes a day and with 5 transistors, it will be 15,000 transistors a day. In chart form it works out the following way:

	Modules	Ceramic Chips	Diodes	Transistors
Year	1.2 million	7.2 million	24 million	3.6
Month	100 thousand	600 thousand	2 million	300 thousand
Day	5 thousand	30 thousand	100 thousand	15 thousand
Wafers			200	30

This is assuming that we get 500 dice per wafer. This is a reasonable guess if the dice are 30 mils square. If the very bit of a 7/8 inch wafer were used, there is enough area to get 660 dice. There will be some rejects and the corners cut off the wafer and so 500 is probably a good number if we get a high yield. If we pay $5.00 for the basic wafer we have already invested a penny per dice. If we invest $10.00 in the wafer, the materials are two cents per dice. This is a high number considering we haven't started the process of the wafers as yet.

It is interesting to note that if we go from 30 mils square to 20 mils square we get 2.2 times as many dice out and if we go to 10 mils square we get 9 times as many dice. We want to make the chips as large as possible because mechanical handling is the big problem but if we ever get to using 24 million diodes per year, the cost of the material might be high enough to be worth more expensive handling equipment. For now, getting into production is the most important and we'd better use large dice.

There is, however, a way which we could have our cake and eat it too. We can put two diodes on one chip with a common cathode. This would be useful in the bulk of our fast diode applications. The R002, the R111 and the R141 all use diode pairs with common cathodes. In addition, the diode capacitor gate uses five diodes, four of which are pairs with common cathodes. If we do this, it would almost cut in half the number of diode dice we need.

For the non-planer forward biased diode, we might someday make this with integrated circuit techniques to get four in series on one chip with two terminals but for now we might use a similar technique like stacking four wafers together under pressure and heat so that they are thoroughly soldered together like plywood. We then saw them up or cut them out with an ultrasonic cutter and we can then drop them on our ceramic chip and we only have one unit to handle and only one lead to weld. For those applications where just two are needed, we can use the same technique.

Ken Olsen

KHO:ech

H. Anderson

INTEROFFICE MEMORANDUM

DATE September 4, 1964

SUBJECT Management Operational and Accounting Reports

TO Data Processing Committee FROM R. Mills

CC- Members of the Works Committee

Introduction

In considering the reports that would be required for managing, operating and accounting within the company, the objectives of these reports by area within the company have to be considered. This proposal attempts to view the entire reporting problem within the company as only then will we be able to accumulate and disseminate information which will result in the highest return on our investment and concomitantly the highest profits on our product line. I have blocked out a program in five phases as follows:

Phase 1 - To establish the tone of the program with stated objectives.
Phase 2 - An examination by area of the company requirements.
Phase 3 - A detailed program of reports by area of operation.
Phase 4 - A consideration of Phase 3 in the light of computerization vs. manual.
Phase 5 - The generation of these reports and the handling and interpretation and analysis by a report organization.

As will be seen in the following presentation, the basic areas of business flow within the company which are necessary to control 80% to 90% of our dollars are confined to few gross variables, but with the execution within each variable, in some cases quite intricate. From the generation of the order to interpretation into production figures, the accumulation of cost, raw material, direct labor and overhead, to eventual stocking in Finished Goods, out to the customer through Sales and billings, back from the customer Receivables in cash, is the basic framework with pricing, trends in cost, sales, etc. following on from these.

Types of Reports

Reports fall into three gross categories in order of importance as follows:

1. Action Reports

These are reports to all areas of the company which require action on the part of the Manager in order to correct, institute or expand areas of responsibility.

2. Status Reports

These reports fall in the area of forecasting and reporting of performance against established norms in order that the manager may know how he performs against what is hopefully a known bench-mark base.

3. Historical Reports

These reports are a reflection on past performance of the company used most often in predicting future costs or expected results from a given course of action, performance

of sales territories from one year to the next by customer, by branch, by state, etc. Values to be obtained from these are many if properly followed up.

In a general way, these reports could be disseminated to management, product line coordinators and first line supervisors.

Areas of Reporting

In considering the first major areas of reporting, I would like to discuss the following as a possible approach:

1. General Management
2. Sales
3. Finance and Accounting
4. Sales
5. Production
6. Engineering
7. Technical Publications
8. Administration
9. Purchasing

Control Areas within Functions

1. General Management

An initial list of happenings to be reported might be as follows:

Orders by product vs. Forecast
Production by product Forecast vs. Actual for Profit & Loss, Balance Sheet, Number of Employees, Inventories, Plant and Equipment, Cash Performance, Financing Requirements, Engineering Project Review, Product Line Performance, Return on Investment, Product Line to Product Review

2. Sales

Sales by Product
Branch, Customer, with emphasis on exception reporting of purchases between years to show customers who have not performed as well as previous years and those that have performed better.
Sales, high to low, primarily to give us an idea of how committed we are to our various customers.
The usual Renegotiation reports and Accounting Reports
Expenses by branch office
Subsidiary Operations
Forecast
Procedures

3. Finance and Accounting

This area will be dealt with in detail under phase 2 of our program, but for the moment these areas look like major ones to consider at this time:

General Accounting
Forecasting
Foreign Operations
Business Statistics
Cost Department
Accounts Payable
Accounts Receivable
Tab Operations
Project Reporting
Report Section

4. Production

Regular reporting of product production
Labor Usage
Material Usage
Overhead Costs, coordinated with pricing considerations
Purchase Requirements

would seem to be major areas of consideration. Inventory balance would be implied from requisition and purchase report considerations. I would like to discuss in some detail here under phase 2 the objectives of our reporting by level of supervision.

5. Engineering

The prime item in this area is control of projects with a secondary of employees and overhead expenses. I believe reports for forecast vs. actual by project with strong product line orientation, plus manpower requirements and a regular review will control the bulk of expenditure here. Details of this reporting procedure will be covered in Phase 2.

6. Technical Publications

Reporting of material purchases and accumulation of costs by jobs and overhead expenses with direct charges being made to projects with separate reporting for national advertising will pick up the bulk of expense in this area.

7. Administration

Since this area deals with the highest level of management, this in effect would be reporting of results by area of responsibility to top management. This would seem to involve a grouping of areas of reporting as mentioned above by individual senior manager for consideration by top management. This would include required summaries of cost centers by manager responsibility with correlations to products on a P & L basis.

8. Purchasing

I would like to discuss our reporting here by material purchased as it reflects the total dollars of annual purchases in order to assist them in regulating quantities

of purchase on those items which are undoubtedly the largest number of items but undoubtedly the lowest value in dollars so that those purchasing considerations come up infrequently. Reports of purchases by vendor, by type of product, with performance factors against required deliveries would seem to be prime considerations.

Required Analysis Work on Reports

I would like to discuss within the framework of (1) what has happened, (2) what is happening, (3) what could happen, on a current trend of an operation or happening which would be covered within a specific report, how much analysis work a manager would like to have done on the report before he receives it. If he would expect to receive a report with conclusions from operational results being drawn, this would call for a different approach to preparing the report.

Timing of Submission of Report Requirements

The following schedule is an attempt to place time factors for accomplishment of the five phases of this program in order to better schedule our departmental time:

Phase 1 - Objectives of program, September 11
Phase 2 - Examination by area, October 9
Phase 3 - Specific Repor ts by Area, October 30
Phase 4 - Computerization vs. Manual, November 20
Phase 5 - Report Organization, December 18

I believe this schedule is extremely tight as a limited number of people will be able to do this job, but with emphasis on the preparation on the departmental level, I believe we can come close to the schedule.

Computerization of Reports

Attached you will find schedules of required reports as currently constituted for the regular recording of happenings within the company, but does not include output reports.

Output repor ts will be taken care of in Phase 2 of this program.

Summary

I believe if we follow this program with the objective of generating as few reports as possible with emphasis on action reports within the context of controlling 80% to 90% of the company activity in a firm manner, that the remaining 10 to 20% which are expenditures of an almost stable percentage of departmental expenses, we will continue to make a high return and a high profit.

TO: DICK MILLS.

FROM: FRED MARTIN

REPORTS:	SOURCE DATA	PRODUCED BY	FREQUENCY	HOW USED:
1. COST OF GOODS SOLD (GOODS, COMPS. SYST.)	COST	GA	MONTHLY	PREPARATION OF FINANCIAL STATEMENTS
2. LOAN + CONSIGN. INV. STATUS.	COST	GA	"	" + MAINTAIN CONTROL OVER TAX STATUS
3. CONTRIBUTIONS WKS.	GA.		"	CALCULATION OF EMPLOYERS PAYROLL TAXES
4. YEAR-TO-DATE EXCESS RUNS	TAB	GA	"	TO DISTRIBUTE PAYROLL EXPENSES
5. PAYROLL DISTRIBUTION	GA		"	TO PREPARE JOURNAL ENTRIES, TO DIST. EXPS.
6. VOUCHER SUMMARY	TAB	GA	"	TO DETERMINE THE OVER OR UNDER A/ OH VARIANCE
7. OVERHEAD BY COST CENTER	TAB	GA.	"	TO PREPARE SCHEDULE FOR FINANCIAL STATEM'T.
8. OPERATING EXPENSES S. G. A.	TAB	GA.	"	TO PREPARE FINANCIAL STATEMENTS.
9. PRELIM. + FINAL TB'S.	TAB	GA.	"	TO PREPARE COMPARATIVE STATEM'TS
10. COMPANY FORECAST	FORECASTING	GA.	QUARTERLY	TO PREPARE PRODUCT LINE DISTRIBUTION AND COST OF SALES WKSTS.
11. SALES INVOICES	SALES	GA.	MONTHLY	TO JOURNAL REDUCTION OF RESERVE
12. WARRANTY USAGE + WRITE OFF	COST	GA.	"	
END OF SECTION I				
13. QUARTERLY FORECAST	FORECASTING		QUARTERLY	TO PREPARE P+L, BAL.SHT. + SUPPORTING SCHEDULES
14. COST CENTER REPORTS	TAB	FORECASTING	MONTHLY	TO COMPARE FORECAST VS ACTUAL
15. FORECAST VS ACTUAL SALES EXPERIENCE	SALES	FORECASTING	WEEKLY	TO " " " "

CONTINUED ON PG. 5

CONTINUED FROM PG. 3

REPORTS.	SOURCE DATA	PRODUCED BY:	FREQUENCY	HOW USED
16. SHORT TERM (3 MONTHS) CASH FORECAST	FORECASTING		QUARTERLY	CASH FLOW CONTROL
17. CASH FLOW ACTUAL VS FORECAST	FORECASTING	GA.	MONTHLY	FINANCIAL STATEMENTS

END OF SECTION II

18. ASSET REPORT	TAB	PROPERTY SECTION	MONTHLY	DEPRECIATION - PROPERTY CONTROL

END OF SECTION III

19. ACCOUNTS RECIEVABLE (BY INVOICE #)	TAB	A/R	WEEKLY	WEEKLY PROGRESS REPORT
20. ACCOUNTS RECIEVABLE (BY CUSTOMER)	TAB	A/R	WEEKLY	
21. CASH RECIEPTS + DISB.	TAB+A/R	A/R	WEEKLY	
22. SALES REGISTER FIGURES	A/R		WEEKLY	
23. NEW ORDERS, SHIPMENTS, BACKLOG.	TAB	A/R	WEEKLY	
24. FACTORY PRODUCTION	PROD. CONT.	A/R	WEEKLY	
25. FOREIGN STM'TS AND GOV. REPORTS	A/R		MONTHLY	FINANCIAL STATEMENTS
26. FED. GOV. MONTHLY AND QUARTERLY REPORT	TAB	A/R	MONTHLY	FILING 941's + FED DEP. RECIEPT.

END OF SECTION IV

	REPORTS	SOURCE DATA	PRODUCED BY	FREQUENCY	HOW USED.
27.	CHECK LOG - MODS. COMP. SYST.	TAB	BUS. STAT.	WEEKLY	AS A CONTROL AND RECONCILIATION CHECK
28.	SALES, NEW ORDERS BY CUSTOMER DOMESTIC, FOREIGN SALES OFFICE	TAB	BUS. STAT.	MONTHLY	PERFORMANCE CONTROL
29.	COST CENTER REPORTS ALL SALES OFFICES DOMESTIC + FOREIGN	TAB	BUS. STAT.	MONTHLY	PERFORMANCE CONTROL
	END OF SECTION V				
30.	ENGINEERING COST RECAP	TAB	COST	MONTHLY	TO RECORD IN GEN LEDGER + JOB LEDGER USAGE OF MAT. + LABOR + OVERHEAD
31.	MFG. COST RECAP	TAB	COST	"	CONTROLLER + PRODUCTION MANAGER.
32.	INVENTORY CHANGE SCH.	COST	COST	"	PRODUCTION CONTROL
33.	UNIT COST OF MFG. PTS.	TAB	COST	"	PROJECT MANAGER
34.	JOB COST ANALYSIS.	COST	COST	Request	REDUCTION OF RM. INVENTORY
35.	RAW MAT USAGE BY CLASS.	TAB	COST	MONTHLY	FINANCIAL STATEMENTS
36.	COST OF GOODS (MODULES)	TAB	COST	"	ALLOC. OF OPERATIONS EXPENSE
37.	COST JOURNAL	GA	COST	"	RES. RELIEF + C.R. INFORMATION
38.	FIELD SERVICE RECAP.	TAB	COST	"	STANDARDS PERFORMANCE + INPUT TO W.I.P.
39	STAND. COST VARIANCE	COST	COST	"	

REPORTS	SOURCE DATA	PRODUCED BY	FREQUENCY	HOW USED
10. COMPARATIVE OH. RATE SUMMARY	COST	COST	QUARTERLY	COMPARISON & CONTROL OF OH RATES.
4. PRICING FORMS.	COST	COST	REQUEST	COST EST. TO MFG. SPECIFIC PROD.
12. SPARE PARTS PRICE LIST	COST	COST.	4 months	SUGGESTED SELLING PRICES
13. PURCHASE PRICE VAR.	COST	COST	monthly	CONTROLLER - PRODUCTION MNG. - PUR. AGT.
2. SCHEDULES TO SUPPORT THE MATS. + LABOR FLOW FOR 3 MONTHS OPERATIONS.	TAB	COST	MONTHLY	ENG. + MFG. COST RECAPS.

END OF SECTION VI

H. Anderson

dec INTEROFFICE MEMORANDUM

DATE September 4, 1964

SUBJECT Project MAC - MIT

TO Tom Whalen FROM Bob Lane

Project MAC - MIT presently has a PDP-1 consisting of the following items:

1. Processor with 16K Memory	160,000.
2. CRT Display, Type 30H	14,300.
a. Symbol Generator 33	4,900.
b. Intensity Feature	250.
3. Light Pen, Type 32	1,300.
4. Data Control, Type 131	10,500.
5. High Speed Channel Control, Type 19	9,000.
6. Micro Tape Control Unit, Type 550	9,400.
7. Micro Tape Unit, Type 555	7,400.
Total	217,050.

They are trading the above system for a PDP-6 configuration consisting of the following:

1. Arithmetic Processor, Type 166-626	146,100.
2. Data Control, Type 136	10,000.
3. Micro Tape Control Unit	14,000.
4. Dual Micro Tape Unit	7,400.
5. Memory, Type 162	30,000.
6. Memory, Type 163C	126,000.
7. Display, Type 346 less char. generator	32,300.
8. Paper Tape Reader	9,000.
9. Paper Tape Punch	3,500.
	380,300.

As you can see, the net difference is:

380,300.
217,000.
163,250.

Their purchase order number 16284 dated 8-26-64 is for $8,800.00 and covers items 1, 4, 5, & 6 of the PDP-1 and items 1, 2, 3, 8, & 9 from the PDP-6 list, plus a special interface for the Type 30H Scope to the PDP-6 @ (3,100).

i.e.	PDP-1	PDP-6
	$160,000	$146,100
	10,500	10,000
	9,000	14,000
	9,400	9,000
	$188,900	5,500
		$184,600

There was a $10,000 error in the HEA memo dated March 20, 1964 which quoted PDP-6, Item 1 at $156,100. I corrected this, but too late to get into their last year's budget.

In summary:

$194,600	=	184,600 + 10,000 error
-188,900		
$ 5,700		
+ 3,100		Special Interface to 30H
$ 8,800		Current P.O. Amount

Now R. Mills has requested funds to purchase additional equipment, namely: Items 5, 6, & 7 from the PDP-6 list. Also we have agreed to accept as trade items 2, 2a, 2b & 3 from the PDP-1 list.

i.e.:

PDP-1		PDP-6	
	14,300		30,000
	4,900		126,000
	250		32,300
	1,300		188,300
	20,750		

Also, since they are trading in their PDP-1, 30H Scope they will not have any requirements for the adapter covered on their P.O. # 16284 dated 8-26-64 (3,100.).

Consequently, there next P.O. which R. Mills will be preparing after he returns from vacation and after he secures the necessary approvals is:

+ 188,300	Add'l items
- 20,750	Trade PDP-1 Scope (30H)
167,550	
- 10,000	error correction
157,550	
- 3,100	
154,450	Net total of new Purchase Order

Alan Kotok and I have requested a meeting with R. Mills upon his return to discuss this P.O., advise him of the lateness of the PDP-6 and to assist him in site preparation criteria.

CC: Bob Beckman
H. Anderson
A. Kotok
R. Mills
J. Shields

INTEROFFICE MEMORANDUM

DATE September 4, 1964

SUBJECT BIWEEKLY REPORTS

TO

FROM Jack Atwood

K. Olsen	D. Denniston	K. Larsen
H. Anderson	J. Burley	J. Jones
S. Olsen	E. Harwood	P. Greene
R. Best	G. Huewe	R. Oakley
H. Crouse	L. Prentice	R. Colman
J. Fadiman	G. Bell	G. Rice
T. Johnson	R. Mills	D. Henderson
R. Hughes	R. Savell	T. Quinn
M. Sandler	W. Hindle	R. Lindsay
R. Beckman	N. Mazzarese	J. Leng
D. White	D. Doyle	R. Smart

The Biweekly Report is dead.

