2020

BUSINESS PLAN

R. H. BINGHAM
REV. 0
FEBRUARY 12, 1977

CHAPTER 1

SUMMARY

1.1 IDENTIFYING INFORMATION

1.1.1 Project Name 2020

1.1.2 Project Number E6309252

1.1.3 Revision Number 0

1.1.4 Funding Status Budgeted

1.2 OVERVIEW

1.2.1 People

Product Manager -	Tom Campbell
ENGINEERING MANAGER -	Ron Bingham/Tom Dundon
Principle Engineer -	Bob Reid
Microcode Engineer -	Don Lewine
I/O Designer -	Fred Doll
Memory Designer -	Steve Pomfret
Software TOPS-20 -	Ron McClean
Software Networks -	Dave McClure
Manufacturing -	Tom Porada
Material Planner -	Dan Hodgdon
Diagnostics -	Bob Petty

1.2.2 Goals

1. Get to market as quickly as possible to meet current competive challenges.

2. To provide the basic tools necessary to reliably build and maintain the current 2020 design.

1.2.3 Type Of Product - New Product

1.2.4 Product Description

The 2020 is the low cost member of the DECsystem-20 family of computers. It features .9 the performance of the 2040 at roughly a third the cost.

1.2.5 Co-requisites - 16K MOS Chip And RM03

1.2.6 System Costs

	MIN	AVG	MAX
FY78	$30K	$60K	$125K
FY79	$23K	$46K	$90K

1.2.7 Summary Schedule

Start Design	April 1, 1976
Operate Prototype	April 1, 1977
Limited Release	August 1977
Public Announcement	May 1978
First Customer Ship	October 1977

Estimated Product Life -2.5 years

Production

First Month of Vol. Prod.	4
Build Up Rate	2/month
Steady State Rate	32/MONTH
Total Life Vol.	654
Estimated Total Dev. Cost	$ 1.4M
Planned Development Manpower	22 man-years
Price	$224K
Manufacturing Cost	$59.1K
Percent Mfg. to MLP	26%
Manufacturing Yield	100%

1.2.8 Relation To Other DEC Products And Overall DEC Strategy

There has considerable discussion about the probable impact of the 2020 on STAR and the 11/70. The appropriate question to be asked in these discussions is "Where do product gaps exist in DECs offerings that in the near term the 2020 could fill?". I believe the following areas are appropriate for the 2020:

1. Commercial medium cost system with a reasonable performance COBOL

2. A local processing system with a link to a larger DECsystem-10 or DECsystem-20 for use by timesharing utilities.

3. A DECsystem-20 front end

4. A low cost entry for DECsystem-20

5. An OEM DECsystem-20

6. A team computer for software development

7. A graphics design system

8. An ARPA net node

1.2.9 Risks

1.2.9.1 Multiwire - MUTIWIRE is a new technology to DEC and for the first year at least we will be single sourced.

1.2.9.2 FORECAST - We may have under estimated volume by at least a factor of 2

1.2.9.3 16K MOS - If 16K MOS volumes and yeilds are not high enough then the machine is limited to 128K wds of memory and our market penitration will be lower.

