digital

INTEROFFICE MEMORANDUM

TO: DISTRIBUTION

DATE: 14 JUNE 78
FROM: Stanton Pearson
DEPT: Eng. Strategic Planning
EXT: 3-2424
LOC/MAIL STOP: ML12-2/E38

SUBJ: SPRING 78 PRODUCT/MARKET LONG RANGE PLANS (RED BOOK I)

This is your copy of the Spring 78 Red Book I, which describes the strategic product development plans for Central Engineering for FY79-81.

These plans have been developed by the six product/market POTS, which have been formed to couple market needs and technology. They allocate $45.6 million in FY79 engineering cost (which is over half of the Central Engineering budget and about one-third of Digital's total engineering investment). The plans and funding will be reviewed and approved by the Engineering Board of Directors (EBOD), a subcommittee of the Marketing Committee with representation from product lines and Central Engineering chaired by Andy Knowles.

RECOMMENDATIONS

Based on analysis of the plans, Engineering Strategic Planning makes the following recommendations to the Engineering Board of Directors:

1. Market Requirements

   A. Further definition of the degree of compatibility required between various DEC operating systems to meet market requirements should be provided by the applications POTS.

   B. Further definition of the degree of Communications & Network functionality and performance between various DEC operating systems should be provided by the application POTS.

2. Funding Expectations

   Product development funding expectations for FY80 and 81 should be developed during Q1,FY79 by EBOD and the POTS.

3. Tools To Aid The Investment Tradeoff Process

   A. The capability to project and track the revenue related to a product or Product/Market segment should be developed for use as a metric in comparing alternative uses of product development funds.

B. We should invest in a model to evaluate the impact of various product development efforts on system performance for use as a metric in comparing alternative uses of product development funds.

4. Systems I/O Strategy

The product development strategy for systems I/O should be reviewed during Q1,FY79 by EBOD. This includes systems bus strategy, intelligent sub-system strategy (NDS) and software I/O architecture strategy.

Interfaces

Central Engineering Operational Plans (Beige Books) for each line organization describe the tactical plans for implementing specific products described in the Product/Market strategies.

If you have further questions, please call:

Overall:	S. Pearson	(3-2424)
	D. Quimby	(3-6743)
Commercial Applications:	E. Fauvre	(264-5622)
	G. Reyer	(264-5974)
Real Time/Computation:	B. Heffner	(247-2091)
	J. Mileski	(247-2172)
Base Systems:	B. Demmer	(247-2112)
	F. Sanjana	(3-3150)
Small Systems & Terminals:	D. Clayton	(3-4353)
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Networks/Communications:	G. Plowman	(3-3329)
	C. Stein	(3-7941)
Storage Systems:	G. Saviers	(3-4520)
	K. Sills	(3-5805)

NOTE:

Hydra is not included in this document.

Hydra (32 bit Multiprocessing project) is currently budgeted at $4M for FY79.

The FY79 requirements for Hydra are being developed between TELCO and Central Engineering for presentation to EBOD in July.

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These plans have been developed by six product/market groups called POTs, which have been formed to couple market needs and technology capability in product planning. They allocate $45.6 million in FY79 engineering cost, over half of the Central Engineering budget and about one-third of Digital's total engineering investment. The plans and funding will be reviewed and approved by the Engineering Board of Directors (EBOD), a subcommittee of the Marketing Committee with representation from product lines and Central Engineering chaired by Andy Knowles.

Recommendations

Based on analysis of the plans, Strategic Planning makes the following recommendations.

1. Further definition of the degree of compatibility required to meet market requirements should be provided by the application POTs.

2. Product development funding expectations for FY8Ø and FY81 should be developed over the next two quarters by EBOD.

3. The capability to project and track the revenue received directly from a product, and other incremental revenue attributable to the product, should be developed to act as a metric in comparing alternative uses of product development investment.

4. Strategic Planning's observations and concerns, in the Summary section, are presented so that EBOD can consider taking action or delegating the task of inretigating and formulating a recommendation.

Interfaces

Central Engineering Operational Plans (Beige Books) for each line organization describe the tactical plans for implementing specific products described in the Product/Market strategies.

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SPRING '78 PRODUCT/MARKET LONG RANGE PLAN

(RED BOOK I)

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TU70, 800/1600 BPI, 200 IPS tape drive

TU72, 1600/6250 BPI, 125 IPS tape drive

TU77, 800/600 BPI, 125 IPS tape drive, FCS Q2/FY79

TU78, 1600/6250 BPI, 125 IPS tape drive, FCS FY81

UDA, UNIBUS Disk Adapter (Small NDS), FCS FY82

UNIBUS, PDP-11 standard bus

UNIFONZ, Fonz-based 11/04 replacement system

VAX, 32-bit processor family, including 11/780 (STAR), 11/780 MP, COMET, NEBULA, LSI/VAX, and SUPERSTAR

VMS, virtual management system software for VAX family

VT52, current video terminal

VT61, VT62, soft copy smart terminals for specific markets/applications

VT100, soft copy terminal successor to VT52

Winchester, integrated head/disk technology

X.25, communication transport mechanism standard

INTRODUCTION

This year's Red Book reflects the formation of six POT groups to couple market needs and technology capabilities in product development plans for the following Product/Market segments:

- Commerical Applications
- Real Time/Computation Systems
- Base Systems
- Network Software and Communications Hardware
- Small Systems and Terminals
- Storage Systems

Each POT is steered by a team of about 12 people, with the intent to have balanced representation from product lines and Central Engineering.

The six POT strategic plans for FY79-81 are included in Sections II-VII.

Section I is a management overview of the POT plans, including highlights of the individual POT plans, strategy elements common to several POTs, major products planned for development, analysis of investment and POT revenue expectations, progress on issues identified in the Spring 77 Red Book, and Strategic Planning's observations and concerns.

Section VIII includes as background information a glossary for the other seven sections and a full Product Calendar, which will be used as the baseline for Yellow Books during FY79.

POT PRODUCT STRATEGY DOMAINS

Each POT is responsible for developing the product strategy and approving the funds allocation for development in a different section of the product/market space. Following is a brief description of these domains. For a more detailed description of products in development see the product calendar in Section VIII.

Commercial Applications

- Operating System: RSTS/E
- Programming Languages: BASIC Plus 2, COBOL, DIBOL
- File/data base management software: RMS, DBMS
- Commercial pre-configured system products: Small Commercial System (SCS)
- Transaction processing: TRAX
- Commercial applications tools and software utilities important to the commercial market

Real Time/Computation Systems (RT/C)

- Operating systems: RT-11, IAS, RSX-11M, M+(MP), and S
- Programming languages: FORTRAN, DOD standard language, BASIC-11, MACRO, APL
- Real time applications tools and software utilities important to the real time/computation market

Base Systems

- PDP-11 UNIBUS processors and pre-configured system products
- VAX processors and pre-configured system products
- Main memories, power and packaging for the above
- UNIBUS and MASSBUS
- Operating system kernels from which several operating systems can be developed (application-independent system resource allocation capability) for PDP-11 and VAX processors
- Multiprocessing

Terminals and Small Systems (T/SS)

- PDP-11 QBUS processors and pre-configured system products
- Main memory, power and packaging for the above
- QBUS
- Hard copy terminals and line printers
- Soft copy (video) terminals
- Intelligent terminals

Network Software and Communications Hardware (N/C)

- DECnet and protocol emulators for non-DEC equipment
- Communications hardware: interfaces, modems
- Communications protocols

Storage Systems

- Floppy disks
- Small, medium, large rigid disks
- Small, medium, large tapes
- Intelligent subsystems for mass storage devices
- Mass storage subsystem handlers and drivers
- Mass storage device diagnostics

SUMMARY OF POT STRATEGIES

This section contains Strategic Planning's summary of the POT strategies, based on the POT Long Range Plans and discussions with POT representatives. For additional information or more detail, please refer to the individual POT plan.

Base Systems

Extend the VAX CPU family down in cost as fast as resources permit, with 11/780 functionality as the CPU standard.

Maintain the competitiveness of the PDP-11 CPU family in the short run by improving mid to high-end COBOL performance and protecting midrange exposure to limited physical address space.

Maintain long-term PDP-11 competiveness with improved price/performance products, setting essentially 11/74 functionality as the PDP-11 CPU standard.

Respond to market requirement for improved availability with PDP-11/74 MP as earliest entry. Continue development of VAX-11/780 MP for high availability where applications are not predictable for effective segmentation, and establish a task force to recommend a system topology for continuous operation where applications are predictably segmented.

Use 16K MOS RAM chips in main memory, and make error checking and correcting (ECC) memory available on all CPUs. Track 64K MOS RAM chip development.

Focus on compatibility of software, external busses, and architecture to preserve cumulative user and DEC investment. Force adherence to the K2 (PDP-11) and VMS (VAX) kernels to avoid operating system proliferation.

Increase focus on systems through Corporate Packaged Systems, and by designing and manufacturing to lead in selected configurations.

Evolve longer-term to a corporate UNIBUS replacement to correct increasing competitive exposure to interconnect functionality, performance, cost and data integrity as a major artery of the business.

Commercial Applications

Develop a broad spectrum of commercial products, using 32-bit processors for mid to high end and 16-bit processors for low end.

Target industry leadership in transaction processing through TRAX and in small commercial systems through SCS-11.

Maintain competitiveness of mid to high end PDP-11 products while developing the 32-bit mid-to-high end product line.

Move toward supplying a more complete solution to end-user problems by shifting our investments away from systems-level tools, such as operating systems, and towards applications-oriented tools such as data base management systems.

Networks/Communications

Develop the communication functionality of each operating system to a uniform base level, selectively enhancing some with additional functionality as defined by market requirements.

Design toward user transparency to transport level (inter-node) line protocol differences among DEC (NSP, DDCMP), IBM (SNA), and common carriers (X.25).

Shift focus from intercomputer communications to intercomputer data management.

Use one standard protocol for all communication interconnect capability to minimize required number of products, maintaining flexibility for foreign machine connection through use of writable control store microcode in intelligent line interface boards.

Real Time/Computation

Maintain leadership in a DEC traditional market with a large cumulative investment in software by enhancing FORTRAN and file utilities and improving reliability and ease of use. Create a 16-bit distributed real time system model and tools.

Lay the foundation for evolution to 32 bits, phasing over as market demand shifts from 16 bits. Develop 32-bit real time and host support for network systems.

Prevent specification lock-out by implementing a real-time language (DOD-1, Pascal, PL/1).

Test the multiprocessing market with the 11/70 MP.

Storage Systems

Develop intelligent subsystems (NDS and Small NDS) to improve availability, data integrity functionality and configurability of storage subsystems, differentiate DEC products and reverse proliferation of device controllers for all classes of disk and tape.

In mid and high range storage subsystems, combine fixed disks (for capacity, cost, and reliability) with removable disks and tapes (for interchange, data backup, software distribution, and personal storage).

In low end subsystems offer removable floppy or rigid disks.

Improve competitiveness of medium disks, which are projected to produce more revenue than other disk classes, by investing in new disk technology introduced by IBM in high-end products, and migrating the technology to medium disks fast enough to meet or beat competition.

Compete in high end disks through intelligent subsystems, early buyout and/or manufacturing license, or early reverse engineering to manufacture an equivalent product. Evolve toward building high-end disks as resources permit.

Build rigid and floppy low-end disks; pursue AZTEC rigid low-end disk development and track floppy disk technology development.

Provide industry standard compatible tapes through 6250 BPI group code recording (GCR) technology.

Review the use of price as a strategic alternative to accelerated new product development, due to cost of engineering development, value on timeliness of product introduction, and relatively short product life at introduction price.

Terminals and Small Systems

Capture a higher percentage of terminal ports shipped on DEC systems for DEC terminals. Protect and grow independent base terminal business.

Enter the intelligent terminal business. Protect low end and enhance mid to high end total systems through use of intelligent terminals.

Focus on general purpose base and intelligent terminals, leaving application-specific terminals for product line engineering.

Supply T-11 and F-11 chip sets for DEC internal use, and T-11 and F-11 boards and boxes for external sale.

Reduce transfer cost through emphasis on dock-mergeable or drop-shippable products.

COMMON STRATEGY ELEMENTS

Each POT's strategy is its response to its particular product/market space. Five elements seem to have broader significance, since they appear in one form or another in several POT plans.

Compatibility

Four POT plans show some emphasis on product compatibility. Base Systems calls for fixed architecture and hardware functionality, adherence to use of operating system kernels, and compatibility of software and external busses.

Commercial Applications' strategy is based on a spectrum of compatible products and compatibility for migration of existing customers to new products. In Network/Communications, common base level communication functionality, complete line interconnect capability derived from a standard protocol, and transparency to the communication carrier system all drive toward compatibility. Storage Systems will move toward compatible mass storage interfacing with intelligent subsystems.

Availability

Availability as a goal, or mechanisms to improve system availability, appear in all POT plans. Base Systems' approach is through multiprocessing and ECC memory capability. Commercial Applications stresses the need for availability in transaction processing systems, as well as low support cost for their area as a whole.

Network diagnostics and maintainability are included in the Network/Communication plan. Real Time/Computation addresses reliability and ease of use, and Terminals and Small Systems includes reliability and cost of support among its key leverage factors. Storage Systems' intelligent subsystems will increase data integrity and improve diagnostic capability.

Protecting and Fine-tuning

Five POTs refer to protecting or fine-tuning existing products. Both Base and Commercial state the need for protecting PDP-11 processors, and Base also proposes evolving to a long-term UNIBUS replacement. RT/C will maintain market leadership through existing product enhancements. Storage Systems intends to review strategic pricing of its products. Terminals and Small Systems mentions protecting its base terminals and low end systems business.

Breadth

A broad range of products is not explicitly mentioned in all POT plans, but seems to be a strategy element in five. Commercial's first market goal is to maintain a broad spectrum of products from $5K to $300K. Base Systems' processors are planned to cover the range between Small Systems and Large Computers. Small Systems and Terminals is expanding its range of processors and terminals, and adding intelligent terminals.

Storage Systems' strategy provides for a full range of disk and tape products. Network/Communications' intention is to develop a range of capability from straightforward communication to intercomputer data management.

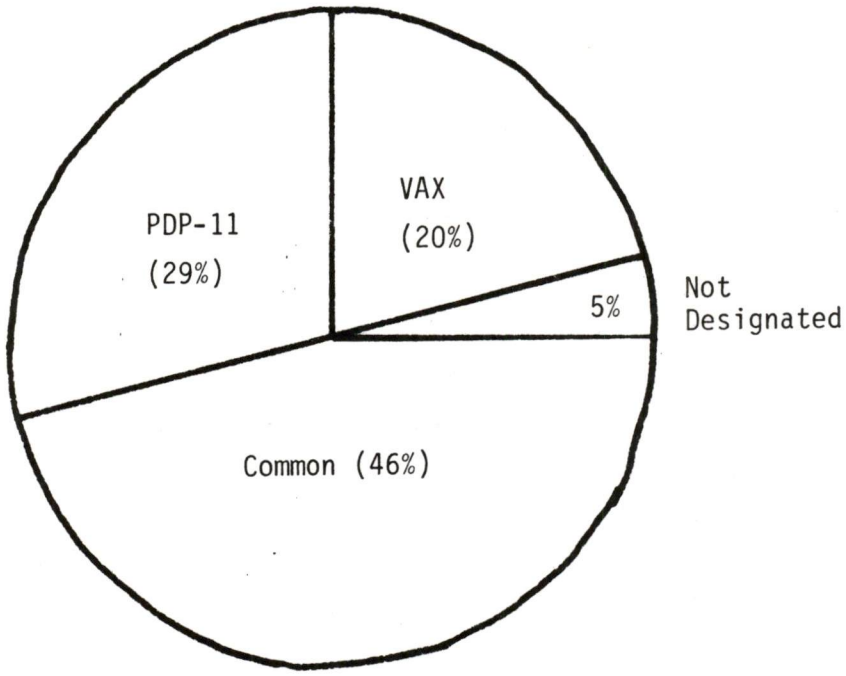
New Thrusts

The product plans of five POTs include significant new product thrusts. Base Systems is moving toward multiprocessing products, and calls for central development of new memory technologies. Commercial is developing the Small Commercial System. Network/Communications intends to move its program focus to intercomputer data management. Storage Systems is pursuing the AZTEC low-end rigid disk and intelligent mass storage subsystems. Small Systems and Terminals is entering the intelligent terminal market.

SUMMARY PRODUCT CALENDAR

On the following page are twenty-six products, each over $500K in FY79 development cost, that represent 70% of total FY79 Central Engineering product development. The remaining 30% supports an additional 45+ products.

Products specific to the PDP-11 family account for 29% of FY79 development, while VAX family products are 20%. Common products such as peripherals and DECnet will use 40% of FY79 product development, and 50% is not designated at this time.



Distribution of FY79 Central Engineering
Product Development Investment ($45.6M total)

TOP 26 POT PRODUCTS

FY79 Engineering Development Cost over $500K

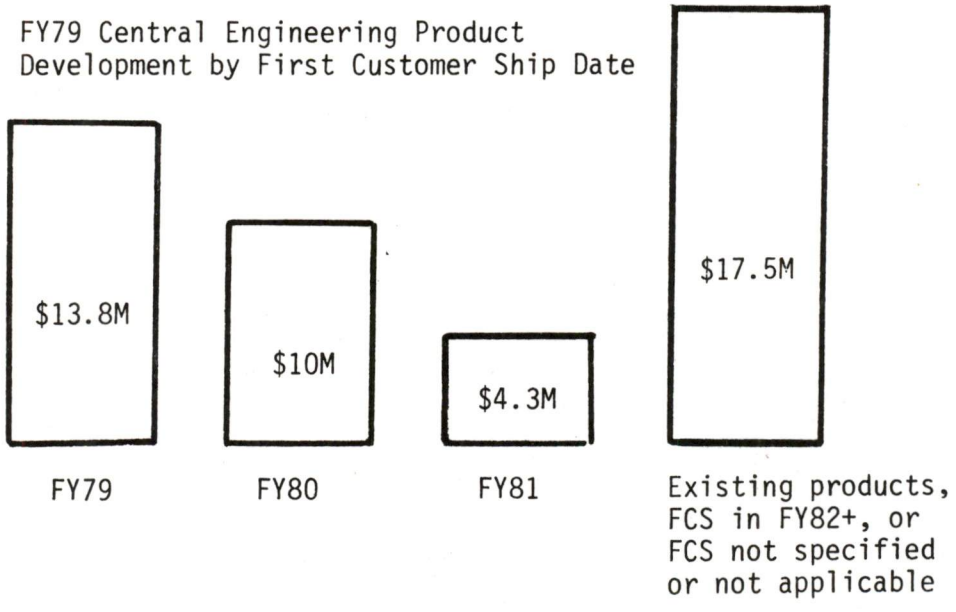
		FCS Date	FY79 Cost ($K)	POT
PDP-11 Family				
FONZ	Higher performance LSI-11 chip set successor	12/78	1,975	T/SS
Small Commercial Systems	Small business systems software package for lower cost and entry in COBOL market (includes small COBOL and ADE-1)	Q1,FY80	1,257	Commercial
11/74, 74MP	Corp. cabinet 11/70 with commercial instruction set and multiprocessing extensibility	Q3/FY79	1,450	Base
11/44	11/34 processor plus commercial instruction set, physical address extension	Q4/FY79	1,200	Base
K2 Kernel	Operating system kernel for mid to high-end PDP-11s	n/a	1,050	Base
TRAX	Dedicated transaction processing system (V1 FCS 7/78)	Q4/FY79 (V2,T)	858	Commercial
11/68	Lower-cost 11/74 replacement	Q4/FY80	850	Base
Tiny-11	Lower cost LSI-II successor	on hold	750	T/SS
Unifonz	Fonz-based 11/04 CPU replacement	Q1/FY80(t)	500	Base
Other PDP-11	(17 products)		3,405	
TOTAL PDP-11 FAMILY			13,295	
VAX FAMILY				
Comet	Midrange VAX CPU: two-thirds 11/780 performance at one-third 11/780 cost	Q1/FY80	3,200	Base
VMS Kernel	Operating system kernel for VAX family	n/a	1,700	Base
11/780, 780 MP	High end VAX CPU: twice 11/780 performance in native mode (11/780 shipped 12/77)	n/c	1,550	Base
COBOL-79	High performance native mode compiler	FY81	598	Commercial
Other VAX	(10+ products)		2,148	
TOTAL VAX FAMILY			9,196	
Common				
R80	143 MB fixed disk drive	FY80	2,870	Storage
DECnet	Advanced network functionality	n/a	2,700	N/C
50MB Removable	Low cost RK07 (cartridge disk) replacement	FY81	1,435	Storage
LA00	Low cost 300 baud hard copy terminal	11/78	1,400	T/SS
RL01/02	5/10 MB cartridge disk drive and controller (RL01 shipped 12/77)	Q4/FY79 (RL02)	1,135	Storage
IT-100	Intelligent Terminal Family	n/c	990	T/SS
NDS	Intelligent subsystem for disks and tapes	FY81	920	Storage
LA120 & Options	1200 baud hard copy terminal	9/78	900	T/SS
TU77/78	Large tape (125 IPS, 1600/6250 BPI), family	Q4/FY79 (TU78)	763	Storage
RP07/07+/08	Large (292-542 MB) fixed disk	Q3/FY79 (RP07) FY80 (RP07+/08)	675	Storage
RK07	Medium (28MB) cartridge disk	3/78	580	Storage
VT100	Display terminal successor to VT54	9/78	515	T/SS
TS04	Small tape (45 IPS, 800/1600 BPI)	FY79	514	
Other Common	(18+ products)		5,484	
TOTAL COMMON			20,881	
TOTAL 11, VAX, and COMMON			43,372	
Not designated			2,228	
TOTAL PRODUCT DEVELOPMENT			45,600	

FINANCIAL HIGHLIGHTS

The relationship between planned engineering investment and expected impact on future revenues should be a factor in evaluating product/market plans. However, as several POTs have based their revenue projections on the total revenue of systems sold with their products, the comparative analysis that can be done is limited.

The four charts on the next two pages show the Central Engineering budget for FY78, the current planned budget for FY79, and trial solutions for the budget in FY80 and FY81. The trial solutions are offered as a reference point for POT planning, and may be changed as POT plans and priorities vary. POTs are shown as six categories under Product Development, with the POT budgets distributed among Central Engineering line managers by the POTs.

The total FY79 POTs budget of $45.6M will begin to produce revenue as shown in the following illustration of cost by product first customer ship date:



About 30% of FY79 product development supports products with FY79 FCS, 22% is for products to ship in FY80, and 9% for products with FCS in FY81. The relatively short-range emphasis of these product plans is complemented by Advanced Development ($7.1M), Research ($1.8M), and Development Tools ($8.3M) which have a longer-range payoff.

Functional Line Mgr. / ENG. ACTIVITY	CLAYTON	DEMMER	KEVILL	CUDMORE	MARCUS	PORTNER	PUFFER	BELL	UNALLOC.	FY78 TOTAL
Product Dev.										
Comm'l						4815				4815
RT/C						659				659
Base Sys.		7437		700		1560				9697
Sm Sys & Term	7600		500	300	100					8500
Net Comm					1100	2060				3160
Storage			9600							9600
Sub Total	7600	7437	10100	1000	1200	9094				36431
Research				700				1328		2028
Adv. Dev.	1700	340	1800	1800	100	222				5962
Prod. Support	2544	1213	600	300	400	2587				7644
Prod. Mgt.	1211	502	400	100	79	849				3141
Adm.	240	324					4002			4565
Dev. Tools	1700	182		1000		1990	1430			6302
Sub Total	7395	2561	2800	3900	579	5648	5432	1328		29643
Unallocated									*1000	1000
Total FY78	14995	9998	12900	4900	1779	14742	5432	1328	1000	67074

* TEWKSBURY RESERVE

Functional Line Mgr. / ENG. ACTIVITY	CLAYTON	DEMMER	KEVILL	CUDMORE	MARCUS	PORTNER	PUFFER	BELL	UNALLOC.	FY79 TOTAL
Product Dev.										
Comm'l						6000				6000
RT/C						2100				2100
Base Sys.	1000	8150		400		2950			500	13000
Sm Sys & Term	7455		450	150		600			345	9000
Net Comm					800	2700				3500
Storage			11220	210		570				12000
Sub Total	8455	8150	11670	760	800	14920			845	45600
Research								1800		1800
Adv. Dev.	1040	725	2250	1400	100	600			*1000	7115
Prod. Support	3700	2075	525	500	500	3700				11000
Prod. Mgt.	1510	800	475	200	100	1100				4185
Adm.	200	165	150				5300			5815
Dev. Tools	2200	200		2100		2585	1200			8285
Sub Total	8650	3965	3400	4200	700	7985	6500	1800	1000	38200
Unallocated									1200	1200
Total FY79	17105	12115	15070	4960	1500	22905	6500	1800	3045	85000

*RESEARCH AND ADVANCED DEVELOPMENT RESERVE 4-18-78

Functional Line Mgr. / ENG. ACTIVITY	CLAYTON	DEMMER	KEVILL	CUDMORE	MARCUS	PORTNER	PUFFER	BELL	UNALLOC.	FY80 TOTAL
Product Dev.										7.8
Comm'l										2.6
RT/C										14.3
Base Sys.										10.8
Sm Sys & Term										4.2
Net Comm										15.6
Storage										
Sub Total										55.3
Research										1.3
Adv. Dev.									1.3*	9.9
Prod. Support										13.0
Prod. Mgt.										5.0
Adm.										6.9
Dev. Tools										9.6
Sub Total	10.3	4.6	4.2	5.0	0.9	9.5	7.8	2.1	1.3	45.7
Unallocated										5.0
Total FY80										106.0

* RAD

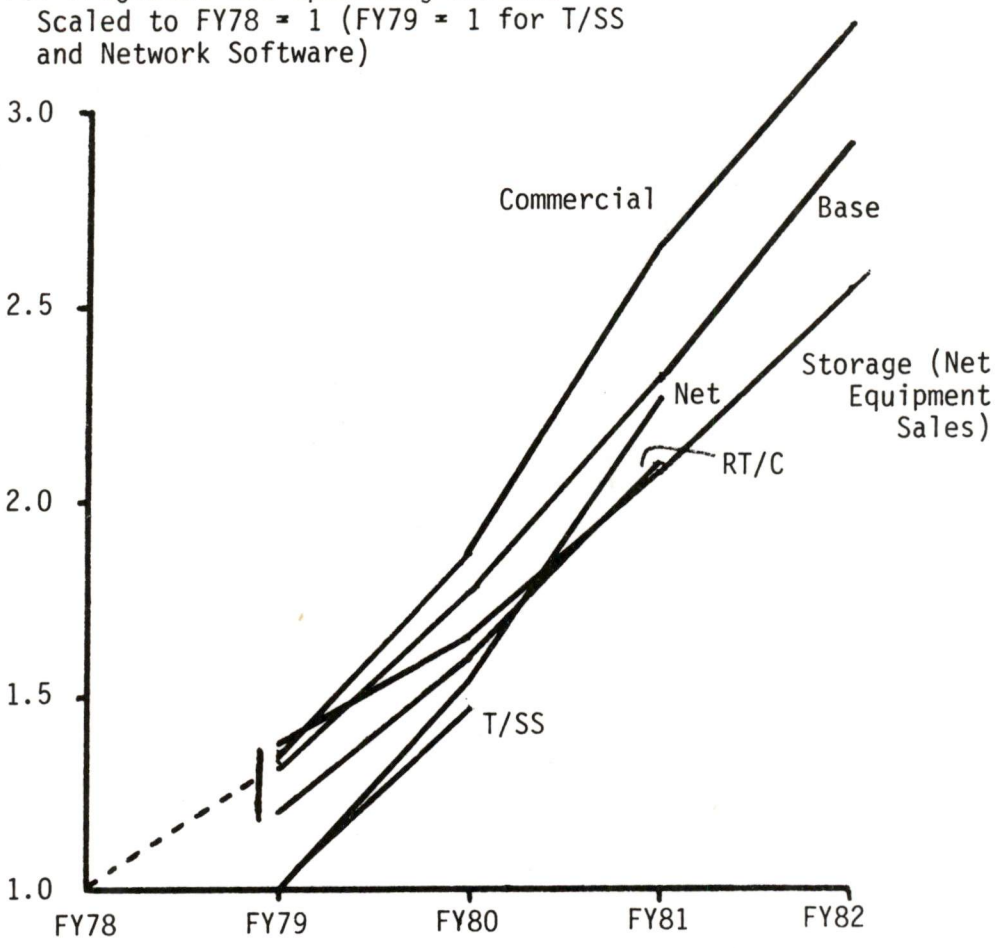
Functional Line Mgr. / ENG. ACTIVITY	CLAYTON	DEMMER	KEVILL	CUDMORE	MARCUS	PORTNER	PUFFER	BELL	UNALLOC.	FY81 TOTAL
Product Dev.										10.1
Comm'l										3.3
RT/C										16.6
Base Sys.										13.5
Sm Sys & Term										5.0
Net Comm										20.0
Storage										
Sub Total										68.5
Research										2.6
Adv. Dev.									1.7	11.6
Prod. Support										15.9
Prod. Mgt.										6.1
Adm.										8.5
Dev. Tools										11.8
Sub Total	12.6	5.8	5.4	6.3	1.2	11.7	9.2	2.6	1.7	56.5
Unallocated										7.0
Total FY81										132.0

* RAD

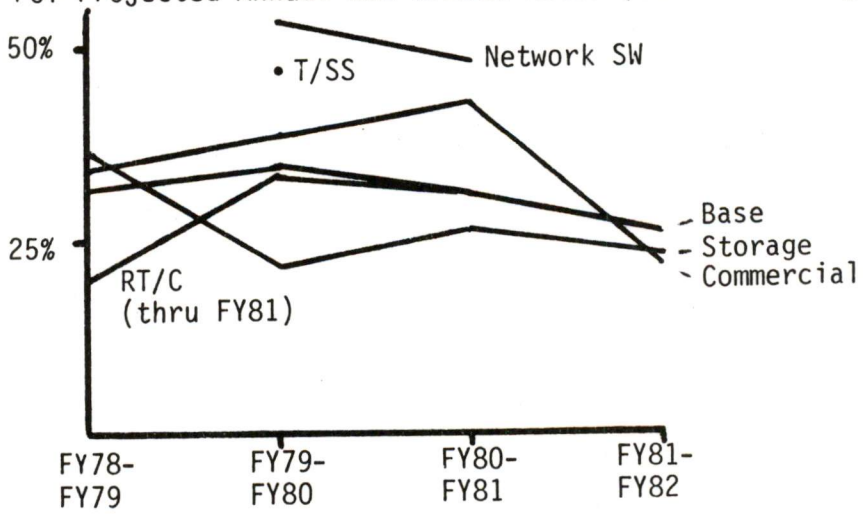
On the following page are two graphs representing POT revenue estimates. In the first graph, the revenues have been scaled to compare FY79-82 projections to FY78 estimates for each POT, to minimize the impact of accounting for revenue by systems (Network Software and Terminals and Small Systems is scaled to an FY79 baseline).