Its demise was due partly to its displacement as a communications medium by the Engineering and Sales Newsletters and partly to the fact that contributions to the Biweekly were voluntary.

The question to decide is whether the newsletters can now meet our information needs or whether we should have a replacement for the Biweekly.

If we attempt a new type of report, one thing seems obvious. Those who agree to contribute must do so on a regular basis - not just when the spirit moves.

Will you tell me on the accompanying questionnaire how you feel. I would like your reply by Friday, September 11th, so that the results can be summarized for the Works Committee.

J.L.A.

fjd

Please complete and return to Jack Atwood, Tech Pubs, by Friday, September 11th.

I feel that our internal communications needs:

☐ Can be satisfied by the Sales and Engineering Newsletters.

☐ Cannot be satisfied unless we have a replacement for the Biweekly Report.

Note: If you think we need a new type of report, please answer the following additional questions.

I think the report should include:

☐ Information on activities or developments of general interest from each department, field office and subsidiary.

☐ Summaries of decisions reached at meetings of the various operating committees.

☐ Other _____

_____

_____

_____

I do not think the report should include:

_____

_____

_____

_____

Please complete and return to Jack Atwood, Tech Pubs, by Friday, September 11th.

I feel that our internal communications needs:

☐ Can be satisfied by the Sales and Engineering Newsletters.

☐ Cannot be satisfied unless we have a replacement for the Biweekly Report.

Note: If you think we need a new type of report, please answer the following additional questions.

I think the report should include:

☐ Information on activities or developments of general interest from each department, field office and subsidiary.

☐ Summaries of decisions reached at meetings of the various operating committees.

☐ Other _____

_____

_____

_____

I do not think the report should include:

_____

_____

_____

_____

I feel the report should be issued:

☐ Every other week ☐ Every week ☐ Once a month

I would be willing to provide a contribution to each issue of the report.

☐ Yes ☐ No

I would also ask the following people in my group to contribute to the report on a regular basis (R) or periodically (P):

Name	R	P	Name	R	P
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐

I would probably route my copies of the report to the following people in my group:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Signed_____

dec INTEROFFICE MEMORANDUM

DATE September 4, 1964

SUBJECT MIT Project on Computer-Generated Music.

TO Win Hindle
H. Anderson ✓

FROM Bob Lane

This has been dormant for several weeks now!

Do we take next action?

Could this be part of our comp. center plans?

Please advise!

dec INTEROFFICE MEMORANDUM

DATE September 8, 1964

SUBJECT FORTRAN Demonstrations

TO R. Lane
G. Moore
H. Anderson
N. Mazzarese

FROM R. P. Harris

The present status of the FORTRAN compiler for PDP-6 is as follows:

(1) Although it has some bugs, a compilation may take place with input from either paper tape or punched cards and output in symbolic language either on paper tape or line printer. It does not seem to be foolproof enough to try without Peter Samson around to smooth things over.

(2) The assembler to translate compiler output to binary machine language is not written. The symbolic tapes produced by the compiler may be assembled in three passes by a version of the MACRO-6 Assembler, however, several of the statements such as COMMON as of now cannot be dealt with by this assembler. The I/O system for FORTRAN is also not in a useable state.

A simple conclusion from these facts is that customer FORTRAN programs may not be compiled and run on PDP-6. The programming department informs me that this is from two to three months away.

To alleviate the pressures being put on us by customers to see FORTRAN running on the PDP-6, I make the following suggestions:

(1) Peter Samson supply the Sales Dept. with a copy of the compiler that will list the symbolic output on the line printer with a reasonably good reliability. This will allow customers at least a look at the kind of code the compiler is going to produce with their programs. (This has been done with reasonable success with Brookhaven).

(2) Clark Frazier and Bill Segal have said they will prepare for me a simple FORTRAN program that detours all the pitfalls of the present system and will be able to compile and run. I suggest they go ahead and do this to use as a "stock demo" until the system is useable.

(3) That as much effort as possible be exerted into having a useable FORTRAN in less time than two months. (We have promised systems with FORTRAN before then).

dec INTEROFFICE MEMORANDUM

DATE September 8, 1964

SUBJECT FORTRAN Demonstrations

TO R. Lane
G. Moore
H. Anderson
N. Mazzarese

FROM R. P. Harris

The present status of the FORTRAN compiler for PDP-6 is as follows:

(1) Although it has some bugs, a compilation may take place with input from either paper tape or punched cards and output in symbolic language either on paper tape or line printer. It does not seem to be foolproof enough to try without Peter Samson around to smooth things over.

(2) The assembler to translate compiler output to binary machine language is not written. The symbolic tapes produced by the compiler may be assembled in three passes by a version of the MACRO-6 Assembler, however, several of the statements such as COMMON as of now cannot be dealt with by this assembler. The I/O system for FORTRAN is also not in a useable state.

A simple conclusion from these facts is that customer FORTRAN programs may not be compiled and run on PDP-6. The programming department informs me that this is from two to three months away.

To alleviate the pressures being put on us by customers to see FORTRAN running on the PDP-6, I make the following suggestions:

(1) Peter Samson supply the Sales Dept. with a copy of the compiler that will list the symbolic output on the line printer with a reasonably good reliability. This will allow customers at least a look at the kind of code the compiler is going to produce with their programs. (This has been done with reasonable success with Brookhaven).

(2) Clark Frazier and Bill Segal have said they will prepare for me a simple FORTRAN program that detours all the pitfalls of the present system and will be able to compile and run. I suggest they go ahead and do this to use as a "stock demo" until the system is useable.

(3) That as much effort as possible be exerted into having a useable FORTRAN in less time than two months. (We have promised systems with FORTRAN before then).

INTEROFFICE MEMORANDUM

SUBJECT 40th Meeting Of The Test Equipment Committee

DATE September 8, 1964

TO Richard L. Best

FROM Russell Doane

Members of the Committee:

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

1. Jim Cudmore asked Dick Tringale and Steve Lambert about shareing the 555 between them. Dick is happy without it.

2. We decided to order 10 Hewlett-Packard 110A current probes, at $100 each, to make it possible for field service and other potential users to get more benefit from our Hewlett-Packard 175A oscilloscopes. These have been received.

3. Bill Titelbaum will order 3 scope carts.

4. We ordered, and have received, two type 581 oscilloscopes with type 82 plug-in units; 1 for Ed Harwood's group, and 1 for Ron Wilson on the PDP-7. A third was freed for Ed Harwood by Field Service's purchase of 8 Fairchild 50mc 'scopes.

5. We have ordered 2 type 1A1 general purpose high gain fast dual trace plug-in units to offer dual trace operation and special characteristics superior to Tektronix types, D, E, G, & H. We have 10 oscilloscopes, at present, with delaying sweep. For the future, we decided to convert Hewlett-Packard 175A's to the delaying sweep, to fulfill future needs for oscilloscopes with this feature.

6. Bill Titelbaum will publish, in Engineering News, a list of expendable items that Test Equipment Service will keep in stock for the use of engineers and technicians with oscilloscopes.

7. Further refinement of plans to collect data on temperature and time drift with metal film resistors in oscilloscopes was established.

8. We have received requests to buy thermometers and Variacs. Bill Titelbaum will write, in the engineering news, a list of advantages that the Simpson thermo-meter has over glass thermometers, so that potential users will not be getting along with inferior test equipment, when they could be using the best.

The next meeting of the committee will be on Friday, September 11, at 1:30 P.M., in Bob Hughes' office.

dec INTEROFFICE MEMORANDUM

DATE September 8, 1964

SUBJECT Standard Module Production

TO Harlan Anderson
Maynard Sandler

FROM Dave Packer

The Works Committee decision on standard module production was referred to us for a proposal. My recommendations follow.

Recommendations

1. 10 weeks of inventory: I suggest we immediately begin to reduce our module inventory for customer orders to ten weeks of average orders. The reduction of inventory should occur over a six month period.

   In terms of the module production decision rule, this recommendation means changing inventory desired for customer orders from 20 weeks of demand to 10 weeks of demand. Inventory desired for internal orders should remain at 4 weeks of demand.

2. Use of sales forecast: The rule in operation is based on a past average order rate (which, implicitly, is our best estimate of future demand). The rule will not respond quickly to large changes in demand. Now, after the introduction of the new module line, we expect a substantial decrease in demand for standard modules. We should incorporate this expectation in the rule by using a forecast of future order rate instead of an average of past order rate. I suggest using the average weekly order rate forecast for the next 4 months instead of the average order rate for the past 4 months in the rule.

   The forecast should be used for both customer and internal module orders.

Implementation

As before, target production should be computed weekly. The target figure should be used as the basis for production planning.

Information requirements and sources are:

1. Forecast of customer orders: A month by month forecast of standard module orders for a 12 month period should be made monthly by Module Sales.

2. Forecast of internal orders: A month by month forecast of internal standard module requirements for a 12 month period should be made monthly by Computer Sales and Sub System Assembly.

New Rule

Target Production (units/week) =

Average order rate forecast* (units/week)

$$+ \quad \overbrace{\text{(1/24 weeks)}}^{\text{Adjustment Period}} \; \overbrace{\text{(10 weeks)}\left(\frac{\text{Customer order}}{\text{rate forecast}}\right) + \text{(4 weeks)}\left(\frac{\text{Internal order}}{\text{rate forecast}}\right)}^{\text{Inventory Desired}}$$

$$- \quad \overbrace{\text{(Actual Finished Goods and Test Inventory)}}^{\text{Inventory Actual}} - \overbrace{\text{(3 weeks)}\left(\frac{\text{Average Order}}{\text{rate forecast}}\right)}^{\text{Backlog Desired}}$$

$$+ \quad \overbrace{\text{(Actual order backlog)}}^{\text{Backlog Actual}}$$

*Sum of customer and internal forecast over next 16 week period.

KEA

dec INTEROFFICE MEMORANDUM

DATE September 10, 1964

SUBJECT Initiation of Engineering Projects

TO Dick Best
Jim Hastings
Win Hindle
Harlan Anderson ✓

FROM David W. Packer

This memo proposes a mechanism for initiating, changing, and deleting engineering projects within the company. The scheme presented here is, in fact, currently followed in most cases now. It aims, however, at insuring that:

a) new projects receive adequate consideration

b) product line coordinators are brought into project decisions

c) the data processing system received adequate information to accumulate and report costs properly.

Project Support

A fundamental concept of the company's product line orientation is that all engineering projects should be "supported" by product lines. "Supported" means that product lines agree to have the costs charged against their development account before the costs are actually incurred. For projects that affect only one product line, gaining support entails only the product line coordinator's agreement that the project is worthwhile. For projects that affect several product lines (less than 15% of the total), an agreeable support arrangement should be negotiated among the project leader and the product lines coordinator involved. It seems desirable that the negotiation process be an informal one. Should the support negotiations prove fruitless, the appropriate Guidance Committee should make the support arrangement decision (or veto the project).

It is, of course, both desirable and proper that some projects should be undertaken that benefit no existing product lines. Such projects can be considered and approved by the Guidance Committees (if small), or the Works Committee (if large).

Formality

Only two written documents appear to be desirable. They are:

1. A proposal, prepared by the project leader and filed in the engineering department, giving:

   a) verbal description of project and potentials (what and why)

b) a schedule (per the new engineering scheduling system)

c) a cost forecast.

2. A report to accounting after the project has been accepted, giving:

a) a project name, leader, and number

b) total cost forecast

c) monthly cost forecasts for the fiscal year

d) details on other forecasts affected, if any.

A second formality recommended is final consideration of all new projects by either a Guidance Committee (for small projects) or the Works Committee (for large projects). Definition of "large" and "small" is purposely left vague.

Steps in Originating a New Project or Changing an Existing Project

1. Develop proposal.
2. Discuss with the chief engineer.
3. Recommend product line support (% of costs to be borne by each product line).
4. Send proposal and support recommendations to relevant product line coordinators.
5. Revise support arrangements if necessary.
6. Get approval for expenditures from:
   a. Guidance Committee if a small project
   b. Works Committee if a large project.
7. Give cost forecasts and project description to Jim Hastings, who will assign a number and relay information to accounting.

Steps in Discontinuing an Existing Project

1. Discuss with chief engineer.
2. Notify product line coordinator.
3. Notify Jim Hastings, who will close number and relay information to accounting.

DWP :ncs

Dave Packer

DEC INTEROFFICE MEMORANDUM

DATE September 10, 1964

SUBJECT PDP-6 Program Status

TO H.R. Morse, N. Hirst, L. Hantman, B. Segal, S. Ogard, D. Watt, T. Eggers, P. Samson, S. Piner, C. Frazier, D. Witcraft, H. Hyman

FROM Larry Portner

Copy to: H. Anderson

A meeting has been scheduled for Friday, September 11, at 11 a.m. in Conference Room A, Building 12.

The purpose of this meeting is to discuss the status of the PDP-6 Programs.

LP:tw

dec INTEROFFICE MEMORANDUM

DATE September 10, 1964

SUBJECT SYSTEMS SPECIFICATIONS

TO ALL PDP-6 PROGRAMMERS
Harlan Anderson

FROM L. Portner, N. Hirst

It is now imperative that we make a detailed specification of the system. To this end we must have, by Wednesday, Sept. 16, the following documents from all programmers:

1. A list of all programs written, and being written.

2. For each program we need:

   a. A description of its function.

   b. Flow chart (as detailed as possible).

   c. How to use the programs (linkage, etc.)

   d. Inputs to the Program.

   e. Outputs from the Program.

   f. Other interface requirements--if there are some.

   g. Data formats

   h. Record layouts

   i. Storage requirements

   j. Other programs required for it to operate.

   k. Status.

   l. When it will be done.

   m. etc.

Painful though it may be, your cooperation is absolutely necessary and will be appreciated.

lw

FORTRAN BUILT-IN FUNCTIONS (SINGLE PRECISION)

FUNCTION NAME	INTRINSIC FUNCTION	DEFINITION	NUMBER OF ARGUMENTS	MODE OF ARGUMENTS	MODE OF FUNCTION	RESTRICTIONS
XABSF ABSF	Absolute Value	$\|a\|$	1	INTEGER FLOATING	INTEGER FLOATING	None
XINTF INTF	Truncation	Sign of a times largest integer $\leq \|a\|$	1	FLOATING FLOATING	INTEGER FLOATING	$\|a\| < 2^{34}$ a Normalized
XMODF MODF	Remaindering	$a_1 (\text{Mod } a_2)^1$	2	INTEGER FLOATING	INTEGER FLOATING	None $\|a_1 / a_2\| < 2^{27}$
XMAXØF XMAX1F MAXØF MAX1F	Choosing largest value	$MAX(a_1, a_2, \ldots)$	≥ 2	INTEGER FLOATING INTEGER FLOATING	INTEGER INTEGER FLOATING FLOATING	None
XMINØF XMIN1F MINØF MIN1F	Choosing smallest value	$MIN(a_1, a_2, \ldots)$	≥ 2	INTEGER FLOATING INTEGER FLOATING	INTEGER INTEGER FLOATING FLOATING	None
FLOATF	Float	Convert to Integer (largest integer $\leq a$)	1	INTEGER	FLOATING	None
XFIXF	Fix	Conversion from INTEGER to FLOATING	1	FLOATING	INTEGER	None

6-MP FT2-DEC BUILT IN FUNCTIONS-GS-PRE. 1

FUNCTION NAME	INTRINSIC FUNCTION	DEFINITION	NUMBER OF ARGUMENTS	MODE OF ARGUMENTS	MODE OF FUNCTION	RESTRICTIONS
XSIGNF SIGNF	Transfer of Sign	Sign of a_2 times $\|a_1\|$	2 2	INTEGER [2] FLOATING [2]	INTEGER FLOATING	None
XDIMF DIMF	Positive Difference	$MAX(a_1-a_2, \phi)$	2	INTEGER FLOATING	INTEGER FLOATING	None

[1] NOTE: The function MODF or XMODF(A_1,A_2) is defined as $a_1 - [a_1/a_2]$ where $[X]$ is the greatest integer in $|a_1|$ times the sign of a_1.

[2] The mode of the second argument of SIGNF, XSIGNF may be INTEGER or FLOATING.

DIGITAL MAYN

DIGITAL EQLA

Andy, This was read to Nick on the phone (he's at home today) - he asked that you see it. N.

MSG. NO. LA-1954

9/10/64

TO: NICK MAZZARESE

FROM: BOB STIVER

SUBJECT: RAND CORP, JIM TUPAC

SAYS THE WHOLE PROJECT IS IN THE HANDS OF THE U.S.A.F. IN WASHINGTON, AND IT MAY BE 2-3 WEEKS BEFORE ANYTHING MORE IS KNOWN. THEY REALIZE ANOTHER MONTH SLIP IN DELIVERY IS EMINENT, BUT WILL JUST HAVE TO BE SATISFIED WITH WHATEVER WE CAN DO. HE APPRECIATES OUR DESIRE TO PROVIDE THEM WITH A SYSTEM ON THEIR ORIGINAL TIME TABLE, BUT THERE IS JUST NO WAY FOR THEM TO ISSUE ANY FURTHER PAPER WORK.

H. Anderson

INTEROFFICE MEMORANDUM

DATE 14 September 1964

SUBJECT Spare Unit Prices

TO Works Committee

FROM Don Smith

Pricing of Spare Units has been and still is, determined on an emotional basis. The purpose of this presentation is to form a concise pattern of determining Spare Unit Prices.