CHAPTER 2

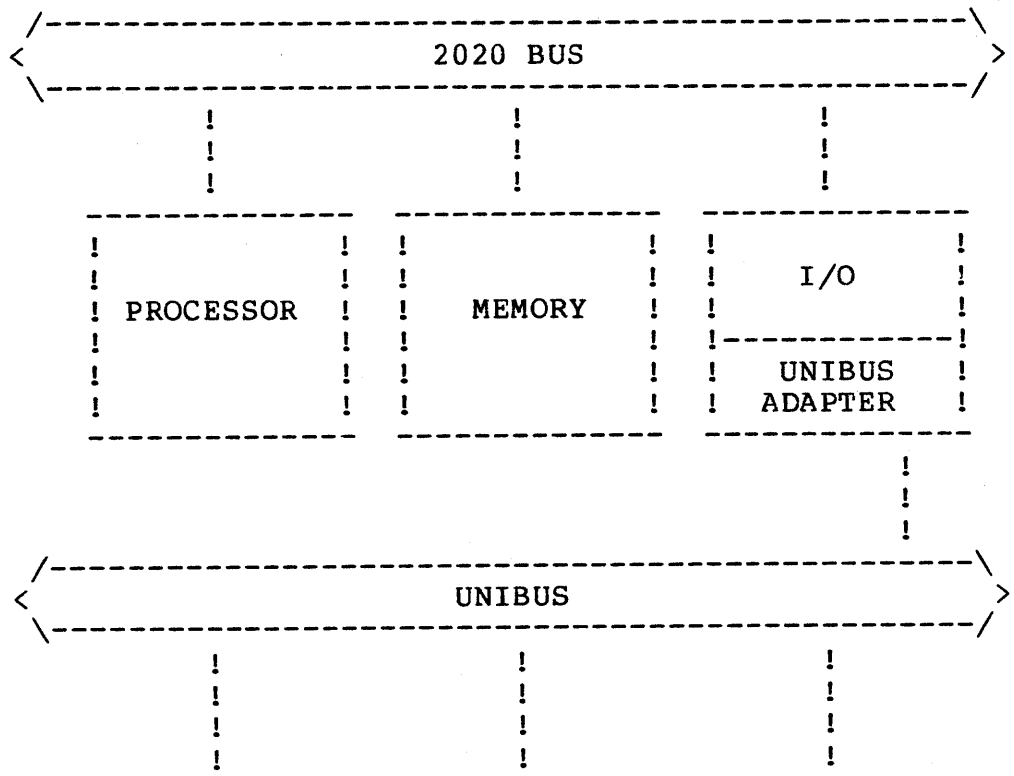
PRODUCT DESCRIPTION

2.1 DESCRIPTION

The 2020 is the low end member of the DECsystem-20 family of computers. The 2020 features somewhat less performance than the 2040 at roughly a third the cost.

2.1.1 System Organization

All system elements communicate over a common 50 line synchronous bus that carries clock signals, transmits commands, and multiplexes address and data.



PDP-11 PERIPHERALS

2.1.2 PROCESSOR

The 2020 processor consists of 5 extended hex boards.They are the data path boards DPE, DPM, the microstore boards CRA, CRM, and the console board CSN. The processor is implemented in low power Schottky TTL, featuring the AM2901 4 bit data path slice. Features are:

* 512 word virtual address write through cache
* 8 blocks of 16 fast general purpose registers
* Parity checking on the processor data path
* 8080 microprocessor to perform the console functions boot the system, and isolate detected parity errors
* Fast byte operations on 7 bit ASCII
* Virtual memory
* 2000 96 bit words of writable control store

2.1.3 MEMORY

The 2020 memory system consist of a single extended hex control module and up to 8 storage modules. Each storage modules contain either 16K of MOS memory or 64K of MOS memory depending on whether a 4K chip is used or a 16K chip is used.
Memory features are:

* 1.050 us cycle time
* Single bit error correction
* Double bit error detection
* Up to 128K words of 4K MOS
* Up to 512K words of 16K MOS

2.1.4 I/O

All I/O to the 2020 takes place over the 2020 backpanel bus and slots are provided for up to three additional extended HEX module interfaces. The maximum throughput of the 2020 is limited by the memory cycle time which is 1050ns. In addition a 2020 bus to UNIBUS adapter is provide which allows PDP-11 peripheral to be attached.

NOTE:

The full bandwidth of the UNIBUS is available to peripherals unlike PDP-11 systems in which peripherals compete with the CPU for bus cyc_es.

The following peripherals will be supported:

1. RH11
2. RP04
3. RP06
4. TU45
5. RM03
6. DZ11
7. KMC11
8. DUP11
9. LP20
10. LP05

2.1.5 Speed

In a general scientific mix we believe the 2020 to be roughly .9 times 2040 performance.

2.1.6 Error Rates

To be supplied.

2.1.7 Environment

Class A

2.1.8 Reliability / Maintainability

The systems reliability is determined primarily by the RM03.
MTBF: 2000 hrs MTTR: 3hrs

2.1.9 Physical Characteristics

Weight : unknown
Size : 1 standard corporate cabinet.
CPU : 5 12"X15.5" extended hex modules
MEMORY : 1 extended hex control module plus up to 8 extended hex storage modules.
UNIBUS ADAPTER : 1 Extended hex module.
The CPU, MEMORY, UNIBUS ADAPTER, and RH11 are all contained in the bottom section of the cabinet in a single card cage. The remaining peripheral controllers are housed in a BA11K in the top portion of the cabinet.

2.1.10 Corporate Buses

UNIBUS
MASSBUS

2.1.11 Power Requirements

RH11, CPU, MEMORY, UNIBUS ADAPTER and RH11 consume less than 500 watts. See appropriate specs for standard '11 peripherals.

2.1.12 System Programming

The 2020 will be supported in release 3 of TOPS-20

2.1.13 Maintenance Philosophy

The maintenance will be done on a board swap basis except for the memory array which will employ chip replacement . A remote diagnosis facility will be provide in the hardware.

2.2 RANGE AND FLEXIBILITY

	MIN	AVG	MAX
CPU	1	1	1
MEMORY	128K	320K	512K
RM03	1	2	7
ASYNC LINES	8	16	32
TU45	0	1	4
SYNC LINES	0	1	2
LP05	0	1	1

2.3 OTHER CONSIDERATIONS

2.3.1 Relationship To Other DEC Products

2.3.1.1 To Existing DEC Products - The 2020 fits into DECs product offering slightly above the 11/70 and below STAR.

2.3.1.2 Other Products That This Product Is Dependent Upon -

1. 16K MOS
2. RM03
3. TOPS-20 Release 3

2.3.2 Standards To Be Followed

DEC std 102 class A environment

2.4 POSITION ON TECHNOLOGY

The 2020 takes advantage of the current industry trend toward Low Power Schottky, 16K MOS memory chips and Switching Regulator power supplies.

2.5 TECHNICAL RISKS

The technical risks on this project have been kept to a minimum in order to meet schedule and development cost constraints. No more than a dozen IC's do not have Dec part numbers and purchase specs.