The second graph shows projected revenue growth as estimated by the POTs. Three of the FY78-FY79 grow rates are over 30%, while current corporate estimates are in the mid - 20's. In the FY79-FY81 time frame, T/SS, Network Software and Commercial estimate growth rates of 36 - 50+%, Base and RT/C estimate 30-35%, and Storage 20-25%.

POT Projected Net Operating Revenue
Scaled to FY78 = 1 (FY79 = 1 for T/SS
and Network Software)



POT Projected Annual NOR Growth Rates (NES for Storage)



OBSERVATIONS AND CONCERNS

Following are Strategic Planning's observations and concerns based on POT plans and discussions with POT representations and Central Engineering staff.

1. Product development funding for FY80 and FY81 is an issue in three plans. RT/C and Network Software/Communication Hardware feel that they will require funding in excess of the published trial solution. Storage Systems has analyzed their expected revenue growth and questions whether product development funding growth is adequate to support it.

   Realistic funding expectations will be a key input to long-range plans next year, as development opportunities will exceed available product development funds.

2. External bus strategies may require some clarification. Base Systems raises as an issue the stability of Small Systems and Terminals' decision not to implement a quad board QBUS FONZ processor as an important factor in deciding whether to implement UNIFONZ. Base Systems also proposes a long-term UNIBUS replacement, which would impact VAX and PDP-11 processors, including present QBUS machines.

3. The Base Systems POT plan shows a graph of processors in price versus performance and functionality space. The current and planned mid-to-high end processors (NEBULA, 11/68, COMET, 11/70, 11/74, 11/780) are closer to each other in this representation than has historically been the case.

   Commercial Applications' strategy is to sell mid-to-high end VAX systems and low-end PDP-11 systems, and Real Time/Computation intends to phase over to 32 bits as market demand shifts from 16 bits.

   Given the application POTs' strategies to shift to 32 bits, is the level of investment in the 11/68 the best use of product development funds?

4. Part of the Network Software and Communication Hardware POT strategy is to move toward intercomputer data management. The POT is investigating to avoid aggressively pursuing high end network capability at the expense of the low end, where competitive products and typical user entry level could leave DEC vulnerable to a competitive gap due, for instance, to reduced line efficiency caused by line protocols.

5. Revenue growth projections for POT plans range as high as 50% per year, compared to a corporate projection in the mid - 20's.

6. Several 16 and 32 bit multiprocessing products are included in the Red Book. The HYDRA 32 bit multiprocessing project is currently funded by Telco and is not included in POT plans. A corporate group may be needed to coordinate multiprocessing development for high availability or performance on 16 and 32 bit processors.

7. Given technology trends to increasing circuit and power density, are power and packaging receiving due attention?

8. Real Time/Computation, due to funding constraints and the absence of any specific requirements, assumes that other POTs' planned products (DECnet, DBMS, RMS, commercial languages) will not require changes to RT/C's operating systems. Other POTs should review their requirements and funding alternatives.

9. Development of products using CCD and bubble memory has appeared in previous plans, but appears this year only in Storage Systems' NDS. Are CCD and bubble technologies being pursued?

digital

INTEROFFICE MEMORANDUM

TO: Stan Pearson

DATE: 23 MAY 1978
FROM: Glenn Reyer
DEPT: Commercial Engineering Planning
EXT: 45974
LOC/MAIL STOP: MK1-2/D3

SUBJ: COMMERCIAL POT INFORMATION
FOR SPRING REDBOOK

INTRODUCTION

The POT has been concentrating primarily on finalizing an FY'79 budget to date. That budget is reflected in the Planning Calendar attached. The basis for the work of the POT during this period has been the Commercial Group System Plan prepared by the Commercial Product Lines last June. The emphasis of the POT at this point in time is to take that Plan and revise it to reflect a Corporate commercial strategy. Our intention is to complete this activity by the end of Q1 FY'79. The POT also recognizes its obligation to integrate this plan with that of LCG over a period of time.

MARKET GOALS

- Maintain a BROAD SPECTRUM of COMPATIBLE PRODUCTS as a key competitive strength for DIGITAL from $5K Intelligent Terminals through $300K Midi-Computers.

  Customers want to minimize application development costs and serve wide ranges of volume requirements. We will strengthen our competitive position by offering a family of 4-5 systems (1-128 users) that are upwardly compatible for application programs and files.

- Show a continuing COMMITMENT to CURRENT CUSTOMER BASE by maintaining product compatibility throughout its evolution where necessary by providing easily used migration tools to help customers move to newer products; and by maintaining support for older products. Our customers have a large investment in Application Software and Training. Show the customer that Digital is sensitive to his investment in our technology and that we will help protect that investment; if possible, by making new systems compatible - if not by making migration easy.

- Do not abandon our current General Purpose/Time-sharing Base, which has been a source of significant growth for Digital, as we move into newer markets such as Small Systems and Transaction Processing.

- Support the Corporation's Improved ROA Objectives through products engineered for lower Manufacturing, Sales and Support costs.

  Reduce the number of commercial systems offered to the above-mentioned families. Produce packaged systems that meet 80%-90% of customer requirements to reduce inventory and forecasting problems. Pre-tested configurations that work and have known performance should reduce warranty and A/R costs.

- Achieve a competitive position in Systems Performance for Commercial applications which is on a par with Digital's performance leadership in the Scientific/Computational area.

  Systems that are one half in performance relative to competition cost a lot to sell. We do not have to be the fastest in all areas but should target for ± 10% of competition unless there is no additional cost to get more.

- FOCUS on INDUSTRY LEADERSHIP in TRANSACTION PROCESSING through High Availability, Performance, Data Integrity and Security with a DISTRIBUTED PROCESSING approach. This is our chance to establish an image in the marketplace early when it is easy to do. We will also focus on SMALL COMMERCIAL SYSTEMS usable by the novice computer user.

The POT intends to continue to refine these goals particularly in the area of high availability, low end systems, uniqueness strategy, non goals, profitability, market share and service revenue goals.

COMMERCIAL POT DEVELOPMENT STRATEGY

In FY'79, follow a SURVIVAL Strategy in the mid-to-high-end 11 family in order to protect our mainstream business while we begin to build momentum in the 32-bit area (in both development and sales). This implies short-term, "hole-fill" oriented product development for 16-bit mid- and high-end products, and basic product development for the 32-bit area.

Simultaneously, in FY'79, ramp up our development efforts on commercial systems to replace CTS-300 and provide the basis for continued aggressive development and marketing of low-end commercial products in future years.

In FY'80, introduce our first cross-product commercial Small System, continue moderate level of effort in the 32-bit area; and maintain an aggressive sales posture on 16-bit mid-and high-end products while reducing investment by focusing on competitively targeted high-impact, low-cost enhancements to existing systems.

In FY'81, begin shift in emphasis to 32-bits for the mid- and high-end, focusing on solid migration capabilities, and begin winding down 16-bit development. Maintain aggressive development on low-end 16-bit products focusing on upwards and downwards compatibility. Ramp up our efforts on application tools across the board and begin to pursue an application software strategy especially at the low-end, as budget constraints allow.

Beyond FY'81, shift major Corporate-wide emphasis away from basic software development towards availability, application tools and applications. Concentrate on products and related sales tools which are geared to customer solutions, low sales and support costs.

Two major alternatives to this strategy have been investigated at various times. First, in June 1977 as part of the Commercial Group Systems Plan an alternative strategy to continue to enhance CTS-300 and RSTS as a general purpose commercial base was rejected as a long term strategy because of the general feeling that technologically these products did not have the expansion capability and flexibility that would be necessary in order to remain competitive in the three to five year period. More recently, the alternative of moving more aggressively to a 32-bit base for the mid-to high-end commercial systems was investigated by the Commercial POT and was rejected as a high risk technological alternative in light of the current business situation. The current strategy implies a gradual change in product emphasis over the next two to four years in the mid-to high-end product space from a 16-bit to a 32-bit base. The eventual goal as suggested by this strategy is to have a single compatible family of commercial products using 16-bit architecture at the low-end and 32-bit architecture at the mid-to high-end.

ASSUMPTIONS & IMPLICATIONS

MARKETS:

The Commercial POT has used a model segmenting markets into three generic application areas: General Purpose, Transaction Processing and Real Time/ Communications. The characteristic of these segments is described in the attachment titled "Commercial Market Segmentation". The POT intends to refine the segmentation and to analyze Digital's current position and future opportunities in each of these segments over the next few months, with concentration on the General Purpose and Transaction markets.

COMPETITION:

The POT believes that the major competitive influences within the next two years will come from IBM, HP and DG. The POT is also concerned with the impact that TANDEM is having in our markets. We expect to remain in "catch-up" mode relative to these companies for at least the next two years.

For the longer term, we must address the implications of satellite technology, the potential impact of the Japanese consortium threatening from above with "370 on a chip" technology, and the small companies, particularly micro manufacturers now developing systems capability, threatening from below. We will also watch Prime, Wang, Honeywell, Burroughs, NCR, CDC and UNIVAC for signs of threatening activity.

The majority of the POT activity relative to competitive analysis is yet to be done. We intend to perform the initial analysis on our major short-term competitors during the next few months.

TECHNOLOGY:

The POT has been operating on the implicit assumption that the completeness of our software tools and their performance will be the key priorities for the next two years. We are in "catch-up" mode in these areas in order to provide basic, entry-level capability for the Commercial Market. Beyond this two-year period, we are assuming that a stabilization of internal architectures and a shift in investment emphasis will enable us to concentrate on systems capability which is closer to the customer's solution, which is more approachable to a wider range of potential computer users, and which addresses internal efficiencies of manufacturing process, sales and support costs.

Specific long-term technological issues include:

- a commercial terminal strategy
- marketing and engineering strategies that help reduce manufacturing costs, especially at the low end
- systems salable, supportable and usable for the novice computer user
- storage technologies and their effect on the above
- communications technologies and their effect on the above
- whether the 32-bit architecture is a viable and cost effective architecture for the low end as an alternative to the current 16-bit low-end strategy.

REVENUE

The POT is currently collecting more accurate and detailed revenue data by the market segments defined. Current data available is based on Q1 FY'78 budgets and is attached under Commercial NOR forecasts.

INVESTMENT

Investment data is included with the Product Calendar attached. In general, the POT believes that the Commercial budget is so constrained as to provide NO flexibility in terms of exploring new opportunities in the low-end, 32-bit and applications areas. (Our FY'79 budget includes only a portion of our SURVIVAL items.) We have major exposures in terms of our ability to invest in commercially-oriented terminals, high-availability, 32-bit software, migration tools, application tools and commercial utilities.

RISKS and EXPOSURES

- Our ability to discipline ourselves to complete our basic systems tools in an expeditious fashion and shift our innovative energies away from basic computer architecture towards application tools and user solutions for the Commercial Market. Will the competition force us to invest in new architectures?

RISKS and EXPOSURES (con't)

- Our ability to market, sell and support Commercial systems competitively.

- The effects of Satellite Communications and 360/370 software availability on low-cost hardware on our mainline mini-computer business.

- The viability of low-end business from a Sales and support viewpoint. Resolution of the question of the long-term implications of indirect vs. direct distribution channels for small systems.

- Higher than expected investment to become viable and remain competitive in the Commercial market.

/kc

COMMERCIAL MARKET SEGMENTATION

	General Purpose	Transaction Processing	Real Time, Sensor Based Communication
Environment	o Multiple Independent Applications	o Optimized to Large No. of Terminals Doing Small No. of Jobs	o Fixed Functior o Communications
Oriented Toward	o Fast Program Development	o Production Environment (Response in Seconds)	o Performance (Response in Microseconds)
Use Wants	o Ease of Use	o Ease of System Modification o Sophisticated System Management	o To Get Close t Hardware for Tunability o Building Block Approach
ystem Allocation	o Time Slice for Equal Resource Allocation	o Event Driven for Resource Allocation	o Event Driven for Resource Allocation
ontrol By	o User (Terminals Control System)	o System Controls Terminals	o System Controlled Production Environment
ill Pay For	o Average Security and Availability	o High Security and Availability	o High Security and Availability

COMMERCIAL NOR FORECASTS

BASED ON Q1 FY'78 BUDGET PASS

BUS, DDP, TELCO, IPG, OEM, G/A, W/P	78	79	80	81	82
32-BIT	2.7	28.5	95.4	265.7	483.6
LARGE-16 (11/60,11/70, 11/74)	165.3	190.2	217.3	229.8	147.4
MID-16 (11/34,11/44P,11/68)	203	272.6	333	374	281
SMALL-16 (11/03, FONZ, (Q,U, NO BUS)	56	75.7	134.5	243.3	430.7
SUBTOTAL	427	567	780.2	1112.8	1342.7
MDP/LDP (NO BREAKOUT)	19	32	48	72	100
TOTAL	446	599	828.2	1184.8	1442.7

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	ANNC. DATE	FCS DATE	FY'78 $K	FY'79 $K	TOTAL $K	PROD. MGR.	DEV. MGR.
16-BIT MID+HIGH END	PDP-11 COBOL	ANSI-74 COMPLIANT COBOL V4A/V4B - PERFORMANCE RELEASES WITH PACKED DECIMAL DATA TYPE	Q2FY'79 (V4A/V4B)	Q2FY'79 Q3-V4B	142.6	183.9	326.5	PIETRAVALLE	HAM
	RMS-11	CROSS-SYSTEM COMPATIBLE SEQUENTIAL, RELATIVE, MULTIKEY ISAM FILE MANAGEMENT	Q2FY'79 (V1.5)	Q2FY'79	247.9	337.2	585.1	PIETRAVALLE	DALEY
	BASIC-PLUS 2	COMPILER SYSTEM FOR THE LANG. "BASIC", (DEC STANDARD)	JUNE '76	SEP'77	106.7	0	106.7	PIETRAVALLE	HAM
	FAST BACKUP	RP07 FAST BACKUP(1) UTILITY FOR RSTS/EV7A	N/A	RSTS/ EV7A		61.3	61.3	PIETRAVALLE	DALEY
	DBMS-11	CODASYL COMPLIANT DATA BASE MGMT.	FY'77	JAN'77	154.1	--	154.1	PIETRAVALLE	
16-BIT LOW END	SMALL COBOL	ANSI STANDARD COBOL FOR SCS-11	Q4 FY'79	Q1FY'80 (2)	216.9	275.9	492.8	PIETRAVALLE	HAM
32-BIT	COBOL-11/VAX	NATIVE EXECUTION OF	Q2FY'79	Q2FY'79	179.7	92	371.7	PIETRAVALLE	HAM
	RMS-32	COBOL-11 RMS-11 COMPATIBLE FILE MANAGEMENT FOR VAX	Q2FY'79 (ISAM)	Q3FY'79 (ISAM)	355.7	367.8	723.5	PIETRAVALLE	HAM
	SORT	HIGH PERFORMANCE FILE SORT FOR VAX	Q2FY'79	Q3FY'79	97.0	76.6	173.6	PIETRAVALLE	HAM
	BASIC+2 COMPILER	BASIC LANGUAGE COMPATIBLE WITH PDP-11 BASIC-PLUS-2	Q4 FY'79	Q1 FY'80	191.3 --	306.5	497.8	PIETRAVALLE	HAM
	COBOL-79	NATIVE HIGH PERFORMANCE COBOL FOR VAX	FY'81	FY'81	223.6	597.7	821.3	PIETRAVALLE	HAM
	DBMS-32	CODASYL COMPLIANT DATA BASE MGMT FOR VAX	FY'81	FY'81	--	183.9	183.9	PIETRAVALLE	
	EDITOR/VAX	DEC STD. EDITOR FOR VAX	N/A	VMS	--	30.7	30.7	PIETRAVALLE	HAM
	VAX/OTS	COMMON RUNTIME SUPPORT	N/A	N/A	241.9	183.9	425.8	PIETRAVALLE	HAM

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	ANNC. DATE	FCS DATE	FY'78 $K	FY'79 $K	TOTAL	PROD. MGR.	DEV. MGR.
16 BIT MID+HIGH RANGE	DATATRIEVE-11	INQUIRY LANGUAGE/ REPORT WRITER FOR RMS-11K	OCT.'77	JAN'78	174.9	46	220.9	PIETRAVALLE	HAM
	CIS	SOFTWARE SUPPORT FOR PDP-11 COMMERCIAL INS. SET	N/A	N/A	206.8	--	206.8	PIETRAVALLE	HAM
	EDITOR	COMMON IMPLE. ON PDP-11 SYSTEMS & VAX COMPLIANT TO DEC EDITOR STD.	N/A	N/A	53	--	53.0	PIETRAVALLE	HAM
32 BIT	VAX TAPE ACP	ANSI TAPE SUPPORT FOR VMS V1.0	N/A	VMSV1	54.6	--	54.6	PIETRAVALLE	HAM
	VAX LDM R1A	CHECKOUT LANGUAGE & UTILITIES UNDER VAX COMPAT. MODE	N/A	VMSV1	24.6	--	24.6	PIETRAVALLE	HAM

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	ANNC. DATE	FCS DATE	FY'78 $K	FY'79 $K	TOTAL $	PROD. MGR.	DEV. MGR.
16-BIT LOW END	SCS-11	SMALL BUSINESS SYSTEM SOFTWARE, CONSISTING OF PACKAGED RSX-11M BASED O/S (PRE-SYS-GENED) AND SMALL FILE MANAGER (UPWARDLY COMPATIBLE WITH RMS)	Q4FY'79	Q1FY'80 (2)	365	736	1101	WEBBER	MORGAN
	ADE-11	APPLICATIONS DEVELOPMENT FACILITY ORIENTED TO FIRST-TIME END-USER MARKETPLACE AS WELL AS IMPROVING PROGRAMMER PRODUCTIVITY BY DEC OEM'S/DISTRIBUTORS - BUNDLED WITH SCS-11	Q4FY'79	Q1FY'80 (2)	46	245	291	WEBBER	MORGAN
16-BIT MID & HIGH END	RSTS V7A	THIS RELEASE FEATURES SUPPORT OF LARGE FILE (OVER 65K BLOCKS), SHARED LIBRARIES (RMS), DISK CACHING, NEW DEVICE SUPPORTS AND CONTINUED AVAILABILITY OF SMALL (64KW) RSTS CONFIGURATIONS W/V6C FUNCTIONALITY	Q2FY'79	12/78	369	307	676	WEBBER	DALEY
	RSTS V6C		Q4FY'78	12/77	270	---	270	WEBBER	DALEY
	RSTS V7B	THIS RELEASE FEATURES IMPROVED SPOOLER, BACK-UP, AND BATCH FEATURES AND IMPROV. IN THE RSTS TASK BUILDER, AS WELL AS NEW DEVICE SUPPORT	----	----	---	199	199	WEBBER	DALEY

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	ANNC. DATE	FCS DATE	FY'78 $K	FY'79 $K	TOTAL $	PROD. MGR.	DEV. MGR.
16-BIT MID TO HIGH END	TRAX	DEDICATED TRANSACTION PROCESSING SYSTEM	5-2-78	7-31-78	$818.5	858	1.676.5	JOHNSON	HAM
32-BIT	COMM. VAX (TRAX-32)	T.P. MONITOR FOR VMS TRAX INTERFACE BLOCK TERMINAL SUPPORT RSTS CONVERTER AIDS HUMAN ENGINEERING ENHANCEMENTS (3)	------	FY'81 (3)	54.6	305	359.6	JOHNSON	DALEY/ HAM
					4594	5193.4			

PRODUCT CALENDER NOTES

(1) Coordinational Issue with RT/C POT on Fast Backup/ Restore for RSX11M and TRAX to be worked.

(2) FCS for SCS-11, ADE-11, and Small COBOL are dependant on availability of CIS/FONZ system. Q-BUS vs. U-BUS implementation tradeoffs will affect this date.

(3) Preliminary planning data only.

RT/C OVERVIEW

RT/C PRINCIPLES

Our market is mature and having been serviced by DEC since its inception implies that we have been a driving force. Our goals include maintaining that leadership position across a broad range of applications and directing our development efforts to accomplish that before moving into other areas such as specific applications.

We have 3 products: RT for single users, RSX for multi real time user environment and VMS for computation. We are investing in real time software for VMS such that, as the hardware evolves and migrates downward, we can introduce it as an effective RT/C product.

RT/C CONCERNS

The RT/C POT is concerned that due to the past investment made in RT/C products and the market maturity, that there may be a tendency to minimize the need for an aggressive development plan. Our perspective should be that of "bootstrapping" our efforts into new, critical products over the next few years which requires an aggressive plan and cannot use past investments as a leverage point. The key areas requiring a significant effort are:

a) 32-bit real time and host support for network systems. This requires effort much beyond our past 16-bit investments.

b) Pressure to maintain FORTRAN leadership; not by enhancing F4+, but by aggressively producing a mainframe FORTRAN.

c) Defining and creating a 16-bit distributed real-time system model and tools for continued revenue available from a large 16-bit market (i.e., LEVELØ DECNET).

d) An aggressive response to implementing a real-time language (DOD-1, Pascal, PL1) to prevent a lock-out from happening.

These key areas are under review for prioritization, however, we must point out that without the resources to implement a more aggressive RT/C development effort over the next 2-3 years, we will not only be in a position well behind the competition on 32-bit systems, but lack the current system enhancements needed to maintain viable PDP-11 offerings.

RT/C FY81 GOALS

A.

A. Maintain Leadership by enhancing Fortran and file utilities and establishing a stable environment across our 16-bit operating systems making them more reliable and easier to use.

We are testing the MP market with the 11/70 and laying the foundation for a major 32-bit thrust. We expect to respond in a timely manner to any DOD language specification as it will become a lockout specification.

B. Rejected Alternatives: We have currently excluded immediate development of new languages (PL1, BLISS, APL, DOD) due to funding limitations, however, we feel this creates a "hole" in the high end PDP-11 strategy and will require re-assessment and prioritization of FY80+ development funds.

C. Exposures: We are reviewing our long range strategy in the context of other POT's plans. The following issues will be worked and resolved.

.Need a model for "distribution" R/T which includes micro CPU's, DECnet, and distributed I/O.

.Mid-range system phase-over
(hardware: 11/70 - 11/68 -COMET)
(software: IAS/D - K2 -VMS)

.New hardware integration such as CPU features, NDS, large memories.

.Small system VMS to provide host for bounded systems.

.Develop real-timeness in VAX products. (Define needs).

.Evaluate need for comprehensive (mainframe) Fortran for VAX.

.Must produce a timely new language capability.

RT/C ASSUMPTIONS AND IMPLICATIONS

A. Markets are driven by price and performance. We expect an evolution to 32-bits with its leverage. The base of our users will expand and as such require servicing more, less sophisticated users. As a result, ease of system use and overall system RAMP are important factors.

B. Competition is led in technology by IBM due to their investment level. DEC is a reasonable "target" for others to shoot at and compounded by our broad approach to the marketplace. Traditional competitors, (HP, DP, IBM) will continue with a broad approach. Emerging competitors (Prime, Tandem, Modcomp) will carve out specific areas to apply their offerings such as virtual memory, MP and fast real-time. Our response must include continued product breadth (no gaps) with enhancements to our offerings. Also, the timely support of new products and response to market standards will be important.

C. Technology is producing both new 16-bit and 32-bit systems along with a distributed approach to applications as low end costs are driven down. We must clarify our understanding of the high-end PDP-11 strategy in the context of other POT plans and either modify our current strategy of phasing over to 32-bits, or modify the CPU strategy away from high end 16-bit offerings, as their functionality is beyond the support scope of our current offerings. We must also concentrate on understanding and defining our real-time approach to networks which appear to have impact on development plans. A fundamental requirement along with a simpler master/slave approach.

PRODUCT CALENDAR (Figure 1)

The project list for FY79 development is attached as Figure 1. The 2 new products are: 32-bit real-time (scheduled to be available with COMET), and RSX11-MP (2nd half of FY79 with the MP hardware.

BUDGET ASSUMPTIONS AND RISKS

We are assuming that other POT's future products will not require changes to the RT/C operating system (i.e., DECnet, Commercial Languages, RMS/DBMS) and that there are not further cuts in the budget. Our contingency is built into our 32-bit development effort, not current products.

Any further cuts will have significant impact in the short term plan. The level of funding from other POTS remains fixed:

$720K	Mass Storage
$600K	S/S Terminal
$1050K	Base Pot

Current product contigency must be funded by the product lines directly.

RT/C REVENUE (Figure 2)

The attached revenue charts show that based upon projections from the product lines, new products will have a significant impact on revenues in the FY81 timeframe. Most significant is the 32-bit R/T program. Note also, that additional revenues can also be attributed to the high-end 16-bit system if coupled with an enhanced version of RSX11M, supporting larger memories and address features of 11/70 class systems and the 11/68 being developed.

RT/C POT INVESTMENT

The pie-chart is self explanitory. The bulk of the available development dollars used for existing products with 29% on the 32-bit R/T effort to support our FY81 strategy. Resources allow only 6% available for long term investment. The MP effort will slide into the 32-bit area within the next 2 years if the test effort on 16-bits is successful.

FRAMEWORK

We expect to continue to exploit current product strengths and integrate new products into our offerings. We have deferred significant effort on a new DOD language as the specification is still volatile. We anticipate reacting in a timely manner within a year. Our short term effort is directed toward integration of the 32-bit offerings, particularly COMET with good user level capability and documentation for the implementation of R/T applications and migration from the high-end PDP-11 base.

External factors include IBM as the technology leader, and we are monitoring vertically oriented competitors to assure we maintain an aggressive response.

PLAN TO MAINTAIN CURRENT POSITION

We view our current 16-bit offerings as mature and stable. Exploiting will consist of new device support, minor enhancements and making them easier to use. Our plan includes rounding out ou our languages and increasing reliability to reduce the SPR rate. MP will be tested on the 11/70 as a limited product to minimize the risks. The 32-bit R/T effort will include both driver and documentation system testing. Utilities will be "cleaned-up" and a fast backup capability for large disk subsystems.

We can enhance our position with effort in the following areas:

- Small systems VMS package to use in developing RT11 applications for bounded systems.

.PDP-11 source level debug package for F4+.

.High end 11 system to exploit 22-bit address capability (11/44, 11/48, 11/68).

ADDITIONAL DATA

Two revenue charts are included which illustrate the phase in of 32-bit systems. They both represent normalized revenue and the % of revenue by product class.

RT/C PROJECTS FOR FY79

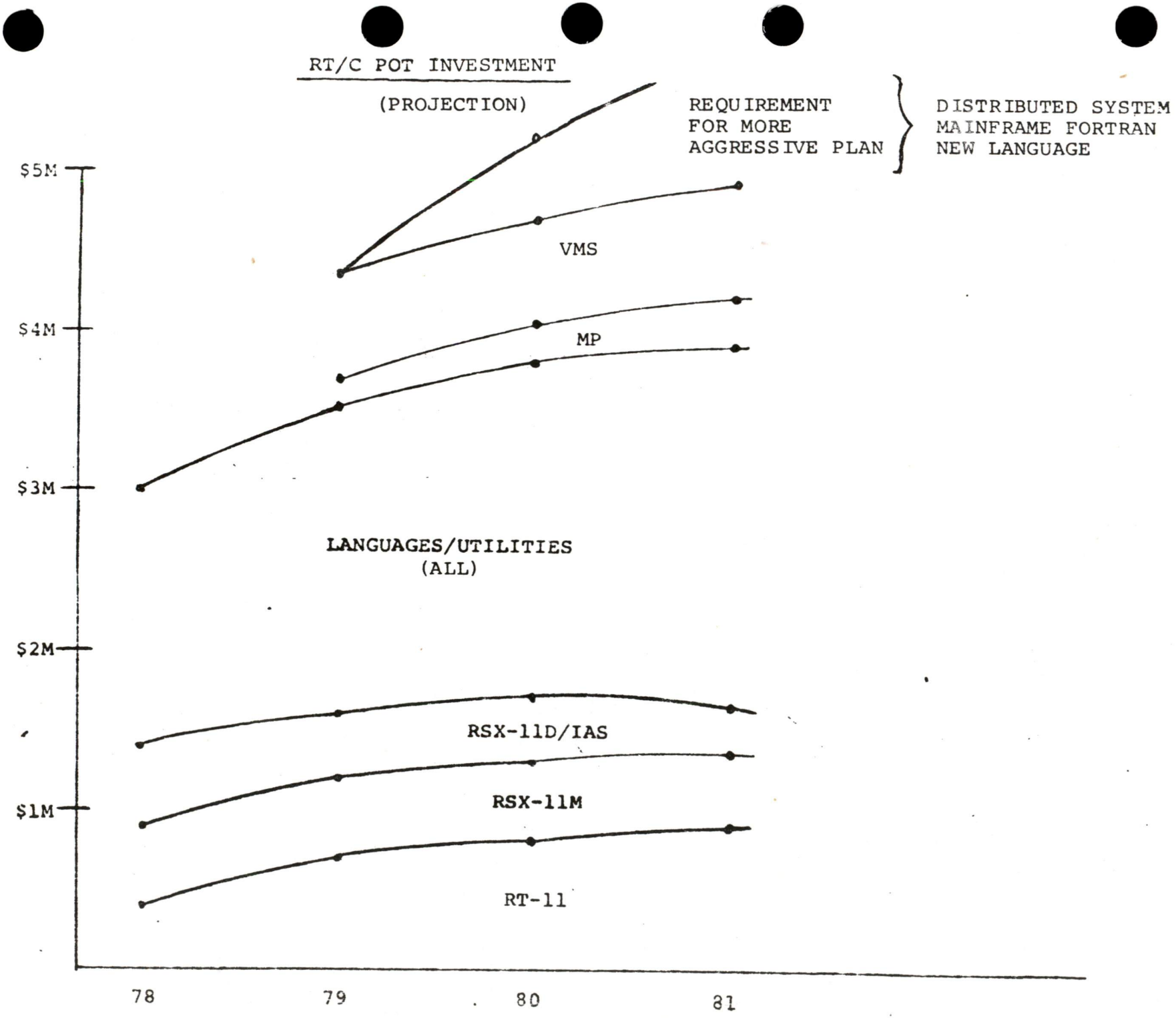
	PROJECT	SUPPORT	COMMITTED	SURVIVAL	TOTAL
REAL TIME POT	RSX-11M+P	-	122	-	122
	D/IAS	61+138	178	60	437
	RSX-11M	414	-	107	521
	RT-11	302	408	-	710
	FILES/UTILITIES	381	123	183+62 (COM POT)	687+62
	FORTRAN IV	215	-	-	215
	FORTRAN IV+	245	218	123	586
	APL	-	-	-	0
	DOD-1	-	-	-	0
	WCS TOOLS	-	-	-	0
	MACRO-11	61	-	-	61
	BASIC-11	302	-	-	302
	VAX RT/C	-	-	600	600
		2119	1049	1073+62	4241+62

(OOD 1700 PL91 200) 2122 (RT POT 2100)

RT/C POT FUNDS

420 - VAX RT/C
60 - VAX F4P Extension
120 - Contingency

FIGURE - 1


RT/C POT INVESTMENT
(PROJECTION)
REQUIREMENT FOR MORE AGGRESSIVE PLAN
DISTRIBUTED SYSTEM
MAINFRAME FORTRAN
NEW LANGUAGE
$5M
$4M
$3M
$2M
$1M
VMS
MP
LANGUAGES/UTILITIES
(ALL)
RSX-11D/IAS
RSX-11M
RT-11
78
79
80
81