Unfortunately, this method uses one emotional decision, however, once the decision is made it is not required again for a unit. That decision is mark-up.

The method is as follows:

1. Obtain the Unit Cost to DEC (A).
2. Determine the mark-up to cover various charges (B).
3. Determine the Unit Price (mark-up times the Unit Cost, AxB) C.
4. Determine the Special Handling Price by totaling all modifications to the unit so that it is self contained as a spare D.
5. Determine the Spare Unit Price (add the Special Handling Price to the Unit Price, C+D) E.
6. Determine the Option Price (add the Spare Unit Price to the Control Price, E+F) G.

Attached are pages which may be filled in. Arbitrary Unit mark-up values have been suggested, however, a space is available under each if a different value is required.

Attached also, is a sample option sheet for the PDP-5.

If the unit mark-up (B) and thus the Unit Price (C) can be determined by the committee, the option sheet can easily be completed by the designing engineer.

COMPANY CONFIDENTIAL

I		DEC Unit Cost A	DEC Unit Mark-up B	DEC Unit Price C
1	Teletype Corporation			
	Model 28 RO Sprocket Feed	956.59	1.829	1750.00
	" " " " "	956.59		
	" " KSR " "	1097.65	1.822	2000.00
	" " " " "	1097.65		
	" " ASR " "	2081.00	1.780	3700.00
	" " " " "	2081.00		
	" 32 RO Friction Feed	381.00	1.968	750.00
	" " " " "	381.00		
	" " KSR (TG) " "	404.00	1.980	800.00
	" " " " " "	404.00		
	" " ASR (TH) " "	578.00	1.903	1100.00
	" " " " " "	578.00		
	" 33 RO (TB) " "	423.00	1.950	825.00
	" " " " " "	423.00		
	" " KSR (TA) " "	460.00	1.956	900.00
	" " " " " "	460.00		
	" " ASR (TC) " "	652.00	1.84	1200.00
	" " " " " "	652.00		
	" 35 RO (AV) Sprocket Feed	1187.00	1.811	2150.00
	" " " " " "	1187.00		
	" 35 KSR (AP) " "	1386.00	1.803	2500.00
	" " " " " "	1386.00		
	" " ASR (AS) " "	2223.00	1.799	4000.00
	" " " " " "	2223.00		
	BRPE-11 PUNCH	717.80	2.020	1450.00
	" " "	717.80		
2	Soroban			
	Typewriter IETC - 777-878	1910.25	1.989	3800.00
	" " " " "	1910.25		
3	Digitronics			
	Model 2500 paper tape reader	769.80	2.014	1550.00
	" " " " "	769.80		
	" 3500 " " "	2145.00	2.005	4300.00
	" " " " "	2145.00		

	DEC Unit Cost A	DEC Unit Mark-up B	DEC Unit price C
4 Potter Instrument Company			
Model M 906 II Tape Trans. 60 cycle	7475.00	2.006	15,000.00
" " " " " " " "	7475.00		
" " " " " " 50 "	7495.00	2.001	15,000.00
" " " " " " " "	7495.00		
5 Midwestern			
Tape Transport	8312.00	1.985	16,500.00
" "	8312.00		
6 Anelex			
Series 5			
Fio - DEC or ASC II Characters			
50 - 60 cycle operation			
Digital levels interface			
Includes buffer			
300 lines/ minute	15,500.00	2.000	31,000.00
" " "	15,500.00		
1250 lines/minute (1000 LPM)	25,260.00	1.999	50,500.00
" " "	25,260.00		
600 lines/minute	17,975.00	1.947	35,000.00
" " "	17,975.00		
7 Burroughs			
Model B-122 200 cards/minute	6,095.00	1.969	12,000.00
" " " " "	6,095.00		
Model B-124 800 cards/minute	11,900.00	1.933	23,000.00
" " " " "	11,900.00		
8 Teckronics			
Model RM 503 display	655.00	1.984	1,300.00
" " " "	655.00		
" " 564 "	1,388.40	1.998	2,775.00
" " " "	1,388.40		

	DEC Unit Cost A	DEC Unit Mark-up B	DEC Unit Price C
9 Calcomp Plotters			
Model 563			
29½", 12,000 steps/min, step .01"	8000.00	2.000	16,000.00
" " " " " "	8000.00		
Model 564			
29½", 18,000 steps/min, step .005"	9650.00	1.968	19,000.00
" " " " " "	9650.00		
Model 565			
11", 18,000 steps/min, step .01"	4550.00	1.978	9000.00
" " " " " "	4550.00		
rack mounted	5050.00	1.980	10,000.00
" "	5050.00		
Model 566			
11", 18,000 steps/min, step .005"	4950.00	2.020	10,000.00
" " " " " "	4950.00		
rack mounted	5450.00	2.018	11,000.00
" "	5450.00		
10 Vermont Research			
10" Drum, 320 track capacity	3500.00	3.0	10,500.00
" " " " "	3500.00		
1750 RPM, maximum of 8 Bars			
Bar (holds 5 Pads)	100.00	3.0	300.00
" " " "	100.00		
Pad (heads for 8 tracks)	224.00	3.0	672.00
" " " " "	224.00		
20" Drum, 896 track capacity	7500.00	3.0	22,500.00
" " " " "	7500.00		
1750 RPM, maximum of 8 Bars			
Bar (holds 14 pads)	300.00	3.0	900.00
" " " "	300.00		
Pad (heads for 8 tracks)	224.00	3.0	672.00
" " " " "	224.00		

IV	DEC Unit Cost A	DEC Unit Mark-up B	DEC Unit price C
Monroe			
Model 1046			
16 column line printer	2290.00	1.965	4500.00
" " " "	2290.00		
IBM			
Selectric in/out	1350.00	2.000	2700.00
" "	1350.00		
a. 24V DC coil	55.00	2.000	110.00
" " " "	55.00		
b. excise tax	84.30		
Burroughs Card Punch			
100 CPM	15,000.00	2.000	30,000.00
100 CPM	15,000.00		
300 CPM	25,000.00	2.000	50,000.00
300 CPM	25,000.00		
A to D Converters		1.5	

OPTION TYPE	C DEC Unit Price	D DEC Special Handling Price	E DEC Spare Unit Price	F DEC Control Price	G DEC Option Price
Console					
ASR 33					
Drum					
250A					18,800.
250B					19,500.
250C					21,500.
Paper Tape Reader					
750					3,500.
Paper Tape Punch					
75A					4,000.
Card Reader					
200 CPM 451A					14,900.
800 CPM 451B					25,600.
Display					
34B 503				3,060.	3,900.
34B 564				3,060.	4,840.
Line Printer					
300 LPM 64					28,900.
Incremental Plotter					
563					13,400.
564					15,500.
565					8,900.
566					9,300.
Tape transport					
50			18,000.	—	18,000.

Suggested Spare Unit Pricing Method

A. The DEC Unit Price contains all of the following changes for the unit only.

1. Handling
2. Ordering
3. Check-out
4. 6 month maintenance warranty
5. Standard manual and prints
6. Investigation
7. Stocking

B. The following charges are not to be included in the DEC Unit Price:

1. Any modifications
2. Write-up for modifications
3. Special adapters
4. System diagnostics
5. Special handling
6. Installation

C. Option interfacing engineering charges are to be added to interfacing hardware (Special Handling Price or Control Price) and not to the unit cost.

D. The spare unit price represents the point where the spare may be most easily interchanged with the original. This price will vary for different computers. The price includes the following charges (Special Handling Price):

1. Modifications to basic unit
2. Write-ups for modifications
3. Special Adapters

E. The spare unit price is determined by adding DEC Unit Price to the Special Handling Price.

F. The following equations are true:

C = DEC Unit Price
D = Special Handling Cost
E = Spare Unit Price
F = Control Price
G = Option Price

$G = E + F$ $\quad E = G - F$ $\quad F = G - E$

$E = C + D$ $\quad C = E - D$ $\quad D = E - C$

dec INTEROFFICE MEMORANDUM

DATE September 14, 1964

SUBJECT Module Ad for "Computer Design"

TO Jack Atwood

FROM Burt Scudney

Please reserve space on the back cover of "Computer Design" magazine for a series of advertisements on FLIP CHIP modules. This commitment can be made for three consecutive issues (October, November, December) at a cost not to exceed $980.00 per insertion.

If we cannot obtain space in these particular issues, or if the cost exceeds the stated amount, please inform me immediately.

In my opinion we have never concisely stated what FLIP CHIPS are, what they do, and what is available. These issued of "Computer Design" provide a perfect opportunity to do so.

BVS:vg

cc: K. Olsen
H. Anderson
S. Olsen

dec INTEROFFICE MEMORANDUM

DATE September 16, 1964

SUBJECT PDP-6 Programming Course

TO R. Beckman

FROM S. Mikulski

Copies: G. Bell
D. Morse
N. Hirst
H. Anderson

1. I am planning to convene a PDP-6 Programming Course on 30 September 1964. It will be a 1.5 week pilot course to determine subject timing, literature needs, and PDP-6 software ability.

2. Enclosed is a schedule of subject material.

3. I am currently producing a course "workbook" which will be nearly completed for use in the course. The first formal course is scheduled for 30 November and is the target date for all class material.

4. I am intending to utilize time sharing in the Bldg. 12 classroom and have made arrangements for two stations in the classroom, and will utilize them for the October class if possible.

5. A summary of PDP-6 computer time is as follows:

Date	Time	Function
2 Oct.	11 - 12	assembly
2 Oct.	2 - 3:30	debug
5 Oct.	3 - 5	assemble/debug
6 Oct.	3 - 5	assemble/debug
7 Oct.	3 - 4:30	assemble/debug
8 Oct.	1 - 2	assemble
8 Oct.	4 - 5	assemble
9 Oct.	10 - 12	debug

If a time-sharing system is available, it should be scheduled to incorporate these times. If a time-sharing system is not available, the above times will

be reserved on the computer.

6. Attendees in the pilot class will be from Brookhaven and possibly Adams. All PDP-6 Programming Classes will be built around time-sharing features for ease of teaching (sharing machine time) and sales viewpoints. When a firm time-sharing schedule is produced, I should be informed in order to reschedule the class labs for future classes.

S. Mikulski

SM:ajc
Attachments: 2

INTEROFFICE MEMORANDUM

DATE September 15, 1964

SUBJECT Drum Systems

TO Computer Guidance Committee

FROM R. Tringale

There are four drums scheduled for delivery in September. Three drums are the Type 24 for Foxboro, the fourth is a Type 250 drum for Foxboro. Presently one of the Type 24's for Foxboro is ready for acceptance test, a second Type 24 is 90% checked out and the third 24 drum is in Production. The drum for the third 24 system has not arrived.

The 250 Drum is in Production, it was scheduled to be completed in Production by September 11, 1964. The drum for the 250 system has not been delivered. It should be here this week.

There is a Type 24 drum scheduled for delivery the first part of October for Hanscom Field. This system is presently in Production.

The new drum for BBN is scheduled for delivery during the last week in September. There are a few mechanical changes going into the system in order to fit the new drum into the 23 Drum Cabinet.

The 236 Drum Control and 237 Drum unit is still being engineered. The new analog circuits for the 237 Drum have been designed, the special cabinet for the drum has been designed, and we are presently cleaning up the logic. There is still a good amount of final detail and checking to do on the logic and the mechanical layout. Both units are scheduled for Production the end of September.

DT/mro

INTEROFFICE MEMORANDUM

DATE September 15, 1964

SUBJECT Annual Report

TO Jack Atwood
cc: Harlan Anderson
Win Hindle

FROM Kenneth H. Olsen

Here are the ideas that I proposed to the Board of Directors for the Annual Report. It should be very simple and skip all unnecessary details. Above all, we should take every advantage to sell our products.

The first part of the Annual Report will be the history of DEC. This is not a normal entry and we will not do it in future Annual Reports but somewhere we should have the history written down in a form that will be convenient to give to people who ask.

We will have no pictures of the Officers.

The next item is a letter from the President. Some of the best technical writing I have ever seen has been in annual reports. The sentences are short and the ideas are simple. I hope we can do the same.

The next item is products of DEC. This is an area which I think you should work on immediately. I'll try to get the first two sections done but I think your lay-out people and artists should work on the product area. There are, of course, four areas; the modules, of which should include the A/D converters, the cabinets, and all the other accessories. Then we have the three computers, the core testers, and module testers. Then we should list the financial figures. We will only list the present Balance Sheet and last year's Profit and Loss Statement and the simple and small letter from the auditors. We will not give comparative figures because this implies a more significant interest in the market than what we mean to show. People will think we're interested in selling stock and I'm afraid we'd be bothered to no end.

In addition, we should somewhere list the Board of Directors. We have a rather impressive Board and we should take advantage of it. The picture we took of them is dreadful and we will simply have a list of the Directors with their titles.

It might also be a good idea to list all of the sales offices. I don't think it would be wrong to list our Orlando office and the Huntsville office even though they were started after the end of the fiscal year.

The cover on the Annual Report should really sell one of our products. It should either be the PDP-6 or the new module. We have to turn out a large number of these and we can't make them look too expensive because it will give the wrong impression. So we have a very fine line which we have to follow. We want to give the impression of old line, stable company and really sell our products and yet we don't want to look like we're out selling stock. I would like to see the new module on the cover if we can work out a way in which we can present it effectively.

We also have to get photographs showing our gold plating line, our module line, our automatic component inserting machine, and also our defusion furnace with all of the fancy glassware would be an interesting picture. I would like to see you start laying out everything except the President's letter and the history and maybe if you run into trouble I'll be able to help there too.

There should be another section which shows how the income was spent. This is made mainly for our own employees to know where all the money goes. It is a breakdown different than the Financial Statements. Many people will divide a pie up or divide a silver dollar up into pie slices but this gets rather corny.

One gimmick which might work if it's not too corny would be to use a silhouette of the module to hold the page number on each of the pages of the Annual Report.

Ken Olsen

KHO:ech

INTEROFFICE MEMORANDUM

DATE 16 September 1964

SUBJECT Teletype Model 33

TO A. Hall FROM D. Smith

Attached is an extract of the PDP-6 prototype log relating to the console teletype. There are about 73 entries concerning the teletype for the period July 23 through September 5. The majority of the entries are concerned with just 3 problems, duplicating characters, line feeds, and the control key. There were at least 10 persons involved in the making of the entries. I wonder how many are telling other persons about the unreliable, always broken down, Model 33 that causes so many problems. I would like to suggest that you read the log, and see how some felt. A lot of important PDP-6 time must have been lost during the trouble period.

As a closing note, I would like to relate a conversation with a PDP-5 customer of ours. He is planning to install a 630 system and was concerned as to whether he should use the Model 33 because of reliability. He said that he didn't think much of the Model 33 after his experience with the one on his PDP-5. He had so much trouble that he rented one from the Telephone Company. The one he got from the Telephone Company is working very nicely. In fact, he now is open to suggestions that possibly the 33 isn't so bad after all.

Do you suppose we could get more of our PDP-5 cusomters to get in touch with the Telephone Company? Possibly the problem is that Teletype Corporation sends us the bad ones and other people get the good ones.

I hope this memo can slow the stampede of condeming the Model 33 and Teletype Corporation.

cc: K. Olsen
H. Anderson
R. Best
W. Hindle
N. Mazzarese
J. Hastings
R. Savell
E. de Castro
E. Harwood
H. Crouse
J. Shields

EXTRACT OF PDP-6 LOG CONCERNING CONSOLE TELETYPE

Date	Entries Per Day		Page
7-23-64	1	Duplicates	5 T
	2	Control key sticks (see method of fix and comment about 33)	5 T,F
	3	Control key sticks	7 F
	4	Duplicates character	7 T
	5	Duplicates character	9 T
	6	Duplicates character	9 F
7-26-64	1	Comment on TTY test	15 C
7-27-64	1	Comment on 33	17 T
	2	Control key sticks	17 T
	3	Extra line feed	17 T
7-29-64	1	Front plate sticks (keys?)	25 T
7-30-64	1	Cover panel fixed	26 F
	2	Bad characters	29 T
7-31-64	1	Teletype troubles still	35 T
	2	Teletype trouble	35 T
8-1-64	1	Vertical motion trouble	35 T
	2	Teletype sick	37 T
8-2-64	1	Teletype sick	39 T
8-3-64	1	Teletype sick	41 C
	2	Misses characters	41 T
	3	Improperly encodes characters	41 T
8-5-64	1	Attempt to fix problem unsuccessful	44 F?
8-6-64	1	Teleprinter getting worse	47 C
	2	Gets extra and incomplete characters	47 T
	3	Gives estra line feeds	47 T
	4	Control key sticks	47 T
	5	Control key sticks	49 T
8-9-64	1	Teleprinter shaky	55 C
8-10-64	1	Teletype adjustments	56 F
	2	Fixed extra line feed	56 F
	3	Fixed sticking control key	56 F
	4	Teletype missing line feeds	57 T
	5	Teletype still missing line feeds	57 T

T = trouble report
F = fix
C = comment

EXTRACT OF PDP-6 LOG CONCERNING CONSOLE TELETYPE (Continued)

Date	Entries Per Day		Page
8-10-64	6	Teletype miss line feeds	59 T
	7	Summary of dates complaining of TTY troubles	59 T
8-11-64	1	Adjusted TTY	61 F
	2	Misses line feed	61 T
8-12-64	1	Running funny	65 T
	2	Misses line feeds	65 T
	3	Adjusted line feed	64 F
	4	Missing line feed	67 T
8-13-64	1	Missing line feed	69 T
	2	Working on TTY	68 F
8-14-64	1	Missing line feed	71 T
	2	Missing line feed	71 T
	3	Missing line feed	71 T
8-15-64	1	Missing line feed	73 T
	2	Missing line feed	73 T
8-16-64	1	Missing line feeds	73 T
	2	Missing line feeds	73 T
	3	Missing line feeds	73 T
8-17-64	1	Line feed	75 T
	2	Line feed but no typeout	75 T
8-18-64	1	Missing line feed 25%	77 T
	2	Line feed comment	79 C, T
	3	Comments line feed not fixed	81 C, T
8-19-64	1	Line feed missing	83 T
	2	Teletype comment	84 C, T
8-20-64	1	Teletype comment ,	84 C, T
	2	Line feed trouble	85 T
	* 3	Put spare TTY on machine	86 F
8-21-64	1	Adjust carriage return	88 F
8-25-64	1	Console teletype running open	97 T
8-26-64	1	Teletype running open	99 C
	2	Trouble in teletype	98 C
	* 3	Put back original TTY which still contains line feed problems	98 C, F
	4	Line feed problems, Strong comments	99 T, C
	* 5	Put Model 35 on in place of 33	100 F
	6	35 need Ø type slug	100 T
8-29-64	1	Working on teletypes	107 C
9-5-64	1	Teletype shift key fails	121 T
	2	Shift key doesn't work	121 T
	* 3	Put on Model 35	121 F

T = trouble report
F = fix
C = comment
* = teletype changed

INTEROFFICE MEMORANDUM

DATE September 16, 1964

SUBJECT 41st Meeting Of The Test Equipment Committee

TO Richard L. Best

FROM Russell Doane

Members of the Committee:

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

1. We have received two 'scope carts, ordered for the two 581 'scopes we bought as a result of the May 22nd meeting.

2. Bill Titelbaum will publish the following items in Engineering News:

   a) A revision of the list of expendable test equipment accessories, stocked by Test Equipment Service, that appeared in the June 8 (#119) issue of Engineering News.

   b) Data on the Simpson Thermo-Meter and Variacs that we own.

   c) Notice of oscilloscopes that are unassigned; probably two type 543 'scopes.