CHAPTER 3

MARKET DESCRIPTION AND REQUIREMENTS

3.1 THE NEED

There currently exists in the market a need which DEC can uniquely satisfy, that need can be characterized as follows:

1. The requirement to maintain a central data base
2. The desire to distribute computing power to departments or remote locations in order to:
    1. Place the processing and control of data near the source
    2. Improve overall data processing reliability and availability by eliminating dependence on a single large vulnerable facility .
3. The need for easy communication and interchange between remote and central site
4. The need to easily distribute the processing load among sites as the organization changes

Current attempts at meeting this need have taken two forms:

1. A central computer with Remote Job Entry stations This approach suffers from several difficulties:
    1. Load on central system is large when several JE's want to run at the same time.je
    2. If central computer is down , every body is down
2. A central computer with a network of distributed CPU's (different from the central CPU). This approach eliminates the problems that RJE's have , but has the following difficulties.

1. Requires personnel to know and develop softwarer on two or more systems

2. Requires significant software overhead in both the central and remote sites to maintain communications protocol

3. Different data and file formats make media interchange difficult

3.2 THE DISTRIBUTED HOST SOLUTION.

With the advent of DECsystem-2020 there is a third solution to the above market needs: The 2050 running TOPS-20 software provides the large central facility, while the 2020 running the identical software provides the remote "mini" functions. This approach has none of the disadvantages of the previous solutions, while offering the following advantages:

1. As a distributed system, computation does not depend on a continuously available communications line or a central computer.

2. Since the remote site has significant data reduction and data base maintainence capability the need to transfer large amounts of raw data continuously is greatly reduced and significant savings in line cost will result.

3. As a distributed system, software interchange, programmer and operator training, data base access and common communications protocol become simple, because there is only one operating system throughout the network.

4. Since all systems in the network can run all the software load leveling can occur.

5. Reconfiguration of the network to meet changing processing needs causes a minimum of dislocation - the software remains the same while the hardware changes.

3.3 APPLICATIONS

3.3.1 Schlumberger

Schlumberger has a world wide operation in which it uses a mixture of PDP-10's and remote minis to provide data reduction of oil exploration operations. They could benefit by being able to distribute low cost 20's which run the same data reduction programs as their central PDP10's thus reducing software conversion costs , training costs and communication costs.

3.3.2 Mobil

Mobile uses APL as their research language and different research problems have different local data bases. A 2050 with 2020's instead of RJE's would lessn the load on a central site and lessen their dependence on communication lines.

3.4 COMPETITION

	2020	COMPETITION
HP300 II 512KB	$182K	$235K
PRIME 400 1MB BUSINESS SYS	$212K	$284K
PRIME 400 1MB COMPUTATIONAL	$249K	$296K

3.5 PRICING

$100K Basic System Price(128k mem, 67MB disk, 8 lines)

* 128k wds Memory	$30k
* 67MB Disk	$18K
* Mag Tape	$25.2K
* Sync Line	$ 5K
* Line Printer 300	$21.5K
* 8 Async lines	$ 1.5K
* 1 Language	$ 8.2K

CHAPTER 4

FINANCIAL

4.0.1 Unit Cost Structure

COST FY78

MAINFRAME MATERIALS:

Component	Cost/unit	NO/min	Cost	NO/Avg	Cost
M8616	475	1	475	1	475
M8617	3050	2	6100	5	15250
M8618	350	1	350	1	350
M8619	425	1	425	1	425
M8620	750	1	750	1	750
M8621	750	1	750	1	750
M8622	700	1	700	1	700
M8623	975	1	975	1	975
CARDCAGE	400	1	400	1	400
BACKPANEL	350	1	350	1	350
POWER SUPPLY	1100	1	1100	1	1100
861C POWER CONTROL	100	1	100	1	100
CABINET/SKINS	500	1	500	1	500
DZ11 8 LINES	400	1	400	2	625
KMC11/DUP11	650	0	0	1	650
RH11	700	1	700	1	700
LP20	800	0	0	1	800
BA11	900	1	900	1	900
SWITCH PANEL	150	1	150	1	150
FAB SETS	250	1	250	1	250
CABEL SETS	200	1	200	1	200
OTHER/MISC.	500	1	500	1	500
	SUBTOTAL		16075		26900

PERIPHERALS

RMO3	6000	1	6000	2	12000
TU45/SKINS	4900	0	0	1	4900
LPO5	4700	0	0	1	4700
TERMINALS	700	1	700	5	3500
	SUBTOTAL		6700		25100

LABOR

MODULE ASSBLY + TEST	9	1890	12	2730
BACKPANEL MODS (10 HRS)	1	200	1	200
CABINET/OTHER ASSBLY (40 HRS)	1	800	1	800
2020 TEST (160 HRS)	1	3200	1	3200
SYSTEM LEVEL ECO'S (10 HRS)	1	200	1	200
SUBTOTAL		6290		7130
TOTAL		29065		59130

COST FOR FY79

MAINFRAME MATERIALS:

