COMPANY CONFIDENTIAL

OPERATIONS COMMITTEE MEETING

April 28, 1969

AGENDA

1. Additions and Corrections to Minutes of the April 22nd Meeting, and the Budget Meeting on April 24th
2. Plans for Education Cross-Product Marketing - (Norm Doelling)
   (Report distributed for April 14th meeting)
3. New Product Development - (Pete Kaufmann)
   (See attached report)
4. PDP-11 Announcement Proposal - (Nick Mazzarese)
   (See attached report from Ken Hedberg)
5. Proposed Display Product Group - (Bob Collings)
   (See attached report)
6. PDP-8 Product Line Organization - (Bill Long)
7. Regulations of Employment for Japan - (Win Hindle)
   (See attached report from Cliff Stanley)
8. Proposed Increases in Medical Benefits Under the Digital Group Insurance Plan -
   (See attached report from Lee Callahan) (Win Hindle)
9. Salary Administration for Wage Class 4 Employees - (Win Hindle)
   (Report from Bob Lassen and Graydon Thayer distributed for April 22nd meeting)
10. Facilities Planning Report - (Al Hanson)
    (See attached report)
11. Proposed Changes in the Public Relations Department - (Mark Nigberg)
    (See attached reports)
12. Land Committee Status Report - (Ed Schwartz/Al Hanson/Bob Lassen/Bob Dill)
13. Product Line Managers Conference - (Gabe d'Annunzio)
    (See attached report)

COMPANY CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 30, 1969

SUBJECT: MINUTES OF THE OPERATIONS COMMITTEE MEETING ON APRIL 28

TO: Operations Committee FROM: Win Hindle, Secretary

Present: Stan Olsen, Pete Kaufmann, Ted Johnson, Win Hindle, Nick Mazzarese

1. Minutes of the April 22 Operations Committee meeting were approved, with the following correction of Item 8. Summer work schedule will run from June 1 to September 30.

2. Education Cross-Product Marketing - We suggested that Norm Doelling go over his plans with Ken Olsen this week, since Ken has a strong feeling that we are not pushing single-user FOCAL systems with enough emphasis.

3. New Product Development - Harry Godfrey prepared a chart of all new products. We asked Pete to have Harry continue to do this and get complete information on the chart.

4. PDP-11 Announcement - Nick proposed that we begin to announce the PDP-11 on July 15, 1969. Nick will call a meeting later in the week to continue this discussion.

5. Display Product Group - We accepted Bob Collings' proposal to establish the Display Product Line. However, we did not accept Bob's proposed profit level of 19%. We asked Bob to redo the budget to come up with 24 - 25% profit. We also asked that Bob prepare a one-page memo outlining to everyone (mostly our salesmen) who has responsibility for each display product.

6. PDP-8 Product Line Organization - Bill Long proposed his PDP-8 organization for the future. We disagreed with some of his organization principles, and made a number of suggestions. Bill will come back again next week to convince us about how he will organize to control his business. In particular, we asked him to say what his organization should look like one year from now and what his schedule for hiring key people is.

7. Medical Insurance - We accepted the proposal for increased medical benefits under DEC's Group Insurance Plan - this includes major increases in hospital room rate coverage and maternity benefits. We asked Personnel to make a presentation to the Operations Committee in the near future on all DEC policies and benefits. Included in this presentation should be our competitive position and projections on future trends and costs.

8. Regulations for Employment in Japan - We accepted the proposed work rules for DEC's Japanese employees.

9. Salary Administration for Wage Class 4 Employees - This item should be on the agenda for the next "Woods" meeting.

10. Facilities Planning - The proposed plans by Al Hanson caused some problems. We asked Al to sit down independently with each member of the Operations Committee to get final numbers for expansion needs through Fiscal Year 1970. Al will make his further recommendations next Monday.

    Also, Al reported that getting more parking space would cost about $300 per car by filling in the pond. We did not make a final decision on how to get the additional 500 spaces needed.

11. Land Committee Status Report - No new information this week.

12. Public Relations Objectives - We accepted Mark Nigberg's proposed set of objectives for the Public Relations Department and his proposal that the Personnel Relations group (Dimitri Dimancesco) transfer and work for Mark.

13. Product Line Managers' Conference - We accepted Gabe d'Annunzio's outline, and suggested he meet with Ken Olsen soon to work out more details.

W. R. Hindle, Jr.

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digital INTEROFFICE MEMORANDUM

DATE: 11 April 1969

SUBJECT: EDUCATION CROSS-PRODUCT MARKETING

TO: Operations Committee FROM: Norman Doelling

The attached memo includes a first cut at the education budget and presents a first very rough attempt to resolve a major dichotomy in cross-product line marketing. Specifically, we are trying to separate the "pure" marketing functions and costs from the product development or educational computer pack activities.

I have three specific goals for education cross-product marketing for next year. These are: First, to extend and expand the pure marketing functions (item 2 on the attached memo) which are aimed primarily at selling current DEC products to the education market, that is, small standalone computers, multi-user FOCAL systems, Time-Shared 8's, and PDP-10's.

Second, I believe we should develop under the education marketing group and in conjunction with the product lines, a Time-Shared 12 and a Time-Shared 15 system. Third, we must address two software problems, the first being administrative and student record keeping which should be done primarily in FORTRAN IV so that both the 9 product line and the 10 product line can benefit. The second software problem which should be addressed is the development of computer aided instruction (CAI) author languages for our time sharing systems. I have no specific recommendations as yet in this area. I am currently investigating possibilities of obtaining materials from Computer Curriculum Corporation, Harcourt, Brace, and World, or Systems Development Corporation.

The past year has been frustrating for all of us from the viewpoint of accountability and coordination of cross product marketing activities for the several product lines. I believe the proposed sub-product concept (item 6 in the attached memo) and coordination of the activities of my staff with Keith Patterson of the 10 line and Bob Pouliot of the module line will produce more effective, more profitable, and more accountable results.

digital INTEROFFICE MEMORANDUM

DATE: 8 April 1969

SUBJECT: EDUCATION CROSS-PRODUCT MARKETING BUDGET

TO: Bob Savell
John Jones
Ed Kramer
Bill Long
Al Devault
Bob Lane

FROM: Norman Doelling

1. Form

In order to separate "pure" marketing functions and product planning functions, I have tried to break the education cross-product marketing function and costs into two classes of activities. The first class includes truly cross-product advertising, brochures, trade shows, direct mail and sales support activities. The second category is distinct hardware and software products and product development activities which I would like to develop for the education market. I would propose to develop and market these products as separate discrete projects using hardware and software resources of the appropriate product lines. As separate products they would have separate and distinct budgets and statements of operations, just as LABCOM, LAB-8, and TSS/8 currently do.

The general cross product education marketing expenses are derived from my January 14 Education Cross Product Marketing Plan. The proposed budget for marketing expenses is almost identical to the budget for calendar 1969 given in sections 3.2a, 3.2b, 3.2c, 3.2d, and summarized in section 6.1, Exhibit I. It differs in Product Line marketing as one staff member will be added.

I summarize below the recommended expenses and the proposed break out by product line. It may be assumed that the expenses are distributed evenly over the four quarters.

2. MARKETING AND PROMOTION EXPENSES

	Total	Mod.	8	9/15	10	12	TPL
Space Advertising	$30K	10% $3	35% $10.5	20% $6	20% $6	15% $4.5	0 0
Brochures and Promotional Lit	$30K	10% $3	35% $10.5	20% $6	15% $4.5	15% $4.5	5% $1.5
Direct Mail	$15K	5% $.75	25% $3.75	20% $3	20% $3	20% $3	10% $1.5
Slide Presentations (Sales presentations and support)	$10K	20% $2	20% $2	20% $2	20% $2	20% $2	
Trade Shows	$15K	33% $5	67% $10				
TOTAL	$100K	$13.75	$36.75	$17	$15.5	$14	$3

3. CROSS PRODUCT LINE STAFF MARKETING EXPENSES

Doelling*	$ 16
Allison	$32
New Hire	$32
	$80K - including travel, secretaries, etc.

*Half time on discrete projects

Recommended distribution:

Modules	PDP-8	PDP-9/15	PDP-10	PDP-12	TPL
$4K	$32K	$16K	$16K	$8K	$4K

4. TOTAL CROSS-PRODUCT MARKETING EXPENSES

TOTAL	Modules	PDP-8	PDP-9/15	PDP-10	PDP-12	TPL
$180K	$17.75	$68.75	$33	$31.5	$32	$7

5. EDUCATION MARKET BOOKINGS FORECAST

TOTAL	Modules	PDP-8	PDP-9/15	PDP-10	PDP-12	TPL
$12.4K	$0.4[1]	$4.5	$3.0	$4.0[2]	$1.0	$.5[3]

1. Does not include Computer Lab
2. Includes CAI applications as well as university computer centers.
3. Primarily add-on to PDP-8's to make multi-user FOCAL systems and TSS/8's.

6. PRODUCT PLANNING AND DEVELOPMENT

Cross product line marketing must involve product planning and product development. In the case of educational marketing, products for the education market are small stand-alone systems, small time-sharing systems, and special software systems which might be integrated with the large PDP-10 time-sharing system. I propose that the small time-sharing systems be developed as computer packs with a separate budget statement of operations and that the development be under the direction of the education cross-product line marketing function.

I have already worked out in detail a budget and statement for Time-Shared 8 for the next fiscal year. I have very roughly begun estimates for a TSS/12 and for a TSS/15. I would propose to have a "sub-product" manager or managers to handle the development projects using programming and engineering resources from the appropriate product line. If you want, in a certain sense, the software and hardware people from the product line would be assigned to the sub-product manager during the development period.

I strongly recommend this approach because the growth of our business and the proliferation of sub-products makes it difficult for us to measure profit and loss of individual sub-products. I recommend that this be carried out under the education marketing section because these products are so closely identified with the education market. In addition, the cross product nature of the function provides a more objective basis for determining the necessity and appropriateness of developing for example the Time-Shared 12, given the availability of the Time-Shared 8. Finally, I believe we have begun to develop and can continue the development of a strong core of time-sharing software and marketing specialists for the small machine area.

A Time-Shared 12 offers several sales advantages over a Time-Shared PDP-8. First, I expect cost will be slightly lower. Second, I believe the LABCOM software can be developed very simply to handle student record keeping functions instead of patient record keeping. For many smaller colleges, this system operated in a non time-sharing mode would provide the answer to administrative needs which TSS/8 does not currently respond to. Third, in engineering and technical schools, the PDP-12, when operated in non-time-sharing mode, provides an ideal vehicle for teaching the use of display, A/D Converters, D/A Converters, process control and the like. A small Time-Shared 12 configuration would thus satisfy many needs that current TSS/8 configurations do not.

NOTES FOR BUDGET STATEMENT OF OPERATIONS

Line:

(1) Estimate average system price is $100K

(2) Estimate about 10% of total is sales to subsidiaries

(5) Discounts assumed 10%

(8) Estimate service income $1200/system/quarter

(10) Cost taken as 40% of sales

(15) Warranty expenses taken as 9% of Sales in 1st and 2nd quarter and 6% of Sales in 3rd and 4th quarter

(16) Maintenance taken +0.80 income

(40) See attached sheet

(50) Product Line Marketing

	Q1	Q2	Q3	Q4
Project Manager N. Doelling	8	4	2	2
Software and Marketing Manager (Bailey)	5	5	5	5
Marketing Manager	8	8	8	8
	21	17	15	15

(51) Taken as 6% of bookings

BUDGET STATEMENT OF OPERATIONS

DATE 7 April 1969

		Fiscal Quarters 1970				Total Fiscal Year 1970
		First	Second	Third	Fourth	
	BOOKINGS TO DATE 1,500	1,000	1,000	1,500	1,000	4,500
1	Equipment Sales of Parent	600	1,500	2,000	1,600	5,700
2	Equipment Sales of Subsidiaries					
3	Contributions	10	10	10	10	40
4	Allowances					
5	Discounts	60	150	200	160	570
6	INCOME FROM SALES OF EQUIP	530	1,340	1,790	1,430	5,090
7	Rental Income					
8	Maintenance & Service Income	0	7	25	49	81
9	NET OPERATING REVENUE	530	1,347	1,815	1,479	5,171
10	Domestic Job and Standard Costs	240	600	800	640	2,280
11	Subsidiary Job and Standard Cos					
12	Manufacturing Overhead Varianc					
13	Variances From Standard					
14	Allowances					
15	Warranty & Installation Expense	54	135	120	96	405
16	Royalty Expense	3	7	10	2	22
17	COST OF SALES - EQUIPMENT	297	742	930	738	2,707
18	Depreciation of Leased Equipmer					
19	Maintenance & Service Expense	0	6	20	40	66
20	COST OF NET OPERATING REVENUE	297	736	910	698	2,641
21	Margin on Equipment Sales (6-17	233	598	860	692	2,383
22	Margin on Rentals (7-18)					
23	Margin on Maintenance & Servic	0	1	5	9	15
30	TOTAL GROSS MARGIN (21+22+	233	599	865	701	2,398
40	Product Line Engineering	42	35	26	19	122
41*	Shared Product Engineering	11	27	36	30	104
42*	Manufacturing Projects	3	7	9	7	26
43	TOTAL ENGINEERING EXPENSE	56	69	71	56	252
50	Product Line Marketing	21	17	15	15	68
51	Domestic & Foreign Selling	60	90	120	96	366
52	Advertising & Promotion	10	10	10	10	40
53	Cross Product Expenses					
	TOTAL SELLING EXPENSE	91	117	145	121	474
61*	ADMINISTRATIVE EXPENSE	42	108	145	118	413
62*	OTHER (INCOME) & EXPENSE					
70	PROFIT BEFORE FEDERAL TAXES	44	305	504	406	1,259
	*To be completed by accounting	8%	23%	28%	27%	24%

PRODUCT LINE ENGINEERING BUDGET

(Includes any Market Application Expenses)

Product Line PS5/8

Date 7 April 1969

Center No.	Description		Fiscal Quarters - 1970			
			First	Second	Third	Fourth
	Hardware Manuals	J. Bellantoni	5			
	Software Manuals	L. Portner	10	10	5	
324	Model Shop	G. Gerelds				
325	Drafting	R. Melanson	2	2	2	
330	Mech. Eng.	L. Prentice	2			
335	Test Equip. Serv.	J. Cudmore				
339	Process Eng.	T. Stockebrand				
357	Module Eng.	A. Devault				
359	PDP-10 Eng.	R. Savell				
360	Programming	L. Portner	18	18	18	18
363	Analog Develop.	C. Crocker				
365	Program Library	L. Portner				
369	DECUS	L. Portner				
374	Production Eng.	D. Knoll				
375	Display Eng.	R. Collins				
377	PDP-9 Eng.	J. Jones				
380	Linc Eng.	R. Clayton				
381	"8" Engineering	R. Cady	5	5	1	1
386	Special Project	J. St. Amour				
	(A) Contingency Memorex					
	Disk - Estimate $50K					
40	TOTAL PRODUCT LINE ENGINEERING*		42	35	26	19

C. Rix 2/69

* Not including (A).

digital INTEROFFICE MEMORANDUM

DATE: April 24, 1969

SUBJECT: NEW PRODUCT DEVELOPMENT

TO: Operations Committee FROM: P. Kaufmann

To assist us in getting our arms around the new products we are developing, I asked Harry Godfrey to put together the attached chart showing us all the new products which we know are being developed (there may be more that we do not know about). It also shows the estimated steady state of production and the estimated sales price as well as approximate Release To Build and Release To Production dates.

/kb
Attachment

Data Acq Sys INT			
GC9			
PDP-14			
KA11		60/mo	
4K mem		100/mo	
CONSOLE		100/mo	
TTY CONT		100/mo	
1K ROM	PDP-11 OPTIONS	100/mo	
64 W mem	"		
Rdr/PUNCH	"		
Ex mem	"		
SMALL DISK	"		
CHP TAPE	"		
Real Time CLK	"		
XY SCOPE	"		
Printer	"		
Data Comm	"		
Dectape	"		
CarD Reader	"		
CarD PUNCH	"		
11/40 (Ex 11)	"		
H.S. Printer	"		
MAG TAPE	"		
A-D CONV	"		
H.S. DISK	"		
8 REPLACEMENT			

Notes: 1. DATES AND FIGURES are approximate.

2. See appropriate "New Products" MEMOES FOR UNPLANNED Produc

REVISIONS

REV.	CHANGE NO.	CHK

DEC FORM NO.
DRD 102A

8 7 6 5

UNIT NAME	Description/Remarks	EST STEADY STATE	EST SELL PRICE	FY A	FY
MAIOTA	Tester	6 ONLY	COST 6K		▲RTB
RM10B	BRYANT DRUM	10/MO	50K		▲RTB
TU30	MAG TAPE	4/MO	20K	▲RTB	
VT03	KYBD DISPLAY	8/MO	8K		
RP10	DISK PACK	5/MO	25K		▲RTB
RA10	BRYANT DISC	6/4R	150K		
CP10	CARD PUNCH	2/MO	30K	▲RTB	
DC10B	Data set	1/MO	5K	▲RTB	
VP10	POINT PLOT DISPLAY		5.6K		
DK10	REAL TIME CLK		5K		
LT37	TTY	5/MO	3K		▲RTB
1usec CHP mem	REPLACE MAIO	10-20/MO	50K		
MASS CORE		10/MO	70K		
KI10	NEW IO PROC	5/MO	180K		
PA68K	POS BUS PA68A	10/MO	35K	▲L.R.	▲RTB
PA63	Graphic & New Type SETTING System				
PDP-15		30-40/MO	25K		
CHP 15 MCM					
LARGE 15 MEM					
15 LINE PRINTER			35K		
RP15	DISK PAC	4/MO	18K		
DISPLAY MUX					
RF09/RS09		20/MO	6K/9K		
TC08/TC09		100/MO	4.5K		
15 GAS CHROM					
VT15					
IC - TC58 - TC59					
PC04	Rdr/Punch	80/MO	3.3K	▲L.R.	
PC05	Rdr/Punch	80/MO	3.3K	▲L.R.	
TU56	REPLACE TU55	100/MO	3K		▲
TU10	TAPE UNIT	40/MO	6K		
SMALL PRINTER		100/MO	4K		
VR12	DISPLAY	35/MO	2K		
KV8I	"	10/MO	6.5K		
VT01	"	10/MO	6.5K		
VT02	"	5/MO			
KV8L	"		6.5K		
VS08	"				
VT15	"				
VT10	"				
338 FRONT END					
LIGHT PEN		5/MO			
Rand Tablet	DISPLAY OPTION				
A/D					

B

RTP

QTY.	DESCRIPTION	PART NO.	ITEM NO.
	PARTS LIST		

UNLESS OTHERWISE SPECIFIED	DRN. H. Lodfrey	DATE
UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES TOLERANCES DECIMALS ± .005 · FRACTIONS ± 1/64 · ANGLES ± 0°30' FINAL SURFACE QUALITY ✓ REMOVE BURRS AND BREAK SHARP CORNERS	CHK'D.	DATE
	ENG.	DATE
	PROJ. ENG.	DATE
	PROD.	DATE
MATERIAL	FIRST USED ON	
FINISH	SCALE	
	SHEET OF	

digital EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

TITLE
New Product Spread Sheet

SIZE	CODE	NUMBER	REV.
D			

DIST.

REV	NUMBER	SIZE	CODE
		D	

B

A

4 3 2 1

REV. | NUMBER | SIZE | CODE

FY 70 | FY 71

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PDP-11

DATE: April 24, 1969

SUBJECT: PDP-11 Announcement Proposal

TO: N. Mazzarese

FROM: K. Hedberg

COMPANY CONFIDENTIAL

DO NOT COPY

Announcement Timing and Strategy

Certain criteria for announcement were discussed and the most important are as follows.

1. Running Prototype
2. Running basic software
3. Documentation package

The documentation package is particularly important and will be the only possible hold-up of the three. This package consists of the following documents.

1. Price list and Discount Schedule
2. Brochure
3. Interface description
4. User software manual
5. Software description
6. Deliver information
7. Sales strategy
8. Model
9. Press kit
10. Preparation for press conference

Because of the time involved in getting the information together for the Documentation Package, after analysis, it was found that the PDP-11 could be announced on July 15, 1969. However, because of the projected loss of sales, we propose to announce the PDP-11 on June 15, 1969. The documentation package would be complete, but would not be in a final printed form.

BREAKDOWN OF DOCUMENTAION ANALYSIS

	DATE TYPED COPY AVAILABLE[1]	PRODUCTION & PRINTING TIME	DISTR. TIME	DATE IN FIELD[2]	WHEN REQUIRED IN FIELD
Price list & Discount Schedule	June 1	4 wks.	2 wks.	July 15	July 15
Brochure	June 1	4 wks.	2 wks.	July 15	July 15
Interface Description	June 1	2 wks.	2 wks.	July 1	July 1
Preliminary User Software Manual	June 1	2 wks.	2 wks.	July 1	July 1
Software Description	May 15	0	0	May 15	Prerequisite to Brochure (May 15)
Delivery Information	June 1	2 wks.	2 wks.	July 15	July 15
Sales Strategy	June 1	2 wks.	2 wks.	June 15	June 15
Model	May 15	0	0	May 15	Prerequisite to Brochure (May 15)

NOTES:

1. These dates allow us to xerox copies and distribute to the field in time for proposed announcement of June 15, 1969.

2. These dates allow us full printing and distribution time to announce July 15, 1969.

digital INTEROFFICE MEMORANDUM

DATE: April 24, 1969

SUBJECT: Display Product Group

TO: Operations Committee FROM: Bob Collings

I would like to propose the establishment of a Display Product Group. This group will assume full responsibility for the marketing, engineering, and profitability of the following display products:

KV Graphics System including the VT01 Storage Tube, the H306 Joystick, the VT02 Stand-Alone Terminal, and associated interfaces.

VR12 and associated controllers on all products with the exception of the PDP-12.

Light Pen on all display products.

338, 339, and 340 Programmed Buffered Displays.

Type 33 and Type 37 Compatible Electronic Keyboard.

Alphanumeric terminals including the VT03 on all products with the exception of the PDP-10.

It is expected that this reorganization together with the proposed program will more than double display product sales and profitability during 1970 over what they would be without the establishment of this group. Gross sales are expected to be $2,231,000 with a net profit of $424,430. Engineering and Development Expenses are $245,000 and the contribution to Sales and General Administrative Expenses is

$357,820 or (16% gross sales). Since most of the products proposed for the Display Group are presently not available, profit margins during 1970 will increase from 11% of sales in Quarter 1 to 22% of sales in Quarter 4. During 1971, we can reasonably expect Display Product sales to double and profit margins to increase further to 24 - 26%.

The reason for expecting dramatic results is that we are only realizing a small portion of the substantial potential of our Display Products. Historically 16% of all PDP-5 systems included displays, 22% of all PDP-6 systems, 37% of all PDP-7 systems and 27% of all PDP-9 systems. The percentage of displays on our more recent computer systems (i.e. PDP-8/I, 9/L, and 10) is estimated to be less than 2%.

There are three distinct factors contributing to this decline. First, our markets are changing and a greater percentage of our systems are now going to OEM and Industrial customers rather than laboratory oriented customers who typically use displays for the real-time monitoring of experiments. Secondly, until recently, our display products received virtually no sales effort nor marketing support. Many of our display products are older but still competitive, and they can be sold providing there is adequate push and support. Several of our newer products are the finest available, and they warrant a full-

fledged marketing effort. Third, the majority of our display products are available on only a few of our computer systems. This is true of our KV Graphics System, the VR 12 and VT 15.

Of these three factors, the latter two are readily rectified. I am proposing that the major thrust of the Display Products Group's efforts be towards making available existing display products across all of our computer lines together with the development of the marketing support (demonstrations, product brochures, advertising, etc.) necessary to sell these products.

The following discussions are intended to present a preliminary program for each of the Display Group's proposed products. Due to time limitations, these discussions are preliminary and they will be expanded and presented later in full detail.

BFC/tkw

DISPLAY PRODUCT GROUP TOTAL

	Q 1	Q 2	Q 3	Q 4	TOTAL
Sales	$439,000	$550,000	$640,000	$602,000	$2,231,000
CGS	228,000	292,500	305,250	288,000	1,113,750
Engr'g.	66,000	60,000	58,000	62,000	246,000
Mkt.	28,000	22,000	20,000	19,000	89,000
SGA	70,200	89,000	102,400	96,220	357,820
Net Profit	$ 46,800	$ 86,500	$154,350	$136,780	$424,430

KV Graphics System

The initial response to the KV Graphics System has been very gratifying, and orders are running ahead of the budget presented on January 22, 1969. The application of this option to other computer systems is expected to further expand the demand and profit potential of this product by almost 40 percent.

We have just begun deliveries of KV Graphic Systems on PDP-8/I's, and shortly we will be offering the option on the PDP-8/L, PDP-8 and PDP-12. Originally, we intended to offer a VS09 interface which would have adapted the KV Graphics System to the PDP-9/15, but this portion of the project was temporarily dropped. Presently there are four known PDP-9 customers interested in the option, and the Display Group plans to complete the development of the VS09 interface.

We also intend to explore offering a similar interface for the PDP-10. To date, two orders for combined multi-scope KV Graphics System, PDP-8/I and PDP-10 system have been received, and several other large orders are pending. Because of the significant cost of a PDP-10 system, the use of a PDP 8/I as a controller/concentrator/character generator is readily justified, and the need for a direct PDP-10 to KVGS interface is less apparent.

One other possible extension of the KV Graphic System will be considered, and that is a complete "stand-alone" unit. Such a device would allow a KVGS terminal to be used at the end of a dataphone or as a teletype substitute on any computer system.

KVGS

Sales

PDP-8	$284,000	$295,000	$300,000	$300,000	$1,179,000
PDP-9/15	10,000	20,000	20,000	30,000	80,000
PDP-12	----	10,000	20,000	30,000	60,000
PDP-10	----	20,000	20,000	20,000	60,000
PDP-11	----	----	10,000	40,000	50,000
	$294,000	$345,000	$370,000	$420,000	$1,429,000

Sales	$294,000	$345,000	$370,000	$420,000	$1,429,000
Est. CGS (58%)	165,000	(56%) 207,000	(53%) 196,000	(53%) 220,000	788,000
Less Engr.	30,000	20,000	15,000	10,000	75,000
Less Mkt.	15,000	15,000	15,000	15,000	60,000
Less SGA @ 16%	47,000	56,200	59,200	67,100	229,500
Net Profit	$37,000	$46,800	$ 84,800	$107,900	$276,500

VR-12

The VR-12 Point Plotting Display is presently available only on PDP-12. The original objective of this project was to offer a large screen replacement (12 in.) for the smaller (5 in.) RM503 scope purchased from Tektronix, that could be utilized on all of our computer lines. We are still far from accomplishing this goal. In fact, it appears that all display controllers (VC8/I on the PDP 8/I, VP09 on the PDP 9, VP10 on the 10, 338/I and the VS38 slave controller) must be modified before the VR-12 will operate satifactorily.

Because we consider this development effort incomplete until the VR-12 is available on all computer systems, the display group is proposing to accept responsibility for the completion of this project. Included in the enclosed budget is provision for a Display Group engineer to resolve with each computer product line the necessary modification(s) to the controller and the assurance that this engineer will carry out the implementation of that modification(s) or E.C.O. In the Profit and Loss estimate provided below, the value of the display controller has been included for two reasons.

1. The sale and shipment of displays and controllers are directly related and the marketing, software support, production forecasting, etc. should not be separated for maximum effectiveness.

2. Since all controllers require modification and the responsibility and cost of accomplishing this is being borne by the display group, they should also reap the benefits.

One other subject deserves mention at this time. That is, display developments in other groups, (Computer Special Systems, M. I. T., etc.) which can be utilized and incorporated into standard products. As a specific example, John Larkin will be developing for NIH a low-cost refresh type controller that will have more capabilities (vector generation) than our present devices and will possibly also have a larger profit potential. This project will be reviewed formally to determine its potential as a standard display product.

	Q 1	Q 2	Q 3	Q 4	TOTAL
Sales	$25,000	$75,000	$125,000	$150,000	$375,000
CGS @ (40%)	10,000	30,000	50,000	60,000	150,000
Engr.	10,000	10,000	10,000	10,000	40,000
Mkt.	8,000	5,000	3,000	3,000	19,000
SGA @ (16%)	4,000	12,000	20,000	24,000	60,000
Net Profit	(7,000)	18,000	42,000	53,000	106,000

338/339/340 Buffered Display Products

As the VT/15 (and VT10?) become available, the sale of 339's and 340 systems will completely cease with the exception of Traditional Product sales. We would also expect that the sale of 338/I's will be seriously affected since the customer can purchase a more powerful computer (18 bit) and display for less money. Existing PDP-8 and 8/I customers will constitute the remaining market. We expect that seven systems will be shipped during 1970, and that the responsibility for this group should be transferred to Traditional Products in the fourth quarter.

	Q 1	Q 2	Q 3	Q 4	TOTAL
Sales	$120,000	$120,000	$120,000	---	$360,000
CGS	53,000	53,000	53,000		159,000
	$ 67,000	$ 67,000	$ 67,000		$201,000
Engr'g.	6,000	3,000	1,000		10,000
Mkt.	2,000	1,000	1,000		4,000
SGA	19,200	19,200	19,200	---	57,600
	$ 39,800	$ 43,800	$ 45,800		$129,400

Light Pen

The solid state light pen is expected to be available in September. Total sales of light pens over the next three years has been estimated at 665. Sales during 1970 are projected at 135 units. The solid state light pen will be utilized on the following display products: VR12, VT15, VT10, and 338/I. In addition, an effort will be made to establish OEM customers.

	Q 1	Q 2	Q 3	Q 4	TOTAL
Sales	---	$10,000	$25,000	$32,000	$67,000
CGS	---	2,500	6,250	8,000	16,750
		$ 7,500	$18,750	$24,000	$50,250
Engr.	$2,000	$ 2,000	$ 2,000	$ 2,000	$ 8,000
Mkt.	3,000	1,000	1,000	1,000	6,000
	(5,000)	$4,500	$15,750	$21,000	$36,250
Less SGA @ 16%	---	1,600	4,000	5,120	10,720
	(5,000)	$2,900	$11,750	$15,880	$25,530

VT15

The VT09/15 interactive refresh display system is presently a PDP 9/15 project. The VT09/15 has not been included in this proposal because a substantial portion of the development costs has already been borne by the PDP 9/15 product line, and their feeling is they would rather do it themselves.

The Display Group has contributed to both expanding the capabilities (raster mode) and the versatility of the device (so that it can be offered on a PDP 10 as well). A PDP 10 compatible version (VT10) of the VT09/15 should be accomplished (simultaneously) for several reasons:

1. Availability of the device on more computer products means more units will be sold; hence, more sales and profit.

2. Our engineering and development expenses will be spread over a greater number of units; hence, more profitability per unit.

3. It is easier to train and inform our sales force about a single display, and their interest and knowledge will be much greater with a device that is discussed and sold more frequently.

It is strongly recommended that the scope of the VT09/15 project be formally expanded to encompass a PDP 10 compatible version, and the development costs of this project be shared by the two product lin Providing this is accomplished, it would not seem necessary in the short run to have this activity a Display Group effort, although in the long run, this would probably be desirable.

Alphanumeric Terminal & VT03 Terminal

Last Fall I conducted an in-house survey of the demand for an alphanumeric terminal. This terminal was envisioned as teletype compatible, with a capability of displaying approximately 1000 characters (64 character set), while operating as a stand-alone device. The initial manufacturing goal was $1500. The following conclusions resulted:

1) Volume of all product groups would range from 900-1375 units per year (would probably grow from this level at least at a rate proportional with the total company growth).

2) An A/N terminal product is probably quite price sensitive.

3) The quantity estimated is for known markets. New markets could possibly increase this number by a factor of 2 to 10 times.

4) All groups are quite compatible with the basic specification.

Due to a shortage of engineering manpower, this project was temporarily shelved. The PDP-10 group had an immediate need for an alphanumeric terminal, so they solicited bids from many outside vendors and selected the Conrac Display at an approximate cost of $3300 (in quantities of 200). The pricing of the VT03 display was set at $7900 which unfortunately is "above the market." This fact, together with limited marketing support has resulted in very little activity in the product.

The Display Group is proposing to help support this device, develop a product brochure, and ensure the device is available on all product lines. This exposure will be very useful for becoming more familiar with the various Market/Application areas and desirable product characteristics.

Because the purchase price of $3300 precludes our marking up the Conrac terminal to an attractive multiple, while at the same time capturing a significant share of this very substantial but very priced sensitive market, the development of an in-house device with a cost goal of $1500 is highly attractive. Hence, I have included in the total budget for the Display Product Group the following amounts for an Alphanumeric Terminal Development expenditures:

	Q 1	Q 2	Q 3	Q 4	Total
Engr'g. & Dev. Exp.	$18,000	$25,000	$30,000	$39,000	$112,000

Recognition of the Display Group as a Product Group is not interpreted as an approval of this development effort. This project will be formally proposed in greater detail at a later date. It has been included only to provide a total picture of possible activities in 1970.

digital INTEROFFICE MEMORANDUM

DATE: April 24, 1969

SUBJECT: ORGANIZATION OF PDP-8 PRODUCT LINE

TO: Operations Committee

FROM: Ken Olsen

For next Monday's Operations Committee meeting, I have asked Bill Long to present his new organization chart and a schedule for filling the chart. We should get a detailed explanation of how errors will be eliminated in scheduling, reporting, and engineering.

ecc

digital INTEROFFICE MEMORANDUM

DATE: April 16, 1969

SUBJECT: Proposed Increases in Medical Benefits Under The Digital Group Insurance Plan

TO: Operations Committee

FROM: Lee Callahan/Personnel

Attached is a proposal to increase our Group Insurance Hospital and Medical Benefits. The proposed increases in these benefits were determined by extensive surveys conducted by the Personnel Department and confirmed by our Insurance Consultant.

We propose to increase Hospital Room and Board, Surgical, Maternity and Major Medical Coverages. In addition, we propose the addition of a Supplemental Accident Expense coverage which provides for expenses for treatment of accidental injuries in a physician's office, clinic or hospital. We have received many complaints because of inadequate coverage for accidental injuries.

We also propose that Digital pay the entire cost of the additional coverage. Our surveys indicate that we would not be competitive if we were to increase the level of employee contributions for the revised plan.

Lastly, we will reduce the cost of the new coverages by introducing Coordination of Benefits and by Self-Insuring Accident and Sickness Benefits for hourly employees.

Proposed Date of Announcement - June 15, 1969.

INTEROFFICE MEMORANDUM

DATE: April 22, 1969

SUBJECT: REGULATIONS OF EMPLOYMENT - Japan

TO: Operations Committee FROM: Clifford O. Stanley COS

Japanese law requires employers to file formal regulations of employment when employment reaches ten or more individuals.

Attached are these regulations written in compliance with the Labor Standards Law of Japan and other accepted practices for American companies operating in Japan.

These regulations have been reviewed and approved by Bob Lassen, Graydon Thayer, and Ted Johnson and are submitted for your final review and approval.

COS:jaq

CONFIDENTIAL

REGULATIONS OF EMPLOYMENT

Digital Equipment Corporation International

Japan Branch

April, 1969

CONTENTS

CONTENTS (cont'd)

GENERAL STATEMENT OF REGULATIONS

Article 1 APPLICATION OF ARTICLES

These regulations shall constitute the rules of employment applicable to all employees of Digital Equipment Corporation International, Japan Branch, hereafter called the Company, in accordance with the Labor Standards Law of Japan and other relative laws and regualtions prescribing the rules for service and other terms and conditions governing the employment of the Company's employees, unless such an employee may hold an individual contract between himself and the Company stating as part of the contractual agreement which of the following articles and provisions are applicable to him.