3. We decided to purchase the following Tektronix test equipment:

   a) Two 581A 'scopes with dual-trace plug-ins for Production Test.

   b) Two 547 'scopes with dual-trace plug-ins for Computer Checkout.

   c) One 105 variable frequency, variable amplitude squarewave generator for Test Equipment Service.

   d) One 107 fast-rise squarewave generator for Special Systems and Test Equipment Service.

   e) One 180A time-mark generator for Test Equipment Service.

   f) Four dozen X10 probes to saturate the company with 'scope probes and thereby mitigate the present intensive borrowing and hoarding of probes.

   g) One X10 and one X100 passive probe for the 661 sampling 'scope.

4. We decided to buy 10 630-NA-RM multimeters for use in the Model Shop and Quality Control module test stations, with the older 10 630-NA-RM meters (DEC tweed panels) being concentrated in Production Test to preserve the color scheme there. If any panel-mounted multimeters are left over, they can be added to the burst-generator test setups in module engineering or any other place which requires constant availability of a meter. (Power Supply Test, Special Systems, & Semiconductor Test should be checked for need).

5. A subcommittee headed by K. Doering, and including W. Titelbaum and R. Doane, will decide how many electrochemical elapsed time meters of what type to order and install in oscilloscopes. This is to put into effect the plan presented by Bill Titelbaum, and approved by the committee, for reducing the work load of oscilloscope calibration. The plan calls for a regular check of each 'scope, and recalibration at either a fixed period of operation (measured by the meter) or a fixed period of time, whichever is sooner. The present calibration interval for 'scopes in non-critical areas will remain on a 6-weeks schedule. Cost of the plan is expected to total approximately $1000. Published data from IBM indicates an early return on this investment can be expected.

6. The following investigations will be made before the next committee meeting:

   a) Bill Titelbaum will find out how well the 10 Hewlett-Packard fast-rise clip-on current probes will work on Tektronix and Fairchild 'scopes, so that we may be able to use them everywhere. If they are not interchangeable, we will have to order more Tektronix current probes or transfer HP 175A 'scopes to current-probe users.

   b) Field Service has requested that a second EDC reference voltage source be bought. Bill Titelbaum will first make a close comparison between the EDC device and the recently calibrated Kin Tel source, as a check on the stability of the relatively inexpensive and portable EDC device. We will also find out whether the need for a third source persists now that the Kin Tel is back from calibration.

   c) Field Service has 15 pocket multimeters; needs 6 more. We will see whether some scrounging will suffice. If not, the committee decided we should order 10 more meters like those we now have (Triplett 310 meters and 369 leather cases).

   d) We will try to establish whether 'scope accessories, now stocked in Test Equipment Service, should be duplicated in the Engineering Stockroom, or perhaps stocked only in the stockroom so as to remove this routine responsibility from Test Equipment Service.

7. The committee decided to try to sell the Telequipment 'scope, whose lack of built-in delay makes it obsolete for the Field Service

purposes for which it was bought.

8. Jim Cudmore will return the 515 'scope to Power Supply Test to get their present 540 series scope back to a more demanding use.

The next meeting of the Test Equipment Committee will be:

Monday

November 2nd

1:30 P.M.

Bob Hughes' Office

INTEROFFICE MEMORANDUM

DATE September 17, 1964

SUBJECT Systems Product Line Content

TO Harlan Anderson
Stan Olsen
Nick Mazzarese
Pat Greene
Burt Scudney

FROM R. Mills

On our Product Line Profit and Loss statements, we have given credit to the computer line when the systems section was building a computer special system. There are now four (4) computer special systems in process which are being engineered by Special Systems, Princeton, NASA, Remington Arms and Tokyo University. The final resting place of these sales will be in the appropriate Computer Product Line rather than Systems Product Line. This does not properly reflect the effort being made by Systems.

In addition to those special systems, Pat Greene considers the following to be Memory and Core Tester supported:

1. Current Drivers
2. Current Calibrators
3. Current Driver Power Supplies
4. Core Handler Spare Parts

At the present time, the High Current Pulse Equipment is listed on our Product Line Profit and Loss statement under miscellaneous as a product line. Since the engineering construction and sales effort is contained in the Systems area, I am proposing that we transfer the High Current Pulse Equipment to Systems Product Line.

dec INTEROFFICE MEMORANDUM

DATE September 17, 1964

SUBJECT PDP-5 Maintenance and Programming Classes

TO K. Olsen
H. Anderson
S. Olsen
N. Mazzarese
R. Beckman
T. Johnson
Receptionist, Bldg. 12
All Sales Personnel
All District Offices

FROM S. Mikulski

Reservations for the PDP-5 Maintenance and Programming classes convening December 7 and 14 are closed. These classes will not be held at the Maynard Plant.

Reservations are still being taken for the classes scheduled on October 26, November 2, 9 and 16.

Future PDP-5 classes will not be scheduled until after the first of the year. Reservations will be accepted for these classes after publication of the schedule which should be sometime before 30 November 1964.

****

ajc

INTEROFFICE MEMORANDUM

DATE 21 September 1964

SUBJECT Visit to Brookhaven

TO H. R. Morse
L. Portner
G. Bell
H. Anderson
B. Lane

FROM Harris Hyman

On the basis of a week spent with Brookhaven, I've been rash enough to make the following promises:

1. Software System at delivery (Oct. 15 - Nov. 1)

   DECtape oriented:

   - Assembler
   - Fortran System including
     - Compiler
     - Rules
     - I/O Formatting Subroutines
     - Arithmetic Subroutines
   - Editor
   - I/O Subroutines
   - Loader with trivial executive.

2. Installation up-date plus two weeks:

   Mag-tape I/O subroutines (I'll write these on site if necessary)

3. Documentation adequate to use the above routines (at delivery).

4. Documentation on the construction of monitor I/O subroutines so that they can build their own for their own devices. (Somewhere after delivery.)

Since they are not ordering a paper tape punch, we must provide a micro --(oops!) DECtape system. They are not now interested in time-sharing. The above software is necessary to allow them to use their machine.

HH:tw

dec INTEROFFICE MEMORANDUM

DATE 21 September 1964

SUBJECT LRL PDP-6

TO H. Anderson
G. Bell
S. Olsen
N. Mazzarese
R. Lane
L. White

FROM R. Beckman

On 10 September Larry White and I visited LRL, Livermore. Larry will report on his discussions concerning system details. The following comments cover my discussions with Dr. Fernbach, Budd Wirsching, and Mr. Masson of the LRL Purchasing Department.

The paper work on the additional 16K memory and the fast memory is presently at AEC in Washington. This order will include three extra memory bus interfaces for the new memory and three extra interfaces for the memory that is already on order. I told them we would put the interfaces on the existing memory before delivery of the system and would try to get the additional memory and the fast memory on at that time also.

They agree that they should get a paper tape reader, but don't want to rock the boat at AEC at this time by trying to get it included. I told them that we would have the reader on the system when it was delivered because we will need it for check-out purposes anyway. I agreed to leave the reader in the system on a loan basis, with the understanding that they will come through with a purchase order for it before the end of the warranty period.

Arrangements have been made for two LRL maintenance people to attend the four-week course in November. The programming course in December is too late for them, so they plan to send one man to the pilot course in October.

They are interested in maintenance contracts for the PDP-6 once it is off warranty and the PDP-1 system that they presently have. I pointed out to them that if they were willing to enter into a contract to cover the PDP-1 immediately, and add the PDP-6 at the end of its warranty period, we could then afford to station a man in the immediate area and provide them with what would amount to an on-site man for those systems during normal working hours. I am preparing a letter and detailed breakdown of the costs for the PDP-1 system and will send this to Ed LaFranchi.

H. Anderson

INTEROFFICE MEMORANDUM

DATE September 22, 1964

SUBJECT Visit To LRL 9/10/64

TO R. Beckman
H. Anderson
N. Mazzarese
G. Bell
R. Lane
K. Larsen
R. Savell

FROM L. White

The trip to LRL was made to meet the LRL people who will be working with the PDP-6 system, discuss hardware and programming questions, and focus attention on Flip-Chip Modules.

Additional hardware was requested by Dr. Von Holdt and Norman Hardy. Dr. Von Holdt wants a machine instruction which will convert a binary fraction, $0.1 < F < 1.0$, to its decimal equivalent in BCD. The instruction should be capable of converting the binary fraction to one or more significant decimal digits, by selection, up to a maximum of five digits. Dr. Von Holdt pointed out that another computer manufacturer - I think he specified the SDS 924 - offered a binary-decimal conversion feature as an option for $2,000.

A cursory look at the problem indicates that such an instruction could be added with little additional hardware by using the existing multiplication operation within the Arithmetic Processor.

Norman Hardy requested a means of converting between two different sets of 64 characters. He also requested a means of transposing the 36 bits of the PDP-6 word to represent a 6 x 6 matrix in order to process input from a card reader.

His first problem should probably be handled by Programming. If hardware is to be implemented for the second problem then I think the most suitable location would be in the interface that LRL is building for the Card Reader.

Bob Wyman, who is constructing interfaces with DEC modules to connect onto the I/O and Memory Buses, and I discussed the bus systems and circuits. Bob's principle project is to build a multiplexer to the memory bus through which the following computers will communicate with the memory modules:

1. Two IBM 7094
2. Two CDC 3600
3. One CDC 6600
4. Two other presently undefined devices

The multiplexer will use our Pulsed Bus Transceiver 1665 to drive the Memory Bus Lines.

We also discussed the physical layout and installation of the system. We are tentatively planning to connect together all cabinets of the system.

Bob is interested in using Flip-Chip Modules in building future equipment that will be added to the system. For the hardware that he is now constructing he prefers to use our 4000 and 1000 series modules.

Another request was made by Ed La Frankie to change the color of the cabinets to the tan and grey colors of one of the CDC machines. Aside from the problem of obtaining paint and paint chips from CDC, the re-painting of the Arithmetic Processor Cabinet would cost a weeks time in Checkout plus the labor involved to do the job. After further discussion of the situation, Ed seems doubtful that the request will be pushed.

LW/mro

H. Anderson

INTEROFFICE MEMORANDUM

SUBJECT: Installation Manuals and Spare Parts Lists

DATE: September 22, 1964

TO: PDP-6 Group
Sales

FROM: Robert E. Savell

An Installation Manual F-68 for PDP-6 has been prepared and is available from Technical Publications.

Spare Parts Lists are available from Joe Rutschman for Arithmetic Processor 166 and most optional devices. The module and power supply portions of the lists will be updated automatically by Drafting. It will be the duty of any person initiating changes to update the other items on the spares lists when necessary by providing Joe Rutschman with a list of changes to be made.

RES/mro

INTEROFFICE MEMORANDUM

DATE September 23, 1964

SUBJECT Progress Report

TO K. Olsen
H. Anderson ←
S. Olsen
T. Stockebrand
B. Scudney

FROM J. Smith

Test Run of 500 C-D Flat Chips

Resistor screening and firing has been completed on all 500 chips.

350 chips have had the below operations completed:

Resistors screened and fired
Conductors screened and fired
Diode and capacitors stuck down

Remaining operations on the 350 chips:

Resistor trimming
Diode and capacitor wisker bonding
Test wires soldered to the chip
Potting

Resistor Trimming:

All mechanical parts required for the trimming machine have arrived. Ulrich is in the process of designing the control logic. He estimates he will have it complete the end of this week. It seems to be a fairly straight forward package, and we should have little trouble wiring and installing it the latter part of next week. Phil feels the machine will be de-bugged and operational in three weeks.

In the mean time, I will use a crude mask I have constructed and the present trimmer to trim the above lot of 500.

Wisker Bonding:

To date we have only bonded a small quantity of diodes to develop our techniques. There does not seem to be any great problem outside of training personnel.

Potting:

This operation is still up in the air. Tom is currently experimenting with a one-dip potting compound that looks very promising.

Current Plans:

Today we plan on screening the conductor and sticking down components on the remaining 150 chips of the lot of 500.

We also plan on starting resistor trimming and wisker bonding.

I expect to have all 500 chips complete and ready for life test by the middle of next week. Potting will have to be done by hand.

- -

Test Lot of 500 -3 Chips

George Gerelds is presently in the process of laying out the chip. He expects to have the layout complete by the middle of next week. At that time, we will start constructing the -3 chip. We expect to have this lot complete and ready for life test one week from the date the layout is complete.

dec INTEROFFICE MEMORANDUM

SEP 24 1964

DATE September 23, 1964

SUBJECT Applied Programming
Maintenance of MACRO6

TO J. Ridgeway

FROM Harris Hyman

As we agreed a couple of weeks ago, on about October 1 your Applied Programmers Group would begin to assume responsibility for the maintenance of MACRO6.

It has been running with more or less reliability for over 3 1/2 months and I believe it is fairly well documented, so the job shouldn't be too difficult.

HH:tw
cc to: G. Bell
H. Morse
L. Portner
N. Mazzarese
R. Beckman
H. Anderson

dec INTEROFFICE MEMORANDUM

DATE September 23, 1964

SUBJECT PROPOSAL PROPOSAL

TO S. Olsen
N. Mazzarese
B. Scudney
T. Johnson
J. Fadiman
R. Beckman
F. Kalwell

FROM Stu Grover

CC: H. Anderson ✓

The purpose of this memo is to establish some degree of planning for producing better proposals at less expense to the company. Specifically we should aim to minimize

Overtime charges
Rework
Duplication of effort
Disruption of production schedules
Errors
Sloppiness of contents and appearance

and to maximize

Technical completeness and accuracy
Good organization
Attractive, business-like appearance

The recommendations that follow add up to a sharpening of responsibilities in Advertising and Sales. At DEC, the good proposals have been the ones where these two departments worked well together. A team effort, starting from the decision to respond to an RFQ, will pay off in a better job, and that difference between excellence and mediocrity does influence decisions to buy.

RECOMMENDATIONS

1. That for each proposal one person in Sales and one person in Advertising be assigned to carry total project responsibility in their respective departments. That means that the Sales project manager provides:

   a. Advance notice to Advertising of impending bids (2 weeks is suggested)

   b. A standard Tech Pubs Work Order when enough is known to fill one out

   c. Draft materials, including typed manuscript, sketches, special enclosures, standard boiler plate, and a copy of the RFQ, if available

d. Answers to questions throughout the production of the proposal

e. Additional technical information as necessary from Engineering, Programming, or Sales

f. Approvals

g. Delivery information, such as address and covering letter

The Advertising project manager is a focal point for all production activities. Through him pass all the draft materials, and he sees that they go through to timely completion and assembly. Specifically he either performs or oversees the following services:

a. Editing and rewriting

b. Final typing

c. Ink rendering of diagrams

d. Selection and printing of photos

e. Typesetting of cover material

f. Printing and binding

g. Mailing or delivery

2. That a file containing one copy of all printed proposals be maintained in Advertising for reference and possible re-use. "I want a photo just like the one they used in the XYZ proposal," says the Sales project manager. For this reason it is important that all printed proposals go through an Advertising project manager and get a place in the file.

3. That a file containing standard proposal materials be set up and maintained in Sales. In this file would be a few copies each of the current Terms and Conditions, Maintenance Contracts, Warranty, Facilities and Services, overseas delivery and service information, and so forth. As needed, these would be incorporated by the Sales project manager in the draft after the usual modifications were made. It is suggested that one girl be designated the keeper of this file.

4. That a few minimum time allowances be observed in the production of proposals. This suggestion usually brings forth smiles of understanding and nothing more. But the figures given below are really neither unreasonable nor hard to meet. Just a bit of planning ahead and a measure of responsibility on the part of the Sales project manager and it will be easy to give Advertising a chance to perform well.