Component	Cost/unit	/min	Cost	/Avg	Cost
M8616	440	1	440	1	440
M8617	1886	2	3772	5	9430
M8618	322	1	322	1	322
M8619	386	1	386	1	386
M8620	722	1	722	1	722
M8621	731	1	731	1	731
M8622	511	1	511	1	511
M8623	681	1	681	1	681
CARDCAGE	400	1	400	1	400
BACKPANEL	350	1	350	1	350
POWER SUPPLY	500	1	500	1	500
861C POWER CONTROL	100	1	100	1	100
CABINET/SKINS	500	1	500	1	500
DZ11 8 LINES	400	1	400	2	625
KMC11/DUP11	650	0	0	1	650
RH11	700	1	700	1	700
LP20	800	0	0	1	800
BA11	900	1	900	1	900
SWITCH PANEL	150	1	150	1	150
FAB SETS	250	1	250	1	250
CABEL SETS	200	1	200	1	200
OTHER/MISC.	500	1	500	1	500
	SUBTOTAL		12515		19848
PERIPHERALS					
RM03	6000	1	6000	2	12000
TS04/SKINS	2200	0	0	1	2200
LP05	4700	0	0	1	4700
TERMINALS	700	1	700	5	3500
	SUBTOTAL		6700		22400
LABOR					
MODULE ASSBLY + TEST		9	750	12	1000
CABINET/OTHER ASSBLY		1	600	1	600
2020 TEST (80 HRS)		1	2400	1	2400
SYSTEM ECO'S			100		100
	SUBTOTAL		3850		4100
	TOTAL		23065		46384

ASSY & TEST BBD & PILOT MFG

PARTS ORDERING

MACHINE DEFINITION

DRAFTING

MECH/IND DESIGN

DESIGN QUALIFICATION

MEMORY ARRAY

IC/GR TEST

MICROCODE

DIAGNOSTICS

DOCUMENTATION

MANUFACTURING

PILOT ASSY & TEST

MFG.

ETCHED BDS

PHASE INTO PILOT SYSTEMS AS AVAIL

CONT'D. ENGRG SUPPORT

PLANNING ACTION REQUIRED:

~~A. INDICATE INTERRELATION SHIPS~~

B. TIME ESTIMATES EA. ACTIVITY IN WEEKS (2.0) & MANPOWER ALLOCATION

C. MGMT. REVIEW & APPR'L.

D. ENTER DATA INTO PERTX AND GET REPORTS.

SM-10
PHASE II

PRELIM. PERT 3-2-77
REV A 3-29-77
REV B 4-26-77

(CK BERGER)

********** FINANCIAL SUMMARY **********

ACCTS REC: 3 MONTHS. WORK IN PROCESS: 4.7 MONTHS.

SD	SA.F	CS.F	PR.F	K$SALES	K$PC	PC%	RI%	K$DEV	D/S%	XOVR
0	1.0	1.0	1.0	111180	40696	36	111	3283	3.0	7907

YEAR		76/07	77/07	78/07	79/07	TOTAL	
SHP#		0	50	220	384	654	'SHIPMENTS
PRUP	1K	224	200	200	200	824	'PRICE (PER UNIT)
DSFX		0.85	0.85	0.85	0.85	3.4	'DISCOUNT FACTOR ON SALES PRICE
S S	1M	0	8.5	37.4	65.2	111	'SALES (NET)
C UC	1K	59.1	59.1	46.3	46.3	211	'COST (PER UNIT)
C X	1M	0	2.95	10.2	17.8	30.9	'COST
M SX	1K	0	900	0	0	900	'MANUFACTURING START UP
M OX							'MANUFACTURING (OTHER)
M.TM	1K	0	900	0	0	900	'MANUFACTURING FIXED COSTS TOTAL
F SX							'FIELD SERVICE SPARES
F EX							'FIELD SERVICE EDUCATION (TRAINING)
FWUX	1K	20	20	20	20	80	'FIELD SERVICE WARRANTY (PER UNIT)
F TF	1K	0	1000	4400	7680	13080	'FIELD SERVICE TOTAL
G MG	1M	0	3.64	22.7	39.7	66.2	'GROSS MARGIN
D HX	1K	300	913	800	800	2813	'HARDWARE DEVELOPMENT COSTS
D SX	1K	20	100	100	100	320	'SOFTWARE DEVELOPMENT COSTS
D OX							'DEVELOPMENT (OTHER) COSTS
TOTA	1K	0	50	50	50	150	'DEVELOPMENT PRODUCT MANAGEMENT
D TD	1K	320	1063	950	950	3283	'DEVELOPMENT TOTAL
SSUX		10000	10000	10000	10000	40000	'SOFTARE SUPPORT (PER UNIT)
SSTU	1K	0	500	2200	3840	6540	'SOFTWARE SUPPORT TOTAL
SAU	1K	22.3	22.3	22.3	22.3	89.5	'SALES COST (PER UNIT)
SATP	1K	0	1119	4927	8601	14649	'SALES COSTS TOTAL
M..M	1K	0	350	350	350	1050	'MARKETING
P.CN	1M	-0.32	0.61	14.3	26	40.6	'PRODUCT CONTRIBUTION
%PC%		0	7.2	38.4	39.8	36.6	'% PRODUCT CONTRIBUTION
C.EX	1K	75	184	56	0	315	'CAPITAL EQUIPMENT (INCREMENTAL)
NCF	1M	-1.55	-4.53	4.1	26	24	'(NET CASH FLOW) PRODUCT CONTBN BASED ON WIP AND ACCTS REC DELAY