Article 2 EMPLOYEE CONDUCT

The employee shall refrain from any act or conduct which might impair the prestige or reputation of the Company. He shall not divulge any confidential information about the Company, its customers, or its business which may come to his knowledge by reason of his employment with the Company. He shall not use the name of the Company or the title of his position in the Company unless approved by the Company as being necessary in the discharge of his duties. He shall not engage in any other occupation without the approval of the Company. The employees

of the Company shall faithfully abide by these rules, keep order, and cooperate in exerting their full effort for development of the business of the Company. Failure to comply will be the basis for immediate dismissal.

EMPLOYMENT

Article 3 SCREENING

Persons desiring to be employed by the Company shall undergo the following screening procedure:

A. A written application must be submitted including statement of personal and business history, family background, residence records, school certificates of attendance and grades, photograph, and other records or documents as deemed necessary by the Company in consideration for employment. Such application shall be written in the English and Japanese languages.

B. The requirements of Item No. A having been met and the applicant determined appropriate to be considered for the position, he/she will be interviewed by a member of management to determine his/her further eligibility for employment.

C. Personal and professional references will be required from each applicant and must be acceptable to the Company in order to qualify the applicant for further consideration by the Company.

D. Individuals meeting the above three requirements and offered a position will undergo a pre-employment

physical examination by a physician so designated by the Company and be able to meet the physical requirements of the job, as approved by the Company, for which he/she is applying. The expense for this examination will be borne by the Company.

The above requirements must be met before the individual will be considered eligible for full time permanent employment.

Article 4 PROBATIONARY PERIOD

Any person employed by the Company will be subject to a probationary period of at the shortest three months or at the longest six months from the date of employment. Within the probationary period, the Company will confirm in writing the individual's permanent employment retroactive from the date of employment, if such person gives satisfaction in the position held. Except for the case provided in Article 18, when the Company wishes to terminate the employment of an employee either on probation or in permanent employment, it shall give written notice thereof at least thirty days in advance or in the case of immediate termination pay in lieu of notice equivalent to thirty days' pay.

COMPENSATION

Article 5 BASE COMPENSATION AND REVIEWS

A. The amount of compensation for employees will be determined by the level of job responsibility, the prevailing economics of the labor market, and the assessment by the Company of the employee's qualifications and ability to perform the job.

B. An individual's compensation is normally reviewed on an annual basis.

C. Increases will be determined by the Company and granted to individuals on the basis of their performance, attendance, loyalty, integrity, the Company's ability to pay, and local economic conditions.

PAYROLL PRACTICES

Article 6 PAY PERIOD

The compensation of employees shall be computed on a monthly basis and paid once per month. For employees who have become employed or who have terminated prior to the end of the month, compensation in this case shall be prorated from or to the effective date. When the pay day falls on a holiday, earnings shall be paid on the preceeding work day.

Article 7 PAYROLL DEDUCTIONS

Payment for Income Taxes, Health Insurance, charges for Welfare Pension Insurance, and other such required deductions will be withheld from the monthly earnings of the employee and paid by the Company to the appropriate agency.

Article 8 TRANSPORTATION ALLOWANCE

The amount of transportation allowance payable to employees shall be a minimum rate established by the Company and may vary from time to time at the discretion of the Company.

Article 9 WORKING HOURS

The normal working hours of the Company are prescribed as follows:

1. From Monday through Saturday, excluding Saturday in every two weeks: the time for commencement of duties is 9:00 a.m.; the time for cessation of duties is 5:30 p.m.
2. Lunch excepting Saturdays in Item No. 1 above: 12:30 p.m. to 1:30 p.m.
3. The working hours of personnel in charge of telephones cables, telex, mail, and other special service employees may be individually prescribed provided, however, that the total average working hours for this group of

employees for a four-week period shall not exceed forty-eight hours in a week as set down in Article of the Labor Standards Law of Japan.

Article 10 OVERTIME

In accordance with the Labor Standards Law of Japan, overtime will be paid at the rate of full time plus 25 percent (time and one-quarter) for time worked in excess of forty-eight hours per week or over eight hours per day. Should overtime be required of an employee performing night work, extending his/her overtime to between the hours of 10:00 p.m. and 5:00 a.m., the overtime rate will be full time plus 50 percent (25 percent overtime and 25 percent for night work).

PAID TIME OFF

Article 11 HOLIDAYS

Paid holidays of employees shall be as follows:

A. Sundays

B. Japanese national holidays

C. Christmas day

D. Such other days as may be prescribed from time to time.

Article 12 ADHERANCE TO WORKING HOURS

When deemed necessary for the purpose of its business, the Company may, not withstanding the provisions of Articles 3, 4, and 5, cause its employees to work longer than normal working hours as provided herein or to work holidays as provided herein to the extent that it does not contravene the provisions of Article of the Labor Standards Law of Japan.

Article 13 VACATION

Employees who have worked continuously for one year with an attendance record of 80 percent or better shall be granted an annual leave with pay exclusive of holidays in the following manner:

A. Paid leave time accrued at the rate of five-sixths of a day for each full month of employment to be taken only after the individual has completed one year of continuous service.

B. An employee will accrue an additional day of paid leave per year after his/her sixth year of continuous service up to a maximum of fifteen days of paid leave upon completion of ten years of continuous service.

All leaves shall be taken, meeting the above outlined conditions, at a mutually acceptable time between the employee and the Company. Notice of intention to take such leave must be submitted in writing at least 21 days in advance to the individual's immediate supervisor. However, it shall be the option of the Company to defer such leave duly requested in cases where the supervisor requests a change for unavoidable reasons which would be detrimental to the best interests of the Company. Paid annual leave cannot be carried over to the following calendar year, making it emcumbent upon the employee to use such leave time as prescribed above. In accordance with this condition, the Company is not responsible for reimbursing any employee for carried-over vacation time not taken.

Article 14 PERSONAL FAMILY ABSENCE

When an employee marries or loses his or her parent in blood, spouse, or child, a special paid leave of up to five days, in addition to leave provided for in other articles, will be granted commencing with the event.

Article 15 SICK LEAVE

If an employee is absent because of illness, he shall report

to his immediate supervisor as soon as possible the nature of his illness and the expected duration of his absence. The employee shall, upon demand, submit to the Company a certificate from a medical doctor and/or other proof clarifying the nature of his illness to meet the Company's satisfaction, otherwise payment of compensation may be withheld. The individual's immediate supervisor may waive this requirement for such absence not exceeding three days if in his judgment the illness is bona fide. Payment for such authorized absences as outlined in this article will not exceed a total of six days per year which the individual will accrue on the basis of one-half day per month of continuous employment.

Article 16 UNAUTHORIZED TIME OFF

Other absences or lateness not appropriately reported to the individual's immediate supervisor or other responsible member of the Company will cause such employee to have his compensation (computed on an hourly basis) withheld for the time not worked.

Article 17 EXTENDED ABSENCES

Except for those employees on probation as defined in Article 4, individuals whose illness requres an extended absence from

their duties shall be entitled to their full compensation for a prescribed period of time. In order to qualify for compensation for extended absences, the employee must submit to the Company, within the first three (3) days of the absence, a certificate from a medical doctor and/or other proof stating the nature of his illness and the expected duration of his absence. Such compensation for extended absence will be provided for in accordance with the following:

A. Employees with less than five years of service - one month

B. Employees with five years or more, but less than ten years of service - two months

C. Employees with ten years or more of service - three months

When an employee has exhausted the appropriate above stated time period, he will be taken off the payroll and no longer compensated by the Company. The employee may, however, be reinstated within the period guaranteed by the Health Insurance Law if approved for full-time duties by a registered medical doctor. Such extended absences will be deducted from credited service for purposes of calculating service related benefits, but by no means will the employee lose continuity of service.

TERMINATIONS

Article 18 DISCIPLINARY TERMINATION

The provisions of Article 4 shall not apply when the Company terminates the employment of an employee for any of the following reasons:

A. Embezzlement of Company funds or stealing of Company property

B. Willful neglect of duty

C. Absence from duty for no justifiable reason

D. Refusal to obey Company regulations or gross negligent conduct not in compliance thereof

E. Drunkenness on duty

F. Sentence to imprisonment by a Japanese court

Infraction of any one of the above outlined reasons will normally result in an immediate dismissal.

Article 19 COMPANY INITIATED TERMINATION

Except for those cases provided in Article 18, when the Company wishes to terminate the employment of an employee, either on probation in accordance with Article 4 or permanently employed, it shall give notice in writing thereof thirty days in advance provided, however, that the Company may effect immediate termination by payment of compensation for thirty days.

Article 20 VOLUNTARY RESIGNATION (other than retirement)

Employees wishing to terminate their employment on their own initiative other than retirement shall notify the Company in writing at least thirty days in advance. In such cases, the employee shall remain actively on duty until the day specified in the written notice or to an earlier date mutually agreed upon by the employee and the Company.

CONCLUDING STATEMENTS QUALIFYING ARTICLES

OF REGULATIONS OF EMPLOYMENT

Article 21

These regulations are written in both the English and Japanese languages. In any case of dispute arising over these regulations, the Japanese version will govern.

Article 22

Matters not provided for herein shall be governed by the Labor Standards Law and other laws and regulations of Japan.

Article 23

These regulations shall be deemed effective as of _____.

FOR DIGITAL EQUIPMENT
CORPORATION INTERNATIONAL

by _____

AGREED TO BY:

Representatives of employees

_____

_____

DATE: _____

digital INTEROFFICE MEMORANDUM

DATE: April 24, 1969

SUBJECT: Facilities Planning Report

TO: Members of the Operations Committee

FROM: Al Hanson

Attached you will find Proposal No. 1, with suggested locations for all facilities relocations and expansions.

The 35,000 square feet that we needed in our first proposal was acquired by reducing the Purchasing Department by 10,000 square feet, the Traffic Department by 14,000 square feet, and the other 11,000 square feet we gained by reducing each department on a straight percentage basis.

Table A below indicates the number of departments to be relocated, and the number of departments that will remain, but will require expansion.

TABLE A

		Departments	Square Footage
1.	Relocations with Expansion	21	80,500
2.	Remain & Require Expansion	22	53,720

I am looking forward to a general discussion about this matter on Monday morning, April 28, 1969.

PROPOSAL 1

BUILDING 1-1 Workable Area: Now - 12,900
1/70 - 32,500

	In	Out
Existing to remain	3,900	
Wire Wrap Department	3,000	
Gardner Denver (6D-1)		
N. C. Wire Wrap (4-3)		
Auto Wire Test (1-4)		
Sub-Assy Staging (5-3) or D. F. 32 (3-5)	5,000	
Shipping & Crating		4,800
Module Stock Room		3,400
Crating Supplies		2,300
TOTALS	12,900	10,500

* Footnote-Expand N. C. Wire Wrap from 3,000 to 23,000 after 1/70.

BUILDING 1-2 Workable Area: 32,900

	In	Out
Module Test (5-4)	13,400	
Module Repair (5-3)	3,000	
Test Equipment Service (5-3)	1,000	
Corrugated Supplies (1-1)	6,000	
Prod. Line 99 Stock Room (Now)	2,000	
N. E. Sales (5-3)	4,000	
Module Administration	2,000	
TOTALS	31,400	

*Footnote-Building 1-2 will not be available to us until 1/70.

BUILDING 5-2 Workable Area - 53,200

	In	Out
Existing to remain	31,500	
Accounting office (Exp.)	2,200	
PDP 8 Engineering office (Exp.)	1,400	
Sm. Computer Eng. A/D Dev. Office (Exp.)	1,000	
E. D. P.	2,000	
PDP 8 Marketing & Administration Office (Exp.)	1,200	
Display Engineering Office (Exp.)	1,000	

BUILDING 5-2 (Cont'd)

Desk Calculator Office (Exp.)	500	
PDP 11 Marketing Office (Exp.)	2,000	
Small Computer A/D Lab (Exp.)	2,500	
Traditional Products Lab (Exp.)	2,500	
Desk Calculator Lab (Add.)	2,400	
Special Systems Office (Exp.)		1,200
Technical Documentation		3,500
Advertising & Sales Promotion Office		2,000
Training		5,000
Special Systems Lab		5,500
TOTALS	52,200	17,200

BUILDING 5-3 Workable Area: 53,000

	In	Out
Existing to remain	23,125	
Mod. Eng. Office (Exp.)	2,700	
Computer Marketing PDP 9 Office (Exp.)	1,000	
9/I Engineering Office (Exp.)	1,000	
Computer Administration Office (Exp.)	1,300	
General Sales Office (Exp.)	6,400	
Purchasing Office (All Dept.) (Add.) (5-4)	15,000	
Legal Dept. Office (Add.) (5-2)	600	
Sub Assy Staging		700
Module Administration		1,500
N. E. Sales		4,000
Model Shop		7,500
Module Repair		1,000
Field Service		13,800
P. C. Drafting		1,400
Test Equipment Service		1,000
TOTALS	51,125	30,900

BUILDING 5-4 Workable Area: 52,000

	In	Out
Existing to remain	34,100	
Module Production (Exp.)	7,000	
Personnel (Exp.)	3,000	
Cafeteria (Exp.)	1,900	
Advertising & Sales Promotion (Add.) (5-2)	6,000	

Includes Art Dept. (3-5)

BUILDING 5-4 (Cont'd)

Module Test		8,400
Incoming Mech. Inspection		1,900
Semi Conductor Test		2,000
Purchasing		3,700
Receiving		2,100
TOTALS	52,000	18,000

BUILDING 11-2 — Workable Area: 6,000

	In	Out
Technical Documentation (5-2)	6,000	
Training		6,000
TOTALS	6,000	6,000

BUILDING 21-1 — Workable Area: 11,000

	In	Out
Shipping & Crating (1-1)	6,200	
Module Stock Room (1-1)	4,800	
TOTALS	11,000	

BUILDING 21-2 — Workable Area: 11,000

	In	Out
Material Control	11,000	
TOTALS	11,000	

BUILDING 21-3 — Workable Area: 11,000

	In	Out
Special Systems Office and Lab	11,000	
TOTALS	11,000	

BUILDING 21-4 — Workable Area: 11,000

	In	Out
Field Service	11,000	
TOTALS	11,000	

BUILDING 5-5 Workable Area: 52,000

	In	Out
Existing to remain	44,600	
PDP 10 Eng. (Exp.)	2,400	
Production Eng. (Add.)	5,000	
PDP 10 Production		7,400
TOTALS	52,000	7,400

BUILDING 3-5 Workable Area: 19,000

	In	Out
Existing to remain	6,400	
Program Library (Exp.)	2,700	
Programmers (Exp.)	4,800	
Computer Center (New) (Add.)	5,000	
Printing Department		3,800
Art Department		1,400
Photo Lab		500
Disc Production		5,100
TOTALS	19,000	10,800

digital INTEROFFICE MEMORANDUM

DATE: April 25, 1969

SUBJECT: PROPOSED CORPORATE PUBLIC RELATIONS OBJECTIVES

TO: Operations Committee FROM: Mark Nigberg

cc: Bob Lassen
Gabe d'Annunzio
Dimitri Dimancesco
Public Relations Groups

In support of the attached memo,"Proposed Centralization of DEC's Public Relations Activities," we also request Operations Committee approval for the following public relations objectives:

The overall objective of the new Public Relations Department will be to communicate with all of DEC's major publics--employees, communities, buying, investing, general--to responsibly inform these publics of corporate activities of specific interest to them. To this end, we are structured around functional lines which can be pooled and coordinated to offer a cohesive program of activities. These function areas are:

PRODUCT/MARKET PUBLICITY, which stimulates sales by widespread distribution of information concerning our products and by selective efforts with key media to promote our overall corporate expertise.

FINANCIAL RELATIONS, which stimulates and maintains interest in DEC by the investing public by providing it with meaningful, but non-proprietary information concerning our fiscal activities.

COMMUNITY RELATIONS, which projects an image of DEC as a responsible citizen in those communities in which plants and offices are located and gains the support of our employees, neighbors, local government and civic leaders.

EMPLOYEE RELATIONS, which develops a high level of confidence about the corporation in our employees and their families with the primary objective of recruiting, maintaining and developing necessary manpower resources.

Each of these areas is so defined as to serve specific publics. However, the aggregate of these efforts is to maintain DEC as an influential entity in those areas served by the corporation in the computer market place and in the broader industrial complex.

MN/sf

digital INTEROFFICE MEMORANDUM

DATE: April 23,1969

SUBJECT: PROPOSED CONSOLIDATION OF DEC'S PUBLIC RELATIONS ACTIVITIES

TO: Operations Committee FROM: Mark Nigberg

cc: Bob Lassen
Gabe d'Annunzio
Dimitri Dimancesco
Public Relations Groups

We propose that DEC's two public relations groups, Product/Market PR and Personnel PR, be combined to form a Corporate Public Relations Department with its own cost center.

We have discussed this reorganization with Dimitri Dimancesco, supervisor of the Personnel PR group; Bob Lassen, Personnel Manager; and Gabe d'Annunzio, and all enthusiastically support this proposal.

We believe that all public relations activities interrelate, and that DEC could get the most effective use from its public relations professionals if these activities are centralized.

As a PR team, each professional in the department could contribute his own unique expertise to our primary objective: Gaining and maintaining the maximum possible public understanding and support for DEC products, policies, and actions, thus contributing to the overall success and future growth of the company.

An added advantage of the centralized PR department is that management would be able to consolidate the pockets of money now scattered in a number of cost centers so that it could exactly determine what the company spends on its public relations program. From our standpoint, it would give DEC's PR professionals an opportunity to have our performance measured in the same way as are other professional groups at DEC.

Attached is our proposed organization for the new department.*

---

*The manpower shown in the attached chart does not reflect proposed increases in staffing based on our FY 1970 program/budget.

Since we propose that members of the Personnel PR group move laterally into the new department, the following is the approach we would take to handling current Personnel programs:

RECRUITMENT ADVERTISING

Handling of Personnel's recruitment advertising would remain the same. Personnel establishes and controls the budget and has final say in selection of agency.

D. Dimancesco will continue to coordinate recruitment advertising activities, working very closely with all members of Personnel.

Advantages of Rearrangement: When needed, Advertising's creative and art services will be readily available.

RECRUITMENT/PERSONNEL LITERATURE

D. Dimancesco will continue to be responsible for servicing Personnel's needs in this area. Under the rearrangement, he will be able to use Advertising's creative and art services much more extensively.

EMPLOYEE COMMUNICATIONS

Responsibility for employee communications will remain with Personnel. Publications such as ON LINE and Maynard News Bulletin, will be produced and approved in the same manner as before.

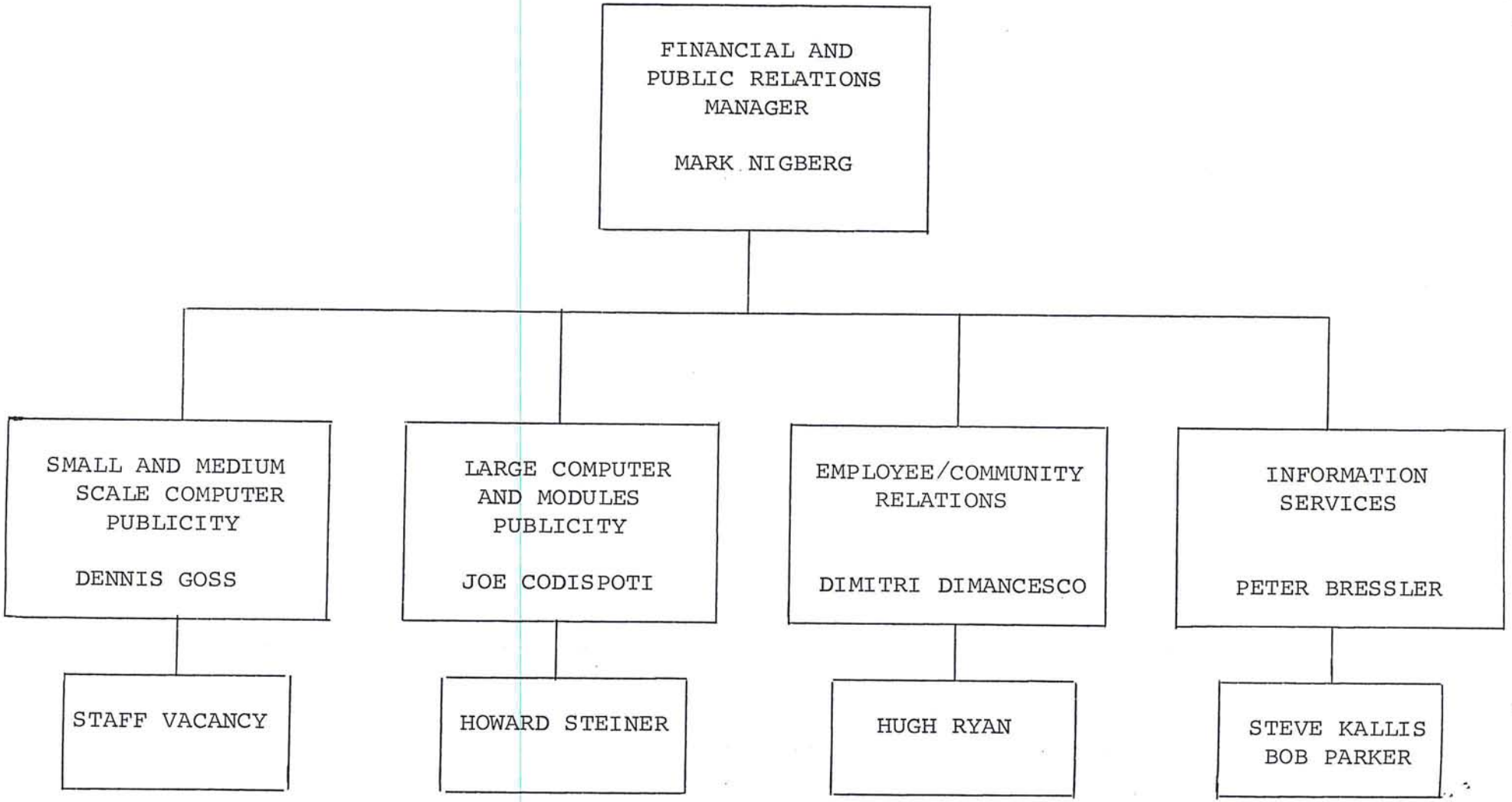
The PR staff will be able to contribute far more; bringing in news items from the field, considering employee communication needs when gathering product information, etc.

EMPLOYEE ACTIVITIES (Outing, Christmas Party)

Will be organized by D. Dimancesco in close cooperation with Personnel as in the past.

We would very much appreciate the opportunity of discussing this matter with you at your earliest convenience.

PROPOSED ORGANIZATION FOR A NEW PUBLIC RELATIONS DEPARTMENT



digital INTEROFFICE MEMORANDUM

DATE: April 25, 1969

SUBJECT: PRODUCT LINE MANAGERS WEEKEND MEETING.

TO: Operations Committee FROM: Gabriel d'Annunzio

In attempting to develop topics to be discussed and documented, BOB SAVELL, BILL LONG, GRAYDON THAYER, and I came up with the following outline. It is obviously in rough form and at least one more meeting is needed to condense it into a more manageable format.

I. Role Definition - to manage all aspects of a product line's business.

II. Areas of Accountability.

A. Prime Criteria

1. Profit

2. % Profit

3. Dollar volume income

B. Performance Measurement

1. Attaining marketing goals

2. Attaining engineering goals

C. Indirect Areas of Responsibility

1. Sales

2. Field Service

3. Production

4. Technical and nontechnical support activities

III. Key Elements of Product Line Managers Job

A. Defining operating objectives (current and future)

B. Implementing plan to attain profit goals

C. Delegation of authority and responsibility

D. Budgeting

E. Progress Review

F. Scheduling

G. Functional relationships within product line

H. External functional relationships

I. Customer relations

J. Perpetuation of product line (long range planning)

K. Market definition and establishing a producable product mix

L. Leadership

GdA/dc

Jed

COMPANY CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 24, 1969

SUBJECT: MINUTES OF 1970 BUDGET MEETING, APRIL 24, 1969

TO: Operations Committee FROM: P. Kaufmann

cc: Ed Savage

Corporate Goals

The goals for the 1970 budgets were agreed upon as follows:

1. Pretax profit for the corporate total $\geq$ 24%.
2. Engineering expenses for the corporate total approximately 10%.
3. For each quarter of the four quarters of fiscal 1970; the pretax profit must be budgeted $\geq$ 22%
4. Shared Projects will = 2% including a corporate slush fund.

Present Status of Budgets

At present the 1970 budgets yield the following Income from Sales of Equipment (Line 9) and Pretax Profit (Line 70).

	Ken Olsen Edict	Present 1970 Budget 4/23/69	Pretax Profit 4/23/69
8 Family	43.0	54.0	24.0
11	5.0	3.2	-
Business Applications	-	.2	-
NC	-	.7	-
Modules	15.0	12.0	30.2
14	-	3.0	13.6
9/15	12.0	14.0	25.0
K	-	-	-
10	32.0	33.0	26.5
12	8.0	9.2	25.3
Traditional	5.0	4.5	25.5
	120.0	133.8	23.0*

*In the 23.0% pretax profit, there is the following unresolved differences between cost center budgets and product line budgets.

		Cost Center	Product Lines	Difference
Data Acquisition	R. Noonan	309.0	201.0	108.0
Displays	B. Collings	235.0	80.0	155.0
Drafting	R. Melanson	1172.6	863.0	309.6
Mech. Eng.	L. Prentice	370.7	291.0	81.7
Prod. Eng.	R. Puffer	993.5	865.0	128.5
				782.8

This is a drop of 0.5% in Pretax Profit.

Conclusion

After much discussion, it was concluded that the following action will be accomplished:

1. Pretax Profit Improvement will be rebudgeted as follows:

Traditional	340K	5.0%
PDP-8	800K	1.5%
PDP-11	300K	-
PDP-10	400K	1.3%
	1840K	+1.3%

These improvements seem possible if a more detailed review is made of discounts (which appears to be 1.1 million over present percentages) and field service prices.

2. Certain G & A reductions will be made as follows.

Accounting	-100K
Training	-200K
Personnel	-300K
	-600K

This will yield an increase of pretax profit of 0.4%.

The combination of all of these adjustments (if they are possible) will yield a corporate pretax profit of 24.1%.

jb

COMPANY CONFIDENTIAL

OPERATIONS COMMITTEE MEETING

April 22, 1969

AGENDA

1. Additions and Corrections to Minutes of the April 14th Meeting
2. Marketing Review Committee Summary - (Ted Johnson)
   (See attached minutes of the April 14th meeting)
3. KI-10 Arithmetic Processor - (Bob Savell)
   (See attached report from the PDP-10 Product Line)
4. Proposed Change in Vacation Policy for Employees Fulfilling Military Obligations -
   (See attached report from the Personnel Committee) (Win Hindle)
5. Proposed Addition to the Employee Transfer Policy - (Win Hindle)
   (See attached report from the Personnel Committee)
6. Proposed 1969 Hourly Wage Review for Canada - (Win Hindle)
   (See attached report from Paul Chambers)
7. Proposed Summer Work Schedule for 1969 - (Win Hindle)
   (See attached report)
8. Salary Administration for Wage Class 4 Employees - (Win Hindle)
   (See attached report from Bob Lassen and Graydon Thayer)
9. Facilities Planning Report - (Al Hanson)
   (See attached report)
10. Company Sign Proposal - (Al Hanson)
    (See attached report)
11. Proposed Escort Service - (Al Hanson)
    (See attached report)
12. Proposed Reorganization of the Advertising and Sales Promotion Department -
    (See attached report) (Gabe d'Annunzio)
13. Overdue Orders - (Stan Olsen/Nick Mazzarese/Win Hindle)
14. Monthly Status Report by Vice-Presidents
15. Personal Investment Considerations - (Ted Johnson)
    (See attached report)

COMPANY CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 24, 1969

SUBJECT: MINUTES OF THE OPERATIONS COMMITTEE MEETING OF APRIL 22

TO: Operations Committee

FROM: Win Hindle
Secretary

Present: Stan Olsen, Pete Kaufmann, Nick Mazzarese, and Win Hindle

1. Legal/Patent Matters - Bob Cesari reported on trademarks and his efforts to protect "DEC," "PDP," and "digital." Protecting the word digital is difficult.

   Bob also commented on his work on patent protection for PDP-10 systems and new patents for the PDP-14.

   He suggested that we should have a few people who spend full time on looking at new developments outside the Company so that DEC does not get surprised by some development. We felt it would be a good idea to formally name people to keep track of new developments in specific technical areas, and to have these people write a report once a quarter.

   Bob also suggested keeping in closer touch with the software patent question by talking regularly with Larry Portner.

2. Minutes of the April 14 Operations Committee meeting were approved. On Item 15, Purchase of Trailer and Tractor, Stan reported that the economics favored outright purchase.

3. Minutes of the April 14 Marketing Review Committee were received.

4. KI-10 Processor Proposal - We accepted the proposal. We need a project budget before making this a formal project. Also, Stan suggested that the question of the devices used and the packaging techniques to be used should be presented to the Engineering Committee and the results reviewed by the Operations Committee.

5. Vacation Policy for Employees in Military Reserves - The proposed change in the Military Reserve policy to allow reservists to take normal vacations was approved.

6. Employee Transfer Policy - The proposed change, which places Personnel in the role of mediator in setting the dates for transfers to take place, was approved.

7. Wage Review for Canada - The proposal by Paul Chambers for Canada was accepted.

8. Summer Work Schedule - We accepted the Manufacturing Department's proposal to start work at 7:00 a.m. and end at 3:30 p.m., with 30 minutes for lunch. Also, this schedule will coincide with Daylight Savings Time, running from June 1 to September 30.

9. Company Sign - We unanimously suggested using Donnelly's non-illuminating, blue and white signs (alternate #1 in Al Hanson's April 17 proposal), subject to Ken Olsen approving this selection.

10. Proposed Escort Service - We rejected Al Hanson's April 14 proposal to hire escorts. We asked him to report to us any violations of escort rules for visitors.

11. Facilities Planning Report - Al Hanson has the projected needs for Fiscal Year 1970. He will come back next week to suggest how we lay out the space, since the needs in Maynard on this pass come out to 35,000 square feet more than we have in the Maynard facility. We also need to know how to provide 500 more parking spaces, and Al will propose an answer to this, also.

12. Reorganization of Advertising and Sales Promotion Department - We discussed Gabe d'Annunzio's organization, and told him we thought he had too many organization levels. Gabe agreed to restructure his group to take care of this objection.

13. Product Line Manager Conference - We discussed the May 9 - 10 conference for developing a Product Line Manager checklist. Gabe will bring a proposal back to us next Monday.

14. Overdue Orders - We looked at overdue orders, and feel that we have kept appropriate pressure on our people so that overdue orders are not slipping through the cracks.

15. Personal Investment Considerations - We approved Ted Johnson's proposed letter to salesmen on personal investments in customers' businesses.

16. Budgets - We will meet on Thursday at 8:30 a.m. to review budgets which are being redone on a spread-sheet format.

W. R. Hindle, Jr.

ecc

CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 15, 1969

SUBJECT: KI10 Arithmetic Processor

TO: Operations Committee FROM: PDP-10 Product Line

I. Recommendations

It is recommended that a project be authorized for the PDP-10 Product Line to design, produce and market a new arithmetic processor designated the KI10 which will have the following features:

A. A manufacturing cost roughly equivalent to the present KA10 processor of between $30,000 to $35,000.

B. Compatible with existing software, input/output devices and memories.

C. Improved priority interrupt structure to provide faster interrupt service.

D. Faster I/O bus cycle time - around 2.0 μs.

E. One mircosecond average instruction time as compared with 2.8 microsecond average instruction time for KA10.

F. Program controlled margin checking to minimize checkout and preventative maintenance time.

G. Up to four blocks of general purpose registers compared with KA10 which allows only one set. Multiple blocks provide for faster context switching.

H. Paging scheme to provide more efficient memory management.

I. Double Precision floating point hardware.

It is further recommended that the project proceed as outlined in the KI10 Engineering Schedule found in Appendix C of this report. This schedule would allow for display of an operating system at Spring Joint Computer Conference in May 1970 and first deliveries in October or November 1970. Maintaining this schedule is extremely important if the PDP-10 System is to retain its competitive advantage in 1970 and the years immediately following.

II. Introduction

The KI10 represents another milestone in the evolutionary development of medium scale computing systems by DIGITAL. The PDP-6 system was the first step in this process. The PDP-6 featured a very advanced hardware architecture and the first manufacturer-supported-time-sharing software system. The market for this system was mainly in the real-time area.

The PDP-10 system employed the same basic system architecture as the PDP-6, but, in addition, provided higher speed operation, higher reliability, more advanced memory management techniques and a complete line of peripheral equipment including a wide selection of magnetic tape and on-line disk storage units. The system software developed on the PDP-6 was readily adapted to the PDP-10 because the two systems have very similar instruction sets. New languages were added including COBOL and BASIC. The system software was expanded to include re-entrant programming, accounting routines and a concise command language. The PDP-10 extended the real-time markets developed by the PDP-6 and has been extremely successful in selling to the rapidly growing time-sharing utility markets. While total sales of the PDP-6 totaled approximately 20 systems, 200 PDP-10 systems should be installed by the second quarter of fiscal 1971 at which time the KI10 will begin to be delivered.

The KI10 is a further step in this evolutionary process. The KI10 retains the same basic instruction set as the PDP-6 and the PDP-10 which implies that the software developed for the PDP-6 and PDP-10 can be directly carried over to the new processor and be operational prior to initial deliveries. In addition, the wide range of peripheral devices developed for the PDP-10 system will be immediately available with the new system. The KI10 will enable DIGITAL to continue growth patterns in both real-time and time-sharing markets.

III. The Product

The KI10 will enable Digital to consolidate its strong market position in the medium scale scientific computing field. The proposed interrupt structure, multiple register blocks and the paging scheme are items in which both our potential and existing PDP-10 customers have expressed considerable interest. In fact, the SDS Sigma 7 currently has both multiple register blocks and paging hardware. The current SDS software (BTM) does not utilize the Sigma 7 paging hardware. However, the proposed SDS "Universal Time Sharing" (UTS) system will use the paging hardware.

The increase in processing power of approximately 3 to 1 will make the KI10 as much as three times faster than the Sigma 7. The KA10 would compete favorably on a performance basis compared with the Univac 1108 and the IBM models 360/65 and 360/67. The KI10 would also compete favorably with the CDC 6400 on a performance basis where single precision accuracy in the KI10 is adequate. When viewed in relation to the competitive pricing situation shown in the next section, it is apparent that a system centered around the KI10 would be an extremely competitive medium scale computing system.

The instruction set proposed for the KI10 is one of the most powerful and extensive instruction sets yet devised. This instruction set should continue to provide competitive advantages for the next 4 to 5 years. Even more important, however, is the fact that the compatibility of the KI10 instruction set to that of the KA10 arithmetic processor will make it possible to deliver a system with an extensive software capability at a minimum software development cost.

The KI10 represents but one step in a gradual upgrading of the PDP-10 system performance. Higher speed swapping devices will greatly increase the performance of the existing PDP-10 system and are a must for the system with the KI10. The KI10 will perform in an optimal fashion with memories in the 400 to 700 nanosecond region, but will also operate effectively with existing 1.0 us memory. Such developments can take place independently of the KI10 development. For example, a higher speed swapper will be available on the KA10 system prior to initial KI10 deliveries, while higher speed memory could follow the KI10.

It is expected that the KI10 will prolong the competitive life of the PDP-10 system for up to 3 or 4 years from the date of initial deliveries currently forecasted for the Fall of 1970. This would extend the life expectancy of the PDP-10 system to 1973 or 1974 before major revisions in the product concept will be required.

IV. Competitive Situation

The KI10 could be introduced at a price somewhat higher than the present KA10 price. The KI10 will be aimed at customers with high computing loads and for large systems with a high total systems price. The KA10 could be dropped in price and continue to be sold for small systems with limited budgets.