Example 1: A proposal consisting of
30 pp draft (double spaced) = 20 pp final
2 block diagrams
3 photos (from existing negatives)
5 copies to be sent to prospect

Minimum Allowances:

Draft to Advertising at H minus 24 working hours (3 days)
Sketches to Advertising at H minus 16 working hours (2 days)
Photo requirements to Advertising at H minus 16 working hours (2 days)

Example 2: A proposal consisting of
50 pp draft (double spaced) = 35 pp final
same requirements otherwise

Minimum Allowances:

Draft to Advertising at H minus 32 working hours (4 days)
Drawings to Advertising at H minus 24 working hours (3 days)
Photo requirements to Advertising at H minus 24 working hours (3 days)

COMMENTS ON THESE RECOMMENDATIONS

The heart of this proposal proposal is the project manager idea. It's not a new idea, certainly, and yet proposals suffer in direct proportion to weakness in the discharge of the PM's responsibility. A common instance of such failing is when a project manager, because of the pressure of other work, passes responsibility for writing the proposal on to an associate. The associate is rarely able to provide the things described under Recommendation 1, and he probably does not have the motivation to do so. If a project manager cannot follow through to completion, it must be that the prospective sale was not important enough in the first place. The decision to propose should not have been made.

Once the decision to propose has been made and the project managers designated, they should be available to each other on short notice throughout the production phase. If a PM has to be out of his office for more than a few minutes, he should leave a phone number where he can be reached.

Finally, the Advertising project manager can be of more help to the Sales PM if he can study the RFQ. Sometimes we aren't responding to a written request, and often we don't respond to everything in a written request. But when we have got an RFQ in the house, it should be in the hands of the Sales project manager who gives a copy to his partner in Advertising.

C. S. G.

cad

INTEROFFICE MEMORANDUM

DATE September 25, 1964

SUBJECT Mag Tape and the PDP-6 Monitor

TO
H. Anderson
B. Lane
H. R. Morse

FROM Harris Hyman

Magnetic tape is completely compatible with the Monitor system and may be freely interchanged with one file of DECtape.

Thus it may be substituted directly into a Phase Ø, 1 or 2 time sharing system.

There is a problem, however, the type of time sharing we are implementing presumes on-line debugging and editing. Both of these operations require manipulation of large number of relatively short files. This is impractical on a Phase Ø Mag tape system since only one file may reside on one tape. In the Phase 1 or 2 systems (drum or disc), it is practical since the files are carried in the high speed secondary storage and dumped only rarely.

If an installation were to perform editing off line on cards or tape as is the current practice in the Extra-DEC world, a Phase Ø Mag tape system is not a bad thing. It will require no more than 2 man weeks to implement this system. The time would be spent in integration and checkout, not programming. The pieces will all be there-they only need be put together and tested.

INTEROFFICE MEMORANDUM

DATE
September 25, 1964

SUBJECT
PDP-7 Input/Output Control

TO
FIELD SALESMEN

FROM
Rod Belden

Because of the great demand for more information on the PDP-7 from the Field Sales Offices, copies of the typed proofs of the Input/Output Chapter 3 from the PDP-7 Reference Manual are being distributed for your advance information. The I/O chapter is by far the longest in the manual, and includes most of the small differences between PDP-4 and PDP-7. Care has been taken to have these proofs factually correct, but you will have to excuse a few format inconsistencies that will be corrected at the last review. Only three figures are included, these are new and are at the end. Other figures will be taken from the PDP-4 manual.

To save time, I have listed most of the differences between the I/O of the 4 and the 7. Taken together these features give the PDP-7 an I/O thrust which is unmatched by any other computer in its class.

PDP-7	PDP-4
7 Channel IC, easily expandable in multiples of 7.	8 Channel IC.
Input/Output Control (Re-named to be consistent with the PDP-5 and PDP-6).	Real Time Control.
I/O Trap Mode and instruction ton (700162) trap-on. Also turns on program interrupt.	Not available.
Programmed punch control.	Not available.
4 Channel Data Interrupt Multiplexer Type 173	3 Channel equivalent.
8-bit ASCII tape code 33 KSR teleprinter	5-bit Baudot tape code 28 KSR teleprinter

CHAPTER 3 INPUT/OUTPUT

INPUT/OUTPUT CONTROL

- Iot Instruction
- Program Flags
- Device Selector
- Information Collector
- Information Distributor
- Input/Output Status
- Input/Output Skip
- Input/Output Trap
- Data Interrupt Control
- Real Time Clock
- Program Interrupt
- Automatic Priority Interrupt Type 172 (optional)

I/O BUFFERING

I/O ROUTINES AND DATA TRANSFER

INPUT/OUTPUT DEVICES

- Teletype Model 33 KSR
- Perforated Tape Reader Type 444
- Perforated Tape Punch Type 75
- Analog-To-Digital Converter Type 138
- Analog-To-Digital Multiplexer Type 139

* * * * *

Descriptions of the remaining options are not included in this proof

- DECtape
- Automatic Magnetic Tape Control Type 57A
- Magnetic Tape Transport Type 570
- Precision Incremental CRT Display Type 340
- High Speed Light Pen Type 370
- Digital Symbol Generator Type 33
- Card Reader and Control Type 421A
- Card Punch Control Type 40
- Automatic Line Printer and Control Type 64
- Serial Drum Type 24
- Data Interrupt Multiplexer 173
- Data Interrupt Control 174
- Data Communication System Type 630

CHAPTER 3

INPUT/OUTPUT

Functions

Information is transferred between the PDP-7 and peripheral equipment by the input/output control. This interface sets up the information path between computer and device, controls the transfer, and mo nitors the state of availability of each device. It also includes facilities for data, clock and program interrupts. Figure I shows in schematic form the section of the input/output control. The input/output control is itself controlled by the programmed input/output transfer (iot) instructions. An iot instruction causes the input/output control to produce pulses . These pulses are the ones which select an I/0 device and initiate a data transfer. The single iot instruction is microprogrammed to control all input/output devices.

IOT INSTRUCTION

The input/output transfer (iot) instruction causes the Input/Output Control to produce pulses which select I/O devices and transfer information. All iot instructions are octal code 70 with a bit assignment shown in figure X.

Mnemonic	Instruction Code	Operation
iot	700000	input/output transfer

(see figure 7, page 24 of PDP-4 Manual)

Figure 2 - Bit Assignment for Input/Output Transfer Instruction (iot).

Bits 0-3 signify the iot instruction. Bits 4-13 specify the external device and its mode When bit 14 is a 1, the accumulator will be cleared prior to the data transfer. Bits 15-17 select the pulses sent to the device during event times 1, 2, and 3. For ease of recognition, the IOT pulses are coded according to bits 17, 16, and 15 as IOT 1, IOT 2, and IOT 4 respectively. IOT 1 is used to check the status of a device. IOT 2 and IOT 4 are initiated by the Device Selector to cause a transfer of information to and from the Infomation Collector and the Information Distributor.

PROGRAM FLAGS

The status of each I/O device is indicated to the central processor by flag bits. A program can read the flag bits of a device and initiate appropriate action. In this way, input/output transfers and program operation may easily be coordinated. Flags may be connected to the program interrupt control, status bits, and the input/output skip facility.

A flag may indicate one of several things depending upon where it is connected

1. Connected to the program interrupt a flag may indicate that:

   a. /an output transfer has been completed and the device buffer is now available for re-filling.

   b. /An input buffer contains information for transfer into the computer.

   c. /a device operating asyncronous has information for input or requires information for output.

2. Connected to the input/output skip facility a flag may indicate:

   a. /Skip the next instruction if the device buffer is full.

   b. /Skip the next instruction if an output operation has been completed.

3. Connected to the status register a flag may indicate the

   a. /occurrence of an error.

   b. /direction of data transfer.

   c. /direction device is operating, forward, reverse.

   d. /mode of operation in a device.

   e. /sub-device connected to a central device.

   f. /busy or idle condition of a device.

DEVICE SELECTOR (DS)

The Device Selector selects an input/output device or sub-device according to the address-code of the device in memory buffer bits 4-13 of the iot instruction. It then generates an IOT pulse at event time 1 if memory buffer bit 17 is a one, event time 2 if memory buffer bit 16 is a one, and at event time 3 if memory buffer bit 15 is a one. The I/0 event times differ from those of the microprogrammed operate group event times. A complete table of the IOT pulses and corresponding times is given below.

Event Time	Computer Cycle Time	Instruction Bit	IOT Number
1	5	17	1
2	7	16	2
3	1 (next cycle)	15	4

Upon receipt of an iot instruction the device selector determines which device has been selected then performs one or all of the following functions:

1. IOT #1 senses the state of the flag or flags associated with a device.

2. IOT #2 clears the flag or flags associated with a device.

3. IOT #4 transfers data from the buffer of an input device through the information collector into the accumulator, transfers data from the accumulator through the information distributor into the buffer of an output device, or initiates operations within a peripheral device (ex. a line of perforated tape is read into the tape buffer, or a card is moved to a reading or punching station).

The specific function or functions an IOT performs is selectable and depends on the device, and its timing requirements. A device may use any number or combinations of the three pulses. Devices requiring more than three pulses may use multiple device codes. For extremely expanded mode selection, a device may sense the state of the accumulator bits loaded prior to the iot instruction.

The 6-bit device selection numbers, memory buffer bits 6-11 are decoded by a diode decoder module B171. (See Figure). The 6-bit code therefore produces as assertion level for the selected device. This level, in turn, controls I/0 pulses through the device selector gates. The device selector amplifiers transmit pulses to the selected device according to bits 15, 16, and 17 of the iot instruction. The DS pulse amplifiers are capable of supplying 2.5 volt (ground reference) positive or negative p ulses of 70, 400 or increments to 1000 nanoseconds. Also available is a 100 nanosecond pulse from -3 volts to ground.

The standard device selector contains selector modules for the standard devices and has provisions for up to 20 decoders, gates, and amplifiers. When peripheral I/O devices are added to the PDP-7 a device code is easily established in the device selector by clipping out the diode of the unasserted level in the B171 module. Figure shows the B171 with the clipping point marked with a Ⓒ.

INFORMATION COLLECTOR (IC)

The Information Collector is a seven channel gated mixer which controls the transfer of 18-bit words from external devices to the accumulator. Pulses from the DS control the IC gates according to the device specified by the iot instruction. Because the accumulator must be cleared before a word is transferred through the IC to the AC, the iot instructions are usually microprogrammed to clear the accumulator (bit 14 a one).

In the standard PDP-7, seven channels of IC are used. The paper tape reader and I/O status bits each occupy one 18-bit IC channel. The teleprinter occupies 8 bits of a third channel. The remaining four and one-half channels are available for connection to any peripheral and optional input equipment. All PDP-7 input options connect directly into one channel of the IC (ex Extended Arithmetic Element type 177, A-D Converter type 138, DEC tape Control Unit type 550A.)

For operation of more than seven input devices, the IC is easily expandable in blocks of seven channels to accomodate any number of channels.

The modules used in the IC are the seven-channel R141 gates. The R141 accepts standard levels of 0 and -3 volts or standard 70-nanosecond or wider pulses. The input load is 1/2 ma. per grounded inputs.

Bits transferred to the AC correspond to the incoming polarities

0 volts	0	transmitted to AC
-3 volts	1	transmitted to AC

INFORMATION DISTRIBUTOR (ID)

The Information Distributor is an output bus system through which information is transferred from the accumulator to external devices. Eighteen line drivers buffer and drive the accumulator output through the external device connection cables. Other drivers and cable slots are used to transfer memory buffer and device control bits. Nine 18-bit ID channels are standard on the PDP-7. The paper tape punch and teleprinter use two of the nine channels. A third channel is used for the expanded ID connection.

Other external devices are easily connected to the Information Distributor. Each device receives pulses from the Device Selector to gate in bits from the bus.

The ID can be expanded to any number of output channels.

The signal polarities presented to the output device by the ID are:

-3 volts	AC bit contains a 0
0 volts	AC bit contains a 1

INPUT/OUTPUT STATUS

The status of each I/O device, as indicated by its flags may be read into assigned bits of the AC. Figure 3 shows the standard assignment for the commonly used devices. An x indicates that the flag is connected to the program interrupt control. The presence of a flag is reflected by a 1 in the corresponding AC bit.
The status of 18 flags may be read into the AC at one time using the following iot instruction.

iots	700314	Input/output read status. The contents of given flag replaces the contents of its assigned AC bit.

FIGURE 3 BIT ASSIGNMENT FOR INPUT/OUTPUT STATUS INSTRUCTION (iots)

The type 57A Magnetic Tape Control has its own status bit word. This is read by the mtrs instruction with the same format as above. The bit assignment is given in the 57A control description.

INPUT/OUTPUT SKIP FACILITY (IOS)

The input/output skip facility enables the program to branch according to the status of an external device. The IOS has eight inputs and is expandable to any number. When an input/output skip instruction is executed, the DS selects one of the Skip inputs, if the flag connected to that input is set to 0, the next instruction in the program sequence is executed. If the flag status is 1, the next instruction is skipped. An I/O pulse for a skip must occur at event time 1.

Commonly used skip instructions are:

clsf	700001	Skip if clock has overflowed
rsf	700101	Skip if paper tape reader buffer has a character
psf	700201	Skip if paper tape punch is ready
ksf	700301	Skip if teleprinter keyboard buffer has a character
tsf	700401	Skip if teleprinter is ready to output
dsf	700501	Skip on display flag (light pen)
cpsf	706401	Skip if card punch is ready
lpsf	707501	Skip if line printer is ready
lssf	706601	Skip if line printer spacing flag is a 1
crsf	706701	Skip if card reader buffer has a character

Instructions to clear the flags are listed in the Appendix.

INPUT/OUTPUT TRAP

The PDP-7 I/O Trap Mode is designed to simplify programming of sophisticated input/output routines and to provide the basic hardware necessary for a time-shared or multi-user system. The effect of the trap is to insert a program break in place of the iot instruction. Two other conditions are also trapped, an xct instruction whose subject instruction is also an xct and the hlt portion of an Operate class instruction.

The Trap provides the PDP-7 with the basic hardware necessary to use the PDP-7 in a time-shared mode. With the use of the Extend and Trap modes, multi-user installations with full memory bank protection are possible. A program operating in one or more independent 8K (or smaller) memory banks can be protected from accidental disturbance by a program operating in other memory banks. All I/O operations can be monitored to check for use of restricted I/O devices or restricted memory locations. In this way the PDP-7 can be used for real-time process control and simultaneously be available to share time with other programs in other memory banks without the threat of program interferrence.

The Trap Mode is enabled by the ton instruction (700162) with the console Trap switch on. The Trap Mode is disabled by any program break. The ton (700162) also turns on the Program Interrupt through a microcoding of the ion instruction (700042). Since the I/O Trap may not be disabled by a program without causing a program break, control over input/output rests entirely with the I/O interrupt routines. Other use of the Program Interrupt and Extend mode is controlled by the Trap, for the Extend status may not be changed and the interrupt mode may not be disabled by a program running in the Trap mode.

The trap initiates a sequence of events depending on the trapped instruction.

iot: A program break in place of the trapped instruction increments the Program Counter and stores its contents in location 0, bits 3 to 17, stores the link in bit 0, and stores the extend status in bit 1. Control then transfers to location 2. The Extend Mode is enabled and the Program Interrupt is turned off. The next instructions are taken from the appropriate I/O routine.

xct: An xct instruction is ignored.

hlt: A microprogrammed hlt of an operator class (740000, and 750000) instruction is ignored. The rest of the instruction is executed.

DATA INTERRUPT CONTROL (DIC)

The Data Interrupt Control allows a high-speed input/output device such as a magnetic tape unit or drum, to operate independently once the information transfer has been initiated. The data address (15 bits) is transmitted directly to the memory address register. The data itself is read directly into the MB, bypassing the AC entirely. Since the data interrupt has priority over all other interrupts, a request will be granted at the completion of the current instruction. When a data interrupt occurs, the program is delayed for one cycle while the transfer is made; the program then resumes. A transfer rate of 571,000 18-bit words per second is possible.

The external device must supply 15 address lines, 18 data lines, a request line, and a transfer in (out) line. All lines are -3 volts for assertion, ground for 0. The external device may also request the computer to slow its cycle to approximately 4 microseconds for the duration of the transfer.

The optional Type 173 Data Interrupt Multiplexer increases the data interrupt facility to 4 channels arranged in a priority chain. Thus, several high-speed devices such as a type 57A Tape Control, a type 24 Drum, etc., may operate simultaneously at a maximum combined transfer rate of 571 KC.

The optional type 174 Data Control controls and buffers high speed transfer between the computer and external devices which do not have the necessary control facilities. The type 57A Tape Control and type 24 Drum do not require this data control. Maximum transfer rate is 571 KC.

REAL TIME CLOCK

The clock produces a pulse every 1/60 second (16.7 milliseconds). When the clock is enabled, every clock pulse causes a clock interrupt. The clock interrupt is similar to a data interrupt in that the contents of no active register is changed. This interrupt has priority over a program interrupt but is of lower priority than a data interrupt. During the interrupt the contents of memory location 7 are incremented by 1. If, the contents of location 7 overflow, the clock flag is set to 1. The clock flag is connected to the program interrupt system and may cause a program interrupt.

Three iot instructions are associated with the clock:

clsf	700001	Skip the next instruction if the clock flag is set to 1.
clon	700004	Clear the clock flag and disable the clock.
clof	700044	Clear the clock flag and enable the clock.

Clock frequencies other than 60 cps can be (optionally) selected for use with the clock interrupt. Depressing the START key on the operator console clears the clock flag and disables the clock.