DECSYSTEM-2020

THE

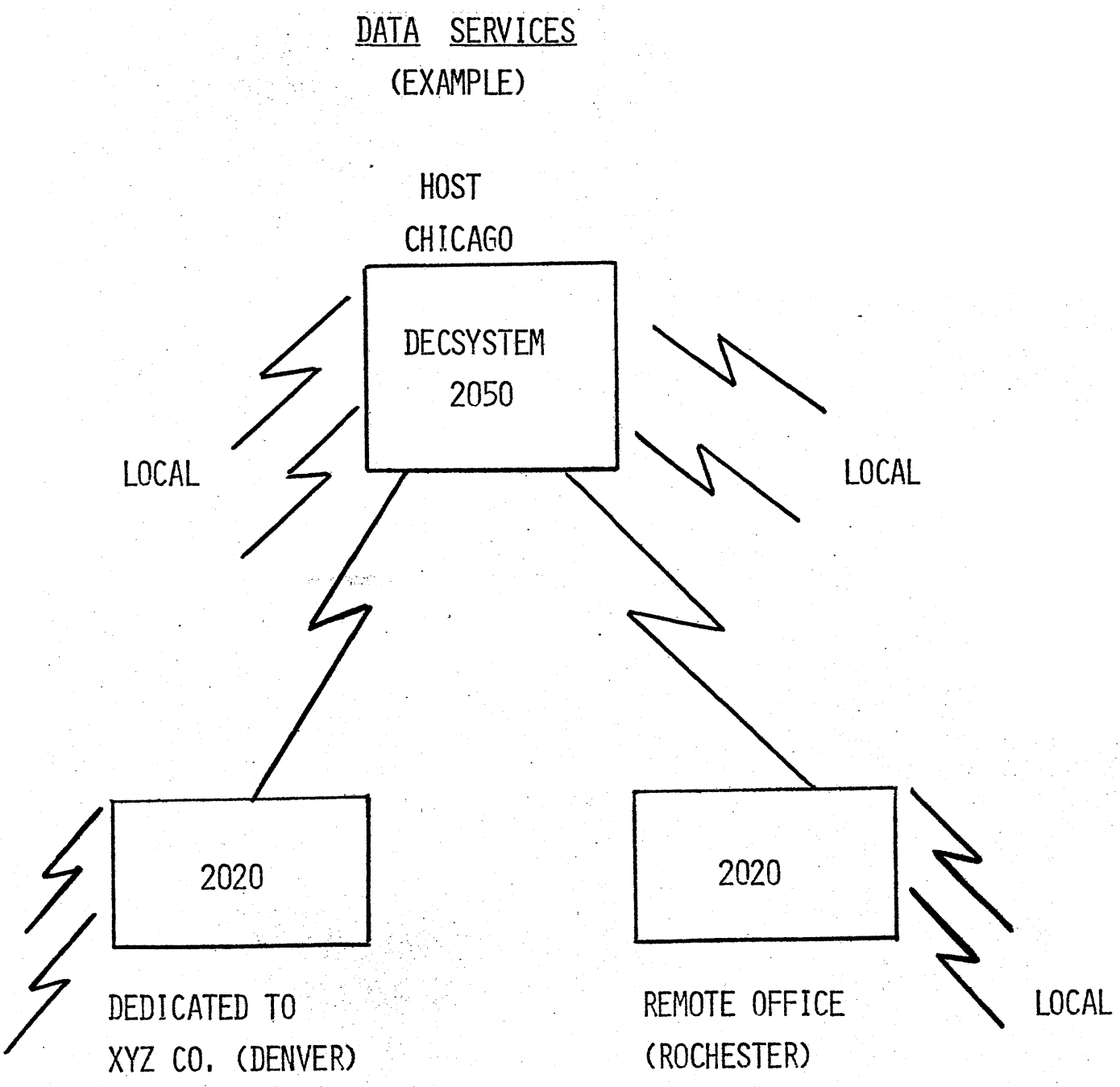
SATELLITE

COMPUTING

SYSTEM

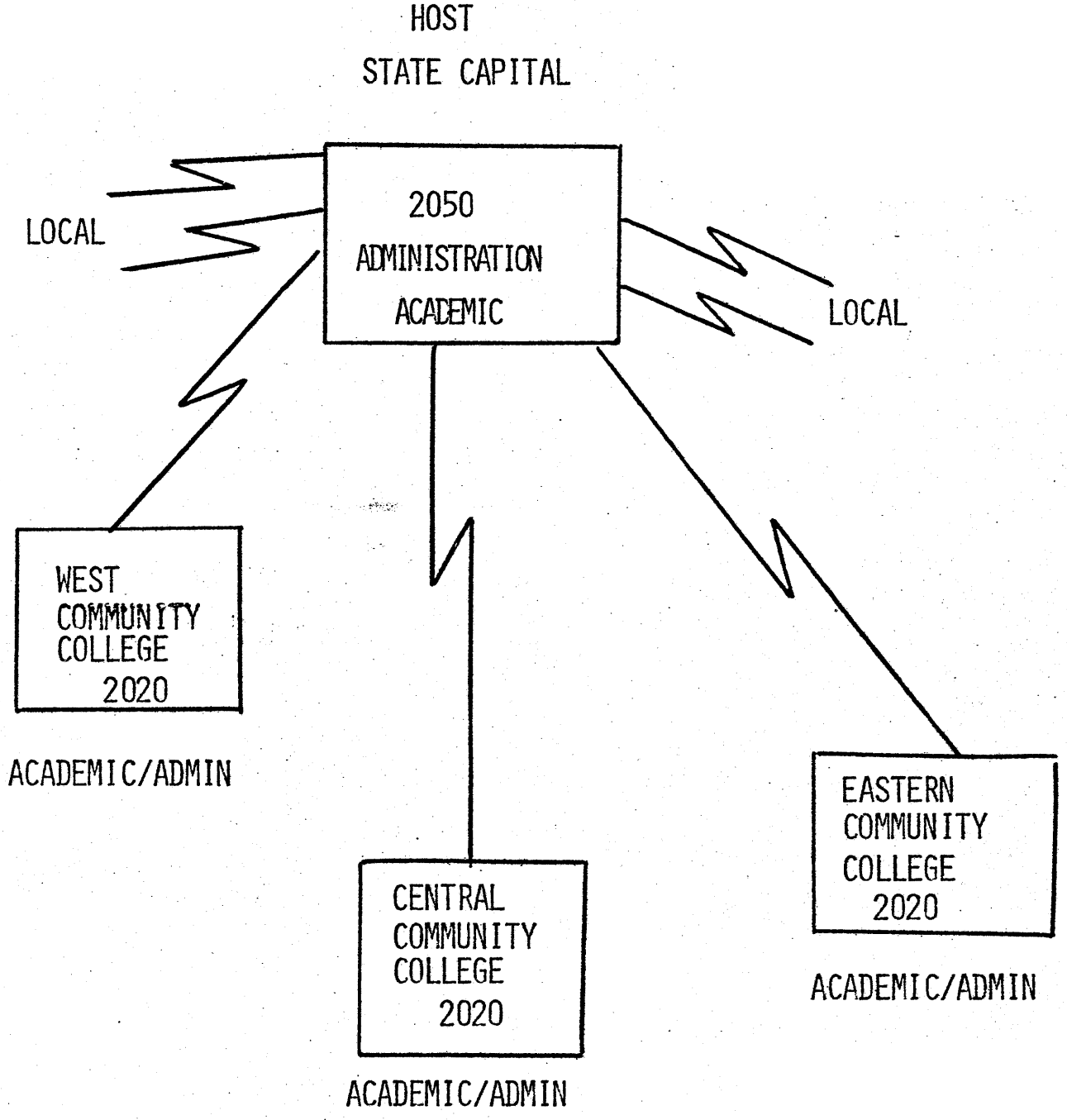
MARKET STRATEGY

- POSITION AS LOW-END SATELLITE AND ENTRY PRODUCT FOR DEC-20
- ESTABLISH NEW CONCEPT IN MINI COMPUTERS "THE DISTRIBUTED MAIN FRAME"
- SOLD IN FY78 TO TARGET ACCOUNTS ONLY WITH A VIEW TO SEEDING MARKET VOLUME SALES IN FY79 AND BEYOND
- ANNOUNCE AT 10/20 DECUS IN MAY 78
- FCS Q3 FY78 (NORAM)
  Q1 FY79 (EUROPE)


DATA SERVICES
(EXAMPLE)
HOST
CHICAGO
DECSYSTEM
2050
LOCAL
LOCAL
2020
2020
DEDICATED TO
XYZ CO. (DENVER)
REMOTE OFFICE
(ROCHESTER)
LOCAL