Anticipated competition will probably come from the following systems:

	KI10		KA10	
Company	Model	System Pur. Price	Model	System Pur. Price
SDS	Sigma 7	$350K - $1,000K	Sigma 5	$200K - $400K
	Sigma 9 (on drawing bd.)	est.$400K - $1,500K		
Burroughs	6500	$1,000K - $3,200K	5500	$640K - $3,000K
	7500	$1,000K - $3,200K		
IBM	360/65	$1,360-$4,000 K	360/40	$200K - $1,400K
	360/67	$1,360K - $4,000K	360/44	$200K - $1,000K
	360/75	$1,880K - $6,800K	360/50	$560K - $2,200K
UNIVAC	1106 (T/S version of 1108)			
	1108	$1,800K - $5,000K		
	1109 (not announced)			
CDC	6400	$1,480K - $2,440K	3100	$120K - $680K
	6500	$1,480K - $2,440K	3200	$200K - $800K
	6600	$2,480K - $3,640K	3300	$220K - $1,200K
			3400	$680K - $1,200K
			3500	$240K - $1,200K
			3600	$320K - $2,600K
			3800	$1,700K - $2,800K

	KI10		KA10	
Company	Model	System Pur. Price	Model	System Pur. Price
GE	635	$1,400K - $6,600K		
Honeywell	H632	$98K - $800K		
	H832 (not announced)	$160K - $900K		

SDS represents primary competition for both our existing markets and a large segment of our projected future markets. The Sigma 7 system already incorporates many of the advanced features proposed for the KI10 including memory paging, multiple blocks of accumulators and hardware double precision. The PDP-10 has sold effectively against the Sigma 7 mainly because of our advanced time sharing software which SDS has as yet been unable to duplicate.

There are indications from our customers that SDS is now able to demonstrate a reasonable time sharing operating system for up to 20 users. It is obvious that our overwhelming competitive advantage in system software will decrease over the next year. If this is the case, it is reasonable to expect that hardware features and performance will play an increasingly important role in computer selection.

SDS is currently working on the Sigma 9 system which has been described by SDS personnel as a "super Sigma." It is possible to project to some degree of accuracy the structure of the Sigma 9. First, we would expect that SDS will have improved their engineering and production techniques having learned by their mistakes with the Sigma 7. Therefore, it is expected that SDS will be able to ship and install the Sigma 9 system with less difficulty than they experienced with the Sigma 7 and the Sigma 5 in its earlier stages.

In view of the large investment which SDS has made in Sigma 7 software, it is reasonable to assume that the Sigma 9 will be essentially program compatible with the Sigma 7 much the same way we are proposing the KI10 to be program compatible with the KA10. This implies that the Sigma 9 will be a 32 bit, 8 bit byte oriented system. The major change we expect will be in computing speed. The architecture which we are proposing for the KI10 should compete very favorably with the Sigma 9.

We would expect that SDS will take advantage of the same improvements in circuit technology which we are planning for the KI10. Therefore, we expect the Sigma 9 to be 2 to 4 times faster than the KA10 and the Sigma 7. It may also be assumed that SDS will introduce the Sigma 9 at a higher price than the present Sigma 7 and that the Sigma 7 will continue to be sold at a reduced price unless its reliability and maintainability problems warrant removing it from the market. It is of course possible that SDS will attempt to design the Sigma 9 to compete directly with expensive and powerful systems like the UNIVAC 1108 and 1109. IF SDS does move into the very large scientific computing market, the KI10 would still be very competitive at a price and performance level between the Sigma 7 and 9.

Our best estimate is that SDS will announce the Sigma 9 sometime during calendar 1970, possibly at the Spring Joint Computer Conference. In view of the fact that the initial Sigma 7 delivery was made seven months after its official announcement it is expected that deliveries will be scheduled for the last quarter of calendar 1970 or early in 1971. If we do not proceed with the KI10 we will be forced to compete with a system that has reasonable software, and 2 to 4 times the computing power and a somewhat higher price than the present system.

Such a condition would cause DIGITAL to lose a major part of our market share in the markets proposed in the following section. We would continue to sell a number of PDP-10 systems

to our existing customers for compatibility reasons much the way SDS has continued to sell the obsolete 940 system to customers like COMSHARE.

Honeywell has been very unsuccessful in marketing its 32 bit scientific computer, the H632. This system was aimed at the OEM markets and did not have a reasonable software package to accompany it. It is doubtful that any manufacturer will be able to break into the medium scale computer market at this stage without a massive investment in software. Honeywell will announce shortly the H832 which will most likely be very similar to the H632 but will contain segmentation hardware. It is doubtful that the H832 will be a significant competitor for the KI10 or KA10 due to its limited software. Present plans call for an executive system (Exec 4) which only provides an advanced foreground/background operating system. The H832 will be aimed mainly at real time and OEM markets.

SEL is also rumored to be building a 32 bit computer to compete for the OEM markets with a minimal amount of software. Once again it's doubtful that this computer will be a viable competitor for present PDP-10 markets due to limited software.

The KI10 system will significantly underprice the UNIVAC, CDC, and GE systems. Although we currently do not compete directly with these systems, the high performance of the KI10 would give DIGITAL a strong competitive advantage when the systems are compared with respect to their price/performance ratios.

If the KI10 is not developed, we will not be able to compete effectively with the Sigma 9, the Burroughs, UNIVAC, CDC, and larger IBM 360 systems. The introduction of COBOL and the KI10 will make DIGITAL very competitive with these systems.

V. Markets

Pure Computing

The pure computing markets listed below will benefit directly from all of the proposed KI10 features. The most important benefit will be increased system throughput resulting from increased computing speed, more efficient memory management techniques and higher speed context switching in a multiprogramming environment.

A. Time sharing utilities (service bureaus).

B. Industrial in-house time-sharing.

C. Medium-sized universities (a majority of small universities would probably continue to purchase the KA10 for small systems).

Real Time

System response is the key factor in real time operations. Therefore, faster context switching and a vastly improved interrupt system will be key features in these markets. The proposed paging scheme will provide for very flexible "real time core management" techniques. Increased computing speed will, of course, be desirable for all scientific computing requirements. The KI10 will penetrate the following major real time markets:

A. Physics - processing power and real time features are important.

B. Chemical and Biomedical.

C. Simulation - processing power is of prime importance.

D. Computer Science.

Market Structuring

With the introduction of the KI10 with an operating COBOL system, the scientific plus business capability of the KI10 will result in a more rapid growth of the pure computing area compared with real time markets. Pure computing markets will account for 60% - 75% of our system sales, while the dollar volume of this market will account for even higher percentages of total sales, due to larger numbers of peripherals normally purchased with these systems. A projection of relative sales volume in the various markets is shown below:

KI10 Sales Estimates by Market

	Major Segment	Sub-Segments
Pure Computing	75%	
1. Time-Sharing Utility		35
2. Industrial In-house		20
3. Small University		15
4. Large University		5
	Total	75%
Real-Time	25%	
1. Physics		10
2. Chemical & Biomedical		8
3. Simulation		3
4. Computer Science		4
	Total	25%

VI. Alternatives Considered

A. Low Cost Processor: A low cost central processor was considered as an alternative to the KI10. However, the low cost processor was found to be a non optimal alternative for several reasons.

First, it would be undesirable to attempt to reduce the processor cost by reducing the instruction set and hence the logic cost of the system. Such an approach would void the advantage of software compatibility with the present KA10 and would result in large software development costs. The proposed logic costs might be reduced somewhat by performing more operations serially but the reduction in cost would be very small compared with the resulting loss in performance.

Secondly, all of the developing PDP-10 markets call for higher performance rather than lower cost and lower performance. Both the real time and time sharing markets indicate requirements for more powerful processing capabilities. The declining interest in 24 bit computers indicates the lack of interest in the market for low cost/low performance medium scale systems. This could result from the fact that a customer may have already decided that processing power is important once he has decided to purchase a computer with a 32 bit or larger word size.

The third major reason for choosing the KI10 over the low cost system centers on pricing structure. If we choose the low cost system, we are constrained to our present KA10 price or lower depending upon the performance comparison. If the KI10 alternative is chosen, the KI10 may be functionally priced considerably above the present KA10 price and the KA10 price dropped to provide a low cost market entry even though the processor manufacturing costs would be practically identical. It is clear that choosing the KI10 alternative provides for flexibility in pricing and market approach which will enable us to maximize profit and to enhance our competitive advantage.

B. Paging Hardware: There are two alternatives connected with the paging hardware. First, should the present dual protect scheme be used or the proposed paging hardware? Second, should the memory mapping technique chosen be optional or standard on all systems?

The dual protect scheme currently employed on the KA10 was a major improvement over the previously employed single protect system. The major advantage gained with the dual protect system is that it provided an efficient means of implementing reentrant software. However, the dual protect system has a number of limitations. Because of the restriction that programs must reside in contiguous sections of core memory, moving programs into core in a multiprogramming swapping environment is limited by the sizes of contiguous areas of available core. The present system attempts to "shuffle" or compact programs in order to make free core available

in as large a contiguous element as possible. A paging system would eliminate the overhead for shuffling and would simplify the associated problems of memory management. This simplification is particularly important in real time systems where jobs may have to be "locked" in core because of their response requirements which could result in a serious fragmentation of available memory space.

The proposed paging scheme is an extension of our present dual protect system. In many cases such as multiple real time operations, the paging system will tend to simplify rather than complicate the software system.

It was decided to propose the paging hardware as a standard feature rather than as an option. Approximately 95 percent of our present PDP-10 customers chose the multiprogramming option (KT10A). We would expect the percentage choosing the paging hardware to be similar. In view of the increased expense of the design and checkout of processor options, it was decided that it would be a much lower cost alternative to make the paging hardware a standard feature on all systems.

C. Additional Register Blocks: Additional register blocks were proposed as an option. The register blocks will be of primary interest to real time customers with very fast context switching requirements. The register blocks lend themselves to modular plug-in design.

As less than fifty percent of our future customers would be expected to acquire the additional blocks if they were offered as an option , it was considered less costly to provide the additional register blocks as a customer option.

VII. Processor Design

The KI10 will be a new, generally integrated circuit, central processor for the PDP-6/10 system market. The machine will be compatible with the existing PDP-6/10 software, I/O devices, and memories. It is intended to improve the price/performance ratio of systems offered by providing some additional features and somewhat faster operation. To reduce manufacturing, engineering, and selling costs, there will be no optional features, except for additional register blocks, eliminating the extensive decision logic and associated additional checkout and manufacturing test time presently required.

The increase in speed will be achieved by making better use of the memory bus system than at present and by using commercially available MSI products which make certain instructions (notably shifting and arithmetic) more efficient without increasing cost.

The KI10 will also incorporate new features in its I/O bus system to gain a marketing advantage in the on-line, real-time process control and hybrid systems area.

New features of the KI10 system are a compatible priority interrupt system combining the API features of the PDP-9 and assignable priority features of the PDP-10 I/O systems.

Compatible programming features which will be added include flip-flops to hold a program requested interrupt on a particular PI channel, so that a monitor requested interrupt does not get lost; the ability to do any instruction which does not save the PC and still dismiss the interrupt automatically; and a way to request a lower priority interrupt as the only result of a BLKI/O overflow at interrupt level.

The I/O bus cycle will probably be made 2 μs long to reduce the execution time of I/O instructions without any increase in complexity.

The sharing of the I/O bus by two (or more) processors is being contemplated for process-control and on-line users who need failure resistance and fail-soft capabilities using redundant systems. The inclusion of this feature is primarily dependent on being able to add it with little or no increase in cost or complexity.

Improvements in instruction operating speed will be gained without significant increase in complexity by using MSI products to realize up to four position shifting and two-and four-bit-at-a-time multiplication algorithms. Double-precision floating-point instructions will be implemented in hardware using the same algorithms presently implemented in software.

Presently unresolved is whether interrupts must be locked out during these instructions (i.e. for an excessive time) or whether it is possible to interrupt these instructions without undue complexity in resuming them. As a maintenance feature, program-controlled margin checking of the KI10 will be included, facilitating checkout in manufacturing and maintenance in the field.

The memory bus will be more efficiently used by requesting the next memory reference before the previous one has been completed. With only a single speed of memory in the system the problem is quite simple; however the existence of older memories, current 1.65 μs and 1.0 μs memories, and the prospect of both somewhat faster, less expensive memories and much larger, slow, mass memories necessitates the more general solution described in Appendix A.

Although the machine will take reasonable advantage of faster memories (400 to 700 ns) no attempt will be made to gain speed thru the complexity required for efficient use of 100 ns or faster memories of the CDC 6600 variety.

The memory bus interface to the machine will allow the processor to be placed in the middle of the memory bus as is presently allowed on the DF10 channel. This will reduce cable delays. In a system with 800 ns to 1.65 μs memories these delays may presently add 300 ns (almost 40%) to memory cycle times and 60% to present 500 ns read access times.

With the advent of smaller DEC machines equipped with memory buses (the PDP-11 and PDP-15), these machines will be used as general and special-purpose I/O processors (display processor, data communications handlers) using the 10 memory space to deposit data and eliminating complicated, expensive machine to machine channels presently being sold.

It will be possible to add up to four additional fast memory blocks to the machine to facilitate job changing in high-speed real-time applications where customers think immediate response is an overriding consideration.

A memory paging system will be provided to simplify multi-user system operation and remove some of the software problems of the time sharing system:

1. User's I/O buffers to remain in core while swapping rest of user's program out onto storage, instead of locking the user's entire program in core for the sole purpose of accessing its I/O buffers.

2. All or part of a number of "real-time" jobs (typically process control, hybrid simulation, or experimental physics applications) to remain locked in core without tying up the unused nearby core due to the fragmentation of these unused core areas.

3. Programs can be spread over core without requiring contiguous core areas which must presently be produced by shuffling other jobs to merge fragmented unused core areas.

4. Retains and expands the two segment feature of the present machine which allows the major part of the standard software packages (FORTRAN, BASIC, etc.) to be shared by many users simultaneously instead of each user having his own complete copy of the package, reducing the amount of total core required for a given number of users.

5. A rather small associative memory will keep track of memory references and will keep most jobs (which are seldom as large as 8K or 16K) running at full speed without requiring additional memory references for paging control.

6. The present monitor can operate in the new machine with a very few changes. Approximately 30 man months of programming effort are required to make full use of the new feature including the paging hardware for more efficient memory management.

7. Provision for write protecting or read protecting (execute only) portions of memory to prevent the theft of proprietary programs offered by the customer to users.

If a user's memory request is illegal or the page requested is not in core, the machine will trap to the monitor in EXEC mode, saving the system state so that the program can be restarted at the instruction which trapped if desired. The address which caused the failure is also preserved.

An instruction to allow the monitor (in EXEC mode) to reference user's areas thru the paging transformation is included to facilitate monitor operation.

The procurements of the associative memory, read/write integrated memory for fast registers and paging, shift rotate gating, and adders for the machine are fairly simple as at least two vendors (Fairchild and Signetics) have usable MSI units and should be willing to make modifications in metalization to become second source for products of the other vendor. The fast memory will probably be a large size version of the Fairchild 9030 which is used in the present machine with no problems.

Mechanically the new machine will use the standard DEC cabinets and associated sheet metal work and castings. The use of integrated circuits will allow the reduction of logic space from 2 1/2 bays to 2 bays but the processor will still require a third bay for the operators console. The possibility of building the operator's console into a desk-height cabinet separated from the logic cabinet by up to 30 feet is being considered. The electrical and logic problems associated with this seem to be minimal. The operator's console will include the present switches and indicators, and perhaps a paper tape reader/punch and a dual DECtape drive. Eventually it may be possible to build in a console teleprinter but with the Teletype Model 35 or 37 this seems impractical. The maintenance indicators will still be mounted at the top of the machine's logic bays.

The present cooling arrangements will continue to be used with the addition of high pressure blowers to force air through the stack of regulator heat sinks.

Appendix A

Technical Details

A. PI System

The KI10 will feature a new type priority interrupt system which will combine the best features of the "API" (a la PDP-9) and the present PDP-10 assignable priority system. The bus and the devices designed for it will be upward and downward compatible with existing PDP-10 (and PDP-6) equipment.

The new I/O bus works as follows (see Figure 1): New and old devices may be mixed on the bus, and are assigned one of seven (or no) priority levels as at present. When the processor sees a PI request, the priority network decides which, if any, of the channels is to be honored. It then sends out a pulse (on a presently spare wire), and simultaneously places the number of the priority interrupt level which it is servicing on I/O bus data lines 0 thru 2. Each new device, in response to the pulse, strobes its PI request line into a synchronizer flip-flop. Thus, if the request was made by a new-style device, at least one device (possibly more) will have its PI level number and the level number being serviced equal and will have its synchronizer flip-flop set.

After the logic which checks for a match has had a chance to settle, the processor sends a second pulse out (on a second spare wire). This pulse is gated in each new-style device and bused across in each old-style device. The new device nearest the processor which detects a PI level match and has its PI request synchronizer flip-flop set uses this pulse to gate its interrupt address onto I/O bus data lines 18 thru 35. All other devices must relay the pulse from the processor on to the next device. The device selected also indicates the nature of its request in I/O bus data lines 3 thru 5. If the device requesting the PI is an old-style device, the pulse will reach the end of the I/O bus and be sent back to the processor as a 1 in bit 5 of the I/O bus data lines, indicating to the processor that it should use the standard PI address (40 + 2N where N is the priority level requesting service). If a (new-style) device returns 1's in both bits 4 and 5 of the I/O bus data lines, the processor will ADD the signed number on I/O bus data lines 6 thru 17 to the contents of the address in bits 18 thru 35. This extended memory increment feature should enhance the PDP-10 system's operation in realtime and physics applications.

B. Memory System

To accommodate higher/average speed memory systems expected in the future, the memory bus overhead is effectively reduced by overlapping the data portion of one memory cycle with the memory module selection and access portion of the next memory cycle. In order to avoid the problem of a second memory providing data to the memory bus before the first one is finished with the bus, three types of memory requests are generated by the processor.

The overlapped memory system will accommodate as many as three different speeds of memory. The memories are classified as "immediate" memories which respond with the data at essentially the same time as it acknowledges the memory request; "fast" memories which provide read data in T nanoseconds after the memory request is acknowledged (T is nominally 250 ns); and "slow" memories which provide read data T* nanoseconds after the memory request acknowledge (T* is not fixed but all "slow" memories are adjusted to have equal T*s). A particular physical memory module may sometimes react as a "immediate" memory and at other times as a "fast" memory, for example. Both the "fast" and "slow" memories deliver a "T warning" pulse to the processor T nanoseconds before they deliver the read data to the processor.

See Figure 2 for a state diagram of the processor memory control. If the processor has no memory request outstanding, it generates a "general" memory request. Memories of all classes are allowed to respond to this request. If an "immediate" memory responds, the request is satisfied and the memory control is again idle. If a "fast" memory responds, another memory request, limited to "slow" memories, may be initiated by the processor since if this class of memories responds, it will certainly take longer than the first memory request. I f either a "fast" or "slow" memory responds and a "T warning" pulse has been received, another memory request, limited to "fast" and "slow" memories, may be initiated by the processor, again since if these classes of memories respond, they will certainly not provide data before the original request has been completed. If a request limited to "slow" memories has not been acknowledged by the time a "T warning" pulse is received by the processor, it is upgraded by a request limited to "fast" and "slow" memories. If a request limited to "fast" and "slow" memories has not been acknowledged by the time the read data is received by the processor, the request is upgraded to a "general" request, since the bus is now idle and even an "immediate" memory will not provide data too soon.

The memory control will only request a write cycle when the memory bus is idle, since the processor provides data to the memory bus as soon as the memory module acknowledges the request to write.

C. Paging System

The paging system provides a monitor-controlled mapping from the user's apparent memory space to the physical memory space of the machine. It appears as follows (see Figure 3): Each memory reference made in User Mode causes the most significant 9 bits of the effective (User's) memory address to be compared with the 16 (or 32) word associative memory. If a matching 9 bit word is found in the associative memory, an associated 11 bit high order address part is combined with the low order part of the effective address to yield a 20 bit physical memory address. This 20 bit memory address is used for the actual memory reference. (This allows 2^{20} words of memory.) A 3 bit word is also supplied to the request checking logic to determine if the request is legal for this user in the area addressed. If the memory reference is illegal, the memory cycle will not be started and the program will trap to the monitor instead.

If no matching 9 bit word is found in the associative memory, the paging control will squeeze in an additional memory reference before the user's, using the user's most significant 9 address bits as the least significant 9 bits of physical address and 11 bits from a segment register controlled by the monitor for the most significant bits of the physical address. If the contents of the location addressed by the additional memory reference contains a valid physical address, it is loaded into the associative memory and the user's memory reference is completed. If the contents of the location addressed by the additional memory reference contain an invalid physical address, the program traps to the monitor.

Words are loaded into the associative memory in sequential cells. Although not optimum, simulations indicate that this scheme with one additional cell of associative memory is better than the optimum scheme for any practical number of associative memory cells. Since the cost of one additional cell is less than the cost of implementing optimum or nearly optimum cell loading algorithms, the former is being implemented.

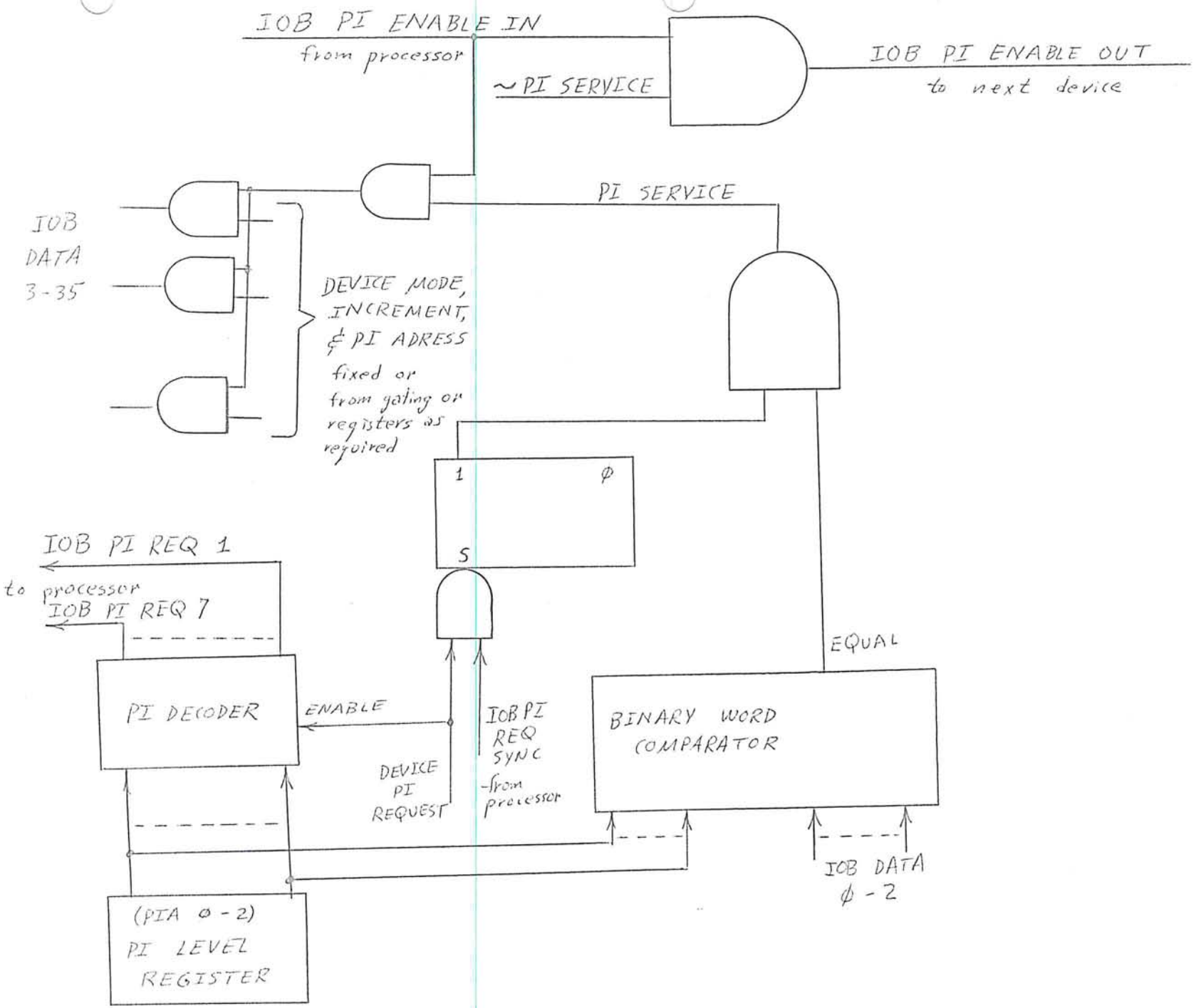
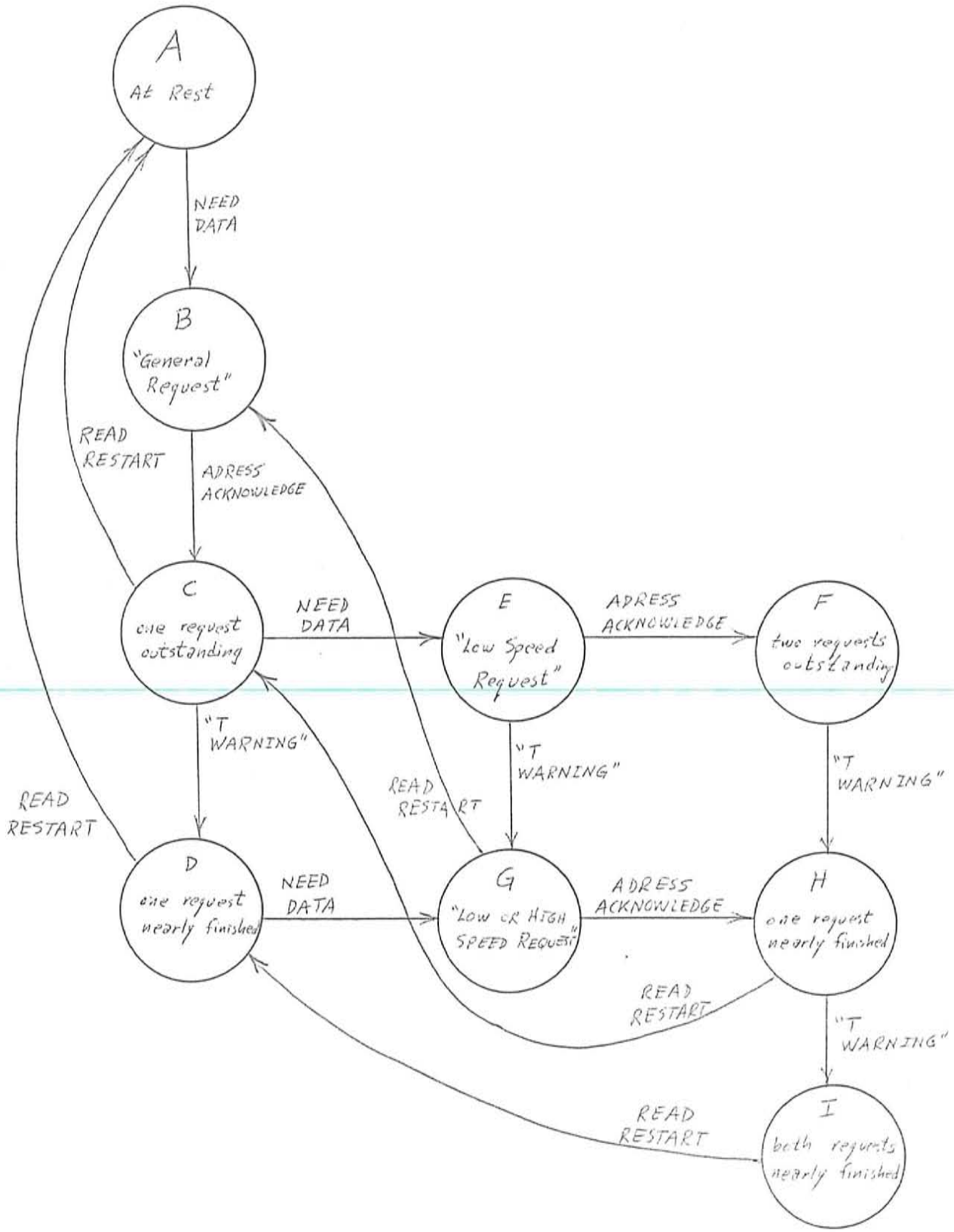


FIGURE 1
METAL PRIORITY LOGIC

FIGURE 2

MEMORY READ CONTROL STATES



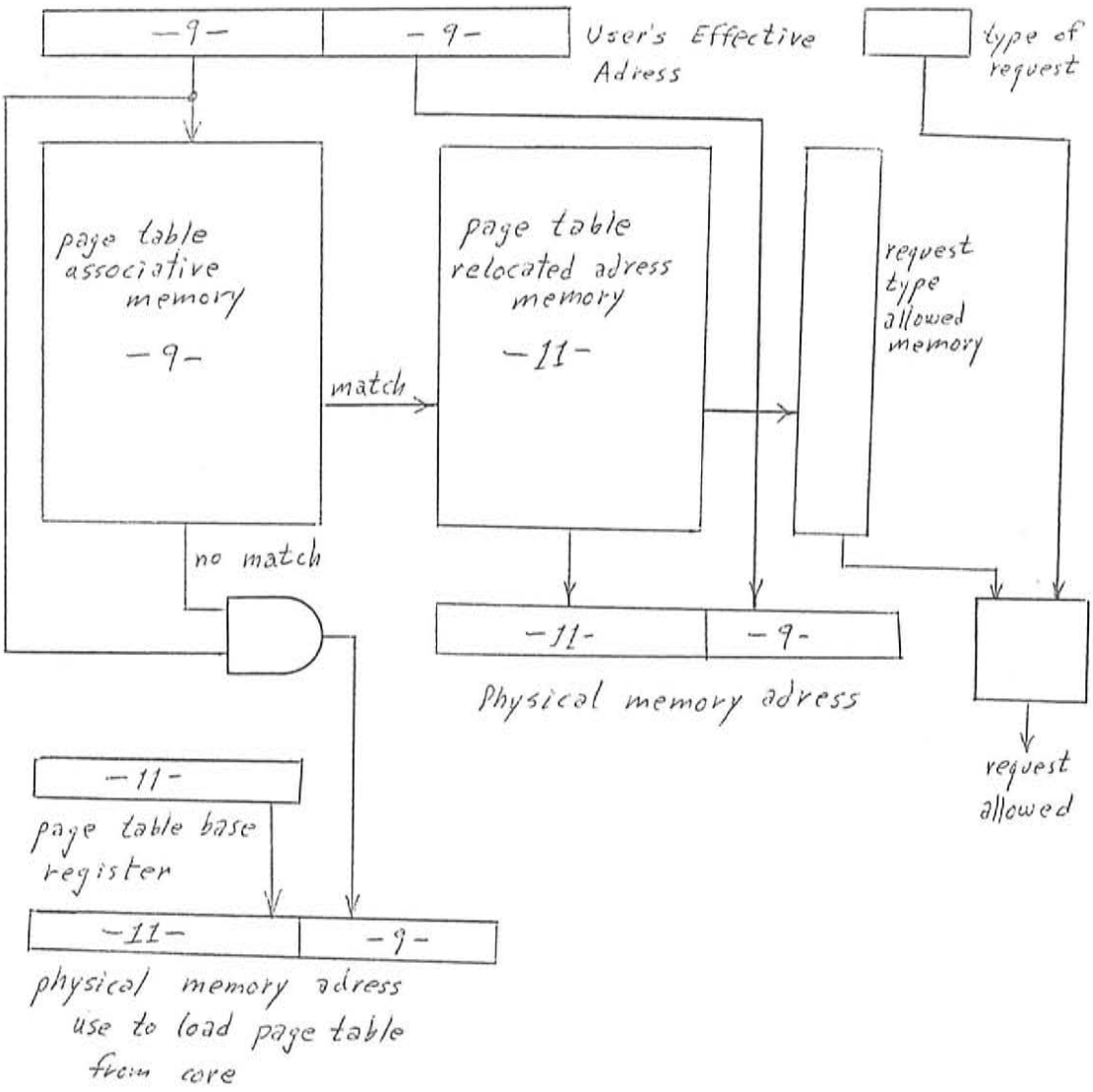


FIGURE 3

PAGING SYSTEM

RELOCATION SCHEME

Appendix B

KI-10 Estimated Costs

Unit Name	Amt Used	Material Unit Cost	Time (hrs.)	Labor	Overhead	Cost
Marg. Check Bay #1	2	$ 13.33	3	7.50	15.00	$ 35.83 *
Marg. Check Bay #2	2	13.33	3	7.50	15.00	35.83 *
Marg. Check Bay #3	1	28.44	4	10.00	20.00	58.44 *
Fan Housing Bay #3	1	83.12	4	10.00	20.00	113.12 *
Fan Housing (plenum)	3	24.02	2	5.00	10.00	39.02 *
Heat Sw. Assembly	3	14.04	1	2.50	5.00	21.54 *
Marg. Check Maint.	1	72.83	8	20.00	40.00	132.83 *
Ind. Panel #1	1	224.00	2	5.00	10.00	239.00 *
Ind. Panel #2	1	224.00	2	5.00	10.00	239.00 *
Console	1	250.00	4	10.00	20.00	280.00 *
Blowers	3	79.35	2	5.00	10.00	94.35 *
Cabinets						
Bay 1	1	103.00				557.27 *
Bay 2	1	103.00				541.26 *
Bay 3	1	103.00				539.82 *
Fan Housing Screen	2	128.45				256.90 *
End Panels (Gray)	2	40.00				80.00 *
Front Door	2	90.00				180.00 *
Rear Door	3	90.00				270.00 *
Logic Bay 1	1	1,101.00		297.00**		1,398.00
Logic Bay 2	1	1,151.00		391.41**		1,542.00
Logic Bay 3	0	0		0		0
Modules	1080					12,359.69
Power Supplies						1,400.00
Teletype 37	1					2,200.00
PCO	1					810.00
Tape Cables	50					890.00
				Total		$24,313.90
		Labor and overhead for construction and Checkout				8,000.00
						$32,313.90

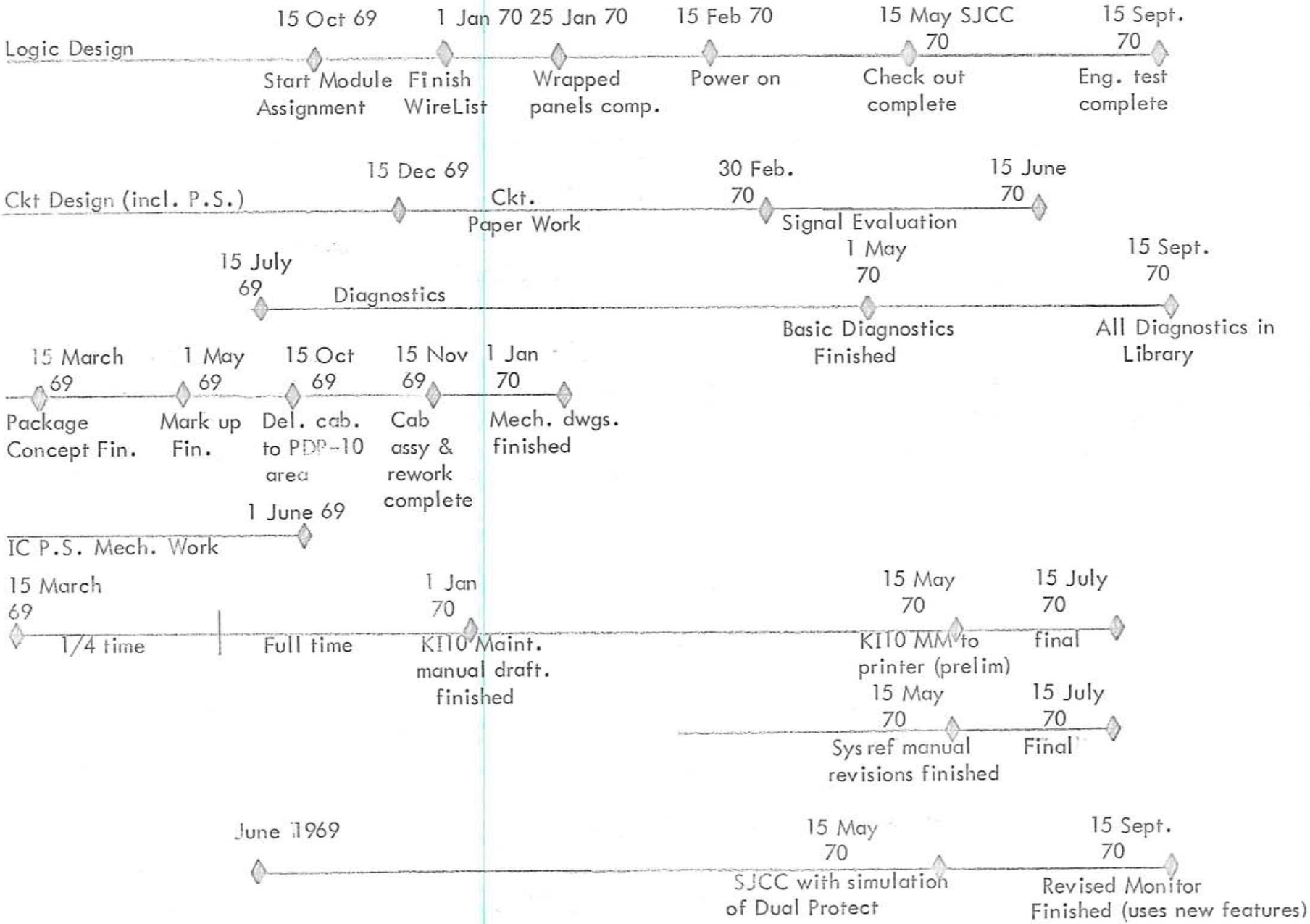
** Pastoriza costs
* KA10 Actual Costs

Appendix C-1

Marketing Schedule

Prototype Checkout Complete	May 1970
Announcement	SJCC - May 1970
First Showing	SJCC - May 1970
First Delivery	October or November 1970
Rate of Delivery	October
	November
	December
	January

KI-10 ENGINEERING SCHEDULE



Appendix C-3

KI-10 Programming Schedule

	Man/Months
1. Modify KA10 Software to Simulate dual protect and relocate registers on the paging hardware - required for SJCC and initial processor checkout	1
2.a) Modify swapping software to provide scatter/write and gather/read capability necessary for efficient swapping in paging environment.	30
b) Modify core allocation facilities of monitor to take advantage of paging hardware.	
3. CUSP software - no modification required for initial deliveries.	0
Total	31 Man Months

Assuming two programmers

Project Time = $\frac{31}{2} \approx$ 15 months

Appendix C-4

Diagnostic Programming Manpower Estimate

	Man/Months
Basic Processor Diagnostics	12
Shift Rotate, Mul-Div, FP & Byte Diagnostics	8
Basic Instruction Reliability Tests	4
PI Reliability	5
Protect and Relocate Diag. & Reliability	6
	42

5 men for approximately 8 months.

digital INTEROFFICE MEMORANDUM

DATE: April 15, 1969

SUBJECT: Proposal to Change Vacation Pay Policy and Administration as it applies to Employees with 2-Week Military Training Obligation

TO: Operations Committee

FROM: Personnel Committee
(Graydon Thayer, Paul Chambers)

Our current practice is as follows:

1. Employees receive their accrued vacation pay when they leave for their 2-week military training session.

2. When they return, we make up the difference between their base pay and their military pay.

3. We allow them an additional week off without pay with the approval of their supervisor.

The Boston Survey Group survey indicates that all except one company allows employees to take their accrued vacation in addition to receiving the military pay differential. We therefore propose the following in order to make our policy competitive.

