digital EQUIPMENT
AUSTRALIA PTY. LTD.

CENTRAL COMPUTING EQUIPMENT AND ASSOCIATED SYSTEMS AND FACILITIES FOR UNIVERSITY OF QUEENSLAND AND GRIFFITH UNIVERSITY

TENDER FORM

TO: REGISTRAR
UNIVERSITY OF QUEENSLAND
ST. LUCIA, QLD. 4067

We, the undersigned, do hereby tender to supply and install computing equipment and associated systems, facilities and components at the Prentice Computer Centre, University of Queensland, in accordance with the tender documents submitted herewith including the schedules and supporting material.

FULL NAME OF TENDERER	DIGITAL EQUIPMENT AUSTRALIA PTY. LTD.
SIGNATURE OF TENDERER OR AUTHORIZED REPRESENTATIVE	B Tamock
POSITION OF REPRESENTATIVE	QUEENSLAND MANAGER
ADDRESS OF TENDERER	50 WATER STREET, SPRING HILL BRISBANE
SIGNATURE & ADDRESS OF WITNESS	J Day, 50 WATER ST. SPRING HILL, BRISBANE
DATE	28/2/77

ME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. DATE 28TH FEBRUARY, 1977

Item	Total installed price	Capability/capacity and other comments reflecting on performance of initial system
RDWARE -		
Central Processor(s)	SEE UQCC02	No of units .1.. For each unit: Average instruction rate (state basis) 1.4 .x10^6/sec Average instruction length .1 .words of .36 .bits
Primary Memory		Cycle time (excluding interleaving) ...1x10^{-6}sec Capacity .512K words of .36 bits Interleaving YES, 4 WAY Number of ports .8..
Secondary Memory (if applicable)		
Disk Drives		Number of drives ..5. Total Capacity 1000 .M chars For each Drive: Transmission rate 806.x10^6 char/sec Average track access time (state basis) 28.mse Rotation time 16..6.msec
Magnetic Tape Transports		Number of units .2.. For each unit: Transmission rate .120.Kchar/sec Density .1..6.Kchar/in Number of tracks .9...
Line Printer		Print rate 1220 .lines/min Line width 132 .char Number of fonts ...2
Card Reader(s)		No of units .N/A Read rate .N/A cards/min
Controllers and Switches linking the above items		
Front-end Communications System		Total number of lines .128 Async 8 synch. (2 x DN87S) Total bandwidth .10K char/sec full duplex
[illegible]	1,169,974	

PRICE/PERFORMANCE SUMMARY - INITIAL SYSTEM

Item	Total installed price	Capability/capacity and other comments reflecting on performance of initial system
Brought Forward	1,169,974	
ENGINEERING SPARES (Col 7 UQCC03)	148,000	
SOFTWARE (including sources)		
Operating System		
Communications	No Charge	
FORTRAN IV	(Included Item 1 and 3	
COBOL	UQCC02)	
Assembler		
Other languages included in paragraph 10.12 (or recommended equivalent)		
Other software essential to effective operation of initial system.		
Total Software (Col 5 UQCC04)		
ALL OTHER CHARGES (Col 5 UQCC05)	10,000	
TOTAL INSTALLED PRICE OF INITIAL SYSTEM	$1,327,974	

SCHEDULE DQCC02

HARDWARE PRICES - INITIAL SYSTEM

(if prices subject to variation state basis of variation at foot of schedule)
(prices must be given for individual items)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. DATE 28TH FEBRUARY, 19

ITEM			PURCHASE					ADDITIONAL INFORMATION
Item No.	Identification No.	Short description	Price including installation and acceptance costs (excluding freight, customs and primage) ($A)	Freight ($A)	Customs and primage ($A)	Total price ($A)	Monthly maintenance (including parts and one-shift operation) ($A p.m.)	(i) Name of pr manufactur (ii) Date firs installed (iii) Warranty period
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1090-HB	KL10, RTP06-B, 256KW, TOPS-10 license, QH505 license, Software Maintenance Service, 13 training credits, LA36-C, DN87S, 16 asynchronous lines				731,600 ✓	2,010	
2	MH10-L	256K word memory				153,400 ✓	654	
3	DN87S-AB	Second comm. system				38,940	226	

HARDWARE PRICES - INITIAL SYSTEM

(if prices subject to variation state basis of variation at foot of schedule)
(prices must be given for individual items)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. DATE 28TH FEBRUARY,

ITEM			PURCHASE					ADDITIONAL INFORMATIO
Item No.	Identification No.	Short description	Price including installation and acceptance costs (excluding freight, customs and primage) ($A)	Freight ($A)	Customs and primage ($A)	Total price ($A)	Monthly maintenance (including parts and one-shift operation) ($A p.m.)	(i) Name of manufact (ii) Date fi installe (iii) Warrant period
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4	8 x DN81-H	8 synchronous lines				33,700	209	
5	DN81-H	Cabinet plus 16 asychronous lines				12,200	61	
6	6 x DN81-ED	16 x 6 asychronous lines (system total 128 asynchronous)				48,285	334	
7	2 x DN81-FA	16 lines 20mA signal				2,240	35	
		TOTALS						

SCHEDULE 3QCC02

HARDWARE PRICES - INITIAL SYSTEM

(if prices subject to variation state basis of variation at foot of schedule)
(prices must be given for individual items)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD.

DATE 28TH FEBRUARY, 19

ITEM			PURCHASE					ADDITIONAL INFORMATION
Item No.	Identification No.	Short description	Price including installation and acceptance costs (excluding freight, customs and primage) ($A)	Freight ($A)	Customs and primage ($A)	Total price ($A)	Monthly maintenance (including parts and one-shift operation) ($A p.m.)	(i) Name of pr manufactu (ii) Date firs installe (iii) Warrant period
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8	14 x DN81-FC	112 lines EIA signal			15 354	37,005	382	
9	TU45B-EB	Magtape & control			✓	31,150	196	
10	TU45A-EF	Second magtape drive			✓	16,520	131	
11	LP100-BB	Charaband LP with 2 fonts			✓	76,700	371	
12	4 x RP06-AB R+ 20	Additional disk drives (system total of 5) DISC	($43,247 00)		43 248 12 383	172,990	828	
	2 PACKS							

SCHEDULE CC02

HARDWARE PRICES - INITIAL SYSTEM

(if prices subject to variation state basis of variation at foot of schedule)
(prices must be given for individual items)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD.

DATE 28TH FEBRUARY,

ITEM			PURCHASE					ADDITIONAL INFORMATION
Item No.	Identification No.	Short description	Price including installation and acceptance costs (excluding freight, customs and primage) ($A)	Freight ($A)	Customs and primage ($A)	Total price ($A)	Monthly maintenance (including parts and one-shift operation) ($A p.m.)	(i) Name of pr manufactur (ii) Date firs installed (iii) Warranty period
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
13	Warranty	12 months				65,244		
14	Trade-in	Trade of KA10, 3 x MA10, 2 x TU30, DF10, RP10-C				- 150,000		
15	Discount	University discount				- 100,000		
		TOTALS				1,169,974	$5,437	

SCHEDULE UC 3 ENGINEERING SPARES PI 3 - INITIAL SYSTEM

(prices must be given for individual items to include all initial spares, special tools, diagnostic programs engineering documentation and any other items necessary for the University to conduct maintenance on the initial equipment)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. DATE 28TH FEBRUARY, 197

ITEM			PURCHASE					Other charges payable
m No.	Identification No.	Short description	Price including acceptance costs (excluding freight, customs and primage) ($A)	Freight ($A)	Customs and primage ($A)	Total price ($A)	Annual continuing charges (if applicable) ($A p.a.)	($A)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	KL10B	Spares kit	126,000					
2	MH10	Spares kit	17,000					
3	DN87S	Spares kit	7,000					
4	LP07	Spares kit	17,000					
5	TU45	Spares kit	9,000					
6	RP06	Spares kit	31,000					
			207,000					
7	Discount applicable only if spares complement purchased with initial system		-103,000					
8	ZH005-C	Diagnostic & Maintenance Documentation.	44,000					
		TOTALS	148,000					

CHEDULE UQCC04

SOFTWARE PRICES - INITIAL SYSTEM

(prices must be given for individual items; the schedule must include communications software, operating system, essential languages (or recommended substitutes) and all other software essential for the viable operation of the initial system)

AME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. DATE 28TH FEBRUARY, 1977

ITEM				PURCHASE			Annual rental price including maintenance	Other charges payable
tem No.	Identification No.	Short description including version no.	Prime supplier	Price including sources ($A)	Price excluding sources ($A)	Annual maintenance price ($A p.a.)	($A p.a.)	($A)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

SEE PROPOSAL SECTION (11.03) 2.9

SCHEDULE UQCC05

OTHER PRICES - INITIAL SYSTEM

(Prices must be given for individual items. Prices are required for all items arising out of the specification for the installation and effective operation of the initial system not included in Schedules UQCC02 to UQCC04)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD.

DATE 28TH FEBRUARY, 1977

ITEM				PURCHASE		Annual rental charge (where applicable)	Basis of charging (where applicable)
Item No.	Identification No.	Short description	Specification paragraph reference no.	Price installed ($A)	Annual continuing charges ($A p.a.)	($A p.a.)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Engineer Training	20 Weeks Customer Engineer Training	8.01 (viii)	10,000			
			TOTALS	10,000			

DULE UQCC06 HARDWARE PRICES - EXPANDED SYSTEM (TWICE THROUGHPUT CAPACITY OF INITIAL SYSTEM)

(prices must be given for individual items)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. DATE 28TH FEBRUARY, 1977

ITEM			PURCHASE			
em No.	Identification No.	Short description	Price including installation and acceptance costs (excluding freight, customs and primage) ($A)	Freight ($A)	Customs and primage ($A)	Total price ($A)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	KL10-B	Expansion to 1099				466,000.00
2	(2) MH10-L	Add 512K Words				306,800.00
3	RTP06-BB	RP06 and Control				61,700.00
4	(4) RP06-C	All Drives Dual Access				24,310.00
5	(2) DN87S-AB	Comm Systems				77,880.00
		TOTALS				936,690.00

SCHEDULE UQCC07

SOFTWARE PRICES - GENERAL LIST

(Prices must be given for individual items. The schedule should include all items of software supported by the manufacturer or from other sources recommended by the manufacturer)

NAME OF TENDERER DIGITAL EQUIPMENT AUSTRALIA PTY. LTD.

DATE 28TH FEBRUARY, 1977

ITEM				PURCHASE			Rental price including maintenance	Other charg payable
Item No.	Identification No.	Short description including version no.	Prime supplier	Price including sources ($A)	Price excluding sources ($A)	Maintenance price ($A p.a.)	($A p.a.)	($A)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	QH045	IQL Extended	DEC	16,500		1,428		
2	QH010	DBMS-10 V3	DEC	27,500		3,245		
3	QH071-A	APL-10/SF	DEC	22,500		1,947		
			TOTALS	66,500		6,620		

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

Almost exactly nine years ago, the University of Queensland ordered one of the first dual KA10 PDP-10 systems, the largest order placed up to that time with a very small organisation called Digital Equipment Australia. During those years, we have grown rapidly, only with the business and excellent references from customers like the University, to become a major equipment supplier in Australia. During those same years University needs changed dramatically from those of a computer science and engineering facility to those of a service facility tasked with satisfying the diverse needs of 2,500 registered users in 124 widely different departments responsible for the education of 18,000 students. The Prentice Computer Centre is now responsible for serving the computing needs of Griffith University as well.

Just as the orientation of computing within the University has shifted from research toward general service, so has Digital Australia's orientation shifted from a relatively narrow scientific and educational market to a range as wide as any manufacturer in the industry. We have also concentrated on the aspect of offering a wider range of services to our clients, and our virtually non-existent (in 1968) engineering and software service staff has grown to nearly 200. Consistent with this increasing emphasis on service as distinct from hardware, we have followed the industry trend of "unbundling" our various service costs and charging each customer for what he elects to use. This has worked to the satisfaction of the great majority of users who concentrate on a small subset of our software products and services. In the case of the University and other educational customers who have a genuine need for "a little bit of everything", unbundling has presented difficulties in the vendor-user relationship.

By and large, the relationship between Digital and the University since your initial purchase, has been excellent, considering the unforseen changes happening in both organisations.

This year, as you have clearly expanded the 1055 to the limit of its practical capacity, we hope that once again our proposal is looked upon favourably, not because of the past, but because of what we offer you as being the most practical, most powerful manner in which to satisfy current and future growth requirements. As you read this proposal, you will find a few places where we have "bent" certain of our new procedures developed since we sold you the KA10. In each case the result is to your advantage as one of the customers who made our growth possible. Should you choose to accept our proposal, you will become the largest DECsystem-10 user outside North America (at least to our knowledge), and that status should not detract from the reputation of the University as a trend-setter. We hope, in fact, that our proposal excites you as much as it does us!

1.2 COMPUTER CENTRE OBJECTIVES

The Prentice Computer Centre is an organisation serving 2,500 users in 124 departments on two campuses (University of Queensland and Griffith University). It is responsible for the management of central computing facilities as well as providing systems and technical support for both Universities for teaching, research and administrative work.

Currently the Computer Centre uses a Digital DECsystem-1055 with 123 terminals and four remote batch stations, running three shifts Monday through Friday. This system is saturated to capacity. Its replacement must be operational by 1978, and must be capable of replacing the 1055 entirely by 1980. Replacement is complicated by the wide range of applications software, much of it interactive, developed by the user population. Not only do the Centre's clients want a dramatic increase in visible performance from the new system, but they will not look kindly upon any replacement which fails to offer at least the timesharing and batch user facilities now available on the 1055.

Communications software developed by the Centre has permitted earlier implementation of a working network of minicomputers than would have been the case had the University waited for the manufacturer to release standard network software. While desiring to remain a leader in network implementation, the Centre wants to reduce the costs associated with maintaining "home grown" software. The replacement system should offer network software with at least the facilities currently enjoyed by the University, and preferably with many additional features.

The University must meet its educational goals in a time of ever-diminishing grants and other sources of income. Thus the recurring cost of overall operation of replacement equipment is as significant as the cost of purchase. The vendor must consider the physical requirements cost, maintenance cost and the cost of software including source code.

1.3 PROPOSED SOLUTION

Digital Equipment Australia proposes to install a DECsystem-1090 running in parallel to the existing 1055, which would be reduced to a single processor 1050 configuration by the deletion of certain peripherals and the older DEC memory cabinets as well as the KA10. The 1050 could then be used as a teaching machine as well as back-up to the 1090.

The 1090 would include one billion bytes of on-line mass storage, plus 2.5 million bytes (512K words) main core memory. There is no need for a swapping device such as the RD10 in such a 1090 configuration. As configured, the 1090 meets all requirements set out in the RFP. More significantly, it meets the 30% growth requirement for eight years (see next Section).

The University is invited to share the cost of a special hardware maintenance course at Marlboro, Massachusetts for KL10B customers desiring to do their own hardware maintenance. We will provide a one year warranty, plus are heavily discounting the cost of a full spares kit for the proposed configuration. Digital will help defray the expenses of software maintenance training, also in Marlboro. We propose a licensing arrangement whereby the University continues to get source code for all compilers and utilities on the DECsystem-10.

1.4 EXPANSION CAPABILITIES

The proposed DECsystem-1090 can be expanded to approximately six times the capacity of the initial system, which is already more than twice as powerful as the existing 1055. Details of the various expansions by hardware type are given in Section 2.18.

1.5 PRICE AND DELIVERY SUMMARY

The proposed DECsystem-1090, including software, twelve months warranty, spares, diagnostic and maintenance documentation, is priced at $1,327,924 as per our schedules. This price is based on the exchange rate of A$1.00 = US$1.08.

If Digital receives a firm purchase order from the University by 27 May 1977, we can have the system installed and operational before Christmas 1977.

The $44,000 included in the above price for diagnostic and maintenance documentation may be deferred until twelve months after installation when in-house maintenance commences.

Also, the $65,244 warranty amount, which is in fact a twelve months Maintenance Contract price, would be expended throughout the first year of installation via three-monthly invoices.

Our offer, which proposes that the University maintain a continuing DECsystem-1050 service, ensures that operations income to the University undergoes minimum disturbance. Also, familiarity of the Computer Centre clients with the DECsystem-10 ensures that service income on the DECsystem-1090 becomes available to the University in the shortest period!

2.0 PROPOSED SOLUTION

2.1 STATEMENT OF THE PROBLEM

For more than eight years the Prentice Computer Centre has provided computing resources, initially to only the most technically oriented departments, but increasingly to the University at large, based on a dual KA10 DECsystem-1055. Consistent with the directions of the Australian Universities Commission, every effort has been made to extend existing facilities rather than replace the entire installation. At this point in time, with 123 terminals, 4 remote batch stations, 124 client departments and 2,500 individual users, the 1055 has effectively reached its capacity, hence the first objective of the Centre in procuring new equipment is to maximise increase in capacity.

If the solution to this requirement for a significant, readily visible increase in capacity means a change in operating system or even manufacturer, then there must be a period of changeover such that users of the 1055 can convert their programs and control language, also transfer or convert data files into the replacement system. In this event the new equipment must be able to replace the 1055 in 1980.

Not only must there be a dramatic performance improvement, but the replacement system must by no means be configured near the limits of its potential capacity. In fact, the new configuration must be expandible to meet a growth rate estimated at 30% per annum for at least 8 years following installation, (i.e. over 6 times the initial capacity). As the RFP calls for the capability to handle 100 jobs from 200 terminals in a virtual storage of 1M 36-bit words, with 1B 8-bit bytes of on-line mass storage, this implies that the system tendered should be capable of expansion to 600 jobs from 1200 terminals, with at least 6M 36-bit words virtual addressing (i.e. 23-bit addressing) and 6B bytes of mass storage. AND the upgrade steps to achieve this level of capacity should not require expenditure at any one point, more than a fraction of the initial procurement cost (e.g. $300-400,000 maximum).

There are other significant factors besides the hardware performance at a price of roughly $1.2M. The University must keep the operational (i.e. recurrent cost) of the facility to a minimum, and for this reason the vendor must help the University to perform all hardware maintenance on the system following the warranty period. This implies that the University must have access to the latest spares, engineering training and documentation which the vendor would normally restrict to his own employees as service contracts are a significant source of revenue. Another aspect of the upgrade or replacement which is vital to the University, is the availability of source code for all compilers and other tendered software. Today, vendors seldom release source code as their software investment often far exceeds their hardware investment in a particular system. Furthermore, at a time when manufacturers are trying to recoup that software investment wherever possible by selling unbundled packages at not insignificant prices, for educational purposes the University requires the broadest possible range of software.

This is how we view the University's problem as we set out to determine our best solution.

2.2 ALTERNATIVES CONSIDERED

Since the University of Queensland is already using a Digital 36-bit DECsystem-1055, it was fairly obvious that the only logical replacements or upgrades would come from the Digital 36-bit computer range. Three major 36-bit computers have been announced by Digital since the University purchase in 1967: the KI10 in 1971, the KL10 in 1974 and the new DECsystem-20 in 1976. The KL10 superseded the KI10 so obviously the KI can be excluded as no one wants to buy obsolete equipment in a major procurement. However, the KL10 and the DECsystem-20 seem to overlap in many respects, and Digital Australia has been observed promoting the -20 virtually to the exclusion of the -10. In fact, we (Digital) see the two products as a marketing tool aimed at attracting a wider customer base, and we believe each system is an excellent solution for the problems of the market it is aimed at. In the following paragraphs we risk being quite candid about how we view the two systems, in confidence that, by understanding our perspective, you will gain insight into the advantages of either system.

In January, 1976 Digital Equipment announced a "new" DECsystem-20 series commencing with the 2040. The more powerful 2050 was announced in November. DECsystem-10 customers have reacted to the 20 with a mixture of emotions. Many see the 20 as the only future 36-bit offering from DEC and read between the lines that the 10 will go the way of the PDP-15 Interestingly enough, some 10 customers are buying more 10s in volume despite thorough briefings on the 20. Perhaps the 10 customers who recognise the 20 for what it is are among those with the closest ties to our Large Computer Group product line, developers of both.

About five years ago Digital had an enormous problem with its PDP-11 line. When first designed, the PDP-11 was expected to sell in configurations worth roughly US$20,000. It soon developed that the average system shipped for well over $40,000, partially because of the wide range of peripheral devices offered as options. Eventually this phenomenon reached a stage where very few systems were ever the same

configuration, and for both the technicians checking out the hardware in final test, and for the software specialists installing software in the field, the incredible variety of permutations became a nightmare. Digital solved this problem by significantly discounting "packaged systems" based on hardware "building blocks" consisting of a base CPU, memory, disk and appropriate peripheral configurations on which the hardware and software teams could gain expertise through repeat sales. At this stage (1972) DEC was already aware that labour costs were approaching 50% of manufacturing and installation (i.e. fixed per unit) cost.

In the succeeding years at least one PDP-11 product line, the Commercial Group, has found it most cost-effective in terms of both manufacture and field support (hardware and software) to severely limit the options available for configuration of a DEC Datasystem. Many salesmen have grumbled about unnecessary expense and wasted expansion and power options, but facts attest to the achievement of the stated product line goal: a DEC Datasystem works on installation, and keeps on working with a minimum of "funnies". In recent months this same group has been restricting software equally stringently to achieve the same purpose.

Since its introduction in 1971, based on a product announced four years earlier (PDP-10) as a replacement to a 1964 product (PDP-6), the DECsystem -10 has eluded truly widespread acceptance as a commercial mainframe. To be sure, the university computer centres and the timesharing bureaux have adopted the 10 with enthusiasm, as have many scientific users and a number of pioneer commercial customers (e.g. First City National Bank) but even the latter bought the 10 primarily for timesharing and communications, not for batch processing. Yet Digital, stung by criticism over its lack of COBOL and general batch capabilities, had spent literally millions developing a batch capability that, in 1974, could outperform competition (e.g. CYBER 73 reputed to be strong in batch processing.

In that year (1974) Digital began to design a "batch package" that appeared sufficiently different so as to attract attention in the commercial marketplace as a new, commercially oriented system. Batch processing was to be emphasised, some of the less commercially used languages, but a deliberate exclusion was made of the traditional DEC "real-time" capability as well as the general purpose interfacing capability to connect non-standard peripherals. In fact, only one disk model, one tape control model, and one communications interface were offered. The only selection of peripherals were between two card readers and two line printers, consistent with the "batch machine" image. Thus was the DECsystem-20 unveiled as a new system distinct from DECsystem-10.

DECsystem-20 does differ from the -10 in several respects. To begin with, it extends the functions of the integrated console PDP-11 announced earlier on the 1080 (KL10A) to include driving all low speed peripherals, everything except MASSBUS peripherals in fact. Also significantly different is the operating system, TOPS-20, based on TENEX developed by DEC customer number one, Bolt,Beranek and Newman, for use in the (U.S.) nation-wide network ARPANET. TOPS-20 appears to the non-DEC user to be much easier to learn than TOPS-10, which has a reputation for being a clever system for clever people. Commercial users are genuinely suspicious of the reliability of clever systems developed for (and sometimes by) Universities and laboratories

Simplicity has its price. The DECsystem-10 offers an unusually wide range of compilers and utilities. Conversion of these to run under TOPS-20 is a major, time-consuming task. Some systems, such as MCS, may not be converted at all. Communications, especially as regards networks, are naturally limite on a system which until recently supported only asynchronous terminals.

Simplicity also has its advantages, especially if seen from the manufacturer' viewpoint in supporting a new machine. With so few peripheral options allowe nearly all DECsystem-20 configurations are identical, or at least bear high similarity, a major advantage when developing and field testing not only a new operating system but a whole host of compilers and utilities. It is no

coincidence that the physical core limit (256K words) matches the 18-bit address limit, or that the two channels announced support one string of tapes and one of disk. To succeed in the commercial marketplace, DECsystem-20 must earn a reputation for fast installation followed by unusual reliability of both software and hardware. Also, support costs must be kept to a minimum if the low (compared to DECsystem-10) price tag is to be justified by volume sales of virtually identical configurations. In summary, "technically interesting, state-of-the-art applications" are being actively discouraged where by contrast they have always been encouraged for DECsystem-10.