Since the clock register is core memory location 7, its contents may be loaded or deposited by a program. A standard technique for using the clock is to preset the contents of location 7 with the complement of the desired count and then to enable the program interrupt and the clock. An interrupt will occur at the end of the desired time. To cause an interrupt at the end of 1 second the following routine can be used

```
0/
1/          jmp end-of-time
clock       lam* - 60       /load -60 into accumulator (same as
                             law 17720).
            dac 7           /preset clock to -60.
            clon            /turn on clock .
            ion             /turn on interrupt.
                            /continue with 1 second worth of program.
```

* lam is a pseudo-instruction to the assembler which generates the equivalent machine instruction using a law instruction .

PROGRAM INTERRUPT CONTROL (PIC)

The Program Interrupt Control increases the efficiency of input/output operations by freeing a program from the necessity of constantly monitoring program flags. When the PIC is enabled and a peripheral device becomes available, the PIC automatically interrupts the program sequence and causes a trap to occur. A subprogram beginning at the trap location may then sense the program flags to determine which of the devices caused the interrupt, service the device, and return to the main program.

The PIC may be enabled or disabled by the program. When it is disabled, program interrupts do not occur, although device flags may be set. Interrupts for these devices occur when the PIC is re-enabled. When the computer is operating with interrupt-producing devices, the PIC is normally enabled.

The following iot instructions control the PIC.

iot	700002	Interrupt off. Disables the PIC
ion	700042	Interrupt on. Enables the PIC

Each of the input/output devices has associated with it a program flag which is set whenever the device has completed a transfer and is ready for another. When the interrupt is enabled and the device is ready, the setting of the device flag (connected to the PIC) causes a program interrupt. The main instruction sequence is halted, the Program Counter, Link, and Extend mode status are stored in location 0, and control transfers to location 1. Thus, a jms 0 has effectively been executed. The interrupt is then disabled and the Extend mode is turned off. The word stored in location 0 has the following format:

If the interrupt was caused by the I/O trap, control transfers to location 2 instead of location 1 and the Extend mode is turned on. The routine beginning in location 1 (or 2) is responsible for finding and servicing the device that caused the interrupt. When a program interrupt occurs, the PIC is automatically disabled since only single level interrupting is provided. The interrupt routine can re-enable the interrupt mode at any time.

The status of the PIC is displayed on the operator console by the indicator marked PIE, program interrupt enabled.

AUTOMATIC PRIORITY INTERRUPT TYPE 172

The Automatic Priority Interrupt Type 172 increases the capability of the PDP-7 to handle transfers of information to and from input-output devices. The 172 identifies an interrupting device directly, without the need for flag searching. Multi-level interrupts are permissable where a device of higher priority supersedes an interrupt already in process. These functions increase the speed of the input-output system and simplify the programming. In this way more and higher-speed devices can be serviced efficiently.

The Type 172 contains 16 automatic interrupt channels arranged in a priority chain so that channel 0 has the highest priority and channel 15 has the lowest priority. Each channel is assigned a unique, fixed, memory location in the range of 40_8 through 57_8; starting with channel 0. When establishing priority, each in-out device is assigned a unique channel. The priority chain guarantees that if two or more in-out devices request an interrupt concurrently, the system grants the interrupt to the device with the highest priority. The other interrupt will be serviced afterwards in priority order.

The Automatic Priority Interrupt is assigned a priority just below that of the data interrupt, a position held by the real time clock. The 172 replaces the real time clock. The priority interrupt system may operate in either of two modes, the multi-instruction subroutine mode or the single instruction subroutine mode. The mode is determined by the instruction in the memory location assigned to the channel.

The Multi-Instruction Subroutine Mode

This mode is generally used to service an in-out device that requires control information from the PDP-7. Such devices are alarms, slow electromechanical devices, teleprinters, punches etc. Each device requires a servicing subroutine that includes instructions to manipulate data and give further instructions, such as continue, halt, etc., to the interrupting device.

An interrupt request from a device is granted if the following conditions are met:

The 172 is in the enabled condition (by program control).
There is no data interrupt request present.
The requesting channel is in the enabled condition (by program control).
There is no interrupt in progress on a channel of higher priority.
There is no interrupt in progress on the requesting channel.

When an interrupt is granted, the contents of the channel memory location are transferred to the MB and executed. If the instruction executed is jms Y, the system operates in the multi-instruction subroutine mode. The contents of the program counter and the condition of the link are stored in location Y, and the device-servicing subroutine starts in Y + 1. (Note that it is often useful to store the contents of the AC before servicing the device and to restore the AC prior to exiting from the servicing routine).

The interrupt flag is normally lowered by the I72, but can be lowered by an iot instruction if desired. Program control now rests with the servicing routine.

A return to the main program is accomplished by a restore the AC and link, a debreak iot and a jump indirect to location Y, where the contents of the PC prior to interrupt are stored. The debreaking iot requires no channel designator, since the interrupt priority chain automatically releases the correct channel and returns it to the receptive state. This iot normally inhibits all other interrupts for one memory cycle to insure that the jump indirect Y is executed immediately.

The following program example illustrates the action that takes place during the multi-instruction subroutine mode. Assume an interrupt on channel 3.

Mem. Loc.	Instruction	Function
1000	add 2650	Instruction being executed when interrupt request occurs.
0043	jms 3000	Instruction executed as a result of interrupt on channel 3. The jms determines multi-instruction mode.
3000	-	The Link, condition of the Extend Mode, and the PC are stored in location 3000.
3001	dac 3050	First instruction of servicing routines stores AC.
3002 3003 3004	-	Instructions servicing the interrupting in-out device
3005 3006		
3007	iac 3050	Restores AC for main program
3010	dbr	Debreaking iot releases channel.
3011	jmp i 3000	Return to main program sequence.
1001	-	Next instruction executed from here unless another priority interrupt is waiting.

The Single Instruction Subroutine Mode.

In some instances it is desirable for the PDP-7 to receive information from an external device, but not send control information to the device. Such an application would be the counting of real time clock pulses to determine elapsed time. The single instruction subroutine mode simplifies programming a counter.

An interrupt request is subject to the same conditions as in the multi-instruction mode, and the appropriate memory location is addressed as before. Then the single instruction subroutine mode is entered if the channel memory location does not contain a jms instruction. Normally the instruction is isz. In any case, since the single-instruction constitutes the entire subroutine, the interrupt system automatically lowers the interrupt flag, debreaks the interrupting channel, and returns the channel to the receptive condition.

If the isz instruction is used the 172 acknowledges only the indexing operation and neglects the skip to avoid changing the contents of the program counter. If an overflow results from the indexing a flag is set. This flag can be entered in another channel of the interrupt system to cause a further program interrupt.

The following program coding illustrates operation in the single instruction subroutine mode. Assume an interrupt on channel 6.

Mem. Loc.	Instruction	Operation
1200	dac 1600	Operation being executed when interrupt occurs.
0046	isz 3200	Instruction executed as a result of break on Channel 6. If overflow, flag is set, PC not changed.
1201	lac 1620	Next instruction in sequence of main program.

Priority Interrupt Instructions.

The following instructions are added to the PDP-7 with the installation of the 172. Some instructions, for example cac and asc, can be microprogrammed.

Octal Code	Mnemonic	Operation
cac	705501	Clear all channels. Turn off all channels.
asc	705502	Enable selected channel(s). AC bits 2-17 are used to select the channel(s).
dsc	705604	Disable selected channel(s). AC bits 2-17 are used to select the channel(s).
epi	700004	Enable automatic priority interrupt system. Same as real time clock "clon".
dpi	700044	Disable automatic priority interrupt system. Same as real time clock "clof".
isc	705504	Initiate break on selected channel (for maintenance purposes). AC bits 2-17 are used to select the channel.
dbr	705601	Debreak. Returns highest priority channel to receptive state. Used to exit from multi-instruction subroutine mode.

AC bits 0 and 1 are available for expansion of the basic system to 4 groups of 16 channels.

I/O BUFFERING

Separate parallel buffers are provided on each input/output device attached to the PDP-7. The high-speed paper tape reader control contains an 18-bit buffer and binary word assembler. The high speed paper tape punch, the teleprinter, and the teleprinter keyboard each contain separate 8-bit buffers. All DEC optional equipment contains separate I/O buffers. Information is transferred between the accumulator and a device buffer during the execution time of a single cycle iot instruction. Because the maximum time the accumulator is tied to any one external buffer is 1.75 microseconds, many I/O devices can operate simultaneously under control of the basic PDP-7.

Figure - shows the data path between device buffers and the AC through the Information Collector or Information Distributor.

ROUTINES AND DATA RATES

Routines:

Most input/output data transfer rates are limited by the speeds of the I/O peripheral equipment. Routines to transfer data under these conditions can be of two types, those that delay the central processor until the I/O device is ready and those that interrupt the central processor only when the I/O device is ready.

The simpliest I/O routines are those that delay the central processor until the I/O device is ready to transmit or receive the data. The following two routines should serve as examples: (iotf and iots are generalized examples of skip and transfer instructions).

```
input     iotf          /skip if device ready
          jmp    .-1    /not ready, return to test
          iots         /read device buffer into AC

                       /continue (using data)

Output    lac    data   /pick up data
          iotf         /skip if device ready
          jmp    .-1    /not ready, return to test
          iots         /transfer AC to device buffer

                       /continue
```

For application when there are heavy time demands on the central processor, it is not practical to delay the CP during each input/output cycle. Instead, the program or priority interrupts are used. An example of the use of the program interrupt with input-out transferring is given in the following section.

I/O Data Rate

The maximum speeds at which the PDP-7 can transfer 18-bit data words between one or more devices is the data rate. Examples of data transfer are given for three conditions, direct memory access, program controlled, and program interrupt controlled.

A computer-limited condition assumed. That is, data is considered to be available from a very high speed source, such as a fast A-D system.

1. Direct Memory Access, bi-directional, single device at a time. The fastest speed of block data transfer is provided by the Data Interrupt Channel. The Data Interrupt can operate up to

rates of 1.75 microsecond per word. Four input/output devices can be connected to the high-speed Data Interrupt Channel with the addition of the Type 173 Data Interrupt Multiplexer. The maximum combined transfer rate is 571,000 18-bit words per second, making the Data Interrupt Multiplexer well-suited for use with devices such as multiple magnetic tape systems (a Type 57A Tape Control) several magnetic drums (a Type 24 Drum), and extremely high speed analog-to-digital converters. Computer to computer direct data transfer can also occur at this rate.

2. Program Controlled, single device, without interrupt. The data rate is determined by the speed of a program loop to transfer, count, and address the data. No initialization is considered, for only the repetitive loop-time is desired. A computer-limited condition is assumed.

```
                INPUT

        iot                             /transfer the next data word; word is
                                         already at device buffer before computer
                                         calls for it (computer-limited)
        dac     i       10              /store data in memory list
        isz             COUNT           /increment and check COUNT
        jmp             .-3
```

Routine takes 7 machine cycles and loops at a speed of 81 kilocycles. A similar routine using a lac instruction could transfer data out at the same speed. This type of loop could also be used, with an iot skip and a jmp instruction added, to provide a count and addresses for block-like data transfer at slightly slower speeds.

3. Program Interrupt Controlled. When the program interrupt is used to free the central processor between data transfers on a slow I/O device, the PDP-7 can do arithmetic or other I/O transfers while the slow device is in operation. The following sequence gives the limiting rate at which the PDP-7 could acknowledge repetitive program interrupt from the same device. The time available each cycle for other computation is roughly (seconds/word device rate - seconds/word computer rate).

```
        -                               /interrupt occurs during a lower priority
                                         program, the Linc and the PC are saved
        dac             TEMP            /save AC
        ios                             /skip on interrupt flag from device
        jmp             CONTINUE        /
        iot                             /transfer data from device buffer to AC
        dac     i       10              /store data in memory list
```

```
isz             COUNT       /increment and check COUNT
jmp             DONE
lac             TEMP        /reload AC
ion                         /turn on interrupt
jmp     i       0           /return to program
```

The routine takes 15 machine cycles or 26.25 microseconds per loop. If the data is ready at the I/O device buffer each time the interrupt is turned on, the cycle rate is 38 KC. A similar routine can be used for data output.

TELETYPE MODEL 33 KSR

The standard Teletype Model 33 KSR (keyboard-send-receive) can be used to type in or print out information at a rate of up to ten characters per second. Signals transferred between the 33 KSR and the keyboard printer control logic are standard serial, 11 unit code Teletype signals. The signals consist of marks and spaces which correspond to idle and bias current in the Teletype and zeros and ones in the control and computer. The start mark and subsequent eight character bits are one unit of time duration and are followed by the stop mark which is two units.

Each of the 64 type characters and 32 control characters are represented by an 8-bit standard ASCII code. The Teletype eight-level code is listed in Figure . The teleprinter input and output functions are logically separate, and the programmer may think of the printer and keyboard as individual devices.

Keyboard

The keyboard control contains an 8-bit buffer (LUI) which assembles and holds the code for the last character struck on the keyboard. The keyboard flag becomes a 1 to signify that a character has been assembled and is ready for transfer to the accumulator. When the flag is a 1, a relay contact opens to disable the reader. This flag is connected to the computer program interrupt and input/output skip facility. It is cleared by command. Instructions for use in supplying data to the computer from the keyboard are:

ksf	700301	Skip if the keyboard flag is set to 1. If the flag is 0, the next instruction is executed. If it is 1, the next instruction is skipped. The flag is set only when a complete character is present in the buffer.
krb	700312	Read keyboard buffer. The contents of the buffer are placed in bits 13-17 of the AC. The keyboard flag is cleared.

Teleprinter

The teleprinter control contains an 8-bit buffer (LUO) which receives a character to be printed from AC bits 10 through 17. The LUO receives the 8-bit code from the AC in parallel and transmits it to the teleprinter serially. When the last bit has been transmitted, the teleprinter flag is set to 1. This flag is connected to the computer program interrupt and input/output skip facility. It is cleared by programmed command. The instructions for printing are :

tsf	700401	Skip if flag is set.
tls	700406	Load printer buffer and select. The contents of AC_{10-17} are placed in the buffer and printed. The flag is cleared before transmission takes place and is set when the character has been printed.

PERFORATED TAPE READER TYPE 444
(Standard Equipment with the PDP-7)

The tape reader is a timed-transfer device which senses the holes punched in 5, 7, or 8-channel paper (or Mylar-base) tape. The standard input medium is 8-channel tape. The maximum reading rate is 300 characters (lines) per second. A power switch is provided on the reader. This switch is usually left on, however, as the reader power is removed when the computer is turned off.

Operation of the tape reader is controlled entirely by the program. When the reader is selected, the brake is released and the clutch engages the drive capstan to move the tape past the photocells which sense the holes punched in the tape. For each hole present in a given line of tape, a corresponding bit of the reader buffer is set to 1.

Information can be read from tape and assembled in the reader buffer in one of two modes:

Alphanumeric Mode: Each select instruction causes one line of tape, consisting of eight bits, to be read and placed in the buffer. Blank tape is ignored. The absence of a feed hole causes the character punched in that line to be ignored.

Binary Mode: In the binary mode, select instruction causes three lines of tape to be read. The first six bits of each line are assembled in the buffer, thus three lines form a single 18-bit word. The seventh bit is ignored. However, a character is not read unless the eight bit is punched.

Figure - shows the format of standard ASCII 8-channel tape. The corresponding bits of the reader buffer for each mode are also given.

Figure - Perforated Tape Format and Reader Buffer Bit Assignment

In the alphanumeric mode, the reader flag is set when a full 8-bit character is present

in the buffer. In the binary mode, the flag is set when three 6-bit characters have been assembled into a word by the buffer. To keep the reader running at its maximum rate, the next select instruction must be given within 400 microseconds after the flag is set. The timing for each mode is shown in Figure - . The reader flag is connected to the PIC.

Figure - Perforated Tape Reader Timing

The following iot instructions control the tape reader:

rsa	700104	Select reader in alphanumeric mode. One 8-bit character is read and placed in the reader buffer. The reader flag is cleared before the character is read. When transmission is complete, the flag is set.
rsb	700144	Select reader in binary mode. Three 6-bit characters are read and assembled in the reader buffer. The flag is immediately cleared and later set when character assembly is completed.
rrb	700112	Read the reader buffer. The contents of the reader buffer are placed in the AC. The reader flag is cleared.
rsf	700101	Skip if reader flag is set.
rcf	700102	Clear reader flag and or the reader buffer into the accumulator.

PERFORATED TAPE PUNCH TYPE 75
(standard equipment on the PDP-7)

The Tape Punch is a timed-transfer device capable of punching 5, 7, or 8 channel tape at a maximum rate of 63.3 characters per second. The standard input medium is 8-channel tape.

Operation of the Tape Punch is controlled by either the program or the computer operator. The operator may punch blank tape (feed hole only punched) by depressing the punch feed button on the console or he may force on the punch power by turning on the console punch switch. Normally, the punch is left completely under program control. An instruction to punch when the punch is turned off causes the punch to be turned on and the actual punching takes place approximately one second later when the punch motor is up to speed. Subsequent punching follows at normal punch speed. The motor remains on for five seconds after the last punch command is given.

Note that the computer is not tied up by the first turn-on command of the punch cycle. However as would be expected, the second and remaining characters cannot begin a transfer to the punch buffer until the punch-ready flag is set. Two easy means of gaining the effect of automatic punch turn-on and immediate punching are 1) to give the first psa command at least 1 sec. ahead of time in the program, or 2) to give the first psa command and then use the program interrupt to indicate a punch ready state. The punch flag (connected to the PIC) is cleared by a select punch command and then set when the punching is complete. It may also be cleared by the pcf instruction.

When the punch is selected, the contents of AC10-17 are sent to the punch buffer and then subsequently placed on tape, If a bit in the AC is a 1, the corresponding bit in the bufferis set. Since the punch buffer is automatically cleared after punching a character, it is impossible to OR into it. Information is handled by the punch logic in one of two modes.