1. Allow employees to take their accrued vacation with pay in addition to their 2 weeks of training.

2. Continue to make up the difference in pay as before.

jfr

digital INTEROFFICE MEMORANDUM

DATE: April 15, 1969

SUBJECT: Proposed Addition to Employee Transfer Policy

TO: Operations Committee

FROM: Personnel Committee
(Paul Chambers)

In order to more effectively administer employee transfers we propose that the following wording be added to the current policy:

> Permanent transfers must be accomplished as quickly as possible to prevent potential negative employee morale resulting from unreasonably delayed employee transfers.
>
> Once it has been determined that an employee is qualified for a transfer, a mutually agreed upon date will be established between the outgoing and incoming department managers.
>
> The Personnel Department will act as a mediator if the managers involved cannot agree on a date of transfer within 1 week. If necessary, Personnel will meet with the employee and then with the managers concerned in order to establish a transfer date.

jfr

digital INTEROFFICE MEMORANDUM

DATE: April 15, 1969

SUBJECT: Proposed 1969 Hourly Wage Review - Canada
Effective April 28, 1969

TO: Operations Committee

FROM: Personnel (Paul Chambers)

I am extremely confident that this proposal accurately represents what our hourly wage position must be in Canada for the 1969 Hourly Wage Review.

I visited Carleton Place from March 18 to March 21 and personally conducted wage surveys. The results of this work including this proposal has been reviewed and approved by all Maynard and Carleton Place Managers concerned (Denny, Bert, Fred, Cy and Jack Shields).

	FIELD SERVICE	CLERICAL	MANUFACTURING	TOTALS
AVERAGE % INCREASE	8.6	11.0	13.5	12.4
ADDITION TO PAYROLL	8K	8.8K	43K	59.8K
No. OF EMPLOYEES	13	19	110	142

FIELD SERVICE

Wage surveys clearly indicate a need to increase our rate range 25¢ per hour (from $2.75-$3.75 to $3.00-$4.00 per hour). The resulting 8.6% increase compared with 11% for 1968 is quite reasonable in view of the new expanded rate range.

MANUFACTURING

The minimum starting rate by law was increased 15¢ per hour (from $1.15 to $1.30). Results of the wage surveys show a need to also increase the maximum rate in female assembly 20¢ per hour (from $1.80 to $2.00). It is primarily for these 2 reasons why the percentage increase is 13.5% as compared to 9.5% for 1968.

CLERICAL

Wage surveys in Carleton Place as well as in Montreal and Toronto indicate a rise in wages primarily for Secretaries and Senior

digital INTEROFFICE MEMORANDUM

DATE: April 14, 1969

SUBJECT: Proposed Escort Service

TO: Members of the Operations Committee

FROM: Al Hanson

Because of the many problems related to escorting visitors through the plant, and the security measures necessary to monitor these visitors, Plant Engineering would like to submit this proposal for an Escort Service.

digital INTEROFFICE MEMORANDUM

DATE: April 17, 1969

SUBJECT: Facilities Planning Report

TO: Members of the Operations Committee

FROM: Al Hanson

Attached you will find a Facilities Planning Report, showing all department relocations and additional areas required.

The report only describes the departments which need expansion, and in each case, we indicate the existing area, the additional area, total area, and suggested location. As you can see from sheet 3, the Summary Section of the report, the total additional area required for Maynard is 161,700 square feet. Yet, we only have a total vacant working area of 125,840 square feet. Therefore, we lack 35,860 square feet in the Maynard complex. I do feel, however, that we could adjust the figures and arrive at a density ratio whereby 100% of the Maynard facility would be assigned, reducing vacant areas to zero.

At present, there are 2,420 employees per day shift. Together, with the Personnel Department, we have projected that from a facilities stand point only, we could populate the Maynard complex with another 1,580 people, showing a maximum of 4,000 employees. Based upon that figure, we would require an additional 500 parking spaces.

digital INTEROFFICE MEMORANDUM

DATE: April 17, 1969

SUBJECT: RE-ORGANIZATION OF A&SP DEPARTMENT

TO: Operations Committee FROM: Gabe d'Annunzio

In developing our promotional communications plans for FY-70, it became increasingly apparent that certain organizational changes would be desirable in order to effectively handle the increasing workloads and broader responsibilities of the department.

The attached organizational chart shows how I would like to restructure the group. Underlying this restructuring is my recommendation to change the name of the group from Advertising and Sales Promotion to Marketing Communications. This, I think, is a much more accurate description of the department's broad range of communications activities.

Under this new organization, I would like to elevate Chris Scott to the position of Advertising Manager. Chris would be responsible for the execution of our advertising and promotional literature programs. Working with Chris will be Peter McGowan and Gabe Del Rossi. Peter will act as creative director for PDP-10, 11, 12, and 15 advertising and promotional efforts; while Gabe will concentrate on PDP-8, 14, modules, module related products, and traditional products.

Here are what I consider to be the major attributes of the new organization:

1. It allows us to effeciently "time-share" the department's resources so as to be more responsive to high priority tasks.

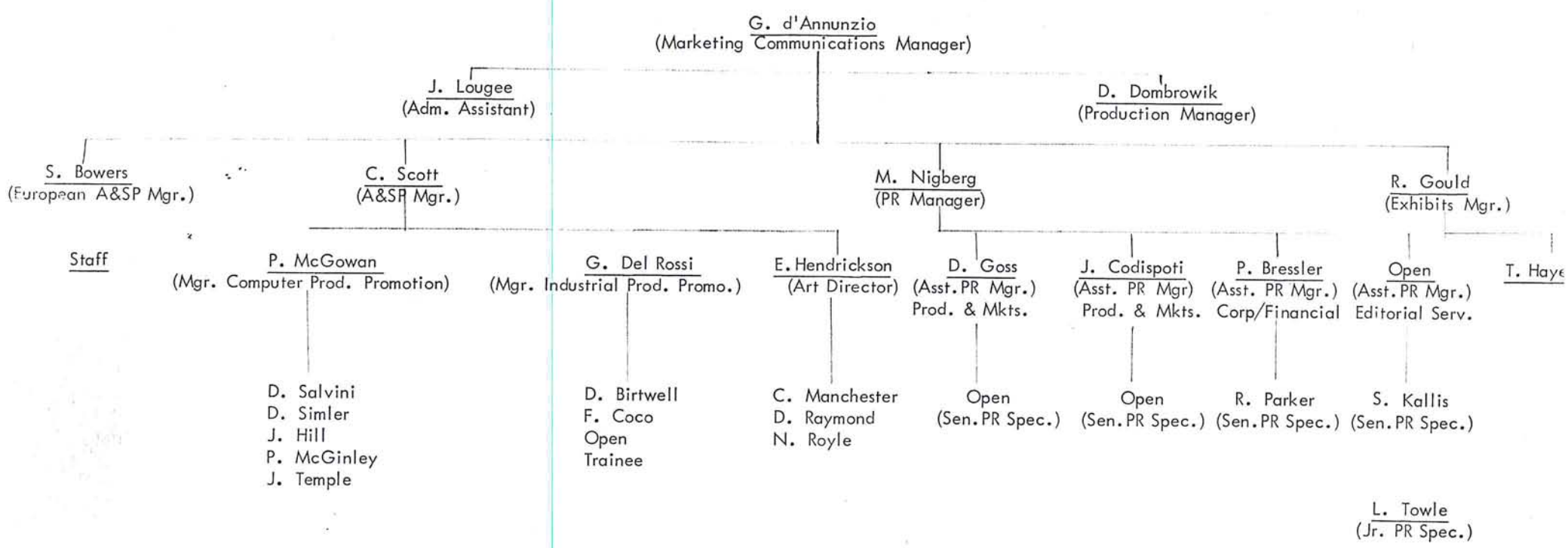
2. It develops an important new strata of responsibility, thereby providing a visible growth pattern to the junior people in the department.

3. It allows me to be more flexible in working with Roy, Mark and Chris in developing new programs and re-evaluating present efforts.

4. It will enable Mark and I to work more closely as a team in the areas of financial and consultant relations.

/meb

Attachment



Secretarial Support

Mary Ellen--Gabe
Rhonda--Chris (Also to assist Peter and Gabe if the need arise)
Bonnie--Peter (Also to support Dot, Dave, Jerry, Pam, John)
Priscilla--Gabe (Also to support Dave, Frank, etc.)
Elaine--Elliott, Dean
Debbie--Jean
Jane--Roy, Tom

Suzanne--Mark
Nancy--Dennis, Joe (etc.)
Lois--Peter, Bob
Judy--Steve
Judy S. (to support Nancy)

digital INTEROFFICE MEMORANDUM

DATE: April 18, 1969

SUBJECT: PERSONAL INVESTMENT CONSIDERATIONS (Item for Sales Newsletter)

TO: Operations Committee FROM: Ted Johnson

Employees are advised that any personal investments in other organizations, or participation such as being a member of a board of directors, must be subject to the test of prudent judgement and free of any possibility of conflict of interest. If, for instance, holding stock in a customer's company, in any way can prejudice a DEC employee's actions toward that customer, or that customer's competitor, the DEC employee should remove himself from that involvement position. If in doubt, please consult your Vice President for open disucssion of any situations of this nature.

mr

OPERATIONS COMMITTEE MEETING

April 14, 1969

AGENDA

1. Additions and Corrections to Minutes of the April 7th Meeting
2. Marketing Review Committee Summary - (Ted Johnson)
3. Final Approval of Stock Options
4. Proposed Change in Digital's Wage Administration - (Win Hindle)
   (See attached report from the Personnel Committee)
5. Discussion on Trade Shows - (Gabe d'Annunzio)
6. Status of Office Services Department - (Nick LoRusso)
7. Air Travel Proposal - (Nick LoRusso)
   (See attached report)
8. Land Committee Report - (Al Hanson/Ed Schwartz/Bob Dill/Bob Lassen)
9. Commercial Applications Market Proposal - (John Cohen)
   (See attached report)
10. Capital Equipment Justification Procedure - (Joe St. Amour)
    (See attached report)
11. Special Projects Plans and Budgets - (Joe St. Amour)
    (See attached report)
12. Texas Instruments' Thermal Printer as Teletype Replacement - (Joe St. Amour)
    (See attached report)
13. 1970 Wire-Wrap Machine Requirements - (Jack Smith)
    (See attached report)
14. New Peripheral Products and Production Plans - (Bob Antonuccio)
    (See attached report)
15. 1970 Budgets - (Ed Savage)
16. Fall Joint Computer Conference - (Roy Gould)
    (See attached report)
17. Personal Investment Considerations - (Ted Johnson)
    (See attached report)
18. Light Pen Proposal - (Bob Collings)
    (See attached report)
19. Discussion on Plans for Next Year - (Norm Doelling)

digital INTEROFFICE MEMORANDUM

DATE: April 18, 1969

SUBJECT: MINUTES OF THE OPERATIONS COMMITTEE MEETING OF APRIL 14

TO: Operations Committee

FROM: Win Hindle, Secretary

Present: Ken Olsen, Stan Olsen, Nick Mazzarese, Pete Kaufmann, Ted Johnson, and Win Hindle

1. Minutes of the April 7 meeting were approved.

2. Minutes of the April 7 Marketing Review Committee were accepted.

3. Capital Equipment Justification Procedure - We accepted Joe St. Amour's proposed procedure.

4. Special Project Plans and Budgets - We accepted Joe St. Amour's report on his plans, including Bob Antonuccio's section on production plans.

5. T. I. Thermal Printer as Teletype Replacement - Report from Joe St. Amour received as information.

6. Proposed Change in DEC's Wage Administration - We accepted the proposal that a Salaried Non-Exempt Category be established in which the individual fills in a clock card only for time not worked and for overtime. We did not accept the proposal to do away with time clocks, although members of the Operations Committee are in favor of this in the future. We asked the Personnel Committee to survey work habits on overtime. If the Personnel Committee has confidence in discipline on overtime, then we may go along with this proposal of eliminating time clocks.

7. Air Travel Proposal - We suggested that Ted Johnson's group try the TWA credit card approach proposed by Nick Lo Russo before committing the whole Company to changing.

8. Handbooks - Gabe d'Annunzio pointed out that it costs as much to mail a handbook as it does to print it. The mail group is looking into ways of mailing it cheaper.

   Gabe described his thoughts on preparing a time-sharing handbook about the PDP-10.

   Ken expressed his strong desire to have a simple catalog which describes all of DEC's products, prices, and discount schedules. He asked Gabe to standardize the literature and have every product line follow the standard.

9. Fall Joint Computer Conference - We decided to take 40 linear feet at the Las Vegas FJCC in November. The PDP-11 will be the focus of the show. Other products can distribute literature.

10. Land Committee Report - Ken, Stan, and Pete will act as a committee to make decisions on new land.

11. Commercial Applications - We agreed to John Cohen's proposal on the commercial applications market. One change we made in the proposal was that we will not develop new prospects until the system is proved. We asked that Larry Portner and Jack Shields review the proposal and comment on it.

12. Senior People - Since July 1, the following men have been hired at salaries over $17K:

	Hired Since July 1	On Order with Personnel
Ted	7	3
Stan	1	0
Win	2	1
Nick	2	1
Pete	8	3
Financial	0	0

Ken is very concerned that Stan, Win, and Nick are not concerned enough over hiring senior people.

13. 1970 Wire-Wrap Machine Requirements - We accepted Jack Smith's proposal on wire-wrap needs.

14. Light Pen Proposal - We accepted Bob Collings' light pen proposal on the condition that he could sell the idea to the product lines who will pay the expenses.

15. Purchase of Trailer and Tractor - We decided to purchase a tractor and trailer for $23,000. Stan will check into the appropriate way to finance the purchase.

16. 4TH Quarter, FY1969, and FY1970 Budget - We discussed our concern over profit levels for the next 5 quarters with Ed Savage and Bob Dill. We will meet individually with Product Line Managers during the week to work on this problem.

17. Stock Options - Another pass at stock options was made.

W. R. Hindle, Jr.

lmm

JUSTIFICATION PROCEDURE

Joe St. Amour
April 8, 1969

General:

This procedure is a tool which, when properly used, will allow maximum gain from funds invested in improvements, tooling and capital equipment. There is no single formula or group of formulas which by itself is sufficient to indicate the best investment. Decisions must be made on available data, existing conditions, current knowledge and an awareness of future happenings.

For improvements and cost reduction proposals, it is recognized that there is always a better way; what must be determined is the selection of areas, processes, etc. that will be improved. This implies that certain items will not be improved because the return on the investment required to make these improvements is not satisfactory. This procedure will allow a priority to be established for each proposal and the selection of those with the greatest rate of return.

Certain investments are required (new product requirements, health, moral, etc.) and priorities must be established separate from cost reduction proposals. This procedure will assist in establishing the most economical approach for these specific requirements.

To assure maximum success on any program, it is necessary to evaluate a minimum of three alternate methods of obtaining the same end results. It is also necessary to consider all of the

costs associated with a specific proposal. (Included at the end of this procedure is a checklist of factors which can be significant in determining the selection of the correct alternative).

For a cost reduction proposal, the first alternative to consider is improvement of the present method. This improvement can usually be done in minimum time at minimum cost and provides a realistic basis for comparison of other alternatives.

For major mechanization proposals, make sure that mechanized equipment tolerance requirements, including their effect on parts being fed to the system, are fully understood.

Project approval includes the responsibility to continually monitor expected return on investment as well as cost and schedule. Evaluation should be made at increments of investment exceeding $10,000 or time periods of three months to determine that neither internal (sales projections, product mix, etc.) or external factors (new developments) have made a significant change on the original investment decision.

Procedure

A. Determine method to be improved or new product requiring tooling.

B. Cost Reduction, a three-phase procedure

Phase I

Propose improvement and evaluate on rough-estimate basis to determine approximate rate of return. Evaluation

of alternatives minimal. Purpose is to determine priority for implementation.

Phase II

Projects with highest priority are evaluated on a thorough basis to determine if return on investment is as estimated in Phase I. Go, no-go decision to be made at this point.

Phase III

A final analysis of return on investment just before release of orders for capital equipment, tooling, etc. Decision could again be go, no-go, or even to re-evaluate alternatives considered in Phase III.

C. Select alternative methods of obtaining the end result.

a. Break major items into detail and evaluate details.

b. Do not consider cost or practicality at this point. Evaluation of cost, etc. tends to limit ability to select additional alternatives.

c. Question the need for each element and list possible alternatives. (The best alternative is to eliminate).

d. Evaluate alternatives and combine for optimum solution.

e. Outside purchase should be one alternative.

D. List selected alternatives. For cost reduction, comparison will be of the present method.

E. Comparison of alternatives can be made by comparison of cost elements that are different. Determine:

a. Cost difference or actual cost

b. Capital equipment costs*

c. Expense items*

d. Expected life

e. Expected volume

f. Credit, if any, on existing equipment

g. Credit for proposed equipment at end of expected life

F. Use the discounted cash flow system to determine whether the proposed investment (capitalized plus expensed) is justified by the earnings or savings it will create over its useful life. Return on investment is the measure of the rate of earnings with respect to the required expenditure over a period of time. The form, (page 6) properly completed, will provide a time adjusted rate of return for the selected alternatives. Time adjustment, through the use of present value factors, takes into consideration the fact that one dollar today has more value than one

*Review factors to insure inclusion of all items.

dollar to be received at some future time.

*Note that the form provides space for cost summaries only. Attach individual worksheet to show detailed costs. Page 8 outlines single payment, present worth factors to be used for determining rate of return on investment.

G. When submitting justification, include a schedule for implementation of the proposed plan. Show commitment dates for capital expenditures and manpower requirements as they are expected to occur.

---

*The minimum acceptable rate of return for project approval is a variable dependent upon funds available for investment. Budgetary procedures will allow publication of a minimum rate of return for a specific year. As a general rule, 20% return is marginal.

Factors to consider for significance in evaluation of alternatives:

1. Expected life
2. Reason for eventual obsolesence
3. Present volume
4. Forecast volume
5. Present cost
6. Projected cost
7. Credit for sale of present equipment
8. Credit for equipment at end of expected life
9. Effect on other processes
10. Effect on other products
11. Change, if any, in
    a. tolerance
    b. quality
    c. performance
12. Value or cost of change in product
13. Engineering costs (ECO, drafting, etc.)
14. Purchasing costs, including change in inventory levels
15. Obsolesence cost
16. Direct labor cost
17. Indirect labor costs that are associated with this method
    a. Engineering
    b. Maintenance
    c. Shipping and receiving
    d. Purchasing and expediting

e. Inspection

f. Supervisory

g. Floor support

18. Fringe Benefits - 20% of all labor

19. Variable Overhead (20% of all labor and fringe)

20. Replacement parts inventory

21. Usage of spare parts

22. Power

a. Is capacity available?

b. Cost additional capacity installation

c. Cost of power used

23. Water

a. Is capacity available?

b. Cost additional capacity installation

c. Cost of water used

24. Gas - Including Air

a. Is capacity available?

b. Cost additional capacity installation

c. Cost of gas used

25. Floor Space

a. Availability

b. Rent

c. Heat

26. Special Area Preparation

a. Air conditioning

b. Humidity control

Definitions:

Capital Equipment

Any expenditure involving acquisition or modification of assets which have a useful life of three years or more, a unit cost of $250 or more and are not experimental in nature. Exceptions are desks and other office equipment which are capitalized.

Expense

Any expenditure, other than for capital equipment, for goods and services required to design, make and market a product.

Depreciation

This is the allocation of the cost of capital equipment over its useful economic life. It is not an out-of-pocket expense but has an impact on income taxes. Use straight-line depreciation over project life for justification purposes.

Project Life

The estimated period of time over which the project will affect operations in generally the same manner as at the beginning. Life may be limited by the assets' physical life, its technological life, or its product-market life. Normal life for production equipment is three years, for machine tools (general purpose) five years. Projects with longer life estimate must discount forecast with time after these periods.

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Cash Flow

The receipt or expenditure of cash over a period of time. Cash-out flow can result from the purchase of capital equipment and expenses such as direct labor, indirect labor, materials, etc. Cash-in flow can result from an increase in sales, the sale of an asset, or the elimination of current expenditures.

Budget

A planning tool which forecasts expenditures over a period of time. Budget approval is not an authorization to spend. Authorization to spend is based on adequate justification. Money available to invest can vary over or under budget based on the variation in actual conditions versus planned conditions throughout the year.

RATE OF RETURN ANALYSIS RATE OF RETURN ___ %
PROJECT LIFE ___ YEARS

YEAR	0	1	2	3	4	5	6	7	8
CAPITAL EQUIP — TOTAL									
EXPENSE ITEMS - TOTAL									
NET SAVINGS									
DEPRECIATION									
EXPENSES									
PROFIT BEFORE TAXES [3-(4+5)]									
TAXES (__%)									
PROFIT AFTER TAXES									
DEPRECIATION									
CASH IN FLOW - (8+9 IF +)									
CASH OUT FLOW (8+9, IF −)									
CASH OUT FLOW - ITEM 1									
NET CASH FLOW + OR −									
__% PRESENT VALUE FACTOR	1.000								
__% DISCOUNTED CASH FLOW									
__% PRESENT VALUE FACTOR	1.000								
__% DISCOUNTED CASH FLOW									
__% PRESENT VALUE FACTOR	1.000								
__% DISCOUNTED CASH FLOW									

digital INTEROFFICE MEMORANDUM

DATE: 9 April 1969

SUBJECT: Special Projects Plans and Budgets

TO: P. Kaufmann FROM: J. St. Amour

Total dollars spent have been kept under budget, but projects have taken longer than expected. The proposed FY'70 budget includes safety margins and shows some stretch-out over time. Even so, I'm more convinced than ever that short turn-around time can be achieved. To do this requires the correct design philosophy, the correct attitude by the Project Engineers and involved management. It all sounds easy, but I am having my troubles trying to implement this. An occasional ray of light convinces me the approach is correct and that nothing works as well as the pressure of a close delivery date.

Somehow, I have got to get my people to make higher risk commitments. As long as customer orders are not accepted until after working prototypes, we should be even more willing to take a chance with shorter schedules.

Planned projects and comments are noted below. No major expenditures will be made without prior Operations Committee approval.

1. Paper Tape Punch and Reader

   a. No work, other than maintenance is planned in this area. Have already received request to make special PC05. Have stated our goal was a standard unit and the product line would have to fund money, and I would need approval to make special unit.

2. Tape Transports

   a. TU-10 is on schedule. Original proposal, costs and schedule is based on 25 ips machine with a follow-on project for TU21 which is 45 ips machine. All design, parts procurement, etc. is based on 45 ips design, and we expect to reach that speed within the TU-10 schedule. Arnold does not want to commit to greater than 25 ips, and I think part of this is overreaction to statements of others that tape transports take two to three years.

b. TU-80 is a 75 ips machine to be proposed. Design plan will include ability to increase density to 1600 bpi, then speed to 125 ips. I expect that resources planned for TU21 will be available to improve TU80.

c. DECtape - This is proceeding according to what I consider the right design philosophy. (It was with this approach that I was accused of productionizing the engineering design effort). A one-year schedule was cut back to six months to start realizing savings at the earliest opportunity. Follow-on program will be directed at low cost controllers to come up with a simple, low cost, free-standing unit.

d. Funds are provided in Fourth Quarter, FY'70 for start on TU80E and a new generation of controllers for tape transports. Nothing is included for tape cassette. Is 8 Line doing it? Should we plan to do it? Is low cost DECtape better bet than cassette?

3. Disks

a. My insecurity shows here. First Quarter, FY'70 is planned as a wrap-up of all problems on both RF/RS08 and DF32. The key is producibility and serviceability, control of head configuration and flying characteristics could get us there without other changes. If so, investigations in peak detection and RF08 sophistication are preparing us for the next step.

b. Have a proposal for a disk that is Burroughs' equivalent, and budget shows this as a project in FY'70. Not sure this is best way to get there and looking for alternatives that allow evolution into this capacity.

c. Fourth Quarter, FY'70 shows start on next generation disk.

d. Have Mono Disk available for Spring Joint Computer Conference. Looking at using our logic to give us unit at $4,000 cost (approximately 2,000,000 six-bit characters with access time of 239 milliseconds).

e. Talking with Hitachi; they have disk pack drive at half the cost of Memorex. Access time is slower. Getting firm fix on cost; also, has potential of equivalent capacity.

4. Printers

a. Have commitment to build thermal sensitive unit. Budget shows completion during Third Quarter, FY'70. In the meantime, we are looking at other alternatives. Expenditures to date have been approximately $15,000 to develop head. When we know we have good head design, we will be ready to run on entire program.

b. Using people from Special Systems and Mechanical Engineering; plan to buy mechanism of high speed impact line printer, marry it to our logic and sell as interim product. Completion is planned for Third Quarter, FY'70.

c. Plan is to start development of our own high speed line printer possibly using new non-impact techniques.

/gp

digital INTEROFFICE MEMORANDUM

DATE: April 9, 1969

SUBJECT: NEW PERIPHERAL PRODUCTS AND PRODUCTION PLANS

TO: Central Planning FROM: R. Antonuccio

These comments supplement the attached New Peripheral Products Schedule.

1. RS08/RS09 Discs
RS/RF08 shipments (2) began in March and increase to (40) per month August and (80) in January. RS/RF09 shipments (5) will start in July and increase to (20) per month in January. Head vendor's capacity and space could be limiting factors.

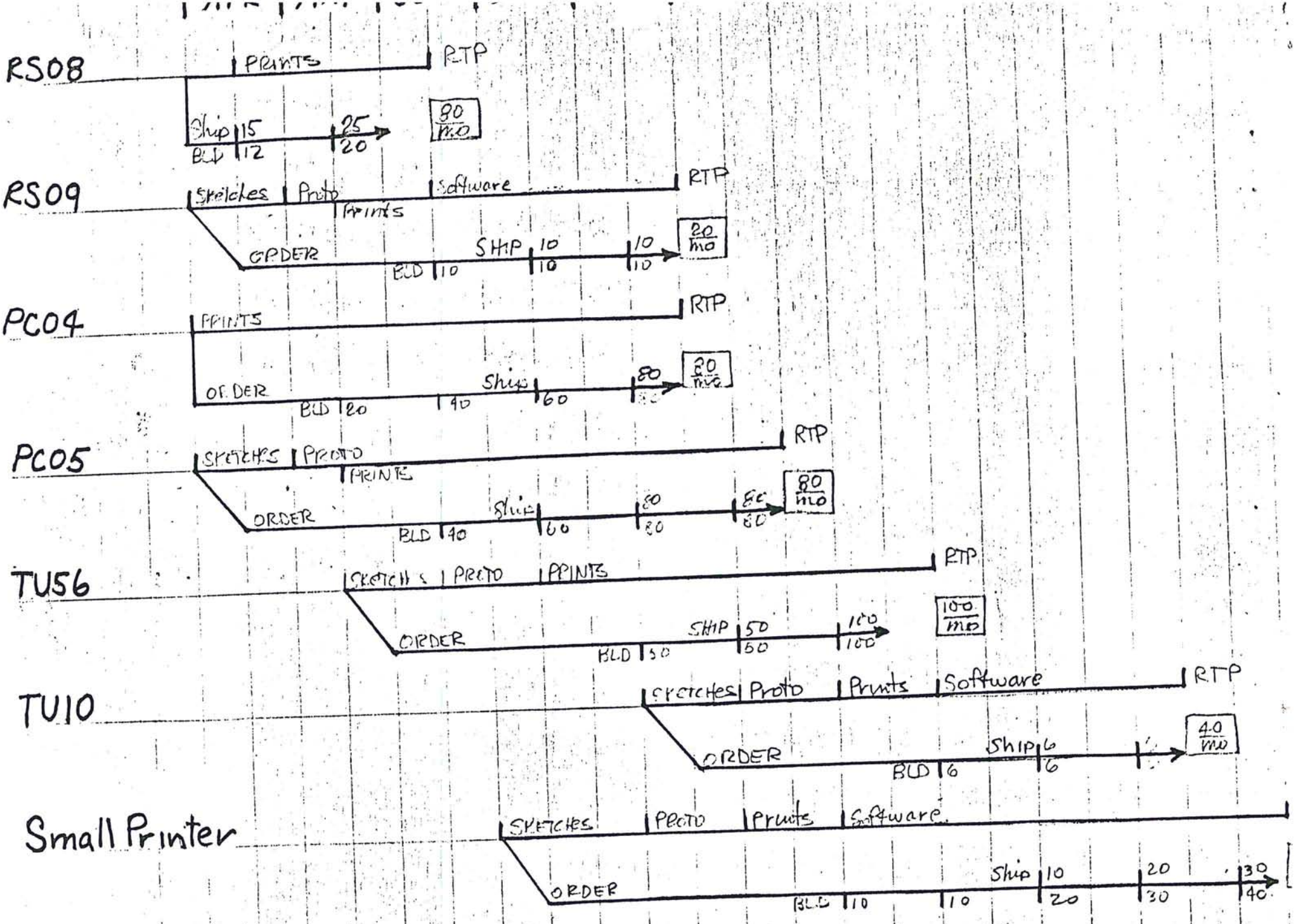
2. PC04/PC05
These products will obsolete all of our high-speed paper tape units (PC0's) and will interface to positive and negative logic respectively. During June and July we will build new and old units to deplete the old inventory. We will ship PC04 and PC05 only in August. The mix will be approximately (80) PC04's and (80) PC05's per month.

3. TU56
This unit is equal to (2) TU55's and will obsolete the latter in October. The TU55 and TU56 units will be shipped in September. The changeover must be expedited to take advantage of the 30% cost savings.

4. TU10 - 45bpi Mag Tape Unit
Prototype in September. First ships (10) in December. Rate will reach (40) per month. Design of the faster TU80 is slated to start this quarter.

5. Small Line Printer
Prototype in August. First ships (10) in December. Ultimate rate unknown could be (50) or (500) per month. The design has narrowed to (2) printing techniques and a prototype of the printing head will be available in April.

/kb
Attachment



New Peripheal Products Schedule — R. Antonuccio 4/7

PROJECT DESCRIPTION	RECOM. PRIORITY	EST. TOTAL COST	APPROVED EXPENDITURES	BASIC PROJECT TEAM	PLANNED $ SPENT TO DATE	ACTUAL SPENT TO DATE	TOTAL BUDGET F/ TO	BUDGET BY COST CTR. SPC'L PROJECTS	PROD. ENG.	DFTG.	PROG & MANUALS	OTHER	COMMENT
TAPE TRANSPORTS													
1. TU10 (25 LPS)	1		241.0			30.0	115.9	41.9	40.0	8.0	19.0	7.0	COMMITMENT FOR 25LPS - EXPECTS TO BE @ 45LPS. FOR SAME $ SPEND SOME OF THIS FOR OPTION
2. TU21 (45LPS)	1	185.0	0				185.0	109.0	49.0	11.0	8.0	8.0	
3. TU80 (75LPS)	4	~250.0	0				232.5	136.5	32.0	26.0	16.0	22.0	
4. DEC TAPE	4	~100.0	0				72.0	40.0	7.0	6.0	8.0	11.0	NEW CONTROLLER - PRESENT COST REDUCTION COMPLETE
5. TU80E (EXPANDED 75LPS)	6	~200.0	0				9.0	9.0					
6. TC 68-69	5	~100.0	0				14.0	14.0					
7. SUPPORT			0				32.0	30.0				2.0	
SUB-TOTALS -							650.4	380.4	128.0	51.0	51.0	50.0	
PRINTERS													
1. SMALL PRINTER (THERMAL)	1		164.0		25K	15.0	199.0	99.0	52.0	17.0	5.0	26.0	
2. CONVERT ANELEX OR EQUIV	2	200.0	0				175.0	56.0	43.0	22.0	12.0	42.0	
3. H.S. LINE PRINTER	5	300.0	0				244.5	162.5	24.0	25.0	17.0	16.0	
4. SUPPORT							INCLUDED IN ABOVE FIGURES						
5. PCO							PROJECT COMPLETE 9/ RTP						
6. - KEYBOARD FOLLOW ON SMALL PRINTER		30.0	0				INCLUDED IN ITEM #1						
							618.5	317.5	119.0	64.0	34.0	84.0	
DISKS													
1. SUPPORT & CLEAN UP RS/RFOS + DF32	1	73.0					73.0	43.0	12.0	6.0	6.0	6.0	
2. - NEW DISK	4	540.0					408.0	251.0	60.0	31.0	17.0	49.0	MUST RE-WORK PROPOSAL TO FIND BETTER WAY AND SPEND LESS $
3. MODULAR DISK	6						40.4	20.4	6.0	7.0	5.0	2.0	
4. - MONO-DISK	3						FIGURE COVERED IN ABOVE						
5. - HITACHI DISK DRIVE	3						FIGURE COVERED IN ABOVE						
SUB-TOTAL							521.4	314.4	78.0	44.0	28.0	57.0	
TOTALS							1800.3	1012.3	325.0	159.0	113.0	191.0	

digital INTEROFFICE MEMORANDUM

CONFIDENTIAL

DATE: 7 April 1969

SUBJECT: T.I. Thermal Printer as Teletype Replacement

TO: Those Listed

FROM: J. St. Amour

T.I. has a very attractive machine - $1,250 includes paper tape punch and reader ($950 without). It runs at 30 characters per second compared to teletype at 10 cps.