All of which is remarkable, considering the DECsystem-10 and DECsystem-20 are really the same machine.

When one reads the technical literature on the -10 and -20 (KL10 series), which is deliberately restricted from general circulation, one finds that Digital's engineers never made any pretense of the identity of the CPU design. Technically there are minor backplane differences between the 1080 (KL10-A) and 2040 (KL10-C) but with the October, 1976 announcement of the 1090 (KL10-B) and 2050 (KL10-B) these have become insignificant. Both systems support cache memory, eight integrated channels, 23-bit (8 million word) virtual addressing, and the same instruction set implemented by slightly different microcode. It is possible to run TOPS-10 on the DECsystem-20 and equally possible to run TOPS-20 on the DECsystem-10. However, and this is a very important point, each operating system is designed to run in a different hardware environment with regard to peripheral and communications "front-ends".

TOPS-10 expects its peripherals, excepting the latest integrated channel devices, on the traditional external I/O BUS. TOPS-20 doesn't know about an I/O BUS, and given -20 support philosophy regarding "hairy" or obsolete peripherals, it never should support an I/O BUS. TOPS-20 expects the PDP-11 console to support everything except disk and tapes. In contrast, TOPS-10 supports its own card reader and line printers and expects PDP-11 "front ends" called DN87S to handle all terminal as well as network communications.

Actually TOPS-10 can support an incredible combination of new and obsolete hard-wired, PDP-8 based and older model PDP-11 communications options as well as the DN87S. There is no intention to burden TOPS-20 with this legacy. Both systems use identical console PDP-11s running the same software, and future communications and network support for both systems will use one or more additional PDP-11 DN87S "front-ends."

Finally, one major distinction between TOPS-10 and TOPS-20 is that only TOPS-10 can support a multiple CPU configuration such as the University's 1055 or the latest model 1099. Digital's Computer Special Systems group offers all manner of switches for memories, peripherals, channels and busses, all of which are foreign to TOPS-20.

Now that we have established some essential characteristics of DECsystem-10 and DECsystem-20, let's examine where Digital is committed to go in future 36-bit offerings. Figure 2-1 shows the long range migration strategy announce together with the 1090 and 2050 in October. Note that the 1090 is announced as being capable of running either TOPS-10 or TOPS-20. No such claim is made for the 2050 for the reasons explained above. However, what <u>is</u> claimed is that either machine can be upgraded directly to future 36-bit systems, which is not true for the older machines. The implication is that the 1090 is the last TOPS-10 system and that future systems will use TOPS-20.

In fact, TOPS-20 has considerable development yet to be done, as shown in figure 2-2. The steepest slope in the "functionality curve" is shown as occurring this year and next. By comparison, figure 2-3 shows the same curve for TOPS-10, which is fairly flat after the release of version 6.04 next year. This is because TOPS-10 is a fairly mature product, and 6.04 is expected to be the last major release, with subsequent releases to reflect maintenance and support for further software development residing in the PDP-11 network machines. Note that version 6.03 is the last TOPS-10 release which supports the KA10 CPU. Likewise, KI10 support will be dropped at some future date, possibly with 6.04. Eventually Digital hopes customers will upgrade obsolete equipment so that our internal support costs can be concentrated upon equipment owned by the majority of customers, avoiding major design problems caused by supporting peripherals existing on a small

LONG-RANGE MIGRATION STRATEGY

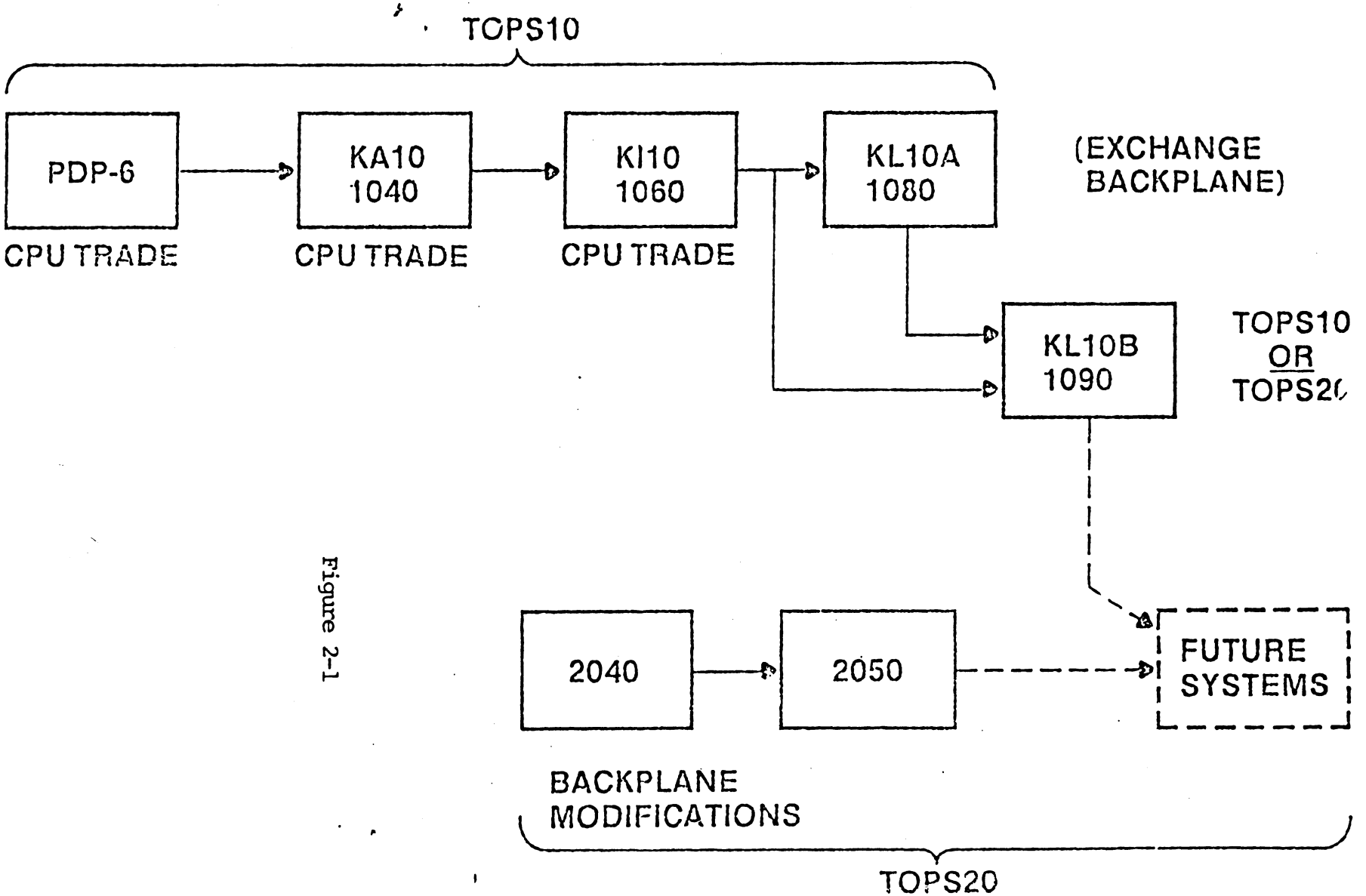


Figure 2-1

MONITOR DEVELOPMENT PHASES
FUNCTIONALITY – VS – TIME

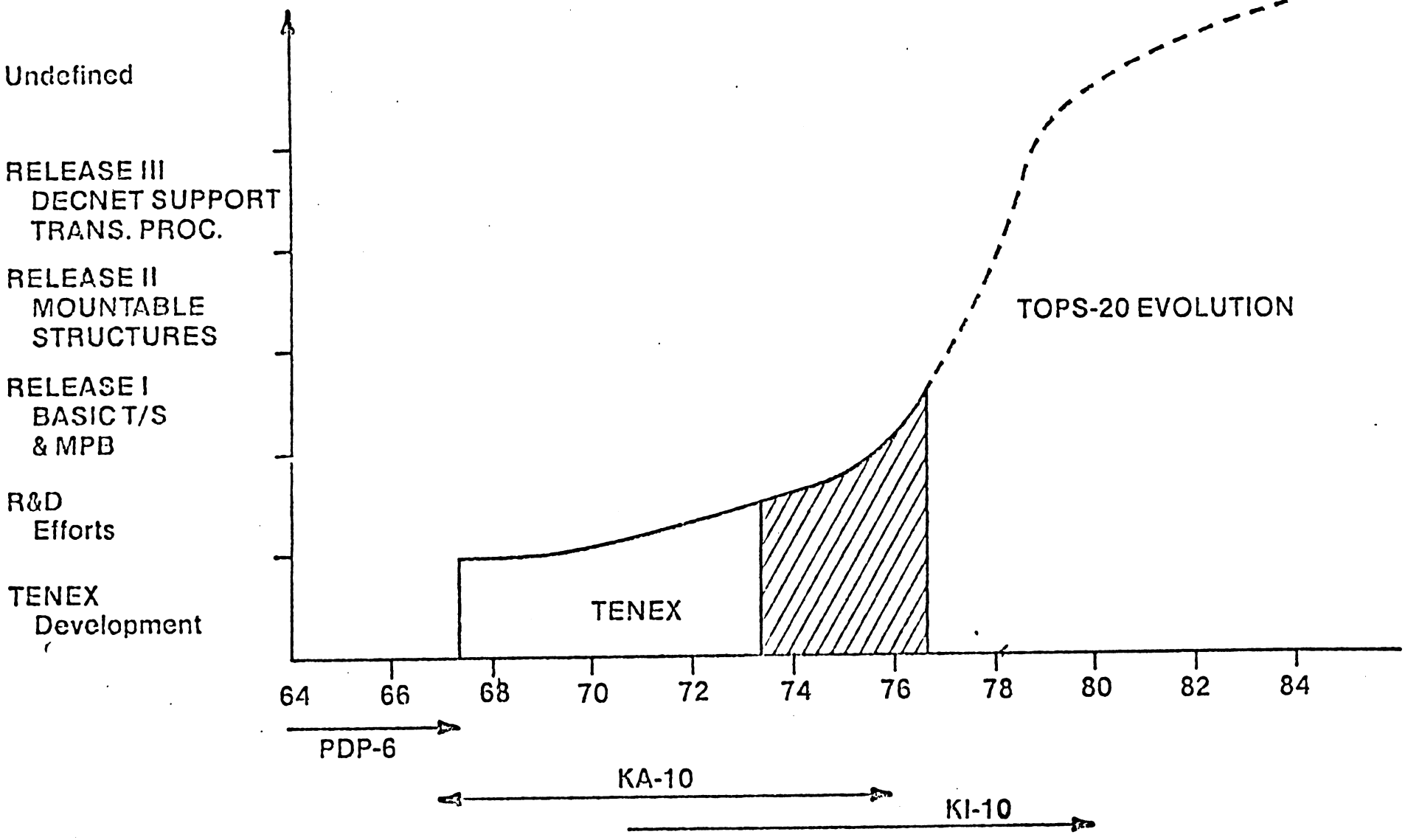


Figure 2-2

MONITOR DEVELOPMENT PHASES
FUNCTIONALITY -- VS -- TIME

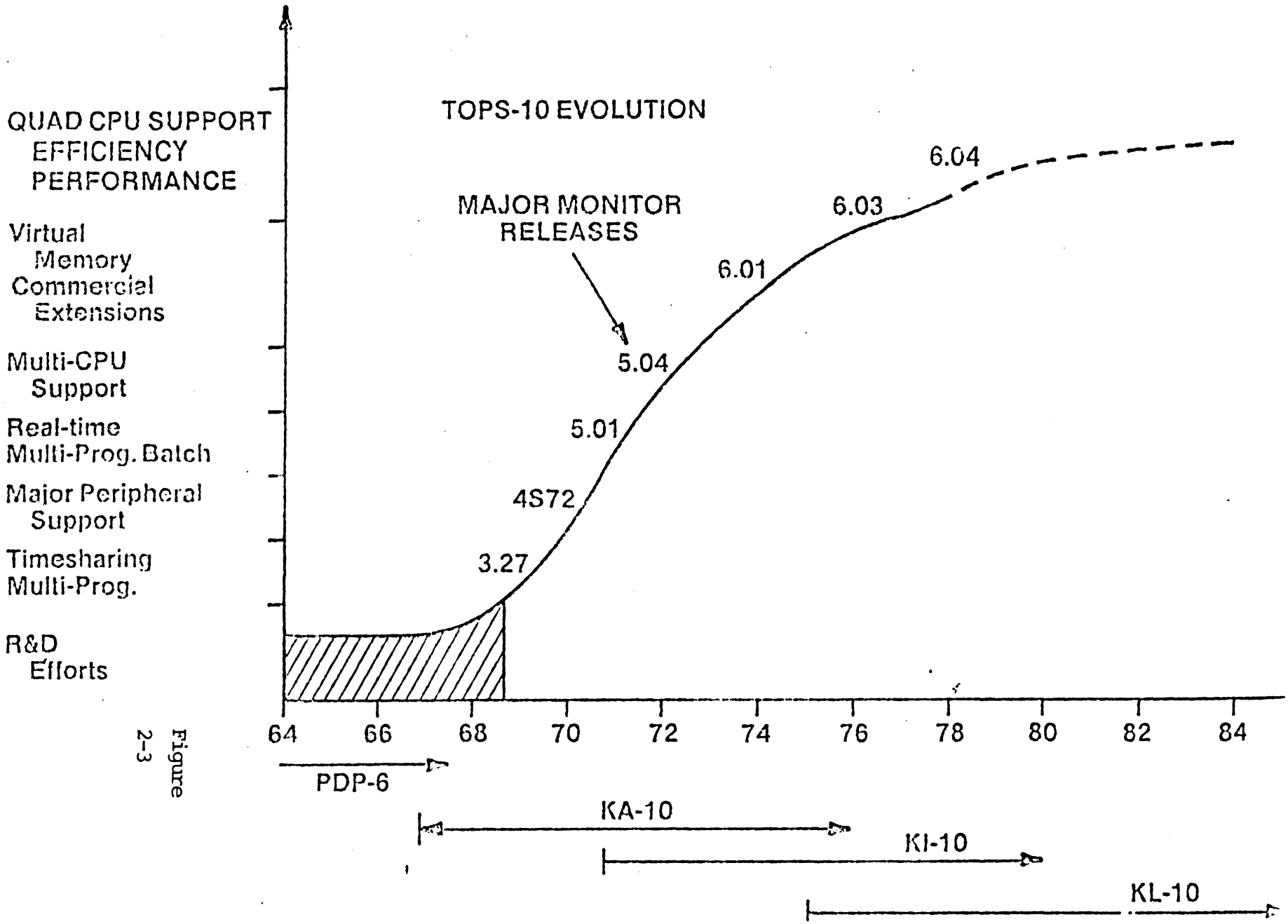


Figure 2-3

number of sites.

Figure 2-4 shows an overlay of TOPS-10 and TOPS-20 functionality, indicating that TOPS-20 will surpass TOPS-10 in functionality by 1980. The basic reason this intersection is anticipated is that at its lower price, the DECsystem-20 should overtake DECsystem-10 in population by 1979, so that more development money will continue to be spent on the higher volume system. Of course much of this is conjecture, but these are the expected events on which corporate planning is being based at present.

Just to confuse the issue, Stanford University has a dual CPU configuration running TENEX, so DEC is interested in developing a dual-20 product. Also, a small number of very competent customers have been sold DECsystem-20s with the external I/O BUS supported by extensions to TOPS-20. Finally, for the reader who has kept interest to this point, not only the microcode page fault handler but also the physical memory boxes are different (less ports on the 20 internal memory).

Figure 2-5 summarises the product capabilities of the systems considered for the University of Queensland. The 2040 is not quite twice the performance of the 1040, and is clearly not an upgrade replacement for a 1055. The 2050 has exactly the same KIPS rate (meaning number, in thousands, of instructions executed per second) as the 1090, not surprising, as they use the same processor, but the 1090 has a 10% performance edge over the 2050. Why? Because the TOPS-20 software is still heavily using the TOPS-10 compatibility package, causing unnecessary machine cycles, also the number of separate disk controllers (4 on the 1090 versus 2 on the 2050) is significant on large installations. In addition, the high performance TU70, TU71 and TU72 tape transports require the DX10 channel only supported on the 1090.

Performance of the 1099 versus the 1090 is of especial interest to a 1055 customer. When the 1055 and 1077 were introduced, the basic philosophy was to concentrate the second CPU on batch queues, while only the "master" CPU ran monitor code (because most MUUO's were non-re-entrant). The net effect

MONITOR DEVELOPMENT PHASES
FUNCTIONALITY – VS – TIME

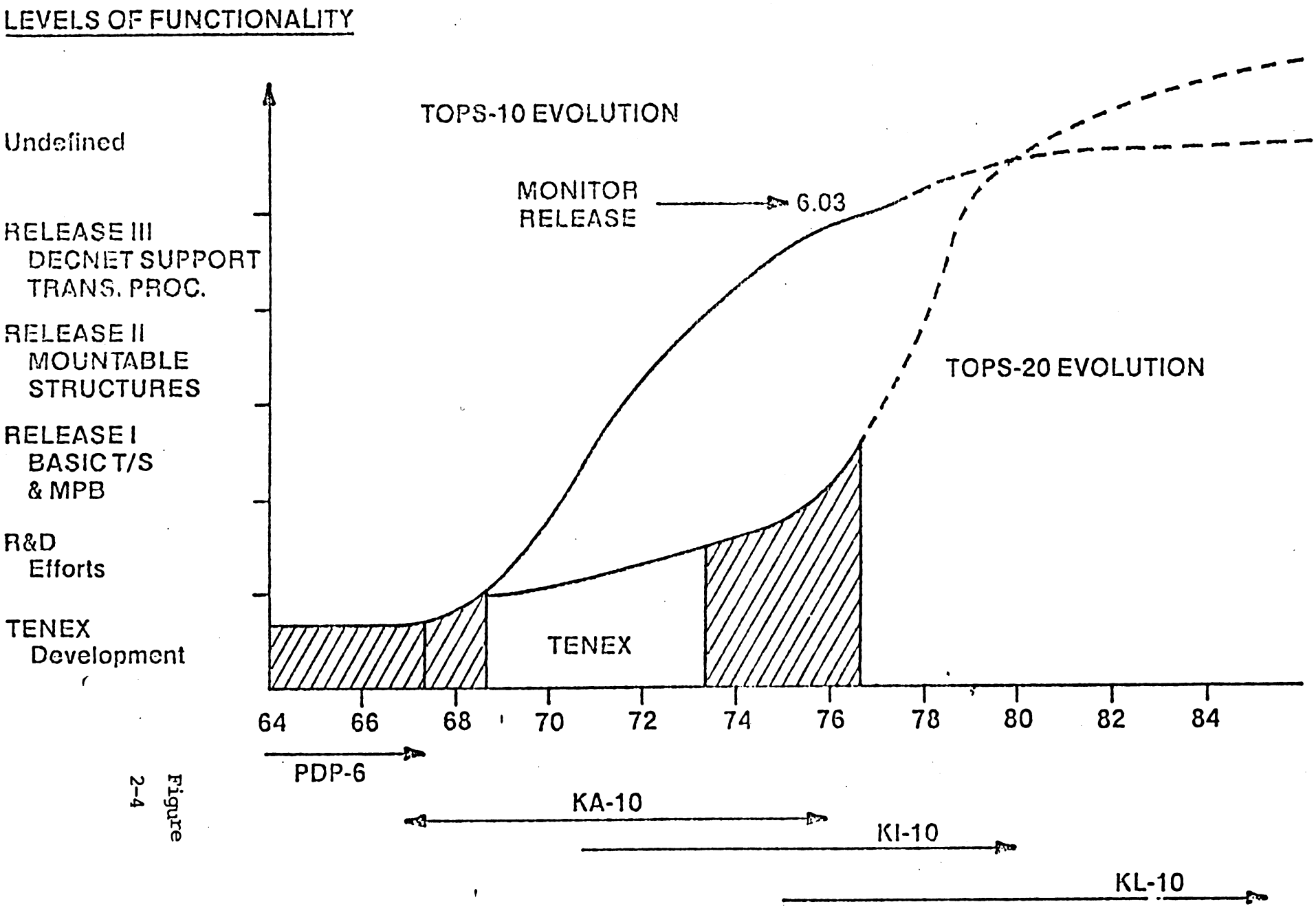


Figure 2-4

PRODUCT CAPABILITIES SUMMARY

Model	Performance Factor	KIPS	(words) Max. Core	# terminals	Maximum Bytes	Maximum System Bandwidth	Typical System Price Range
11/70	N/A	500	2M	64	1.6B	750B/KHZ	$100-225K
1040R	1X	400	256K	128	5.6B	5.0M/HZ	N/A
1060R	2.0X	700	4M	128	5.6B	5.0M/HZ	$500K average
2040	1.8X	650	256K	64	1.6B	1.5M/HZ	$300-$500K
2050	3.6X	1500	512K	128	3.2B	3.0M/HZ	$500-$700K
1090	4.0X	1500	4M	128	5.6B	5.0M/HZ	$700-$1M
1099	5.6X	3000	4M	256	5.6B	5.0M/HZ	$1M +

Figure 2-5

was to improve batch performance without downgrading terminal response. On the 1099 the philosophy is different. Both "master" and "slave" execute monitor code, at least the re-entrant MUUO's, although only the "master" can handle input/output because it has all the I/O hardware. Overall performance goes up only 40% but significantly, this configuration can maintain response to twice as many terminals.

2.3 PROBLEM SOLUTION

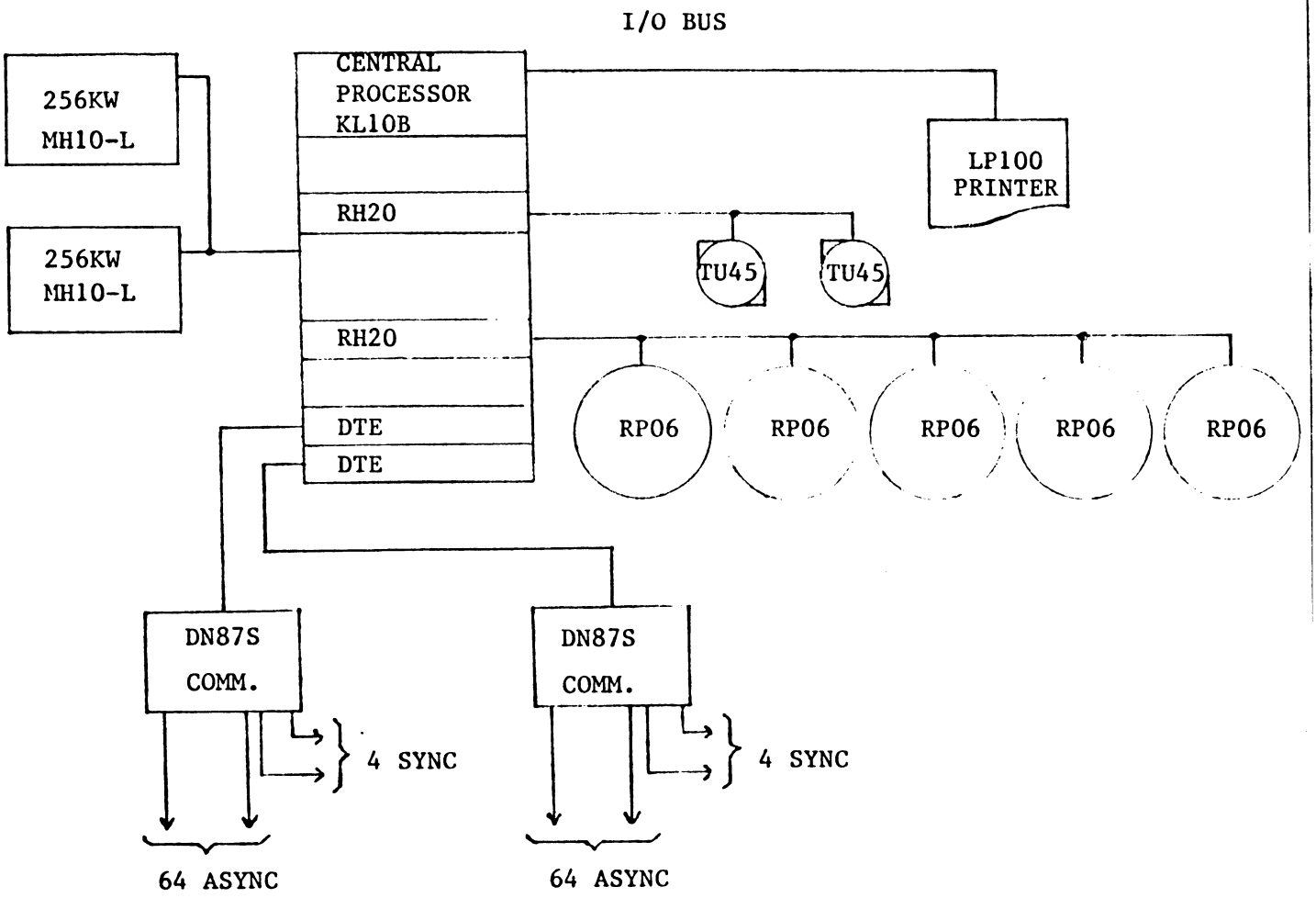
Digital proposes the KL10-B DECsystem-1090 as the most logical solution to the University's EDP requirements. But we have also considered the other aspects of the problem as addressed in 2.1 above.