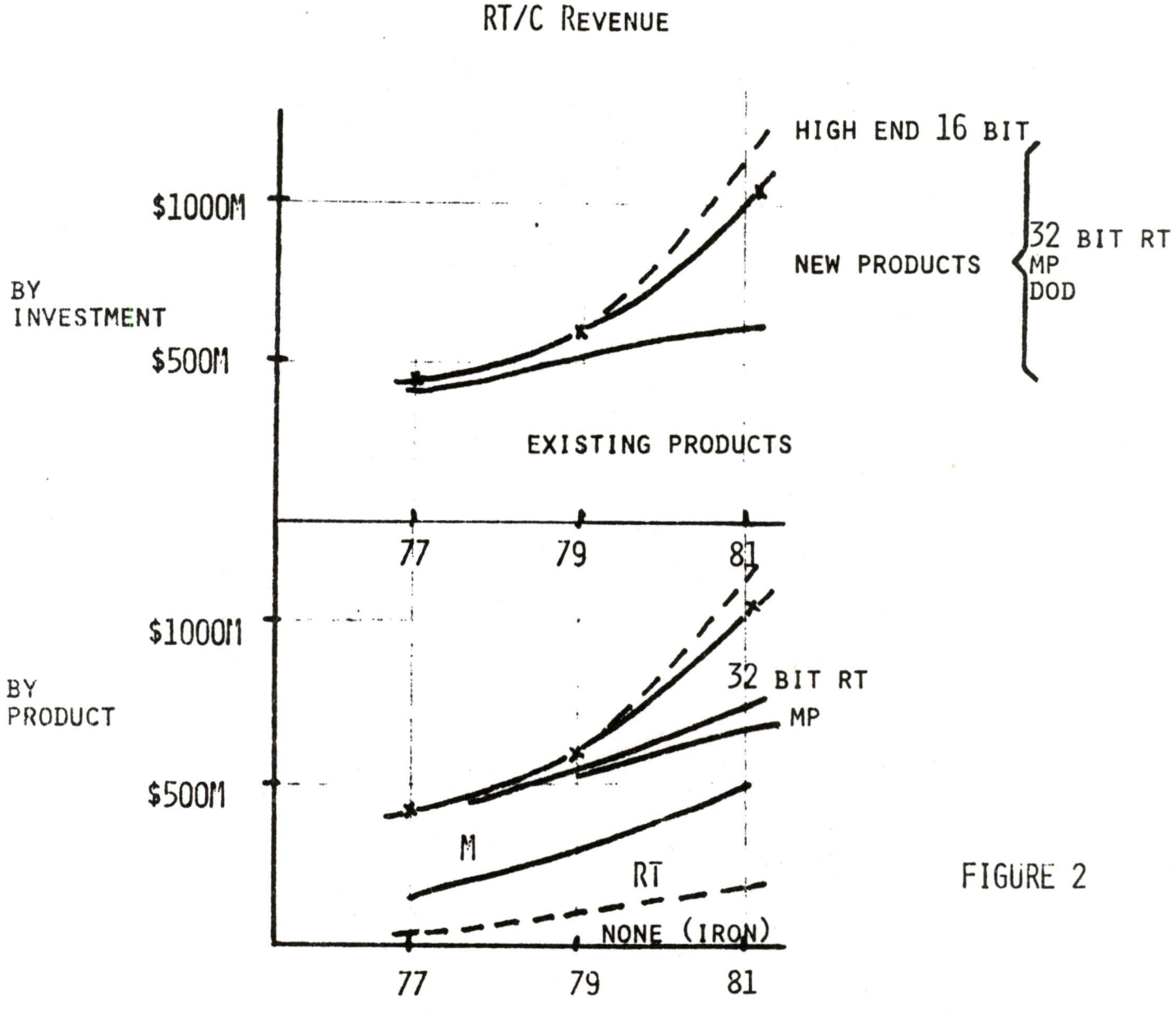
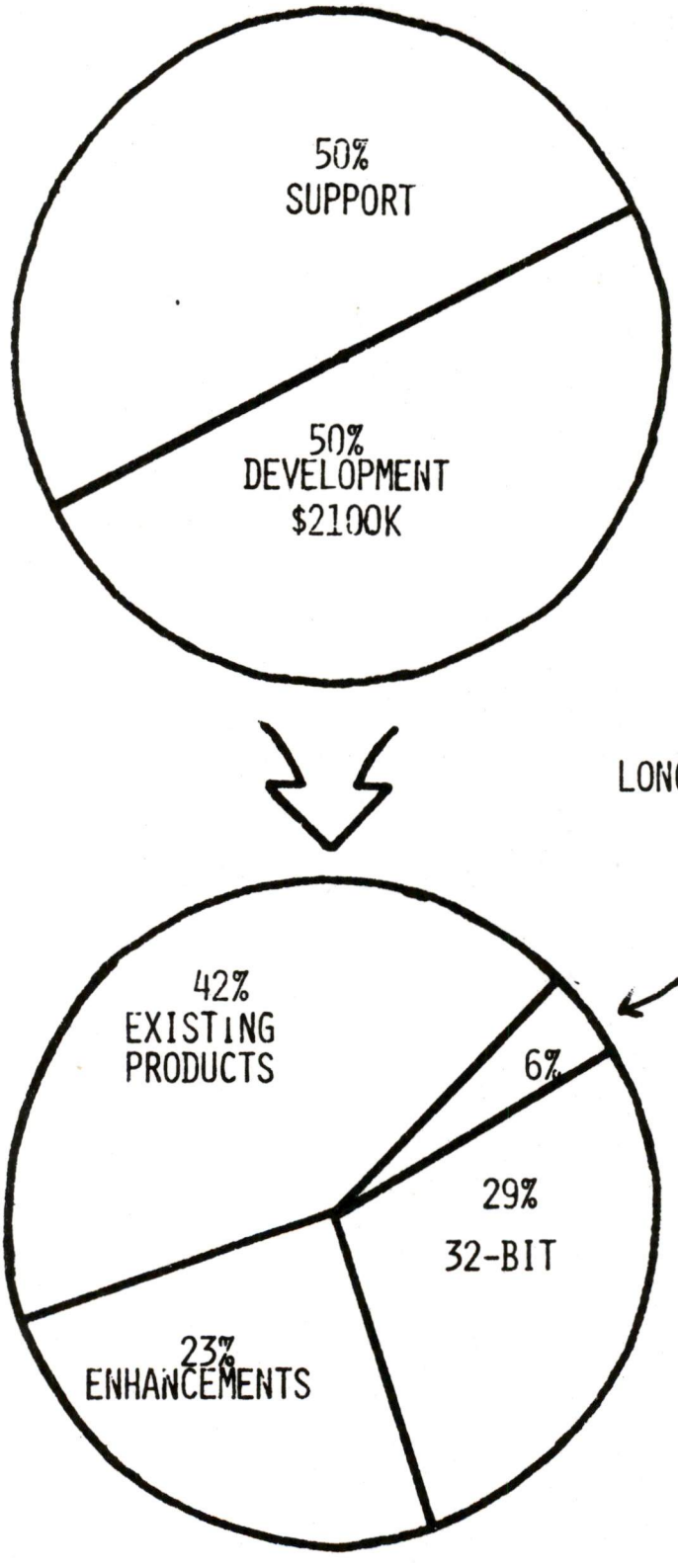


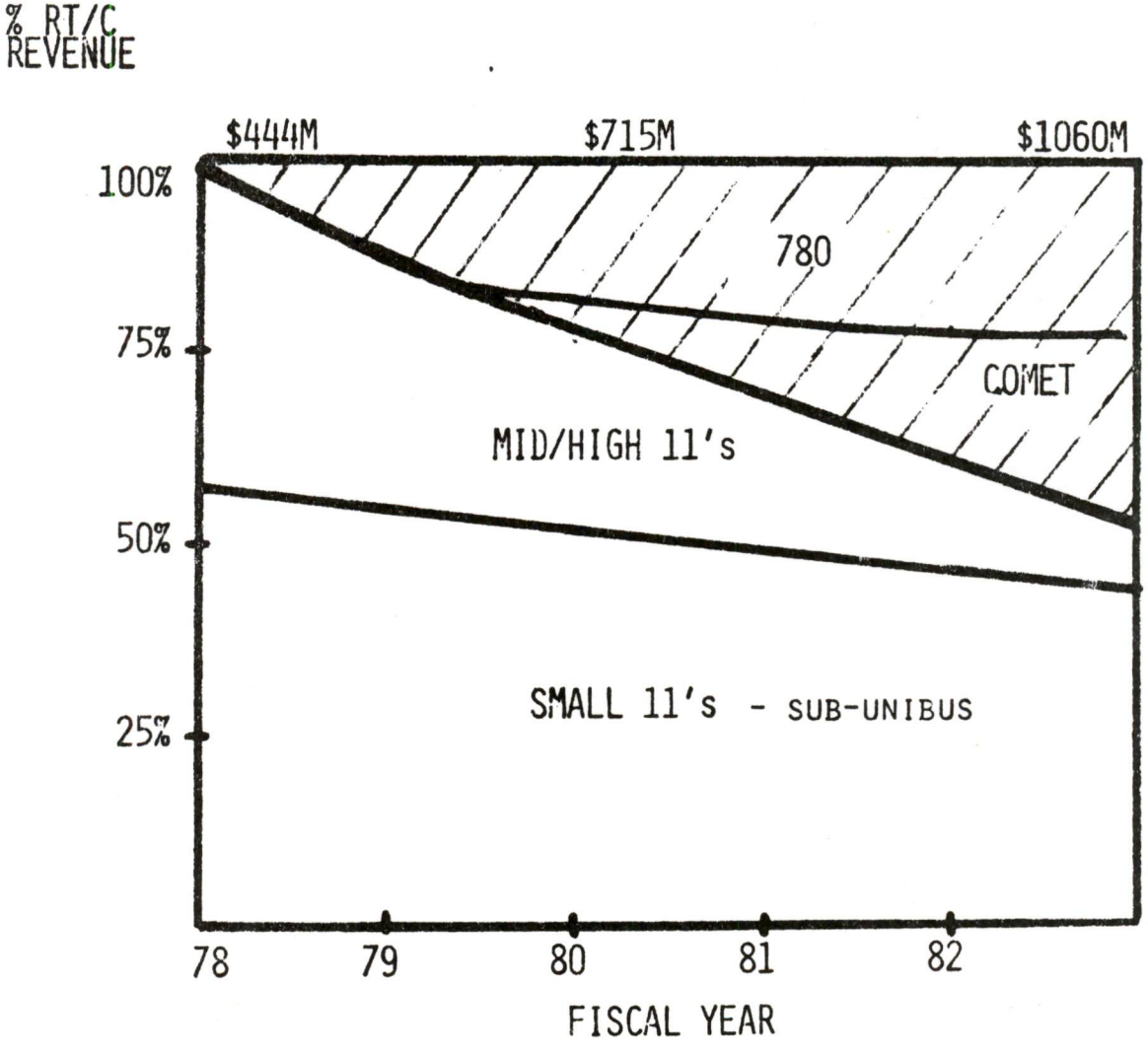
FIGURE 2

FIGURE - 2

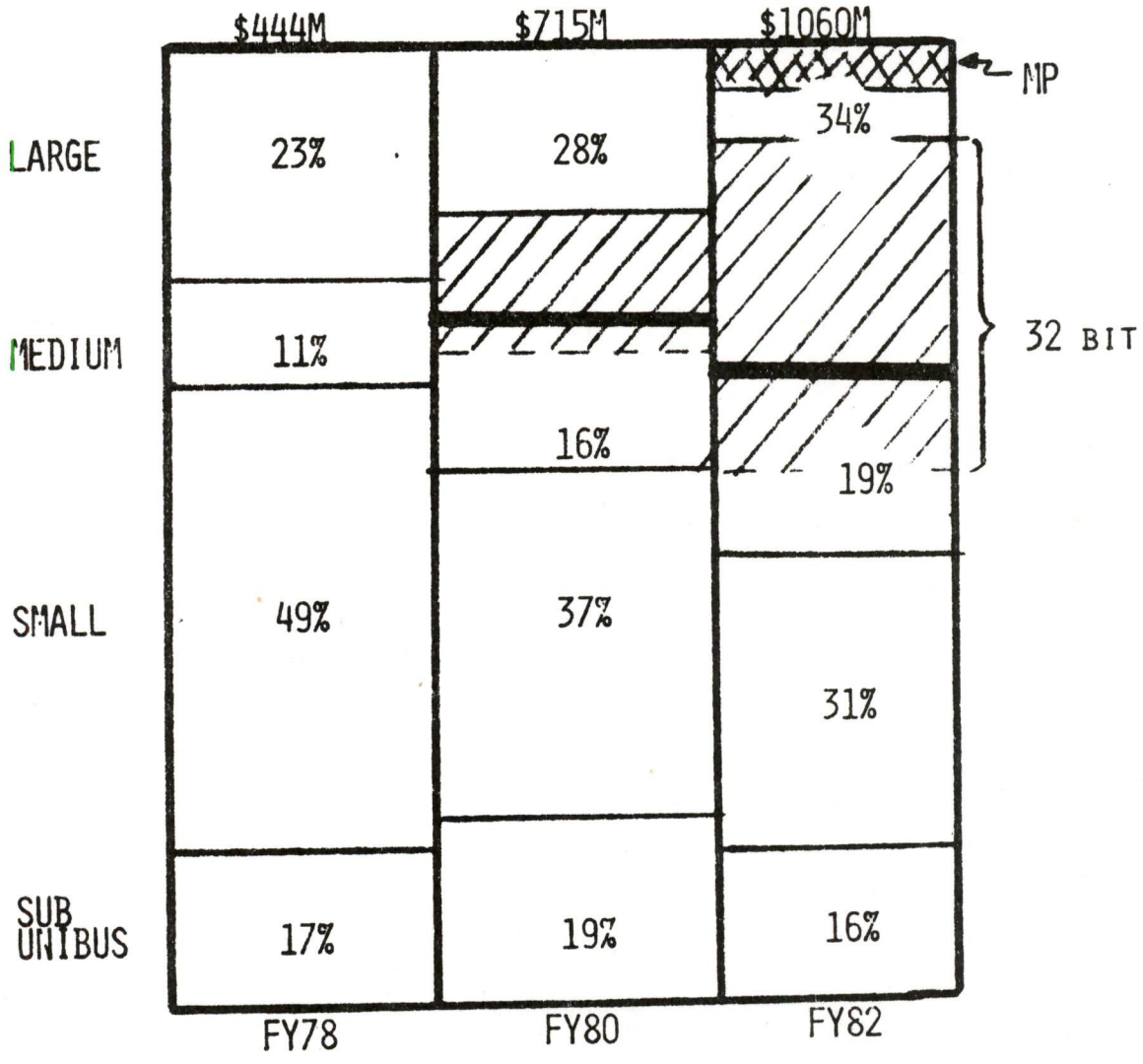
RT/C FY79 POT INVESTMENT



RT/C REVENUE PROJECTION



RT/C NOR PROJECTION
BY CPU CLASS



32 BIT: FY80 = 20%
FY82 = 35%

3/16/78

DRAFT
REV 4
17 May 1978

BASE SYSTEMS POT

LONG RANGE PLAN

SPRING 78

1.0 GLOSSARY OF TERMS

11/44	Medium UNIBUS11 CPU extending the 11/34A
11/48	Medium UNIBUS11 CPU replacing 11/34A & 44
11/68	Large UNIBUS11 CPU replacing 11/60, 70 & 74
11/74	Enhanced 11/70 for CIS & mP capabilities
CCD	Charge Coupled Device memory technology
CERBERUS	Codename for 11/74 mP project
CIS	Commercial Instruction Set
COMET	Medium VAX11 CPU, next down from 11/780 (STAR)
CPU	Central Processor Unit
EBAM	Electronic Beam Addressable Memory technology
FCS	First Customer Ship
FONZ	CPU chip set successor to LSI11
FPP	Floating Point Processor
HMOS	Higher-level NMOS technology
IT	Intelligent Terminal
LSI	Large Scale Integrated semiconductor circuit
LSI/VAX	Low-end VAX11 CPU next down from NEBULA
MASSBUS	High-performance controller-device interconnect
MBM	Magnetic Bubble Memory technology
MOS	Metal Oxide Semiconductor technology
mP	Multi Processor
NEBULA	Small VAX11 CPU, next down from COMET
NMOS	N-channel or Nitride MOS technology
PAX	Physical Address eXtension of 11/70 origin
PMI	Processor-Memory Interconnect, generic
PULSAR	Codename for LSI11 mP project
RAM	Randomly Addressable Memory
RDS	Remote Diagnosis Service
SUPERSTAR	Large VAX11 CPU successor to 11/780 (STAR)
TTL	Transistor-Transistor Logic
UNIBUS	Standard PDP11 family interconnect
UNIFONZ	Small FONZ-based UNIBUS11 CPU replacing 11/04
VMS	Virtual Management System software for VAX11

2.0 PRODUCT CALENDAR

TITLE	DESCRIPTION	FCS as of SPRING77	FCS as of SPRING78
VAX11			
COMET	o Base CPU with integral warm-FPP & CIS and optional WCS o Hot-FPP option	Q4,FY79t	Q1,FY80 Q1,FY80t
PDP11			
KK11A	Cache option for 11/34A	Q1,FY79t	Q4,FY78
11/74	Corp cab 11/70 with CIS option & mP Extensibility	Q1,FY79t	Q3,FY79
11/74mP	CERBERUS 11/74 mP under RSX11M-PLUS	Q1,FY79t	Q3,FY79
11/44	Extended 11/34A with PAX & CIS options	-	Q4,FY79
UNIFONZ	FONZ-based 11/04 CPU (board) replacement with integral warm-FPP & CIS	-	Q1,FY80t
11/68	Lower-cost 11/74 CPU replacement	-	Q4,FY80t
11/48	Higher performance 11/44 & 34 CPU replacement at UNIFONZ cost	-	FY81-2t
MEMORIES			
MSIIL	16K MOS chip upgrade for 11/04-34	Q1,FY79t	Q1,FY79
MS780D	16K MOS chip upgrade for 11/780	-	Q1,FY79
MKA11	4K MOS chip memory for 11/74	Q4,FY78	Q3,FY79
MS11KC	16K MOS chip upgrade for 11/74	Q1,FY79t	Q4,FY79t
MS11M	ECC 16K MOS chip memory for 11/44		Q4,FY79

Note: t=targetted (vs committed)

3.Ø ASSUMPTIONS & IMPLICATIONS

Markets

- o Overall market competitiveness and growth can be secured by top down evolution of the 32-bit VAX11 family and ensuring the vitality of the 16-bit PDP11 family underneath.

- o Continued leadership in traditional real-time & computation markets can be realized by VAX11 & PDP11 positioning with VAX11 establishing quickly in applications requiring large program performance or richer functionality.

- o Performance and commitment to commercial markets can be strengthened by (COBOL-supported) PDP11 CIS extensions particularly in the high-end and additionally by VAX11 commercial software developments.

- o Cumulative investments in volume or software-leveraged markets will impede PDP11 migration to VAX11 and require PDP11 (lower-cost) evolution to overlap more with VAX11 than might otherwise be necessary.

- o Improved availability trends can be expected to shift to continuous availability in a larger part of the on-line and real-time markets or become a major selling feature. This requires the formulation and implementation of an appropriate and aggressive product strategy.

Competition

- o IBM will move closer to minicomputer price-performance trends across the range. Successors to Series 1 (high-performance), System 34 (improved functionality), 370/115 & 125 (E Series virtual memory) will challenge starting 1978.

- o DG will introduce a 32-bit machine around the end of 1979.

- o HP will concentrate on lower-cost & functionality extensions to the 3ØØØ & 21MX's up to the 198Ø's atleast.

- o Traditional 16-bit competitors will all provide minicomputer evolutions at lower cost mostly.

- o TANDEM could set the high-availability market place with their multiprocessor offering.

Technology

- o Semiconductor LSI is the driving force on CPU & memory developments, eg:

Custom NMOS	CPU: UNIFONZ	FCS	Q1, FY8Ø	
TTL Gate Array	COMET		Q1, FY8Ø	
Off-The-Shelf	11/68		Q4, FY8Ø	
Off-The-Shelf	NEBULA		FY81	Provisional
Custom HMOS?	11/48		FY81-82	Provisional
Custon HMOS?	LSI/VAX		FY82	Provisional
ECL Gate Array	SUPERSTAR		FY82	Provisional
16K MOS RAM's	MEMORIES		FY78	
64K MOS RAM's	MEMORIES		FY81	Provisional

4.0 PRODUCT GOALS & STRATEGIES

4.1 VAX11

Extend the VAX11 family down in cost from the 11/780 at constant functionality:

COMET
- o leadership midrange 32-bit CPU
- o FCS Q1, FY80
- o 65% 11/780 performance at 35% cost
- o 16MB physical memory addressing
- o integral CIS, warm FPP & RDS-hooks
- o optional hot FPP & WCS
- o system & box packaging
- o PMI, MASSBUS & UNIBUS
- o TTL gate array LSI technology

Products in an advanced development or conceptual stage through FY79 are:

NEBULA
- o earliest low-cost 32-bit CPU driven by distributed processing
- o FCS FY81
- o trade-off performance for 50% COMET cost

LSI/VAX
- o 32-bit microprocessor entry
- o FCS FY82
- o some 25% COMET performance and cost

SSTAR
- o leadership high-end 32-bit successor to 11/780
- o FCS FY82
- o some twice 11/780 performance at 65% cost

4.2 PDP11

Correct midrange exposure to physical memory address space, and - Improve midrange and high-end performance for COBOL computation:

11/44
- o build on 11/34A as lowest-cost midrange base
- o FCS Q4, FY79
- o 20% faster than 11/34A at small (5%) additional cost
- o 4MB physical memory addressing with PAX
- o PAX & CIS additions to 11/34A FPP & cache options
- o built-in CERBERUS mP hooks (only), like 11/74
- o box packaging
- o PMI & UNIBUS

11/74
- o enhanced 11/70 for commercial performance & CERBERUS multiprocessor extensibility
- o FCS Q3, FY79
- o CIS addition to FPP option
- o field upgradable to CERBERUS mP
- o corporate cabinet repackaging

Standardize on the revised PDP11 CIS specification for improved performance through extended data type support.

4.2 PDP11 (Cont.)

Maintain longer-term PDP11 competitiveness. Provisional product definitions are:

UNIFONZ
- o earliest small UNIBUS CPU by capitalizing on FONZ chip technology for 11/04 & lower-half 11/34A replacement.
- o FCS Q1, FY80
- o performance of 90% base 11/34A, 10% 11/34A FPP & 10% 11/44 CIS, all at 11/04 cost
- o integral warm FPP & CIS on single CPU board
- o board replacement for 11/04 & 34 CPU's with common packaging
- o PAX hooks (only) & system packaging under evaluation
- o custom LSI MOS (FONZ)

11/68
- o high-end 11/74 replacement at lower cost
- o FCS Q4, FY80
- o 11/74 performance and functionality at $4.5K base CPU (box) & 256KB memory cost or always less than 50% 11/74 cost.
- o integral warm-FPP & RDS-hooks
- o CIS & hot-FPP (1.5 FP11E speed) options
- o built-in CERBERUS mP hooks (only), like 11/74
- o system & box packaging
- o PMI, MASSBUS and UNIBUS
- o LSI off-the-shelf technology

11/48
- o building-block approach to UNIBUS CPU replacement in the UNIFONZ to 11/68 space.
- o FCS FY81-82
- o custom LSI (HMOS?) converged with FONZ chip successor

4.3 MULTIPROCESSING

Productize CERBERUS 11/74 multiprocessor under RSX11M-PLUS for FCS Q3, FY79 as earliest response to high-performance improved-availability markets.

Continue 11/780 multi-port memory development for FCS Q3, FY79.

Design a CERBERUS-like 11/780 multiprocessor offering higher availability with high performance for applications where load sharing requirements are high and not predictable for effective application segmentation.

Establish a task force to identify the system topology in greater depth to satisfy those applications that require continuous operation and where the application is generally predictably segmented.

Continue PULSAR LSI11-based advanced development (non-POTS funded) for more understanding of a multiprocessor approach to a general purpose product set for the future.

4.4 MAIN MEMORIES

MOS RAM is the dominant technology for main memory

- o upgrade all MOS memories from 4K to 16K chips by FY79 for major bit-cost reduction.
- o track 64K chip development and cost-effective availability, probably FY81/82

Introduce ECC capability across the range with optional availability for small UNIBUS CPU's ie 11/04, 34 & UNIFONZ

Continue centrally-funded evaluation of new technologies (eg MBM, CCD, EBAM) fitting in the price gap between MOS & disc storage for optimum memory hierarchy architectures. Current product strategy does not incorporate such new technologies.

Maintain aggressive technology tracking and pricing posture

4.5 ARCHITECTURE & COMPATIBILITY

Focus on software and external bus compatibility across the broadest range of CPU and system families

Keep architectures sufficiently fixed to provide products resulting from historic cumulative investments, internal & external.

Settle on 11/74 functionality less Dual Registers & Stack Limit Register as the internal standard for PDP11 CPU software compatibility. Hold on to 11/780 functionality as the VAX11 CPU standard.

Avoid Operating System proliferations by forcing adherence to the RSX11M & K2 Kernels for PDP11's (except the Low End) and the VMS Kernel for VAX11's.

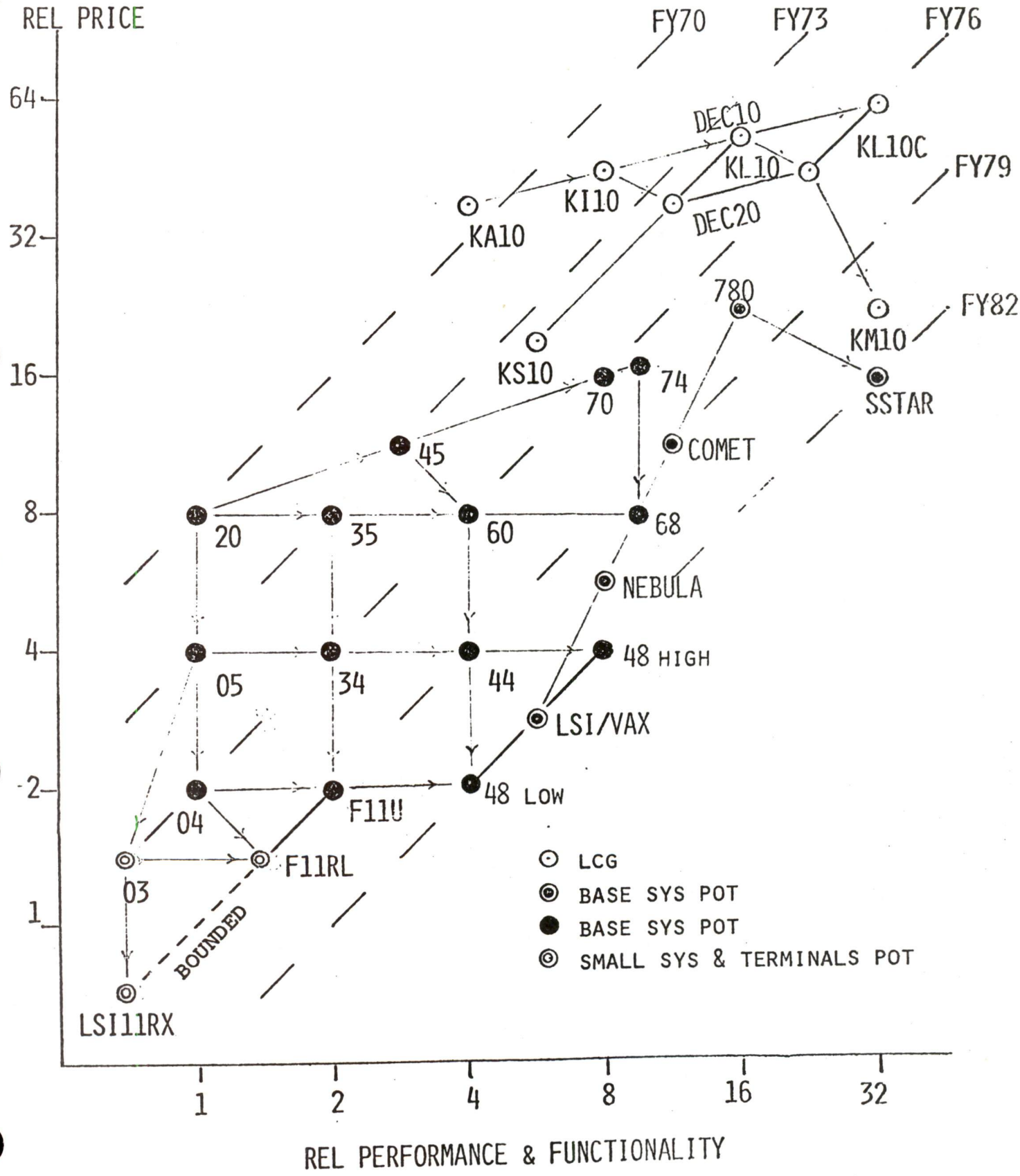
Evolve longer-term to a corporate UNIBUS replacement to correct increasing competitive exposure to interconnect functionality, performance, cost and data integrity as a major artery of the business.

4.7 SYSTEMS FOCUS

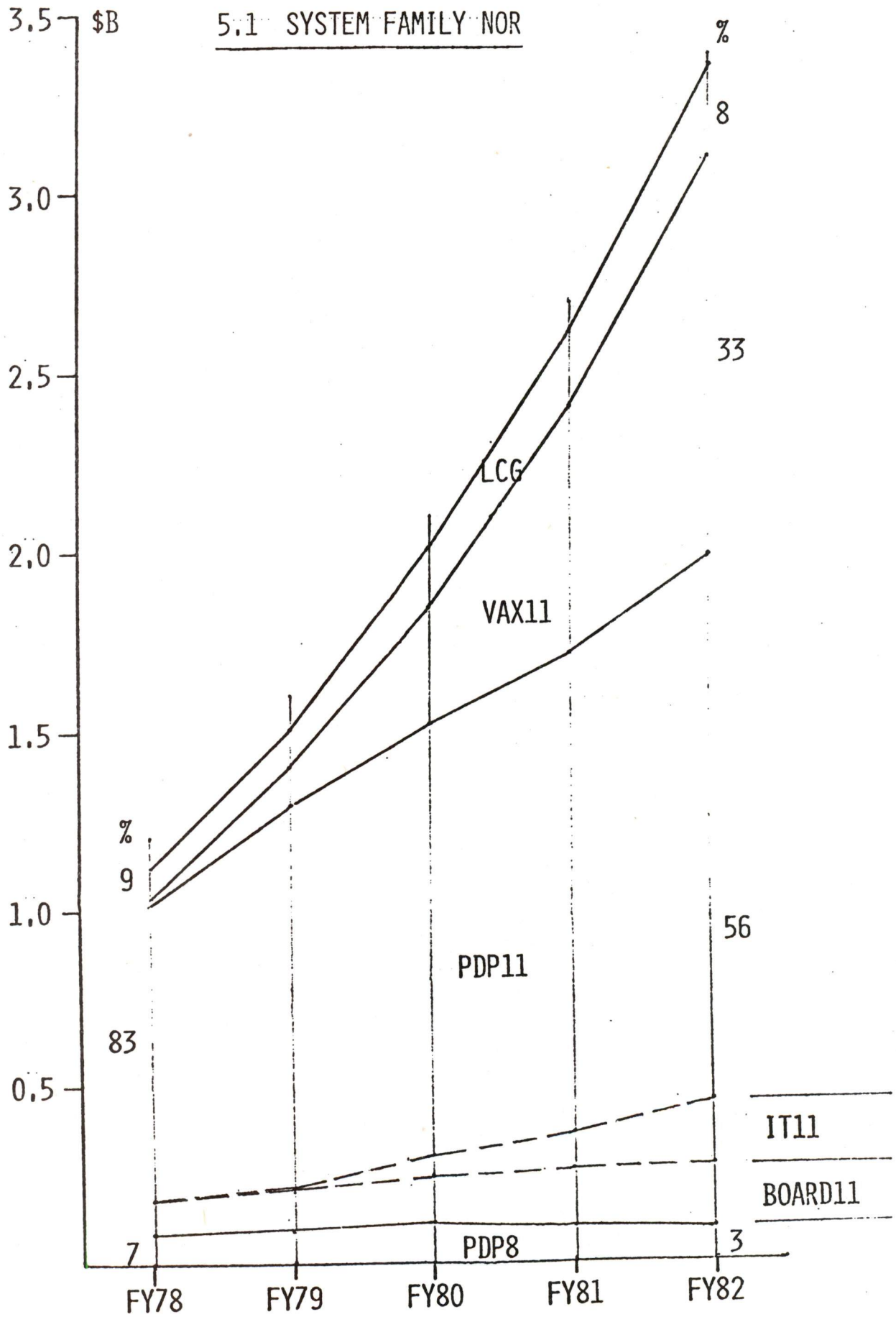
Push Corporate Packaged Systems as the process and tool for improved focus on the systems business.