The big disadvantage is their use of a 5 x 5 matrix to create characters. Legibility is not as good as it should be (samples attached). Cost of paper is high, but it looks as if NCR will sell paper separately, and if so, this can be discounted.

T.I. wants an immediate marriage to start producing machines without paper tape punch and reader by January 1970 and to produce with by April, 1970.

It looks like they are on the right track; their choice of a 5 x 5 head was dictated by present solid state technology and assembly techniques. It's pretty certain they will eventually get to a better matrix. When this happens, I think they will be able to compete in the typewriter market.

Use of multiple heads will allow high print speeds at a later date. Paper costs will determine how attractive this can be.

They would like to firm up prices and sign a contract, including furnishing us a machine for the Spring Joint Computer Conference. I would like to see us with the machine at the show but cannot see us signing a contract this soon. I feel the matrix must be better, and the paper problem must be solved before any commitment on our part.

Attached are their specifications and random notes taken during our visit. Rather than go through a long, wordy memo, I'd like to meet with each group to discuss the machine. In the meantime, Bill Owens is pushing the head for our machine, and we will be

CONFIDENTIAL

running it sometime next week. Our goal is 120 characters per second. Except for the head, everything else will be similar so we are talking in the same dollar range for teletype volume.

/gp

dl: Operations Committee
Marketing Committee
Engineering Committee
R. Best
H. Crouse
A. Kent
W. Owens

4-2-69

Visit Texas Instruments
Dick Best, Al Kent, H. Crouse, W. Owens, J St Amour
Orm Henning (Sales) Frank Gleason Mkt Mgr, Jerry Finlay
Mfg, Herman Pope Project Eng, Roy Nealy Mfg

Their printer, which uses thermal sensative paper, was demonstrated and the following comments apply:

Demonstrator was IBM 1050 equivalent, running at 15 characters per second.

Planning to introduce at Spring Joint Computer Conference.

Ran unit at stated design maximum of 30 cps and also 40cps driven with inputs from paper tape. At 40 cps was not smooth and having problems with starting and stopping. At 30 cps, tended to bounce on carriage return, might need dampening.

Head was in contact with paper at all times during print stroke, was withdrawn for carriage return. Driven against spring which provided return power.

Head was silicon, probably with oxide coating on contact surface. Used 5x5 matrix for ease of manufacture. Each element separated from the other by

small air gaps. - Each element had transistor built into it and connected to transistor on mating silicon surface. Transistor used as resistor for heating required

Head connected to unit by means of Cecil Corp - Flex Cable which was made up of individual braided wires (50 at .001" diameter) molded in silicone rubber.

Since head does not leave paper, have possible problem of wear due to paper abrasion. Surface of paper must act as lubricant to keep head wear down. (Some papers have caused excessive head wear)

Admit papers cost could be problem. Using 3M paper (either 504 or 304) at 5¢ to 10¢ per roll. Price depends on quantity (Teletype paper estimated at $1.12 per roll of 500 feet)

Working with suppliers (Sabelon, Appleton, and 3M) to reduce costs. Are funding paper research by Gorham Research. Think can get price into 3¢ per roll neighborhood.

They have doubts that NCR paper will be available for use with other machine.

Must check affect of paper cost, seems like 5¢/roll might be tolerable. (.01 per 8½×11" page)

They are willing to work with us and modify unit for teletype replacement. Changes in their specs which we requested are noted below:

1.- Look at carriage return time. It is too slow. We would like max. of 3 characters but don't think they can get it. Herman Pope to look at and advise. Dick Best and Al Kent to give more consideration for alternate solutions.

2.- Need 2 pairs of wires to be teletype compatable. Alan suggests go to EIA Specs

3. Must be able to generate all 32 control characters even if some keys are triple function. T.I. feels can do by use of control key but reserve right to use control + shift together to get to third level.

4. Question of parity. Will advise if can come up with fixed parity but of 1. We both need to consider this more thoroughly.

5. Must be able to operate reader with fan fold paper tape. Henry to send samples!

Paper Tape punch and reader not fully designed at this time but have concepts on paper.

Estimate complete unit - printer - keyboard - paper tape punch - + reader at $1250.00. Printer and keyboard only at $950.00. Based on comments 1250 prob. high, they might be in $1000 total range.

Will have firm prices by April 21. which includes changes we request and possible spare parts information.

Would like to see us make commitment of 10K to 15K units over three years. Would then be willing to accelerate th[illegible] submissions

production in Jan. 1970. Could have 100 units in Nov. as pilot production.

Current schedule (printer + keyboard only)

1. 50 units now being built to replace some of their 1050's. Could get some units in May-June

2. - Pilot production of 100 units - printer and keyboard planned start June, complete Jan 1. We could up this get 100 units in Nov or Dec. Could get 500/month Jan 1970

3. - Will start prototype paper tape punch and reader in April, complete in Aug

4. - Pilot Production and Tooling PTP + Reader August to March

5. - Del. of PTP + Reader, March 1970

Feel real solid on MOS, LSI technology

Real difference between pilot and full production such items as permanent

They proposed a program for possible DEC, TI collaboration

1.- April 2-7 — Finalize Specs

2.- April 10 — They submit contract

3.- April 17 — Review contract

4.- April 21 — Firm up prices

5.- April 28 — Review unanswered details

6.- May 12 — Sign Agreement - Make Public announcement.

They will send us an enclosure (casting) in 1-2 wks to paint and return to them for assembly. Will make unit available to us 1 wk before show

They would plan to show 1050 (15cps) version at show - we to have teletype equiv. at 30 cps.

Need to know if there is need for a stand, do we want a private label and color. Would we eventually want to design our own pkg.

They understand our need to have two sources and seem agreeable to licensing. This should be worked out at this time.

Really want blanket order - even with del of 100 and bal. based on performance to specs. to meet fast delivery. Otherwise schedule will probably stretch out.

Cost Factors brought out by them

1.- Service - Have inputs that they costs average 50^{00}/month to service. (1500 hrs for major overhaul is normal, after 4500 junk unit)

They estimate 4000 hours MTBF - failure would probably be in head which is a simple assembly replacement at approx $100^{00}

2.- Throughput 30 cps vs 10 cps

3. Downtime Noted that then chart recorder which is more complicated machine has 2500 hrs MTBF

4.- Paper costs

5.- Product life

6.- Competative pricing

Discussed product improvement plan with them, matrix other than 5×5 for more legible characters and higher speed in particular.

They state working on improved scheme for character generation (improved print font) and expect to file patent on new method.

Present head has heat/cooling capability of up to 70 cps but need better ~~[illegible]~~ start stop characteristics

Also looking at full width head that (with added cost) will do 120 cps

Have programs underway - expect will take thru mid-70's to do this.

Noted that present character generator will drive 5x7 font configuration. This is MOS/LSI type 4880. Standard chips are 4480 code.

Expressed interest in having us work on other programs with them (line printer as an example)

Keyboard is micro-switch with MOS/LSI Endoder in 28 lead package

THIS DEVICE IS STATION D LINE 25

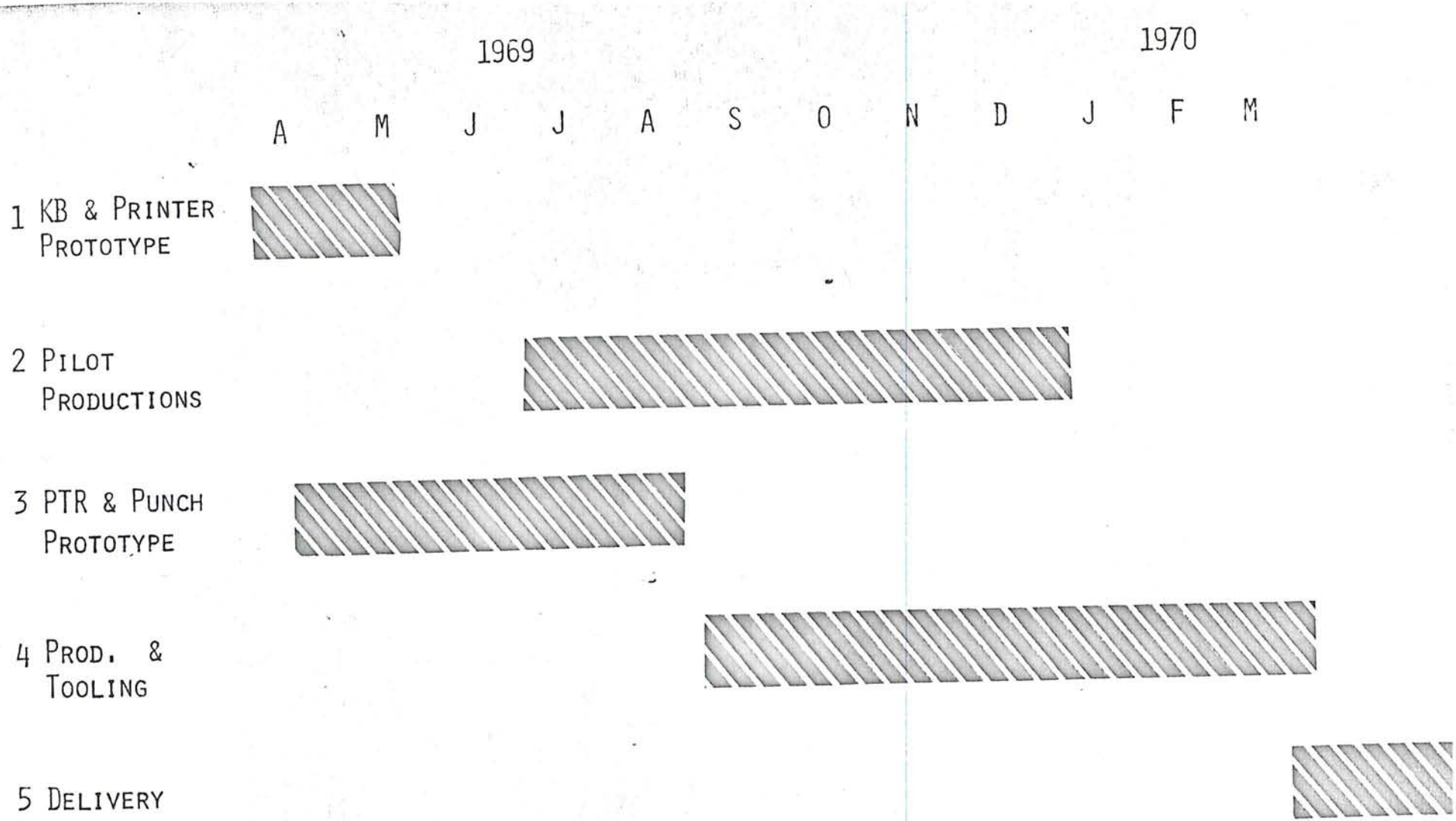
1234567890-ABCDEFGHIJKLMNOPQRSTUVWXYZ

Characters on production machine to look like after

PROPOSED CONTRACT SCHEDULE

TARGET DATE	
APRIL 2-7	FINALIZE COMPLETE SPECS
APRIL 10	SUBMIT PROPOSED CONTRACT
APRIL 17	REVIEW OF PROPOSED CONTRACT
APRIL 21	ESTABLISH PRICING
APRIL 28	REVIEW UNANSWERED DETAILS
MAY 12	SIGN AGREEMENT

WEG:JCS
4/1/69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A M J J A S O N D J F M
1 KB & PRINTER PROTOTYPE
2 PILOT PRODUCTIONS
3 PTR & PUNCH PROTOTYPE
4 PROD. & TOOLING
5 DELIVERY

PRINT PAPER PROGRAM

NOW USING STANDARD 3M PAPER

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3M

APPLETON

PAPER RESEARCH

GORHAM RESEARCH

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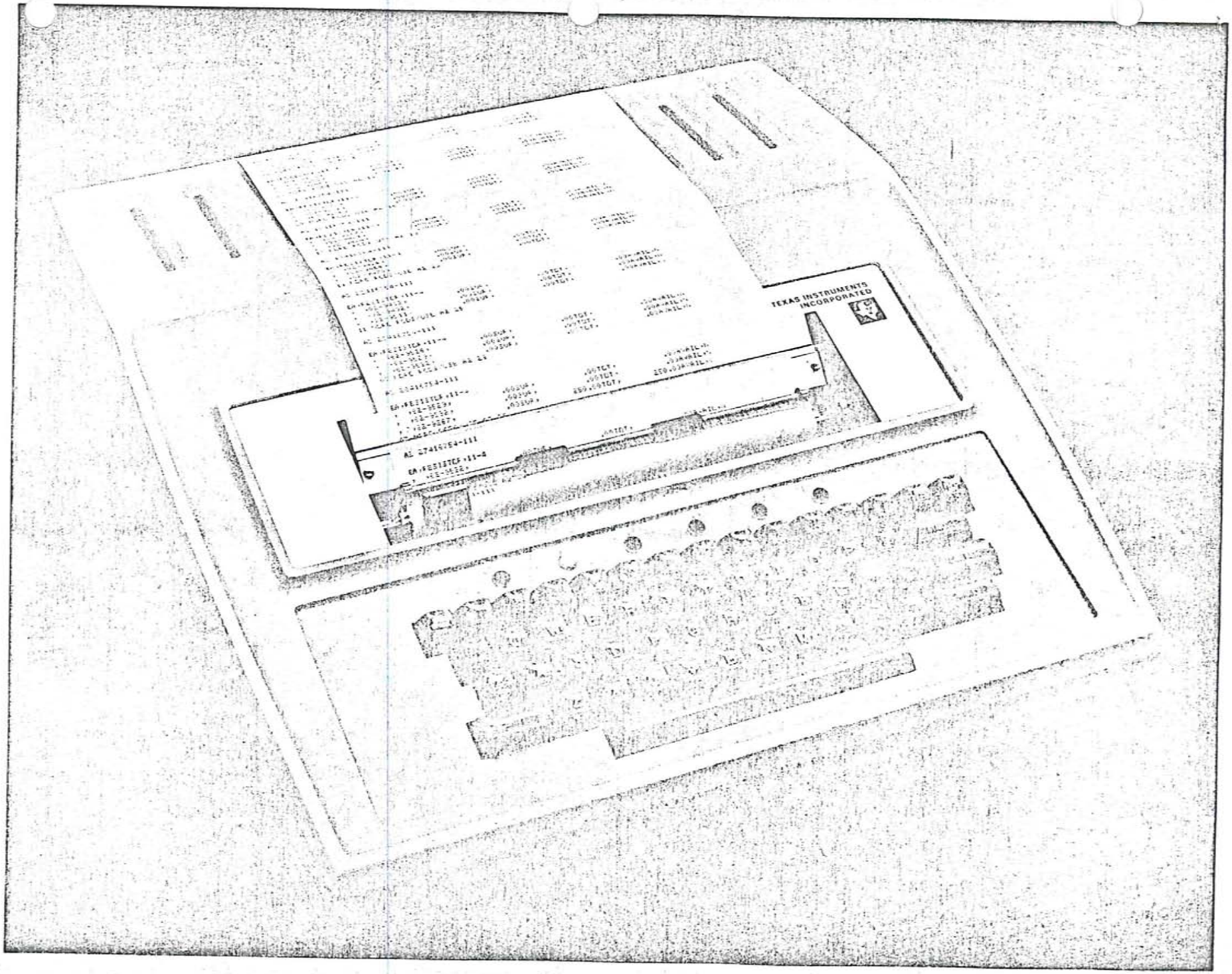
Samples from prototype running at
40 characters per second

ED STEWART
PHOTOGRAPHY & ASSOCS INC.
HOUSTON TEXAS

H. Crouse has photos



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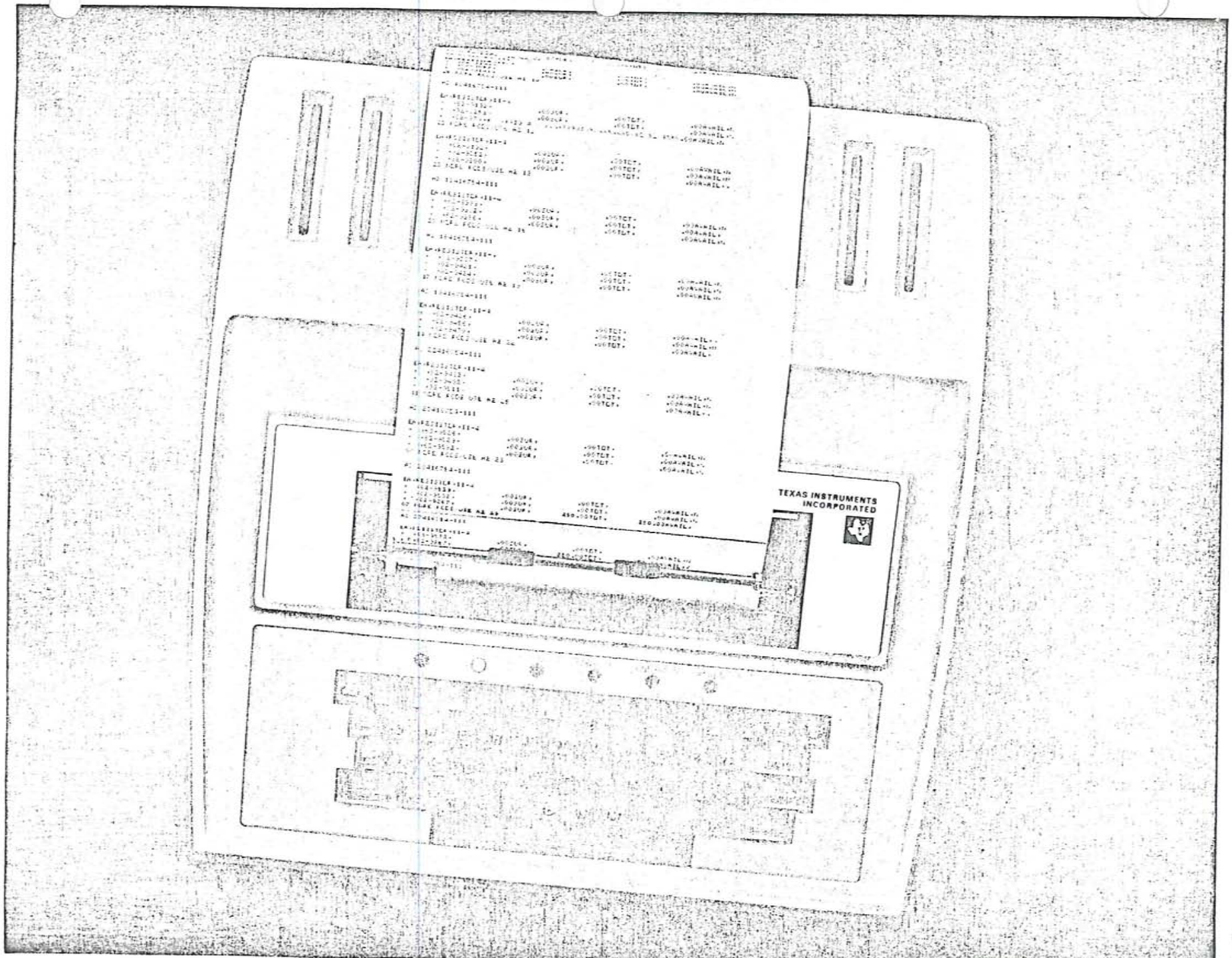
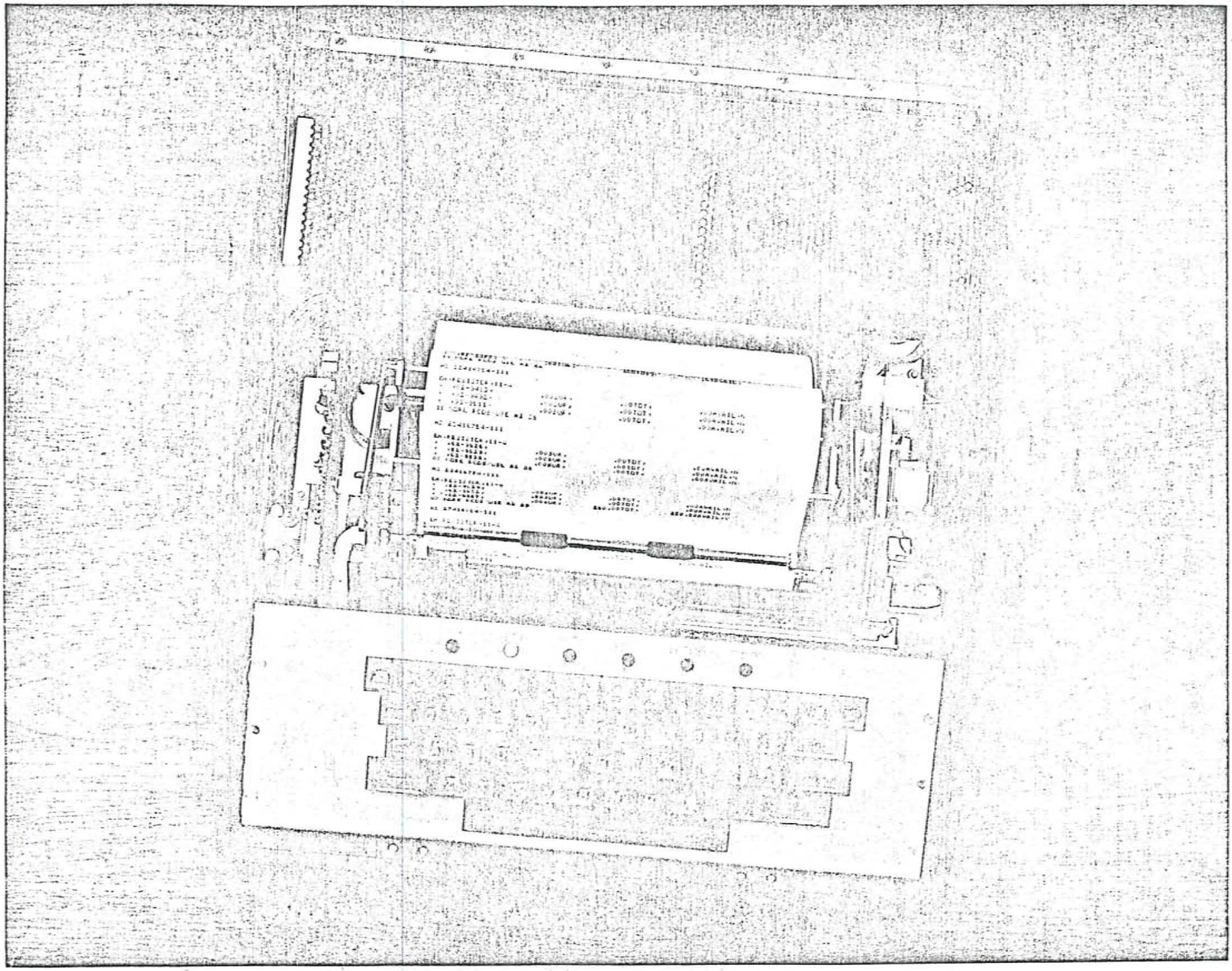
HOUSTON TEXAS





TEXAS INSTRUMENTS
INCORPORATED
12201 SOUTHWEST FREEWAY • STAFFORD, TEXAS
INDUSTRIAL PRODUCTS DIVISION

April 3, 1969

Mr. Henry Crouse
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts 01754

Dear Henry,

First of all, let me again tell you how much we appreciate your visiting with us in Houston to discuss the electronic printer. Attached are revised specifications incorporating the requests you made during our meeting with one exception - we are unable at this time to reply on your question regarding carriage return speed. We are studying this problem and will have an answer within the week.

Please let us know immediately of any changes, so that we can hold to our program schedule and finalize specifications by the seventh.

The next critical date will be April 10 when we are aiming to submit our proposed contract for your review. I'll be anxious to hear from you next week.

Very truly yours,

O. F. Henning

OFH/sw
Enclosure

D BEST
J. ST. AMOUR
A. KENT
B. OWENS

PROJ NO.	SIZE	NEXT ASSY NO.	QTY	DASH NO.	PROJ NO.	SIZE	NEXT ASSY NO.	QTY	DASH NO.	REVISIONS			
										CHG LTR	ECN NO.	DATE	DRAFTSMAN
										A	-	9-3	

PRELIMINARY

EQUIPMENT SPECIFICATION

FOR A

CONSOLE I/O TERMINAL

WITH PAPER TAPE READER

AND PUNCH

DR 3/21/69 J. Burgess	APPD	TITLE Preliminary - Equipment Specification for a Console I/O Terminal with Paper Tape Reader and Punch	TEXAS INSTRUMENTS INCORPORATED APPARATUS DIVISION HOUSTON TEXAS
CKD	APPD		SCALE / SIZE A / 213711 / REV A
ENGR 3-21-69	RELEASE		SHEET 1 of 27

TABLE OF CONTENTS

1.0 SCOPE

This document covers the specifications for a keyboard, printer, control logic and an accessory paper tape reader and punch for use as a local or console input/output terminal.

2.0 APPLICABLE DOCUMENTS

2.1 USAS Standard X3.4-1967 Standard Code for Information Interchange

2.2 USAS Standard for Character Structure and Parity Sense X3.16-1966

2.3 USAS Standard for Bit Sequencing of the USASCII Code X3.15-1966

2.4 USAS Standard for One Inch Perforated Paper Tape for Information Interchange X3.18-1967

2.5 EIA Standard RS-232-B

3.0 GENERAL DESCRIPTION OF EQUIPMENT

This equipment includes a keyboard and paper tape reader as input devices and a printer and paper tape punch as output devices. The necessary control logic and interface circuits are included to allow it to function as an "on line" console terminal with full duplex input and output or an "off line" paper tape maker, verifier or duplicator selectable by a local/on-line switch. Figure 1 shows some of the modes of operation and the particular components used with each. The keyboard, printer and control logic are housed in a separate enclosure from the reader and punch but electrically operate as a single I/O terminal. The printer utilizes a "state of the art" solid state printhead which creates an image or print through the transfer of thermal energy to a thermal sensitive paper. The resulting printing process, then, is quieter, faster and more reliable than conventional impact printing. The particular embodiement of this technology covered by this specification is a moving head page printer. That is, a single matrix printhead which moves across the paper to generate a line of print. Salient features of the equipment include:

Quiet operation

Speed of 30 characters/second

Small size through use of integrated circuits & MOS/LSI

Full duplex operation

Punch and reader addressable from computer

Ease of maintenance through modular construction

4.0 FUNCTIONAL DESCRIPTION

4.1 General

The terminal operates in a full-cuplex mode with serial data input and serial data output. A functional block diagram of the terminal is shown in Figure 2. The functional blocks are the serial interface, the terminal control, the keyboard and the printer. In addition, functional blocks are shown for a paper tape reader and punch.

The printer and punch operate in parallel. The punch may be turned on and off manually by a switch on the device and may also be turned on and off automatically by the computer through the remote on and remote off lines. The printer may be turned off manually only.

The keyboard and the reader cannot operate at the same time. The reader may be turned on and off manually by a switch on the device or automatically by the computer through the remote on and remote off lines. In addition, the reader will be turned off whenever it transmits the device control character assigned to that function (DC3). Whenever the reader is on, the keyboard is inhibited. Whenever the reader is off, the keyboard is operational.

The terminal control selects the parallel data from the keyboard or from the reader and transmits it serially. It also receives data serially, converts it to parallel data and strobes the printer and the punch.

The output interface converts the MOS logic signals from the terminal control to a EIA standard interface to the computer. The input interface converts the EIA interface signals from the computer to MOS logic signals for the terminal control.

4.2 Printer

4.2.1 General Operation

The printer accepts data from the terminal control logic and either prints the indicated character or performs the indicated control action. A functional block diagram of the printer is shown in Figure 3. As is shown, most of the logic functions are performed by two MOS/LSI components, one for character generation and one for printer control. The 7 bits of data are received and decoded by both MOS circuits. If the data is a printable character, the character generator will encode it into the 25 bit code necessary to print the character. The input strobe, then, is directed to the print timing and printhead control to effect a print, and finally to the carriage drive control causing the printhead to move to the next position. If the input data is a control function such as line feed, the output of the character generator remains zero and the control MOS circuit initiates a line feed function upon the application of the strobe from the terminal control logic. The printer may be manually disabled by a switch.

4.2.2 Detail Specifications

Paper width - 8.5"

Line length - 80 characters

Line spacing - 6 lines/inch

Character spacing - 10 characters/inch

Character size - .1" x .08"

Print matrix - 5 x 5 (25 elements)

Character set - 63 printable characters and 3 control characters as defined by Figure 4

Paper drive - friction feed

Printing speed - 30 characters/second

Line feed time - same as time for printing, i.e., 33.3 ms

Carriage return time - 240 ms maximum (from extreme right hand margin)

Local paper advance rate - continuous at 30 lines/second

Input code - modified version of the 7 level USASCII. See Figure 4

4.3 Keyboard

The keyboard consists of solid state key switches and an MOS/LSI encoder. A block diagram of the keyboard is shown in Figure 5 and the keyboard arrangement in Figure 6. Figure 4 shows the specific codes generated by the keyboard, and Figures 6a, 6b, and 6c show the status of the shift and control keys to generate the codes. The keyboard contains 52 keys, dark gray in color with white legends. A two key rollover feature is included to allow for the possibility of operation of a second key before the first key is released. The circuitry for this feature blocks the strobe output during the interval when more than one key is depressed, but allows the strobe for the second key when the first key is released. The parity bit out of the keyboard encoding may be forced to "one" or used as "even" selected by a jumper on the pc board.

The keyboard panel also contains light indication of power on.

4.4 Terminal Control

A block diagram of the terminal control is shown in Figure 7. The terminal control contains a crystal-controlled master clock with separate countdown logic for the transmit and receive sections. It can simultaneously transmit serial data and receive serial data.

When a start bit is received, the receive control clocks the serial input data into the receive shift register. When an entire character has been received, the data is transferred to the buffer register and an output strobe is generated.

The keyboard or the reader is selected as the parallel input device by the select gates. When a strobe is received from the parallel input device, the parallel input data is transferred to the transmit shift register and then is serially transmitted. When the reader is on, it is strobed by the transmit control at the maximum system frequency so that transmitting occurs at the maximum rate (30 characters/second).

The control character decode recognizes the four device control characters DC1, DC2, DC3 and DC4 of the USASCII code. The functions accomplished by these characters are DC1, reader on; DC2, punch on; DC3, reader off; and DC4, punch off. Whenever one of these characters is received in the input shift register, the appropriate device is turned on or off if the local control switch is in the auto position. In addition, if the reader transmits DC3, it is turned off.

The parity check circuit detects a parity error in the received data and indicates this on the parity error line.

4.5 Paper Tape Reader and Punch

4.5.1 General Description

The paper tape reader and punch operate as two distinctly separate sections but are packaged as a single unit. The sections are side by side as viewed by the operator with tape flow from rear to front. Separate feed reel wells are provided for each section. The loading of tape in either section consists of raising the tape clamp, threading the tape through the punching or reading section, extending the tape over the feed sprocket, and then reclosing the tape clamp. When a tape clamp is raised, an interlock prevents or stops operation of that section. This same interlock also detects "tape out" in a section and stops operation.

Each section has a three position switch consisting of "off", "automatic", and "manual". The "manual" position is spring loaded so that if not held in place the switch lever will revert to the "automatic" position. The "manual" position is used to generate the momentary start pulse required to initiate operation. When in the "off" position and with tape clamps engaged, a manually actuated thumbwheel may be used to advance or retract the tape in either section.

A chad drawer is accessible from the front of the unit. Use of the chad drawer may be bypassed by extending the chad chute through a trapdoor in the

chad drawer. Chad would then exit through a hole in the bottom of the base plate.

Connection to the I/O terminal is by means of an umbilical cord and a PC edge connector which plugs into the rear of the terminal.

The reader uses the starwheel sensing principle. The starwheels are automatically retracted when the tape clamp is raised. Fan fold paper tape may be read as well as roll tape.

See Figure 8 for a functional block diagram of the punch and reader.

4.5.2 Specifications

Tape Punching & Reading Standards: Complies with United States of America Standards Institute specification X3.18-1967, One Inch Perforated Paper Tape for Information Interchange, as applicable to eight channel tape. Standard tape dimensions are shown in Figure 9.

Tape types: paper, mylar, paper-mylar, aluminized mylar

Tape width: 1.000 ±.003 inches

Tape thickness: .003 to .0045 inch

Tape reel: 8.00 outside diameter (maximum), 2.00 ±.05 inside diameter of core

Tape leader: 2 inches minimum

Tape drive: unidirectional

Number of channels: eight plus sprocket hole

Speed: 0 to 30 characters per second, asynchronous

Manual advance/retract tape:

The punch and reader have individual thumbwheels to advance or retract the tape when that section is not operating.

Interlock switches:

The punch and reader have individual switches to detect that either the tape clamp is raised or the section is out of tape. This detection shuts down the section at which it occurs.

5.0 ELECTRICAL INTERFACE

5.1 Power Requirements

The terminal requires 120 Vac ±10%, 50 Hz or 60 Hz power at 90 watts peak, 67 watts average without the paper tape reader/punch unit. With the paper tape reader/punch unit, average power is 95 watts. Power connection is by a standard 3 wire power cord and male plug.

5.2 Signal

The signal interface shall comply with EIA Standard RS-232-B. Signal connections are provided at the rear of the keyboard and printer by a 25 pin male connector Cannon #DB-25P or equivalent. Pin assignments are as follows.

Pin Number	Function
1	Protective Ground
2	Transmitted Data
3	Received Data
4	Request to Send (Held to a "ON" status by terminal)
5	Clear to Send (Should be held to a "ON" status by computer)
6	Data Set Ready (Should be held to a "ON" status by computer)
7	Signal ground
8 thru 19	Unused
20	Data Terminal Ready (Held to a "ON" status by terminal)
21 thru 25	Unused

Data transmission is asynchronous serial by bit. Character structure and parity sense complys with USAS Standard 3.16-1966 and bit sequencing complys with USAS 3.15-1966 as shown in Figure 11. The code used is the USAS Code for Information Interchange as shown in Figure 4.

6.0 ENVIRONMENTAL SPECIFICATIONS

6.1 Ambinet Temperature

Operating: 15° to 40°C

Storage: -40° to 70°C (not including paper)

6.2 Shock and Vibration

Vibration: 10 to 60 cps, 0.1 g

Shock: Operating - 0g

Storage and Handling - 10g

6.3 Humidity

Operating: 10% to 90%

Storage: 10% to 90%

7.0 PHYSICAL

7.1 Keyboard and Printer

An outline dimension drawing is shown in Figure 12. As indicated, the top half of the enclosure is hinged and raises to provide access for maintenance and paper loading. Figure 10 shows an approximate layout of the functional parts that make up the system.

The unit may sit directly on any desk or table top or it may be mounted to an optional stand with four screws.