EDUCATION

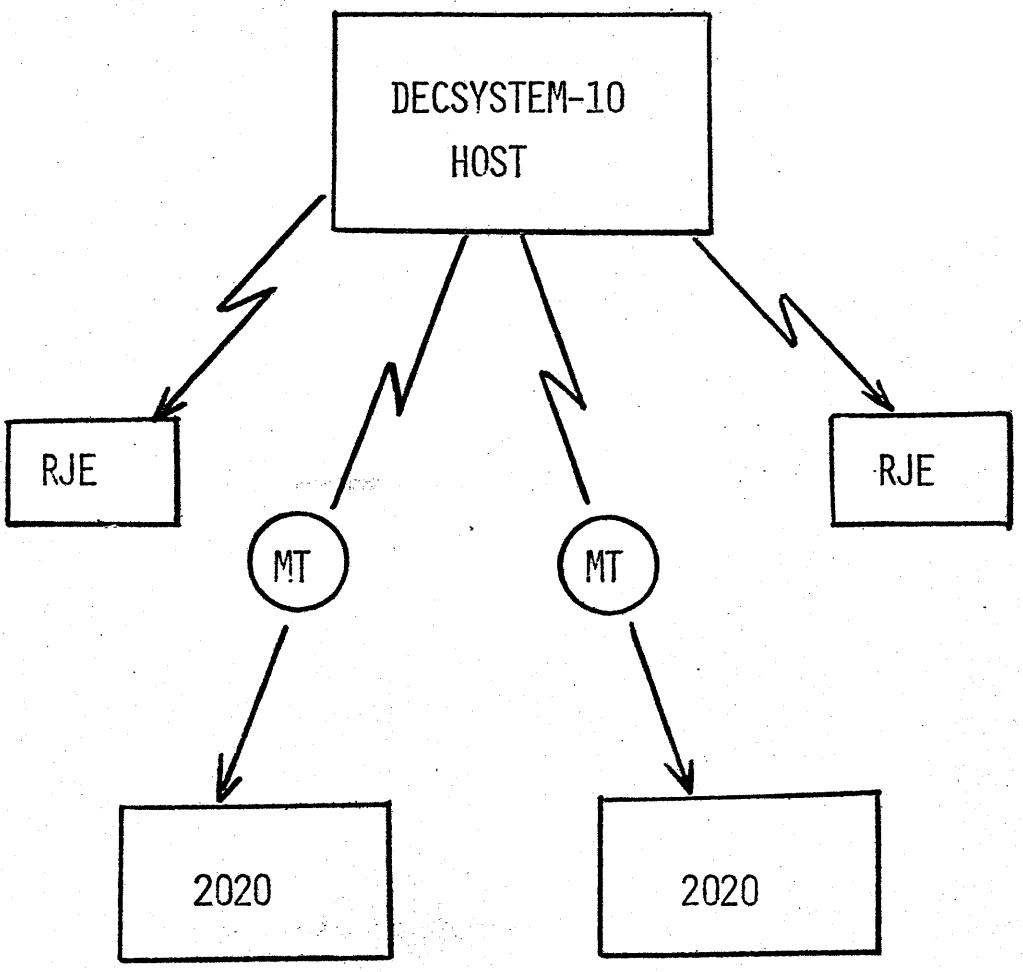
(EXAMPLE)



MINIMUM DEPENDENCE ON 2050 HOST

ENGINEERING/SCIENTIFIC

PETROLEUM DATA SERVICE

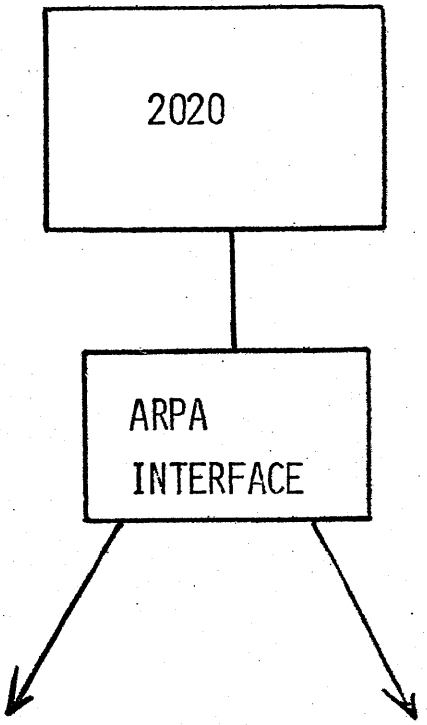


EXCHANGE MT ONLY

NOT DEPENDENT ON COMMUNICATIONS LINK TO PROCESS APPLICATIONS SOFTWARE AT REMOTE SITE IN NATIVE MODE

GOVERNMENT

A SATELLITE IN THE ARPA NET



CAN READILY INTERFACE TO ARPA PACKET SWITCHING NETWORK AND RUN DEDICATED MILITARY APPLICATIONS DEVELOPED UNDER TOPS-20.

WHEN DEC-20

&

WHEN PDP-11

- DEC-20 BEST SATISFIES:
  - NEED FOR MULTIPLICITY OF FUNCTIONS BATCH, LANGUAGES, TIMESHARING, ETC.
  - HIGH SOFTWARE INVESTMENT
  - HIGH COBOL USAGE
  - HEAVY PROGRAM DEVELOPMENT
- PDP-11 BEST SATISFIES:
  - DEDICATED APPLICATIONS
  - SINGLE LANGUAGE (BASIC OR FORTRAN)
  - NETWORK HARDWARE AND SOFTWARE
  - REAL TIME

SUGGESTED
DECSYSTEM-2020 PRICING
(BASED ON FY79 PROJECTED COSTS)

TYPICAL SYSTEM

DESCRIPTION	PRICE	XFER COST	MARK UP
• BASIC SYSTEM (128K WDS, 67 MB DISK, 8 LINES, SOFT. PKG.)	100K	24.5K	4:1
• ADDITIONAL EQUIPMENT			
• 128K WDS MEMORY	30.00K	4.3K	7:1
• 67 MB DISK	18.00K	6.0K	3:1
• 1 TAPE SUBSYSTEM	25.00K	4.9K	5.1:1
• 1 SYNC. LINE	3.00K	.7K	5.1:1
• 1 L.P. (300 LPM)	21.53K	5.5K	3.9:1
• 1 C.R. (300 CPM)	6.17K	1.4K	4.4:1
• 1 LANGUAGE	8.20K	--	--
TOTALS	$212.70K	$47.3K	4.5:1