Use system design and manufacture to lead in selected system configurations.

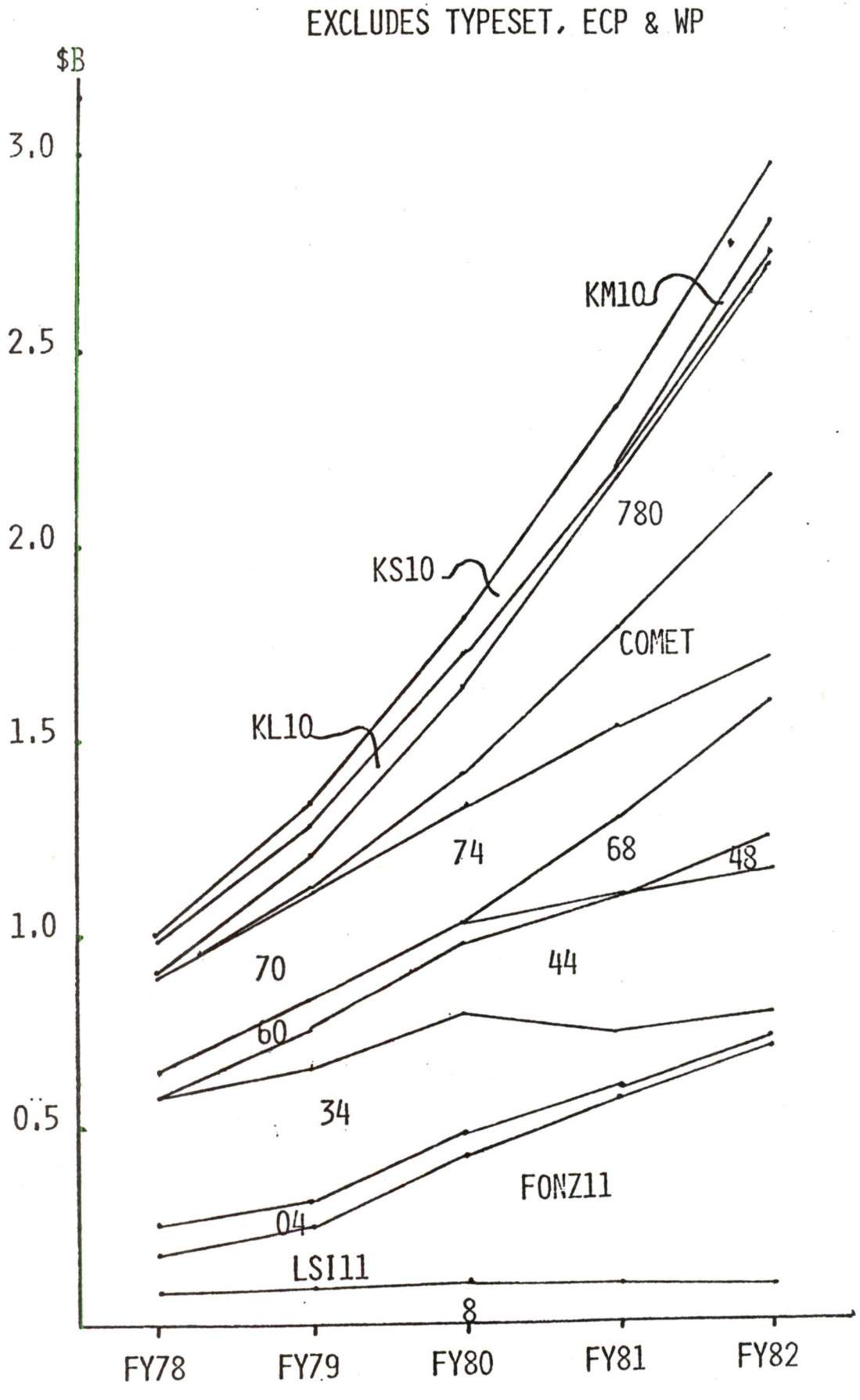
4.8 CPU FAMILIES: PRICE & PERF POSITIONING



5.0 REVENUES


5.1 SYSTEM FAMILY NOR
$B
3.5
3.0
2.5
2.0
1.5
1.0
0.5
%
8
33
56
3
%
9
83
7
LCG
VAX11
PDP11
PDP8
IT11
BOARD11
FY78
FY79
FY80
FY81
FY82

5.2 SYSTEM NOR BY CPU



6.0 INVESTMENT ($M)

PROGRAM	FY78	FY79	FY80
11/780	2.4?	0.6	-
VMS	2.0?	1.7	1.5[4]
COMET	2.3?	3.2	1.0
NEBULA	-	-	1.3
SUPERSTAR	-	-	1.3
11/780mP	0.3	0.95	-
11/74 mP	Note 1	0.55	-
Collective mP (FY80)	-	-	2.5
K2 Kernel	0.5?[2]	1.05	0.5[4]
Standard Systems	0.2	0.4	0.4
11/74	0.7[3]	0.9	-
11/68	0.3	0.85	1.9
11/60 (62)	0.3	-	-
11/48	-	0.2	2.0
11/44P	0.8	1.2	0.3
UNIFONZ	-	0.5	0.2
Memories	0.9?	0.4	0.6
Contingency	-	0.5	0.5
TOTAL	10.7?	13.0	14.0
Annual Growth	-	21.0%?	8.0%

Note:
1. $1M TELCO funding
2. Plus $0.4M TELCO funding
3. Plus $0.2M DDP funding
4. Assumes $0.5M Product Support funding by non-POTS each

7.0 MAJOR ISSUES

Is the 11/68 CPU cost aggressive enough? To be reviewed.

Do we need a multiprocessor solution, PULSAR or its like, to mainstream CPU development? PDP11 only? Is PULSAR advanced development funding stable or adequate enough through FY79?

Can SUPERSTAR and KM10 (next high-end DEC20) be the same base CPU?

Interconnect strategies, specifically QBUS vs UNIBUS, are being worked but are taking a long time to reach any reasonable corporate concensus.

How stable is the Small Systems & Terminals POT strategy to not develop a quad QFONZ successor to the 11/03? A reversal might impact UNIFONZ strategy.

APPENDIX : SYSTEM NOR BY CPU

CPU	SYSTEM NOR $M					
	FY78	FY79	FY80	FY81	FY82	TOTAL
PDP8	80	90	111	100	91	472
BOARD11	87	113	138	155	178	671
IT11	--	6	41	100	180	327
03, UNIFONZ	72	107	219	300	347	1045
04, 05	81	80	66	41	19	287
34, 35	324	344	305	150	71	1194
44, 48	--	101	183	335	417	1036
60	60	63	56	17	2	198
68	--	--	40?	233	410	683
70, 74	253	292	258	201	122	1126
PDP11 TOTAL	877	1106	1306	1532	1746	6567
COMET	--	2	89	256	470	817
780	8	80	215	383	547	1233
VAX11 TOTAL	8	82	304	639	1017	2050
KS10	7	46	102	132	146	433
KL10	94	80	65	55	22	316
KM10	--	--	--	15	88	103
LCG TOTAL	101	126	167	202	256	852
TOTAL	1066	1404	1888	2473	3110	9941

NOTE: EXCLUDES TYPESET, ECP & WP

Education Products Group

education products for the globe

digital

18 April 78

TO: Stan Pearson
Bruce Delagi

FROM: Al Dziejma Strategy Manager, T/SS POT
Jerry Witmore Chairman, T/SS POT

SUBJECT: T/SS REDBOOK STRATEGY DOCUMENT

Enclosed is a revised (as of last Friday's POT Meeting) Strategy Document.

Future POT Meetings will focus on major issues and their impact two to three years out.

JW:kb
Enclosure

XC: Dick Clayton

DIGITAL EQUIPMENT CORPORATION, 146 MAIN STREET, MAYNARD, MASSACHUSETTS 01754
(617) 897-5111 TWX: 710-347-0212 TELEX: 94-8457

T/SS STRATEGY

	NOR		DEV. EXP.	
	79	80	79	80
BASE TERMINALS	135	160	3130	4400
INTELLIGENT TERMINALS	26	66	990	2100
CHIPS, BOARDS, RACK & STACK	60	80	2575	6000
SMALL SYSTEMS	63	128	1490	
LINE PRINTERS	50	56	170	500
CONTINGENCY			645	800
TOTAL	334M	490M	9000K	13800K

T/SS STRATEGY

MARKETS SERVED

- DEC SYSTEMS TERMINALS REQUIREMENTS (ALL DEC MARKETS).
- INDEPENDENT: DUMB, SMART AND INTELLIGENT TERMINALS MARKETPLACE.
- LOW-END OF OEM AND END-USER MARKETS. (BOARDS TO SMALL SYSTEMS, BOUNDED AND RACK/STACK).

COMPETITION

- SYSTEMS COMPETITION (I.E., IBM, DG, BASIC FOUR, HP, WANG).
- COMPONENTS COMPETITORS (I.E., INTEL, T/I, ZILOG, MOTOROLA).
- TERMINAL COMPETITORS (I.E., TELETYPE, LEAR SEIGLER, TI, ETC.).
- INTELLIGENT TERMINAL (I.E., SYCOR, ADDS, DATAPOINT, ETC.).

T/SS STRATEGY

WHERE WE ARE TODAY: C/E PRODUCTS ONLY

- DUMB TERMINALS

  HARD COPY: LA36
  SOFT COPY: VT52

  - INDEPENDENT TERMINAL BASE
  - DEC SYSTEMS

- SMART TERMINALS

  VT61
  VT62

  - MARKET/APPLICATION SMART TERMINALS

- INTELLIGENT TERMINALS

  NONE

  - NEW MARKET/PRODUCT OPPORTUNITY

- RACK & STACK

  PROCESSOR: LSI 11
  BOXES: 11/03L
  PERIPHERALS: RX01, RL01
  PRINTERS: LA180

  - GENERAL PURPOSE COMPONENTS FOR VOLUME & END-USER MARKETS.

- SMALL SYSTEMS

  11V03
  11V03L

  - PRE CONFIGURED SYSTEMS FOR VOLUME & END-USER MARKETS.

T/SS STRATEGY

WHERE WILL BE BE IN FY79/80: (CONSTRAINED C/E DEVELOPMENT 9.0)

- DUMB TERMINALS

  HARD COPY: LA120, LA00
  SOFT COPY: VT100

  - INDEPENDENT TERMINAL BASE- & DEC SYSTEMS

- SMART TERMINALS

  VT100 (EDITING VERSION)

  - PRODUCT LINES MUST FUND MARKET/APPLICATION SPECIFIC SMART TERMINALS

- INTELLIGENT TERMINALS

  IT100 A (NO MASS STORAGE)
  IT100 B (TU58 MASS STOR)

  - SOFT COPY TERMINAL BASED SYSTEM. BOUNDED BY COMPONENET PACKAGING & AVAILABLE SOFTWARE.
  - ALLOWS NEW BUSINESS TO BE REALIZED.

- RACK & STACK

  PROCESSOR: LSI11, FONZ 11 DUAL, T-11 CHIP
  BOXES: 11/03L
  PERIPHERALS: TU58, RX02, RL01/02
  PRINTERS: LA180

  - GENERAL PURPOSE COMPONENTS FOR OEM & END-USERS P/L'S.

- SMALL SYSTEMS

  11V03L, 11T03L, (LSI-11 WITH RX02 AND RL01)
  11V23, 11T23 (F-11 WITH RX02 AND RL01)

  - PRE CONFIGURED SYSTEMS FOR VOLUME & END-USER MARKETS.

T/SS STRATEGY

KEY STRATEGY ELEMENTS

DUMB TERMINALS:

- CAPTURE DEC'S SYSTEMS TERMINAL BUSINESS.
- PROTECT AND GROW EXISTING INDEPENDENT BASE TERMINAL BUSINESS.
- EXPLOIT BASE TERMINAL TECHNOLOGY TO SUPPORT PARALLEL EFFORT IN INTELLIGENT TERMINALS.
- FOCUS ON GENERAL PURPOSE RATHER THAN APPLICATION SPECIFIC TERMINALS.
- MAXIMIZE COMMON TECHNOLOGY BETWEEN HARD AND SOFT COPY TERMINALS FOR VOLUME AND DEVELOPMENT BENEFITS.

INTELLIGENT TERMINALS:

- ENTER A NEW BUSINESS TO DEC.
- PRODUCE A GENERAL PURPOSE INTELLIGENT TERMINAL, USING THE PDP11 ISP THAT IS COMPETITIVE WITH THE INDEPENDENT INTELLIGENT MANUFACTURERS FOR FCS IN FY79.
- PROTECT LOW-END OF DEC'S EXISTING BUSINESS FROM EROSION BY INTELLIGENT TERMINAL MANUFACTURER.
- ENHANCE DEC'S TOTAL SYSTEM OFFERING TO THE MEDIUM AND LARGE COMPUTER BUYER.

T/SS STRATEGY

KEY STRATEGY ELEMENTS

COMPONENTS (BOARDS):

- ENTER MARKETPLACE WITH LOW COST IMPLEMENTATION OF PDP-11 INSTRUCTION SET (T-11) AND EXPAND WITH HIGHER PERFORMANCE IMPLEMENTATION (F-11).

(BOXES)

- PROVIDE DIRECT REPLACEMENT FOR 11/03 BOXES WITH SAME PERFORMANCE & LOWER COST.

(PERIPHERALS)

- PROVIDE PRICE/PERFORMANCE OPTOMIZED MASS STORAGE PERIPHERALS.(I.E. COMPETITIVE PERFORMANCE & PRICE)

- PRODUCT MUST BE DOCK-MERGEABLE/DROPSHIPPABLE

T/SS STRATEGY

KEY LEVERAGE FACTORS

- HIGH VOLUME REQUIRED IN ORDER TO MEET COST GOALS.
- CORPORATE COMPONENT PURCHASING POWER COMBINED WITH FOCUSED PLANTS.
- PRODUCT RELIABILITY/SERVICEABILITY
- DISTRIBUTOR CHANNELS
- PDP11 HARDWARE AND SOFTWARE COMPATIBILITY
- ABILITY TO MANUFACTURE, OR LICENSE, ALL REQUIRED COMPONENTS.
- COST OF SALES AND SUPPORT.
- TIME TO MARKET
- SHORT DELIVERY TIME
- PRODUCT STABILITY
- EASE OF USE
- WEIGHT AND PHYSICAL SIZE
- PHASE-IN/PHASE-OUT IMPACT

T/SS STRATEGY

FACTORS AFFECTING STRATEGY

- RAPID TECHNOLOGY CHANGES ARE FORCING SHORTENED PRODUCT LIFETIME.
- PRODUCT COMPROMISE REQUIRED IN ORDER TO SERVE VOLUME AND DEC SYSTEMS MARKETS.
- COMPROMISE REQUIRED IN ORDER TO LEVERAGE TECHNOLOGY ACROSS BASE TO INTELLIGENT TERMINALS.
- MANY COMPETITORS ARE IN A FOCUSED BUSINESS.
- LACK OF CONTROL OVER DISTRIBUTION CHANNELS.
- LARGE INVESTMENT REQUIRED IN MANUFACTURING STARTUP.
- NEED FOR LONG TERM COMMITMENT TO MANUFACTURING.

T/SS STRATEGY

ISSUES

- THE NET FUNDING LEVEL IS TOO LOW AND CAUSES STRATEGIC DISPERSION, VIA MANY P/L FUNDED POINT PRODUCTS (RXT-11) ETC.
- PROPOSED ELIMINATION OF QUAD FONZ FORCES STRATEGIC DECISION OF "Q" BUS SYSTEMS FUTURE.
- DELAY OF T-11 FORCES REEVALUATION OF INTELLIGENT TERMINAL AND BOARD PRODUCTS AND STRATEGY. (SHIFT TO FONZ)
- NO VERY LOW COST SOFT COPY TERMINAL FUNDED.
- SMALL SYSTEM EVOLVING TO BOUNDED SMALL SYSTEM (RXT11), (IT100). MUST RESOLVE INTELLIGENT TERMINAL VERSUS SMALL SYSTEM.
- NO MICRO PRODUCTS SOFTWARE FUNDED.
- NO LONGER ABLE TO COMPROMISE PRODUCT COST/FUNCTIONALITY IN ORDER TO SERVE ALL MARKETS.
- NO DIRECT LINE PRINTER PRODUCTS FUNDED.

SPRING RED BOOK

NETWORKS/DISTRIBUTED SYSTEMS

MAY 5, 1978

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SECTION I

DECNET

I. DECNET SOFTWARE

1 ASSUMPTIONS AND IMPLICATIONS

1.1 Markets

A. Chief buying influences and requirements, now and later.

1) The desire to share resources between two or more systems is the major provocation for our customers. This takes two forms:

+ The user with an installed system who finds he needs or wants to share data or programs with a neighbor system or a larger system

+ The user who plans an application based on multiple systems sharing resources.

Both types of users are interested in minimized communications costs; control of central data centrally; local control of the processing resource so the local user has a high sense of ownership. The latter user is interested in tailoring each local system to the needs of that application using micro, mini, midi, or maxi computers and RT, Timesharing, or Transaction Processing operating systems where needed.

2) A second major influence is the promise of a networking capability to the user as a protection for today's investment. Many DEC customers will buy our systems because we have DECnet even though they will not buy DECnet today. It is our commitment to networks and Distributed Processing as demonstrated by DECnet and interconnect products that attracts them and ties them to us over the long run.

3) Those IBM customers who want to distribute a process from their mainframe to a stand-alone system, but want to share data between the system and the mainframes. Emphasis is not on networks per se, but on the ability to maintain coherence with the data base. This provokes the need for IBM interconnect protocol emulators.

B. Segmented Description of the Market

1) Stand-alone systems -- not distributed. Characterized by single processor with single terminal access, batch or interactive operation. This is the portion of the market not addressed by networks.

2) Distributed Access Systems -- Characterized by a central processing system accessed by multiple terminal locations; terminals can be batch, interactive, or mixed. Objective is to provide access to system from work locations, while maintaining central processing and data base.

   a. Local Multiple Access -- All terminals local to central system; no communications lines used.
   b. Remote Multiple Access -- Terminals are geo--raphically dispersed from central system location; communication lines used to connect terminal locations to central location.
   c. Concentrators, Multiplexors, and Front-end Processors -- Augment remote multiple access systems to reduce comm and comm processing costs.
   d. Preprocessing without data base -- Intelligent processors provide limited pre-checking of transactions in order to reduce communications traffic, and thereby comm. costs.

   Digital's offerings in this area are DECsystem 10's and 20's, RSTS/E systems, and TRAX. In addition, our protocol emulators allow Digital's systems to interface with large mainframe offerings to provide Distributed Access.

3) Distributed Processing Systems -- Characterized by multiple processors and multiple data bases. Objective is to locate computing power and data bases in closer proximity to work locations, with some or most of processing performed independently of any other processor.

   a. Autonomous Multiple processor Systems -- Application problem is divided among several autonomous processors and data bases, with no communications links between them.
   b. Semi-autonomous Multiple processor Systems -- Computing load and data base are split between several processors with communications links between processors. Each transaction may be handled locally or sent to one or more other processors.
   c. Intelligent Pre-processor with DataBase -- Substantial pre-processing of transactions including access to local database. Some transactions handled locally, others sent to central system.

Digital has focussed its traditional non-network business in 3a above. Single processor systems were sold as autonomous systems with no networks.

Our sophisticated customers provided their own comm capability leading them into b. or c. DECnet Phase II products impact 3b and 3c above, today and in the future.

1.2 Competition

A. Current versus Projected Positioning and their Emphasis.

Currently, we can position ourselves with two types of competition:

+ Those that have network software (IBM, HP, Modcomp)

Of these three only IBM has a network architecture. HP offers similar features to DNA but has no over-riding architecture. SNA is a terminal-oriented architecture with all network knowledge located in the central 370 host. Because of its relative inefficiencies, IBM users have been slow to accept SNA, although we believe SNA is here to stay. IBM's resources and account control will assure that. Our SNA facilities ensure that we can participate in the Distributed Access environment.

HP has diverse network software for the HP3000, HP1000, and the 21MX. They offer advanced functionality (routing, virtual terminals), but lack a consistent architecture. They do an excellent job of marketing the limited products and operating systems by aiming at specific market segments. We appear to have higher maintainability and better performance than HP's offering today. HP will grow in strength and remain a strong contender over time.

MODcomp offers high performance networks with a high comm capabilities and very limited network capabilities. Their key is market focus in the high performance network areas - process control and sensor-based lab areas. They have been successful in taking some large government network business away from DEC. Again, this is a case of marketing a limited capability well against our broader approach.

+ Those with no network software (DG, PRIME).

  These companies compete with us using "roll-your-own" comm software in special cases where DECnet or IBM internetworks don't have any impact. In addition, DG's 3780 package is superior to our 2780 protocol emulators. We must continue to watch these companies since they are on a rapid growth curve and will someday have the resources to compete in this business.

In the future, we are positioning ourselves to compete with IBM and HP with the assumption that if we win consistently against them, we will control a large share of the market.

B. Estimate of Competitors' Spending for Development

IBM	significantly more than DEC
HP	less than DEC on the whole but more on a per product basis.
Modcomp	significantly less than DEC

C. Emerging Competitors.

Primarily, at the low end, we see Datapoint, Harris Wang and other intelligent terminal vendors aiming at our low end products. IBM is certainly emerging as a mini computer supplier, and if GSD is able to break away from SNA and offer a more general network strategy, they will represent formidable competition. Honeywell is expected to make a major network offering in the next year, but it is not clear the extent to which they will compete with us. Microprocessor manufacturers also would seem to be potential emerging competitors.

D. Consequences.

Digital has positioned itself as a principal supplier of network software, through the introduction of DNA. We represent one of the three key interconnect mechnisms today (the other two are SNA and X.25). Because of our product problems in the past, we are now perceived as having backed away from this leadership. Therefore we must:

+ Aggressively sell and market our existing products. We have received a commitment for funding from the Marketing Committee to help us in this domain.

+ Enchance our current products to meet the promises we made in 1976. The strategy portion of this document deals with this subject.

1.3 Technology

A. Technological Assumptions

Basic system cost will continue to decline, and interconnect will become easier, leading to increased demand for distributed computing and to larger networks.

The use of public packet switched networks based on X.25 will become increasingly attractive as a means of interconnecting DEC systems over the next 3-5 years. However, these networks will remain only one of several communications facilities a customer can select from, with his choice determined by his geographical and traffic requirements and common carrier rate structures. ATT's announcement of ACS, based on X.25, is expected to generate considerable legal activity as to be a non-facility for the FY '80- FY '81 time period. Thus, the major thrust of X.25 will be in Europe and Canada.

The current international effort to build a complete standard network architecture based upon X.25 will not result in product requirements in the three year framework, but will impact the state of distributed computing beyond that time-frame. Until then, the primary use of X.25 will be DEC to DEC and possibly DEC to IBM communication.

IBM's SNA will stabilize and become a significant network architecture with which we must interface. Other network architectures will not become significant factors in the market place to which we must interface.

The technology for building the transport portion of a computer network which routes messages over a combination of dedicated, circuit switched and packet switched facilities exists today and can be implemented through advanced development. Providing network security through an integrated application of the Data Encryption standard will be in a similar state within two years.

The technology for distributed access to disjoint data bases is now becoming available. However, providing transparent access to a highly available distributed data base is still a research topic. Current work is being done in the R&D area to help us get an understanding of this complex subject. More aggressive funding will be necessary in the future to allow us to grow in this area.

The economics of LSI technology and minimal requirements for network interconnect will continue to require a sub-low-end solution for bright/intelligent terminals which interface through a host, as distinguished from a low-end solution for small systems which interface as self-contained network nodes.

Local distribution through contention networks (e.g. Ethernet) may come out of the research stage and require incorporation into product strategy. Therefore, we should track this technology for potential applicability.

B. Exposures and Opportunities

The lack of standardization of higher level interfaces across operating systems is a technical/organizational issue which may impede ease of user migration and our use of common firmware implementations.

A breakthrough in the distributed data base technology would represent an opportunity or exposure depending on where the breakthrough developed and its market timing.

The industry wide adoption of a complete standard network architecture built on X.25 would greatly increase the market for distributed computing, while reducing the value of propritory architecture such as DNA. We must track standardization efforts to insure that they are consistent with our philosophy and that our product strategy reflects their progress.

2. PRODUCT/MARKETING GOALS AND STRATEGIES

2.1 Goals

The major emphasis by FY '81 is to have:

a) Transport mechanism transparency - that is the user should be able to transport data through DNA, X.25 or SNA transparently between his application programs.

b) Common subset of file transfer across the network - some subset of our files structures must be available to all our systems over the network.

c) Good network diagnostics - our products must be highly maintainable with low MTTR.

d) Enter the distributed data base area - a pilot project at least to allow distributed data bases as well as files.

e) Have network terminal support.

2.2 Strategies

By FY '81, our transport mechanisms will include DNA, SNA and X.25. The general interconnect must be transparent to the user. We will have co-resident protocols and a common subset of file transfer across the network. This requires much more network diagnostics and fault isolation techniques.

Because of our large number of operating systems in the next three years, we will adopt the following strategy:

+ Some set of systems will be built to basic level of comm functionality and then be maintained.

+ Some set will be enhanced with additional functionality and serve as kernels for future growth.

+ Some set will be built on those kernels with our focus on applications and user interface.

The three new technology areas, investigation of which will be started in FY '79, are Distributed Access for DBMS type data, application focus (understanding how our current tools are used) and the terminals area. The technology is at the point where we should have these capabilities by FY '81.

2.3 What Have We Rejected

We have rejected the concept that DNA is the only transport mechanism needed for DEC in the distributed computing market and will offer both X.25 and SNA.

We have re-evaluated the concept of providing all operating systems with equal functionality and have decided to level off on certain systems once a base level of interconnectability has been achieved.

We have decided to provide limited functionality early where the technology for full functionality is several years away. Two examples are the homogeneous system virtual terminal and one-hop routing planned in FY '79. The heterogeneous system virtual terminal and complex routing will be introduced during 1980.

2.4 The Pivotal Issues?

In expanding the program to include other transport mechanisms, several issues arise: These are:

SNA	-	How do we support the product with all the IBM operating systems? Is it possible to provide a totally transparent interface for SNA? How do we deal with SNA Level 3, Level 4 incompatibilities?
X.25	-	This activity is currently funded by the product lines and not as a corporate product Unless it becomes a corporate product and so funded, it will not meet the distributed systems program goals. Today there is not enough funding for this effort.
Network Support	-	How do we get the field trained to support all our products. What tools are needed and when?

With the strategy to level off specific operating systems, we must expand some basic communciation functionality first. The issues are:

a) Which systems stabilize at what level of functionality?

b) What topology problems does this creat in FY '80 and 81?

c) Are we mature enough to really make this happen?

With all of the product spectrum, how do we sell our products? We have network profiles, customer support plans, and P/L sign off in place now. Is this enough? Do we have the dicipline to implement this?

With distributed access technology available by FY '81, the interaction between networks, RMS/DBMS must be understood in FY '79. Resources must be made available to attach this problem.

2.5 Change in Emphasis

There is basically no change expected in the market except for expansion because of greater user awareness, and better understanding through experience on our part. This has caused a change in our product offerings (e.g. , X.25, SNA, distributed database) and how we interact with the rest of the company. As a result, in FY '78 we broadened our program scope to invest time and resources to address our involvement with Software Services, Field Services, Promotion, and other operating systems groups, Sales, Educational Services, and the Product Lines. We consider the Sales, Support, and Promotion areas to be as crucial to our product's success as the Development activities.

3. PRODUCT CALENDAR

The Product Calendar (see EXHIBIT 1) represents an in-process snapshot of the current product evolution. More work is necessary to refine this thinking and integrate it with the various operating system strategies beyond FY '79. For this reason it must be considered preliminary at this time. However, the requirements to publish are real, and it can serve at least as a point of departure for further planning.

4. REVENUE

4.1 Revenue in FY '81 Compared to Now?

In Q1 of FY '78 we compiled a business forecast for DECnet and our internet products. It showed that roughly 40% of our revenue came from DEC to IBM while 60% came from DEC to DEC. Since then X.25 has become more widely accepted and we would see about 25% of our DEC to DEC business going to X.25. From this assumption we get the following node forecasts:

	FY79	FY80	FY81	TOTAL	%
DEC - DEC (DNA)	1160	1580	1912	4652	50
DEC - DEC (DNA+X.25)	0	175	638	813	9
DEC - IBM (SNA+BSC)	780	1210	1830	3820	41
			TOTAL	9285	100%

4.2 Effect of New Products?

Products with strong market pull will have an effect sooner than those instigated by technology push. Other features are knock-offs -- we must have them to stay around. The following features are classified:

Market Pull	Tech Push	Knock-off
X.25	Routing	SNA
Virtual Terminals	Security	
Low End DECnet	Maintainability	
Auto-dial		
Multi-drop		

4.3 Lost Revenue

The following represents possible lost revenue to the company:

The major un-done (or unfunded) project in FY '79 is an X.25 corporate product. The revenue will probably be covered by the TELCO-direct product, at least in part for the short term. However, there are several aspects of the product that a P/L direct product need not address as major issues:

+ Documentation
+ Support Plans
+ Promotion
+ Universality of Approach
+ Adaptability

The longer these issues are unaddressed, the larger the backing of development costs to ultimately address them. It will cost us more in FY '80 to make the TELCO X.25 project a corporate product than if we do it in FY '79.