Size: 6.0 inches high

18.0 inches wide

20.0 inches deep

Weight: 32 pounds

7.2 Paper Tape Reader and Punch

The reader and punch is housed in a separate enclosure styled similarily to the keyboard and printer. The unit may sit separately on a table with the keyboard and printer, or it may be physically attached to the keyboard and printer case while on a table or on the stand. An outline dimension drawing is shown in Figure 13.

Size: 6.0 inches high

10.0 inches wide

16.0 inches deep

(excluding roll of tape)

Weight: 15 pounds

MODES OF OPERATION

NO.	PRIMARY OBJECTIVE	INFORMATION SOURCE	ACTION ORIGINATOR	ON/OFF LINE	COMPONENTS USED			
					INPUT		OUTPUT	
					KEYBOARD	READER	PRINTER	PUNCH
1	Enter Program	Terminal	Terminal	On	X			
		Terminal	Computer	On		X		
2	Print Out Program	Computer	Computer	On			X	
3.	Punch Tape	Computer	Computer	On			X	X
		Computer	Terminal	On			X	X
		Terminal	Terminal	Off	X		X	X
		Terminal	Terminal	Off		X	X	X
4	Verify Tape	Terminal	Terminal	Off		X	X	X
5.	Duplicate Tape	Terminal	Terminal	Off		X	X	X
6	Turn Off Reader		Computer	On		X		
			Terminal	On/Off		X		
			Reader	On/Off		X		
7	Turn Off Punch		Computer	On				X
			Terminal	On/Off				X
8	Enter Data	Terminal	Computer	On		X		
9	Punch Data	Computer	Computer	On			X	X

FIGURE 1

TEXAS INSTRUMENTS INCORPORATED
INDUSTRIAL PRODUCTS DIVISION
HOUSTON, TEXAS

A 2137 11 SHEET 12 REV A

TI-4259.D

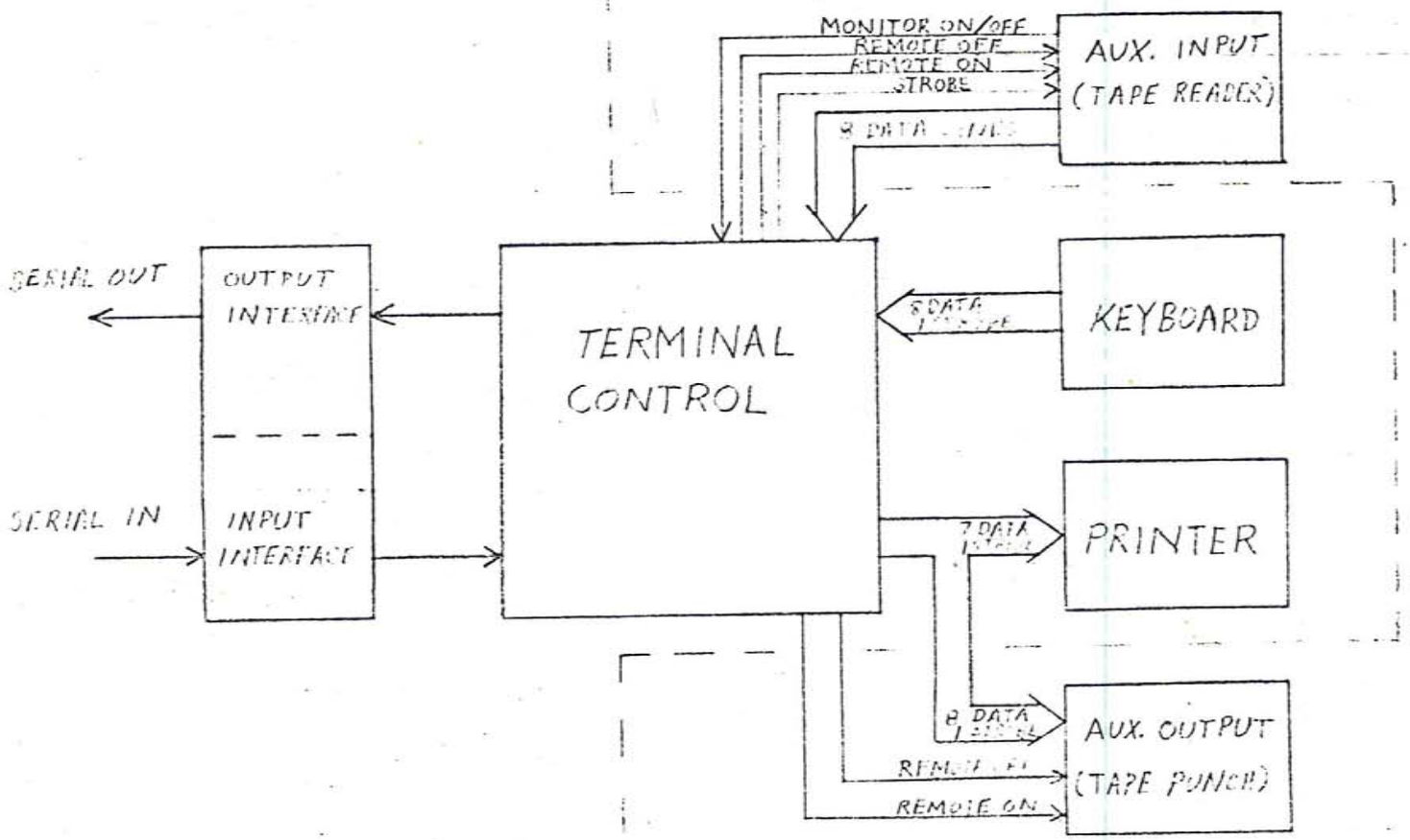
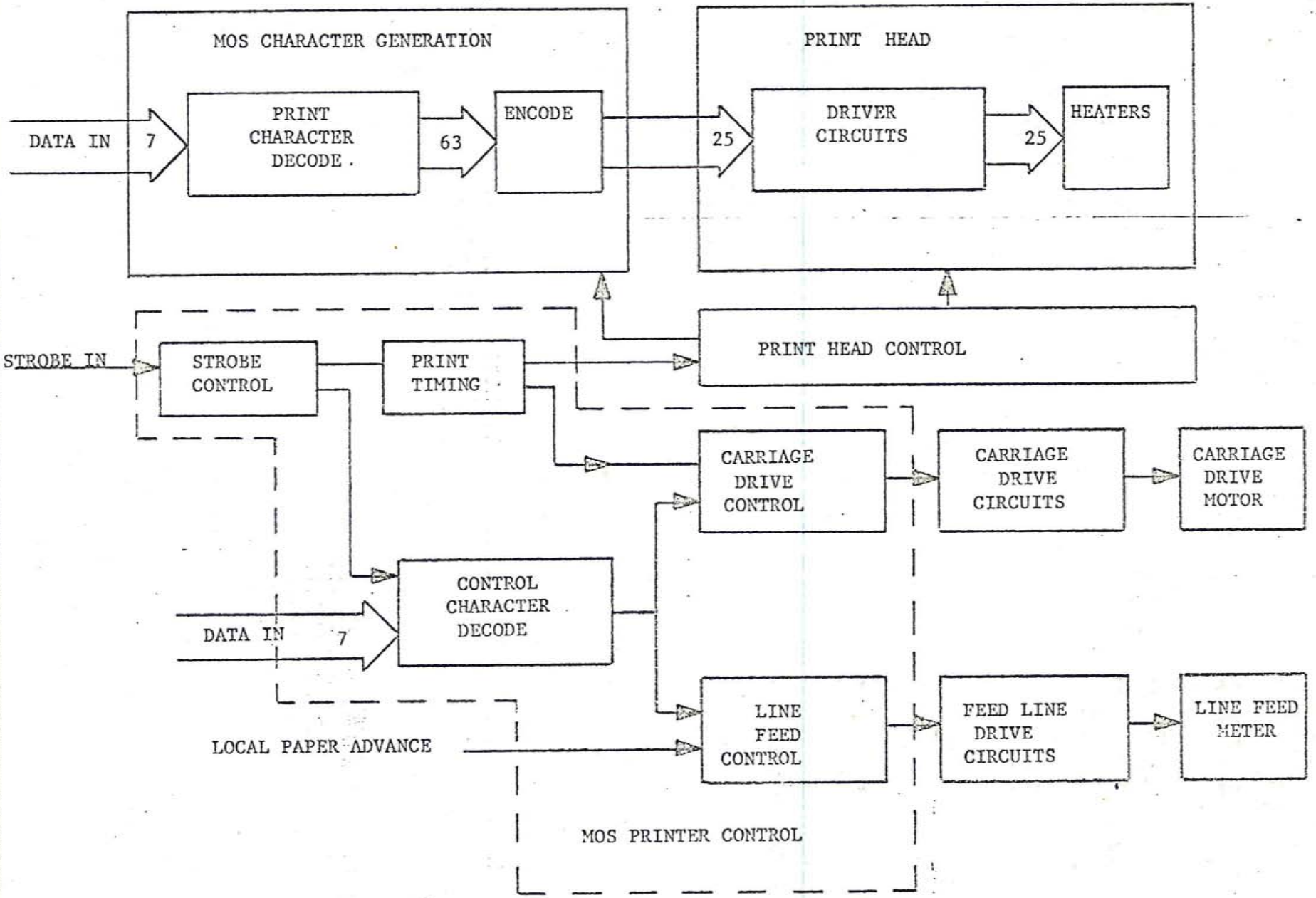


FIGURE 2

FUNCTION BLOCK DIAGRAM

A	213711	REV A



PRINTER BLOCK DIAGRAM

FIGURE 3

b4 b3 b2 b1	b7 → / b6 → / b5 →	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0 0 0 0		NUL	DLE	SP	0	@	P	—	—
0 0 0 1		SOA	DC1	!	1	A	Q	—	—
0 0 1 0		STX	DC2	"	2	B	R	—	—
0 0 1 1		ETX	DC3	#	3	C	S	—	—
0 1 0 0		EOT	DC4	$	4	D	T	—	—
0 1 0 1		ENQ	NAK	%	5	E	U	—	—
0 1 1 0		ACK	SYN	&	6	F	V	—	—
0 1 1 1		GEL	ETB	'	7	G	W	—	—
1 0 0 0		BS	CAN	(	8	H	X	—	—
1 0 0 1		HT	EM	)	9	I	Y	—	—
1 0 1 0		LF	SUB	*	:	J	Z	—	—
1 0 1 1		VT	ESC	+	;	K	[	—	—
1 1 0 0		FF	FS	,	<	L	\	—	—
1 1 0 1		CR	GS	-	=	M	]	—	—
1 1 1 0		SO	RS	.	>	N	↑	—	—
1 1 1 1		SI	US	/	?	O	←	—	DEL

PRINTABLE CHARACTER REF: USAS x 3.4 - 1967

PRINTER CONTROL CHARACTER

AUXILIARY DEVICE CONTROL CHARACTER

CODES GENERATED BY KEYBOARD, BUT NO ACTION TAKEN

FIGURE 4

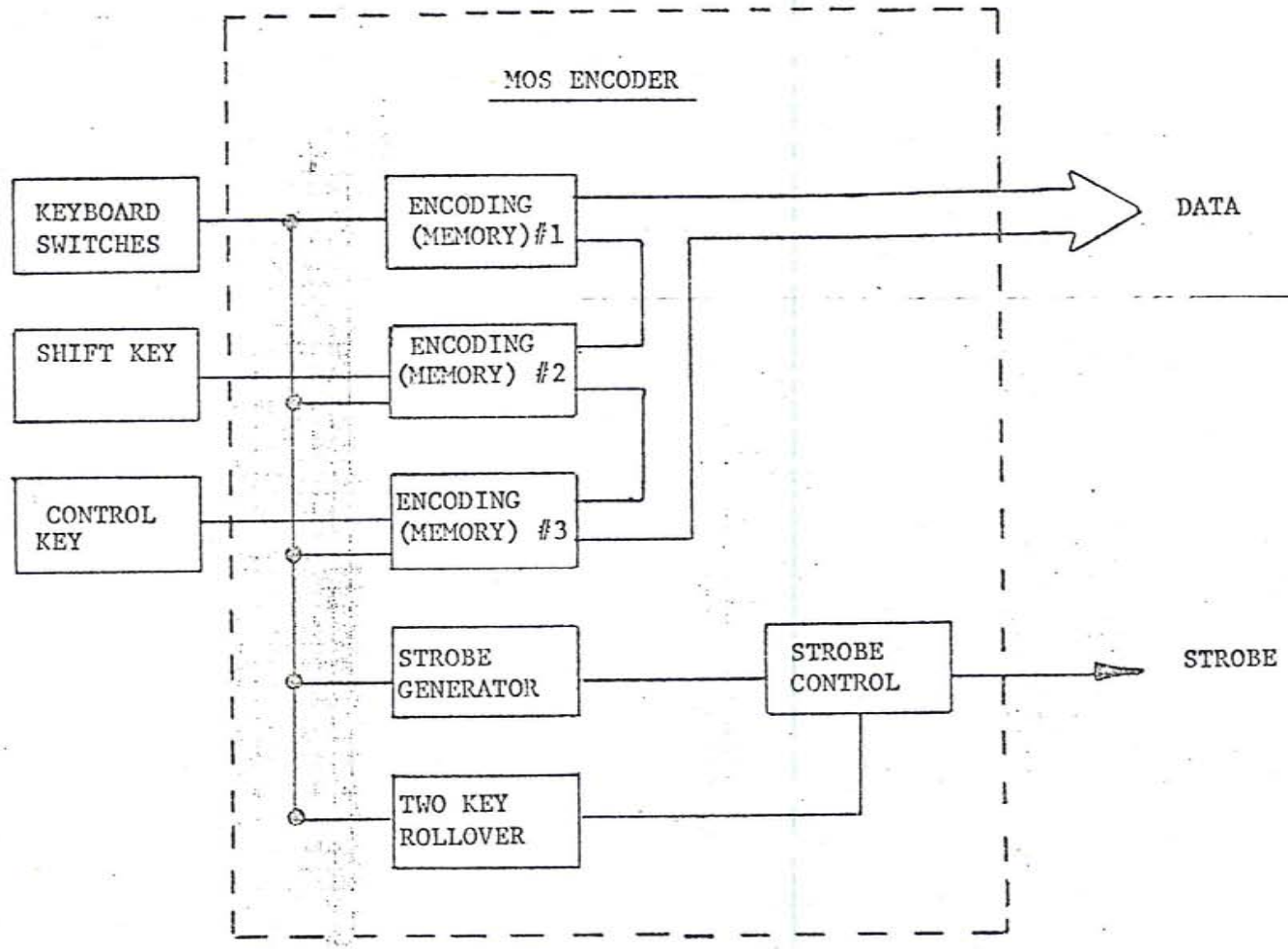
CODE SYSTEM AND CHARACTER SET

TEXAS INSTRUMENTS INCORPORATED
INDUSTRIAL PRODUCTS DIVISION
HOUSTON, TEXAS

A 2137111 REV A

SHEET 15

TI-4259.0



KEYBOARD BLOCK DIAGRAM

FIGURE 5

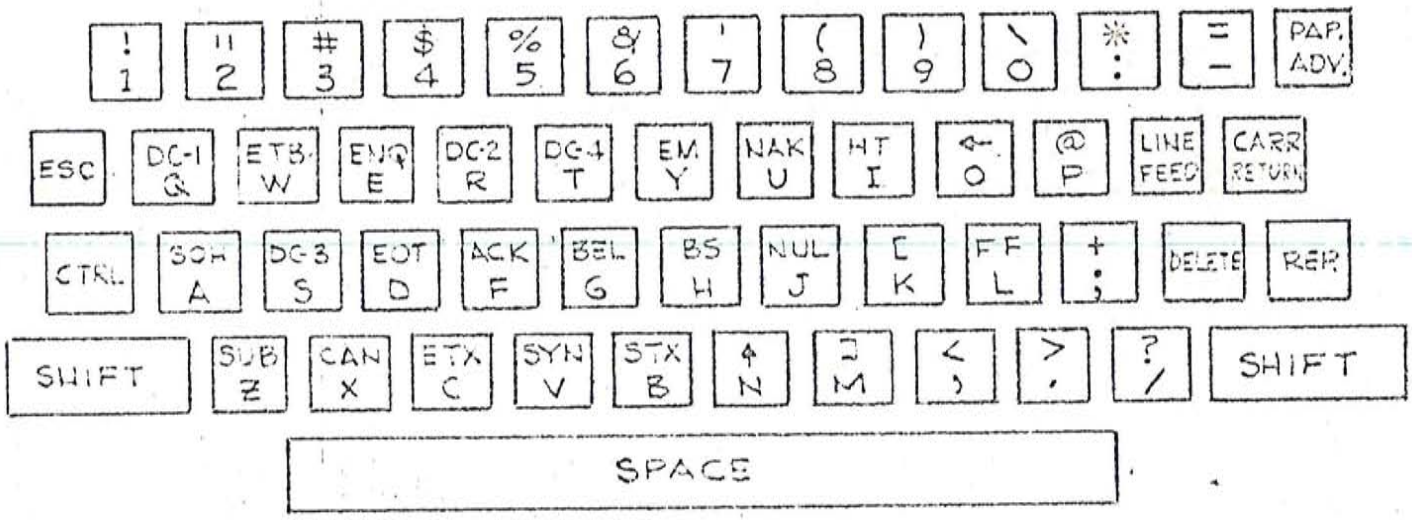


FIGURE 6 KEYBOARD ARRANGEMENT

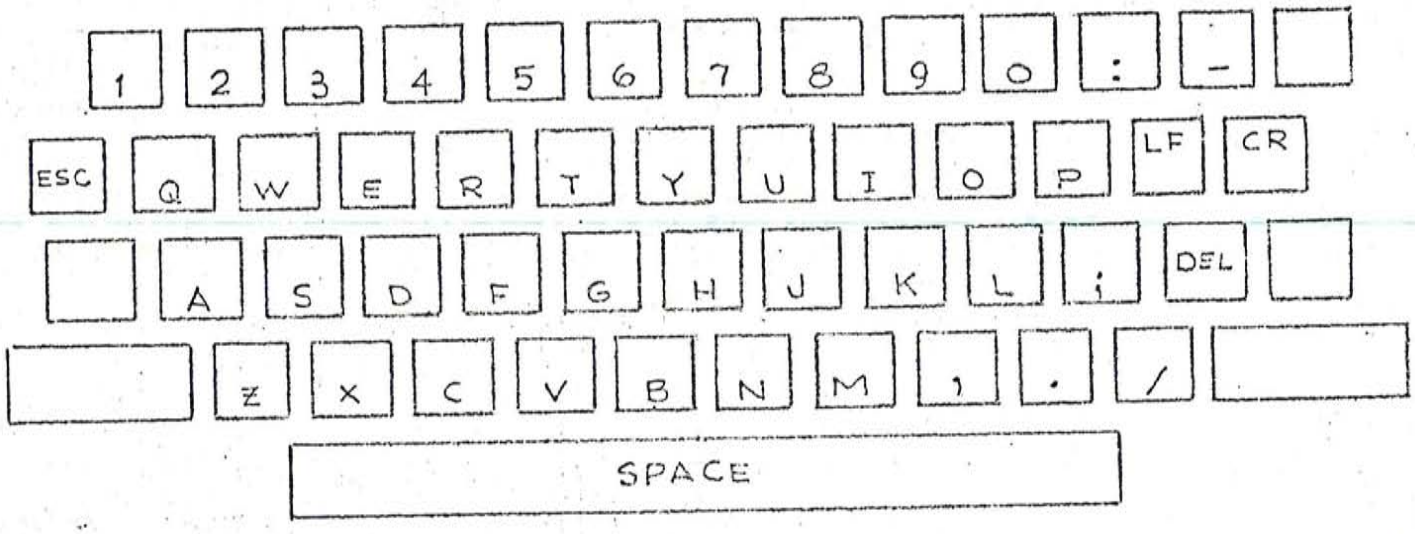


FIGURE 6A KEYBOARD CODES GENERATED WHEN SHIFT AND CONTROL KEYS ARE NOT DEPRESSED

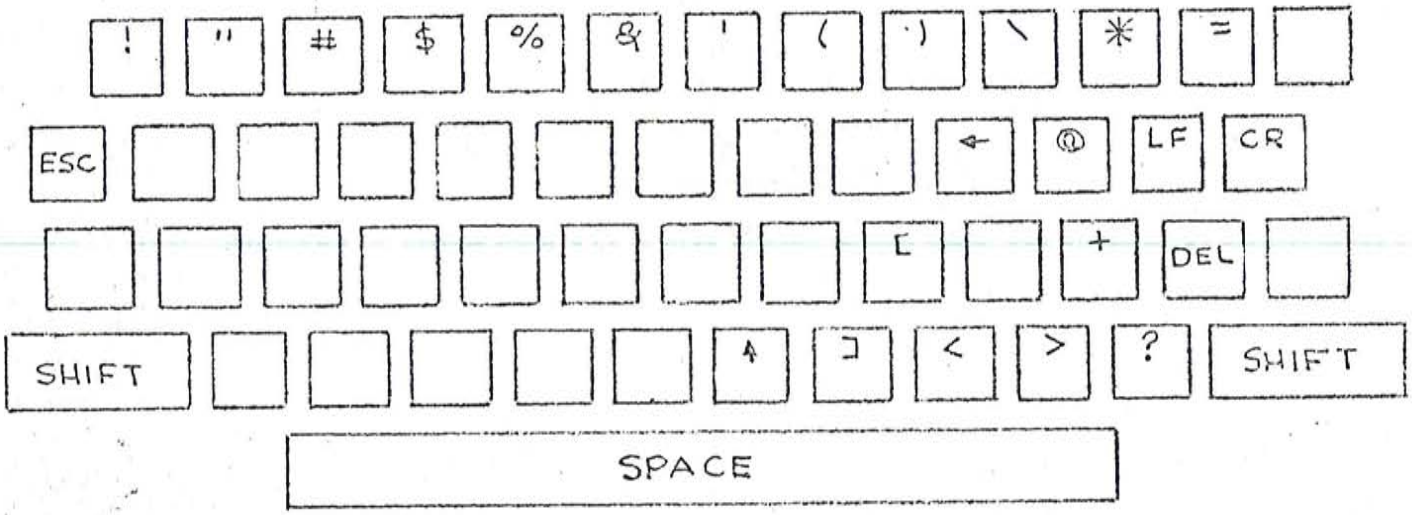


FIGURE 6B KEYBOARD CODES GENERATED WHEN SHIFT KEY IS DEPRESSED

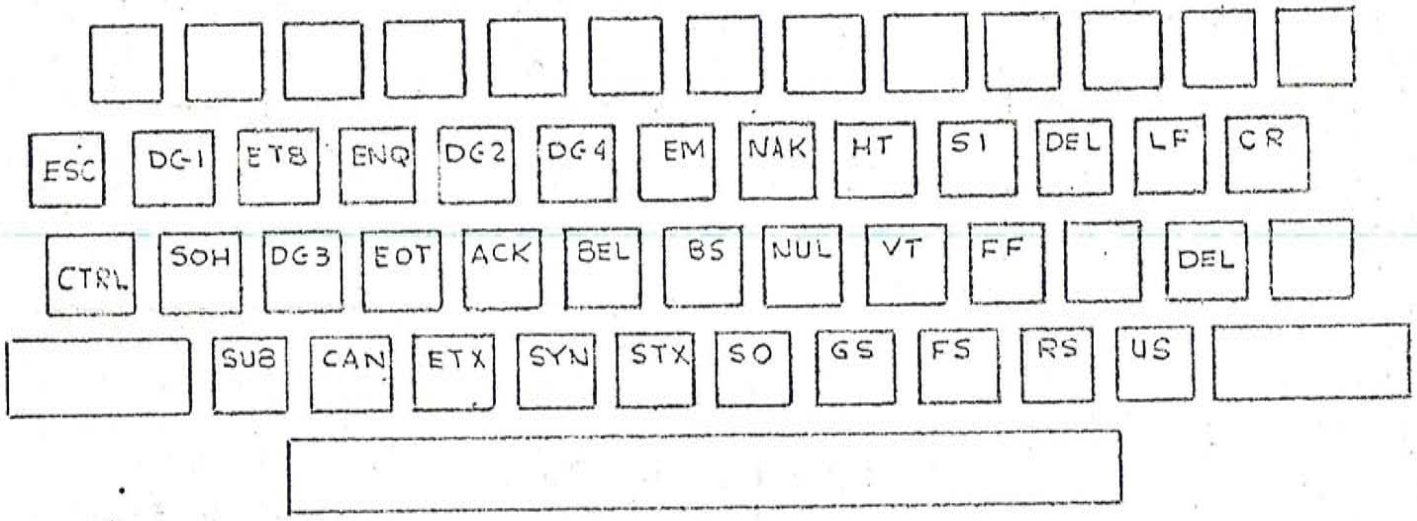
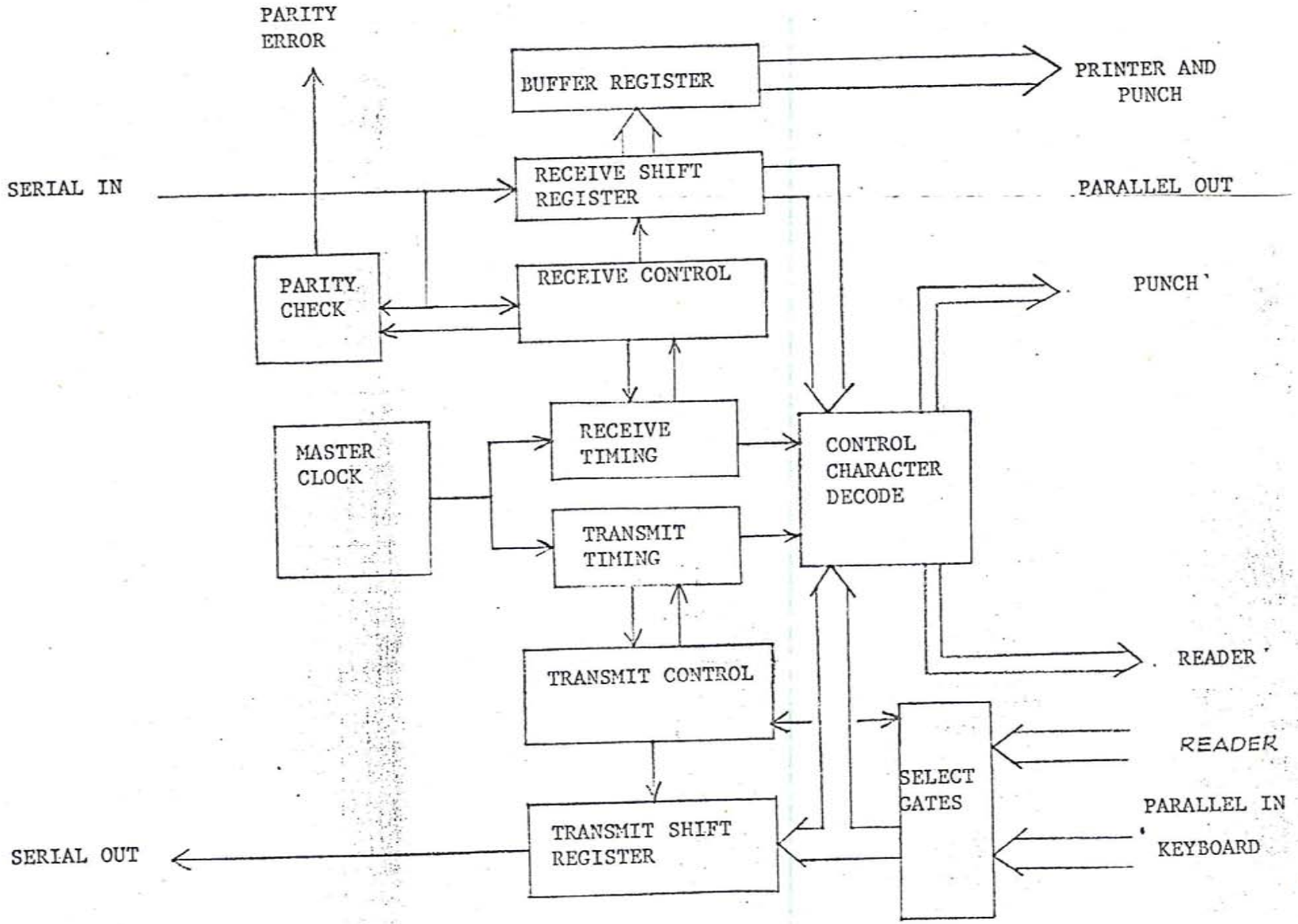
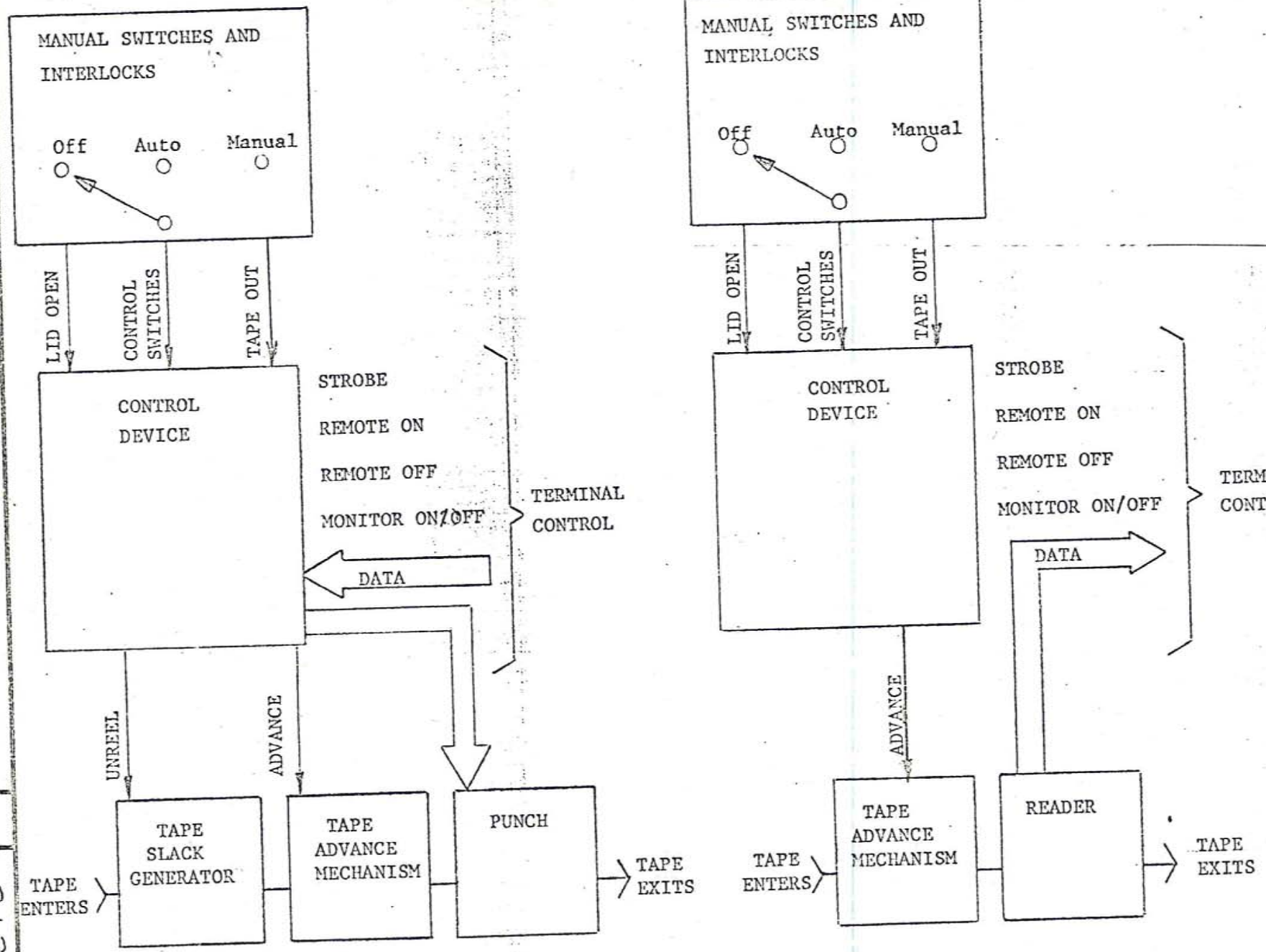