We can use a KA10 processor, the three DEC MA10 memory boxes (48K) the DF10, RP10B and the two DEC TU30 magnetic tape transports from your DECsystem-1055. We propose to pay you $150,000 for this equipment, leaving you with a 192K word DECsystem-1050 with eight RP03 equivalent drives, your line printer, your two TU40 equivalent tapes, your DECtapes, plotter and all your communications equipment, including the network of terminals and four 11/10 remote batch stations. We suggest that this 1050 could be used indefinitely as a teaching facility and as a testbed or research machine to support experiments inappropriate to a large batch/timesharing system.

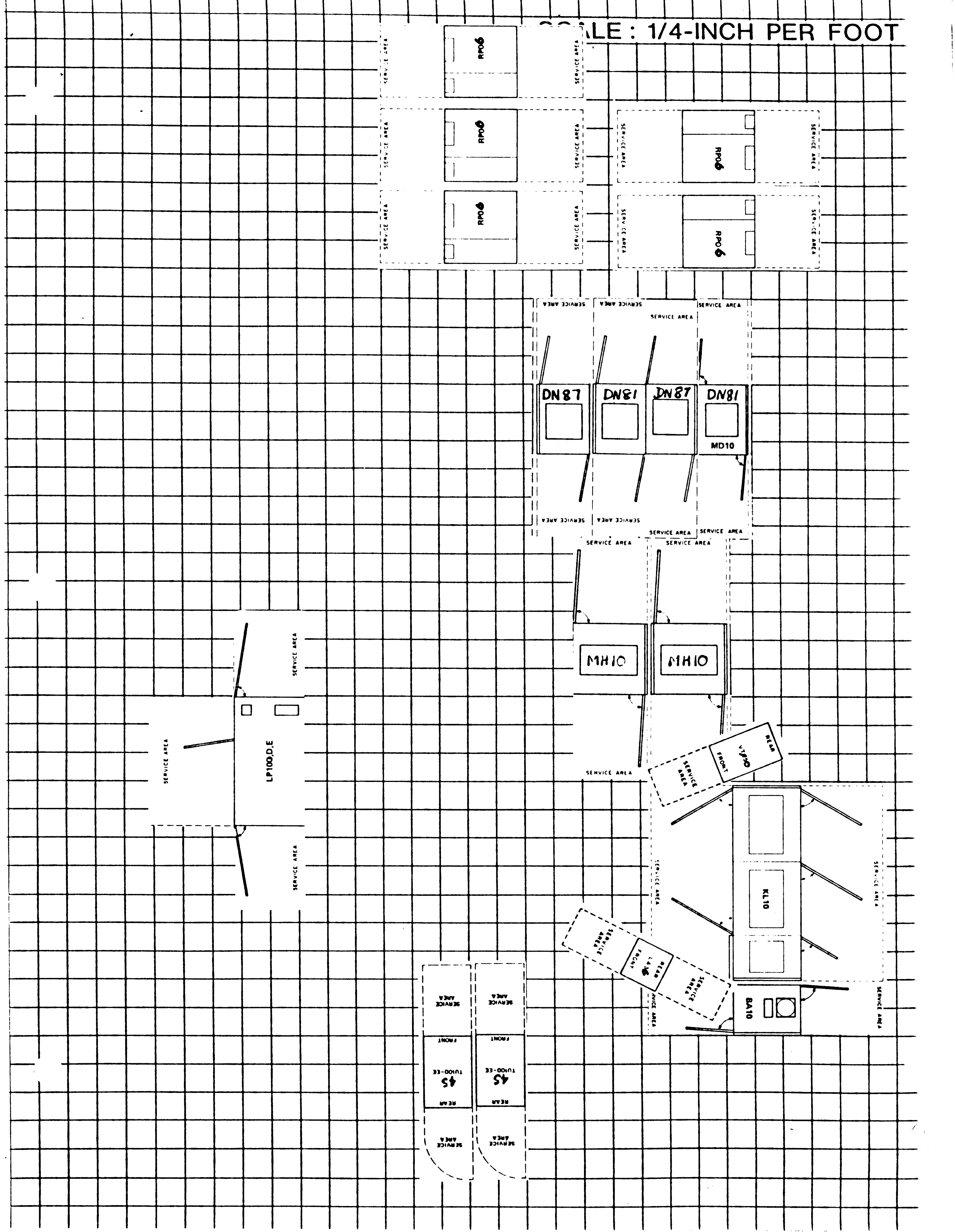
The proposed DECsystem-1090 is configured with:-

- 512K words (2.5MB) of MH10 memory
- Three PDP-11/40 subsystems, one console and two DN87S
- Five 200 MB RP06 drives for 1BB
- Two TU45 (DECsystem-20) magnetic tapes
- A 1500 lpm dual ~~port~~ font Charaband Printer
- Eight synchronous lines
- 128 asynchronous lines

This configuration is illustrated on the following diagram, followed by layout diagram.



PROPOSED CONFIGURATION


SCALE : 1/4-INCH PER FOOT
RP06
SERVICE AREA
DN87
DN81
MD10
MH10
LP100,D,E
V1750
FRONT
REAR
KL10
LA36
BA10
4S
TU100-EE

The capacity of the proposed system is more than twice that of your 1055, so the dramatic increase in performance should be clearly visible to the user, expecially the timesharing terminal user during prime shift. Not only is the KL10B four times the speed of the KA10, but more than twice the memory is available. In terms of millions of 36-bit words, you will have 250 with five RP06's versus 105 (25 with five RP02's and 80 with eight RP03's), more than double your present mass storage capacity. You have not emphasised magnetic tape requirements, but the TU45 units proposed surpass your existing units in both performance and reliability. The Charaband Printer is the latest technology impact printer on the market. We assume from previous discussions that you will transfer your CR10 card reader over to the 1090 and use your remote 11/10 card reader for the 1055. We can satisfy all your stated terminal concentration and remote batch network requirements using the new DAS92 on eight synchronous lines, or by using the more powerful DAS8X series we could simplify the network.

Since the DECsystem-1090 is 100% upwards compatible from the 1055, your users need not be concerned with 1980 or any other deadline for change-over beyond what you determine the life of the 1050 should be. Your users could use either system, or, by means of a single patch panel, could be connected to one or the other on a demand basis. If desired, we could add a DN87 to the KA10, connect it to the DN87S on the 1090, and implement our SET HOST software so that the terminal switching between systems is done by software. The SET HOST software is part of 6.03, but the DL10 plus DN87 is expensive (e.g. over $50,000), so we haven't proposed this approach. Programs and data can be exchanged via magnetic tape since identical file software is used on each system.

Expansion is addressed in 2.18 below but the proposed system will in fact meet the six-fold expansion requirement of the 30% annual growth rate. At no stage do we see a requirement for the University to spend over $300,000 for any single upgrade component.

We have also kept the other requirements in mind - we can enroll University engineers and technicians on a 20-week special course in Marlboro, starting in June or July, the cost to be shared by several users (Section 2.11). We will provide a full spares kit with our maintenance engineer for the first twelve months, replace any consumed items, and will heavily discount the kit if bought in its entirety rather than piecemeal, ensuring that the site will have the same spares as maintenance responsibility passes from Digital (warranty) to the University.

Because you already have a DECsystem-10 and are licensed to use all products distributed before "unbundling", we will confirm those licenses plus issue you a complete set of new software licenses for the 1090. You will thus have sources and can do local modifications such as accounting. We are willing to discount additional software to help you offer the widest possible selection for educational purposes.

In the following sections (2.4 - 2.17), we address how our proposal meets the specific requirements set out in your RFP paragraphs 6.0 to 19.0. Expansion is described in our Section 2.8. Contractural requirements as described in RFP paragraphs 20.0 - 27.0 are discussed under Pricing and Contracts, our Sections 4.2 - 4.8.

2.4 HARDWARE

Digital is acutely aware that in an industry where significant advances in technology occur every few months, investment in research and development is of paramount importance. One of the unique aspects of DEC Corporate philosophy is that earnings which could be expected to be spent on commissions or distributed as dividends are instead spent on research, as the company pays neither commissions nor dividends. In this atmosphere, our engineers continue to develop major products at a rate beyond our capacity to support them in the field. Hence only a fraction of these projects are announced as new products although many are continued as potential later products.

The KL10B central processor is an excellent example of a controlled product announcement incorporating successive stages of rapidly evolving technology. When the KL10A (1080) and KL10C (2040) were announced it would have been technically possible to support integrated channels, cache memory and multiple DTE-connected PDP-11 "front end" computers. However, the field logistics in terms of training, spares and software expertise were not yet in place, and these support plans always take longer to implement than the time to develop hardware in an engineering laboratory. Now that we are ready to support the KL10B as a total organisation, you will also find that the MASSBUS controllers are simplified over what they would have been if announced two years ago, thanks to experience from an ever increasing variety of MASSBUS devices on the 16-bit as well as 36-bit family. In the future, when and if 512K word external memories are reliable and easily serviced, you may see the 23-bit virtual addressing range implemented (if you want 8M words).

We cannot tell you in detail where the DECsystem-10 family is going, but as an early KA10 customer you have seen over the years with central processors, memories, disks and other key peripherals that each successive product offers better price/performance, improved reliability, smaller physical size and support requirements per unit of measure (i.e. KIPS

or MB) and lower maintenance cost per unit of measure. When the KI10 was announced in 1971 it seemed that some of our mini-computers such as the 11/45 were years ahead in logic technology. Now, partially because we have delayed announcement of new 11 processors, the KL processors lead DEC in the use of Emitter Coupled Logic (ECL). Digital will continue to expand its mainframe business only by offering successively more powerful, less expensive, easier to service products with better software.

Each of the major hardware subsystems is described in the following pages.

DEC $153,100

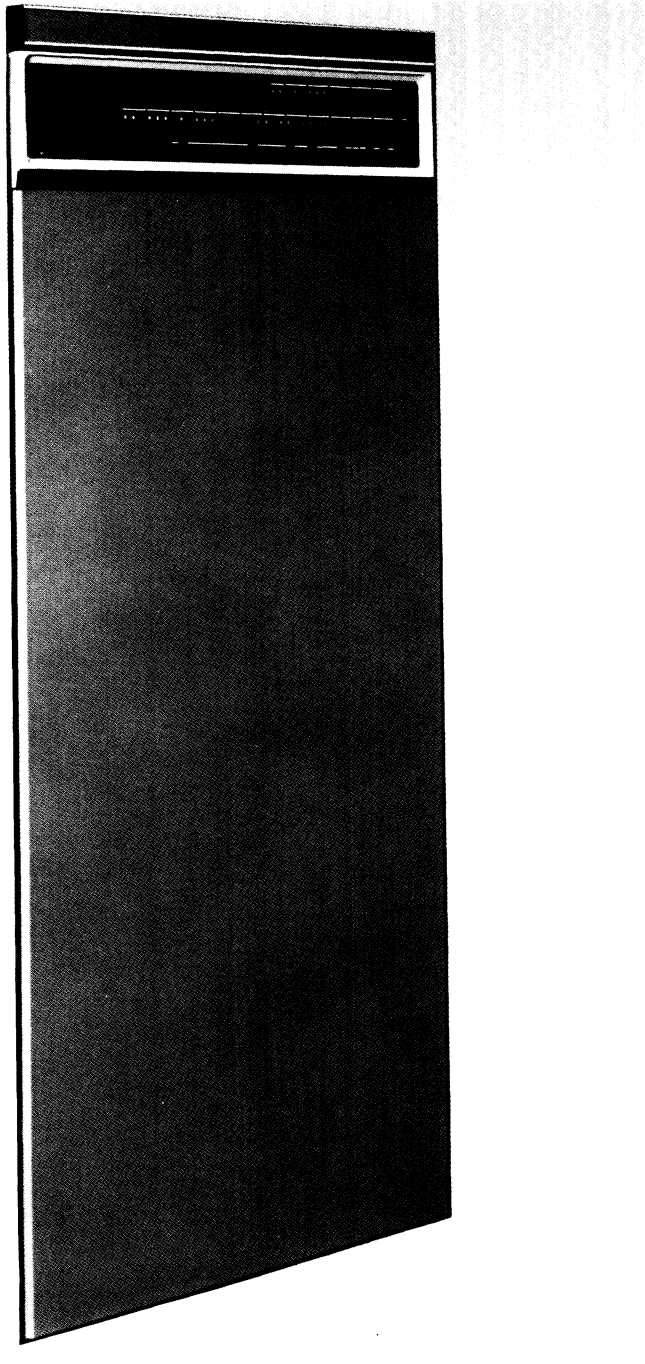
DIGITAL EQUIPMENT CORPORATION

OPTION BULLETIN

decsystem10

OCTOBER 1976

MG10 and MH10 Memory Systems



FEATURES

- 620 nanosecond access time
- Overlapped memory operation
- Two- or four-way interleaving
- Two ports active simultaneously
- Eight memory ports
- 22-bit address logic
- Compatible with all DECsystem-10 processors

DESCRIPTION

The MG10 Core Memory System provides up to 128K (131,072) 36-bit words of memory in each cabinet assembly. The MH10 provides up to 256K words in each cabinet assembly. Each memory module (cabinet assembly) has provision for eight ports: two of highest priority, two of intermediate priority, and four of lowest priority. Within each priority level, the priority of service rotates, with the most recently served port having the lowest priority. Each memory module has a single set of address and mode switches that control the operation of all eight ports, thus minimizing the possibility of operator errors during reconfiguration. Individual ports can be disabled. Each memory module contains up to eight submodules of 16K words (MG10) or 32K words (MH10) each. Dual control logic is provided so that two references, each to a different submodule, can be handled simultaneously. Thus two of the eight ports can be active simultaneously. The internal submodules may be two-way interleaved; in addition, two MG10 or MH10 modules (cabinet assemblies) may be two-way interleaved, giving the net effect of four-way interleave.

The MG10 Memory System has a nominal read access time of 640 nanoseconds, a maximum read access time of 670 nanoseconds and a cycle time of 1 microsecond. The MH10 Memory System has a nominal read access time of 735 nanoseconds, a maximum read access time of 745 nanoseconds and a cycle time of 1195 nanoseconds. [Up to 16 modules may be combined to provide 2048K words (MG10) or 4096K words (MH10) of high-speed memory.] Each module may contain two to eight memory ports for connection to processors, data channels, communication data links and memory port multiplexers. Two- or four-way interleaving is provided by switches on each memory module. Address logic decodes a 22-bit address, (18-bit on KA10) providing up to 4096K words of addressing capability.

INSTALLATION DATA (Each Cabinet)

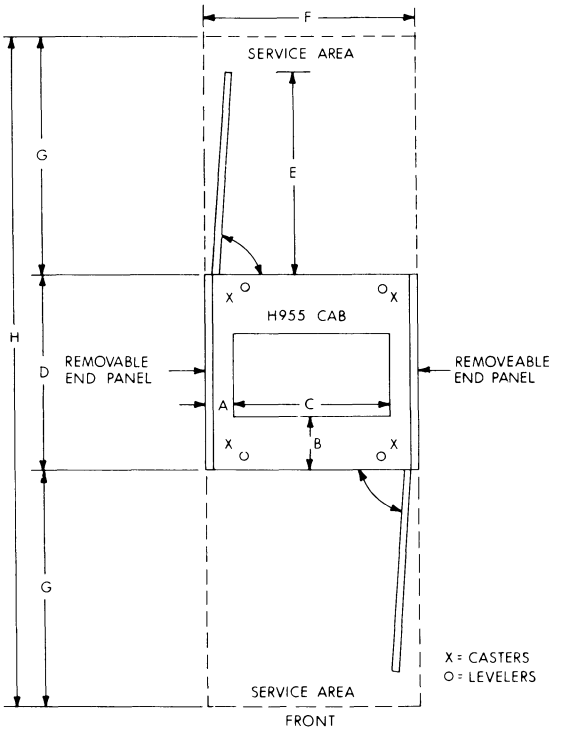
	Voltage	Current @ 120 Vac	Power/Heat Dissipation	Dimensions			Mass (Weight)	Environment	Maximum Cable Length			Air Volume (Inlet)
				Height	Width	Depth			I/O	Memory	Device	
MG	1-phase standard	18 A Inrush: 160A	2200 W 7400 Btu/hr 1860 k cal/hr	1.83 m 72 in.	0.84 m 33 in.	0.76 m 30 in.	350 kg 760 lb	DEC Class A	None	30 m 100 ft "QL" Note 1	None	380 l/s 800 ft³/min (Top)
MH		20 A Inrush: 180A	2400 W 8100 Btu/hr 2030 k cal/hr				365 kg 785 lb					

Note 1: Required cables (one per active port except none on KL10 ports) to connect the two cabinets must be shown on the cable layout and cable order list.

Because of the asynchronous operation of the DECsystem-10 processors, the MG10 or MH10 memory can be intermixed with DECsystem-10 memory systems of various speeds to optimize system performance.

The MG10 and MH10 are compatible with both old (18-bit address) and new (22-bit address) memory buses. Jumpers and a switch allow each port to be either an 18-bit or a 22-bit bus.

When the KL10 processor is connected to an MG10 or MH10 Memory System, two of the processor's four memory buses (buses 00 and 01) are cabled to memory module 0 (and 2, 4, etc. if present) and the other two processor memory buses (buses 10 and 11) are cabled to memory module 1 (and 3, 5, etc. if present). Thus a KL10 processor effectively occupies two ports of a memory system. Other ports of the memory system which are in use are cabled to all modules of the memory system.



DIMENSIONS	A	B	C	D	E	F	G	H
METERS	0.09	0.19	0.61	0.76	0.79	0.8	0.91	2.6
INCHES	3.7	7.5	24	30	31	31.5	36	102

SPECIFICATIONS	MG10	MH10
Word Size	36-bits plus parity	same
Maximum Memory System Size	2048K words	4096K words
Read Access Time		
Typical	620 nanoseconds	735 nanoseconds
Maximum	660 nanoseconds	745 nanoseconds
Memory Cycle Time	1.0 microseconds	1.2 microseconds
Dimensions		
Height	1.83 m (72 inches)	same
Width	1.68 m (66 inches)	same
Depth	0.76 m (30 inches)	same
Weight	720 kg (1600 lbs)	same
Interleave	1, 2, or 4 way	same

OPTION DESIGNATIONS

MG10-H –128K word Memory Unit

MG10-G –64K word Memory Unit

MG10-E –64K word Memory Expansion Unit

MC10-G–Ports (2) for MG10 memory

(Note: Specifications are subject to change without notice.)

MH10-L–256K word Memory Unit

MH10-G–128K word Memory Unit

MH10-E– 128K word Memory Expansion Unit

MC10-H –Ports for MH10 memory

DIGITAL EQUIPMENT CORPORATION
Large Computer Group
Marlborough, Massachusetts 01752

In Europe: Digital Equipment Corporation International, Geneve 26, Switzerland

INFORMATION PER RFD PARAGRAPH 6.02

ITEM	MADE BY	FIRST INSTALLED	WARRANTY *
KL10B	DEC	10/76	12 MONTHS
MH10-L	DEC	10/76	12 MONTHS
DN87S	DEC	10/76	12 MONTHS
DN81-H	DEC	3/74	12 MONTHS
DN81-ED	DEC	5/73	12 MONTHS
TU45-EB	DEC	5/75	12 MONTHS
LP100	DATA PRODUCTS	10/76	12 MONTHS
LP07-YC	DATA PRODUCTS	10/76	12 MONTHS
CR10-E	DEC	6/72	12 MONTHS
RP06-A	MEMOREX	5/76	12 MONTHS

* Warranty can be extended indefinitely by means of a standard DEC Full Service Maintenance Agreement.

2.5. EQUIPMENT NOT SUPPLIED BY THE TENDERER

Digital has no objections to the University connecting to the proposal DECsystem-1090 any equipment not supplied by ourselves, however we caution you as follows:

1. In the event of system malfunction during the warranty period, we reserve the right to request you to disconnect any non-DEC equipment so that we can establish the source of trouble.

2. Bear in mind that TOPS-20 is not designed to support an external I/O BUS, so that if you later convert from TOPS-10 to TOPS-20 this may severely limit your flexibility.

2.6. HARDWARE MAINTENANCE

(i) The following is a list of the spare kits and their respective costs. The special tools required for servicing the RP06 come with the kit.

KL10B	$126K
MH10	$ 17K
DN87S	$ 7K
LP07	$ 17K
TU45	$ 9K
RP06	$ 31K

(ii) The normal replenishment of on-site spares is approximately two months. For emergency requirements it is approximately eight days. Customer spares has an order processing person in Brisbane who co-ordinates with Sydney in placing the orders and the final receipt of parts.

A brochure on customer spares is enclosed.

Below is a chart of the technical organisation of Digital within Australia. The individual branch locations are shown together with the relative manpower. In each of the branches there is carried adequate stock to service our contract customers. The total value of parts holdings within Australia is $4 MILLION.

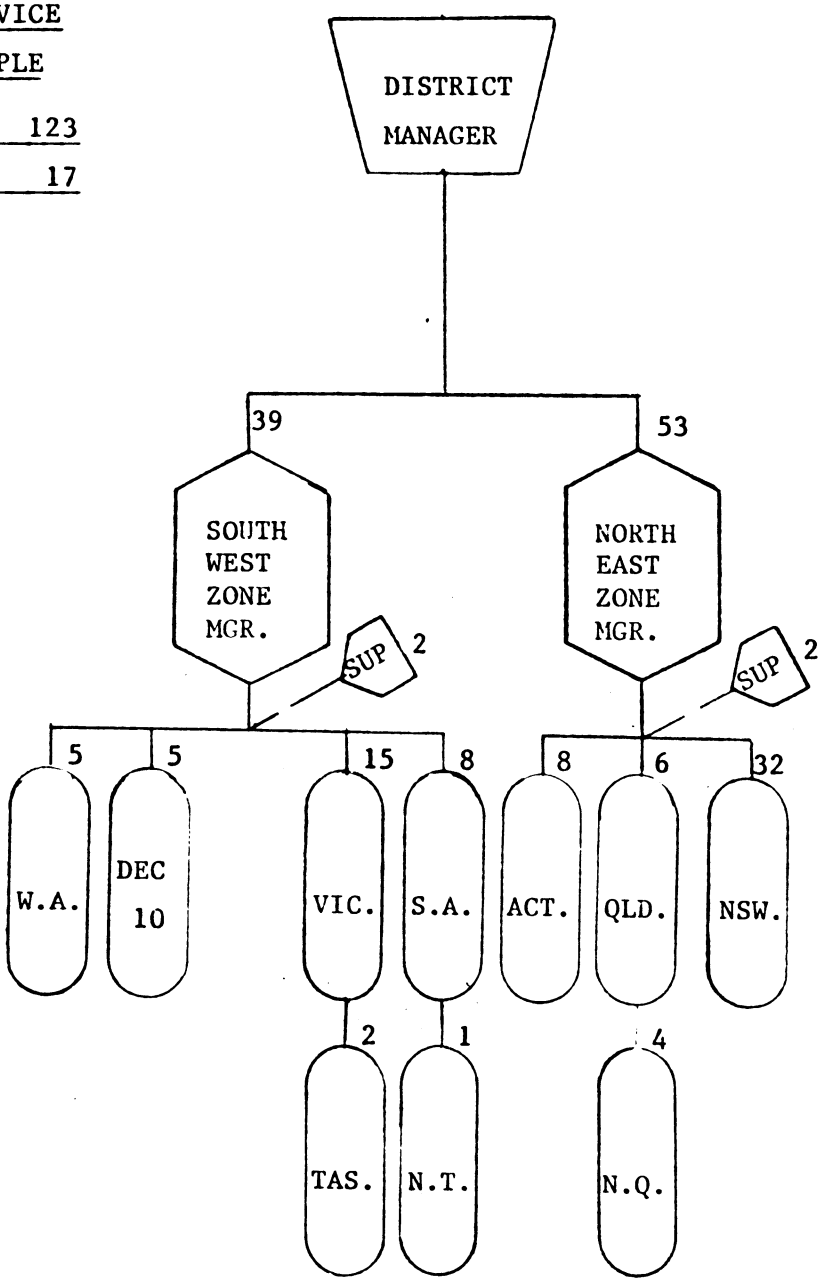
DEANZ

FIELD SERVICE

TOTAL PEOPLE

TECHNICAL 123

CLERICAL 17



(iii) Included are some of the available preventative maintenance schedules for the equipment. With each system a magtape is supplied which allows the engineer to GENERATE a unique preventative maintenance schedule to suit the particular configuration. This is especially valuable where items are added or deleted.