5. INVESTMENT

5.1 Flexibility to Respond To the Unexpected?

There is virtually no flexibility in our present funding. In addition, we invest only $200K for advanced development in FY '79. This is inadequate in an area so needing advanced development. We are constrained heavily by the size of our budget. Our requested funding has been cut by $300K to $3.5M for Hardware and Software. We are very tight in matching our investment dollars to our broad range of products.

5.2 Costs to Complete Projects in Place by the End of FY '78

	OOD $	POT $
Product Management.	$340	$ 60
Architecture/Adv. Dev.	200	-
Product Support.	400	-
Contingency	-	200
Phase II Product Development in place	-	2172
(DECnet M/S, D/IAS, RT SCS, TPS, M+, VAX (V1.0) 3270/3780-VAX)		
Product Development to start (VAX V2.0)		268
TOTAL --	$ 940	$ 2700

Project funding for FY '80 has not yet been determined by the POT. This process will be done once the FY '79 budgets are solidified.

OP SYS	FY79	FY80	FY81
RSX-11M RSX-11S	DNA (Autodial, Multidrop, improved File Access, Simple Routing) SNA X.25, 3271 P/L Direct	SNA X.25 Corp. Product DNA (Complex routing, RMS interface, simple VT) All products coresident together	Expanded File Access Perhaps Dist. DBMS X.29 for term handling
M+	DNA (Same as RSX-11M) 3271	Same as RSX-11M	Same as RSX-11M
TRAX	DNA (M-like in maint. mode, TASK-TASK for TST) 3271 P/L Direct	X.25 Transparent Transport DNA Expansion for SCS	SNA Transparent Transport
SCS	DNA (Phase II DECnet only) 3271	DNA Expansion to M Level Expand User interface for TRAX	X.25 Low End SNA
TOPS-20	Total P/L Funding DNA (TASK-TASK, File XFER, RJE, Block Mode Terms)	Expanded DNA to Routing, Homogeneous VT X.25 Corporate Funding	SNA Interface Expanded DNA X.29 for Term Handling
PDP-11	DNA (Phase II DECnet)	DNA Expansion RT-11 X3, X28	Low End SNA
VMS	DNA Same as M/S 3271/3780 with Trans I/F Expanded Device Support	DNA Same as RSX-11M X.25	SNA X.29 for Term Handling Perhaps Dist. DBMS
RSX-11D IAS	DNA Same as M/S	Maintenance Only	Maintenance Only
RSTS	DNA (Autodial, Multidrop, Homo Virtual Terminals, Add'e Device Support) 3271	DNA File Access thru RMS Additional Device Support	Maintenance Only
RT-11	DNA (Autodial, Multidrop)	DNA (Homo VT to RSX only) Emphasis switched to PDP-11	Maintenance only

EXHIBIT 1

SECTION II

COMMUNICATIONS HARDWARE

II. COMMUNICATIONS HARDWARE

1. Markets

1.1 Communications hardware exists for the purpose of allowing a serial interconnect between two machines. These machines can be either a computer or a terminal over local or remote (common carrier links) which are usually asynchronous and computer-to-computer links over local, remote and multipoint, which are usually synchronous links. As the terminals become more and more computer-like (intelligent terminal), more and more synchronous links per machine will be required.

Communications hardware can be defined as existing in three areas. The first is that of a peripheral to a host CPU where the host CPU performs all the communications process. This has been the traditional market for DEC communication products and is the one we have focused our entire effort on. This peripheral hardware must cover a range of low performance to high performance, to encompass the communications needs of machines from 11/70 and VAX to 11/04's.

Communications hardware can also be defined as a complete system with CPU which is utilized to off load the host CPU (front end). While this can and is often made of general purpose CPU's with normal peripherals, it is a specialized market which some specialized vendors (e.g., COMTEM) perceive as CPU's built expressly for that purpose.

While DEC utilizes communications hardware coupled with small CPU's (11/40) to front end machines such as PDP-10's, we have not developed the concept for the smaller 11 series because of the high cost involved which can only be justified on large machines. We have also not chosen to market such systems for use on other large CPU's since that involves heavy application programming effort and software customizing of systems.

The last segment of the communications hardware business can be defined as the stand-alone system which provides a specific service (TDM's, concentrators) which are utilized to reduce line costs. These stand-alone products again have not been part of a communications hardware strategy because of the turnkey nature of the business and the lack of a sales force dedicated to that market.

Our participation to date has been as a supplier of peripheral interfaces to our computers.

1.2 Technology

The following technology assumptions can be made:

(a) Advancing technology permits the medium and low end to benefit from smart microprocessor-based communication interfaces which have already proven their ability to improve performance and simplify communication software at the high end.

(b) This will allow a large cost reduction in the front end machines making them more viable for the mid-range machines (i.e., the front-end machines become a microprocessor on the same bus).

(c) The very low-end peripheral communications market will be gradually phased out in favor of bounded systems which integrate the communications function within them.

The availability of smart communication interfaces (KMC-11's) implies that we must quickly move a portion of the driver software into the intelligent interface. If we do not, our software system performance will not keep pace with competition since they will have done this.

Also, we must move into the modem area to thwart the effect of add-on vendors for the communications peripheral and provide more DEC-added value to our systems.

2. Product Goals and Strategy

2.1 Goals -- The product goals can be outlined as follows:

(a) Complete the family of low cost UNIBUS interfaces. Where added performance is required, a KMC or DMC microprocessor will be utilized to enhance performance.

(b) Where specific intelligent high-volume products can be defined, use the KMC microprocessor to perform those functions and provide the front-end functions with this technique.

(c) Develop a set of compatible, intelligent multi-point DDCMP interfaces and adaptions for both UNIBUS- and QBUS-based systems and for terminals. These products will provide an intelligent error-free interconnect mechanism for both local and remote networks and will integrate the line driving function within the device. This will provide ease of connectability for all DEC systems and terminals. This is shown in Fig. 1.

(d) Continue to develop a modem capability for higher speed modems and to have this modem capability at the CPU end as well as the terminal end.

Table 1 shows the funded projects which meet these goals.

2.2 Strategies/Alternatives

We have chosen to base our complete interconnect capability on a high level protocol throughout the interconnect space rather than optimize comm devices for a particular type of application (local only). This leads to some inefficiency and non-optimized products, but does lead to fewer product types. For example, a cimpler protocol could have been utilized for the local connection. This would have resulted in a lower cost local-only product, but more different products to produce forecast and support.

We have also concentrated for our own DEC interconnect, on the DDCMP protocol to assure that we will not be driven by outside influences. We understand that we must maintain connectability with other vendors, and have assured that our basic hardware has the right features and will implement foreign machine connection in writable control store microcode within our microprocessor driven interfaces.

3. Product Calendar

Product	Description	Goals From 2.1	FY	FY79 Cost($K)
DZ11-H	DZ11 with increased modem control capability	a	'79	60
DML11	4-line synchronous mux	a	'79	230
DMP11	UNIBUS full DDCMP synchronous interface with local line driver	b-c	'79	220
DMV11	Q-BUS full DDCMP synchronous interface with local line driver	b-c	'80	200
KMC11-B	Enhanced KMC11	a-b	'80	40
DMV-11	Microcode Development	b-c	'80	50
- - - - - - - - - - - - - - - - - - - -		(funding limit FY '79)		

Product	Description	Goals From 2.1	FY
212 Modem	1200 BPS full duplex asynchronous modem	d	'81
801 Dialer	Allows CPU to originate dialing	d	'80
New DL11	Enhanced DL11 to eliminate variations	a	'80
Terminal Module	Interface to intelligent terminals to allow connection to DEC CPU's easily	c	'81
Low cost KMC	PDP-11 ISP version of KMC lower in cost	a	'81
Low cost DMP	Lower cost DMP product	a	'81
201 Modem	Synchronous modem for inclusion in DEC systems	d	'81
Modem card cage	Rack mount of modems in CPU's to add greater value to DEC interfaces	d	'81

4. Revenue

Communications hardware in FY '78 represents a $60 million business for UNIBUS alone. This revenue can be expected to maintain and even increase as a percentage of system sales, with the greater emphasis on distributed processing and networking. Even at a constant percentage of CPU business, communications hardware is expected to represent a $100 million business by FY '81.

5. Investments

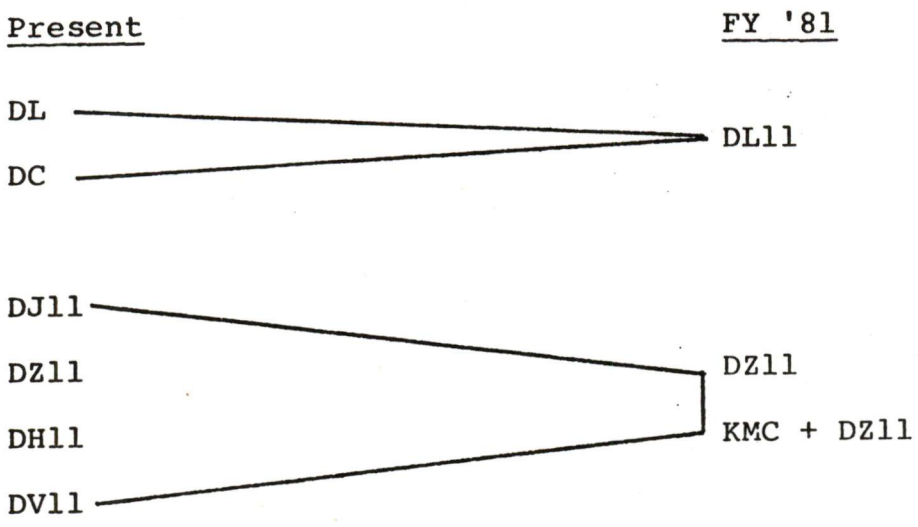
The costs to complete communications hardware projects in place by end of FY '78 are:

	OOD $	POT $
Product Management	100K	
Advanced Development	90K	
Product Support	510K	
Contingency		40K
Product Development		760K
	700K	800K

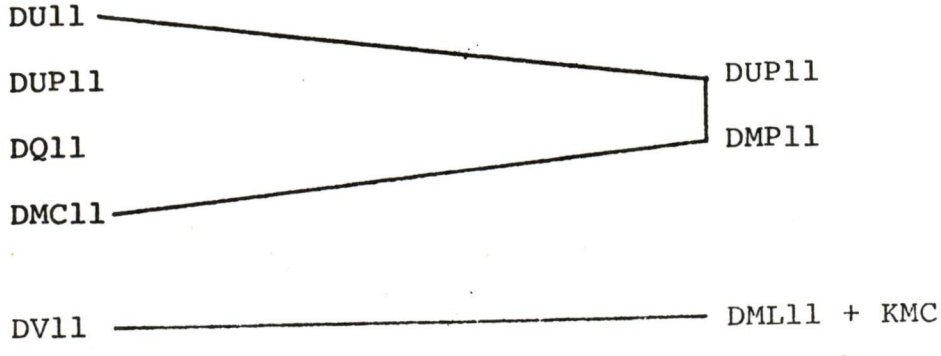
APPENDIX A

Product Evaluation

UNIBUS ASYNCHRONOUS

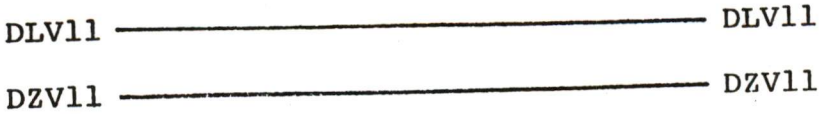


UNIBUS SYNCHRONONOUS



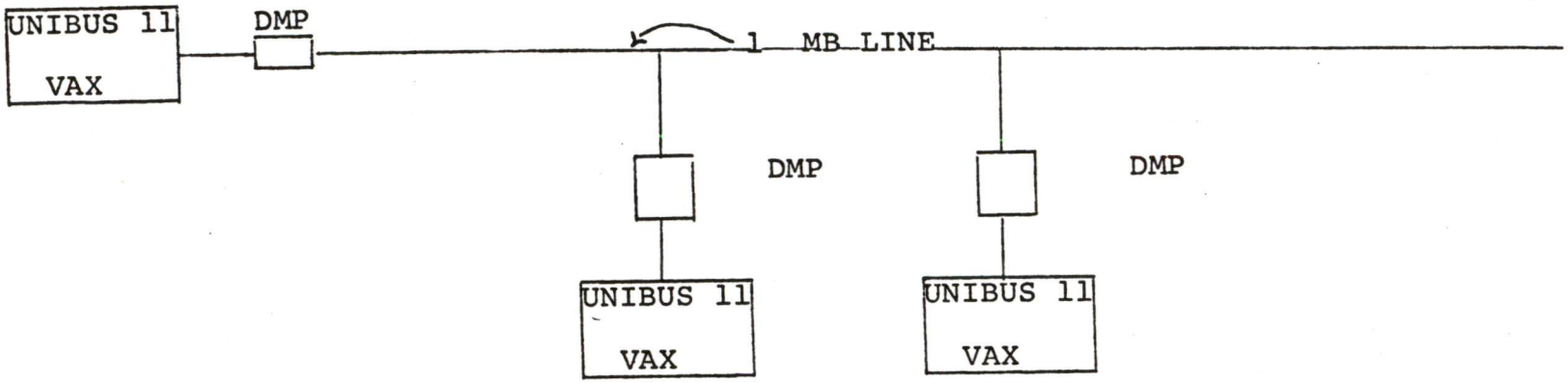
Q-BUS

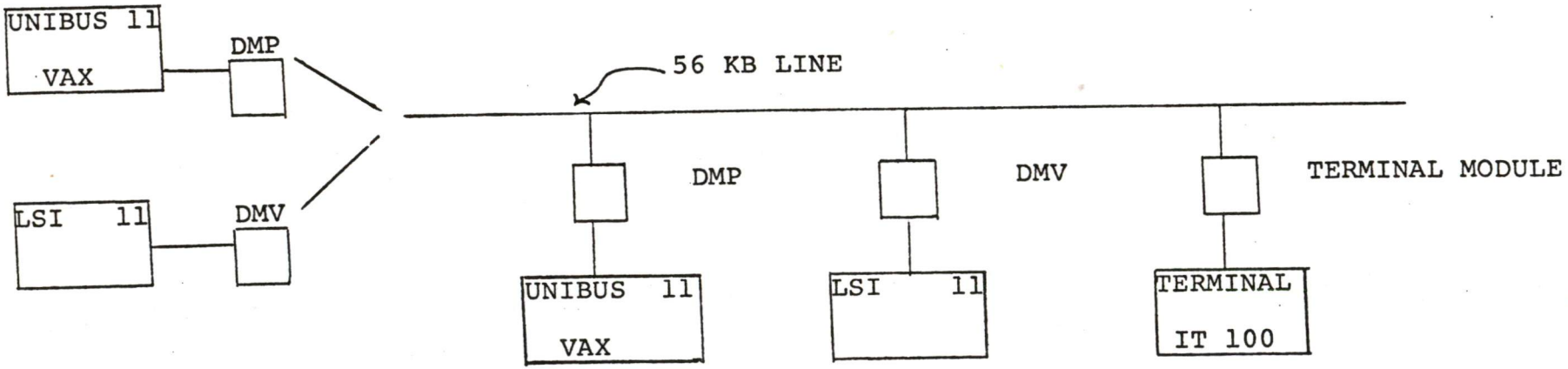
Asynchronous

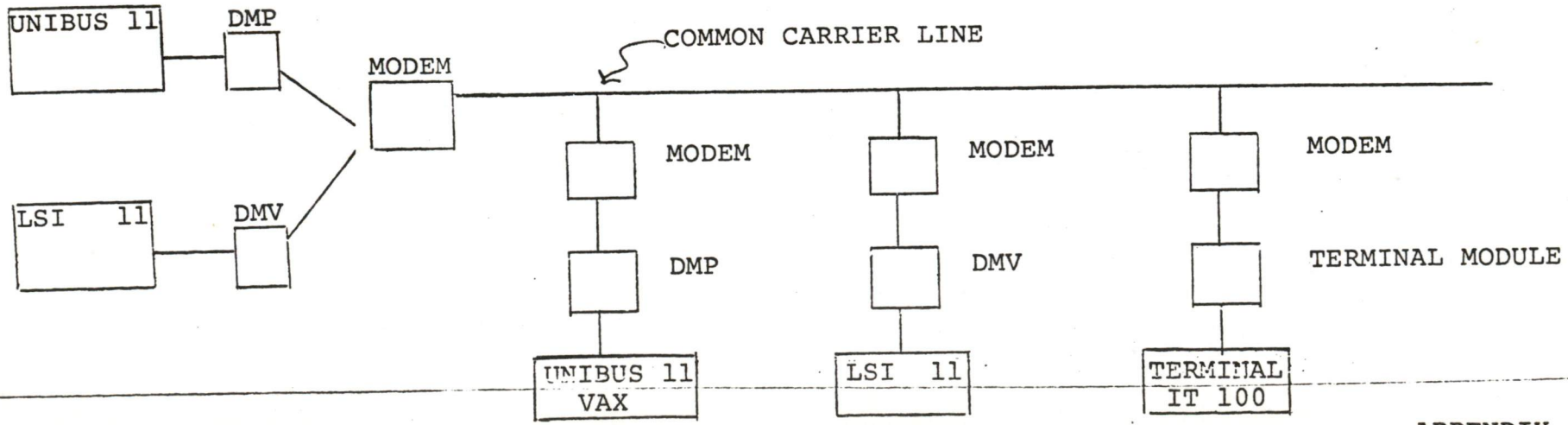


Synchronous

COMPLET[illegible]ONNECTABILIT[illegible]F DEC SYSTEMS







STORAGE SYSTEMS

RED/BEIGE BOOK

A Summary of Mass Storage
Business Strategies, Product
Tactics, and Competitive Trends

May 23, 1978

COMPANY CONFIDENTIAL

Ken Sills
ML1-3/E58
DTN: 223-5805

STORAGE SYSTEMS RED/BEIGE BOOK

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DESCRIPTION OF RANDOM ACCESS PRODUCTS

DEVICE	FORMATTED CAPACITY (Mb)	FIXED/ REMOVABLE	FCS	INTERFACE METHOD (1)	TRANSFER COST ($) (2)
BLOCK FORMATTED TAPE					
TU58	.25	R	Q2,FY79	TU58	200
FLOPPY DISKS					
RX01	.25	R	shipping	QB,UB,OB	744 (FY79)
RX02	.5	R	Q1,FY79	QB,UB,OB	-
RX03	1	R	Q4,FY79	QB,UB,OB	900
RX0X	2-4	R	?	QB,UB,OB	1000 (?)
LOW-END DISKS					
RK05J/F	2.5/5	R/F	shipping	QB,UB,OB	1400
RL01	5.2	R	shipping	QB,UB,OB	1119 (FY79)
RL02	10	R	Q4,FY79	QB,UB,OB	1250 (FY79)
50Mb Removable	50	R	FY81	NDS	1500-2500 (3)
AZTEC	4-8	R	FY81t	QB,UB	500
MID-RANGE DISKS					
RK06	14	R	shipping	UB	2366 (FY79)
RK07	28	R	shipping	UB	2445 (FY79)
RM02	67	R	shipping	MB	6127 (FY79)
RM03	67	R	shipping	MB*	6152 (FY79)
150Mb Removable	150	R	FY80 (?)	NDS	5000-8000 (4)
R80	143	F	FY80	MB,NDS (5)	4400,2700
R81	286	F	FY81t	NDS	2700
HIGH-END DISKS					
RP04	88	R	shipping	MB	10800
RP05	88	R	shipping	MB	11100
RP06	176	R	shipping	MB	10700
RP07	292	F	Q1,FY80	MB	9300
RP07+/08	542	F	FY81	MB/NDS	10000
FIXED HEAD DISKS					
RS03/04	0.5,1.0	-	shipping	MB,UB	5000
CONTROLLERS					
NDS	N/A	N/A	FY81	NDS	2000
Small NDS (UDA)	N/A	N/A	FY80	UB	500

NOTES:
1. QB = Q-BUS OB = OMNIBUS UB = UNIBUS MB* = CPU INTEGRAL MB ONLY (NO RH11)
   MB = MASSBUS OR UB VIA RH11 NDS = NEW DISK SYSTEM
2. All costs are the projected averages of first 3 years shipments except otherwise noted.
3. The 50Mb removable transfer cost is based on RL05 ($1500) or RK08 ($2500)
4. The 150Mb removable transfer cost is based on RP06/NDS ($8000) or RM04 ($5000)
5. The first year of R80 shipments will be Massbus only

DESCRIPTION OF 1/2" TAPE PRODUCTS

Tape Drive	Density (BPI)	Speed (IPS)	FCS	Interface Bus	Slave Transfer Cost* ($000) Master/Slave
TS03	800	12.5	shipping	UB	2.0/1.6
TS04	800/1600	45	FY79	UB	2.7/2.7
TU10	200/556/800	45	shipping	UB	3.5/3.0
TE16	800/1600	45	shipping	MB	5.3/3.0
TU45(CSS)	800/1600	75	shipping	MB	7.4/5.0
TU70(LCG)	800/1600	200	shipping	-	35.0/12.0
TU72(LCG)	1600/6250	125	shipping	-	35.0/12.0
TU77	800/1600	125	Q2,FY79	MB	9.0/6.5
TU78	1600/6250	125	FY80	MB	12.0/7.5
TS6250	1600/6250	22-45	FY81t	NDS	6.5/3.3

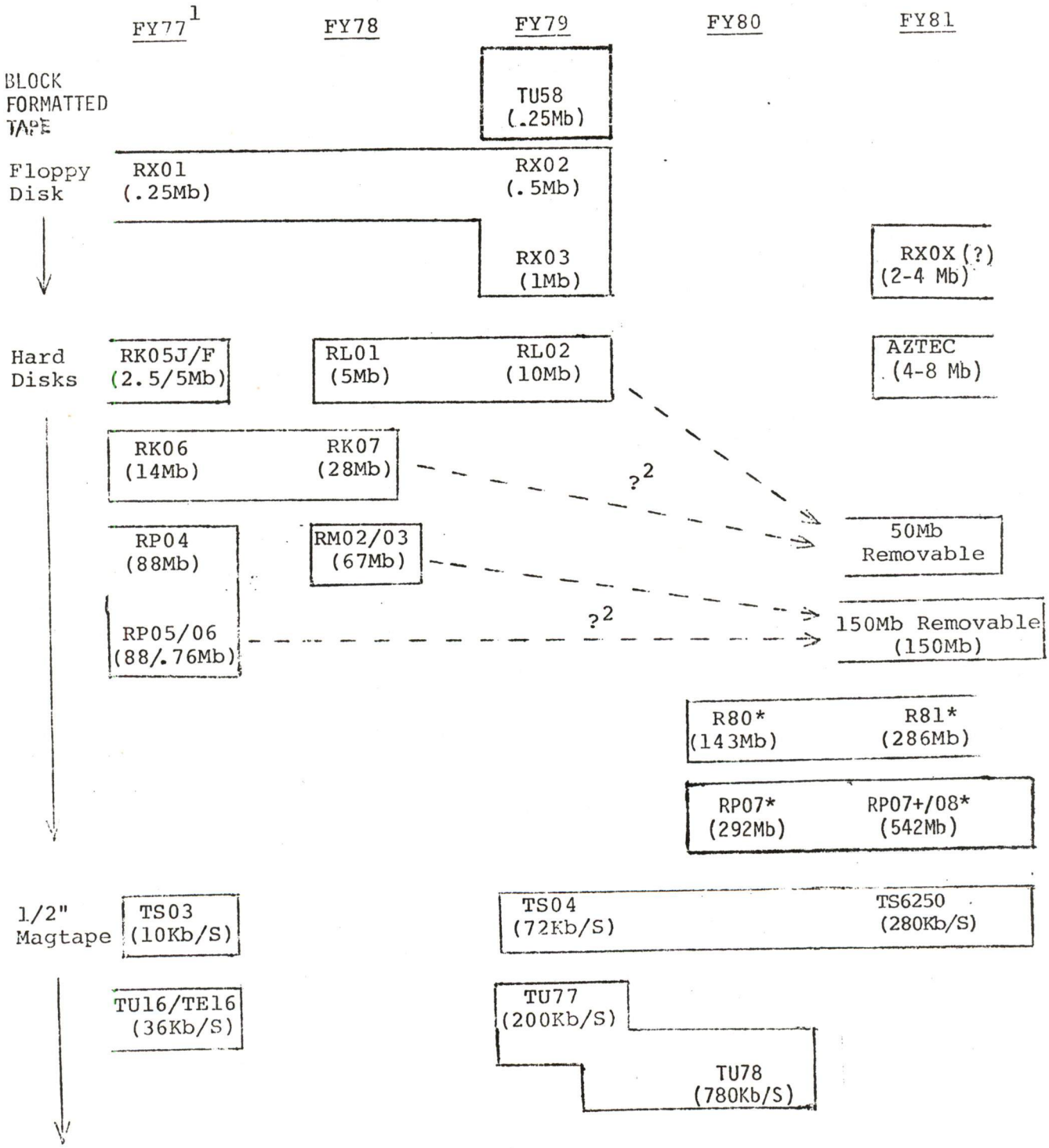
UB = Unibus

MB = Mass Bus or UB via RH11

NDS = New Disk System

* Costs of future products are targets

MASS STORAGE PRODUCT TIMING AND FAMILIES
(Available At End Of Fiscal Year)



* Fixed media disk drive

1. All available products shown to establish baseline
2. Only 1 family will evolve to FY81 product. Decision is currently being analyzed.

II. BASIC MASS STORAGE STRATEGIES

A. Strategy:

We must invest in, and build on, the latest available IBM disk technology. It is required for competitive mid-range disks which are projected to be the largest revenue producing disk class. This technology is the foundation for building new disks across the entire product spectrum.

Comment:

We cannot afford to be competitive in both fixed and removable media mid-range and high-end disks. Our resource limited strategy is to lead in fixed media in the mid to upper capacity ranges. We are concerned about the resulting removable media competitive hole and how rapidly our customers will accept fixed media.

This fixed media technology is currently "Winchester" which is a head/media technology that allows lower head flying heights with resultant higher recording densities. The media is lubricated and allows contact start/stop of the lightly loaded heads. The benefit of Winchester is high reliability at low cost/byte. The first DEC built product to employ this technology is the R80.

B. Strategy:

We must and can build both competitive rigid and flexible products at the low-end by exploiting both DEC and IBM technologies. This assumes that IBM will continue to introduce new technology at the high-end and migrate it downwards over time.

Comment:

We will continue to emphasize low-end disk development. However, we cannot afford to pursue both flexible and rigid technologies. We have selected the rigid technology AZTEC over the RX0X and are concerned about the increased risks, limited alternatives, and our competitors' substantial efforts on high capacity flexible media. The exposure is that floppies offer a less expensive and more "shelf storable" media for personal storage and software distribution.

We can be competitive, and in fact, offer leadership low-end hard disk products by migrating high end technologies or developing new technologies into low-end products faster than competition. The RL family and AZTEC low-end efforts are examples of this strategy.

In general, DEC volumes of low-end storage products are sufficiently high to allow manufacturing economies of scale to produce costs close to those of IBM.

C. Strategy:

It is difficult to build high-end disk products that are cost competitive to IBM. Therefore, we must use a combination of tactics:

1. Subsystem intelligence.

2. Aggressive early buyout or early reverse engineer/license.

Comment:

The difficulty in being cost competitive to IBM is that IBM introduces new technologies in high-end disk products first. IBM also has much greater unit volumes producing manufacturing economies. Since there are several reliable sources of large disk products (e.g. Memorex, ISS/Sperry Univac, Control Data), we will buy their basic product offerings for early introduction (e.g. RP07). We will also differentiate our large disk offerings from competition by using subsystem intelligence (e.g. NDS).

D. Strategy:

Our position is to be able to evolve into building high-end disks. This is not a change in the current priorities which dictate buyout of high-end disks. The build/buy decision is based on:

1. Availability of development and manufacturing resources.

2. Competitiveness and reliability of suppliers.

3. Business economics:

   - Product Line contribution
   - Return on assets
   - Cash flow
   - Unit volumes
   - etc.

Comment:

High-end disks are defined as those having more than four platters. There is some question as to whether DEC's volumes for this size of drive (billions of bytes in 1980's) will warrant the high development expense associated with it. However, we will continue to evaluate the financial attractiveness of such an investment.

E. Strategy:

We must offer 6250 GCR technology 1/2" tape products as they will be the industry interchange standard. We will build a low-end 1/2" tape competitive product for low entry cost, and buy-out at the high end for complete product coverage.

Comment:

The first low-end GCR (group code recording) product will be the TS6250. Due to funding limitations, it will not be as competitive as we desire. The buy-out product offering is the TU78 (which succeeds the very costly TU72). Strategy statements C and D are equally applicable to tape products.

F. Strategy:

We will maintain a floppy offering, competitive with the independents, by tracking capacity increases.

Comment:

Insufficient development funding precludes floppy disk development past the RX03 1 Mb product at this time. The level of funding for advanced floppy disk development will only maintain the nucleus of the team, track technology, and develop basic techniques pertinent to any new floppy disk development.

G. Strategy:

Because of the high risks, we will pursue both the RX0X and AZTEC with one product emerging as a lower cost replacement for the RL01.

Comment:

The product line preference is for the AZTEC (higher media cost, higher performance, relative to floppy). Advanced floppy disk product development will proceed at a minimal level.

H. Strategy:

Our long term strategy is to build intelligent storage subsystems combining both tape and disk products.

Comment:

The first offering of the NDS intelligent controller will probably not include tape. However, the mix of disk and tape is planned for future generations. Off-line (relative to the host CPU) archival backup and other off-line storage manipulation tasks are recognized as an attractive feature as well as being critical to the availability of the total system.

I. Strategy:

Strategic pricing will be reviewed by the POT. It will consider:

1. Competitive situation.

2. Total in-field costs

   - Manufacturing investment
   - Spares cost
   - Training
   - Introduction costs
   - Development costs
   - Inventory
   - Phase-in/phase-out costs

3. Contribution, ROA and other Product Line measurements.

Comment:

For example, this is recognition of the fact that buy-outs can be priced with significantly lower markup than DEC builds, and still have excellent profitability. Another pertinent example is that the life of products can be profitably extended by dynamically lowering the price over time.

J. Strategy:

We must be able to rapidly respond to all relevant IBM mass storage announcements by early buy and analysis of the entire IBM subsystem.

Comment:

Insufficient funding will preclude us from acting on this strategy without reprioritization of projects. We believe that an IBM large disk announcement is imminent and that this disk will use advanced technologies which could be profitably reverse-engineered into the products which we manufacture.

III. GENERAL MASS STORAGE SUBSYSTEM TACTICS

The following general tactics address the implementation of the previously outlined Mass Storage strategy.

A. Offer very low entry cost random access storage by employing block formatted tape cartridges

Market these products in several ways:

1. Component Level - These "kit" sales will be accomplished in conjunction with component level CPU sales. Markets encountered are generally highly skilled OEM's who embed our small CPU's and now micro-peripherals within their product. The top end of these applications would be more prone to floppy based systems for access time.