FIGURE 6C KEYBOARD CODES GENERATED WHEN CONTROL KEY IS DEPRESSED



BLOCK DIAGRAM, TERMINAL CONTROL

FIGURE 7



FUNCTIONAL BLOCK DIAGRAM OF THE PUNCH AND READER

FIGURE 8

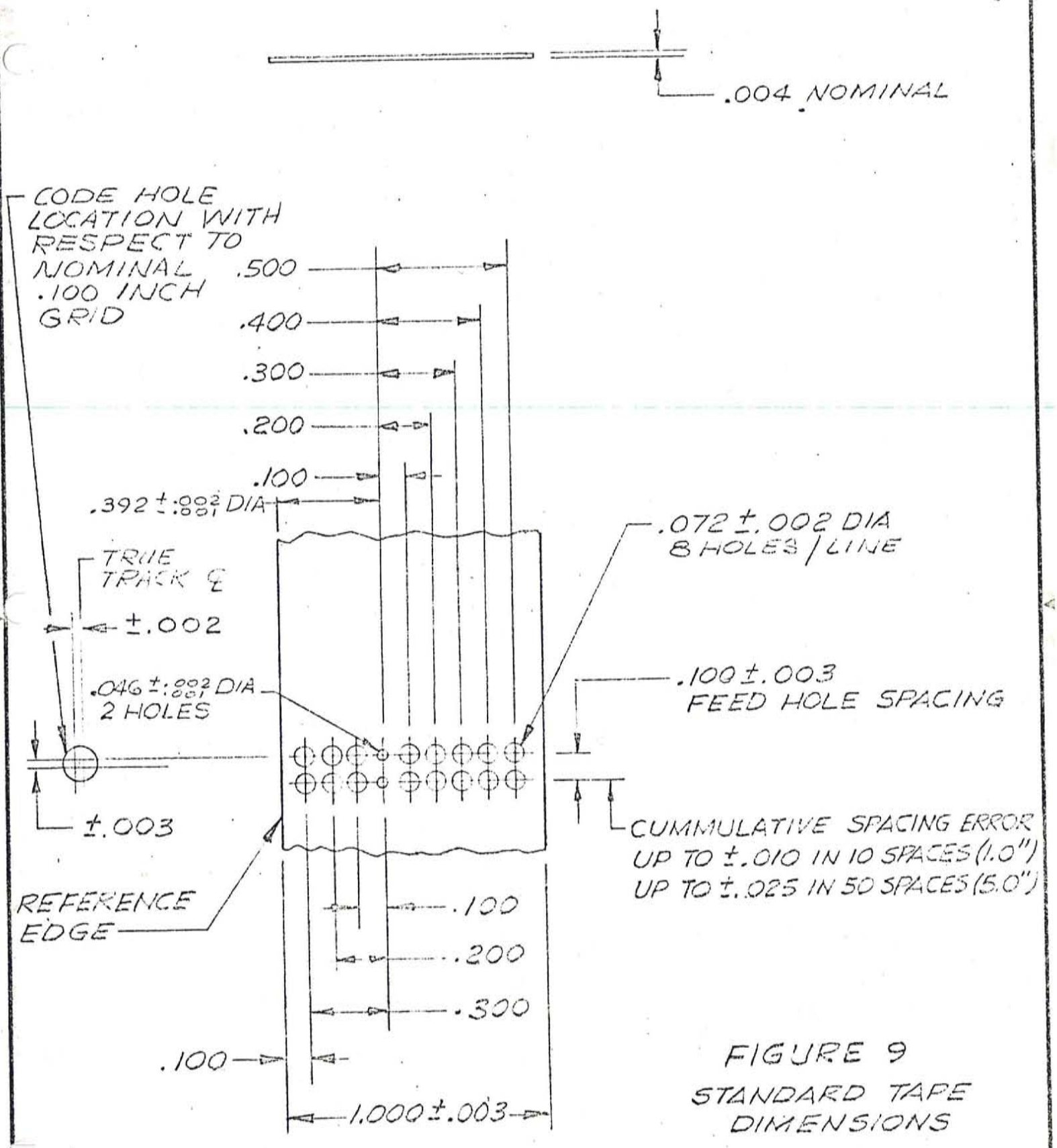


FIGURE 9
STANDARD TAPE DIMENSIONS

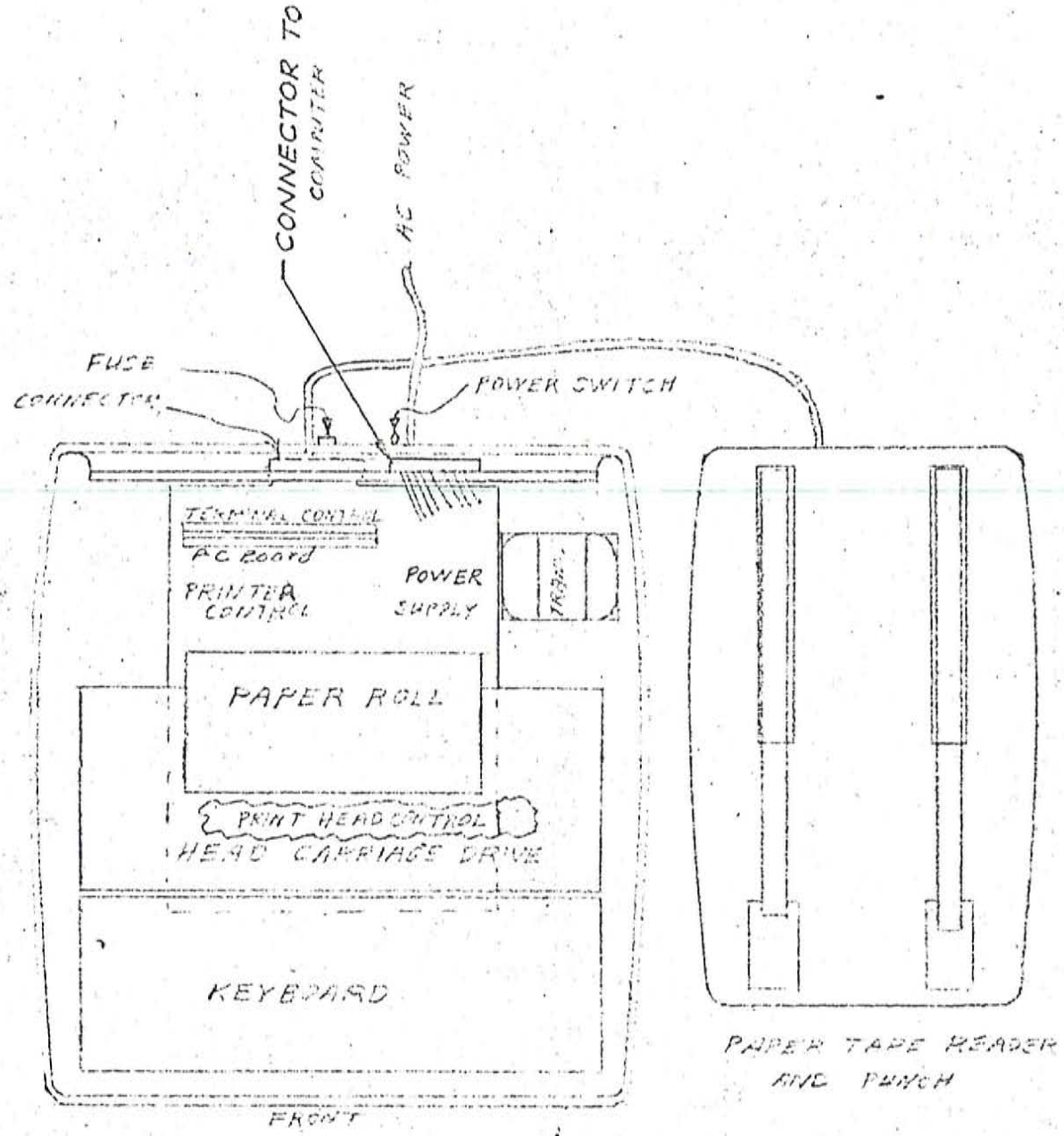


FIGURE 10

KEYBOARD AND PRINTER FUNCTIONAL LAYOUT

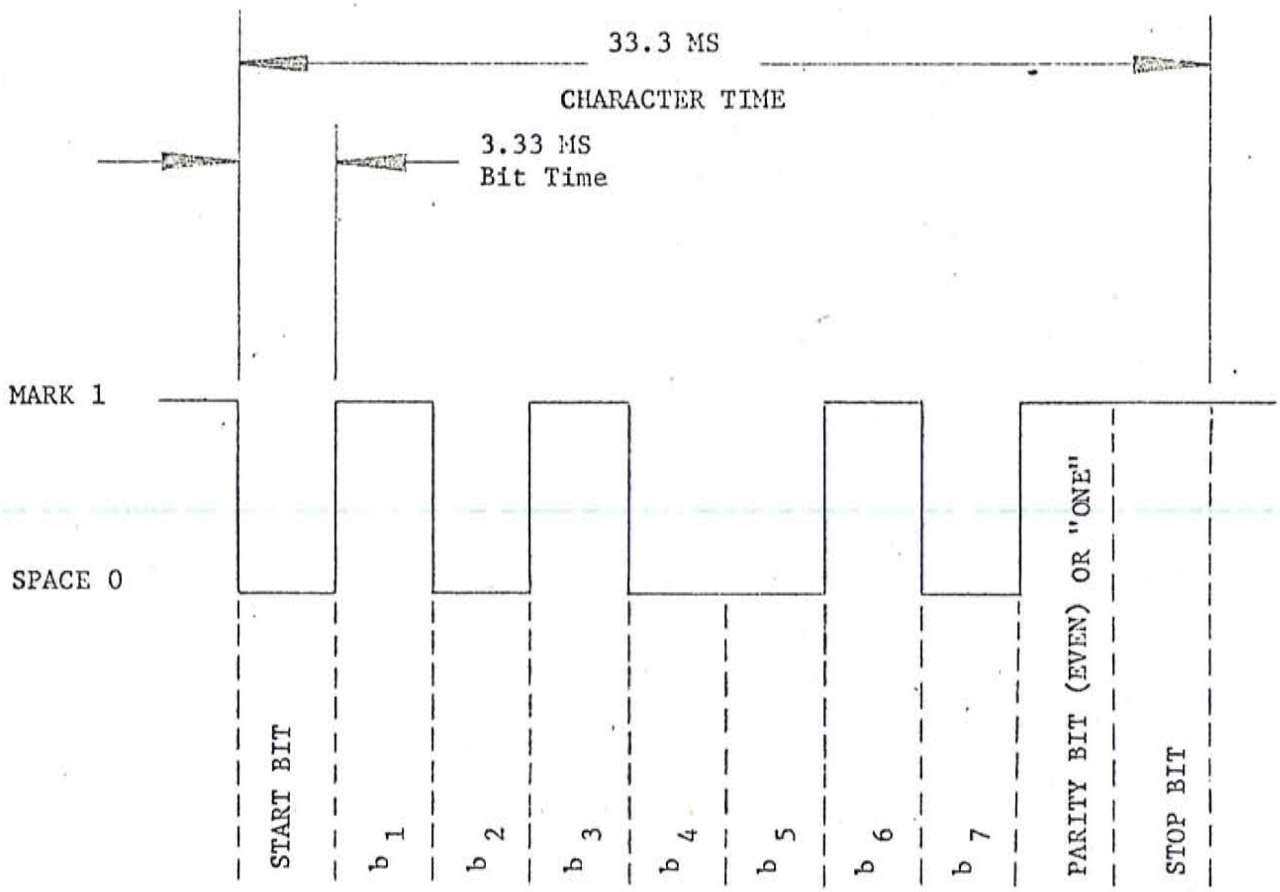
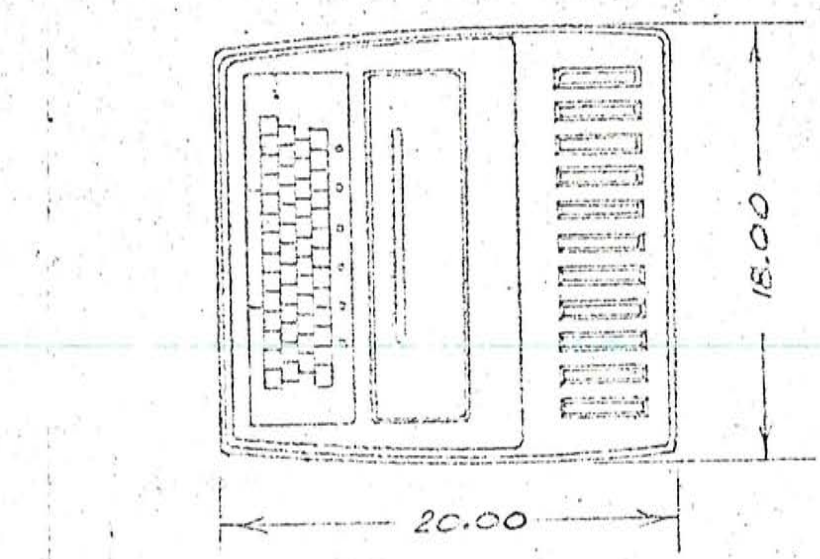


FIGURE 11

CHARACTER STRUCTURE AND BIT SEQUENCING
(FOR CHARACTER "%")



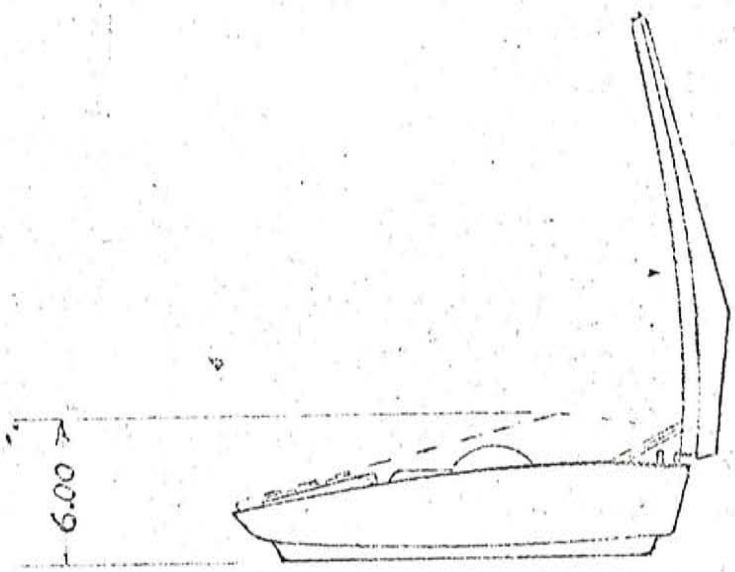
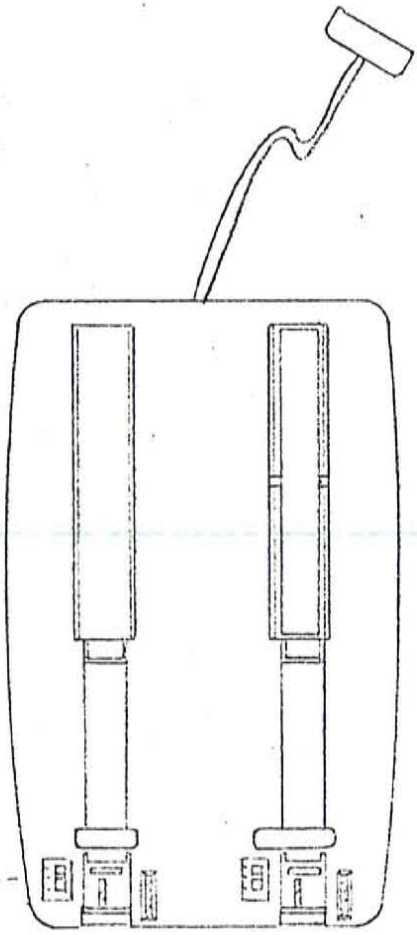
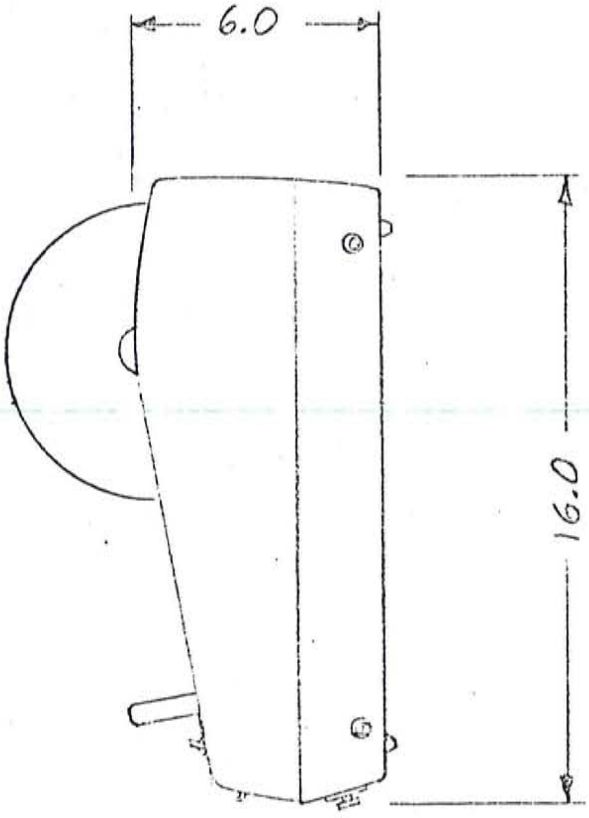


FIGURE 12

KEYBOARD AND PRINTER OUTLINE DIMENSIONS





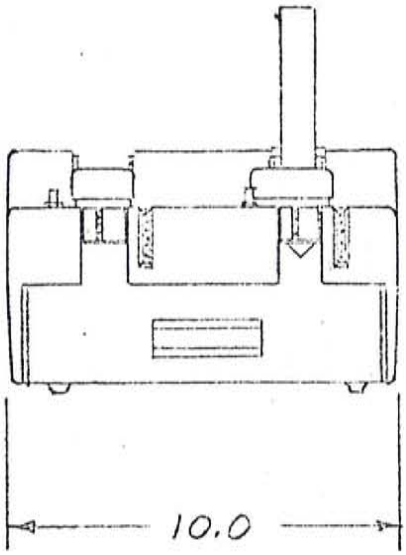


FIGURE 13

PAPER TAPE READER
AND PUNCH
OUTLINE DIMENSIONS

HOURLY - (NON-EXEMPT)

I. REPORTING TIME:
Fill-in Time Card

II. SALARY RANGE:
$3.60 hr - $4.50 hr

III. OVERTIME COMPENSATION:
Time and one half for all hours worked in excess of 40 hours in 1 week or 8 hours in 1 day, whichever is greater.

IV. SICK BENEFITS:
Accrues 1 day per month to a maximum of 12 days. (6 month waiting period).

V. SALARY REVIEW:
3 month probational review, then by vocation with Department Manager and Personnel Department

VI. PERSONAL TIME OFF:
Not paid.

SALARIED - (NON-EXEMPT)

I. REPORTING TIME:
Reports only time NOT worked and any overtime

II. SALARY RANGE:
$156./wk - $240./wk
($8K - $12.5K per year)

III. OVERTIME COMPENSATION:
Time and one half for all hours worked in excess of 40 hours in 1 week or 8 hours in 1 day, whichever is greater.

IV. SICK BENEFITS:
Discretionary to a maximum of 90 calendar days.

V. SALARY REVIEW:
Reviewed on anniversary with Department Manager and Personnel Department

IV. PERSONAL TIME OFF:
Not paid.

SALARIED - (EXEMPT)

I. REPORTING TIME:
Does not report time worked.

II. SALARY RANGE:
$7.8K and up

III. OVERTIME COMPENSATION:
None

IV. SICK BENEFITS:
Discretionary to a maximum of 180 calendar days.

V. SALARY REVIEW:
Reviewed on anniversary or 1 year from last payroll action.

VI. PERSONAL TIME OFF:
Paid.

HOURLY - (NON-EXEMPT)

VII. INVOLUNTARY TIME OFF:

Not paid.

VIII. VOCATIONAL GROUPS INCLUDED:

Stock Clerks	Clerks
Shippers	Secretaries
Receivers	Key Punch Op.
Graders	Computer Op.
Wiremen	Industrial Nurse
Wire-Wrap Op.	Expediters
Pressmen	Schedulers
Mech. Inspector	
Sheet Metal	
Spray Painters	
Welders	
Machinists	
Mech. Assemblers	
Maint. Mechanics	
Electrical Testers	
Janitors	
Truck Drivers	
Carpenters	
Millwrights	
Painters	
Electricians	
Fem. Assemblers	
Technicians	
Draftsmen	

SALARIED - (NON-EXEMPT)

VII. INVOLUNTARY TIME OFF:

Paid

VIII. VOCATIONAL GROUPS INCLUDED:

Group Leaders

SALARIED - (EXEMPT)

VII. INVOLUNTARY TIME OFF:

Paid

VIII. VOCATIONAL GROUPS INCLUDED:

All positions which qualify for Federal Wage & Hour Exemption.

COMPANY CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 9, 1969

SUBJECT: Proposed Change in Digital's Wage Administration

TO: Operations Committee FROM: Personnel Committee

The Personnel Committee strongly recommends the following changes in our Wage Administration:

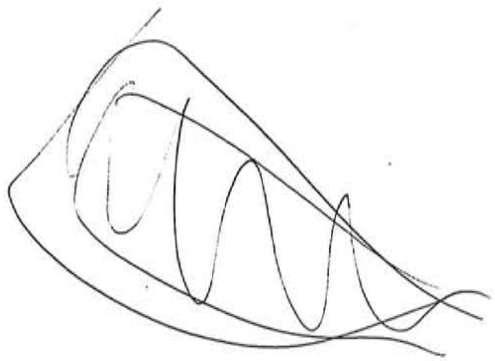
1. Establish a new pay category for certain jobs of higher responsibility in the non-exempt area. This category is commonly referred to as Salaried Non-exempt. All companies currently have this category and include all non-exempt jobs with the exception of hourly production and general factory workers. Our plan is to put Group Leaders into this category, and continue to evaluate what other jobs should be included.

2. Eliminate all time-clocks and allow all hourly employees to "fill-in" their time card (presently only clerical employees are allowed this privilege).

   Several major companies have eliminated their time clocks and as a result have enjoyed significant improvement in their employee relations. They have also found that the majority of their employees are more conscientious when they record time worked via the honor system.

Attached is an outline which explains the policies and benefits proposed for this category. We need your support to bring Digital into line with our competition.

GAT/lw



digital INTEROFFICE MEMORANDUM

DATE: April 9, 1969

SUBJECT: AIR TRAVEL

TO: Operations Committee

FROM: Nick LoRusso

Purpose:

To seek approval to change from American Airlines credit cards and Horizons Unlimited travel service to another system.

Reason:

The companies presently serving our needs have manual billing systems. Apportionment of the charges created by our traveling employees has an end result of creating unnecessary work for our Accounts Payable Department. We estimate that approximately 160 man-hours are consumed each month in Accounts Payable disbursing $42,000 in air travel charges per month to the various departments.

Recommendation:

I recommend we change to Trans World Airlines credit cards and make all our air travel arrangements through that company. The system would work in the following manner:

1) The employee will call a special, unlisted number at TWA to make the travel arrangements.

2) TWA will Teletype our ticket on a pin-feed Teletype machine located in our Communications Center.

3) The ticket will be delivered to the traveler.

Benefits:

1) American Airlines and Horizons Unlimited bill us twice and four times a month respectively. TWA will bill us once a month for all transactions, thus reducing our number of transactions and leading to a better utilization of money. Horizons Unlimited's billing system is particularly annoying, since we must present checks to them in the amount of seven to nine thousand dollars each and every Friday on time.

2) Trans World Airlines' customized billing service will provide us with a summary of each traveler's activity and charges for that month. The format will be an alphabetical list of employees within each cost center and a total cost of air travel for that month. The system automatically identifies those employees who travel first-class.

3) Teletype ticketing provides legible tickets.

I would like to add that the above recommendation meets with Bob Dill's approval.

It may be interesting to the Committee to know that we are discussing with various hotel and motel chains the possibility of a guaranteed rate plan which would enable us to secure accommodations at a reduced rate.

Consideration of the above proposal will be greatly appreciated.

Nick LoRusso

digital

INTEROFFICE MEMORANDUM

PM 36-1

DATE: 8 April 1969

Which Budget

SUBJECT: Commercial Applications Market

TO: Operations Committee FROM: John Cohen

I. Introduction

This memorandum proposes a course of action for DEC to enter the commercial applications market. The plan is based on a first phase which involves a minimum financial commitment. It will enable us to develop marketing, systems analysis and software expertise without very much risk. Basically, I want to get two or three business type systems running successfully this year on PDP-8/I's in customer installations. At the same time, we will build a stockpile of business oriented software. The application portions of the software will be totally machine independent - thus no conversion will be necessary when we go to the PDP-11.

The second phase of the effort (to begin next year) could take the form of OEM "pump-priming" or we could move into complete systems responsibility to end users. We don't need to decide the nature of this second phase now - rather we can wait until the successful completion of the plan proposed here.

We already have two customers who are enthusiastic about letting us use their business for a laboratory to develop our software. These people are described in Section II. Section III. indicates the 8/I system and peripherals we will need in these applications. Sections IV. and V. discuss the systems and applications software we will develop. Finally, Section VI. gives a work plan and cost estimates.

Current estimates for the market discussed here run from one to two billion dollars per year. This plan provides a low cost method for us to get involved quickly. I want to take responsibility for this project and begin immediately.

II. Immediate Customers

We have discussed these plans with two customers. Both are willing to let us use their business as a laboratory to develop the systems and applications software. They will agree to buy the computer system when the software is developed and is running at their installation. I estimate that the price for each system will be about $75,000. We will agree to develop the software, both systems and applications, at no cost.

A. G.E. Stimpson, Incorporated

Stimpson is a medium sized wholesale stationery and office equipment distributor in Worcester, Massachusetts. They are currently using a remote time-sharing service to do billing, accounts receivable and sales analysis. They want their own equipment because the time-sharing service is not responsive to their requests and they would like to add a number of new applications.

They have talked to IBM and were seriously considering a 360/20 before we spoke to them. They have told me that they are very anxious for us to respond with this plan.

B. Pot Shops

The Pot Shops are a local chain of speciality gourmet cookware outlets. Primarily, they want to put their inventory control applications on a computer. They also want to do accounts receivable, accounts payable, sales analysis and general ledger. Like Stimpson, they are enthusiastic about our plan. We will provide the free software - they will only buy the computer (60-75K configuration).

III. Hardware

To get this plan into operation immediately, we must use existing hardware. The PDP-8/I system for the two customers probably will contain:

item	approximate price
8/I with 8K, TTY	16800
2.7M byte disk	20000
300 LPM printer	16000
DEC tape (4 drives)	16800
Paper tape reader	2000
DM01 Multiplexor	2700
	74300

The PDP-11 can be phased into this market when it is available.

IV. Systems Software

We will provide the following:

A. Simple Business Oriented Language

All applications are to be programmed in a simple, totally machine independent business oriented language. The specifications will be less complex than COBOL, but will not contain the serious deficiencies of SAIBOL.

B. Generalized Sort

This systems program will allow the user to easily specify sorts for sequential files with records of either fixed or variable length. Initially it will make use of either the disk or DEC tape.

C. Report Generator

We will also have a simple "report generator" which will allow the user to generate reports by using a series of simple control statements. The control statements will describe the input format, computations, rearrangements and extensions and finally the output formats with column headings, totals, etc. This will be the same type of program as the IBM RPG, but will be much simpler to use.

D. Monitor Control Language

It is important that the user be able to run his applications programs and the systems software with a minimum of knowledge on his part. To accomplish this, we will provide a simple monitor control language to provide the following types of functions:

--Run jobs (programs, sort, report generator) by giving program names and files to be used.

--Update the user program file.

--Copy and edit data files from device to device.

--Run the language compiler, sort or report generator compilers.

--Debug new procedures interactively.

V. Applications Software

In general, the same applications software will be used for both G.E. Stimpson and the Pot Shops. There will be some tailored differences to handle such things as different report and input formats. In addition, the Pot Shops inventory file will need more structure for multiple stores and multiple vendors for individual stock items. However, the similarities of the application software outnumber the differences. All the applications will be written in the machine independent business language. When the PDP-11 phases in, these programs will not be changed at all.

The applications are:

A. Billing

The billing program takes records of sales and return transactions and generates invoices as the prime output. It also generates inputs to accounts receivable, sales analysis and inventory control.

B. Accounts Receivable

This application maintains a file of all open items from the billing runs. It generates periodic statements to customers and also prepares credit reports. It allows posting of cash received which is not assigned to a specific invoice.

C. Sales Analysis

Sales analysis generates reports showing the performance of individual salesmen. It also prepares listings which show the sales of specific vendors and of specific departments. In the case of G.E. Stimpson, current and year to date sales are shown for all items bought by specific customers. These reports are sent to the customers for their records. Another report generated is a listing by item and item classes of sales activity.

D. Inventory Control

A file is maintained with one record for each stock item. The current number of each item on hand is stored. The file is updated by the billing output and by reports from receiving. Periodically a stock status report is generated which shows the dollar value of the inventory and the average monthly sales. This report gives warning "flags" for low stocked items.

E. Accounts Payable

Accounts payable will generate purchase orders from skeleton input information showing the vendor number and requested item numbers and quantities. It generates checks to vendors and inputs to the general ledger application. Another important output is a report showing cash requirements in future months.

F. General Ledger

This application maintains a file of the company's balance sheet accounts. It processes records reflecting the business transactions. It periodically generates a variety of financial reports. The inputs come from the other computerized applications - accounts payable, accounts receivable, etc. (or from manual procedures).

VI. Work Plan

The first phase of this plan should begin now and end on January 1, 1970. At that time we will have accomplished the following:

--A highly marketable business-oriented software system.

--Application packages for the most common business requirements.

--Running, successful DEC hardware/software business systems.

Simultaneously with the software development, Joe McHugh will establish contacts with additional prospects in the eastern Massachusetts area. He will determine the technical requirements for 30 to 40 additional systems. On January 1, 1970, we can evaluate the situation and determine the specific nature of phase 2.

To achieve phase one, I will need the following staff:

Department Manager (John Cohen)

--design systems and applications software
--participate in coding and check out
--participate in establishing new prospects

Marketing Specialist (Joe McHugh)

--establish additional prospects for 1970
--assist in design of software
--interface with G.E. Stimpson and Pot Shops

Applications Programmer (to be hired)

--participate in design of package programs
--coding, check out and documentation

Systems Programmer (to be hired)

--participate in design of business-oriented compiler
--participate in design of generalized sort
--coding, check out and documentation

Programming Aide (to be hired)

--make debugging runs for programmers
--responsible for program and data preparation
--establish and maintain program and documentation files
--do routine programming tasks

Secretary (Martha Hill)

I estimate that the cost center budget for the 8 months (May through December) will be aproximately:

base labor	71,000
overhead	35,000
	106,000

The price of the systems for both G.E. Stimpson and the Pot Shops will be about $75,000 each. Assuming a cost of $37,000 to us for each system, the total first year cost of the project will be about $30,000.

Considering the enormous potential market (1 - 2 billion dollars per year) and the low risk and cost of this venture, I suggest we get moving on it immediately.

JC/mh

J. Smith
4/4/69

Attached is a summary of our fiscal "70" wire-wrap requirements, present utilization, associated costs and capital investment summaries. It is recommended that we budget the necessary capital to meet all fiscal "70" 30 gauge needs in house. Return on investment summaries indicate Numerical Control over Gardner-Denver by a factor of 3 to 1. Depending on back-plane utilization, capital expenditure would be as outlined below:

49	30 Gauge N/C Machines		547K
	19 @ 10.5K	199.5	
	30 @ 11.6K	348.0	
	Back Plane Technology		
	Eliminates 14 @ 11.6K	162.0	385K

From our discussions with the PDP-10 group, which is the largest 24 gauge user, they should be totally converted to 30 gauge within two (2) years. In addition, most new option designs utilize 30 gauge wire wrap. Estimates at this time would indicate that within a two-year period, total 24 gauge requirements would be less than one million wires and decreasing. Our present 24 gauge Gardner-Denver could handle this requirement. Considering return on investment, it is not, therefore, recommended that we invest capital in 24 gauge Gardner-Denver machines. Design of a larger 24 gauge numerical control machine is an alternate to sub-contracting and is being reviewed at this time.

Section 1: Projected Wire Wrap Requirements, Costs and Machine Utilization for Fiscal "70"

Section 2: Detailed Breakdown of Wire Wrap Requirements

Section 3: Return of Investment, N/C Versus Gardner-Denver

Section 4: Capital Investment

Section 5: Impact of Back Plane Technology

Section 6: Space Requirements

sm

4/4/69

Present In-House Capacity

30 Gauge - Canada

11 Machines X 100 W/Hour = 1100 W/Hour X 16-Hour Day

(20 8/I Wk. X 4500 Wraps = Cap of 18K Wk.)

18,000 Wraps Per Day
90,000 Wraps Per Week
360,000 Wraps Per Four-Week Month
450,000 Wraps Per Five-Week Month
1,170,000 Wraps Per Quarter

24 Gauge - Maynard

1 Machine X 500 W/Hour = 500 W/Hour X 24-Hour Day

12,000 Wraps Per Day
60,000 Wraps Per Week
240,000 Wraps Per Four-Week Month
300,000 Wraps Per Five-Week Month
780,000 Wraps Per Quarter

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4/4/69

N/C Capability:

2 Shifts - 5-Day Week

(100 Wires/Hour) (80 Hours/Week) (13 Weeks Per Quarter)

104,000 Wires Per Quarter/Machine

Projected Machine Requirement Above Present Canadian Capability:

First Quarter "70"

3,624,200 ÷ 104,000 = 35 Machines

Second Quarter "70"

3,919,200 ÷ 104,000 = 38 Machines

Third Quarter "70"

4,264,200 ÷ 104,000 = 41 Machines

Fourth Quarter "70"

4,734,200 ÷ 104,000 = 46 Machines

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4/4/69

Fiscal "70" Total Wire Wrap Requirement

Quarter	G	Prod.	Sales/ Eng.	Total
First	24	2,063,840	225,000	2,288,840
	30	4,644,200	150,000	4,794,200
Second	24	2,104,840	225,000	2,329,840
	30	4,864,200	225,000	5,089,200
Third	24	2,228,340	300,000	2,528,340
	30	5,134,200	300,000	5,434,200
Fourth	24	2,331,340	300,000	2,631,340
	30	5,604,200	300,000	5,904,200

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4/4/69

Fiscal "70" Manufacturing Wire Wrap Requirement
(30 Gauge)

Logic Type	No. Wires	1st Quarter Qty.	1st Quarter No. Wires	2nd Quarter Qty.	2nd Quarter No. Wires	3rd Quarter Qty.	3rd Quarter No. Wires	4th Quarter Qty.	4th Quarter No. Wires
Linc M	3500	75	262,500	75	262,500	75	262,500	100	350,000
Linc P	4500	75	337,500	75	337,500	75	337,500	100	450,000
PDP-8/I	4500	360	1,620,000	360	1,620,000	360	1,620,000	360	1,620,000
PDP-8/L	2300	600	1,380,000	600	1,380,000	600	1,380,000	600	1,380,000
PDP-9/I	8000	45	360,000	60	480,000	75	600,000	90	720,000
BA08A	1850	150	277,500	150	277,500	150	277,500	150	277,500
DC08's	1000	100	100,000	100	100,000	100	100,000	100	100,000
DW08A	560	150	84,000	150	84,000	150	84,000	150	84,000
DW08B	560	10	5,600	10	5,600	10	5,600	10	5,600
MM8I	930	120	111,600	120	111,600	120	111,600	120	111,600
PDP-14	500	100	50,000	200	100,000	300	150,000	400	200,000
PDP-11	500	---	-------	100	50,000	300	150,000	500	250,000
BA12	1850	30	55,500	30	55,500	30	55,500	30	55,500
TOTAL			4,644,200		4,864,200		5,134,200		5,604,200

sm

J. Smith
4/4/69

Fiscal "70" Manufacturing Wire Wrap Requirement
(24 Gauge)

Logic Type	No. Wires	1st Quarter Qty.	1st Quarter No. Wires	2nd Quarter Qty.	2nd Quarter No. Wires	3rd Quarter Qty.	3rd Quarter No. Wires	4th Quart Qty.	4th Quart N Wi
184	500	14	7,000						
804	900	60	54,000	60		60		60	
689AG	1900	30	57,000	30		30		30	
637	500	15	7,500	15		15		15	
AA05	900	3	2,700	3		3		3	
AD08A	230	10	2,300	10		10		10	
AD08B	380	15	5,700	15		15		15	
AF0's	950	60	57,000	60		60		60	
AG12	500	35	17,500	35		35		35	
AM12	500	35	17,500	35		35		35	
AM08	570	25	14,250	25		25		25	
AX08A	1050	35	36,750	35		35		35	
RS08 & RS09	350	240	84,000	240		240		240	
TC01	1500	75	112,500	75		75		75	
TC02	1500	15	22,500	15		15		15	
TC58	1850	21	38,850	21		21		21	
TU20(A)	800	70	56,000	70		70		70	
AF16	520	21	10,920	21		21		21	
DF32	920	270	248,400	270		270		270	
DM01	1100	70	77,000	70		70		70	
DP01A	360	11	3,960	11		11		11	

J. SMITH
4/4/69

PDP-10 (24 Gauge)

Logic Type	No. Wires	1st Quarter Qty.	1st Quarter No. Wires	2nd Quarter Qty.	2nd Quarter No. Wires	3rd Quarter Qty.	3rd Quarter No. Wires	4th Quarter Qty.	4th Quarter No. Wire
KA10	16000	12	192,000	15	240,000	21	336,000	24	384,
TD10	2600	18	46,800	18	46,800	18	46,800	18	46,
MA10	5500	45	247,500	45	247,500	50	275,000	60	330,
DC10A	1800	12	21,600	12	21,600	12	21,600	12	21,
DC10B	480	36	17,280	36	17,280	36	17,280	36	17,
DF10	2880	36	103,680	36	103,680	36	103,680	36	103,
RC10	3650	18	65,700	18	65,700	18	65,700	18	65,
DA10	1800	12	21,600	12	21,600	12	21,600	12	21,
BA10	1900	10	19,000	10	19,000	10	19,000	10	19,
164 (MB10)	1900	---	-------	---	-------	---	-------	---	---
GP10	650	3	1,950	3	1,950	3	1,950	3	1,
RA10	3000	3	9,000	3	9,000	3	9,000	3	9,
RP10	3000	6	18,000	6	18,000	6	18,000	6	18,
TOTAL			764,110		812,110		935,610		1,038

sm

Section 3

J. Smith
4/4/69

Return on Investment
N.C. Versus Outside Contractors

Estimated Cost of Production (Canadian Rates)
Based on 16 Hours Usage Per Day: 100 Wires Per Hour - 8,000/Wk.