(iv) To maintain the tendered configuration on a one shift basis would require one Digital trained engineer.

(v) An index on the attached microfiche gives a list of the diagnostic programs available to suit the KL10. The diagnostics are normally supplied on magtape, and there are no special facilities required in order to run these programs. The diagnostics and associated write-ups are included in the Maintenance Documentation Service Kit which also covers hardware, manuals, parts breakdown, wire lists, technical information, module data and miscellaneous handbooks. The entire library comes on microfiche for which a microfiche reader is included. The cost of the Maintenance Documentation Service is $44K.

(vi) The engineering drawings do not come on microfiche and a sample of the KL10 drawings is included here for your benefit. All other documentation is included in the Maintenance Documentation Service and a representative sample of what is in the kit is also supplied.

(vii) A sample of the "Technical Tips" is included with the microfiche supplied.

(viii) The necessary training to maintain a KL10 would have to be done in Maynard Massachusetts. The next available course covering the processor and options is scheduled for July. There would be twenty weeks involved at a cost of $10,000.

2.6.(a) MAINTENANCE AIDS AND WARRANTY.

(1) All documentation pertaining to the maintenance of the equipment tendered will be supplied at the time of delivery.

(2) We will warrant to supply spare parts, all documentation and diagnostics for a period of ten years following the date of installation. However, where equipment is supplied to us from an outside vendor such as Memorex, we are limited by the length of time that they will supply parts to us.

(3) Through our Customer Spares we will supply schedules of prices and regular updates on microfiche. A copy of what can be supplied is included with the other microfiche.

Twelve months warranty is included with the machine. During this time a Digital trained engineer based at the University if required, will perform the necessary preventative and corrective maintenance. There will be no extra costs to the University unless any out of hours work or extra coverage beyond one shift is required.

Following the initial warranty period, support will be available to the University's technicians on a per-call basis. This support will either come from Brisbane, Townsville, Sydney or Melbourne. Manpower support will be chargeable at per-call rates. At present these are $30 per hour during the normal shift and $42 per hour after that. Any travel costs are extra. Technical assistance given over a phone is available at any time. There are no charges associated with this.

2.7 COMMUNICATIONS REQUIREMENTS

Digital recognises that the University has already implemented its own network based on a PDP-8 front end concentrator linked to four PDP-11/10 remote batch stations as well as a TI890 via 1200 baud asynchronous lines. We understand that the compter centre would seriously entertain using standard vendor software if practical to support its network requirements, provided that they were accompanied by a meaningful reduction in system support required by University staff.

We agree with the evolutionary development approach envisaged by the University. In fact, we recommend you keep your existing remote batch stations connected to the 1050 as long as justified by the workload of that system. However, on the proposed 1090 we suggest you would be pleased by today's performance of the DN8X series of 11/40-based network products described on the following pages. There is no need to use circuit switching (time division multiplexing) or other mechanical means of achieving adequate terminal response on a DN81 or DN82 remote station. We have had a DN82 running in Hamilton, New Zealand over a 4800 baud synchronous line connected to a 1060 100 miles away in Auckland since May, 1976 and the response with 8 terminals (including VT50's at 1200 baud) plus a 300 line per minute printer has been virtually identical to that of a locally connected terminal. On the same network we are linking RSX-11M systems into the 6.03 DECNET port (now running pre-release) on DN81 and DN82, also we are extending the DN8X code to support magnetic tape and RK05 cartridge disk. With six programmers full time on New Zealand Health we think we can tap any necessary information to get desired performance from the DN8X software to meet your requirements as stated in the RFP.

For these reasons we suggest you evolve by combining terminal concentration with remote card reader/line printer RJE requirements for the 1090 system by using the DN82 or smaller 8A-based DN92 in your network. Then as DECNET support continues to be enhanced in 11-based standard software,

use the 6.03 DECNET ports to accomplish file transfers. In this way you will be using DEC communications software to meet all your 1090 network requirements and it will be our responsibility to ensure that specifications published in the appropriate SPD's are met to your satisfaction.

The remainder of this section introduces the products we propose, in the case of the mainframe, and recommend, in the case of the network.

2.7.1 THE DN87S FRONT END

The current DECsystem-10 Data Communications Products are all based on the DN87S Universal Synchronous/Asynchronous Communications Front End Subsystem. The DN87S uses a PDP-11/40 system which is configurable in asynchronous only mode (DC10, DC76 replacement), synchronous only mode (DS10, DC75, DC75NP, DAS85 replacement) or with a mixture of synchronous and asynchronous lines in the same DN87. These three modes allow the DN87 to be configured very cost effectively in a wide variety of customer specific configurations. This great increase in flexibility without any significant increase in price is the essence of the DN87S Communications Subsystem.

The DN87S is capable of being configured in synchronous only mode with up to 12 synchronous lines, in asynchronous only mode with up to 112 asynchronous lines or in universal mode with a mixture of less numbers of both synchronous and asynchronous lines. The DN87S communicates with the DECsystem-10 via the DTE Integral Communications Interface and each DN87S uses up one of the three available DTE ports. The DN87S requires the DECsystem-10 be using TOPS-10 version 6.02A (plus the DN87 LIR) or later. Up to four DN87 front ends can be added to a 1090 using a DL10, for a total of eight 11/40 minis (console, 3 DN87S, 4 DN87).

On an eight-line group basis the DN87S is capable of terminating 20 mA current loop, local EIA or EIA with full modem control type of asynchronous line/terminal interfaces. On an individual line basis the DN87S asynchronous lines can be:

* ASCII teletype - compatible code or 2741 EBCD or Correspondence Code.

* Full-duplex with echoplex (i.e. echo generated by computer) or full-duplex with local copy (simulated half-duplex).

* Program selectable line speeds or from 50 through 9600 baud.

* Split transmit/receive speeds.

* Automatically baud rate detected from 110, 134.5, 150 and 300 baud lines.

Some off-loading of the DECsystem-10 host is accomplished in that the DN87S does the majority of the echoing for asynchronous lines. It does not echo special character nor does it echo when the user is in character at a time mode (e.g. DDT, TECO when an individual character can be a command). Also the DN87S does some fill character generation.

The DN87 is also capable of terminating EIA and/or current-loop type synchronous links. The line speeds may be 2400, 4800, 7200, 9600, 19.2K 38.4K or 40.8K baud on an individual line basis. These links operate only in full-duplex with simultaneous bi-directional transmission. The synchronous links use DDCMP protocol for error checking and correction and for point-to-point link control. These synchronous links are capable of communicating with only the DC72NP Remote Station (PDP-8I/8E DC72NP is a software only upgrade of the DC71 or the DC72 remote stations), the DAS80 Series Remote Stations, or the new 8A-based DN92.

2.7.2 DN87S OPTIONS

The DN87S is the Universal Synchronous/Asynchronous Front End Communications Subsystem. Software is included with the DN87S. The DN87S requires the addition of DN81-xx Synchronous and/or Asynchronous Line Options.

ASYNCHRONOUS LINE OPTIONS

DN81-EB Asynchronous Expansion Cabinet including one DN81-EC 16-Line Asynchronous Expansion Group. Requires two DN81-Fx 8-Line Terminator Groups to activate the lines.

DN81-ED Asynchronous 16-Line Expansion Group. This requires two DN81-Fx 8-Line Terminators to activate the lines.

DN81-FA 8-Line Terminators each with 20 mA Current Loop Local Interfaces.

DN81-FB 8-Line Terminators each with EIA Local Interfaces.

DN81-FC 8-Line Terminators each with EIA Full Modem Control Interfaces.

SYNCHRONOUS LINE OPTIONS

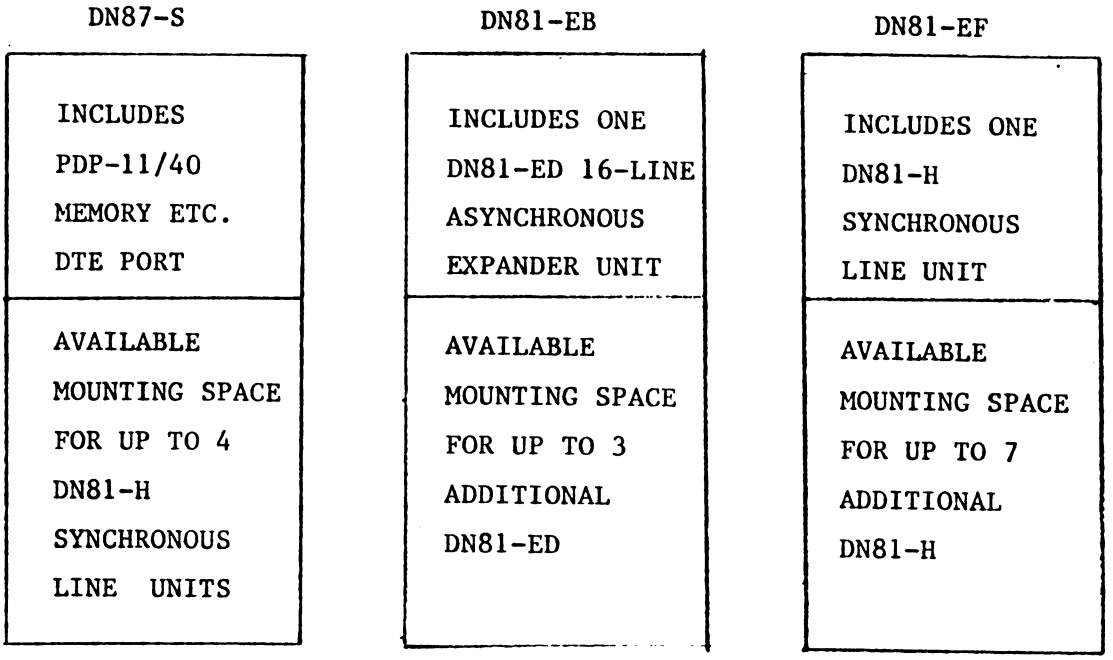
DN81-EF Synchronous Expansion Cabinet. Includes one DN81-H.

DN81-H Synchronous Line Controller Expansion Line. For data transmission speeds of up to 10K baud and for attachment to EIA RS232C compatible modems.

NOTE: These same line options (DN81-xx) are used on the DN87 as described here, on the DAS80 Series Remote Stations, as described in Section 3, and for DC76 add-on orders, as described later in Section 6.

HARDWARE CONFIGURATION GUIDELINES

A pictorial representation of the DN87 cabinet arrangements should help to simplify the explanation of the configuration rules.



ASYNCHRONOUS CONFIGURATION RULES

* The DN87S cabinet comes with 16 asynchronous lines in a separate DN81-EB Cabinet.

* If more than 64 asynchronous lines are required a second DN81-EB Asynchronous Expansion Cabinet must be ordered. This cabinet includes one DN81-ED Asynchronous 16-Line Expansion Group and has available mounting space for up to three additional DN81-ED units. Therefore, the DN81-EB is capable of containing up to 64 asynchronous lines.

* A maximum of two DN81-EB Asynchronous Expansion Cabinets are permitted per DN87S, but the maximum number of DN81-EDs is seven (112 lines).

* Each DN81-ED Asynchronous 16-Line unit requires two DN81-Fx (FA, FB, FC or FD) 8-Line Terminators to activate the lines.

SYNCHRONOUS CONFIGURATIONS RULES

* The DN87S cabinet has available mounting space for up to four DN81-H synchronous line units.

* If more than four Synchronous Line Units are required a DN81-EF Synchronous Expansion Cabinet must be ordered. This cabinet includes one DN81-H Synchronous Line Unit, and available mounting space for up to seven additional DN81-H units.

LINE MAXIMUMS PER DN87

MAXIMUM NUMBER OF SYNCHRONOUS LINES	MAXIMUM NUMBER OF ASYNCHRONOUS LINES
0	112
4	64
8	32
12	0

* Proper number of asynchronous lines are made up using the Asynchronous Configuration Rules from above.

* Proper number of synchronous lines are made up using the Synchronous Configuration Rules from above.

2.7.3 DAS80 SERIES REMOTE STATIONS

The DAS80 Series Remote Stations are a family of remote stations with a wide range of functionality. The DAS80 is a Remote Job Entry Station with a 300 cpm Card Reader, a 300 lpm Line Printer and an LA36 Console. The DAS81 is a Remote Concentrator capable of concentrating up to 32 asynchronous lines. The DAS82 is a combination of the DAS80 and DAS81 facilitating both RJE and Remote Concentration.

The asynchronous lines attached to the DAS81 Remote Concentrators have the same functionality as the asynchronous lines attached directly to the DN87S. These capabilities were outlined in Section 2.7.2. There must be one, and there may be several (depending on network topology) synchronous lines. The DAS80 Series Remote Stations are all downline loadable through the synchronous link from the DECsystem-10.

The Line Printer (LP) and the Card Reader (CR) on a DAS80 or DAS82 Remote Station are available from the DECsystem-10 host in a transparent manner. This means that any user at any terminal can use this remote LP or CR exactly as he would use a LP or CR attached directly to the host. This is accomplished by use of the DECsystem-10 Monitor Command LOCATE which sets the default LP and CR for a specific user who does output to an LP or input from a CR.

The LA36 DECwriter, which is included with the DAS80 Series Remote, can be used as the Operator Controlling Console for the spoolers which are running for the LP and CR at that station. This means that any operator type requests (e.g. LP out of paper) appear at the same location as the LP and CR rather than at the host.

2.7.4 DAS 80 SERIES OPTIONS

REMOTE STATIONS

DAS80-AB Remote Batch Station. Includes 1 DN81-H, DAS80-C, DAS80-LB, PDP-11 and Software.

DAS81-AB Remote Concentrator, Includes PDP-11, DN81-H, DN81-EB and Software. Can add one more DN81-ED for a total of 32 asynchronous lines.

DAS82-AB Remote Batch Station and Concentrator. Includes PDP-11 DAS80-C, DAS80-LB, 1 DN81-H, DN81-EB and Software. DN81-Fx Asynchronous interfaces are also required and must be ordered separately.

UNIT RECORD OPTIONS

DAS80-CB Card Reader, 300 cards per minute.

DAS80-LB Printer, 300 lines per minute, 132 printing positions, 64 printing character, EDP character set.

DAS80-LD Printer, 230 lines per minute, 132 printing positions, 96 printing characters, EDP character set.

ASYNCHRONOUS LINE OPTIONS

DN81-EB Asynchronous Expansion Cabinet including one DN81-EC 16-line Asynchronous Expansion Group. Requires two DN81-Fx 8-Line Terminator Groups to activate the lines.

DN81-ED Asynchronous 16-Line Expansion Group. This requires two DN81-Fx 8-Line Terminators to activate the lines.

DN81-FA 8-Line Terminators each with 20 mA Current Loop Local Interfaces.

DN81-FC 8-Line Terminators each with EIA Full Modem Control Interfaces.

SYNCHRONOUS LINE OPTIONS

DN81-EF Synchronous Expansion Cabinet. Includes one DN81-H.

DN81-H Synchronous Line Controller Expansion Line. For data transmission speeds of up to 10K baud and for attachment to EIA RS232C compatible modems.

NOTE: These same line options (DN81-xx) are used on the DAS80 series remote stations as described here, on the DN87S as described in Section 2.7.2.

2.7.5 DAS92 REMOTE STATION

The DAS92 Remote Station is a low cost remote job entry concentrator that is attached to the DECsystem-10 via one synchronous link to a DN87/DN87S front end. The DAS92 may be configured in the following manners:

1. Up to 16 asynchronous terminal lines.

2. Up to 12 asynchronous terminal lines plus a card reader or line printer.

3. Up to 8 asynchronous terminal lines plus a card reader and a line printer.

Only one synchronous interface is permitted, therefore the DAS92 must be a sequential mode. This means it may not do multi-pathing or route-thru. Data to the DAS92 may be routed from some other node, but no data may be routed through the DAS92.

2.7.6 DAS92 OPTIONS

1. DAS92-AB Basic Unit, including 16K, PDP-8/A processor, VT52 console terminal, desk, ROM for down-line loading, one (1) synchronous line interface and software. Requires at least one (1), but a maximum of four (4) optional units listed below:

   (a) DAS91-EA Asynchronous 4-line multiplexor, including line drivers. The DAS92-EA Asynchronous 4-line Multiplexer will accommodate either 20 mA or EIA lines in any mixture. One out of every four can be full modem control. The baud rate is switch selectable anywhere from 50 to 4800 baud. Maximum of four (4) DAS92-EA's per DAS92-A.

   (b) DAS92-CB Card Reader. The DAS92-CB Card Reader is a Digital CR8-F for 80-column (only) cards, and operates at 285 CPM. Maximum of one (1) Card Reader per DAS92-A.

   (c) DAS92-PA LA180 Printer. The LA180 operates at 180 Characters per second and uses a 96-character set (upper and lower case). The carriage is 132 columns wide. Maximum of one (1) LA180 per DAS92-A.

(d) DAS92-VD LP05 Line Printer, (64-characters). This is the LP05 (LE8-V) and operates at 300 lines per minute using a 64-character set. The carriage is 132 columns wide. Maximum of one (1) LP05 per DAS92-A.

(e) DAS92-WD LP05 Line Printer (96 characters). This is the same as the DAS92-VD except that it uses the 96-character set (upper and lower case). Maximum of one (1) LP05 per DAS92-A.

2.7.7 COMPLEX TOPOLOGIES

This is the name given to a group of general network building capabilities which when put together allow the user to make many different cost, performance and high availability trade-offs so that his network may be configured in a way which is very much optimized for him and therefore very favourable to his environment. These building block capabilities are:

Route Thru: This is the ability for a DAS80 Series Remote Station to send information to a DECsystem-10, via the DN87 Front End, to which it is only indirectly attached - i.e. indirectly through another DAS80 Series Remote Station or DN87 Front End. This is illustrated in figure 2-6.

Information flows from the DAS81 to the DN87S only by being routed through the DAS82. This is a very useful price performance trade-off since the cost of a communications line from 81 to 87 and from 82 to 87 may be substantially cheaper than the cost of lines from 81 to 87 and from 82 to 87. Notice that route-thru can only be accomplished thru DAS80 Series Remotes not with the DC72NP Remote Station.

ROUTE THROUGH

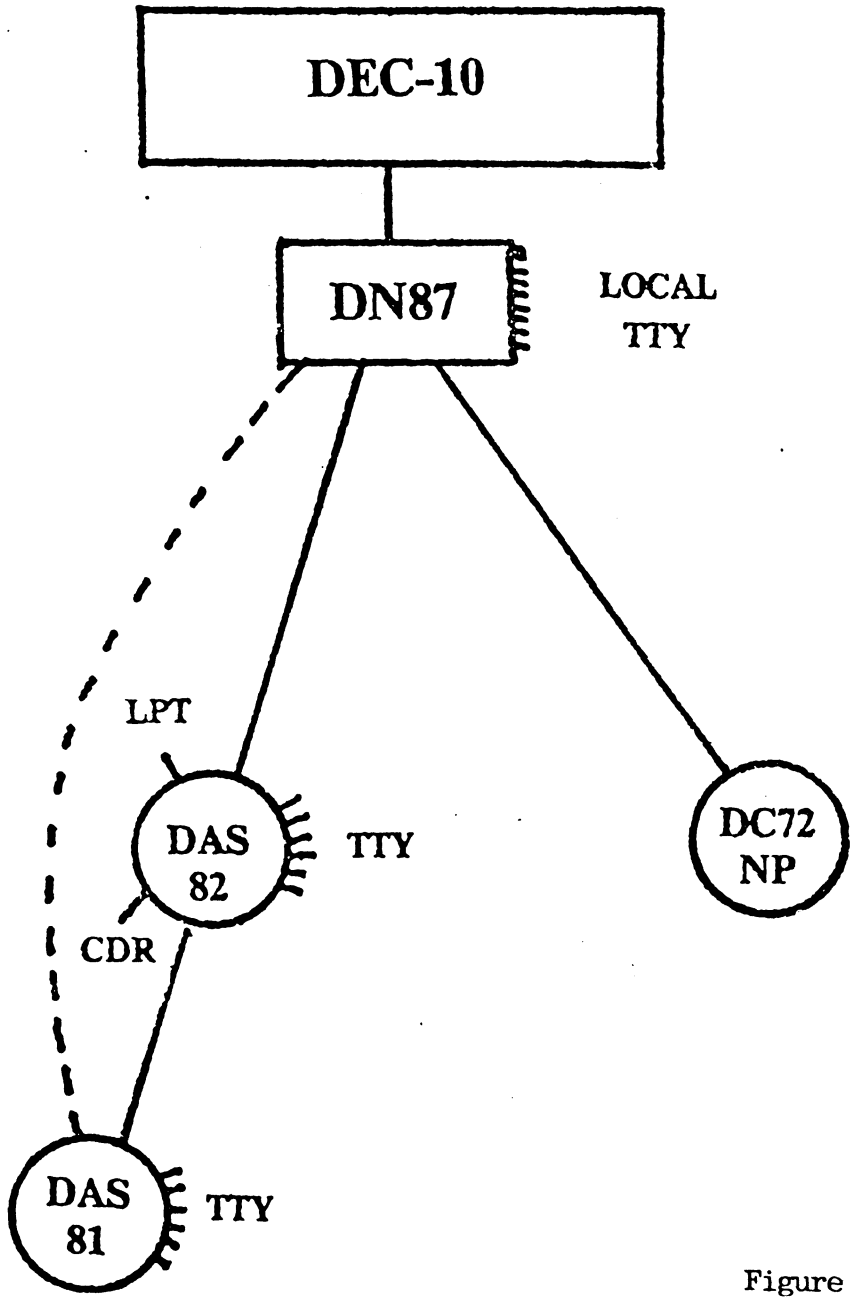


Figure 2-6

PRICE/PERFORMANCE TRADE OFF

The DC72NP may have only one synchronous line on it. Data from a DC72NP may be routed thru DAS80 Series Remotes, but no data may be routed-thru the DC72NP. The same considerations apply to the DAS92.

Multi-Pathing: This is the ability for there to be more than one network path from one node to the desired DECsystem-10. In general, these links are automatically load leveled. This is illustrated in figure 2-7.

The two links between A and B will be automatically load leveled with data flowing through each link. This may be a desirable configuration for high availability systems with for example one link via microwave and one by ground link. This would allow degraded operation if either link went out for any reason. There are also two routes from D to A. The direct link could be a high speed link while the link routed-thru C could be lower speed and used as hot backup to the direct link. Again both of these configurations have desirable benefits that the customer in building his network can pick and choose from depending upon his specific needs and desires. Noticeably we give him the ability to do this rather than having a very rigid set of network configuration rules.