2. Rack Mounted - The major market here is for use in development systems for our intelligent terminal business. Other uses include industrial applications where bays of A-D type equipment are needed for monitoring processes but the mass storage needs are minimal, i. e. for program loading or data exchange for down line processing.

   Another potential here is to replace 1/2" tape on disk based systems where the tape drive was used only for program loading and update.

3. Imbedded in Other Products

   a. Intelligent terminals - for local processing and business management. In these situations entry cost and size of the TU58 will be key features.

   b. Store and forward buffer - for local store and forward buffer as well as archival storage in message transmission applications. The low end of this market will be served by electronic RAM storage; however, for both archival and data security reasons block formatted tape will exhibit a higher level of acceptance.

   c. Software and diagnostic update - when embedded within our larger CPU products block formatted tape will become a corporate solution for a multitude of update distribution media types.

      A major embellishment of this capability will be the use of block formatted tape by our OEM's to distribute both application program updates as well as sell new software features.

d. Personal media - A major segment of the block formatted tape market is personal media. In this application, programmers will use dumb terminals for program development but will want to retain a copy of their program by dumping the software onto a small media which they will carry away.

B. Offer low-end subsystems with only removable floppy or hard disks for the following reasons:

- A two drive removable disk subsystem offers significant performance and availability advantages at a small cost over "fixed plus removable" on a single spindle.

- The amount of data backed-up or archived is usually economically managed with floppy or cartridge disk media.

- Fixed media disks using Winchester technology do not have significant cost advantages over removable media in low cost subsystems (See Section B which follows).

We will, however, continue to examine a F+R disk as the "50Mb removable" product offering. The F+R product offers the lowest entry cost for a backed-up subsystem, albeit at the expense of performance and availability.

C. Offer mid-range subsystems with:

- primarily, fixed and removable disks

and

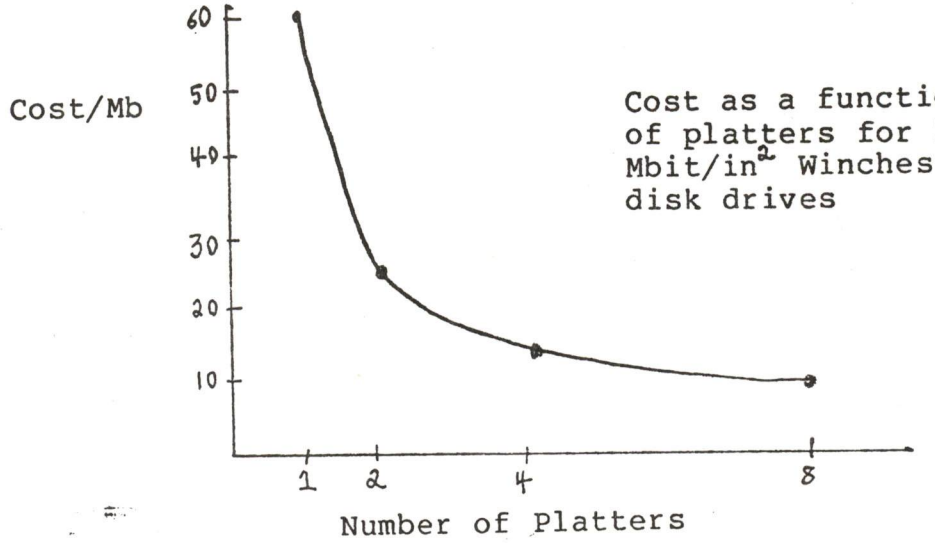
- secondarily, fixed disk and low cost tape

The rapidity of the evolution to the fixed disk and tape subsystem will depend on the attractiveness of our backup routines and on how fast our customers begin to feel comfortable with not having removable disks on their systems. IBM is currently making this transition with their low-end customer base.

1. Fixed media for:

a) Capacity - the typical Digital medium and large interactive application has data permanently mounted on 75% of the available disk drives, i.e., 75% of the on-line data in a typical application is amenable to fixed media.

b) Cost - "Designed from scratch" mid-range fixed media disk drives produce a cost/byte saving of over 50% compared to a removable media disk of equal capacity. In particular, Winchester technology disk drives using the HDA, or head/disk assembly principle become very economical in the 2 to 4 platter range. A cost model used by the Mass Storage Group demonstrates this fact:



Cost as a function of platters for 3 Mbit/in^2 Winchester disk drives

c) Reliability - the more sealed environment of a fixed media drive reduces susceptibility to harmful contamination. There is also no potentially damaging human handling. These factors result in a fixed media drive MTBF which is typically double that of its removable counterpart.

2. Removable media for:

a) Interchange, i.e., transfer of data from one system to another.

b) Data backup - this is particularly important when fixed media drives are used, since the "fixed data" cannot be backed up by simply putting the pack or cartridge on the shelf.

c) Software distribution - on qualified low cost media devices on systems which are configured without tape. Where frequent software updates are expected, disk is still an inferior distribution media having a media price which is an order of magnitude greater than tape. (The TU58 cartridge is an ideal software update medium.)

d) Portable storage, e.g., a user mounted personal data base or program library.

3. Magnetic tape for:

a) Archival costs - where considerable archival storage or backup is required, the media cost of tape becomes attractive.

b) Interchange - to other DEC or other manufacturers' systems using industry standard format.

c) Software distribution - tape is a more cost effective distribution medium given it is already on the system.

d) Processing - certain applications process data sequentially and can effectively use tape. Tape is an ideal device for journaling of transactions, an increasingly important backup method.

D. Where fixed and removable subsystems are configured, maintain a basic subsystem fixed/removable ratio of less than 10X, and aim for 2X to 5X. The ratio will increase on larger capacity subsystems since it is felt that the subsystem removable capacity need only be sufficient to hold 50% of the software distribution requirement, i.e., distribute software on a maximum of two physical media. This ratio goal assumes:

1. Large systems with archival backup requirements will use tape due to the lower media cost.

2. Volume backups will become less frequent due to new incremental backup and journal routines.

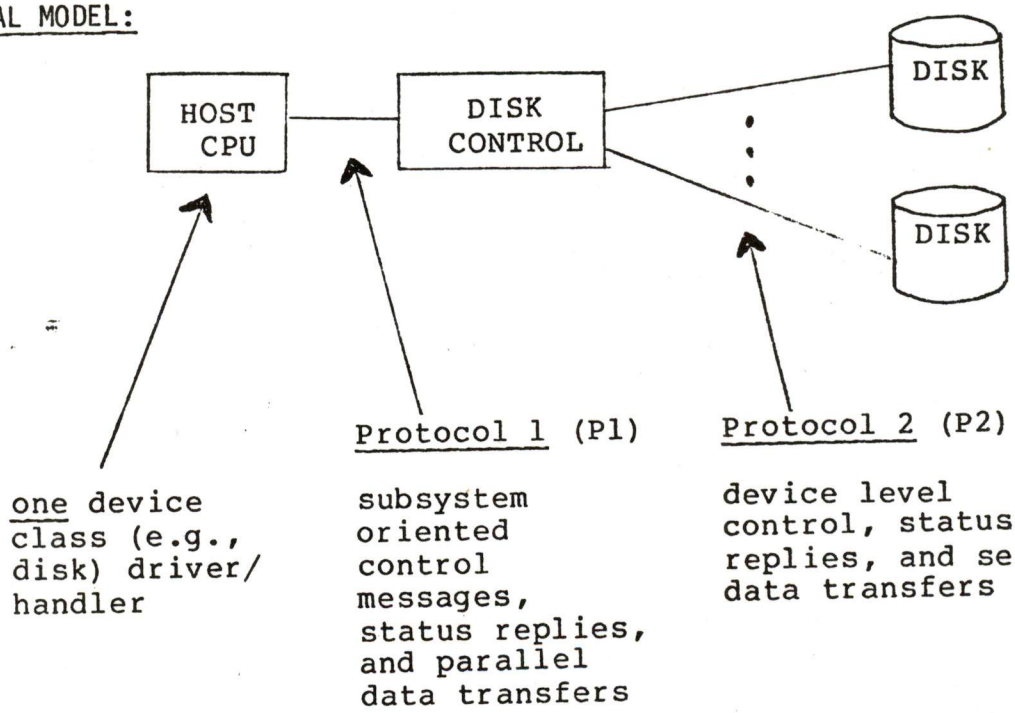
E. Offer high-end subsystems with primarily, fixed disk and high performance tape. Removable disks will be added where the "removability" feature is required. We believe that this class of system will usually require tape for one or more of the previously mentioned reasons. It is therefore unlikely for removable disks to be used as a primary backup device, especially given the very large capacities (>500Mb) per spindle that are "just around the corner". The removable disk, if needed, will probably hold databases for tasks that are executed infrequently.

Coupling the above with the fact that large removable disks are more costly on a per byte basis and less reliable than fixed media, we have concluded that removable disks larger than the current RP06 are not warranted. This belief is supported by talks with our vendors and customers.

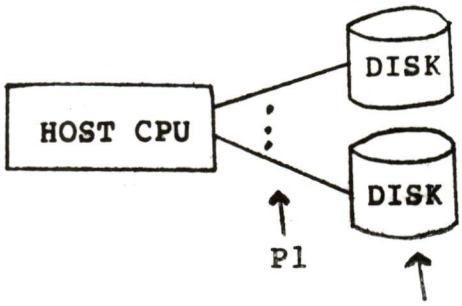
F. Evolve to a Unified Mass Storage Subsystem Strategy. This will lower development costs (hardware and software), allow a high level of configuration flexibility at overall lower product costs, and produce generally higher functionality subsystems. The first phase of this evolution involves disks, with tape products being integrated into the standardized subsystem at a later date. The integration of tape is an advanced development in FY'79 and, therefore, will not be explored further in this discussion.

The disk controller strategy has three specific performance/functionality levels, each of which conforms to two distinctly specified communication protocols:

GENERAL MODEL:



Level 1 - lowest entry cost for price sensitive small systems, low performance, low functionality

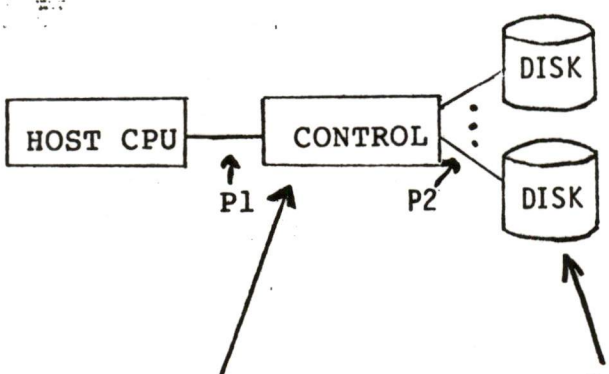


disks
AZTEC
50 MB Rem (?)

controller
none

Integrated control and drive electronics containing ECC and drive diagnostics. Possible shared logic and cooling with multiple spindles sharing one box.

Level 2 - economical low to mid-range subsystem where high performance and availability are not critical



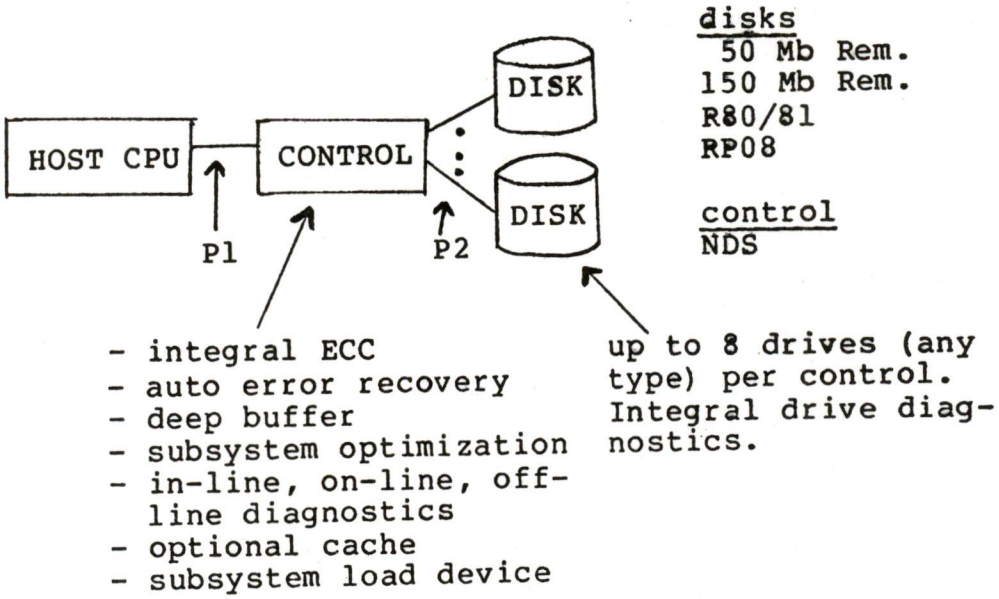
disks
50 Mb Rem.
150 Mb Rem.
R80/81
RP08

control
Small NDS (UDA)

- integral ECC
- auto error recovery
- small buffer
- off-line diagnostics

goal of up to 4 drives (any type) per control. Integral drive diagnostics

Level 3 - high performance and functionality intelligent subsystem for state-of-the-art mass storage applications



G. Operate with a "seven product strategy" in the FY79/80 timeframe. These seven products (product families) cover the entire range of Mass Storage requirements:

RX02/03	floppy disk
RL01/02	low-end cartridge disk
RK07	mid-range cartridge disk
RM03	mid-range high performance disk
RP06/07	high-end disks
TS03/04	low cost 1/2" magtape
TU77/78	high performance 1/2" magtape

H. Four removable disk products will be necessary in the future. The spacing is such that each successively larger subsystem has a cost that is about two to three times its predecessor.

	Approximate Cost	Capacity (Mb)
1. Dual Floppy (or AZTEC) subsystem	$1000	<10
2. Dual RL02 subsystem	2500	20
3. Dual 50Mb drive subsystem	5000	100
4. Dual 150Mb drive subsystem	14000	300

Cost effectiveness for the 150Mb product is not a high priority goal. In fact, there are no development funds in the FY79 plan for this class of product but several promising opportunities are being explored. The potential volumes of the large removable are highly dependent on the customers' acceptance of fixed media, a factor for which we do not have a quantitative feel for at this time.

I. Do not develop new, dedicated or optional fixed head disks. There are better alternatives on the horizon to satisfy current, very expensive fixed head disk applications.

1. Solid-state devices - bubbles and CCD's are significantly more reliable and will soon be more economical than fixed head disks. These solid state products will find immediate application as very fast swapping devices, and possibly as disk caches.

2. Fixed-head option on Winchester technology disk drives - lower cost/Mbyte than dedicated fixed head drives but significantly lower cost/performance than CCD's (to be used a subsystem controlled cache) or even main memory (MOSRAM). A fixed head option of 1-2 Mb is insufficient size for either a paging device or fast store for index tables. The way to efficiently utilize a memory of this size is to manage it as a disk cache. However, using a FHO as a high priority swapping or cache device would "paralyze" the moving head portion of the disk since the disk generally cannot seek while the fixed head area is transferring or in latency wait.

IV. MASS STORAGE PRODUCT TACTICAL PLAN

A. Block Formatted Tape

The horizon of personal portable media has been expanded by the introduction (6/5/78) of DECTAPE II, the TU58. Initial application will be in the PDT 11-130, a new intelligent terminal.

In a cost effective way ($218 for dual drive component level in FY'79) the TU58 will:

1. Provide a new low-end entry level of mass storage in support of a new entry level of intelligent terminals.
2. Provide mass storage capability that is price compatible with our component level CPU sales.
3. Provide a corporate software update distribution solution.
4. Provide a corporate diagnostic and/or microcode update distribution solution.

The TU58 strategy is to:

1. Maintain 4:1 cost/performance with Digital floppy products.
2. Provide a product small in physical size for easy mounting within other terminals.
3. Be block addressable to encourage systems applications.
4. Sacrifice media cost to obtain lowest possible unit entry cost.
5. Minimize power requirements and complexity.

B. Floppy Disks

The strategy in the floppy disk area is to:

1. Exploit standard media.
2. Extend the systems market space downward (e.g., the success of the DS310, 11V03 and VT78).
3. Cover the low-end market space with the smallest number of products.
4. Offer broadly applicable, low cost, high reliability volume products.
5. Be cost and technology competitive with the independents.

Floppy disk cost/performance is improving at approximately 50%/year. This extremely high rate is reflected in "frontier" products, i.e. the best offering in the marketplace, which double in capacity every year for the same $900 cost for a two drive subsystem.

We will track these increases by offering in FY79 the RX02 double density .5 Mb drive and the RX03 double density, double sided 1.0 Mb drive.

The major contingency in the RX03 Q4 FCS commitment is availability of heads from outside vendors which solve the industry wide two-sided media wear problem. The acceptance of a lower specification level for media wear in RX03 applications is another alternative. The technology to design such heads is not a part of the RX03 project, as our plan is to continue to procure floppy heads.

The RX03 is committed to maintaining IBM compatibility. However, a major issue is at what density this compatibility exists, since the RX03 will write floppies which can be read on RX01 and RX02 drives. There are several areas of conflict here which are being investigated. Also, multiple opportunities for RX03 "enhancement" exist:

1. Universal power supply.
2. RX02 cost.
3. Better packaging, cooling.
4. RX02 field upgrade.
5. Better serviceability.

However, these changes to the product will impact both the development cost and schedule.

Larger floppies than the RX03 cannot go into full product development at this time due to funding limitations. In addition, the access time of the RX02 and RX03 will be identical to the RX01 (175 Ms). Several of the competition have recently introduced floppies with seek times of less than 100 Ms. This compromise is, again, based on funding limitations.

C. Low-end Disks (1 platter devices)

The RL01 is a significant improvement over the RK05 in cost, performance, and reliability. However, the RL01 is relatively no closer to the "frontier" (set by IBM's low-end fixed media products) than the RK05 was at its introduction. The RL02 enhancement which will be shipped in the latter half of FY79 will move us much closer.

The RL02 will be the last "RL" class product to use the RL11, RLV11, and RL8A controllers. Future RL extensions will be NDS compatible, or may possibly have an integral controller.

Advanced development is proceeding on the AZTEC. The goal of the AZTEC is RL01/02 capacity, performance, and functionality at 50% of the cost. Reducing cost at the very low-end is difficult and requires radically new technologies. We expect the AZTEC to be transferred to a product development team in the latter half of FY79.

Funding limitations have prevented the RL04 concept from going forward on schedule. Since the RL04 schedule will slip given the current funding level, a study is currently being done to determine the best product to design given available resources in FY79. We have determined that the next "step up" from RL01/02 and AZTEC capacities is about 50 Mb per drive. There are several alternative ways to get to 50 Mb. Several attributes of alternative programs are relatively compared:

		Est. Product Cost (± 20%)	Development Cost ($ millions)	FCS
1.	RL Family Extension	$1,500	2-3	FY81
2.	RK Family Extension	2,500	1-2	FY80
3.	Fixed + Removable	2,000	3-4	FY81

A fixed + removable product would serve the "lowest entry cost backed-up system" market requirement. Alternatives 2 and 3 are technically mid-range disk products.

In any case, Mass Storage believes in, and is committed to, the strategic goal to attain a leadership position in low-end disk products by the early 1980's.

D. Mid-Range Disks (2-4 platter devices)

The RK07 is significantly more competitive than the RK06 and will be a good product offering thru FY80. Further extensions to the RK family are possible but, with the exception of the 50 Mb possibility discussed in the previous section, are not being considered at this time. This is because allocation of scarce resources to an expensive in-house development effort of a >100 Mb removable drive is considered to be a poor investment.

The RM03 is off to a flying start. It has met with a high level of customer acceptance, has essentially obsoleted the RP04/05, and has impacted the RP06. CDC is beginning the development of an RM04 which is totally RM03 device level interface compatible (except for pack) and has twice the capacity. The RM04 would be available for us to FCS at the end of FY80. Current perceived problems with the RM04 specification are:

1. Probable low unit volumes for DEC.

2. No on-board diagnostics.

3. Minimal error data transmitted from drive (same as RM03).

4. Little parts commonality with RM03

We will continue to study the RM04 concept but no development funds have been allocated in FY79.

Question: Given CDC's commitment and the momentum of the RM03, can we now not offer an RM04?

The R80 fixed media, Winchester technology drive is the largest program for Mass Storage Development in FY79. It is designed to provide a highly competitive mid-range foundation. The mechanics of the R80 are being designed to be extendable to an R81 at double capacity. The 61 Mb 2 platter depopulated version of the R80 is still technically feasible but it is questionable whether this is a necessary product. The 61 Mb product is less than 50% of the capacity of the 143 Mb 4 platter version but is about 75% of the cost.

The R80 will be initially offered as a Massbus product by replacing the CDC drive in the RM03. Although this configuration has a cost which is over 50% more costly than the "OEM box" version, the OEM box requires an NDS controller for interconnect. It is probable that none of the NDS family will be available at R80 FCS. In addition, first year shipments of the R80 will be limited to about 1,000 units. The Massbus configuration is an excellent way to limit demand during production phase-in.

E. High-end Disks (>4 platter devices)

Since the RM03 has effectively replaced the RP04/05, the RP06 is the only economically viable "high-end" disk product currently offered. As the competitive graph (see Section VI) shows, the RP06 is not very price competitive with other systems manufacturers' high-end products. The RP07 fixed media product with FY'79 FCS will alleviate this situation.

The RP07 family of buyouts from ISS consists of the RP07 at 292 Mb with a Massbus interface, the RP07+ at 542 Mb with a Massbus interface, and the RP08 at 542 Mb with an NDS interface. The RP07 and RP07+/08 are 6 to 12 months earlier than the R80 and R81, respectively. However, since the R80 family are DEC built products, the R80 and R81 are more cost effective than the RP07 and RP07+/08, respectively. In addition, it is usually more attractive, given equal cost/Mb, to put a given capacity of data on multiple spindles for better performance and availability. Therefore, there is some question as to which members of the RP07 should be introduced, if any. LCG has expressed a strong demand for the RP07, so that program will continue. However, several RP07 program benchmarks have not been met and the scheduled FCS is now realistically Q1, FY80.

The RP07+/08 are essentially backup programs to the R81. The RP07+ will also effectively meet the large storage requirements of those older systems which do not support NDS (the R81 is planned for NDS only). The RP07+/08 program will continue but will undergo periodic go/no-go reviews based on its projected competitiveness vis-a-vis the R81.

As was discussed in earlier chapters, there is a need for an RP06 class removable product in the early 1980's. There are several alternatives for the "150 Mb removable" product which are relatively compared:

		Estimated Startup Costs	Product Cost	Future Feasible Markup*	FCS
1.	Current RP06	None	$10,700	2X	Shipping
2.	RP06 with NDS interface**	$1-3M	8,000 estimate	3X	FY'80
3.	RM04 on NDS	$4-6M	5,000 estimate	5X	FY'81

* A $25K price in early 1980's is competitive.

** No interchange with existing RP06.

Since the market demand for this product is relatively low (given an R80), no development funding has been allocated in FY'79 forcing alternative 1. However, alternatives 2 and 3 are being studied and the respective vendors have been asked to quote.

F. Disk Subsystems

The disk subsystems strategy as outlined in Section III-F is aimed at a small number of generalized controllers that replace the current practice of a different controller for every drive/bus combination. Two explicit projects are underway - NDS (New Disk System) and Small NDS. The cost goals are $2,000 and $500, respectively. The major functionalities of NDS and Small NDS are also outlined in the Section III-F diagrams.

The strategic reasons for building the NDS family of products are:

1. Software Standardization - One device class drive/handler and one set of diagnostics for the majority of new disk drives. Disk level diagnostics will reside within the disk and also be written only once.

2. Hardware Standardization - A significant saving in hardware development costs by not having to develop device/bus specific controllers.

3. Packaging - Advanced technology will produce high functionality products on fewer boards relative to today's disk controllers.

4. Subsystem Cost - Large subsystems ($\geq$ 4 drives) will be considerably more cost competitive than with Massbus architecture.

5. Performance - "Large" NDS will have closely coupled hardware/software optimization of disk subsystem activities that has the potential to significantly improve subsystem performance.

6. Error Correction - A new, powerful error correction algorithm will be implemented in a hybrid hardware/software system. This ECC will enable evolution to higher disk densities at a faster rate than without it, due to effective handling of media defects.

7. Memory Hierarchies - The disk cache concept is well understood and, as an option, will provide outstanding improvement to access time to data.

8. RAMP - Comprehensive, consistent error recovery will be done by the controller transparent to the operating system. Multiport at both drive and controller levels in "Large" NDS will support high availability configurations. Internal diagnostics running at in-line, on-line and off-line levels will efficiently isolate faults to a field replacable unit.

9. Competition - The NDS family will be required as a competitive response to known developments underway. Memorex has announced a CCD disk cache. Many of the independent subsystem suppliers already offer "intelligent" controllers.

The strategic reason for building "Small NDS" (alternatively known as UDA, Unibus Disk Adapter) is to offer a low cost alternative to NDS where its extensive set of features is not required, e.g., for small low-end and mid-range disk subsystems.

Functionality being considered for the second NDS product includes:

1. Magtape control.

2. File and data-base management.

3. Auto backup, journaling, shadow-recording.

4. Encryption and file compression.

5. Bad block handling.

6. etc.

The feasibility of inclusion of these features will be the subject of a joint advanced development study in FY'79.

The major outstanding issues for the NDS programs are:

1. Host interconnect strategy - how to efficiently and reliably connect to a number of different CPU architectures.

2. Relative schedules of NDS and "Small NDS" - Which should be introduced first? Will the earlier "lock-in" the protocols used by the latter? This is a goal so we must carefully specify the protocol of the first product.

These issues will be solved in FY'79 by Disk Product Development in conjunction with Computer Systems Development and the Base Systems POT.

G. 1/2" Magnetic Tape

The TS04 offers three times the cost/performance of the TU10 and five times that of the TS03. Consequently, it will replace the demand for these products and become our primary 1/2" Tape offering for small/medium systems. The TE16 will also be impacted but to a lesser extent, due to continuing

requirements for a 45 ips Massbus drive. The TS04 will be offered in the traditional fashion (including cabinet) as well as in a "no cab" version for the price sensitive OEM market. The TS04 is presently on hold status pending solution of design problems. The design is basically sound but significant redesign will be required prior to introduction to manufacturing. Schedule and program cost (FY'79 funding) will be reassessed by June 1978. FCS is expected last half of FY'79.

The TU77, at 125 ips, will replace demand for the TU45 and fill the gap between the TE16 and TU70 on the Massbus. This product will go a long way to relieve the current pressure caused by the poor reliability image of the TU45 and the extremely high subsystem cost of the TU70. The TU77 is from the same drive family as the TU78, but will not be field upgradable due to different vacuum systems, capstans, and read/write circuits. We are presently attempting to negotiate a contract with a supplier (Pertec) to establish a proper business relationship and firm pricing. If this is successful by early June, we expect to announce the TU77 in Q1 FY'79 and ship in Q2 FY'79.

The thrust of the TU78 program is towards providing DEC with a very competitive 6250 BPI, GCR product which will allow more successful competition at the high end. This product will replace demand for the TU70 and TU72 due to cost/performance improvements of more than 3X. The TU78 moves DEC much closer to the industry frontier established by IBM and STC and will establish DEC as the price leader at the subsystem level (including controller). Additionally, the TU78 provides a basis for migrating the GCR technology downward to provide more competitive products at the low end. Until the contract is negotiated (TU77 above), it is difficult to commit product cost and FCS. Early FY'80 FCS is most likely.

The first low-end GCR offering will be the TS6250, which is planned to use the TU78 formatter (TM78) and TS04 mechanics. We will not design a third generation low cost formatter for the TS6250 due to funding limitations. This will force the product cost goal to $5,000, where it is felt that a one-third improvement to $3,500 would be possible with a lower cost GCR formatter. Due to funding limitations and TS04 schedule slip, this program may not be started until FY'80. FCS is targeted for last half FY'81 on NDS.

V. ADVANCED DEVELOPMENT STRATEGY

In general, it is our goal to stay as close on IBM's heels as possible and ahead of all competitors other than IBM. We are probably fifth in the U.S. on mass storage development expenditures, i.e., behind IBM, CDC (i.e., MPI and CPI), Memorex, and Sperry/Univac (i.e., ISS and tape division). A goal to technologically pull ahead of CDC, Memorex and Univac therefore demands a carefully chosen strategy.

The factors which may be used to distinguish a good product from a lesser product are: cost, size (capacity), system throughput, time of introduction, portability of media, portability of drive, entry cost, data integrity, reliability, system versatility, features, tolerance to environmental stresses, etc. Our emphasis in Advanced Development is in these directions.

Our plan is to:

1. Concentrate on technologies which are quicker and less expensive to develop.

2. Avoid work in areas where we can buy near state-of-the-art components at reasonable cost.

3. Learn good outside technology rather than develop all of our own.

4. Capitalize on our strengths and volume.

5. Bypass work on technologies which are expected to be superceded.

6. Use cooperative developments where a mutual advantage exists.

7. Exploit technologies where constraints of IBM compatibility slow down competitors.

MASS STORAGE FY79 ADVANCED TECHNOLOGY DEVELOPMENTS

TECHNOLOGIES WE ARE DEVELOPING	EXPECTED ULTIMATE BENEFIT (DRIVE LEVEL)	DIFFICULTY	PER STRATEGY NO.	FY'79 EMPHASIS
Plated media	4-8X capacity/$	High	4,5,7	Strong
Improved modulation/ demodulation	2-4X capacity/$	Medium	1,3,7	Strong
Video tape	Potential backing/ archiving store	Medium	2,3,5,6,7	Modest
Microprocessor compensated servo control	Supports high track density	Modest	1,3,4,7	Modest
Disk cache	2-6X throughput and access time improvement	Medium	1,4	Completing
LSI'd electronics	10-20% cost reduction, supports other technologies	Medium to High	2,3,4,6	Medium
Improved positional accuracy mechanics	Supports density increases	Medium	3	Medium
Dynamic mechanical analysis tools	Supports density increases	Medium	3	Medium
Small diameter disk	Low entry cost, 2X throughput improvement, portable media	Medium	4,7	Strong
File backup, bad blocking, system features, tape, etc.	System cost reduction, customer features	Medium	4	Strong
Servo reference repeatability	Supports small disk density increases	Modest	4,7	Medium
Composite Head	1½X density of Winchester monolithic head	Medium	1,3,4,7	Strong
Phase Error Testing	Necessary for support of high density recording	Medium	1,4	Strong
Servo Writer Development	Support of high track densities	Medium	1,4	Strong
Thin Film Head	2X increase in density over Winchester head	High	3,6	Modest
Modular Test Equipment	Family of test equipment for future disk drives	Low	1,4	Strong
Vertical Loading Head	Makes high density test available in removeable products	Medium	1,4,7	Strong

Technologies We Are Not Internally Developing

Because of availability of components or good outside technology or technology trades or heavy investment vs. limited life, we do not intend to invest much time in the following technologies: servo control philosophies, basic circuits, spindles, conventional floppy and disk heads, particulate media, head design models (thin film), pack drive motors, blowers, packaging hardware, interconnect hardware, power supplies, SSI and MSI, 1/2" tape and compatible floppies.