Labor @ $1.50/Hour	$ 120	
Overhead - 175%	210	
Additional Depreciation	48	($10M X 25% ÷ 52)
	$ 378	
Cost Per Wire	$.047	
Wire Cost (Not Inc. Above)	.020	
Total Cost/Wire	$.067	

Present Outside Cost ($.10 + $.02)		$ .120
Estimated Inside Cost		.067
Difference		$ .053
Investment/Machines		$ 11,000
Savings/Year (416M X $.053)		22,048
*After Tax Savings		$ 11,883
Payback	11.0 Months	
Addition to Work In Process Inventory	$6,000 to $8,000	

* Savings $ 22,048
Less Depreciation 2,500
$ 19,548
Taxes 52% 10,165
$ 9,383
Add Depreciation 2,500
$ 11,883

sm

4/4/69

Capital Investment:

Additional Machines - 30 Machine Capability System:

Equipment:

2 - PDP-8/I-D @ 6K	12.0
2 - MC8I-A @ 1.6K	3.2
2 - KP8I @ .25K	.5
2 - MM8I-B @ 4.5K	9.0
2 - PC8I @ 1.5K	3.0
2 - DF32 @ 2.7K	5.4
4 - DS32 @ 1.4K	5.6
8 - H961A @ .15K	1.2
5 - H950-B @ .02K	.1
Hydraulics & Installation	12.0
30 - Stations @ 8.5K	260.0
Interface and Translators @ 1K	8.0
Power Supplies	3.0
	$353.0K

Labor and Overhead:

Installation (480 Hours @ $10.00)	$ 4.8K
TOTAL	$357.8K

Per Station Cost: 357.8 ÷ 30 = $ 11.6K

sm

J. Smith
4/4/69

Impact of Back Plane Technology

50 per cent reduction in wire wraps per 8/I and 8/L frames.
Scheduled introduction unclear at this time.

	No. of Wires	With Back Plane	Number of Wires Eliminated			
			Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4
8/I	4500	2250	810K	810K	810K	810K
8/L	2300	1250	690K	690K	690K	690K
Total Wires Eliminated			1.500K	1.500K	1.500K	1.500K
Machine Savings			14	14	14	14

sm

J. Smith
4/4/69

Space Considerations

Expansion of the present eleven (11) station system and installation of a new thirty (30) station would require 11,000 square feet. The second floor of the Kendell Building in Canada has been laid out to accommodate sixty (60) stations. This space will be available May 1.

sm

Ken Olsen

digital INTEROFFICE MEMORANDUM

DATE: April 10, 1969

SUBJECT: Light Pen Proposal

TO: Operations Committee

FROM: Bob Collings/Richard Burton

We would like to propose the development of a solid state Light Pen to replace our current Type 370 Light Pen. Our present product is unreliable and high priced-$1625-and a detriment to the display products which utilize it (currently the 338, 339, 340, and Type 30, and in the immediate future the VR 12, the VT 15, PDP 12, etc.). This development is proposed as a shared project for the remainder of fiscal 1969 and will be continued as a project within the proposed Display Product group in fiscal 1970.

This proposal was made to the Marketing Committee on March 11. Their reaction was as follows:

"The Committee felt that the objective of a $100 (cost) light pen was commendable, and that we should charge ahead with the project. There was a willingness to share expenses for the project between the Product Lines.

There are apparent engineering problems with the light pen proposal that should be reviewed before the Engineering Committee. The Committee feels that it needs clarification of the organization of the Display Engineering Group."

On April 3, 1969, the project was presented to the Engineering Committee with the following comments:

"Confidence in Dick's Light Pen project was restored to all as a result of his presence and presentation. Specifically: the prototype looks good, but it needs a daintier snoot and the matching up of external finishes; base resistors should be added to the Darlington to prevent oscillation; he will investigate using committee's preference of +5 and -15 voltages; suggested Dick outline test procedures which

will check such things as sensitivity and spectral response; a sense switch on the pen holder will be investigated and possibly a cheaper version using perhaps a commercial pen barrel. In conclusion, the Committee approved the Light Pen project and its proposed Design Review members.

The estimated cost for developing Ligh Pen is $15K which would be incurred over the next four to five months. Responsibility for the project would be assumed by Dick Burton. Over the next three years, we expect to sell 665 Light Pens at a market of at least five times return investment as calculated at 500%.

Preliminary design has taken place and a breadboard model exists. A preliminary design review has been conducted successfully. We anxiously solicit your comments, suggestions and approval of this plan.

Bob Collings

Robert Burton

BC/tkw

encls.

DEVELOPMENT EXPENSES

Model shop	$1,100
Parts	$ 500
Machine shop	$ 100
Mechanical design	$1,800
Drafting	$ 400
Eng	$10,000
Manual	$ 800
Sales Brocure	$ 500
Total	$15,200

MARKET POTENTIAL (OVER 3 YRS)

PDP-8	75 pens
PDP-9	360 pens
PDP-10	30 pens
PDP-11	No estimate
PDP-12	200 pens
OEM	No estimate
Total	665 (Over three years)

MFG COST GOAL: $75 - $100

SELLING PRICE $300 - $500

R.O.I $\frac{(\$400-100)\ (500\ \text{units})}{\$30K} = 500\%$

Assuming: $100 mfg cost
: $400 selling price
: $ 30K Development, Inventory, Overhead, etc
: 500 units sold over 3 yrs.

Light Pen Proposal

General

The solid state light pen to be proposed is a replacement for the Digital type 370 light pen which is composed of a fiber optic light pipe, Photo-multiplier tube, and high voltage inverter power supply. The speed and sensitivity will be the same or better.

Technical Feasibility

The feasibility hinges on the speed and sensitivity of the photo diode. The diode to be used is an H.P. 5082-4502 (See Appendix for specifications.) or equivalent. It is to be mounted in the end of a tube that is similar to a metallic ball point pen.

Accompanying the photo diode in the pen will be a darlington amplifier and a few discrete components (Figure 1). A light-weight twinex coax cable will connect the pen to the machine. The machine end of the cable will use a twinex BNC.

The electronics in the machine (Figure 2) consists of two DIPS and a few discrete components mounted on a Flip-Chip. There will be outputs for a positive logic positive and negative pulse, and a negative logic negative pulse. The sensitivity (threshold) control will be mounted on the front of the machine.

Potential Return on Corporate Investment

We are currently selling six 370 light pens a month. As of April, 1968, the selling price is $1625. The manufacturing price is $346.

The proposed pen will cost roughly $75 to manufacture, depending on the cost of this pen mechanical assembly. We might be able to sell it for $1000. The I.C.C. pen (Appendix) sells for $2000.

Availability of Manpower

This will be essentially a one man project with occasional assistance from Andy Ouellette of the model shop and Charles Vaillant of mechanical engineering.

Compatibility with Existing or Planned Projects

The threshold logic and an additional +15V, -15V supply can be easily accomodated on the 338, 339, 340 and RM 503. A power supply problem might develop on the VR 12 because of electro-magnetic radiation.

Consistency with Company Goals

The project is consistent to the goal of keeping circuits as close to the state-of-the-art as economically feasible.

Verification of the Need to Undertake the Project

The Type 370 Light Pen was released in the early part of 1964. Since then, the state-of-the-art has advanced in the photo diode area so that by using the diode, we can do away with the fragile light pipe, the big pen, and the custom made high voltage supply, but maintain specifications.

Reliability of Schedule and Cost Goals

The schedule and costs are easily realized since all the hardware is off the shelf, except the pen tube. One might consider using a ball point pen with its insides removed.

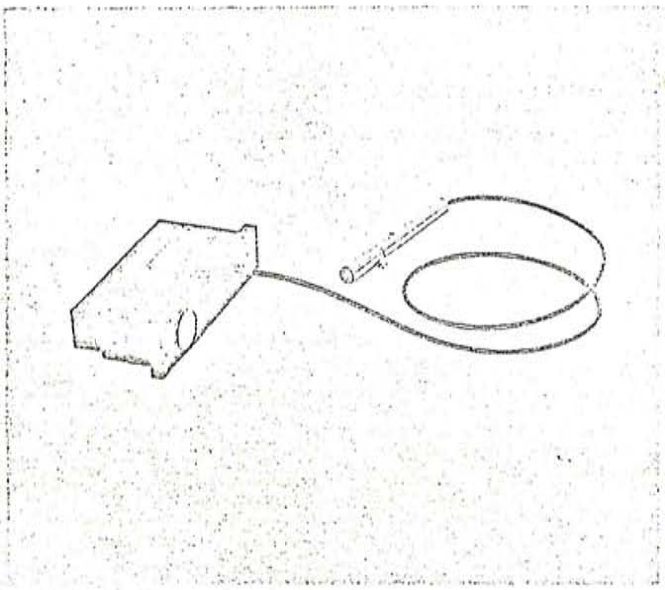
COMPARISON

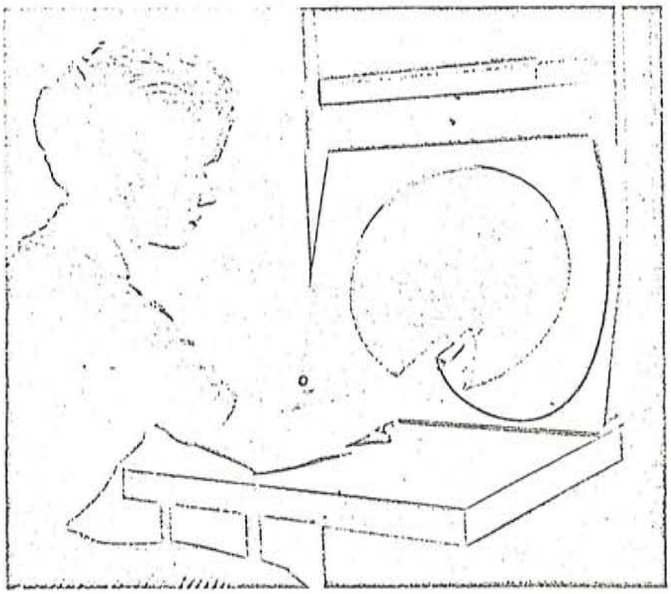
digital

COMPUTER OPTIONS

370 HIGH SPEED LIGHT PEN

REV. 10/64





The Digital Equipment Corporation High Speed Light Pen Type 370 has been designed for use with cathode ray tube displays with rapid plotting rates. It combines a fiber optic light pipe and photomultiplier system for accurate detection and modification of displayed computer information.

Increased sensitivity and high reliability are obtained by photomultiplication of light signals from the cathode ray tube. The Type 370 has a turn on time approximately five times faster than present photodiode systems. This increase in speed permits a greater degree of accuracy in point detection under minimum light intensity levels.

Speed of operation is limited primarily by rise and decay times of the CRT phosphor used. Present DEC CRT displays use phosphor P 7. Phosphor P 15 or P 24 are recommended for faster operation.

Because of the photomultiplier's high gain capability, it has been possible to reduce active circuit elements in the Type 370 to a minimum. The result is simplicity of design and high reliability.

A flexible, fiber optic light pipe eliminates electrical noise problems inherent in photodiode systems. Since all active electrical components are stored inside the display housing, noise, caused by sudden shock or dropping of the pen holder, is eliminated. Other features include: a mechanical shutter which prevents selection of unwanted information during pen positioning, and interchangeable light pen tips in a variety of fixed aperture settings for variable fields of view.

The Type 370 High Speed Light Pen consists of a photomultiplier tube, high voltage power supply, amplifier, and flexible light pipe with pen holder. The photomultiplier tube and voltage power supply are integrated into a single potted modular unit mounted inside the CRT housing of the display.

POWER SUPPLY INPUT: —15 volts at 700 milliamperes.

OUTPUT: The rise and fall times of the output signal are dependent on the rise and decay times of the CRT phosphor. The amplitude of the output signal ranges from 0 to approximately —6 volts. The output is designed to drive the base input of an inverter such as contained in a Type 4106 module. If the phosphor is sufficiently fast, the output may be differentiated. Use of a pulse amplifier with a differentiating input such as the Type 4604, produces a standard output pulse for use with DEC logic modules.

GAIN CONTROL: A gain control is available for adjusting the amplitude of the output signal.

FREQUENCY RESPONSE: Light in the range from 4300 Angstroms to 5600 Angstroms may be detected.

1625 - April 16, 1968

April 11, 1969

PURCHASE OF TRAILER AND TRACTOR

Ken Olsen
Stan Olsen
Peter Kaufmann
Ted Johnson
Win Hindle
Nick Mazzarese

Ray Michel

cc: Frank Kalwell

The increased volume of production and sales goods shipped to and from DECAN on a weekly basis has produced multiple weekly trips in our existing 14 foot van. As a result, I recommend and submit for your approval the purchase of a 40 foot trailer and tractor, at a cost of $23,000. Attached for your review are its yearly operational costs in addition to the service and cost saving benefits that can be realized from its performance.

COST ANALYSIS
(Annual)

I. Fixed Costs

A.	Entire capitol investment	23,000.00
B.	License fees and taxes	1,500.00
C.	Insurance (property damages, public liability, equipment, etc.)	280.00
D.	Depreciation-full value less trade-in over 4 yrs. (25%)	5,790.00
E.	Administration expenses (including time spent on operation, record keeping,etc.)	780.00
	Fixed Total Costs	31,350.00

At annual mileage of 60,000 miles
cost per mile is..... .132

II. Direct Operating Costs (variable)

A.	Primary maintenance of equipment (includes washing, greasing, etc.)	240.00
B.	Road Service costs (breakdowns)	250.00
C.	Garage repairs	200.00
D.	Fuel oil (diesel fuel:6 mi/gallon @ cost - of 28¢/gallon for 60,000 mi.)	2,800.00
E.	Tires & tubes (replacement)	400.00
F.	Vehicle accessories: tires, chains, flares, etc	150.00
G.	Driver's salary and expenses	16,120.00
H.	Toll road fees	2,200.00
	Total Operating Costs	22,360.00

At annual mileage of 60,000 miles, cost
per mile is..... .366

Total cost per mile: ..... .498
Total cost per round trip: 539.00
Total cost via common carrier per round trip 840.00
Total " " leasing " " " " 500.00

Service Benefits

1. Weekly load capacity of 60,000 lbs. enables one trip per week versus two or three on existing vehicle.

2. Weekly pick-ups from vendors located in regular traffic pattern on return trip will provide expedient delivery service. ie. Acme Electric, Ferroxcube, Ren Electronics, Plant X.

3. Fork lift loading and unloading will reduce loading time.

4. Reduced transit time due to high performance of Mack Maxidyne tractor. Total running time will be reduced by 2 hours.

5. Future increases in volume will not require additional storage space as we can purchase another trailer and swap trailers as they are loaded; also, this may be applicable to plants X and Y.

Cost Savings

1. Unless production goods from DECAN triple, we will be utilizing only 1,900 cu. ft. of the 2,750 cu.ft. available. This additional space however, permits us to pick-up the weekly average 13,000 lbs. shipments from Acme at a savings of $400.00 in weekly shipping costs.

2. The current cost of operating 2 vans is $800.00 versus $539.00 via trailer.

3. Denny Doyle informed us that the sales revenue from our journeys last year were in excess of $60,000.00. Expected revenue for F/Y 70 is in excess of $75,000.00.

COMPANY CONFIDENTIAL

OPERATIONS COMMITTEE MEETING

April 7, 1969

AGENDA

1. Additions and Corrections to Minutes of the March 31st Meeting and the April 2nd "Woods" Meeting
2. Marketing Review Committee Summary - (Ted Johnson)
   (See attached minutes of the March 31st meeting)
3. Proposed Revisions of the Corporate Credit Policy - (Don Summers)
   (See attached report)
4. Overseas Relocation Policy/Relocation Allowances for Americans Assigned to Geneva - (Graydon Thayer)
5. Cross-Product Charges and Credits - (Bob Lane)
   (See attached report)
6. Proposal for a Second Back Panel Tester - (Ron Cajolet)
   (See attached report)
7. Investment in Customers' Stock by Our Employees
   (See attached report from Ed Schwartz)
8. Informal Discussion on the IEEE Show, and the Booth for SJCC - (Gabe d'Annunzio)
9. Land Committee Status Report

COMPANY CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 8, 1969

SUBJECT: MINUTES OF THE OPERATIONS COMMITTEE MEETING OF APRIL 7

TO: Operations Committee FROM: Win Hindle, Secretary

Present: Ken Olsen, Stan Olsen, Nick Mazzarese, Pete Kaufmann, Ted Johnson, and Win Hindle

1. Minutes of the March 31 meeting were approved as amended.
2. Minutes of the April 2 "Woods" meeting were approved.
3. Minutes of the Marketing Review Committee were accepted.
4. Corporate Credit Policy - We accepted Don Summers' proposal on the operation of our credit policy. We asked that he meet with Don Berman and Frank Kalwell to insure that the credit policy fit well with our total order processing system. Also, we agreed that this new policy should be carried out early in the order acceptance procedure so as not to hold up shipments.
5. Overseas Relocation Policy - Graydon Thayer's proposed policy was not accepted because it did not distinguish clearly who was covered. We will ask that this be covered before the policy is accepted.

   We accepted the proposed relocation allowances for Americans assigned to Geneva on a nonpermanent basis. It was agreed that U. S. citizens not be allowed to "make money" on the tax equalization if they are away long enough not to pay U. S. taxes.
6. Cross-Product Charges and Credits - Bob Lane proposed that 680 sales be credited to PDP-8 and not to PDP-10, as it now is. We decided not to change the current system, which is to credit 680 systems to PDP-10, because we expect to change the accounting system to solve this problem very shortly.
7. Second Back Panel Tester - We approved Ron Cajolet's proposal for a second back panel tester. We asked the Engineering Committee to review the technical proposal to see if we can reduce the cost.
8. Investment in Customers' Stock by our Employees - We decided that Ted should write a statement for the Sales Newsletter to indicate concern that no one be put in a conflict of interest situation with his customers. Each man should consider how his stock ownership looks to his other customers.
9. Annual Wage Review for Hourly Technical, Production, and General Factory Employees - We accepted the April 2 proposal on wage increases. Pete would like to decrease the number of wage classifications. He would also like to be sure that we have no artificial barriers in the Personnel Department to paying people what we need to in order to get

them; i.e., we may have to pay general workers equivalent to technicians in order to get enough general workers.

10. Discussion on IEEE and SJCC Trade Shows - Ken proposed to Gabe d'Annunzio that we have a Trade Show Notebook which includes: 1) picture of booth, 2) objectives we had before the show, and 3) results we achieved - positive and negative - versus our objectives. After a discussion of how poorly we generally run trade shows, Gabe d'Annunzio agreed to prepare a trade show proposal and bring it to the Operations Committee.

    Gabe reported that the SJCC booth would cost $9,500. The Operations Committee told Gabe that the cost could not be greater than the proposed $1,600 plus 25%.

11. Land Committee Report -

    Decision: a) Do not take option on Leominster land until a builder looks at the land. If it looks good to the builder, we will probably try to take an option on all of it.
    b) Try to get an option on the 20 acres off the Mass. Turnpike in Westfield, plus an option on the Broderick land there.
    c) We will try to rent the top floor of St. Bridget's School in Maynard for eight classrooms for the next year.

12. 1970 Budget - On the G & A Budget proposal, the approach to the Personnel budget was questioned. Ted and Pete asked that the sections of Personnel that hire people for their groups go over the budget and procedures proposed.

    In the Accounting area, Pete and Win will go into the budget and ask for justification. Nick will look into the Writing section increase.

    Stan will look into the Maintenance budget.

W. R. Hindle, Jr.

ecc

digital INTEROFFICE MEMORANDUM

DATE: April 1, 1969

SUBJECT: Credit Policy

TO: Operations Committee FROM: Don Summers

The following is a proposal containing my recommendations for the revision of corporate credit policy.

A. Computer Product Lines

1. Notification of all new customers (except PDP-10 customers) must be forwarded to the Accounting Department by order administration as soon as a purchase order is received; such notification to include name, address, probable first delivery date, product line, and amount of initial purchase. The PDP-10 group salesmen shall forward the name and address of any PDP-10 customer to the credit department for whom he calculates he would have a 50% or better chance of securing a P.O.

2. A full background credit investigation will be undertaken on all customers purchasing in excess of one thousand dollars worth of equipment. Those purchasing under this amount will be investigated on a request basis only.

3. Results of investigations will be forwarded to the product line manager or his designated representative and will contain one of the following conclusions:

a. Extension of normal thirty-day credit terms.
b. Special payment terms (which may include):

1. Cash escrow in advance of shipment.
2. Cash immediately prior to shipment.
3. Letter of credit.
4. C.O.D.
5. Letter of guarantee
6. Security Interest with Filings

4. If the product line desires to release a shipment to a customer designated by the credit department as a risk, without special terms, then written approval from the product line vice president must be forwarded to the credit department.

5. The credit department will be available upon request, at all times, to assist the product line for discussion and to assist in negotiating special payment (financing) arrangements.

6. A periodic review of all existing accounts will be made by the modules and computer department with regard to significant increase in new purchases or a new P.O. from an inactive customer, and such notification shall be forwarded to the credit department.

7. Continual review of open credit balances, as extended to customers and paying records of customers, will be performed by credit department and specific recommendations forwarded to the product line. Again, approval to release equipment to customers whose credit has been suspended by the credit department must be given by the product line vice president.

8. The credit list shall be published by the credit department once a month and shall contain a list of all those customers who should not receive normal day to day credit terms.

9. Salesmen shall notify product line and credit analyst of any situation, in his judgment, that might tend to alter the financial condition of one of his customers.

B. Module Product Line

1. All new orders under $500 will be shipped on a 30 day extension of credit unless there is existing information to indicate unfavorable credit. A background investigation will be undertaken on any customer purchasing under $500 of modules on request.

2. All orders in excess of $500 will be shipped C.O.D. to insure prompt delivery and a background investigation undertaken with specific conclusions forwarded to the product line.

digital INTEROFFICE MEMORANDUM

DATE: April 2, 1969

SUBJECT: 1. Overseas Relocation Policy - Amer. Expatriates/Foreign Nati
2. Relocation Allowances Americans Assigned to Geneva.

TO: Operations Committee

FROM: Graydon Thayer

Pursuant to the intent of our relocation policies to provide employees transferred at Company request with reasonable and competitive expense reimbursement and allowances, it is recommended that the following areas of consideration be reviewed on Americans expatriated to overseas assignments and foreign nationals who are transferred to other overseas locations so as to insure that appropriate coverages are established.

In addition to the standard provisions of the Overseas Relocation Policy, special allowances in the following areas may be necessitated by costs, conditions, or practices at the new location:

1. Cost of Living Allowance - May be provided when the cost of living at a proposed new location is measurably higher than what an employee experiences at his present location, such that the employee would incur significantly higher costs to maintain his same general standard of living. When appropriate, such allowances will be established as a percentage of the employee's base salary.

2. Housing Allowance - May be provided when costs for similar housing at a proposed new location exceed the normal percentage of base salary customarily expended by the employee at his present location. Allowances to cover such excesses shall be prescribed with a maximum limit (amount) to be determined by a survey of reasonable housing costs at the new location.

3. Schooling Allowance - May be provided when the calibre of public schooling available at a new location is inferior to or incompatible (language, curriculum progression, etc.) with public schooling provided to an employee's children at his present location. Actual and reasonable costs for registration, tuition, and books may be reimbursed provided management is advised and approves in advance of any commitment that charges are appropriate. No cost of transportation to or from school will be reimbursed.

4. Income Tax Equalization - When an American is expatriated to an overseas assignment or a foreign national is transferred to another foreign country for a limited period (normally not more than two years), where the national income tax liability would result in a greater financial burden on his income than under his home location, payment of the difference between the income tax liability on his base salary in his home country and his total tax liability in his new location (including tax on any allowances) may be reimbursed by the Company.

5. Miscellaneous Relocation Expenses - We should include the same payment ($500 for married employees; $250 for single employees) in our Overseas Relocation Expense Policy that we recently incorporated into our Domestic Policy. Basic reasons are the same, but in addition personnel moved to or within Europe, etc. face the additional problem of adjusting to a new way of life and usually incur, at least initially, higher expenses than normally encountered when relocating within one's own country.

It is felt that with these changes we will more clearly establish the philosophy and frame of reference necessary to minimize future problems in this area.

RELOCATION ALLOWANCES AMERICANS ASSIGNED TO GENEVA

1. Cost of Living Allowance - 25% of base salary.

2. Housing Allowance - Payment of the amount in excess of 15% of base salary, up to a maximum of $250/month.

3. Schooling Allowance - Actual and reasonable costs of tuition, registration, and books, provided management is advised and approves in advance of any commitment that charges are appropriate. No cost of transportation to or from school will be reimbursed.

4. Tax Equalization - Payment of the difference between U.S. tax liability on base salary and income tax liability in Geneva, Switzerland.

GAT/lw

digital INTEROFFICE MEMORANDUM

DATE: March 31, 1969

SUBJECT: CROSS PRODUCT CHARGES AND CREDITS

TO: Operations Committee FROM: R. L. Lane

As you are aware, one product line may sell another's product as an option, or as an integral part of their system. The most obvious is the PDP-8/680, and soon the PDP-8I/680.

I personally was more responsible for this error than any other person at Digital. The real arguments against this approach were not obvious at the time the decision was made. (I am not changing my mind just because of different product responsibilities.)

As pointed out in a recent Sales Newsletter by Bill Farnham, the selling effort is being mis-charged, PDP-10 gets booking credit, yet the sales effort is charged to PDP-8. Also, and most serious, is the warranty and maintenance costs; where again, the income goes to PDP-10, but the charges go against PDP-8.

Either all products reside with their true product line, or the user group rename the device, giving it a PDP-10 option designation and assume responsibility for the sales efforts, warranty, and installation costs.

A very real example is: Don Busick is requesting parity options on all PDP-10/680 systems. This includes modules and stack replacements.

el

digital INTEROFFICE MEMORANDUM

DATE: April 7, 1969

SUBJECT:

FROM: Ron Cajolet

TO: Pete Kaufmann
cc: Joe St. Amour
Jim Cudmore
Jack Smith

Enclosed is a request for a second back panel tester (AWT). The total cost will be $60.5K. Completion of tester would be in 4 months. (This tester would be capable of checking PDP/10 panels.)

Included is a forecast of wires for fiscal 1970 which shows the present AWT is capable of checking only 90% of 1st quarter requirements and 70% of 4th quarter requirements. This is based on a more efficient use of the present AWT as recommended in the report.

The pay back on a second AWT is 6 months.

Ron

bn

REQUIREMENTS & CAPACITY

Fiscal 70	Total Wires	Total # Panels	Total Check Time*
1st Quarter	7,083,040	3575	1156 hrs.
2nd Quarter	7,419,040	3786	1219 hrs.
3rd Quarter	7,962,540	4111	1317 hrs.
4th Quarter	8,535,540	4486	1425 hrs.

Present Capacity = 1040 hrs./Quarter
(16 hr./day - 5 days/week)

Present AWT can check:
90% of panels for 1st Quarter
85% of panels for 2nd Quarter
78% of panels for 3rd Quarter
72% of panels for 4th Quarter

*These check times are based on the following improvements to the AWT. Presently, panels take 16 minutes to load and unload and check 160 wire/min. This is based on 4 passes per panel. By combining some repair and QC operations we will cut this down to 3 passes; by reprogramming we will load small panels, such as 8/L's, while the AWT is checking; by adding a line printer we will eliminate waiting for type out errors. The cost of making these improvements is $8K for line printer and $2K programming.

This will yield average check times of 210 wires/min. and 10 minutes load-unload time. Based on these improvements the second AWT will check forecasted wires thru fiscal 1971. If we do not implement all the improvements, the present AWT would be able to check only 65% of 1st Quarter 1970 and 52% of 4th Quarter 1970.

Fiscal "70" Manufacturing Wire Wrap Requirement
(30 Gauge)

Logic Type	No. Wires	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
		Qty.	No. Wires	Qty.	No. Wires	Qty.	No. Wires	Qty.	No. Wires
Linc M	3500	75	262,500	75	262,500	75	262,500	100	350,000
Linc P	4500	75	337,500	75	337,500	75	337,500	100	450,000
PDP-8/I	4500	360	1,620,000	360	1,620,000	360	1,620,000	360	1,620,000
PDP-8/L	2300	600	1,380,000	600	1,380,000	600	1,380,000	600	1,380,000
PDP-9/I	8000	45	360,000	60	480,000	75	600,000	90	720,000
BA08A	1850	150	277,500	150	277,500	150	277,500	150	277,50
DC08's	1000	100	100,000	100	100,000	100	100,000	100	100,00
DW08A	560	150	84,000	150	84,000	150	84,000	150	84,00
W08B	560	10	5,600	10	5,600	10	5,600	10	5,60
MM8I	930	120	111,600	120	111,600	120	111,600	120	111,60
PDP-14	500	100	50,000	200	100,000	300	150,000	400	200,00
PDP-11	500	---	-------	100	50,000	300	150,000	500	250,00
BA12	1850	30	55,500	30	55,500	30	55,500	30	55,50
TOTAL		1815	4,644,200	2030	4,864,200	2345	5,134,200	2710	5,604,20

sm

Fiscal "70" Manufacturing Wire Wrap Requirement
(24 Gauge)

Logic Type	No. Wires	1st Quarter		2nd Quarter		3rd Quarter		4th Quart	
		Qty.	No. Wires	Qty.	No. Wires	Qty.	No. Wires	Qty.	W:
184	500	14	7,000						
804	900	60	54,000	60		60		60	
689AG	1900	30	57,000	30		30		30	
637	500	15	7,500	15		15		15	
AA05	900	3	2,700	3		3		3	
AD08A	230	10	2,300	10		10		10	
AD08B	380	15	5,700	15		15		15	
AF0's	950	60	57,000	60		60		60	
AG12	500	35	17,500	35		35		35	
AM12	500	35	17,500	35		35		35	
AM08	570	25	14,250	25		25		25	
AX08A	1050	35	36,750	35		35		35	
RS08 & RS09	350	240	84,000	240		240		240	
TC01	1500	75	112,500	75		75		75	
TC02	1500	15	22,500	15		15		15	
TC58	1850	21	38,850	21		21		21	
TU20(A)	800	70	56,000	70		70		70	
AF16	520	21	10,920	21		21		21	
DF32	920	270	248,400	270		270		270	
DM01	1100	70	77,000	70		70		70	
DP01A	360	11	3,960	11		11		11	

PDP-10 (24 Gauge)

Logic Type	No. Wires	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
		Qty.	No. Wires	Qty.	No. Wires	Qty.	No. Wires	Qty.	No Wir
KA10	16000	12	192,000	15	240,000	21	336,000	24	384
TD10	2600	18	46,800	18	46,800	18	46,800	18	46
MA10	5500	45	247,500	45	247,500	50	275,000	60	330
DC10A	1800	12	21,600	12	21,600	12	21,600	12	21
DC10B	480	36	17,280	36	17,280	36	17,280	36	17
DF10	2880	36	103,680	36	103,680	36	103,680	36	103
RC10	3650	18	65,700	18	65,700	18	65,700	18	65
DA10	1800	12	21,600	12	21,600	12	21,600	12	21
BA10	1900	10	19,000	10	19,000	10	19,000	10	19
164 (MB10)	1900	---	-------	---	-------	---	-------	---	---
GP10	650	3	1,950	3	1,950	3	1,950	3	1
RA10	3000	3	9,000	3	9,000	3	9,000	3	9
RP10	3000	6	18,000	6	18,000	6	18,000	6	18
TOTAL			764,110		812,110		935,610		1,038

sm

To: Operations Committee

digital INTEROFFICE MEMORANDUM

DATE: March 25, 1969

SUBJECT: Investment in Customers

TO: Win Hindle

FROM: Ed Schwartz

Recently a situation came to my attention which I think should now be brought to your attention for consideration.

I have been informed that certain of our high-level employees in Canada, and perhaps even in the United States, have invested in one of our customers which has gone public. Ordinarily I would not be concerned with this; however, the failure or success of our customer's business is substantially and primarily dependent upon its relationship with us.

This kind of situation smacks of a conflict of interest and therefore should be considered by any of our management team before embarking upon same. I think this would be a proper discussion either before the Operations Committee or the Personnel Committee.

I await your advice.

EAS:o

CONFIDENTIAL

digital INTEROFFICE MEMORANDUM

DATE: April 14, 1969

SUBJECT: Senior Personnel Hires
Current Open Requisitions

TO: Ken Olsen

FROM: Pete Koch

Attached is the information you requested from Graydon on Friday.

Copy to Operations Committee
from Ken Olsen
4-18-69

CONFIDENTIAL

SENIOR PERSONNEL HIRES
and
CURRENT OPEN REQUISITIONS
(over 17K)

July 1,1968 - April 7, 1969

GROUP	HIRES		OPEN REQUISITIONS
	NAME	POSITION	
Finance	S. Sobol	Staff Analyst	V.P. Finance
T. Johnson	W. Gabrielson	Sr.Sales Engr.-Rochester	Sales Manager-Twin Cities
	E. Stewart	Sr.Sales Engr.	Sales Manager- N.Y.C.
	J. Mason	Module Sales Spec.	Sales Manager- Chicago
7	R. Walsh	Contracts Manager	
	M. Myers	Mgr.,Software Supp.-Europe	3
	T. Lawrence	District Mgr.-Geneva	
	G. Fair	Mgr.,Software Supp.-Central	
S. Olsen	D. Brevik 1	Marketing Spec.-PDP-9	NONE 0
N. Mazzarese	R. Noonan	Marketing Mgr.-DAC	Engineering Mgr.-PDP-8
	W. Diehl 2	Marketing Mgr.-INDAC	1
W. Hindle	J. Bell	Prog. Lang. Spec.	Training Manager 1
	F. Wilhelm 2	Engineering Mgr.-PDP-10	

CONFIDENTIAL

Page 2. Senior Personnel Hires and Current Open Requisitions (over 17K) July 1-April 7, 1969

GROUP	HIRES NAME	POSITION	OPEN REQUISITIONS
P. Kaufmann	A. Sherman	Sr.Design Engineer	Central Planning Manager
	E. Corell	Sr.Design Engineer	Materials Manager
	P. Schneebeli	Sr.Design Engineer	Production Manager
	J. Ginzberg	Sr.Design Engineer	
8	A. Erney	Q.C. Engineer	
	R. Puffer	Manager,Mfg.Engr'g	3
	K. Schlenker	Manager,Mfg.Controls	
	J. Lawrence	Ind. Packaging Engineer	

digital INTEROFFICE MEMORANDUM

DATE: April 7, 1969

SUBJECT: Manufacturing Projects

TO: Operations Committee

FROM: Ed Savage

Attached is the proposed budget for manufacturing engineering projects for Fiscal Year 1970. The level of expenditure requested is the same as in past period as a relationship to volume.

Approval or disapproval is required to enable the various cost center's involved to consider this element of cost in their respective budgets.

ELS/ba
Attachment

April 1, 1969

MANUFACTURING PROJECTS

Discrete Project No.	Project Title	FY Qtr 1	FY Qtr 2	FY Qtr 3	FY Qtr 4	FY Total
	Mounting Technique For 288 Pin Block	8.3	8.3	--	--	16.(
	New Packaging Techniques	--	--	10.2	10.2	20.4
97 07113	Enclosure Design + Bezels	6.5	6.1	2.6	2.6	17.8
	Techniques for New Console Switches + Lights	3.5	3.5	3.0	--	10.(
	Wire Wrap -- Canada	13.0	8.0	9.0	--	30.(
97 07139	Module Support	9.5	7.5	9.5	9.5	36.(
	AWT #2 (Maynard or Canada)	15.0	15.0	10.0	--	40.(
	Second AWT for Canada	--	--	15.0	15.0	30.(
	Module Testing AWT (for Wood)	--	5.0	--	20.0	25.(
97 07141	Computer Support	9.5	9.5	7.5	9.5	36.(
97 07132	Insertion Machine	8.0	10.0	--	10.0	28.(
	Fab Shop N.C.	3.0	4.0	3.0	4.0	14.(
97 07406	.01 Capacitor Inserter	--	10.0	--	--	10.(
	Read Only Memory	10.0	10.0	10.0	10.0	40.0
	Environmental Equip. for Q.C. Test	2.0	2.0	3.0	3.0	10.0
97 07407	European Manufacturing Support	10.0	10.0	10.0	10.0	40.0
97 07409	Canada Support	7.0	7.0	7.0	7.0	28.0
97 07170	Puerto Rico Support	7.0	7.0	7.0	7.0	28.0
	Unassigned	30.0	30.0	30.0	30.0	120.0
	TOTAL	142.3	152.9	136.8	147.8	579.8