2.7.8. NETWORK VIRTUAL TERMINALS

If there is more than one DECsystem-10 in a network, the Universal Front Ends on the DEC-10s may be hooked up to each other, or the Remote Stations may be hooked up to each Universal Front End. This allows Teletype users anywhere in the network to select on an individual basis, before they LOGIN, which DECsystem-10 they wish to LOGIN to. This is accomplished by means of the SET HOST command.

2.7.9 DYNAMIC TOPOLOGY

This feature allows individual nodes in a network to go down or come up without affecting the remainder of the network. The exact implications of an individual node going down depend on the type of node and its network functions, but any new node may be added to the network dynamicall

MULTI PATHING

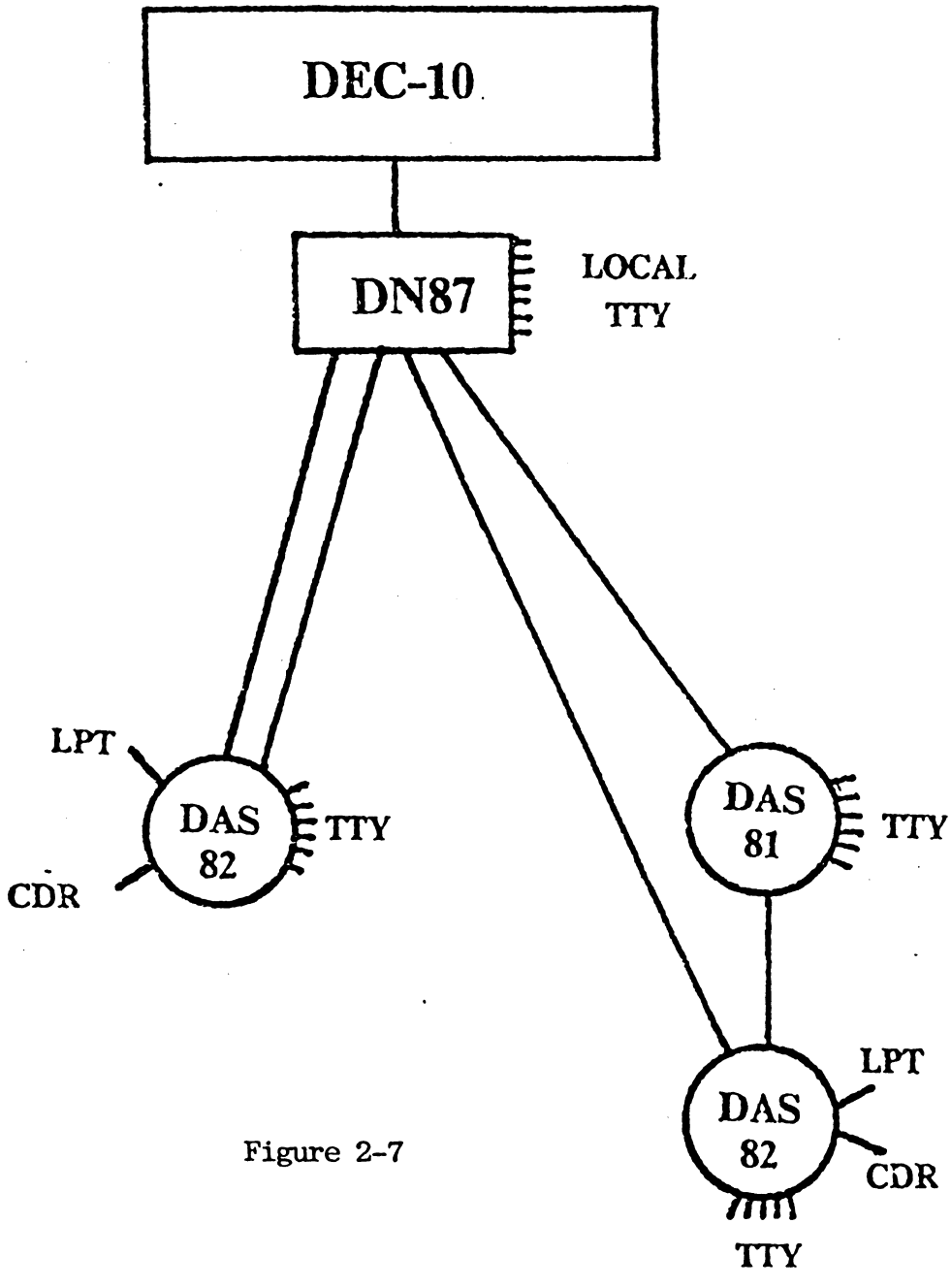


Figure 2-7

PRICE/PERFORMANCE TRADE OFF

2.7.10 TASK TO TASK COMMUNICATION

DECnet-10 provides the capability to have tasks or jobs in different and geographically removed processors communicate with each other in a straightforward manner. These jobs appear to each other as mere I/O devices much like a magtape. Jobs in different DECsystem-10s may communicate with each other, or DECsystem-10 jobs may communicate with other DECnet systems, such as RT-11, RSTS, RSX-11M, D, and S, IAS, and RTS-8.

This interprocessor communication allows only for jobs to talk to each other, not for terminal concentration. It does not directly allow for remote file access, remote device access or program sharing. It does, though, present a mechanism or a build block which could be used to provide those features.

2.8 SOFTWARE.

This Section addresses your RFP paragraphs by number (e.g. 10.90).

(10.01) The tendered software has the same characteristics as the Digital Software currently in use at the University, with the following exceptions:

(i) TOPS-10 Version 6.03 or later is required for the hardware configuration tendered and VMSER is included for virtual memory operations

(ii) The GALAXY batch system replaces the older MPB batch system

(iii) PDP-11 based software is supplied for communications

(iv) Additional optional software such as DBMS-10 is offered

Each user is protected from interference from other users and full protection is provided against unauthorised access.

Diagnostic messages are issued in English and are in general reasonably meaningful to infrequent users.

(10.02) With the tendered software, professional programmers would enjoy the same wide range of advanced software features currently offered by the University.

(10.03) The University may purchase and resell any DEC-supplied manuals. When reproduction in whole or in part is required, the University may apply to Digital for permission to do so on a case by case basis, and reasonable requests of this type would be considered sympathetically.

(10.04) As in the past, DECsystem-10 software sources will in general be provided at no additional charge. Specifically included are the TOPS-10 Monitor, batch system, utilities, BASIC, FORTRAN, COBOL,

ALGOL and the PDP-11 based communications software tendered. Specifically excluded are APL, DBMS, IQL and CPL. Microcode sources are available for separate purchase.

(10.05) The TOPS-10 operating system and batch systems have the following capabilities and facilities:

(i) Up to 256 job slots with up to 128 concurrent batch jobs are supported by software. In a 512K word system, acceptable terminal response times can normally be expected with 100 concurrent logged-in terminals in conjunction with several batch streams and remote batch stations

(ii) The GALAXY job control language is nearly identical to the MPB job control language, and offers the same facilities. In addition, the timesharing command language may be used to drive batch jobs

(iii) Scheduling is automatic, with minimal operator intervention. Re-entrancy allows the sharing of program segments and is sufficiently easy to use that the potential benefits of re-entrancy are actually realised in DECsystem-10 installations

(iv) The disk file system has flexible and secure access control mechanisms allowing file owners to share individual files, to differing degrees, with various classes of users. Disk volumes are removable and labelled.

(v) Spooling is provided for card readers, printers and plotters. Output is directed by default to the input station but this may be overridden by user request. For example, a large print job might be redirected to the central site.

(vi) Peripheral devices may be assigned to user jobs under the control of operational staff. For example, upon a queued

user request for magnetic tape drive, the operator may select any free drive and assign it to the user

(vii) The BACKUP program does provide the ability to selectively save and restore files, but an automatic archiving system is not provided. An important feature of the DECsystem-10 is that disk-to-tape backup may proceed in parallel with normal operations. There is no need to take the system down for several hours per day to perform routine backup operations,as with some other systems

(viii) Each batch job generates a log of all commands issued, system responses and diagnostic messages. All operator interaction via the OPSER program is also logged. In addition, the Monitor logs system reloads and logs details of hard and soft CPU and device errors. These logs may be selectively displayed for management purposes

(ix) Accounting facilities exist and are dealt with under Section 10.07

(x) All system facilities are available to terminal users. The user has complete interactive control of a running program

(10.06) The TOPS-10 operating system is the result of thirteen years continuous development and refinement. First offered on the PDP-6 in 1964, it was in fact the first timesharing operating system to be offered by a computer manufacturer. From the beginning, TOPS-10 was designed as an interactive operating system, an approach which avoided the many pitfalls involved in retrofitting timesharing capability to an existing-batch operating system.

For the ~~purposed~~ proposed configuration, the monitor size is estimated to be in the vicinity of 110 K words.

The thirteen-volume DECsystem-10 Software Notebook provides full technical details of monitor calls available to the system programmer.

An in-depth course on the internals of the TOPS-10 Monitor is available at Digital's Marlboro facility.

(10.07) Standard software measures the usage of various system resources, as described in Section 10.11

(10.08) Processor time may be limited within a single job via job-card options. The facility to set cost limits on a given job or user is not provided by standard software. It is noted that the University has implemented its own software in this area on the program-compatible KA10 processor.

(10.09) A hierarchical accounting structure is not implemented in the DECsystem-10.

(10.10) Stringent mechanisms exist to protect accounting files and prevent unauthorised access to the system. Knowledge of two secret passwords plus access to a privileged terminal are required to gain access to other users' passwords. Without the latter, other users' files cannot be referenced and processing may not be spuriously charged to the account of another user.

(10.11) Charging is based on the usage of each system resource. Raw data gathered by the operating system includes CPU usage, memory utilisation, device mounting, interactive/batch, terminal connect time, cards read, pages printed and disk occupancy. A sample reporting program is provided and installation-specific reports may be tailored with COBOL programs which analyse the raw data files generated by the system.

A new facility called File DEAMON allows the installation to specifically permit or deny access to any file or set of files for specific users. A log of accesses to specific files may be created

for later review, proprietary program billing and the like.

(10.12) The named languages all operate on the DECsystem-1090 configuration proposed.

(10.13) Supported languages include:-

FORTRAN-10
COBOL-10
ALGOL-10
BASIC-10
MACRO-10 Assembler
APL-10/SF (System Functions)
APL-10 Basic
CPL-10 (Conversational subset of PL/I)
IQL (Interactive Query Language)

BCPL, PASCAL and SIMULA are already in the possession of the University and may be run on the 1090 hardware.

DDT, the Dynamic Debugging Technique software, is available for FORTRAN, COBOL, ALGOL, MACRO and CPL.

(10.14) The TOPS-10 Monitor provides a disk file system of named files, supporting sequential and direct access. Indexed sequential file organisation is offered under the COBOL object time system.

A version of RPG suitable for educational purposes is currently under development, but a definite commitment cannot be made at this time. An RPG-to-COBOL translator is available for existing RPG programs.

Included in Appendix 1 are Software Product Descriptions for the following:

(i) SORT-10

(ii) IQL-10 (Interactive Query Language)

(iii) DBMS-10

(10.15) Commonly-used editors include TECO and SOS. The University's own editor, QEDIT, would run on the 1090 configuration. These editors operate equally on source files, data files and documentation files. Editor-produced files may be input to the RUNOFF program for text justification with automatic page renumbering and indexing. ITPS-10 provides full typesetting facilities, driving either photocomposition or hot-metal machines.

Utility programs provided with the system include:-

(i)	SYSTAT/SYSDPY	- Status reporting for operator use
(ii)	BACKUP	- Disk-to-tape failsafe utility
(iii)	DSKLST	- Disk occupancy reporting program
(iv)	REACT	- User profile and password utility
(v)	TRACK	- Performance analysis program
(vi)	MONEY	- Reporting program for resource accounting.

(10.16) Application programs available from third party vendors are documented in the enclosed Application Software Index.

(10.17) No purchase or upgrade charge is applicable, in the proposed hardware upgrade situation, for the Monitor, associated utilities, FORTRAN, COBOL, ALGOL, BASIC, MACRO ASSEMBLER or SORT-10.

(10.18) A current price list for individual software manuals is attached in Appendix 5.

(10.19) A sample Software License Agreement is attached in Appendix 4. Sample documentation on the Monitor, FORTRAN, COBOL, ASSEMBLER, or any other software product, will be supplied on request. The definitive documentation is the Software Notebook in the University's possession.

(10.20) Digital would be prepared to guarantee only that new versions of software would be offered to the University under Digital's then-prevailing terms and conditions, at the then-prevailing prices (if any).

2.9 SOFTWARE MAINTENANCE

(11.01) Before release, major software elements such as the Monitor, FORTRAN, COBOL and system utilities are tested first of all by Digital's Quality Assurance group and then by field test at selected customer sites. Field test periods range from two to six months depending on the complexity and the importance of the software being tested.

Software malfunctions and documentation deficiencies may be reported via Software Performance Report forms. These SPR's are directed from a local forwarding centre to Digital's Software Engineering Group in Marlboro, where they are processed.

Over the last twelve months, SPR logging statistics for Australian DECsystem-10 installations show an average turnaround time (at the forwarding centre) of 9 weeks.

(11.02) The University's two existing sets of loose-leaf Software Notebooks would continue to be periodically updated subject to renewal of the annual Customer Software Maintenance Service. Individual manuals in handbook form are updated from time to time and may be ordered in quantity.

(11.03) Provided the University will execute Software Licence Agreements, in the usual form, covering the execution on the University's existing KA10 processor(s) of all software supplied to the University by Digital in the past, Digital proposes not to charge for Software Licenses covering the execution on the proposed 1090 system of the software listed as "Standard" in Appendix 6.

Appendix 6 lists the Standard and Optional software offered and the applicable support categories (as defined in Appendix 2, the Software Support Categories Addendum to the Software Product Descriptions).

Digital will install on the 1090 system all Category A and Category B software supplied with the system with the exception of IQL. Category A software will be warranted for a period of 90 days after installation, as described in the Software Support Categories Addendum. Category A and Category B software will attract SPR service for a period of one year after installation, as described in the said Addendum.

Digital recommends that the University continues its annual subscription to the Customer Software Maintenance Service (QHK02-K) so as to continue receiving periodical updates to the software supplied. The cost of this service is listed in Schedule UQCC07. Only one subscription to QHK02-K would be required for both the KA10 and the 1090 installations at the University.

On-site software support in addition to the above may be arranged from time to time at prevailing charges. The services offered and current rates are as follows:

CODE	DESCRIPTION	HOURS	$A
QS910-SZ	Hourly Consulting	1	46.00
QS912-SZ	Daily Consulting	7¼	319.00
QS926-SZ	5 Day Consulting (Mon - Fri.)	36¼	1,450.00
QS922-SZ	6 months resident	950	27,550.00
QS924-SZ	12 months resident	1900	51,300.00

Terms and Conditions governing on-site software support are available on request.

In the case of IQL, DBMS and APL/SF, an annual maintenance fee is also applicable, as follows:

CODE	DESCRIPTION	ANNUAL MAINTENANCE FEE
QH045	IQL Extended	$ 1,428.00
QH101	DBMS-10	
	Version 3	$ 3,245.00
QH071-A	APL-10/SF	$ 1,947.00

Such maintenance fees are first payable one year after installation.

2.10 OPERATIONAL MANAGEMENT

(12.01) Programs assisting operational management are listed under section 10.15.

Further programs of use to operators are

(i) OPSER - Multiplexers operator jobs to a single terminal

(ii) OMOUNT - Queues user requests for device mounts.

These systems are documented in the DECsystem-10 Software Notebooks.

2.11 TRAINING REQUIREMENT

Engineers and technicians can be trained at Marlboro on a special course to be held this (Northern Hemisphere) summer, together with several other DECsystem-10 customers, at $500 per week. This would cost $10,000 per man for a twenty week course, plus air fare and expenses. The University would be expected to pay for this course, as Digital no longer provides customer hardware training on a scheduled basis, and if an exception course is arranged the costs are shared between the customers, so no DEC training credits apply.

The 1090 purchase package includes thriteen training credits which can be applied at the rate of one credit per student week towards programming, administrator and operator training. The following courses are offered:-

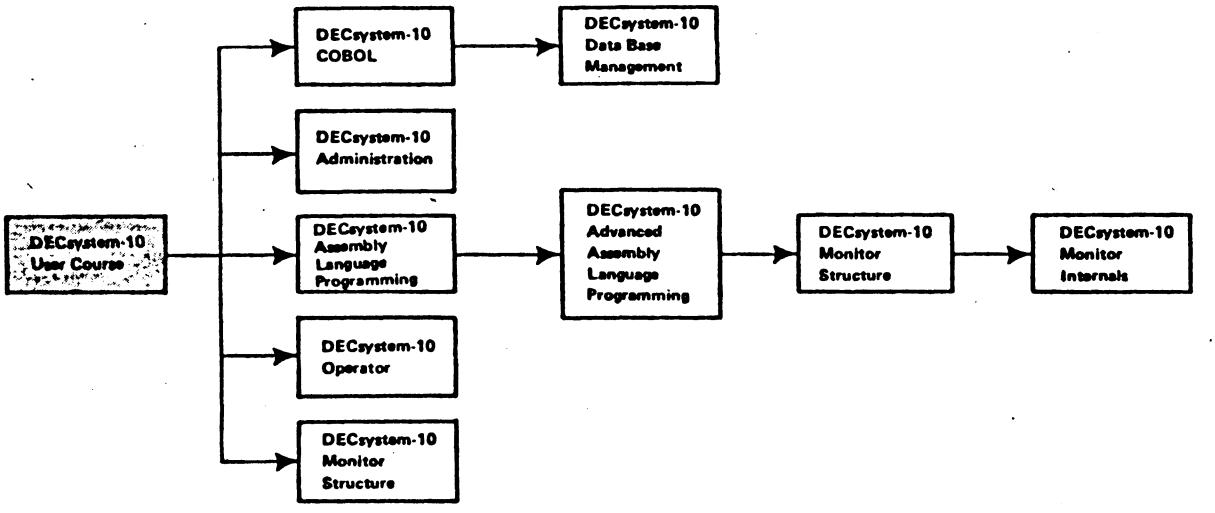
COURSE	TITLE	COMMENT
JAH06	DECsystem-10 User Course	Unnecessary
JHS03-A	DECsystem-10 Assembly Language Programming (2 weeks)	Unnecessary
JHS07-B	DECsystem-10 Advanced Assembly Language Programming	Recommended
JHS08-A	DECsystem-10 Monitor Structure	Recommended
JHS09-A	DECsystem-10 Monitor Internals (2 weeks)	Recommended
JHS12-A	DECsystem-10 COBOL	Unnecessary
JHS13-A	DECsystem-10 Data Base Management	Recommended
JHS05-A	DECsystem-10 Administration	Unnecessary
JHS14-A	DECsystem-10 Operator	Unnecessary

Courses flagged "unnecessary" are those which cover material presumed to be already familiar to the University. In particular, there is a five or six week string of courses, starting with Advanced Assembler and culminating with DBMS, which we recommend the University send at

least two people to Maynard for. These courses are worth five training credits per student, and we are willing to give two additional training credits plus pay the round trip Brisbane-Boston economy class fares to encourage three students to gain this experience at our DECsystem-10 "home office".

Any additional student-weeks would cost US$450 per unit, or US$2,250 for the five unit series. The course schedule for July-December is not yet available, but as these courses are taught in a regular pattern every two months you can assume that there will be one open week in this string, following Advanced Assembler, and there would be no other DECsystem-10 courses taught that week. We could arrange KL10B time for "hands-on" familiarisation during evening hours of that week.

Alternatively, we could attempt to schedule some of the courses at our training facility in Sydney, or even at your site, but as no KL10B hardware would be available, much of the laboratory session material would be wasted. We could approach WAIT for 1090 time, but this is also a second best solution compared to going to Marlboro. Marlboro course materials are not offered for sale, however the materials distributed to your students while in Marlboro could form the basis for your own courses. Also our Sydney training centre manager, Patrick West, feels your students could also get additional course materials from Marlboro as required. The only available training aid applicable to DECsystem-10 (as opposed to minicomputers is our Audio/Visual course on ANSI COBOL. You can purchase the A/V cassettes for US$1,614 and a set of ten workbooks for US$662, both charges include air freight from the U.S.A. and delivery to Brisbane (based on January 1977 tariff rates). As additional A/V courses become available we will offer similar terms, which are published US prices plus freight (i.e. no local charges).



COURSE ABSTRACT

This course is intended for new users of the DECsystem-10 (such as programmers, operators and administrators) who need to gain a basic user-level knowledge of the system.

PREREQUISITES

It is desirable, but not necessary, that the student have some prior computer experience. This might include college courses, industrial courses, or operator or data-entry experience.

COURSE OBJECTIVES

1. Skills
   a. Create and edit files
   b. Given a program – compile, load, execute and generate listings
   c. Transfer files between peripheral devices
   d. Create and submit batch control files and interpret the resulting log file
   e. Utilize several special purpose system programs
2. Knowledge
   a. Hardware and software components
   b. Disk file organization
   c. Multiprogram batch system structure

COURSE OUTLINE

I. Introduction to Timesharing
   A. Timesharing vs batch processing
   B. Multiprogramming concepts
   C. Swapping
   D. Dynamic scheduling
   E. Reentrant software

II. Introduction to DECsystem-10
   A. Hardware overview
   B. Resident software
   C. Non-resident software

III. Disk File Organization
   A. Naming conventions
   B. Protection codes
   C. Structures – UFDs and MFDs
   D. Ersatz devices
   E. Commands to access existing files

LAB 1

IV. Editor Usage
   A. File creation
   B. Basic editing – concepts and commands

V. Transferring Files
   A. PIP
   B. Monitor commands

LAB 2

VI. Advanced Editing
   A. Concepts and commands

DECSYSTEM-10 USER COURSE (CONT)

VII. Running Programs
- A. Compile, load, execute – REL files
- B. Generating listings
- C. EXE and SAV files

VIII. Tape Usage
- A. Concepts
- B. Commands
- C. Programs

LAB 3

IX. Multiprogramming Batch System
- A. Components and concepts
- B. Control files
- C. Log files

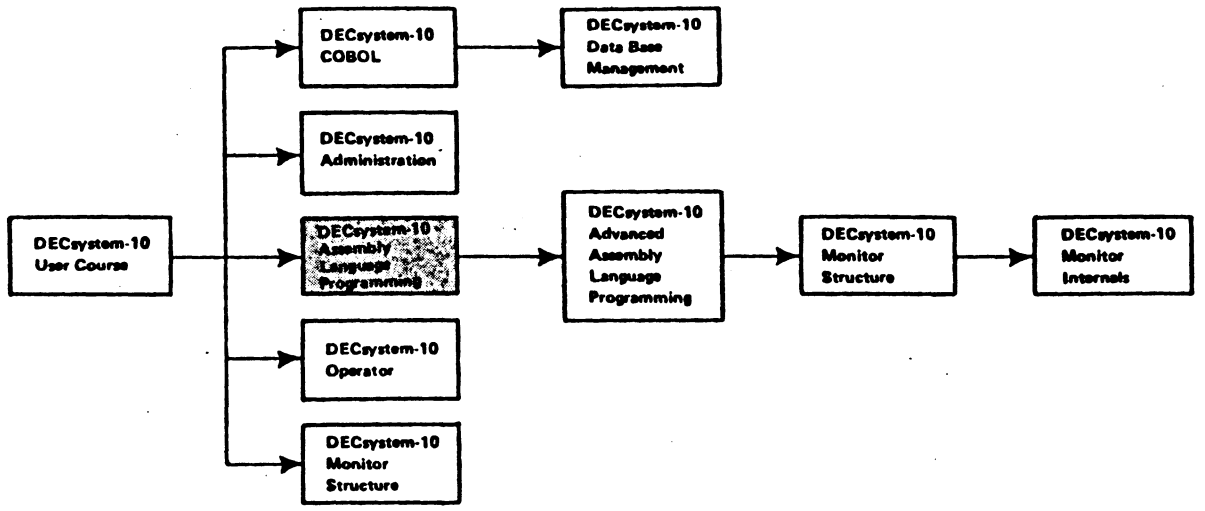
LAB 4

X. System Programs
- A. File Manipulation
- B. Object program examination
- C. Multiple job control
- D. Job information
- E. File formating
- F. Other editors

LAB 5

COURSE LENGTH: 5 days.