ALPHANUMERIC MODE: Each select instruction causes one line of tape, consisting of eight bits, to be punched. A hole is punched in a tape channel if the corresponding punch buffer bit is a one. A feed hole is always punched.

BINARY MODE: Each select instruction causes one line of tape, consisting of eight bits, to be punched. Holes are punched corresponding to bits 12-17 of the punch buffer. Bit 11 is never punched and bit 10 is always punched. This forces the standard format for binary information on tape.

TAPE PUNCH INSTRUCTIONS

psa	700204	Punch a line of tape in alphanumeric mode. The punch flag is immediately cleared and then set when punching is complete.

psb	700244	Punch a line of tape in binary mode. The punch flag is immediately cleared and then set when punching is complete.
psf	700201	Skip the following instruction if the punch flag is set.
pcf	700202	Clear the punch flag.

The following instruction will cause a line of blank tape (except for feed hole) to be punched. The accumulator is also cleared.

psa - 10	700214	Clear AC and punch.
pls	700206	Same as psa

The following instruction as used on the PDP-4 is also available, but is generally replaced with the more direct PSA.

ANALOG-TO-DIGITAL CONVERTER TYPE 138

The Type 138 A-D Converter provides for the conversion of an analog input voltage into a binary number of from 6 to 11 bits. The speed of conversion depends upon the choice of resolution and accuracy of conversion. The front panel of the Converter (Figure -)contains two switches for this purpose. One switch selects the resolution, from 6 to 11 bits. The other switch selects the switching-point accuracy in six steps from ±1.6% to ±0.05%.

Figure - Converter Panel

Figure - gives a table of conversion speeds for the various setting of the switches. The numbers along the diagonal are for most general purposes. The settings below the diagonal are for use where accuracy, repeatability, and differential linearity are more important than resolution (e.g., for histograms). The settings above the diagonal are for the opposite case, where resolution is more important (for example, for averaging).

Figure - Conversion Time for Each Setting of Converter Switches (in use)

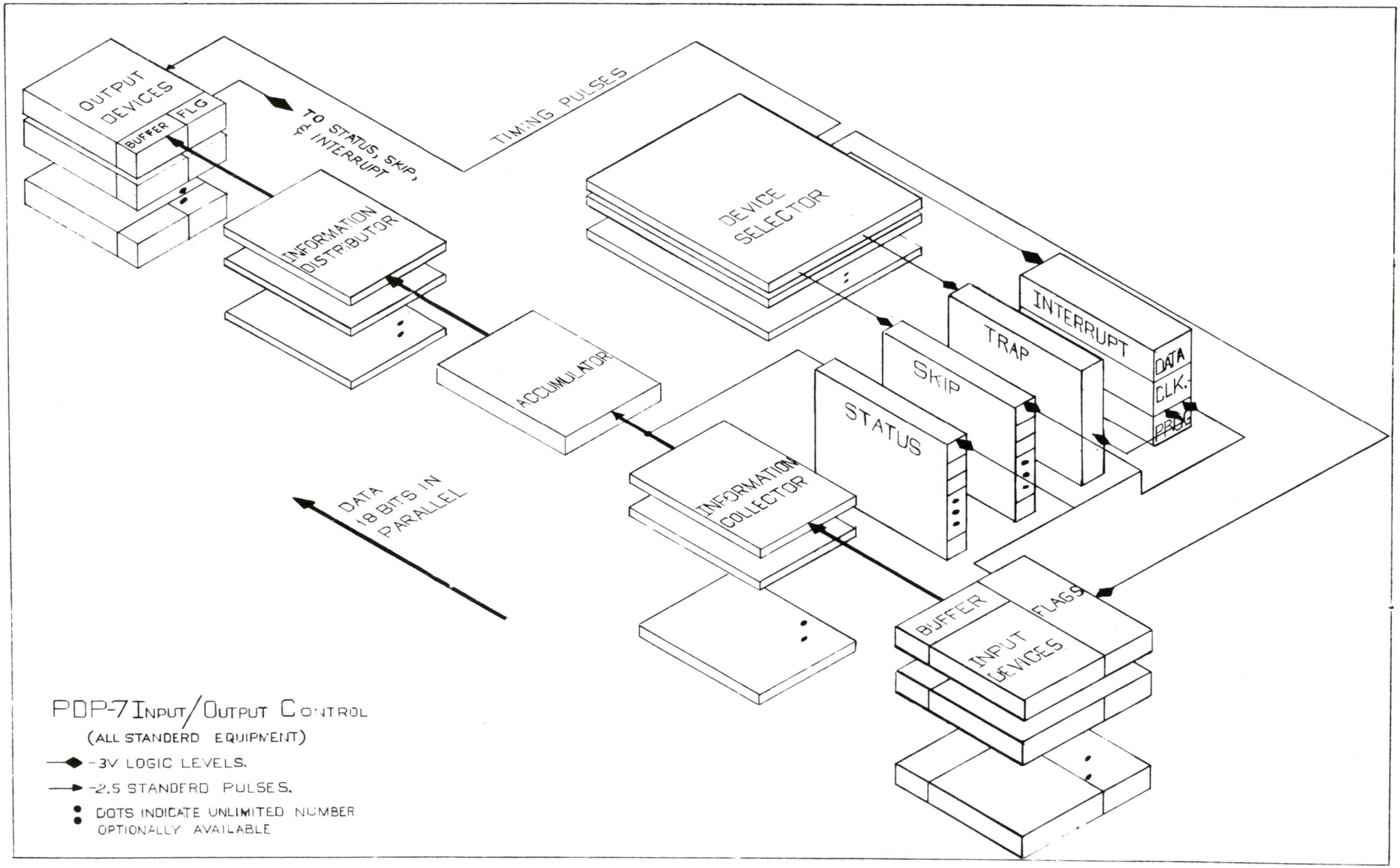
When an incoming voltage is converted, the digital result is placed left-adjusted in the converter buffer. When the contents of the buffer are read into the AC, only those bits used in the conversion (as determined by the switch setting) are transmitted. The number is placed in the AC also left-adjusted. Thus, a 10-bit result would be placed in AC_{0-9}. The remaining AC bits are cleared. Figure - shows the relation between the converted buffer and the AC.

ANALOG TO DIGITAL MULTIPLEXER TYPE 139

With the Type 139 Multiplexer, 64 channels of analog input signals can be connected to the analog-to-digital converter. A 6-bit multiplexer address register (MAR) specifies a channel number from $0\text{-}77_8$. A channel address may be chosen in one of two ways. It can be specified by the contents of bits 12-17 of the AC, or by indexing the contents of the MAR. The following iot instructions are used:

adsm	701103	Select MX channel. The contents of AC_{12-17} are placed in the MAR
adim	701201	Index channel address. The contents of the MAR are incremented by L. Channel 0 follows channel 77_8.

The channel address select instructions do not initiate a conversion. This can be done only by an adsc instruction to the converter.



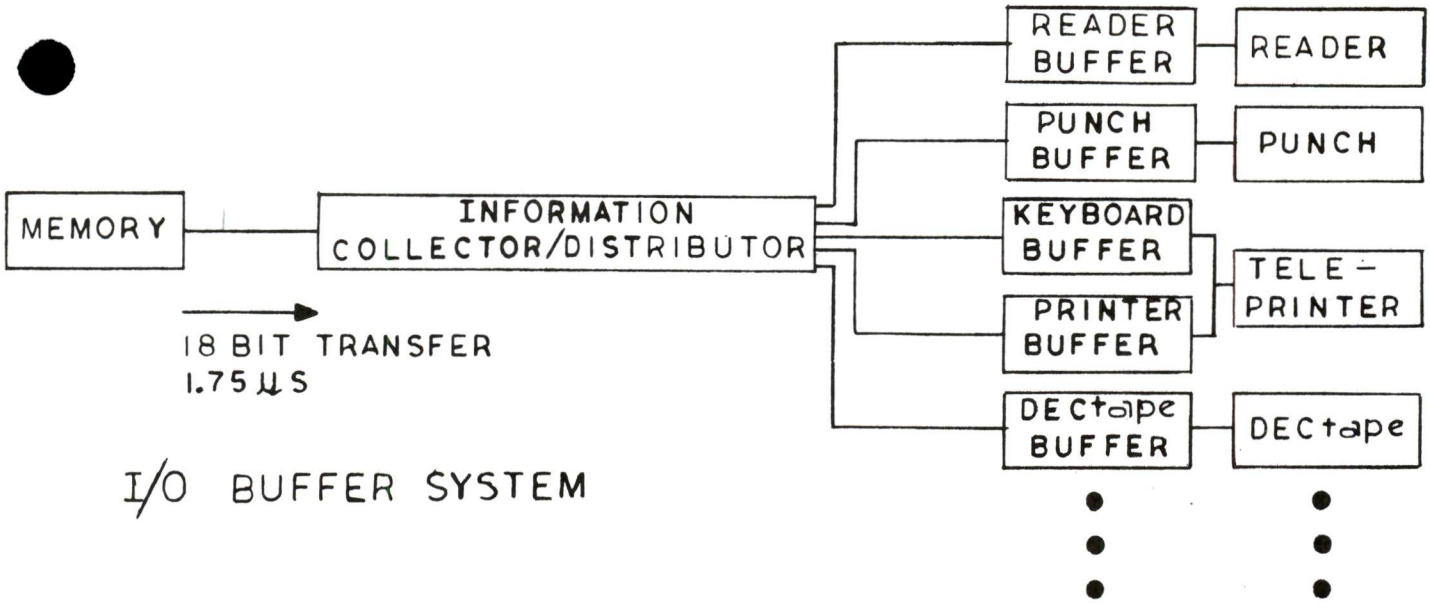
PDP-7 Input/Output Control

(ALL STANDERD EQUIPMENT)

—◆ -3V LOGIC LEVELS.

—→ -2.5 STANDERD PULSES.

: DOTS INDICATE UNLIMITED NUMBER OPTIONALLY AVAILABLE



I/O BUFFER SYSTEM

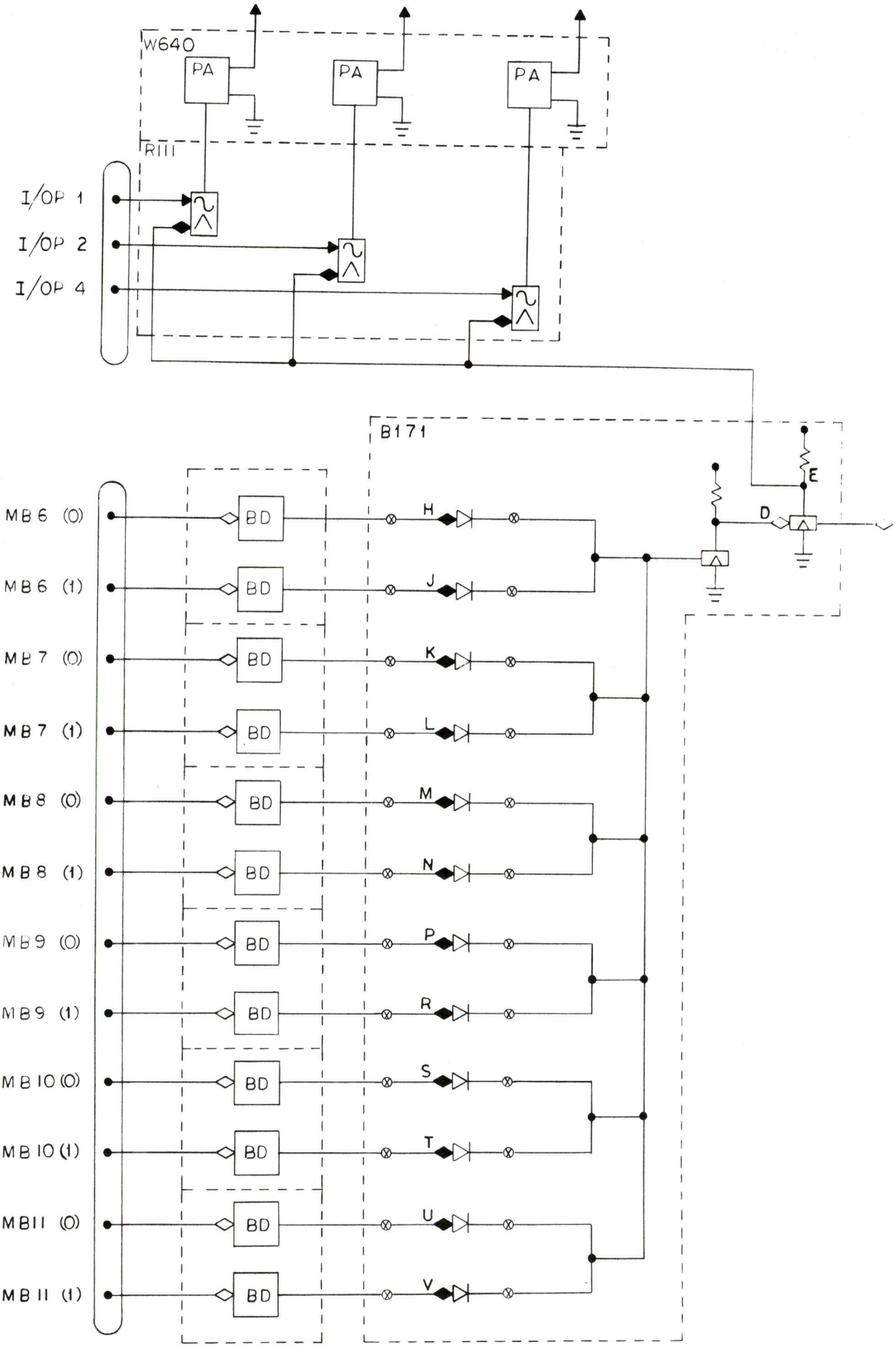


FIGURE DEVICE SELECTOR DECODER

INTEROFFICE MEMORANDUM

DATE September 28, 1964

SUBJECT Magnetic Drum, Type 236

TO Dick Best

FROM R. Lane

We have proposed drums as indicated in the following chart:

Customer	Qty.	Delivery	Probability	
Adams Assoc.	1	1-65	100%	✓
Mich., Univ. of	1	5-65	70%	✓
Rensselaer Polytech.	1	4-65	20%	
Rand Corp.	1	6-65	70%	✓
Oregon State	1	5-65	25%	
BTL	2	12-65	05%	
Lincoln Lab.	1	6-65	05%	
Wash. State Univ.	1	6-65	02%	
Hanford Labs.	3	6-65	02%	
Brookhaven	1	12-65	25%	✓
Edinborough	1	5-65	33%	✓
Axel Springer	2	8-65	05%	
DEC	1	12-64	99%	✓

In summary only 6 appear worthy of consideration (those checked)

Two are positive
Two are certain
Two are probable
Balance are very, very, uncertain.

Considering some new customers who will show up, considering some that will drop out, I recommend we order 6 with no cost cancellation privileges and that we review our position monthly.

CC: Nick Mazzarese
H. Anderson
G. Bell
Bob Savell

dec INTEROFFICE MEMORANDUM

DATE September 28, 1964

SUBJECT LRL - Extra Memory Interface Modules

TO Larry White

FROM R. L. Lane

Extra Memory Module interfaces were priced assuming the cable and checkout to be included. For example:

1 - 1664 @ 230	=	230
3 - 1665 @ 550	=	1650
1 - set I/O Bus Cable	=	500
1 - checkout	=	320
		2700 selling price

With respect to LRL, they need 6 @ 2700 = $16,200. This includes the cable sets. Can you determine the lengths they need? I want to sell them the additional interfaces but I feel they should wait until they buy the I/O processors to get the additional 2 interfaces. They should go ahead and buy 1 additional set for each memory so they can attach their special disc processor. Consequently, I recommend they only get 1 extra set for each Type 163-C at this time. —— Unless they have political reasons such as AEC money is available or they have already requested funds, etc.

Before you take any action, let's discuss this with Nick.

CC: Nick Mazzarese
H. Anderson
R. Beckman

dec INTEROFFICE MEMORANDUM

DATE September 28, 1964

SUBJECT LRL-PDP-6

TO T. Whalen

FROM R. Lane

RE: R. Beckman's Call report 21, September, 1964.
L.R.L. Construction Requisition (Serial No. 1149).

Please add the following information to the LRL Construction Requisition:

(1) Their order number
(2) DEC No.

Please change the delivery date to Nov. 30, 1964.

Please change item 2 from quantity 1 to quantity 2. (16K, 2μsec core memory).

Please add:

Item 7. Fast Memory (Quantity 1) Type 162
Item 8. Add'l Memory (core) interface (quantity 6)
3 each to each Type 163C Core Memory.
Item 9. Paper Tape Reader (Quantity 1) Type 760.

CC: H. Anderson ✓
Nick Mazzarese
R. Beckman
L. White

dec INTEROFFICE MEMORANDUM

DATE September 28, 1964

SUBJECT Time Sharing on Systems Using Magnetic Tape without DECtape

TO H. Anderson, B. Lane

FROM L. Portner

Systems using standard Mag tapes and no DECtapes or conceptually similar devices, such as disc or drum, will be provided minimum time sharing capabilities through the use of our Phase Ø system. This allows users to co-exist in memory but does not provide for the swapping of users from and to various backup devices. In addition to being denied elaborate time sharing capabilities they will not be provided with the facility to edit their Mag tapes, as they will be able to do with DECtape.

The additional programming involved in providing this system is chiefly in writing a minimal loader to load the executive system from Mag tape (if so desired). Alternatively, the executive may be loaded from paper tape.