Planned Breadboard Testbeds:

R81 - Med. capacity, 2 X 3350 density - evaluation complete Q3 FY'79.

AZTEC - small dia. disk, 2 X 3350 density - evaluation complete Q4 FY'79.

? - 4 X 3350 density - evaluation complete Q4 FY'80.

NDS2 - Supports disk cache - evaluation complete Q2 FY'79.

NDS3 - Bad blocking, backup, tapes, etc. - evaluation complete FY'80.

Video tape - On NDS - ?

VI. A STORAGE SYSTEMS POT FY79 PRODUCT DEVELOPMENT FUNDING WITH HISTORY ($000)

	ACTUAL FY77	PROJECTED FY78	BUDGET FY79
RX02/03	600	625	425
RX0X	-		205
TOTAL FLOPPY	600	625	630
RL01/02	1560	2376	1135
AZTEC	-	-	183
50 Mb REMOVABLE	-	480	1435
TOTAL SMALL DISK	1560	2856	2753
RK06/07	2750	1749	580
RM02/03	725	829	150
R80	100	1030	2870
R81	-	-	235
TOTAL MEDIUM DISK	3575	3608	3835
RP07 FAMILY	100	259	675
TOTAL LARGE DISK	100	259	675
TE10/TE16/TM03	600	50	
TS04	710	875	514
TS6250	-	-	260 (3)
TOTAL SMALL TAPE	1310	925	774
TU77/78	510	975	763
TAPE STANDARDS (1)	-	-	155
TOTAL LARGE TAPE	510	975	918
SMALL NDS	-	-	215
NDS	-	397	920
TOTAL INTELLIGENT SYSTEMS	-	397	1135
HANDLERS & DRIVERS			570
CCD CACHE & BUFFER	-	-	210
TOTAL NON-MASS STORAGE	950	900	780 (4)
CONTINGENCY (2)	-	-	500
TOTAL STORAGE SYSTEMS POT	8605	10545	12000

1. In project spending FY77/78
2. Allocated to projects by end of years FY77/78
3. TS6250 product development start may slip to FY80 due to TS04 program
4. VAX diagnostics in project spending for first time in FY79

VI. B MASS STORAGE GROUP - FY79 FUNDING WITH HISTORY ($000)

	ACTUAL FY77	ESTIMATED FY78	BUDGET FY79
PRODUCT DEVELOPMENT			
Storage Systems POT	7655	9645	11220
Terminals/Small Systems POT	-	455	450
Total	7655	10100	11670
ADVANCED DEVELOPMENT			
Servo & read/write	791	440	336
Mechanics		305	356
Mass storage systems		320	425
Heads & media		280	409
LSI		250	266
Flexible media		0	140
AZTEC		60	324
Total	791	1655	2256
PRODUCT SUPPORT	680	380	525
PRODUCT MANAGEMENT	167	370	475
ADMINISTRATION	N/A	N/A	150
GRAND TOTAL	9293	12505	15076

VI. C. Impact of FY79 Funding Level - Our Concerns

The Storage Systems POT and Mass Storage management have reviewed the impact of the FY79 funding plan. At the current funding level, which is significantly lower than requested, we are in serious jeopardy of losing competitive position. In particular:

1. Exposed Flanks - Areas of potential, but not highly probably, competitive pressure.

   a. Massbus Cache - Memorex has announced a CCD cache product for the IBM channel. ISS/Univac and STC are working on similar products. We have given up the ability of upgrading the large number of Massbus disk subsystems in the field by not pursuing this project. Our first hierarchical subsystem will be NDS in FY'81.

   b. Video Technology - Video tape has the capability of becoming an economical random-access storage device for very large amounts of data. The word-processing market has an immediate need for such a device. SONY has approached us and is anxious to develop a "computer-grade" video recorder. Funding limitations preclude all but a low level advanced development effort in FY'79.

   c. RX0X Floppy Disk - We are on a course which over time would put us out of the competitive floppy business. Present funding only allows us to finish the RX02; complete the Rx03, but on a less aggressive than desirable work schedule; and do minimal advanced development work through FY'79 on any subsequent high density or higher performance floppy product. We consider AZTEC advanced development of an ultra low cost hard disk to be a very risky program given no funded backup plan.

   d. Mid-Range Removable Disks - We have essentially stopped all future development of mid-range removable disk products. We are on the uncomfortable course of having no funding for product successors to the RM03 and RP06. In the long range this will create a competitive selling problem, the magnitude of which is unknown because we are unable to accurately forecast the customer shift to fixed media disks.

2. A Gap in Product Tactics - Removable NDS companion for R80.

We have substantially reduced the RL04 development plan. This has forced us to redefine the product (the rule being "if later then necessarily better") and recognize that the RK07 will have to meet the demand for this capacity class of product through FY81.

Between this and not funding mid-range removable disks, there will be no removable disk companion with an NDS interface for R80 when it ships on NDS. The opportunity exists for modification of a current disk (e.g., RK07), or acceleration of a new one (e.g., 50 Mb removable), to be packaged with the R80 in a subsystem which has both architectural and packaging elegance.

3. Major Exposures - Areas with highly probable future problems.

a. Media and Head Investment - Even though it is not POT funded, we are concerned about reduction in Storage Systems Advanced Development, such that FY79 becomes a zero growth year. It is important to understand that only through significant investment in Advanced Development in past years are we to the point where we can design and build reasonably competitive products.

We expect major technological shifts in the head and media area. We have minimal funding to seriously pursue these technologies and are dependent on financially marginal head suppliers (AMC, Infomag) and captive media suppliers (Memorex, Univac, CDC) for technological advances and manufacturing capacity. Based on conservative corporate NOR forecasts and derived needs for heads and media, it is unlikely that adequate external capacity will be available to us in the FY'82 timeframe. Considering our potential competitive posture with existing suppliers and their internal demand, a severe availability situation could develop sooner. Because of the long lead time and process intensive nature of these businesses, substantial funds need to be allocated in FY'79 for development and pilot manufacturing operations if we are to avoid catastrophe in the early 80's.

b. I/O Interconnect - The lack of a coordinated effort and funding for a new mass storage bus is compromising NDS data integrity (if Unibus used), schedule, and standardization goals. The distributed processing nature of future mass storage transactions requires a modern, low cost, multiple master, high performance bus. The Massbus has

served well, but is technologically obsolete and must be replaced by a bus that is architecturally compatible with new CPU's and mass storage subsystems.

c. TS04 Technical Problems and FY'79 Funding - During final engineering design verification testing and initial DMT, a number of design related problems were identified. Manufacturing start-up is on engineering hold pending solution of these problems. Much additional effort is being applied to the project and it is estimated that FY'79 funding will be in excess of $1.0M rather than the $440K budgeted. To continue the program will require the diverting of additional funds. Total program cost and schedule will be reproposed in June.

4. Areas Where Acceleration is Desired and Feasible

a. Small NDS (UDA) - The allocated level of funding explicitly slows development by three to six months. FCS of Small NDS to coincide with the R80 will be impossible.

b. Mid-Range Removable Buyout - See 1d. Funding should be allocated to begin development of a buyout product in FY'79.

c. 50 Mb Removable - See 2.

d. We are less aggressive on low-end ½" tapes than is desired which will cause us to have higher manufacturing costs than we should. In particular, the TS6250 is estimated at $5,000 instead of $3,500.

e. We are unable to sufficiently fund longer term advanced products such as Small NDS, AZTEC, and R81. This will slip the schedule of these products. They are critical to the success of the Mass Storage business in future years.

f. We will be unable to start product development on the very desirable intelligent controller subsystem that will integrate both tape and disk technology into a single mass storage subsystem.

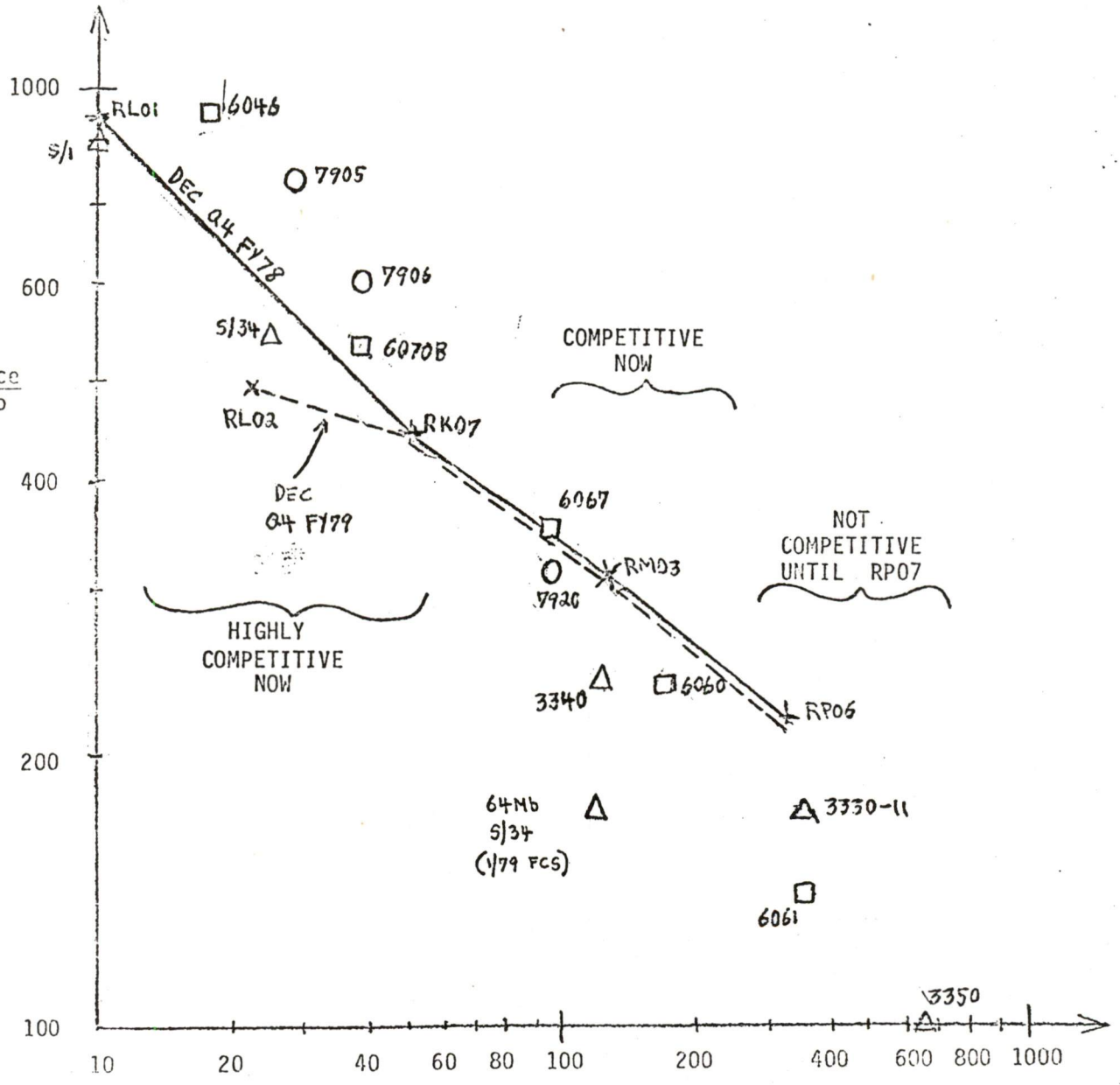
In further support of Storage Systems, it is important to note that we have significantly underfunded development proportional to revenue production. Storage Systems accounts for about 1/3 of corporate revenue. In addition, an ever increasing share of system sales is dependent on Storage System price performance instead of central processor price performance. We seriously believe that more than 1/9 of our corporate engineering investment is necessary to maintain this 1/3 of revenue stream.

VI D. THE MASS STORAGE BUSINESS - COMPARISONS TO OVERALL DEC GROWTH

CORPORATE PLAN	FISCAL YEAR 76	77	78	79	80	81	82
CORPORATE NOR	736	1059	1420	1748	2096	2520	3033
LESS SERVICE & OTHER REVENUE	(149)	(212)	(298)	(367)	(440)	(529)	(637)
CORPORATE NES	587	847	1122	1381	1656	1991	2396
LESS SOFTWARE NES	(23)	(42)	(67)	(97)	(132)	(179)	(240)
HARDWARE NES	564	805	1055	1284	1524	1812	2156
TRANSFER COST OF HARDWARE NES	215	293	378	451	541	650	783
+ 15% FA&T BURDEN	32	44	57	68	81	98	117
HARDWARE CGS	247	337	435	519	622	748	900
% OF HARDWARE NES	44%	42%	41%	40%	41%	41%	42%
CENTRAL ENGINEERING DEVELOPMENT SPENDING	34	46	67	85	106	132	
LESS SOFTWARE DEVELOPMENT SPENDING	(8)	(10)	(15)	(23)	(28)	(37)	
HARDWARE DEVELOPMENT SPENDING	26	36	52	62	78	95	

MASS STORAGE PLAN							
TAPE TRANSFER COST	12	18	28	35	37	47	52
FLOPPY + DISK TRANSFER COST	39	63	89	124	157	197	247
TOTAL MASS STORAGE COST	51	81	117	159	194	244	299
+ 15% FA&T BURDEN	8	12	18	24	29	37	45
TOTAL MASS STORAGE CGS	59	93	135	183	223	281	344
MASS STORAGE NES (2.5 X NET MARKUP)	148	233	337	458	557	702	860
AS % OF HARDWARE NES	26%	29%	32%	36%	37%	39%	40%
MASS STORAGE DEV. SPENDING - POT & NON-POT	6.5	9.3	12.5	15.1	19.3	24.8	
AS % OF MASS STORAGE NES	.044%	.040%	.037%	.033%	.035%	.035%	
AS % OF HARDWARE DEV. SPENDING	25%	26%	24%	24%	25%	26%	

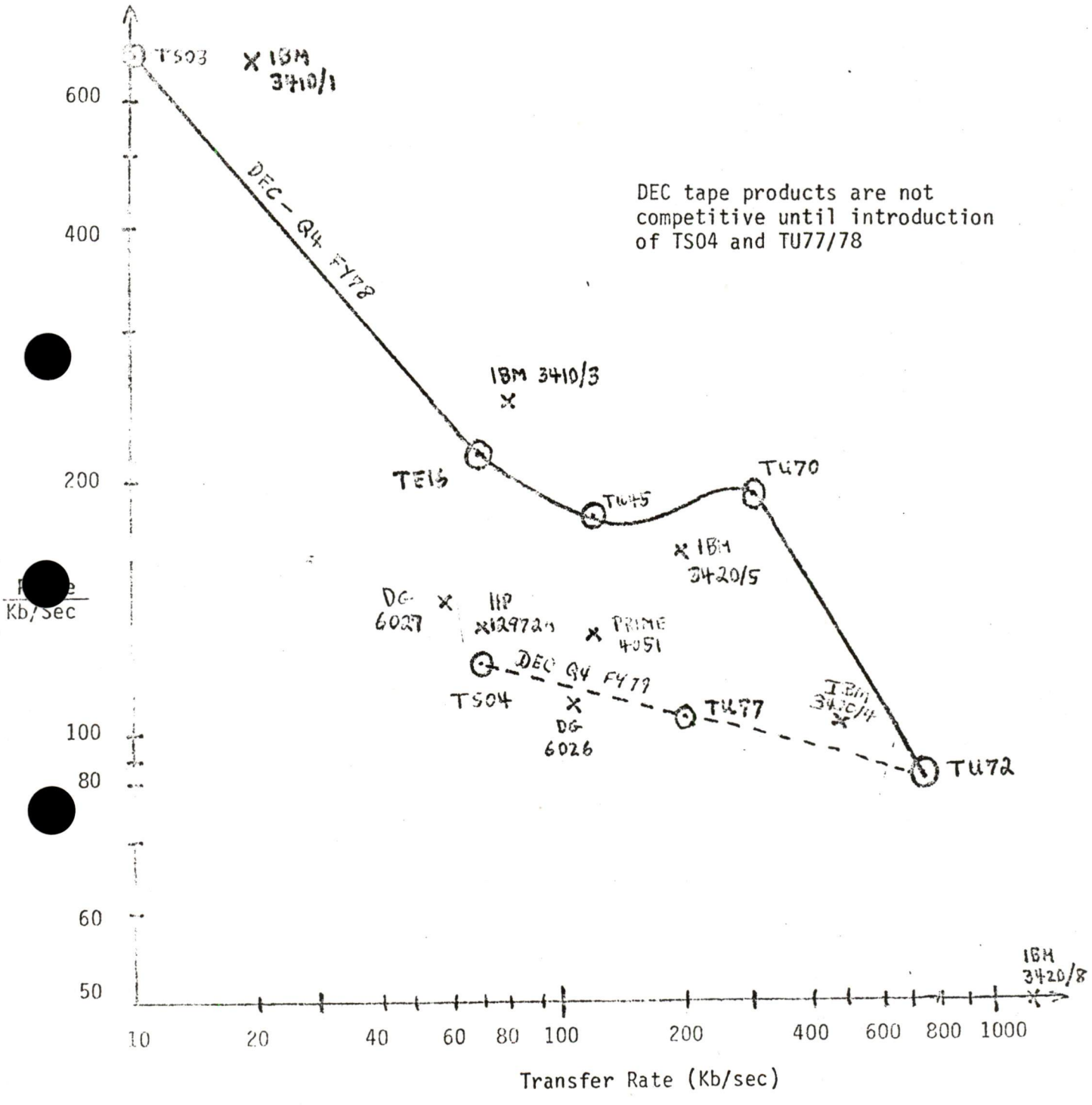
VII. A PRICE COMPETITIVENESS OF DEC DISK OFFERINGS - FY78 AND FY79



KEY
- X DEC
- □ DG
- ○ HP
- △ IBM

Notes: 1. Price is the price of a dual drive subsystem
2. All competition products are currently available. For purposes of FY79 comparison it is reasonable to assume competitive advances will be made.

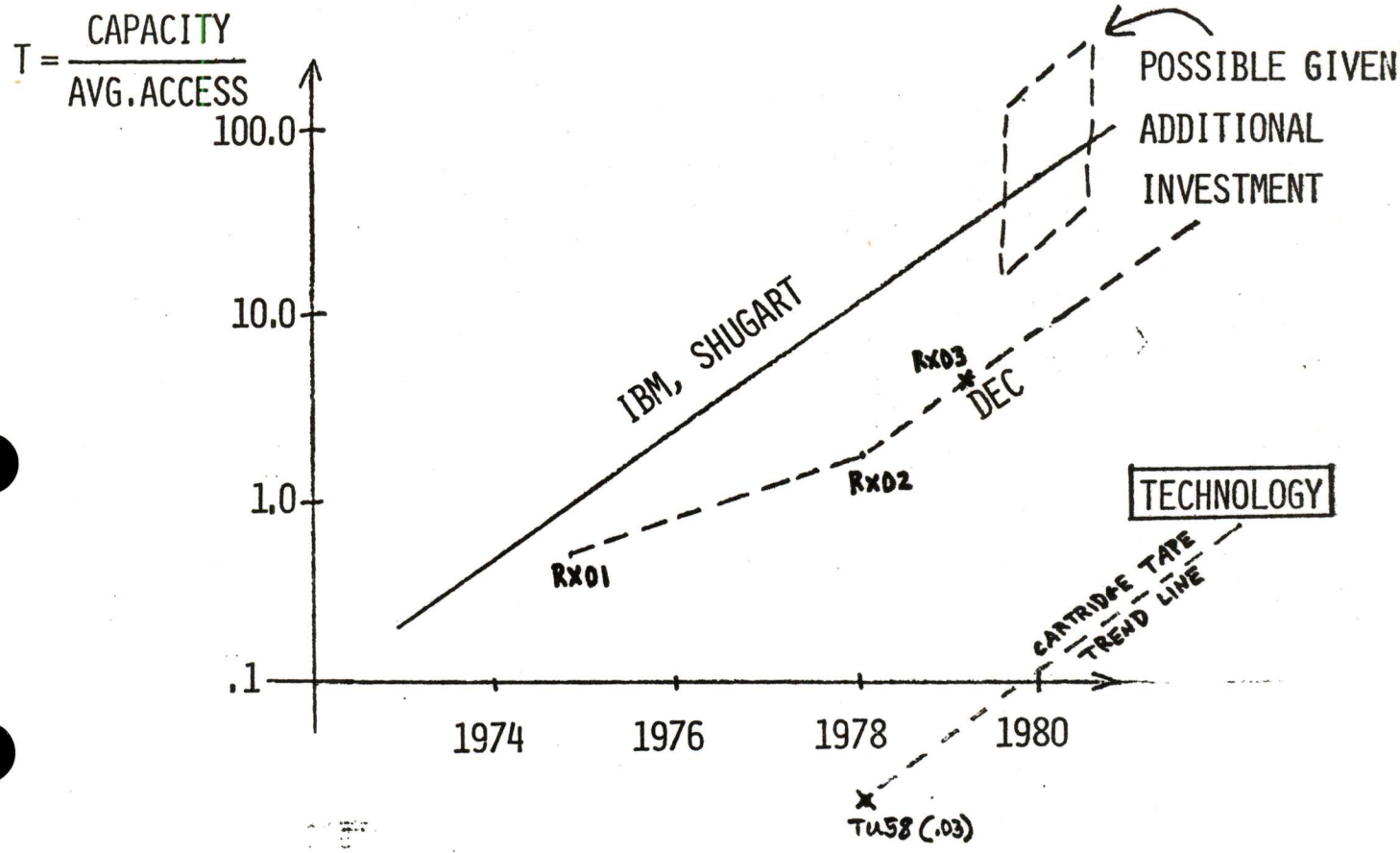
VII. B PRICE COMPETITIVENESS OF DEC 1/2" TAPE OFFERINGS - FY78 AND FY79

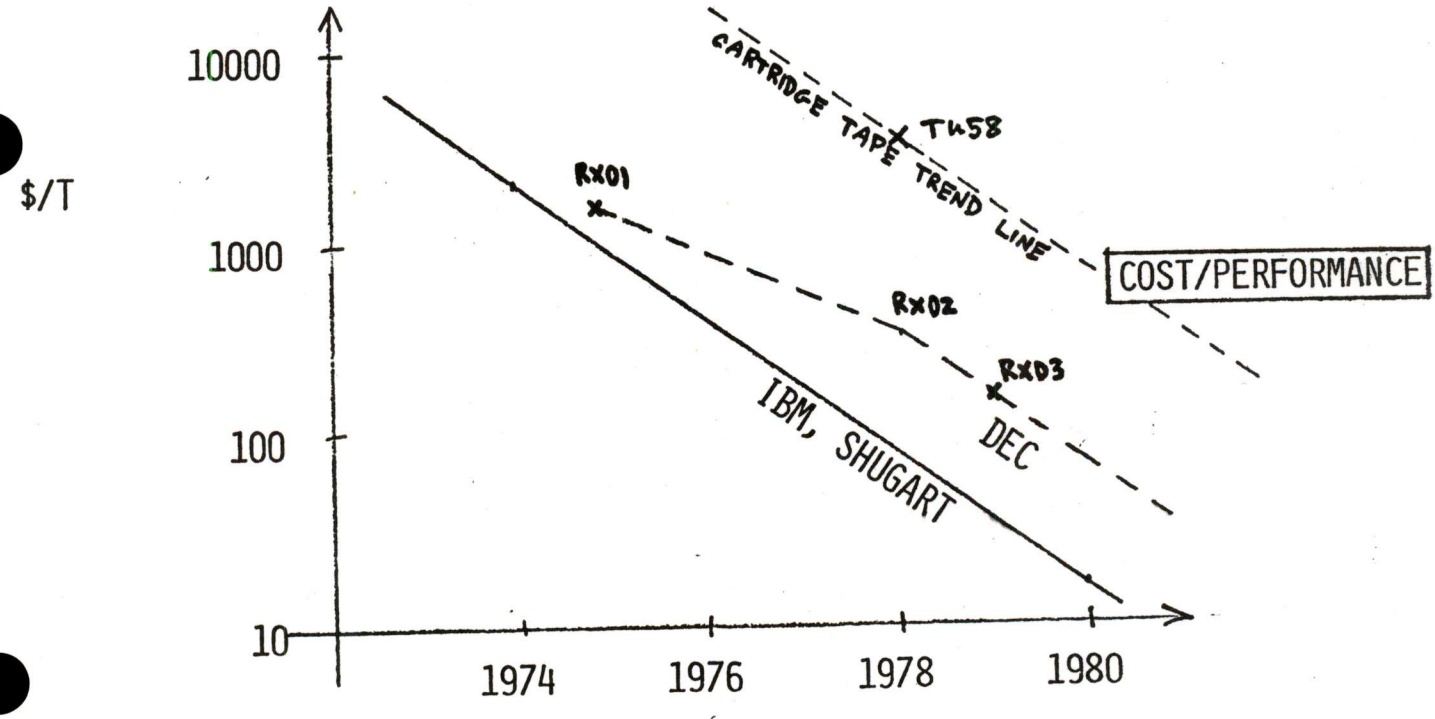


DEC tape products are not competitive until introduction of TS04 and TU77/78

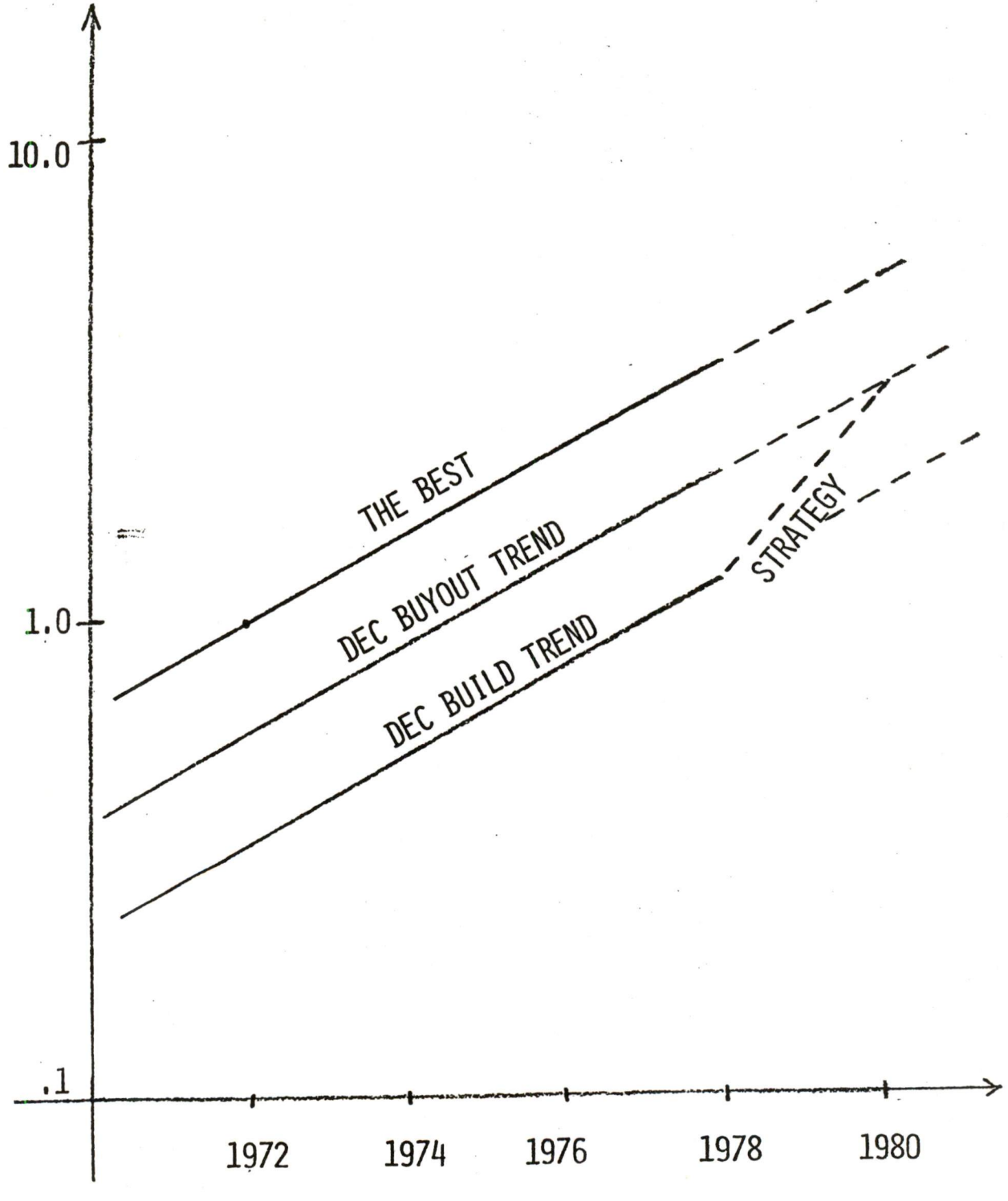
Notes:
1. Price is a weighted average of master and slave drives which assumes 1.4 drives/subsystem.
2. All competition products are currently available. For purposes of FY79 comparison it is reasonable to assume competitive advances will be made.