DECSYSTEM-10 ASSEMBLY LANGUAGE PROGRAMMING JHS03-A



COURSE ABSTRACT

This course covers the DECsystem-10 instruction set, user level I/O programming, and two-segment re-entrant programming. The system programs introduced will be the DECsystem-10 assembler (MACRO-10) and the Dynamic Debugging Technique (DDT). The lectures will be supplemented with classroom and laboratory exercises.

PREREQUISITES

DECsystem-10 User course or have equivalent experience, and some familiarity with assembly languages.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. Write and assemble programs using the DECsystem-10 instruction set and MACRO-10 assembler.
2. Use the common debugging facilities of the Dynamic Debugging Technique to test and debug MACRO-10 programs.
3. Utilize the more common pseudo-ops available to the MACRO-10 assembler.
4. Write a routine which performs buffered user mode I/O.
5. Write a sharable program utilizing the two-segment capabilities of the DECsystem-10.

COURSE OUTLINE

I. Introduction
   - A. Configuration overview
   - B. Processor overview

II. MACRO-10 Assembler
   - A. Nature of the assembler
   - B. Statement syntax
   - C. Listing formats

III. DECsystem-10 Instruction Set
   - A. Full-word transfer
   - B. Half-word transfer
   - C. Program control
   - D. Arithmetic testing
   - E. Byte manipulation
   - F. Logic
   - G. Fixed-point arithmetic
   - H. Logical test and modify

IV. Terminal I/O

DECSYSTEM-10 ASSEMBLY LANGUAGE PROGRAMMING (CONT)

V. User I/O, Buffered and Dump Modes
   A. Device Independent I/O
   B. Device Dependent I/O
      1. Disk I/O
      2. Magtape I/O

VI. MACRO-10 Assembler Facilities
   A. Commonly used Pseudo-ops
   B. Introduction to Macros and Conditional Assembly

VII. DDT (Dynamic Debugging Technique)

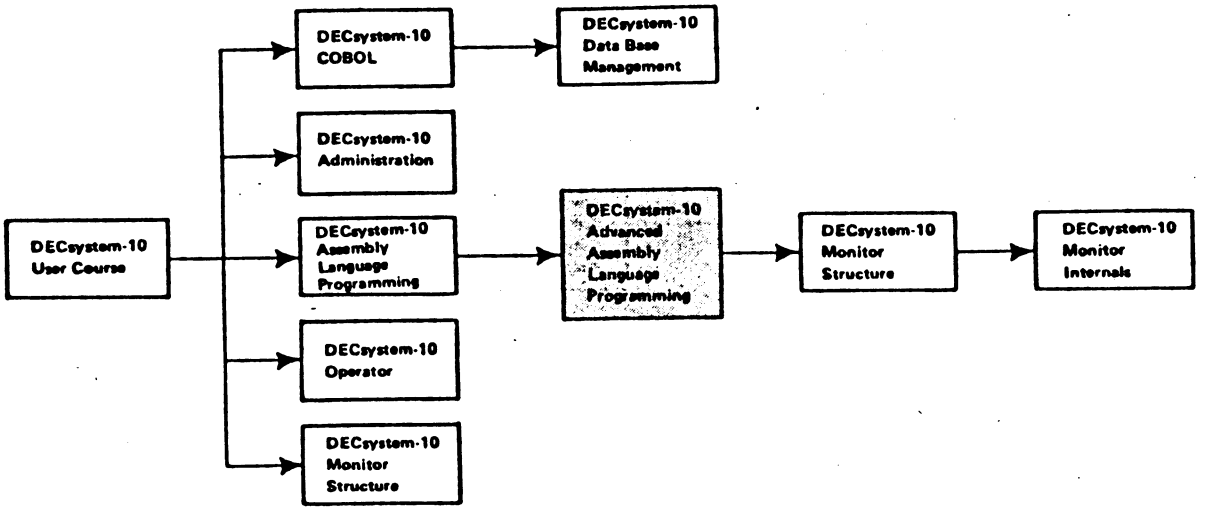
VIII. Subroutine Libraries

IX. Two-Segment Programming

COURSE LENGTH: 10 days

DECSYSTEM-10 ADVANCED ASSEMBLY LANGUAGE PROGRAMMING

JHS07-B



COURSE ABSTRACT

This course is a logical extension of the Assembly Language Programming course. As such, the emphasis is primarily on user level programming, although there is some discussion of real-time and monitor mode programming.

The course is intended for those whose primary job is MACRO-10 programming and for those who expect to serve as an installation's system programmer.

PREREQUISITES

Good user-level knowledge of TOPS-10 and a thorough knowledge of the subject matter of the DECsystem-10 Assembly Language Programming course.

COURSE OBJECTIVES

Upon successful completion of the course the student will be able to:

1. Write programs using the full power of MACRO-10 macros and conditionals.
2. Use a wide variety of advanced TOPS-10 monitor features.
3. Control I/O devices from user programs without monitor intervention.

COURSE OUTLINE

I. MACROS
   - A. Definition and invocation
   - B. Nesting, recursion and redefinition
   - C. Advanced features

II. Conditional Assembly

III. Advanced Monitor Capabilities
   - A. Programmed software interrupt system
   - B. Program to program communication
   - C. Core control
   - D. Environmental information

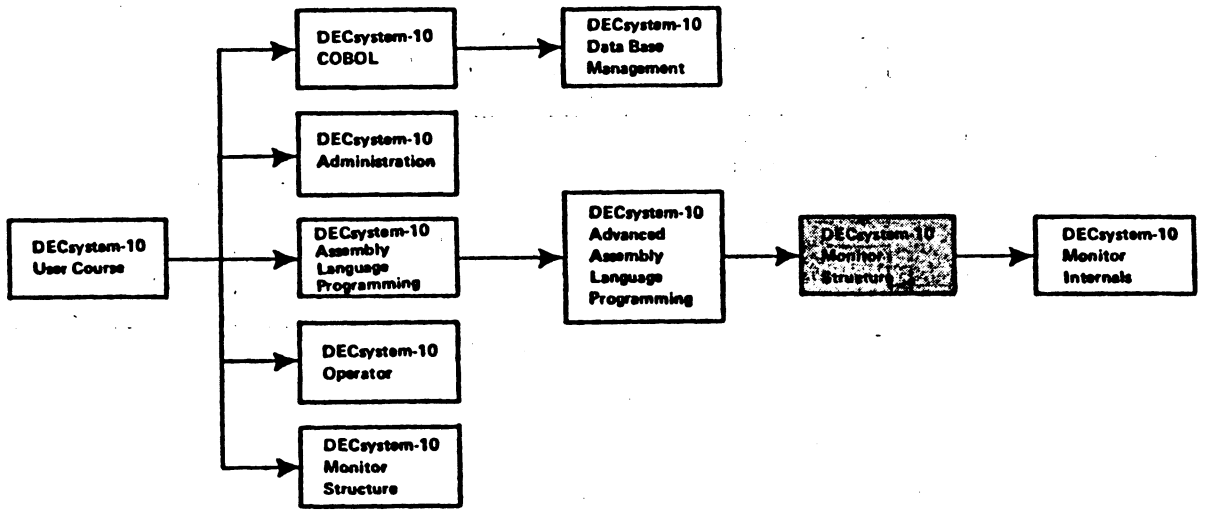
IV. Real-Time Programming

V. Programming in Executive Mode

COURSE LENGTH: 5 days

DECSYSTEM-10 MONITOR STRUCTURE

JHS08-A



COURSE ABSTRACT

Administrators or programmers interested in gaining an understanding of the major monitor modules and their interrelations are the intended students of this course.

The functions and data structures of the major monitor components will be discussed and the links between them highlighted. All students will gain an understanding of the overall system philosophy as well as the scheduler, swapper, virtual memory management, page handling, file management, and device service routines. This course also serves as a necessary prerequisite for *DECsystem-10 Monitor Internals*.

PREREQUISITES

DECsystem-10 User course or equivalent DECsystem-10 experience.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. List the prime functions of each major component of the monitor.
2. Describe the basic algorithms of the major components.
3. Discuss the memory management and virtual memory features implemented in the DECsystem-10.
4. Describe the major functions of device service routines.
5. Discuss system parameters and statistics.

COURSE OUTLINE

I. Hardware Overview
   - A. Configuration
   - B. Processors
   - C. Memory
   - D. Paging
   - E. Priority interrupts

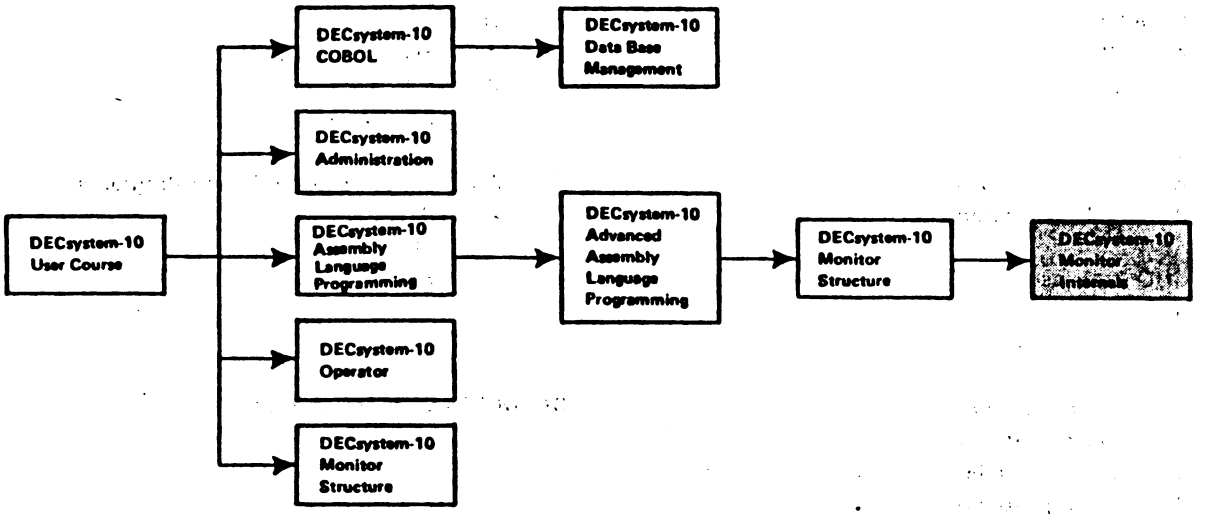
II. Introduction to the Monitor
   - A. Monitor modules
   - B. Monitor data base

III. Monitor Input/Output Services
   - A. Modes of I/O
   - B. Data structures

IV. The Clock Cycle
   - A. Major functions
   - B. DK10 real-time clock

V. Core Management
   - A. KA
   - B. KI/KL
   - C. Virtual memory

VI. Scanner Service
   - A. Hardware environment
   - B. Terminal buffer



COURSE ABSTRACT

This course is designed for experienced system programmers who need to understand the internal algorithms of the monitor in some detail.

The emphasis is evenly divided between an in-depth study of the monitor clock cycle and the device service routines (disk and teletype).

Students will learn about monitor macros and conventions as well as methods for adding commands, UUOs, and device service routines to the monitor.

PREREQUISITES

Extensive MACRO-10 systems programming experience and *DECsystem-10 Monitor Structure.*

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. Describe the steps which must be followed in adding a new command to the monitor.
2. Describe the steps which must be followed in adding a new UUO to the monitor.
3. Describe the principles involved in adding a new device service routine.
4. Given a specific system state, trace the control path through the monitor.
5. Describe the effects of an interrupt on the monitor data base and on subsequent monitor behavior.
6. Describe how a user disk I/O request is handled by the disk service routines.
7. List the actions taken by the scanner service when it receives an I/O interrupt from a terminal.

COURSE OUTLINE

I. Monitor Conventions
   - A. Macros and opdefs
   - B. AC usage

II. Clock Routine
   - A. Cyclic routines
   - B. Time accounting
   - C. Context switching

III. Core Management
   - A. Non-virtual memory considerations
   - B. Virtual memory considerations

IV. Command Processor
   - A. Tables and macros
   - B. Pre and post dispatch checks
   - C. Adding a command

V. Scheduler
   - A. Resource allocation
   - B. Job selection
   - C. Dual processing considerations

DECSYSTEM-10 MONITOR STRUCTURE (CONT)

VII. Scheduler
- A. Philosophy
- B. Components

VIII. Swapper
- A. Basic functions
- B. VM considerations

IX. UUO Processor
- A. UUO processing
- B. Functions

X. Device Service Routines
- A. Device data block
- B. Dispatch table
- C. Interrupt routine

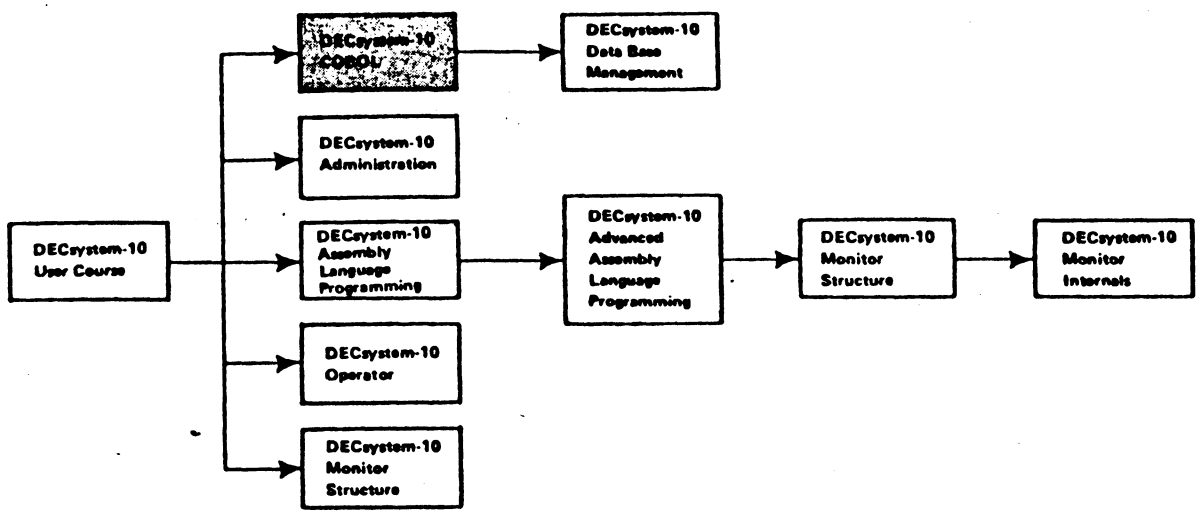
XI. Disk Service
- A. File structures
- B. Allocation
- C. Hardware

XII. Administrative Controls and Programs
- A. BATCON
- B. MONGEN
- C. Parameters

COURSE LENGTH: 5 days

DECSYSTEM-10 COBOL

JHS12-A



COURSE ABSTRACT

This course is intended for the programmer who has a basic knowledge of COBOL. The course covers COBOL 'erences between the DECsystem-10 and other COBOL implementations. In addition the following COBOL features are presented: COBOL SORT, TABLE HANDLING, SUBROUTINE LINKAGE, REPORT WRITER and I/O Access methods. The course includes laboratory exercises.

PREREQUISITES

DECsystem-10 User course and a basic knowledge of COBOL.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. Write a COBOL program using the REPORT WRITER, as well as the COBOL SORT and TABLE HANDLING features.
2. Write a modular COBOL program and understand the various subprogram linkages.
3. Write a COBOL program using the simultaneous update and I/O recovery capabilities.
4. Create COBOL files using any COBOL access method.
5. Use several utility programs effectively, including LIBRARY, SORT and COBDDT.

COURSE OUTLINE

I. Language Review

II. Data Types
- A. Recording modes
- B. Blocking

III. Organization and Access Methods
- A. Sequential
- B. Random
- C. Indexed sequential

IV. Utility Programs
- A. Library
- B. Sort
- C. COBDDT
- D. RERUN

V. COBOL Features
- A. Subprogramming
- B. REPORT WRITER
- C. COBOL SORT
- D. TABLE HANDLING
- E. Simultaneous Update
- F. Declarative Section

VI. BATCH Streams
- A. Test mode
- B. Production Mode

COURSE LENGTH: 5 Days

DECSYSTEM-10 MONITOR INTERNALS (CONT)

VI. Swapper
- A. Basic algorithm
- B. Interface to disk service

VII. UUO Processor
- A. Tables and macros
- B. Pre and post dispatch
- C. Specific features
- D. Adding a UUO

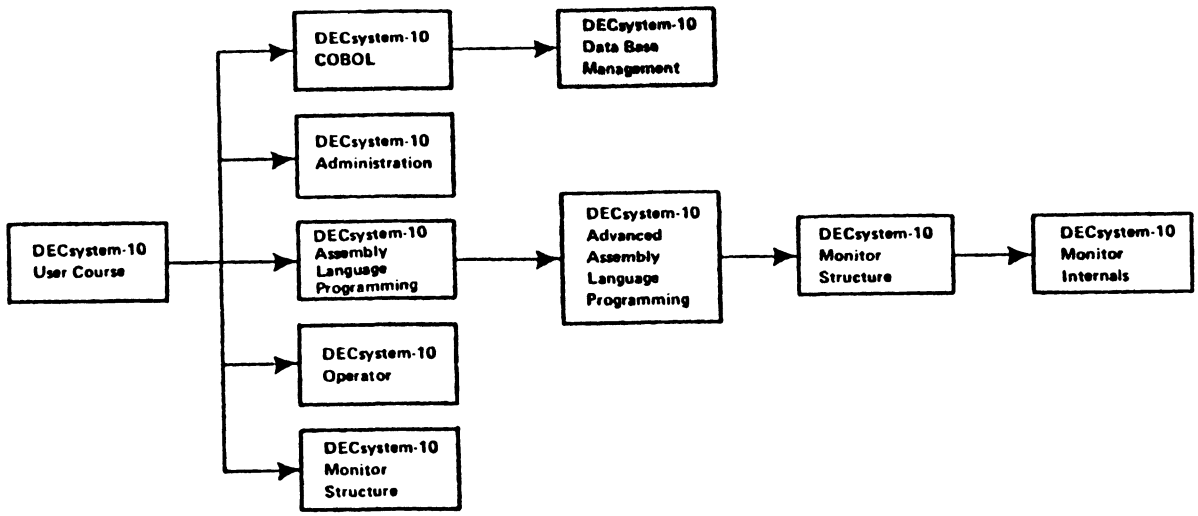
VIII. Device Service Routines
- A. Basic components
- B. PI channel assignment
- C. Adding a device service routine

IX. Disk Service
- A. Disk data base
- B. File I/O requests
- C. Interrupt handling
- D. Optimization
- E. Swapper of interrupt level

X. Communications Service Routines
- A. TTY chunk concept
- B. Receive interrupt
- C. Transmit interrupt

COURSE LENGTH: 10 days

DECSYSTEM-10 DATA BASE MANAGEMENT (DBMS-10) JHS13-A



COURSE ABSTRACT

This course is intended for prospective and initial users of DBMS-10 including management, systems personnel, and application programmers.

The course includes the Data Base Management concepts, facilities, and terminology. Basic data structures will also be discussed, as well as planning for DBMS-10. Functions and responsibilities of the data base administrator and the applications programmer will be covered. The components of DBMS-10 (DDL, DML, and Utilities) will be an integral part of the course and each student will have "hands-on" training in the laboratory sessions.

PREREQUISITES

DECsystem-10 User course or equivalent experience on the DECsystem-10, and a strong familiarity with the COBOL programming language.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. Define and understand the DBMS-10 concepts and terminology.
2. Identify the major factors which should be taken into consideration when planning for
3. Describe, using block diagrams, a sequential structure, a tree structure, and a network structure, as well as the corresponding set relationships.
4. Use the various utility programs as a tool in administering the data base.
5. Use the DDL component to create a Schema and a Sub-Schema.
6. Write a COBOL program using the DML facility to skillfully retrieve, update, and create data base records.

COURSE OUTLINE

I. DBMS-10 Overview
   - A. Definitions
   - B. Objectives
   - C. Benefits/advantages
   - D. Components/specific features
   - E. Demonstration program

II. Structures and Organization
   - A. Organization/access methods
   - B. Storage considerations
   - C. Organizing the data base
   - D. Set relationships

DECSYSTEM-10 DATA BASE MANAGEMENT (CONT)

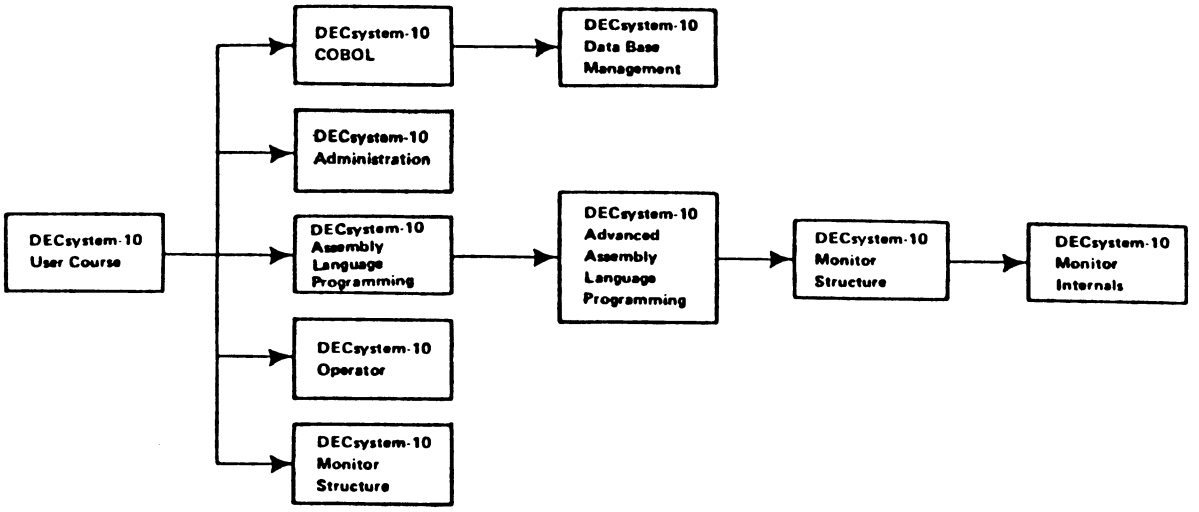
III. Data Administrator
- A. Responsibilities
- B. Functions
- C. Organizing the data base
- D. Security/integrity of data base
- E. Save, recovery, and restart procedures
- F. Data base documentation

IV. Schema Concepts (DMCL, DDL)
- A. DBCS
- B. DMCL
- C. DDL (Schema)
- D. DDL (Sub-Schema)
- E. Sample (Schema)
- F. Lab exercise

V. Data Manipulation (DML)
- A. Special registers
- B. Currency indicators
- C. Verbs
- D. Associated COBOL statements
- E. Sample program
- F. Lab exercise

VI. Utilities
- A. Standard DECsystem-10 utilities
- B. Selective dump and print (DBSDMP)
- C. DBMS-10 utility (DBUTIL)
- D. Utilization statistics
- E. Data dictionary
- F. Other utilities

COURSE LENGTH: 5 days



COURSE ABSTRACT

This course is designed for the individual who has the final responsibility of the technical decisions regarding the installation and operation of the DECsystem-10, as well as the overall responsibility for the effectiveness of the computer installation. The course material is applicable to the new installation where the decision maker must be aware of the system hardware, the system software, and the many parameters that are available to set up and fine-tune the DECsystem-10 for a specific installation.

The student should be the decision maker who will define the system, and/or the policy maker who will define operational policies *and* should know the hardware configuration.

PREREQUISITES

DECsystem-10 User course or equivalent.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. Understand the three major components of a DECsystem-10.
2. Understand the disk file organization, its parameters and their ramifications, and the system software available for management of it.
3. Describe the major pieces of software available for providing administrative control over the timesharing system and its user population.
4. Describe the major components of the Multiprogramming Batch system and the commands that are available to allow the student to provide the exact amount of Batch processing he desires.
5. Understand the various services that are available from DIGITAL.
6. Understand the role of operations management on the DECsystem-10.