LP:tw

INTEROFFICE MEMORANDUM

DATE
9-28-64

SUBJECT
PDP-7 Reference Manual

TO

K. Olsen
H. Anderson
S. Olsen
T. Johnson
N. Mazzarese
R. Wilson
J. Atwood
J. Nangle
S. Grover
T. Karr
G. Moore
R. Best
G. Bell
L. Seligman
D. Cotton
D. Smith
D. Fellows

FROM
Rod Belden

FOR YOUR COMMENTS AND APPROVAL

PROPOSAL FOR PDP-7 REFERENCE MANUAL

Title — PDP-7 Reference Manual

Purpose — To serve as an instruction and reference manual for all PDP-7 system, designers and operators.

Format — 8.1/2 x 11 size.

Single sheets; printed on both sides, numbered by sections (4-1, 4-2 etc.). This is for ease of addition and correction.
Console Copy to be supplied with each PDP-7 in a 3-ring "digital notebook with PDP-7 CONSOLE COPY printed or decalled on the cover.

Cover — All PDP-7 literature covers to be a similar format - similar in appearance to F-61, PDP-6 System Description, but with the PDP-7 blue. Also cover should display our now recognizable "digital" logo in some form.

Contents — Attached is a final draft of Chapter 3, Input/Output, as expanded from the PDP-4 Manual.
Note: The I/O Devices section should include in one binding substantially all of what has to-date been circulated as separate option bulletins. That is, the detailed hardware and operation description for each option would be part of the PDP-7 Reference Manual.

Other PDP-7 literature

System Description
Programming Manual
Fortran II
Maintenance Manual
Course Workbook

	Monday	Tuesday	Wednesday	Thursday	Friday
0900			System Introduction	Review Exam	DDT-6 ↓
1000			Instruction Introduction	Program Transfer & Test Instructions	↓
1100			Data Transfer Instructions	Push Down and BYTE Instructions	Assembly Lab
1200					
1300			Arithmetic Instructions	Input Output Instructions	Class Discussion (Debug)
1400			Logic & Shift Instructions	↓	Computer Time ↓
1500			Executive Instructions	Symbolic Tape Editor	
1600			Workshop ↓	Workshop	Exam ↓
1700					

Class Evening
September 30, 1964

PDP-6 PROGRAMMING CLASS

Week 2 of 2

	Monday	Tuesday	Wednesday	Thursday	Friday
900	MACRO-6 Statements	MACRO-6 MACRO Features	PDP-6 Programming Techniques	Priority Interrupt System	Review
1000	↓	↓	↓	Workshop ↓	Computer Time (Debug) ↓
1100	↓	↓	Input/Output Handling Routines	↓	↓
1200					
1300	Relocations & Linking	MACRO-6 Review	Workshop	Computer Time (Assembly)	Course Critique
1400	Workshop	Workshop	↓	Workshop ↓	↓
1500	Computer Time ↓	Computer Time ↓	Computer Time ↓	↓	
1600	↓	↓	Final Exam Introduction	Computer Time (Assembly)	
1700					

COMPANY CONFIDENTIAL

H. E. Anderson

INTEROFFICE MEMORANDUM

DATE September 28, 1964

SUBJECT Plans for Modules

TO Works Committee

FROM Burt Scudney

This is a preliminary report which attempts to summarize....

(1) The short-term (1 year) manpower requirements for the continued success of DEC modules in our traditional module market; and

(2) The initial manpower and organizational requirements for the opening of new market areas to DEC modules.

15 new people

TRADITIONAL MARKET

Module Sales: Four additional men.

These are additional people required in various field offices. This requirement represents the needs of the West Coast, Denver, Chicago, and New York areas.

Module Applications: Two additional men.

In order to help fulfill our field office needs, we have completely depleted the Maynard applications staff. This staff must now be rebuilt.

Engineering: One additional man.

The burden being placed on the Engineering Department by the PDP-6, PDP-7, PDP-5A results in intermittent attention to the module line. The requirements of the FLIP CHIP line are such that a more continuous effort must be applied.

What about transistor manufacture etc.

NEW MARKET AREAS (OEM)

Module Sales: Five additional men.

In the opinion of the writer, the present field force is neither sufficient nor suitable for the OEM market. We require additional people with suitable backgrounds for serving OEM accounts. Two would be located on the East Coast, two on the West Coast and one in the Mid-West.

Custom Engineering Service: Three additional men.

It is essential that we develop the capability to design special and unique modules for OEM customers. These additional people should be engineers with circuit design backgrounds.

SUMMARY

The above shows a need for a total of 15 additional men, 7 to continue our present module business and 8 to expand into new market areas. It is expected that entrance into the OEM market will not significantly affect sales volume for a relatively long period of time (1-1/2 to 2 years).

① O.E.M. — Special Systems — e.g. A.I.L.

② Back Panel Wiring

③ Special Modules —

] Critical Thinking needed here!

FISCAL 1965 MODULE SALES FORECAST AS REVISED 9/24/64

(thousands of dollars)

	July 1964	$ 252	(actual)
	August	199	(actual)
	September	250	(estimated)
	October	255	(forecast)
	November	350	"
	December	325	"
	January 1965	340	"
	February	310	"
	March	310	"
	April	310	"
	May	335	"
	June	415	"
		$ 3,651	TOTAL
FISCAL 1966	July	355	
	August	360	
	September	385	

H Anderson

INTEROFFICE MEMORANDUM

DATE September 30, 1964

SUBJECT "Midnight Acquisition" of Modules in Computer Checkout Area

TO K. H. Olsen
H. Anderson
R. Beckman
R. L. Best

FROM W. Colburn

For the last two weeks I have been assisting in the checkout of the Central Processor for the Adams Associates PDP-6 System. From this time two and one half days of check-out time has been lost.

This lost time may be directly attributed to the practice of modules being removed from the machine during the night, and either not being replaced at all, or being replaced with a defective one. In either case no note being left to indicate such a transaction.

The score for this "game" now stands at:

a.	Modules missing and unaccounted for	7
b.	Modules switched - bad one left in machine	5
c.	Modules switched - note left or module tagged	5
d.	Modules switched leaving an incorrectly jumpered one	3

As part of the 5 modules under "c", two were borrowed but not replaced and the borrower "could not remember where he took it from!" So a check of every module of that type was required for each one. These were on separate occasions.

The strangest part of this situation is that a key to the Finished Goods Stockroom is available to these nightime checkout people, (a fact related to me by Ed Harwood.)

WC/mro

INTEROFFICE MEMORANDUM

DATE September 2, 1964

SUBJECT My Proposed Trip to France

TO Ken Olsen
Harlan Anderson
Stan Olsen
Win Hindle

FROM Jon Fadiman

My proposal is as follows: I will go to Paris at the beginning of March 1965 and stay there for 8 months. My objectives will be as follows:

1. Set up an operating French office for DEC. I don't think it matters very much whether we set up the office as a wholly owned subsidiary as we have done in England and Germany (in other words an SARL) or whether it is merely a branch office of DEC. I think to start off with, it would be easier to have it merely a branch office of DEC and thus, there would not be any problem in the accounting area. Most of my time could be devoted to sales, engineering, and organization and not to the details of office procedure. However, the details of incorporation are not difficult and in the future we would probably want to incorporate as a wholly owned subsidiary. The important thing, however, is that we must have both sales and service available within France. The French computer market is a significant part of the entire European market, probably third in importance to England and Germany, and we cannot expect to sell any significant amount of equipment from our bases in only England and Germany. Of course, we will need the engineering and sales help from these other offices, but no French company will consider buying an installation of any great size unless it is supported by an operation within France, and the fact that England and Germany are only an hour away by plane does not change this fact. It is essential that whoever is working in France speak the language fluently, since for one thing most French engineers speak English either badly or not at all, and secondly even if they do speak English they are automatically prejudiced against a company that cannot communicate in their language. Furthermore, by trying to sell equipment in France without a French base of operations, we are somewhat endangering our whole European operation by not projecting the required image of adequate sales and service background.

2. My second objective will be to hire French personnel for the French office. Obviously we don't intend to run the French office with Americans, but in order to find a really good man to run the office it is necessary to set up operations and have continual contact with people for a fair length of time. It is for this reason that I have so far been unsuccessful in finding anyone to set up the French office. It is necessary to be resident in France for a

while to do that. The French attitude is very cautious, and until an engineer sees a going concern in France he probably will not want to join it. However, by establishing the office there myself, I will be able to interview people and eventually find a good sales engineer with computer experience to do the job for us in France. Additional personnel could then be hired as necessary. If a senior man cannot be found I could hire a more junior engineer who would be able to do maintenance and learn about computers and with sufficient training would be able to sell for us. This alternative would not be available to us unless we had someone like myself stationed in the Paris office for an extended length of time.

3. The third objective of the proposed European trip will be to solve some of our sales problems in our present offices in Germany and England. In Germany we may find it necessary to hire an aggressive computer salesman, and I will be able to look into doing this when I am there. In England the problem is somewhat different. We are doing very well with John Leng, but he will not be there past April or May. Therefore, I will have to either hire someone else to be in charge of the English office, or send someone over from the U. S., or possibly have Geoff Finch take it over. At the moment I have no feeling as to just what the proper thing to do is, but there obviously will be some problems when John Leng leaves.

4. A fourth objective will be to do a good deal of sales work in some other parts of Europe which we have not yet had time to touch. It would be worthwhile to look into the situation in Israel for a few days, inasmuch as there is a considerable amount of computer activity both in the universities and in the Atomic Energy Commission of the government. A trip to Italy is certainly called for. Computer activity is growing in Spain and I would want to take a trip there in order to survey the Spanish market and see what we could do there. Although I don't speak Spanish, my wife does so fluently and this would help considerably.

Most important, if we are to establish ourselves firmly in Europe and do the type of aggressive business to which we are accustomed here in the U. S., we must be firmly established in England, France and Germany; in other words, in the three major language areas of Europe. Thus, the establishment of a French office would definitely help us not only for our sales in France, but throughout Europe. I am aware that this will be a fairly expensive operation, but I am also aware that it is an essential one if we are to take advantage of the presently expanding European market.

JF:nlz

September 14, 1964

OUTLINE OF JOB TO BE DONE IN STARTING THE FRENCH OFFICE

The preliminaries of setting up the office can be disposed of very rapidly. Since we already have an office, we can send literature there ahead of time so there will not be the problem of going out and talking to customers without having the literature available. It will be possible to find a bi-lingual secretary by advertising in the local press. As is usual in a foreign office, a first-rate secretary who can handle both languages and who, with a little training, can run the office while the manager is not there, is essential. Since we do not intend to set up a separate company in France immediately, there will be very few problems having to do with accounting. It will be necessary merely to open a bank account for the company in Paris which I can draw upon and then the secretary can keep the very simple records that are required. Invoicing will be done from Maynard and a record kept in the French office of sales made and commissions due.

I intend to arrange beforehand to have a Telex installed in the office for efficient communication between Germany, England, Paris, and Maynard.

The office is already furnished with a minimum amount of furniture and all that will be necessary is to buy an electric typewriter, an electric adding machine, and a copying machine.

Thus, the preliminary job of setting things up should go quite quickly and allow me to get down to the business of making sales contacts. We have had correspondence with quite a few customers in France already. Most of these have been requests for information which we have given but without sufficient follow up. By making a careful survey of the correspondence which we already have in our files the first sales contacts should turn out to be more profitable than would be the case if we were just beginning.

Alan Kotok and I will be giving a talk on the PDP-6 before a French computer society on October 21st. This should help to get the name of Digital Equipment Corporation and the PDP-6 a bit more known in France. Some advertising, particularly on the PDP-5, PDP-7, and FLIP CHIP Modules will be done before I go over. While advertising is not going to bring in any direct sales, it should make it a little easier when we go to talk to customers who will at least have seen our name in print before. We already have installed one computer in France, and this will, of course, make it easier for us to sell more computers. Indeed, Dr. Storey himself who bought the PDP-5 at Meudon, is quite interested in the PDP-6.

The market which I shall first attempt to work on is the educational and scientific market. My contacts at the Institute Blaise Pascal, which is the largest computing center in Paris, have been limited to one man, who, it seems to me, does a great deal of talking and not much acting; but it should not be too difficult to get other contacts there. We already have some contacts at the Université de Paris and the College de France. I would expect to concentrate quite a bit of sales effort in the early springtime before people start to go on vacation in July and August. Jean Lebel should be of some help in getting to know some more people in the academic circles. We have had several inquiries from the Université de Grenoble and that would be one trip that I would make very near the beginning of my stay in Paris. Another potentially important area is the medical field. Dr. Remon, who seems to be one of the foremost people in France in this field, when he was here talking to Mort Ruderman seemed convinced that there was quite a market for the Linc or possibly PDP-5, but more likely the Linc in France. However, we have not as yet exploited this, since there is no one in France to do the job.

By the time I go to France in March we will have installed the PDP-4 at Harwell, the PDP-5 at Meudon, and the PDP-7 at Delft. I would hope that we will also have sold a PDP-7 at Oxford, a PDP-7 at Karlsruhe, and a PDP-7 at Aachen. There should be some other sales of 5's by that time also. This is a pretty good base upon which to build future sales in Europe and also to hire personnel. However, it is not possible right now for me to give a detailed sales forecast. From past experience in Europe it looks as if the PDP-7 will be the big seller. This may be partly because of its speed, and we don't know what effect the PDP-5A will have upon the European market. I would hope during the eight months that I would spend in Paris to lay the groundwork for the sale of one PDP-6 and possibly two PDP-7's and two PDP-5's. I don't claim that I will have completed the sale of all of these items in eight months, but I should at least have laid the groundwork for them and concluded some. In addition, I feel that our new FLIP CHIP modules ought to sell quite well in France. We have not sold any modules to speak of except for one fairly substantial order for the College de France for "Hough-Powell" device. However, the prices on the FLIP CHIP modules are low enough that we are now competitive with Philips and with French OEM manufacturers.

One of the main reasons for my going to Paris will be to find a competent manager for the Paris office. This man should be a Frenchman with a working knowledge of the English language. He should be familiar with Digital computers preferably from the standpoint of sales, usage, and programming. We would probably have to pay such a man about $10,000 to $12,000 per year, but this is the type of man that we are looking for. I would hope to find such a person by means of personal

contacts which I will make in the process of doing sales work. I will also be able to advertise for such a man, though I think that this procedure is less likely of success than the personal one. I would hope to have located a person sometime in June who would then be available for work by the first part of August. Depending upon how the sales possibilities work out we will probably also want to hire a maintenance man. Though this man must have a good knowledge of French, it would not be essential that he be a Frenchman. Perhaps we would want to hire someone in Holland who would be responsible for the PDP-7 at Delft and work out of the Paris office for a while.

Cost:

I have not yet had time to work out the detailed costs of this venture. From past experience in foreign offices the cost will probably be in the neighborhood of $30,000 for the eight months. I will be able to make out a more detailed budget shortly.

There is also the problem of how to handle the international office here in Maynard while I am away. Being in Europe I will have much closer control of the European business from the Paris office than I am able to have from here. I would also still be involved in the decisions of what is done in Japan and Australia. The more routine correspondence work and filling of information requests for the foreign offices can be handled by Brad Towle here, provided that he has someone else to work with him to do the detailed work of shipping and invoices. Brad will of course need more help on the technical side than I do.

Jonathan Fadiman
Manager, International Marketing

dec INTEROFFICE MEMORANDUM

DATE September 2, 1964

SUBJECT

TO Harlan Anderson
Dick Mills
Win Hindle
Stan Olsen

FROM Kenneth H. Olsen

I got a call from Ed Fredkin on Monday, August 31st to say that he is interested in buying old, discounted PDP-1s. He is coming to see me on Thursday, September 3rd at 3:30 to talk this over. While making the appointment, he told of something interesting he found out about renegotiation and thought it might be very significant to us. According to Ed, the law says that when a product has a life of more than five years, that percentage beyond five years is not renegotiable. For example, if a computer lasts for ten years, only half of its cost is renegotiable. I think our computers and our modules have lives longer than five years and this might be a significant factor.

Ken Olsen

KHO:ech

dec INTEROFFICE MEMORANDUM

DATE September 3, 1964

SUBJECT KNOX COLLEGE, GALESBURG, ILLINOIS

TO Harlan Anderson

FROM Tom Quinn
Chicago Office

Thanks for the lead on Burton Squires. This is the first I have heard of Mr. Squires's interest, yet he apparently was expecting our follow-up after SJCC. This leads one to wonder how many other people have been overlooked as a result of the confusion surrounding a trade show or just plain negligence. Since trade shows represent a substantial investment in both time and money and are a valuable source of inquiry, I wonder if we can devise a method of assigning responsibility for the transfer of this information. A simple hand written note is all that is required and it should be the responsibility of the person initiating contact to see that these notes are promptly transmitted.

I will contact Mr. Squires immediately. Thank you very much.

Tom

THQ:ms

INTEROFFICE MEMORANDUM

DATE September 3, 1964

SUBJECT UNIVERSITY OF MINNESOTA -- DR. OTTO SCHMITT

TO Harlan Anderson

FROM Tom Quinn
Chicago Office

Thank you for your memo of August 28, 1964, regarding Otto Schmitt's PDP-5. I have been aware of his difficulties for the past month and have initiated action so as to tie off the loose ends as soon as possible. Dr. Schmitt's difficulties are small and principally the result of his not having had time to get into the details of his configuration. This situation should be remedied with the addition of Mr. Bill Hart to Schmitt's staff, who will take responsibility for the installation. I met with these gentlemen last week and have brought them up to date on all documentation relating to their system. I am also trying to get Hart to come back to the plant for the 9/28/64 PDP-5 course. Finally, I intend to visit Schmitt during the week of 9/14/64 and at regular frequencies thereafter so as to prevent any misconceptions regarding the support and service extended by the Digital Equipment Corporation.

TPQ:ms