VII. C FLOPPY DISK TECHNOLOGY AND COST/PERFORMANCE TRENDS

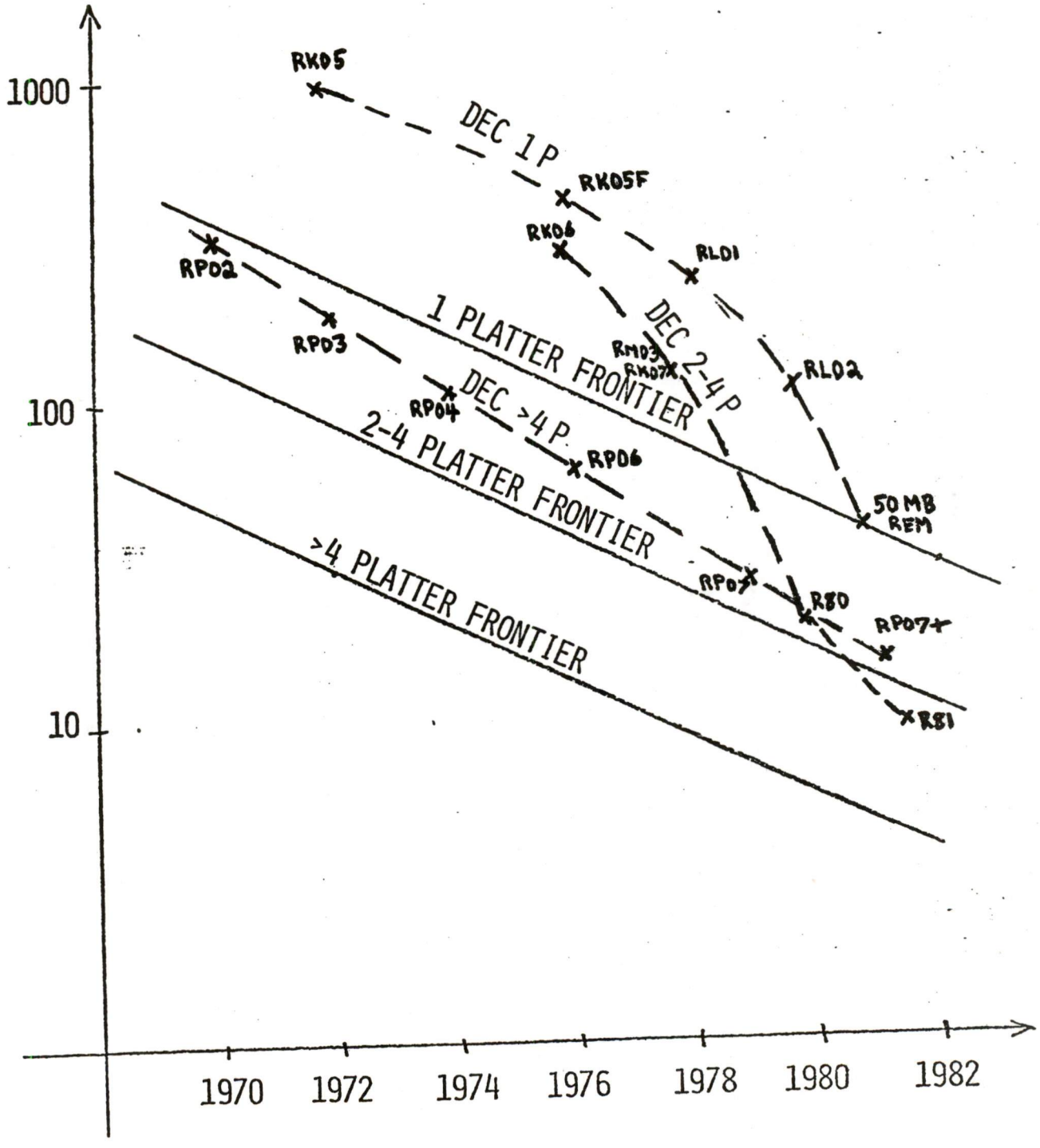




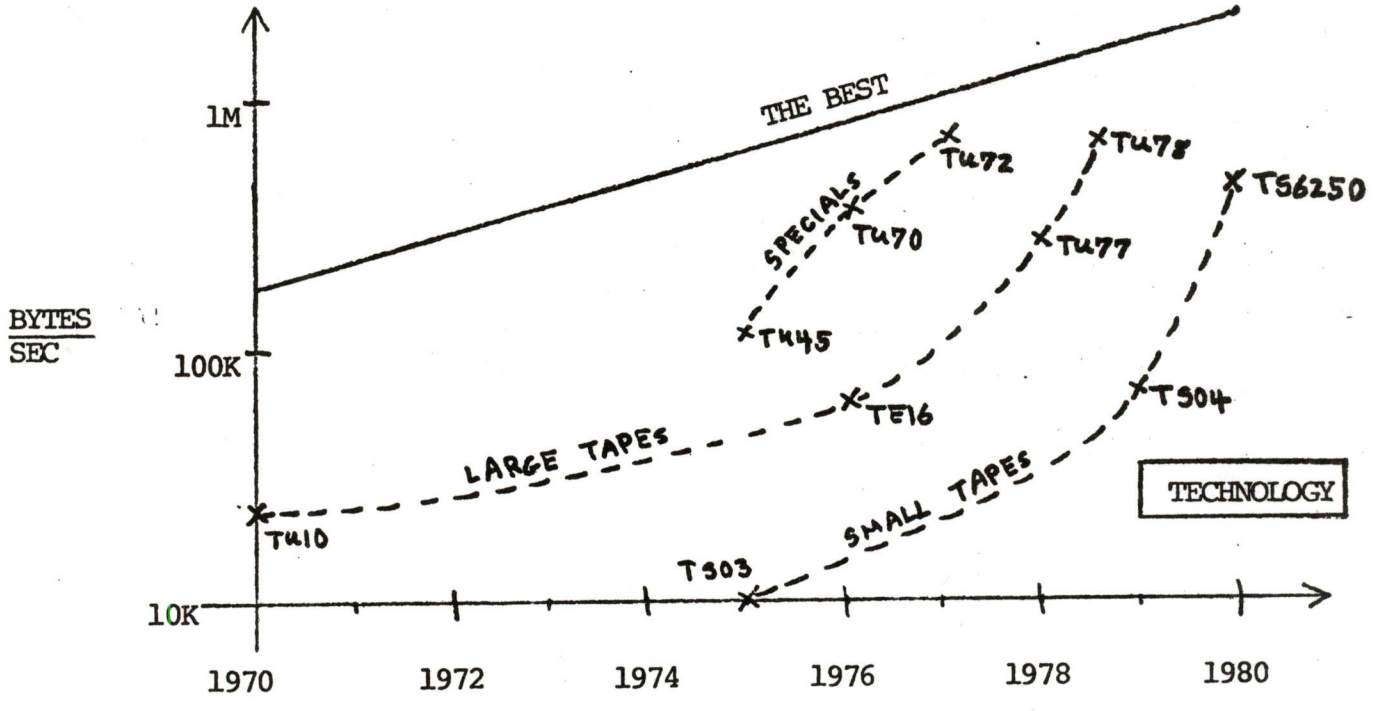
HARD DISK TECHNOLOGY TRENDS

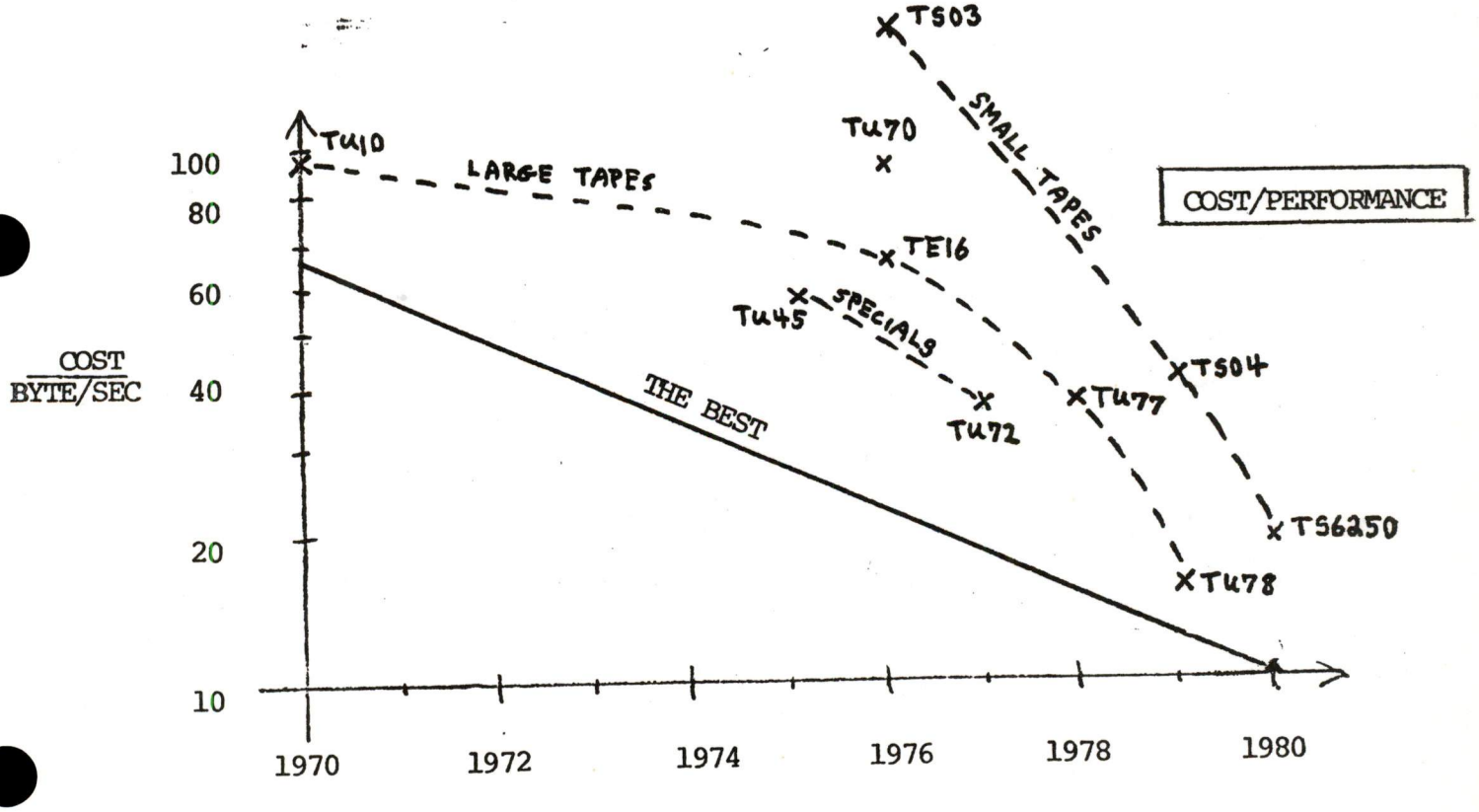


DISK COST/MB TRENDS



MAG TAPE TECHNOLOGY AND COST/PERFORMANCE TRENDS





NOTE: ALL COSTS ARE WEIGHTED AVERAGE OF MASTER AND SLAVE BASED ON 1.4 DRIVES PER SUBSYSTEM

BASE SYSTEMS POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
	BASE Contingency		n/a		500			Unallocated
	Memories	Includes MS11KC, MS11L, MSM11M, MK11, MKA11, MS780D	n/a	900	400			Cudmore
	Packaged Standard Systems		n/a	200	400		B. Flynn	Clayton
11	K2 Kernel	OS kernal for PDP-11s, except low end	n/a	500	1050			Portner
11	Unifonz	Fonz-based 11/04 CPU (board) replacement with integral warm-FPP and CIS	Q1/FY80(T)		500		J. Hamilton	Demmer
11/34	11/44	Central Processor, 11/34 functionality and performance plus CIS, PAX	Q4/FY79	800	1200		B. Fifield	Demmer
11/34	MS11L	16K MOS upgrade for 11/04-34	Q1/FY79		(Mem.)		M. Gutman	Cudmore
11/34	MS11M	16K ECC MOS for 11/44			(Mem.)		M. Gutman	Cudmore
11/48	11/48	Higher-performance 11/34 & 44 replacement at 11/34 cost	FY82(T)		200			Demmer
11/68	11/68	Lower-cost 11/74 CPU replacement	Q4/FY80(T)	300	850		T. Sherman	Demmer
11/70	11/74	Corp. cabinet 11/70 with CIS option and multiprocessing extensibility	Q3/FY79	700	900		M. Powell	Demmer
11/70	11/74 mp	CERBERUS 11/74 multiprocessor under RSX-11M+	Q3/FY79		550		M. Powell	Clayton
11/70	MK11	Singleport MOS memory for 11/70	03/78		(Mem.)		M. Gutman	Cudmore

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
11/70	MKA11	Singleport MOS memory for 11/74	Q3/FY79		(Mem.)		M. Gutman	Cudmore
11/70	MS11KC (was MS11K Prime)	16K MOS memory upgrade for 11/70, 11/74	Q4/FY79(T)		(Mem.)		M. Gutman	Cudmore
VAX	11/780	32-bit system with twice 11/70 performance, equal performance in 16-bit compatibility mode.	12/77(S)	2400	600		B. LaCroute	Demmer
VAX	11/780 mp	Sys Eng			50			Clayton
VAX	11/780 mp	Hardware		300	600			Demmer
VAX	11/780 mp	Software			200			Portner
VAX	11/780 mp	Architecture			100			Demmer
VAX	Comet	Mid range VAX system: one third 11/780 cost, two thirds performance; warm-FPP and CIS	Q1/FY80	2300	3200	6900	D. Best	Demmer
VAX	LSI/VAX		FY82					
VAX	MS780D	16K MOS memory upgrade	Q1/FY79		(Mem.)		M. Gutman	Cudmore
VAX	Nebula	11/780 functionality, 5% of 11/780 performance at 10% of the price, LSI system	FY81(T)					Demmer
VAX	Superstar	Higher performance and functionality than 11/780, lower price	FY82					
VAX	VMS Kernal	OS kernal for VAX-11s	n/a	2000	1700			Portner

COMMERCIAL SYSTEMS POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
	Contingency				605			Portner
11	ADE-1	Application development facility oriented to first-time end user marketplace, as well as improving programmer productivity by OEMs, distributors (bundled with SCS-11)	Q1/FY80	46	245	291	T. Webber	Portner
11	BASIC Plus 2	DEC standard BASIC compiler	09/77	107	0	107	R. Pitetravalle	Portner
11	COBOL	ANSI compliant COBOL V4A/V4B; performance releases with packed decimal data type (V4B FCS Q3/FY79)	Q2/FY79 (V4A)	143	184	327	R. Pietravalle	Portner
11	Datatrieve 11	Inquiry language/report writer for RMS-11K	01/78	175	46	221	R. Pietravalle	Portner
11	Fast Back-up	RP07 fast backup utility for RSTS/E V7A	n/a		60	60	R. Pietravalle	Portner
11	RMS-11	Cross-system compatible sequential, relative, multi-key ISAM file management	Q2/FY79 (V1.5)	248	337	585	R. Pietravalle	Portner
11	RSTS V7a	Support of large files (greater than 65K blocks), shared libraries (RMS), disk caching, new device support, continued availability of small (64K) RSTS/E configuration with V6C functionality	12/78	369	307	676	T. Webber	Portner
11	RSTS V7B	Improved spooler, backup, and batch features, and improvements in the RSTS task builder, and new device support	n/a		199	199	T. Webber	Portner

COMMERCIAL SYSTEMS POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
11	SCS-11	Small business systems software consisting of packaged RSX-11M based OS and small file manager (upward compatible with RMS)	Q1/FY80	365	736	1101	T. Webber	Portner
11	Small COBOL	ANSI standard COBOL for SCS-11	Q1/FY80	217	276	493	R. Pietravalle	Portner
11	TRAX	Dedicated transaction processing system	07/78 (V1)	819	858	1677	C. Johnson	Portner
VAX	BASIC Plus 2 Compiler	For native mode VAX execution, compatible with PDP-11 BASIC Plus 2	Q1/FY80	191	307	498	R. Pietravalle	Portner
VAX	COBOL-11/VAX	Native mode execution of COBOL-11	Q2/FY79	180	92	372	R. Pietravalle	Portner
VAX	COBOL-79	Native mode high performance for VAX	FY81	224	598	821	R. Pietravalle	Portner
VAX	Commercial VAX	Transaction processing monitor for VMS -- TRAX interface (TRAX-32)	FY81	55	305	360	C. Johnson	Portner
VAX	DBMS-32	CODASYL compliant data base management for VAX	FY81		184	184	R. Pietravalle	Portner
VAX	EDITOR/VAX	DEC standard editor for VAX			30	30	R. Pietravalle	Portner
VAX	OTS	Commercial run-time support for VAX subsystems		242	184	426	R. Pietravalle	Portner
VAX	RMS-32	RMS-11 compatible file management for VAX	Q3/FY79 (ISAM)	356	368	724	R. Pietravalle	Portner
VAX	SORT-32	High performance file sort/merge for VAX		97	77	174	R. Pietravalle	Portner

NETWORK/COMMUNICATION POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
Comm HW	DML11	Four-line synchronous multiplexer	FY79		230			Marcus
Comm HW	DMP11	UNIBUS full DDCMP synchronous interface with local line driver	FY79	256	220	500	A. Brind	Marcus
Comm HW	DMV11	QBUS full DDCMP synchronous interface with local line driver	08/79		200	250	A. Brind	Marcus
Comm HW	DMV Microcode	Redesign to make DMV more compact	FY80		50			Marcus
Comm HW	DZ11-H	Additional Modem Control for DZ11	FY79	39	60	187	A. Brind	Marcus
Comm HW	KMC11-B	Enhanced KMC-11 intelligent interface	FY80		40		A. Brind	Marcus
Nets	DECnet	Advanced network functionality for RSX-11M, S, M+, TRAX, SCS, TOPS-20, VMS, IAS, RSTS, RT-11 (see also Red Book)			2700		D. Loveland	Portner

REAL TIME/COMPUTATION POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
	FORTRAN IV+	RMS, VAX, ANS standards, maintenance, enhancement	2H/FY79 (V2)		341		R. Brown	Portner
11	Files and Utilities	Maintenance, enhancement			306		K. Friedrich	Portner
11	IAS	High end general purpose TS, RT, and Batch system, incorporating RSX-11D, PLAS, New Device Support	12/78 (V3)	319	238	500	A. McCray	Portner
11	RSX-11M	High performance sensor based real time. Features to include new device support, ease of use and improved real time performance.	2H/79 (V3.2)		107		K. Friedrich	Portner
11	RSX multiprocessing	Multiprocessor software for 11/70 mp	2H/79		122		K. Friedrich	Portner
11	RT-11	Continued development as kernal, and new device support.	2H/79		408		D. Strauss	Portner
VAX	32-bit Real Time	DR-780 software, FORTRAN IV+ enhancements, KMC-11 tools, OS mods, RT Users Guide, WCS tools, contingency	Q1/FY80(T)		600		Best/McCray	Portner

STORAGE SYSTEMS POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
	Contingency		n/a		500	n/a		Kevill
	Handlers and Drivers		n/a		570			Portner
	Tape Standards		n/a		155	n/a		Kevill
Floppy	RX02/03	.5 MB/1.0 MB Floppy (RX03 FCS Q4/FY79)	Q1/FY79 (RX02)	625	425	2000	L. Powell	Kevill
Floppy	RX0X	Track floppy technology	n/a		205		L. Powell	Kevill
Lg Dsk	RP07/07+/08	292 MB/542 MB fixed disk family (RP07+, 08 FCS FY80)	Q3/FY79 (RP07)	259	675	1600	P. Feresten	Kevill
Lg Tape	TU77/78	125 IPS 1600/6250 BPI tape family (TU78 FCS Q4/FY79)	Q2/FY79 (TU77)	975	763	2500	P. Feresten	Kevill
Md Dsk	R80	143 MB fixed media drive, Massbus and NDS	FY80	1030	2870	7000	K. Sills	Kevill
Md Dsk	R81	286MB drive, NDS	FY81		235	2500	K. Sills	Kevill
Md Dsk	RK07	28MB cartridge disk	03/78	400	580	1000	K. Srivastava	Kevill
Md Dsk	RM02/03	67MB Disk drive, Unibus (RM02), Massbus (RM03) (RM03 FCS 10/77)	04/78 (RM02)	829	150	2000	K. Smith	Kevill
Sm Dsk	AZTEC	5-8 MB drive	FY81		183			Kevill
Sm Dsk	RL01/02	5 MB/10 MB Cartridge drive and controller (RL02 FCS Q4/FY79)	12/77 (RL01)	2376	1135	6000	W. Galusha	Kevill

STORAGE SYSTEMS POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
Sm Dsk	50 MB Removable	50 MB cartridge drive (low cost RK07 replacement)	FY81	480	1435	4000	W. Galusha	Kevill
Sm Tape	TS04	45 IPS 800 or 1600 BPI, Unibus	09/78	875	514	2000	E. Siegmann	Kevill
Sm Tape	TS6250	22-45 IPS 1600/6250 BPI	FY81		260		E. Siegmann	Kevill
Systems	NDS	Intelligent Subsystem	FY81	400	920	3000	K. Sills	Kevill
Systems	CCD Cache and Buffer	CCD array and controller, and RAM buffer, for NDS	n/a		210	300	M. Gutman	Cudmore
Systems	Small NDS	One board Unibus control, NDS protocols	FY81		215	500	K. Sills	Kevill

TERMINALS/SMALL SYSTEMS POT
PRODUCT CALENDAR as of 5/30/78

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
	Contingency				345			Unallocated
	Misc. Small Systems				300			Clayton
	Systems Products	11T03L, 11V03L, Mfg. Intro., PEL, etc.	n/a		670		H. Allard	Clayton
11/23	11/23	Boxed Fonz double, replaces 11/03 (higher performance and same cost); 11V23 with RX02, 11T23 with RL01					G. Dulaney	Clayton
Fonz	Chip Enhancements	MIC, CIS chips			625		G. Dulaney	Clayton
Fonz	Chips	Completion of DAT, CTL, MMU			920		G. Dulaney	Clayton
Fonz	Double & Boot	Double height CPU and bootstrap module, component of 11/23			280		G. Dulaney	Clayton
Fonz	Fonz11	Higher performance LSI 11/Qbus Successor, board level	12/78	1753		4000	G. Dulaney	Clayton
Fonz	Memory	64K MOS, CCD/BBL			150		M. Gutman	Cudmore
Fonz	Quad	Quad with space for CIS, ROM diagnostic, WCS, FP11, KW11, Boot, SLU			0		G. Dulaney	Clayton
Fonz	WCS	F-11 WCS breadboard			0		G. Dulaney	Clayton
Hd Copy	LA00	Low cost, table top, 300 baud hard copy terminal	11/78	1420	1400	3260	D. Cotton	Clayton

PRODUCT FAMILY	PRODUCT NAME	DESCRIPTION	FCS DATE	EST. FY78 COST	EST. FY79 COST	EST. TOTAL COST	PRODUCT MANAGER	ENGINEERING ORGANIZAT'N
Hd Copy	LA120	1200 baud, fully optioned hard copy terminal	09/78	1400	800	2400	P. Maas	Clayton
Hd Copy	LA120 opt	Includes 11 wire head, video option, 212 integration, protocol board integration, option packaging and BSR	9/78		100		P. Maas	Clayton
Hd Copy	LA1200	1200 baud, 120 cps LA00			315		P. Maas	Clayton
Hd Copy	Line Printer	Line printer evaluation	n/a		170			Clayton
IT	IT100 B&C SW	Intelligent terminal software	03/79	400	600	900		Portner
IT	IT100 A&B HW				220		M. Wurster	Clayton
IT	IT100 C HW	Includes development of Toby board (see RLT-11)			170		M. Wurster	Clayton
IT	RLT-11	Disk based intelligent terminal (product space same as IT100D).			0		E. Glazer	Clayton
IT	TU58 (was TAXX)	256 byte cartridge	11/78		450		L. Powell	Kevill
Tiny	Shoebox	T-11 bounded system			220		D. Dezzani	Clayton
Tiny	Tiny11	Lower cost LSI 11 successor for terminal applications	On hold	700	750	1500	D. Dezzani	Clayton
Video	VT100	Display terminal successor to VT5X	09/78		515		E. Glazer	Clayton

GLOSSARY (The intention is to describe usage rather than to define. First Customer Ship is shown for products in development.)

11 family, 16-bit PDP-11 processors, including:

11/03, low-end QBUS CPU

11/03L, large cabinet 11/03

11V03, packaged 11/03 system

11/23, improved performance 11/03 replacement, same price, using Fonz double board, FCS ?

11V23, packaged 11/23 system (RX02 floppy), FCS ?

11T23, packaged 11/23 system (RL01 disk), FCS ?

11/34, midrange CPU

11/44, 11/34 with commercial instruction set and physical address extension, FCS Q4/FY79

11/48, higher-performance 11/34 and 11/44 replacement at 11/34 cost, FCS FY82

11/60, midrange CPU

11/68, lower-cost 11/74 replacement, FCS Q4/FY80

11/70, current high-end 16-bit PDP-11 processor

11/74, 11/70 with commecessor, twice 11/70 performance in native mode, equal to 11/70 in compatibility mode

11/780MP, multiprocessing 11/780

150 MB removable, NDS disk product, FCS FY80

50 MB removable, NDS disk product, FCS FY81

6250 GCR, industry interchange standard tape products, 6250 BPI, group code recording technology

ADDS, Applied Digital Data Systems, Inc., terminal manufacturer

APL, high-level programming language

ATT, American Telephone & Telegraph

AZTEC, 4-8 MB removable rigid low-end disc, FCS FY81

Baud, data transfer rate in bits per second

BISYNC, IBM's synchronous communication protocol

BLISS, system software development tool

Bounded System, system designed with pre-defined limits to configuration extensibility

BPI, bits per inch, density of tape storage

Bubble, magnetic domain (bubble) memory technology

CCD, charge coupled device memory technology

CDC, Control Data Corporation, CPU, disk, etc., manufacturer

CEREBUS, code name for the 11/74 MP project, FCS Q3/FY79

CIS, commercial instruction set for improved COBOL performance

COMET, medium VAX CPU, next down from 11/780, FCS Q1/FY80

CPU, central processing unit

CTS-300, commercial operating system for DIBOL program development and execution

DBMS, data base management system

DC11, dual asynchronous line interface

DDCMP, Digital Data Communications Message Protocol

DG, Data General

DH11, 16 line programmable asynchronous multiplexer

DIBOL, Digital Business Oriented programming Language

DJ11, 16 channel asynchronous multiplexer

DL11, asynchronous line interface

DLV11, QBUS asynchronous line interface

DML11, four-line synchronous multiplexer, FCS FY79

DMP11, UNIBUS full DDCMP synchronous interface with local line driver, FCS FY79

DMV11, QBUS full DDCMP synchronous interface with local line driver, FCS FY80

DMA, direct memory access

DNA, Digital Network Architecture

Dock-merge, bring products or components together for shipment as a system without full Final Assembly and Test Procedure

DOD, language to be specified for all Department of Defense contracts

DQ11, synchronous (BISYNC) DMA interface

Drop-ship, ship products or components directly from manufacturing or warehouse location without Final Assembly and Test Procedure

DS-310, commercial packaged system

Dumb Terminal, terminal that includes no integral processing capability

DU11, synchronous interface

DUP11, non-DMA synchronous line interface for DDCMP, SDLC, HDLC, BISYNC

DUV11, QBUS synchronous line interface

DV11, synchronous/asynchronous 16 line multiplexer

DZ11, 8-line asynchronous interface with modem control

DZV11, QBUS 4-line asynchronous interface

D/IAS, See IAS

EBAM, Electronic Beam Addressable Memory technology (e.g., BEAMOS)

F4+, FORTRAN IV Plus programming language

FCS, first customer ship date

FHO, fixed head option for disks

Floppy, flexible disk medium, diskette

Fonz (F-11), higher performance LSI-11 QBUS replacement, FCS 12/78

FPP, floating-point arithmetic instruction processor

GCR, group code recording tape technology

GSD, IBM's General Systems Division, marketer of Series 1 and System/3

Hard copy, terminal producing printed output

HDLC, Higher Data Link Control communication protocol

HMOS, higher-level NMOS technology

HP, Hewlett-Packard

IAS, large multi-user time-sharing operating system with real time capability, incorporating RSX-11D

Interface, intermediary between a device controller and the processor bus

IPS, inches per second, tape travel speed

Iron, hardware sold without supporting software

IT, intelligent terminal, a terminal with programmable processing capability
IT100, family of intelligent terminals

K2, operating system kernel for RSX-11M+

Kernel, operating system base including application-independent system resource allocation capability, to be used as nucleus of an operating system family (e.g., K2 Kernel, VMS Kernel)

KMC11, intelligent interface

LA00, low cost table-top 300 baud hard copy terminal, FCS 11/78

LA36, hard copy terminal

LA120, 1200 baud, fully optioned hard copy terminal, FCS 9/78

LA180, hard copy printer

LA1200, 1200 baud LA00, FCS ?

LDP, Laboratory Data Processing

LSI, large scale integration semiconductor circuits

LSI-11, current PDP-11 LSI chip set

LSI/VAX, low-end VAX CPU, next down from NEBULA, FCS FY82

MASSBUS, high performance controller-device interconnect

MB, Mb, megabyte

MBM, magnetic bubble memory technology

MDP, Medical Data Processing

MLP, Maynard List Price

MOS, metal oxide semiconductor technology

MP, mP, multiprocessor

MUX, data multiplexor

M+, operating system, enhanced functionality of RSX-11M, short for RSX-11M+

NDS, intelligent subsystem to control disk and tape drives, FCS FY81

NEBULA, small VAX CPU, next down from COMET, FCS FY81

NMOS, N-channel or nitride MOS technology

OEM, original equipment manufacturer, incorporates DEC products into his own products for sale including significant added value

OS, operating system

Packaged System, preconfigured base system sold as a single product

PAX, physical address extension to overcome maximum memory addressable in a 16-bit machine

PL/1, high-level programming language

PMI, processor-memory interconnect, generic

Protocol, the predefined exchanges between system elements necessary for communication of data

QBUS, lower cost standard bus for low-end PDP-11 CPUs

PULSAR, code name for LSI-11 multiprocessor project

Rack & Stack, general purpose components for OEM and end-user product lines

R80, 143 MB fixed disk drive, FCS FY80

R81, 286 MB fixed NDS disk drive, FCS FY81

RAM, random access memory

RAMP, reliability, availability, maintainability program

RDS, remote diagnosis service

RK05J/F, 2.4 MB removable/5 MB fixed low-end disk drives

RK06/RK07, 14 MB/28 MB removable mid-range disk drives

RL01, 5.2 MB removable low-end disk drive

RL02, 10 MB removable low-end disk drive, FCS Q4/FY79

RM02/RM03, 67 MB removable mid-range disk drives

RMS, ISAM file management system

RP04/RP05, 88 MB removable high-end disk drives

RP06, 176 MB removable high-end disk drive

RP07, 292 MB fixed high-end disk drive, FCS Q3/FY79

RP07+, 542 MB fixed high-end disk drive, FCS FY80

RP08, 542 MB fixed high-end NDS disk drive, FCS FY80

RS03/RS04, .5MB/1.0MB fixed head disk drives

RSTS, RTST/E, high performance time sharing operating system

RSX, RSX-11D, M, M+, or S operating system

RSX-11D, see IAS above

RSX-11M, real time multiprogramming operating system

RSX-11M+, RSX-11M functionality with multiprocessing capability

RSX-11MP, see RSX-11M+

RSX-11S, small execute-only operating system, requires host RSX-11M system

RT, RT-11, low-end real-time operating system

RT/C, Real Time/Computation Systems POT

RX01, .25 MB floppy disk

RX02, .5 MB floppy disk, FCS 8/78

RX03, 1.0 MB floppy disk, FCS Q4/FY79

RX0X, 204 MB floppy disk, FCS ?

RXT-11, bounded system developed with product line funds, same product space as IT100D

SBI, Synchronous Backplane Interconnect for VAX-11/780

SCS, Small Commercial System, FCS Q1/FY80

SDLC, IBM's Synchronous Data Line Control communication protocol

SNA, IBM's System Network Architecture

Smart terminals, non-programmable terminals with some processing capability

Soft copy, terminals that display text without printing it

SS/T, Small Systems and Terminals POT, (also T/SS)

STC, Storage Technology Corporation

SUPERSTAR, large VAX successor to 11/780, lower cost and improved performance, FCS FY82

TDM, time-division data multiplexor

TE16, 800/1600 BPI, 45 IPS tape drive

TI, T/I, Texas Instruments

Tiny, T-11, lower cost LSI-11 successor for terminal applications, FCS ?

TOPS-20, DECsystem 20 operating system

TPS, transaction processing system, now called TRAX

TRAX, transaction processing system

T/SS, Terminals and Small Systems POT (also SS/T)

TS03, 800 BPI, 12.5 IPS tape drive

TS04, 800/1600 BPI, 45 IPS tape drive, FCS FY79

TS6250, 1600/6250 BPI, 22-45 IPS NDS tape drive, FY81

TTL, transistor-transistor logic technology

TU10, 200/556/800 BPI, 45 IPS tape drive

TU45, 800/1600 BPI, 75 IPS tape drive

TU58, 256 byte cartridge, FCS 11/78