COURSE OUTLINE

I. System Introduction/Overview/Review
   - A. Hardware configurations
   - B. Resident operating system
     1. Data base
     2. Major modules
     3. Library file
     4. Core image
   - C. Non-resident software
     1. Languages, libraries, and OTS
     2. Editors
     3. Utilities
     4. System software

DECSYSTEM-10 ADMINISTRATION (CONT)

D Controls on BATCH processing
1. Summarize commands
2. 6.02 scheduler

E. Advantages of Other System Programs
1. TWICE
2 DSKLST
3. DSKRAT

II Disk File Organization and Management
A Disk names and overview
B File structures
C File directories
D Files and their protection
E. Clusters
F. Quotas
G DEC PPNs
H SYS: files
I Distribution tapes
J. System overhead files
K. Swapping
L. Search lists

III Administrative Controls
A. MONGEN
Definition of hardware and software, communications, remote stations, and feature-test switches.
B. REACT
Accounting files, user profile and privileges, and user quotas and search list.
C. ONCE
Define file structures, swapping list, and system search list.
D FAILSAFE
Backup for disk files, why, when, and how.

IV. Multiprogramming Batch System
A OPSER, BATCON, and SPOOLER commands
B. BATCH jobs from terminal
C BATCH jobs from cards
D. Controls on BATCH processing
1. Summize commands
2 6.02 scheduler

V. Advantages of Other System Programs
A TWICE
B. DSKLST
C. DSKRAT
D. SPACE
E. SYSTAT/SYSDPY
F. FILCOM
G. GRIPE

VI. Services
A. Software Support
B Field Service
C. Education
D. Documentation

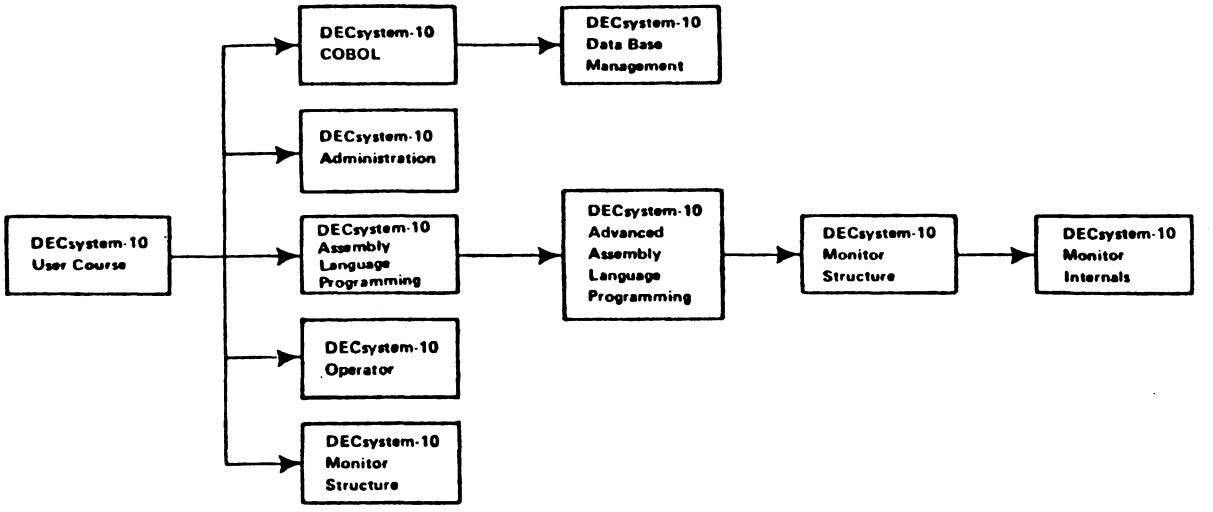
VII. Operations Management
A. Installation of system
B. Scheduling
C. CRASH and recovery procedures
D. Daily operations
E. Operations reports
F. Peripheral devices
G. Security
H. Communication with users

VIII. Personnel Management
A. Personnel for a typical installation
B. Training requirements

COURSE LENGTH: 5 days

DECSYSTEM-10 OPERATOR

JHS14-A



COURSE ABSTRACT

This course is designed to provide the student with the knowledge required for operating a DECsystem-10. The course material is applicable to all phases of computer room operations, and it includes an interaction with most of the DECsystem-10 software.

PREREQUISITES

A working knowledge of basic computer concepts and/or the successful completion of the *DECsystem-10 User* course.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

1. Perform the console duties and procedures with an understanding of their implications.
2. Perform the operations and basic maintenance on peripheral equipment.
3. Describe the basic software-hardware interrelationship.
4. Describe the procedure for defining disk structures.
5. Describe the procedure for saving disk files on magnetic tape.
6. Describe the multiprogramming batch system with its numerous controls.
7. Describe the interaction with users, system programmers, software support, and the system administrator on a day-to-day basis.

COURSE OUTLINE

I. Introduction to the DECsystem-10
   - A. Basic hardware information
   - B. Basic software information
   - C. Operator's console

II. Major Software Considerations
   - A. The resident operating system
   - B. Non-resident software
   - C. MONGEN to generate a Monitor

III. Starting-Up the System
   - A. "YOUR MONITOR" tapes
   - B. Bootstraps
   - C. Disk and file organization
   - D. ONCE only dialogue

DECSYSTEM-10 OPERATOR (CONT)

IV Running the System
- A. Multiprogramming BATCH
- B. Operator privileged commands
- C. Interaction with various users of system
- D. Entering Project-Programmer numbers with REACT
- E. Using the "SYSTEM" programs
  1. DSKLST
  2. DSKRAT
  3. REDALL
  4. SPACE
- F. Saving disk files with FRS

V. Error Diagnosis and Recovery
- A. System diagnostic and error codes
- B. Types of "CRASHES"
- C. CRASH procedure

COURSE LENGTH: 5 days

2.12 PERFORMANCE MONITORING

(14.01) (a) SOFTWARE MONITORING

The SYSTAT program gives a great deal of information on disk performance and error statistics. Incremental statistics may also be obtained from SYSTAT via the REENTER command.

A vast range of further information is made available to user-written programs by the GETTAB monitor call.

TRACK is a program for monitoring the progress and performance of individual jobs and the performance and utilisation of an entire system. It monitors the object being tracked at intervals set by the user and reports under criteria set by the user via switches. TRACK and its associated documentation are currently in the possession of the University.

The Monitor supports a Meter Point facility which allows easy measurement of overheads in user-defined paths of interest within the Monitor.

(b) HARDWARE MONITORING

The four clocks built into the KL10 provide a number of timing and counting functions including an interval timer, a time base, an accounting meter and performance analysis counter.

All of the operations on these clocks are accomplished by means of I/O instructions to internal devices. Many of these functions use a microsecond source of pulses which is counted down from the basic machine clock. The 0.005% tolerance will give less than five seconds drift over 24 hours.

The Interval Timer provides a programmable source of interrupts with a 1 microsecond resolution and is similar to the DK10 real-time clock. It is used for real-time applications and for page management by the Monitor. It is designed so that a real-time deadline schedule with varying deadlines can be implemented.

The Time Base provides a 52-bit microsecond resolution source of elapsed time. This gives over a 142-year maximum time before a wrap-around.

The Accounting Meters provide an accurate and reproducible measure of the amount of processor resource used by a job, interrupts, page features, and cache capacity.

The 60-bit Performance Analysis Counter allows the hardware and software performance of the KL10 to be studies by monitoring hardware signals from different parts of the system. Its use has advantages over purely software measuring techniques in that it creates no system interference, provides measuring "hooks" not usually available to the programmer, and allows for fine measurements at the submicrosecond level. The following machine states or events can be monitored:

* User mode
* PI Level n Active, n = 0-7
* Cache Miss
* Cache Writeback
* Cache Sweep
* EBox to MBox Request
* Microprogram Event
* Channel n Busy, n = 0-7
* ECL Probe Input

To condition the Performance Analysis Counter, the various hardware signals are brought together at the Meter Board and gated with enable levels set by the program. The input gating can be represented by the Boolean expression in the following chart:

TERM (AND ed)	SELECTED PERFORMANCE PARAMETER (O Red)
MODE	User OR Exec OR Don't Care
PI	PIO OR PI1 OR....OR P17 OR No.PI
CACHE	EBox-to-MBox Request OR Cache Miss OR Cache Writeback OR Cache Sweep OR Don't Care
CHANNEL	Channel 0 Busy OR Channel 1 Busy OR... OR Channel 7 Busy OR Dont't Care
UCODE	Microprogram Event OR Don't Care
PROBE	ECL Probe Input High OR ECL Probe Input Low OR Don't Care

Each term in the expression has a matching enable or group of enables. To perform a measurement, the program sets those enables that correspond to the machine parameters to be monitored. The program must also set the "don't care" condition in the groups of parameters that are not being monitored. This is because the terms in the Boolean expression are ANDed, requiring that all the terms be true to enable the clock. With the enables set, the Performance Analysis Counter increments in one of two clocking modes whenever the machine is in the state defined by the program.

The clocking mode, either duration mode or event mode, is also program selectable. In duration mode, the clock increments at one-half the basic machine clock rate as long as the Boolean expression is true.

In event mode, the clock increments whenever the Boolean expression goes from false to true.

The ECL probe may be connected to any ECL pin in the processor, and serves as a built-in hardware monitor.

A METER monitor call is provided to allow full access to the Performance Analysis Counter from a user program.

2.13 SITING AND ENVIRONMENTAL FACTORS

Apart from the processor cabinet which will be direct wired to the switch board, we would require power points to be available under the floor for connection to the other units.

The following is a list of the power requirements of the tendered system. Initially 120 amps per phase would be adequate. An additional margin to cope with future expansion would be 100 amps per phase.

KL10B	3 PHASE	50A	PER PHASE
MH10	SINGLE PHASE	15A	
MH10	SINGLE PHASE	15A	
BA10	SINGLE PHASE	15A	
TU45 (1ST DRIVE)	SINGLE PHASE	15A	
TU45	SINGLE PHASE	10A	
LP100	SINGLE PHASE	10A	
DN87S	SINGLE PHASE	15A	PER CABINET
DN81E	SINGLE PHASE	15A	PER CABINET
RP06 x 5	3 PHASE	6A	PER PHASE

All of the units tendered have circuit breakers, fusing and over voltage protection.

2.14 AIR CONDITIONING

UNIT	HEAT OUTPUT BTU/HOUR	TEMPERATURE RANGE	HUMIDITY
KL10B	75,000	60^{o} - 90^{o}F	20% - 80%
MH10 x 2	16,000	60 - 90	20% - 80%
BA10	3,000	60 - 90	20% - 80%
TU45 x 2	4,000	60 - 90	40% - 60%
LP100	5,000	60 - 90	20% - 80%
DN87 x 2	12,000	60 - 90	20% - 80%
DN81 x 2	12,000	60 - 90	20% - 80%
RP06 x 5	35,000	60 - 90	20% - 80%

The RP06's have absolute filtering on them to less than 1 micron. All other cabinets have coarse filtering.

For the best overall reliability, the following environmental conditions are recommended.

Temperature	-	70^{o}F $\pm$ 5^{o}
Humidity	-	50% $\pm$ 10%
Filtering Efficiency	<	3 microns at 95% efficient.

The total heat output of the configuration is 162,000 BTU/HOUR.

2.15 OTHER SITE PLANNING INFORMATION

The following list shows the cable requirements.

FROM	TO	AVAILABLE	NORMAL	MAXIMUM
KL10	RP06	15, 25, 40	25F	40
BA10	LP100	25, 50	25F	50
KL10	MH10	5, 10, 15, 25, 35	25F	100
KL10	DN87	10, 15, 25,	25F	40
RP06	RP06	2.5, 10	2.5	10

The floor loadings are:-

UNIT	WEIGHT
KL10	2700 LB
BA10	400 LB
TU45	550 LB EACH
MH10	800 LB EACH
RP06	600 LB EACH
DN87	600 LB EACH
DN81	700 LB EACH

Any additional information will be made available as required.

2.16 BENCHMARK TESTS

We can appreciate that at this stage of the tender process, the University is reluctant to invest the considerable time required to assist each vendor in preparation of a benchmark. Since we are offering a completely upward compatible system to your 1055, we assume you may want to run some existing 1055 job streams, possibly in a controlled timesharing environment, on a 1090. We can arrange 1090 time at WAIT, but would prefer that you visit Marlboro to test a configuration similar or identical to that proposed. Also in Marlboro we have facilities for rapid reconfiguration so that alternative hardware configurations can be tested for performance comparison.

2.17 BACK-UP INSTALLATION

Since our proposed solution encourages the University to maintain its 1055 as a 1050 indefinitely, the obvious solution to a 1090 failure is to run essential systems on the 1050. However, in the event of some catastrophe which puts the entire Centre out of operation for an extended period (e.g. a flood, tornado or earthquake), you are already familiar with the other Australian DECsystem-10 users, named below:-

James Cook University - Townsville

* 1 x KA10 (1040)
* 224K words memory
* 3 x RP02 disk drives
* 1 x RP04 disk drive
* 2 x TU55 dectapes
* 2 x TU10 magtapes
* 1 x LP10-F printer
* 1 x CR10-B card reader
* 1 x 565 plotter
* 1 x DC10 communications link - 32 lines - 29 terminals
* 1 x DN87 communications link - 16 lines
* 1 x GT40 graphics

Flinders University - Adelaide

* 1 x KI10 (1060)
* 192K words memory
* 4 x RP03 disk drives
* 2 x TU10 magtapes
* 2 x printers
* 1 x CR10-E card reader
* 1 x CR10-F card reader

Flinders University - Adelaide (contd..)

* 1 x 565 plotter
* 1 x DC72 remote batch
* 1 x DC10 communications mux. - 32 lines - 8 terminals

Australian National University - Canberra

* 1 x KA10 (1040)
* 80K words memory
* 1 x RP02 disk drive
* 1 x TU20 magtape
* 1 x LSP10 printer
* 1 x DC10 communications mux. - 8 lines - 6 terminals

Australian National University - Canberra

* 1 x KA10 (1040)
* 80K words memory
* 3 x RP02 disk drives
* 3 x TU10 magtapes
* 1 x LP10-F printer
* 1 x CR10-F card reader
* 1 x DC10 communications mux. - 16 lines - 7 terminals

La Trobe University - Melbourne

* 1 x KI10 (1070)
* 256K words memory
* 2 x RS04 swapping disks
* 4 x RP03 disk drives
* 2 x TU56 dectapes
* 1 x TU16 magtape
* 2 x TU40 magtapes
* 1 x LP10-F printer
* 1 x LSP-10 printer

* 1 x CR10-E card reader
* 1 x CR10-F card reader - Gould plotter
* 1 x DC10 communications mux. - 96 lines - 60 terminals
* 1 x VT04 graphics

Aeronautical Research Labs - Melbourne

* 1 x KI10 (1060)
* 128K words memory
* 4 x RP04 disk drives
* 6 x TU55 dectapes
* 1 x TU20 magtape
* 3 x TU30 magtapes
* 1 x LP10 printer
* 1 x CR10-B card reader
* 1 x 565 plotter
* 1 x DC76 communications mux. - 64 lines - 33 terminals
* 1 x 338 graphics

Melbourne Stock Exchange - Melbourne

* 2 x KA10 (1055)
* 208K words memory
* 2 x RD10 swapping disks
* 2 x RP02 disk drives
* 2 x RP03 disk drives
* 10 x TU55 dectapes
* 2 x TU20 magtapes
* 1 x LP10-A printer
* 1 x LP10-F printer
* 5 x 6801 communications mux.
* 2 x DC10 communications mux. - 26 terminals

University of Western Australia - Perth

* 1 x KA10 (1040)
* 128K words memory
* 1 x RP03 disk drive
* 4 x TU56 dectapes
* 4 x TU20 magtapes
* 1 x CR10-B card reader
* 2 x plotters
* 1 x DC76 communications mux. - 61 lines - 61 terminals
* 1 x 340 graphics

Western Australia Institute of Technology - Perth

* 1 x KL10 (1090)
* 256K words memory
* 2 x RP06 disk drives
* 1 x TU16 magnetic tape
* 1 x CR10-D card reader
* 1 x LP10-F line printer
* 1 x DN87 communications mux. - 32 asynchronous lines
  - 1 synchronous line
  - 1 remote DN80 RJE

2.18 EXPANSION

Eight years of growth at 30% per annum results in the following demand for capacity:-

A+	X INITIAL CAPACITY
Year 2	1.3
Year 3	1.69
Year 4	2.2
Year 5	2.86
Year 6	3.72
Year 7	4.84
Year 8	6.29

The DECsystem-1090 KL10B central processor is already four times the speed of the KA10, not considering any of the system performance enhancements such as paging hardware, double precision floating point, Quadword 144-bit memory ~~baud~~ band width, integral channels, cache memory, 8-ported memory, etc., etc.. Expansion to a 1099 by adding a "slave" KL10B doubles the potential central processor power. Digital is experimenting with triple and quad CPU configurations, so given the pace of technology in this industry, by year 4 one of two situations is virtually certain: either you can add more than one slave KL10B or you will see an upgrade to the KL10B with at least twice the performance. The latter has happened twice in the past eight years.

There is a design limitation on the KL10 address bus of 16 physical external memories. The latest MH10 256K word memory unit permits 4M words on one system (22-bit addressing) but the 23-bit virtual scheme used by the KL10 could be used to address 8M words should we announce a 512K word unit (note that memory density has doubled every two years since 1965). Even 4M words is far in excess of the University's expansion requirements.

The RP06 disk pack drives store 200MB physically, 176MB formatted. Of the eight integrated channels it is best to restrict disk controllers to the first four as these have priority over the next four. Four RTP06 controllers expanded to eight disks each, or 32 RP06 drives total, would be 6.4BB unformatted or 5.6BB formatted, i.e. the six fold expansion capability desired over the initial 1BB. However, it is doubtful that the RP06 is by any means our "ultimate" disk, judging from the progression from RP02 (5MW) to RP03 (10MW) to RP04 (25MW) to RP06 (50MW) in less than eight years. Within two years we anticipate drives over 1BB per spindle.

The TU45 magnetic tape subsystem can be extended to eight drives. However, at 75 inches per second and 120KC transfer rate, it is by no means our fastest tape. The TU70 and TU71 subsystem (three times the price) gives 200 inches/second and 320KC transfer. The TU72 (9 track only) offers 1600/6250 cpi at 125 inches/second for 781KC, or twelve times the TU45. You can have multiple tape controllers (up to 4 for 32 transports) or in the case of the TU7X series, each transport can be connected to multiple channels so that a 2 X 16 tape configuration can be implemented.

The LP07 Charaband printer is as fast as any current technology impact printers, however, we can drive multiple LP07's should this be required. The general trend these days is already in evidence at the University, i.e. distributed data processing where additional peripheral unit record equipment is placed on remote minicomputers which may even be doing local processing as well as linking users to one or more host mainframes. Digital is setting the technical pace in distributed data processing, and between the DAS DN range and the possibilities with DECNET, we believe we can handle both your unit record and communications network growth requirements.

The number of simultaneous users may be more of a problem. Our technical literature says we can support 256 timesharing users on a 1099 or 1,024 transaction processing users. Experience indicates these numbers will not necessarily increase linearly with increased hardware and software performance capability. The reason for this is that the user gets more sophisticated and his expectations of performance increase as well as the system potential to satisfy him. If every DECsystem-10 user made the same demands on a 1099 that he thought were reasonable on a 1040 ten years ago, we could easily support 512 users. All we can promise here is that we think we are ahead of the game so far as timesharing is concerned and we are investing more money into research and development than any competitor (including IBM) to stay that way. We can show you 600 terminals running on a 1077 at Ramada Inns, but we cannot tell you today how we would best support 1200 terminals in 1985. If our story sounds conservative, have a closer look at those who claim a n-fold increase in timesharing population can be supported merely by increasing hardware capacity n times. How many users can ~~then~~ they show running timesharing today?

In summary, we have selected the equipment for our proposal configuration so that the system not only meets your stated requirements, but can be expanded in incremental, relatively inexpensive steps to satisfy your projected 30% growth rate over the next eight years.

3.0 EXPERIENCE AND SUPPORT

3.1 DEC Background

Digital Equipment Corporation was founded in 1957 by a small group of engineers headed by Kenneth Olsen. Most of these individuals had been deeply involved in computer development at MIT's Lincoln Labs. They contributed to the development of the Whirlwind computer and were actively involved in the design of the first transistorised computer, TXO.

Digital was originally founded to build transistorised logic modules for laboratory applications. It was nearly four years later that Digital produced its first computer, the PDP-1 (Programmed Data Processor). This was the prelude to the development of the PDP-5, the world's first real mini-computer, and predecessor of the now famous PDP-8.

Since that time, Digital has actively pursued the development of the minicomputer through sucessive technological improvements and unique architectural designs. The PDP-11 family of computers exemplifies this philosophy. Digital Equipment has delivered more minicomputers than any other organisation.

Digital is also well known for its large scale computer systems, the DECSYSTEM-10 and DECSYSTEM-20. These systems have been industry leaders in the growing trend towards the timesharing use of large computers in distributed computer networks with a host computer communicating with dedicated minicomputers. Today, the DECSYSTEM-10 has an installed base of over 500 systems.

Sales since 1957 have grown to over $700 million, and all told, over 70,000 DEC computers have been shipped. This outstanding growth, however, has not been solely in the form of offering attractive state-of-the-art hardware at competitive prices, but has been the result of a comprehensive on-going plan to provide the best available total computer resources to our customers. This has included:-

1. The development of a highly skilled worldwide sales engineering staff to help the prospective customer in the proper application and use of the computer tools we offer.

2. The development of a specially trained field service force, now exceeding 3,500 technical personnel.

3. The investment in research development and manufacturing of peripheral computer devices to insure our customers of adequate supply and to generate the continued high quality and performance levels uniquely tailored to the needs of the minicomputer industry.

4. The increasing investment in development of complex software systems to enhance the use and effectiveness of these computer systems. More than 800 professionals are now involved in software development for operating systems, language processors, and applications.

5. The widescale deployment of skilled software support personnel in the field to help install these software systems and support the customer during the early, and often critical phases of its use.

6. The establishment of a worldwide network of training facilities staffed with expert instructors in both hardware and software disciplines. These personnel are also available to develop special courses to be taught on-site should customer requirements so dictate.

7. Custom engineering and manufacturing through the Computer Special Systems group, who undertake design and manufacturing of special equipment interfaces and software specifically to meet customer requirements in a unique application. Over 500 engineers, programmers and support people are at the disposal of the customer with special requirements, including complex multiprocessor and computer network systems.

3.2 Digital Equipment Australia

DEA is a district organisation within DEC's General International Sales Region. General International, consisting of Australasia, Japan and South America is managed by the Australian who started DEA in 1964, Dr. Ron Smart. In thirteen years, DEA has grown from two employees to over 300, with sales offices in Adelaide, Brisbane, Canberra, Hobart, Melbourne, Sydney and Perth, plus additional field service offices in Newcastle, Townsville and Wollongong.

Current support staff within Australia includes 151 Field Service, 34 Software Support and 12 Special Systems personnel.

Over 1200 PDP computers are now installed in Australia, including several communications networks. There are nine DECsystem-10 customers and three DECSYSTEM-20 customers with 8 KA10 processors, three KI plus one KL processors installed, plus one DEC-20 installed and three on order.

In New Zealand, Digital is implementing one of the largest computer networks in the world based on two DECsystem-1060 sites linked to 48 minicomputers for the Department of Health.

3.3 HARDWARE MAINTENANCE SERVICES

Hardware Maintenance Services provide on-site and depot maintenance for all system hardware components, preventive maintenance and installation, and a number of contract arrangements to meet varying requirements.

Field Coverage

Field Service meets its charter responsibility by equipping its in-field force with enough local manpower and material resources to provide customers with the best service cost/benefit comparison to be had in the industry. That word "local" denotes a key concept - Digital has systems-trained service representatives and spare parts depots in 260 locations worldwide. From these locations, 3000 service representatives provide warranty and 10,000 Service Agreement customers with the best computer maintenance service available anywhere, at any price. In N.S.W. alone, we have Field Service representatives located at the Sydney head office, Newcastle, Wollongong and also in the A.C.T. This, combined with the high reliability hardware that has made Digital the leader in the computer industry, ensures maximum availability of systems.

Corporate Support

A great deal of maintenance service, however, is provided to Digital users far from their computer room, perhaps before they even receive their computer system. In-field reliability monitoring for example, begins when the first device service call is made by a Digital service representative anywhere in the world. Field Service call reports are completed and sent to corporate headquarters where they are correlated and stored on an in-house DECsystem-10. From this data, Corporate

Field Service device support specialists are able to spot developing reliability problems and to generate, in co-ordination with design and manufacturing engineers, corrective Engineering Change Orders. These ECO's - priority coded from M-mandatory (must be installed immediately), to K-cosmetic (install at customer request) - are installed free of charge for Warranty and Service Agreement customers.

Logistics Network

Reliability enhancement through automatic ECO installation is only one of the service benefits enjoyed by Warranty and Service Agreement equipment owners. These Digital customers benefit also from a world-wide logistics network which makes automatic distribution of recommended spares to Service offices receiving their first shipment of a new device. Service office inventories are computer-controlled by an inventory management system which correlates device reliability data with the Warranty and Service Agreement base being supported by a given field office. That adds up to high parts availability assurance levels and minimal material shortage downtime.

Field Inventories

But even the best inventory management system can't predict every failure. That is why Digital backs up extensive field inventories with an emergency parts service to ship a customer system spares anywhere in the world by the fastest means available - part of the corporate commitment to keep customer systems working.

Critical Applications Service

Digital's basic service agreement program includes priority response, scheduled preventive maintenance, unlimited parts and labor, and the administration and installation of Engineering Change Orders. This service is available from 8 hours, 5 days per week to 24 hours, 7 days per week.

In addition Digital Field Service is committed to the Critical Application customer - the user for whom uninterrupted system task performance is vital. For this class of customer, Digital has developed the Critical Applications Service Agreement. This service plan guarantees response time within critical time frames and further guarantees that once on site, Digital will work continuously until the system is returned to operating condition. If that commitment means working through and beyond the contract period, the customer sees no additional expense.

With a mature, worldwide service organisation, Digital has a wide variety of Service products which can be tailored to meet the system maintenance needs of any Digital hardware owner. These products range from Critical Applications Agreements to OEM Agreements and Mini-System and Terminal Service plans, to in-field Product Repair Centres.

Product Repair Centre - Sydney

In addition to the field maintenance support team who maintain equipment on-site under contract or on a per-call basis, a Product Repair Centre exists in Sydney. This centre has basically two functions:-

1. To repair and refurbish commonly used devices such as modules, so that during a field service call, an engineer may replace a complete sub-assembly. This minimises any inconvenience to the customer by reducing down time, should any repairs be necessary.

2. A facility to repair equipment returned to the Centre by customers in remote locations. This may be done on a contract basis for designated equipment or on a time and materials basis. This latter facility seems most appropriate for the equipment offered in this schedule.

3.4 SOFTWARE SERVICES

The Digital Software Services organisation represents over 5,000 man-years of experience gained from the development and support of operating systems used in more than 70,000 computer installations. This expertise varies in complexity from real-time executives for minicomputers to complete software networks. Applications experience covers the spectrum from process control and monitoring scientific experiments to implementing reservation and inventory control systems.

This expertise reaches users through services that start from the personal attention of a skilled software consultant to the distribution of up-to-date software and software information. In this way, Digital users can get the most out of Digital computer systems and keep pace with the rapid advancements in software.

Software Consulting Services

Digital's consultants are software professionals specifically trained in Digital products. They are experienced in designing, coding or modifying customer software as well as tailoring Digital software to meet specific needs. Consultants are well versed in application areas such as communications, graphics, commercial data processing, process control and real-time systems. They are complemented by home office software support specialists, who provide additional technical back-up, often lowering your project cost.

Digital software consultants can meet many different needs. For example, you may wish to temporarily supplement your staff to meet a critical project completion schedule. As a new user you may want a consultant to work hand-in-hand with your personnel in order to reduce their learning curve and expedite productivity.

Consulting services are available on a time-and-material basis for a short term (per-call), or a longer term (monthly or resident).

Software Maintenance Services

In order to provide customers with a continuing level of support for their software systems, Digital provides Software Maintenance Services. Several levels of service are available as options ranging from a periodic software newsletter to automatic updates of software and manuals.

Periodic newsletters are mailed to all maintenance service subscribers. They contain information on system enhancements and new software products, general software information, software difficulties and their suggested solutions, and all in a timely manner. This "Software Despatch" is distributed in loose-leaf binder format for easy reference and updating.

Subscribers to more comprehensive maintenance service plans receive the latest software updates on a suitable medium, as well as current issues of manuals and manual updates.

Software components, including documents and updates, can be purchased separately.

Software Distribution Centre

Over 1,000 software items and documents are available from the Software Distribution Centre (SDC). Included are source and binary software products on DECtape, paper tape, disks, magnetic tape, and cassette; paper and microfiche listing; textbooks, handbooks and manuals.

3.5 EDUCATIONAL SERVICES

Digital's training facilities are worldwide and include a competently staffed, well equipped centre in Sydney, dedicated to providing all the timely education and training needed in support of all Digital systems.

Curriculum Philosophy of System Training

Educational Services, through its Course Development Group in liaison with Digital's Engineering and Software Development Groups, has taken a curriculum approach to customer training.

Educational Services can provide a curriculum of courses allowing a computer novice to progress from entry level to advanced level proficiency in software, hardware, or system management. Curricula for every CPU and operating system are graphically illustrated in flowcharts accompanying course descriptions in the Educational Courses Catalogue. These flowcharts make the analysis and planning of a training program a very straightforward procedure.

Facility Courses

Catalogue courses are regularly scheduled classes offered at training centres. Presently, there are more than 100 scheduled classes that cover the range from first-time user to highly specialised training on theory of operation. Most catalogue courses include extensive hands-on laboratory time, and all incorporate the use of a broad assembly of student workbooks, reference manuals, and other instructional materials.

On-Site Instruction

You may find it more economical to have Educational Services conduct courses on your own site. On-site instruction of both catalogue and custom courses eliminates travel and other expenses incurred by students attending

classes at training centres. This method of instruction further enhances training by allowing Digital instructors to emphasise points of particular value to the student's applications and operations.

Customs Courses

Specialised training is available for users with unique applications or training situations. This approach is designed to give the student the maximum relevant material for specific applications while minimising extraneous information. The custom courses are tailored to the individual customer's schedule and typically comprise a series of courses. These can be modified from existing courses or be entirely new programs based on mutually agreed upon objectives.

Audio-Visual Courses

By taking advantage of the latest in audio-visual techniques, Educational Services has developed a series of courses that offers independent learning. Audio-visual courses are convenient, self-contained, and modular in topic. The self-instructional format allows students to progress at their own rates, study when and where they wish, and play back modules for review. Audio-visual course material is available in several forms - typically videocassette, or audio/filmstrip cassette - all supported by student workbooks.

3.6 SPECIAL SYSTEMS GROUP

Digital Special Systems is a worldwide organisation dedicated to serving the special needs of Digital customers. It is comprised of more than 500 people - systems designers, hardware and software experts, a network of project managers, application specialists, technicians and production people. As a widely experienced systems organisation, Special Systems provides a range of special solutions from processor interfaces and handlers to multiprocessors and complete turnkey systems. Fully staffed offices in the U.S., Canada, England, Germany, France, Japan and Australia offer global capability and regional support.

Hardware

Special Systems has been demonstrating its capability for over fifteen years. Its worldwide engineering groups have developed special products such as unique peripherals, data collection systems, special interfaces, multiprocessors, and interactive graphics. Additionally, applications involving process supervisory and machine control have been successfully designed for particular customer needs.

Application Programming

A key ingredient in a successful computer system is tailoring the application software to meet specific needs. Application software may be designed and implemented by the computer system customer or Special Systems, or through an effort utilising combined resources. Special Systems' broad base of experience in computer systems and engineering disciplines, coupled with a staff of application analysts, permits us to grasp unique requirements, rapidly prepare detailed system specifications, and provide application programming services, all on a "turnkey" basis if required. Special Systems personnel have worked on a wide range of applications including steam turbine power plants, batch mixing systems, communication networks, process control and monitoring, warehouse control (stacker cranes), factory

automation and data acquisition, pipeline distribution systems, hospital systems, computerised baggage handling, and graphic display and plotter systems.

Project Management and Systems Engineering

To provide smooth and efficient progress from initial design to full implementation of computer systems, project management is of prime importance. Special Systems assigns a project manager to all projects requiring this function. It is this individual's responsibility to oversee and coordinate system specification and design, schedules, design approvals, documentation reviews, acceptance testing and final installation. The project manager also functions as the customer contact for all communication regarding progress reports, changes to system design, schedules, or any questions pertaining to the system.

As project management ensures that project activities are correctly performed, system engineering performs them. For system integration purposes, Special Systems maintains a high complement of capital equipment, enabling new designs to be tested quickly and effectively. The extensive experience of Special Systems in engineering and project management, ensures a well planned and executed system development.

Special Systems Production

All Special Systems manufacturing operations provide a fast response manufacturing resource to support the prototype engineering of the special products that are unique to Special Systems business. Additionally, Special Systems production has the capability to manufacture an impressive spectrum of high quality products in volume, ranging from printed circuit board plotter controllers to highly complex bus switches for multi-processor systems.

The high quality of Special Systems products is maintained by an effective ongoing quality assurance program that is implemented by a staff of trained inspectors and skilled technicians. The Q.A. program includes inspection

and test of incoming materials and finished goods, mandatory inspection procedures of finished products and systems prior to acceptance for shipment. Another feature of Special Systems production is a specially trained, highly skilled technical support service ready to provide site installation and post installation support of all Special Systems.

Documentation

With each product, Special Systems provides complete documentation. It includes topics such as specifications, operation and programming, and maintenance. All system or software documentation efforts involve complete documentation or specification before implementation begins. The resulting system or program is then capable of easy growth and modification.

Field Service

In-field support of Special Systems products is structured to efficiently and quickly access the level of technical knowledge required for effective support. The product market support organisation is the focal point for field problems, identifying and assigning the proper resource, and monitoring the solution process to assure satisfaction. Resources range from the technical support group, developed to provide in-field assistance to Field Service to the actual designers of the product.

3.7 DECUS

Digital Equipment Computer Users Society (DECUS) is a voluntary, non-profit users group supported by Digital. It is the largest and most active user group in the computer industry. Entirely controlled by users, the DECUS charter is to:-

* Advance the art of computation through mutual education and interchange of ideas and information.
* Establish standards and provide channels to facilitate the free exchange of computer programs among members.
* Provide feedback to the manufacturer on equipment and programming needs.

The Society sponsors technical symposia twice a year in the United States, and once a year in Europe, Canada and Australia. The Society also maintains the Program Library, publishes a library catalogue, proceedings of symposia, and a periodic newsletter - DECUSCOPE.

Membership

Membership in DECUS is voluntary and does not require payment of dues. Members are invited to take an active interest in the Society by contributing to or borrowing from the Program Library, contributing to DECUSCOPE, and participating in meetings and symposia. Membership is open to any installation that has purchased or has on order a Digital computer, or to any individual who uses a Digital computer.

Program Library

The DECUS Program Library is one of the major activities of the users group. It is maintained and operated separately and contains programs contributed by users..

The Library contains many types of programs, such as executive routines, editors, debuggers, special functions, games, maintenance and various other classes of programs.

Library Catalogues are issued which list all programs available from DECUS.

There are submission standards which programs must meet before they are accepted in the Library. Review procedures determine whether the program remains in the Library, is changed, or is removed. Library programs are available to all members on a request basis, for reproduction and handling charges only.

Activities

The proceedings and papers presented at the symposia and seminars are published shortly after each meeting and are sent automatically to meeting attendees and upon request to others.

Joint Users' Group

The Society has been a member of the Joint User's Group (JUG) of the Association in Computing Machinery since April, 1964. DECUS sponsored the first JUG Executive Workshop in April, 1966, and has participated in workshops held once a year ever since. Workshops consist of administrative personnel from several users' groups. The purpose of the meetings is to establish means for intercommunication among user groups.

Local Users' Group

DECUS encourages subgroupings of users with common interests. One of the most successful subgroupings has been Local User Groups. There are over 30 active Local User Groups, called LUGs, operating all over the world.

Special-Interest Groups

Special-Interest Groups (SIGs) are formed to promote the interchange of specialised information and have no geographic limitations. Specialisations may be for application areas, subject areas, such as languages, or even specific computer lines. Examples of active SIGs are users in education, newspapers, clinical laboratories and interactive graphics.

4.0 PRICING AND CONTRACTS

4.1 STANDARD TERMS AND CONDITIONS:

Attached please find the standard terms and conditions of sale of the proposed equipment.

Comments on specific conditions in the specifications are included elsewhere in this proposal.

GLOSSARY OF TERMS:

1. Data Processing System and/or Subsystem -

   The total complement of individual machines which are acquired to operate as an integrated group

2. Equipment -

   An all inclusive term which referes either to individual machines or to a complete data processing system or subsystem

3. Equipment Failure -

   A malfunction in the equipment, excluding all external factors, which prevents the accomplishment of a job normally performed by the equipment

4. Installation Date -

   The date by which the contractor must have the ordered equipment ready for use by the University

5. Machine -

   An individual unit including special features installed thereon of a data processing system or subsystem, identified by a type and/or model number, such as a central processing unit, additional memory modules, a tape unit, or card reader, etc.

6. Mechanical Replacement -

   The replacement of one machine for another occasioned by the mechanical condition of the equipment being replaced

7. Operational Use Time -

   That time during which equipment is in actual operation and is not synonymous with power-on time

8. Preventive Maintenance -

   That maintenance performed by the contractor which is designed to keep the equipment in proper operating condition and which is performed on a scheduled basis

9. Principal Period Of Maintenance -

   The period 8.00 am through 5.00 pm, Mondays through Fridays, excluding holidays observed at the installation

10. Remedial Maintenance -

That maintenance performed by the contractor which results from equipment failure and which is performed as required and therefore, on an unscheduled basis.

11. Maintenance Diagnostic Routines -

The software programs used to test the components of the system collectively and individually for proper functioning and reliability during preventive and remedial maintenance, system audit or problem definition.

12. System Audit -

The testing of an installed configuration with a set of maintenance diagnostic routines and physical inspection to ascertain operating condition. This is usually employed prior to acceptance testing to certify that the system/component is performing at or above the minimum design capabilities, or to document system condition prior to a change in maintenance source.

13. Installation Site -

The physical area where the major portion of the computer system is located (or to be located) including the area within twenty-five (25) feet of the Central Processor.

AGREEMENT

for the
PURCHASE OF A DECsystem-10 COMPUTER SYSTEM

Agreement made this _____ day of _____, 19__ by and between Digital Equipment Australia Pty. Ltd. (hereinafter referred to as DEA) and _____ (hereinafter referred to as Purchaser). DEA is a subsidiary of Digital Equipment Corporation, Maynard, Massachusetts, U.S.A. (hereinafter referred to as DEC).

DEA agrees to sell and Purchaser agrees to buy the DECsystem-10 Computer System more particularly described in Schedule A (hereinafter referred to as System) in accordance with the terms and conditions contained herein.

1. Price

a. The price for the System shall be as specified in Schedule A.

b. Prices are exclusive of all customs import duties, sales tax or any Federal State municipal or other government taxes now in force or enacted in the future. Prices do not include freight, insurance, customs clearance charges unless otherwise indicated, or local delivery, special handling into the final site, or any packing or re-packing specially requested by the purchaser. If a certificate of exemption or similar document or proceeding is to be made in order to exempt the sale from sales or use tax liability, the purchaser will obtain and pursue such certificate, document or proceeding.

c. DEA will assist the purchaser in procuring a license for duty free importation, if necessary. In the event of goods arriving at the port of entry before a license is available, DEA will (a) store the equipment at the purchaser's expense and risk until a duty free license has been obtained if requested by the purchaser to do so. Storage at the purchaser's request shall constitute delivery and the purchase price if not already paid becomes payable; (b) import the goods subject to the following conditions: an invoice will be submitted to the purchaser by DEA for the actual amount of the import duty payable. Customs clearance will be effected after receipt of the purchaser's remittance. Should a duty free license be subsequently issued, DEA will make a claim for remission of the duty paid. Immediately following receipt of duty paid from the Australian Customs, a refund will be made to the purchaser. Additional import duty (if any) found to be payable will be passed on to the purchaser and payable by the purchaser forthwith upon invoice.

4.2 ACCEPTANCE TESTS

In addition to the Acceptance Tests as outlined in DEA's Standard Terms and conditions of sale, the University may elect to conduct its own additional tests. Such tests should previously have been successfully demonstrated on an equivalent system.

DEA reserves the right to charge for the time involved in having its personnel present during these additional tests.

As an alternative to the three months reliability tests requested in the specifications Digital proposes the following Acceptance Test Conditions to arrive at final acceptance.

STANDARD OF PERFORMANCE AND ACCEPTANCE OF EQUIPMENT

A. This paragraph establishes a standard of performance which must be met before any equipment included in this Proposal and listed on a purchase order is accepted by the University. This also includes replacement, substitute machines, and machines which are added.

B. The performance period shall begin on the Installation Date and shall end when the equipment has met the standard of performance for a period of thirty (30) consecutive days by operating in conformance with DIGITAL's published technical test specifications applicable to the type of equipment or as quoted in any proposal, at an effectiveness level of ninety percent (90%) or more

C. In the event the equipment does not meet the standard of performance during the initial thirty (30) consecutive days, the standard of performance test shall continue on a day-by-day basis until the standard of performance is met for a total of thirty(30) consecutive days.

D. If the equipment fails to meet the standard of performance after one hundred twenty (120) calendar days from the installation date or certified ready for use date, whichever is later, the University may, as its option, request a replacement or terminate the order.

E. The effectiveness level for a system is computed by dividing the operational use time by the sum of that time plus system failure downtime.

F. The effectiveness level for an added, substitute or replacement machine is a percentage figure determined by dividing the operational use time of such machine by the sum of that time plus downtime resulting from equipment failure of such machine being tested.

G. Operational use time for performance testing for a system is defined as the accumulated time during which the Central Processing Unit is in actual operation including that interval of time between the start and stop of the Central Processing Unit.

H. Operational use time for performance testing for a machine added, substitute or replacement machine is defined as the accumulated time during which such machine is in actual use.

I. System failure downtime is that period of time when it is not possible to continue to run the program (the program being processed at the time of equipment failure) on available operable equipment immediately after equipment failure of part of the system except that failure of terminals shall not constitute system failure downtime.

J. During a period of system downtime, the University may use operable equipment when such action does not interfere with maintenance of the inoperable equipment as determined by DIGITAL's maintenance personnel. The entire system will be considered down during such periods of use.

K. Machine failure downtime for added, substitute, or replacement machines after the system has completed a successful performance period is that period of time when such machines are inoperable due to their failure.

L. Downtime for each incident shall start from the time the University contacts DIGITAL's designated representative at the pre-arranged contact point until the system of machine(s) is returned to the University in proper operating condition, exclusive of actual travel time required by DIGITAL's maintenance personnel but not in excess of one (1) hour, and provided that all machines that DIGITAL determines necessary to reapir and test the machine that failed are made available to DIGITAL.

M. During the performance period for a system, a minimum of one hundred (100) hours of operational use time with productive or simulated work will be required as a basis of computation of the effectiveness level. However, in computing the effectiveness level the actual number of operational use hours shall be used when in excess of the minimum of one hundred (100) hours. In scheduled operational use time during the performance period, provisions shall be made for preventive maintenance. DIGITAL, at its option, may perform preventive maintenance at times other than during scheduled operational use time. Preventive maintenance time shall be excluded from the effectiveness level computation.

N. The University shall maintain appropriate daily records and shall notify DIGITAL in writing of the date of the first day of the successful performance period.

O. The date of acceptance shall be the first day of the successful performance period.

P. Operational use time and downtime shall be measured in hours and whole minutes, but shall not include any time other than during scheduled operational use time except that all time spent by DIGITAL's maintenance personnel in repairing an inoperable machine shall constitute downtime. Scheduled operational use time shall be between the hours 8.00 am to 5.00 pm Monday through Friday, unless the University notifies DIGITAL in writing of a different period for scheduled operational use time at least thirty (30) days prior to the installation date, or unless otherwise mutually agreed upon.

Q. Should it be necessary, the University may delay the start of the performance period, but such delay shall not exceed thirty (30) consecutive days; therefore, the performance period must start not later than the thirty-first (31st) day after the Installation Date.

R. If a system failure is the result of the failure of programming aids which originated from sources other than DIGITAL, DIGITAL shall be paid for the services of its maintenance personnel.

S. When a system involves on-line machines which are remote to the basic installation site and/or interface equipment not necessarily remote and requires equipment, cables, wires, etc., not supplied by DIGITAL, the required effectiveness level of the equipment supplied by DIGITAL shall be computed to exclude downtime attributable to equipment, cables, wires, etc., not supplied by DIGITAL. The required effectiveness level shall apply separately to the system (excluding remote on-line machines) and to each DIGITAL remote machine unless the University and DIGITAL agree otherwise.

4.3 PRICES

Prices in this quotation would be subject to adjustment if the United States dollar to Australian dollar exchange rate varies from the current Australian Bank T.T. Selling Rate by more than 2% on the date of invoice.

Pricing will be adjusted according to the following formula (all values in Australian currency):-

$$\text{Adjusted Price} = \text{Quoted Price } (0.3 + 0.7^{c}/f)$$

c = current Australian Bank T.T. Selling Rate

f = Australian Bank T.T. Selling Rate at time of invoice

4.4 PAYMENT

DIGITAL proposes that 85% of the system price be paid on completion of the initial acceptance tests, and the remaining 15% on successful completion of the reliability test as outlined in clause 4.2 of this proposal.

4.5 INSURANCE

As per standard terms and conditions of sale.

4.6 DELIVERY AND INSTALLATION

The latest date for finalization of a contract to allow delivery of all items proposed in the initial system by the 23rd December 1977 is 27th May 1977.

4.7 TENDERING AND CONTRACTUAL MATTERS

The proposal submitted by DIGITAL EQUIPMENT AUSTRALIA PTY LTD. (DEA) is based upon the enclosed DEA Standard Terms and Conditions of Sale under which it sells the type of equipment herein proposed.

DEA recognizes however, that certain subjects both addressed and not addressed by its standard terms and conditions maybe of importance to both parties. Accordingly DEA has in this section and elsewhere in its proposal addressed and specifically responded to certain specific provisions of the Specifications.

DEA believes that final contract agreement may be reached which satisfies the interests of both parties.

In lieu of a security deposit DEA suggest that it shall, if required by the University, obtain and maintain a Performance Bond securing its performance in an amount not to exceed the contract price of the Equipment and Software. The price or charge of said Performance Bond is not included in this proposal. For your guidance, current standard performance bond rates are approximately $2.00 per each $1,000 of contract price secured.

4.8 CONFIDENTIALITY

DIGITAL agrees to do all within its power to abide by the wishes of the University in regard to public statements in relation to the specification and any subsequent order for supply.

LIST OF APPENDICES

APPENDIX 6.

TENDERED SOFTWARE

A. Standard Software

ITEM	DESCRIPTION	SUPPORT CATEGORY
Monitor Package	TOPS-10 Operating System virtual memory (VMSER), LINK-10 Loader with Overlays, Assembler, Editor and Fundamental Utilities.	A
-	DN87 Software	A
QH500	FORTRAN-10	B
QH502	ALGOL-10	B
QH503	BASIC-10	B
QH504	COBOL-10	B
QH615	GALAXY-10	B
QH300	SORT-10	B

B. Optional Software

QH045	IQL-10 Extended (with DBMS Support)	B
QH101	DBMS-10 Version 3	A
QH071-A	APL-10/SF	B