DISCOUNT STRATEGY

VOLUME
CONTRACTS: OEM

QDA

* EDP

* NOT APPROVED

- COMBINE W/10'S + 20'S ONLY
- CORPORATE SCHEDULE

  TYPE I
  TYPE III

- CORPORATE T'S & C'S

2020 COMPETITIVE PRICING

	COMPETITION	2020
HP 3001I MOD 9 512K BYTES	$235K	$182K
(BUSINESS SYSTEM) PRIME 400 1 MEGABYTE	$284K	$212K
(COMPUTATIONAL SYSTEM) PRIME 400 1 MEGABYTE	$296.5K	$248.7K
VAX 512K BYTES	$182.5K	$155K

PRESENT COMPETITIVE SITUATION

11/70	BEATS	HP3000 II	ON BASIC
PRIME	BEATS	11/70	ON FORTRAN
HP3000 II	BEATS	11/70	ON COBOL
HP3000 II	BEATS	2040	ON PRICE
2040	BEATS	HP3000 II	ON PERFORMANCE OF COBOL & FORTRAN

H.P. IS EXPLOITING OUR PRICE GAP WITH COBOL

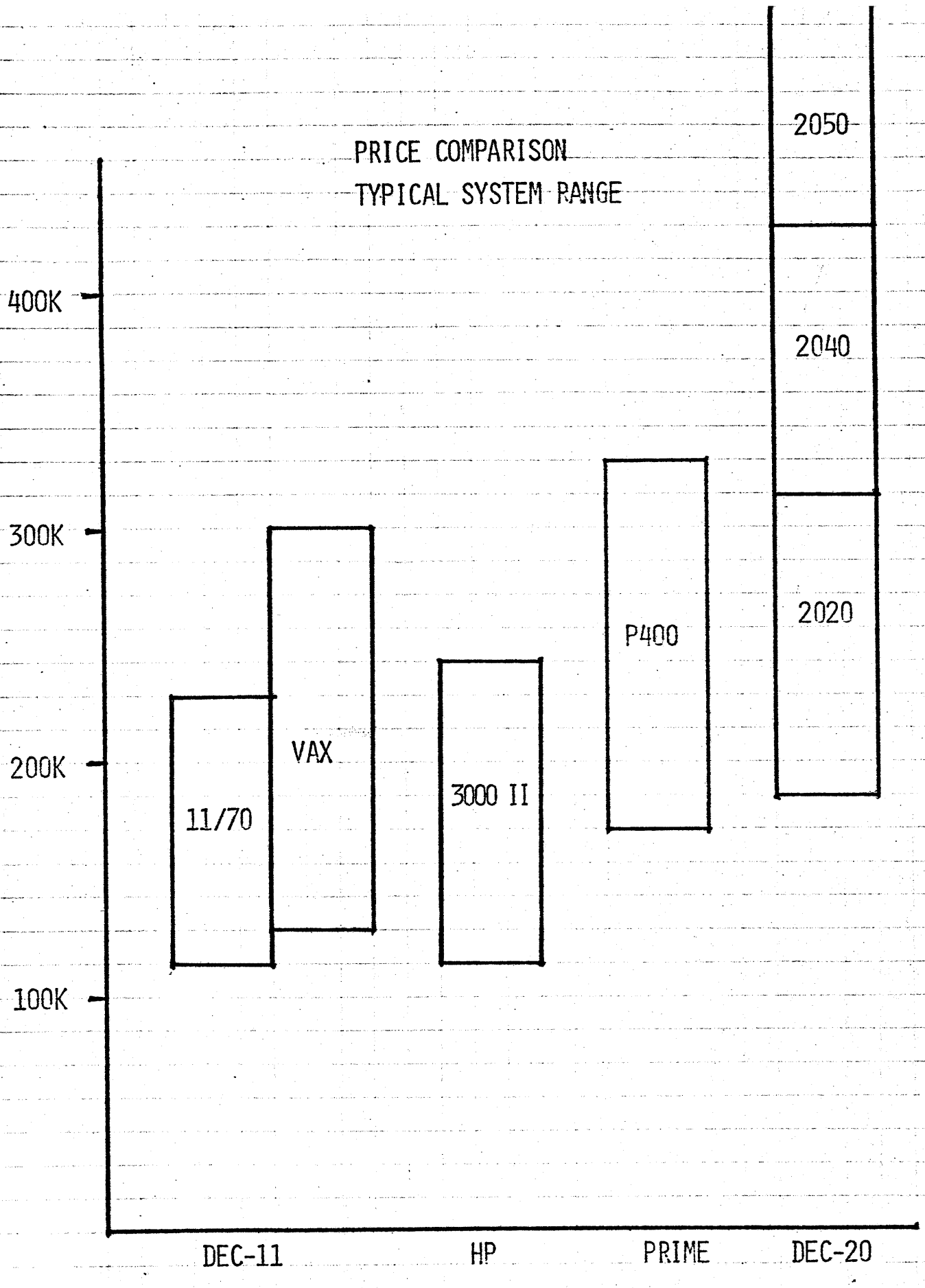
NEW SITUATION WITH VAX & 2020

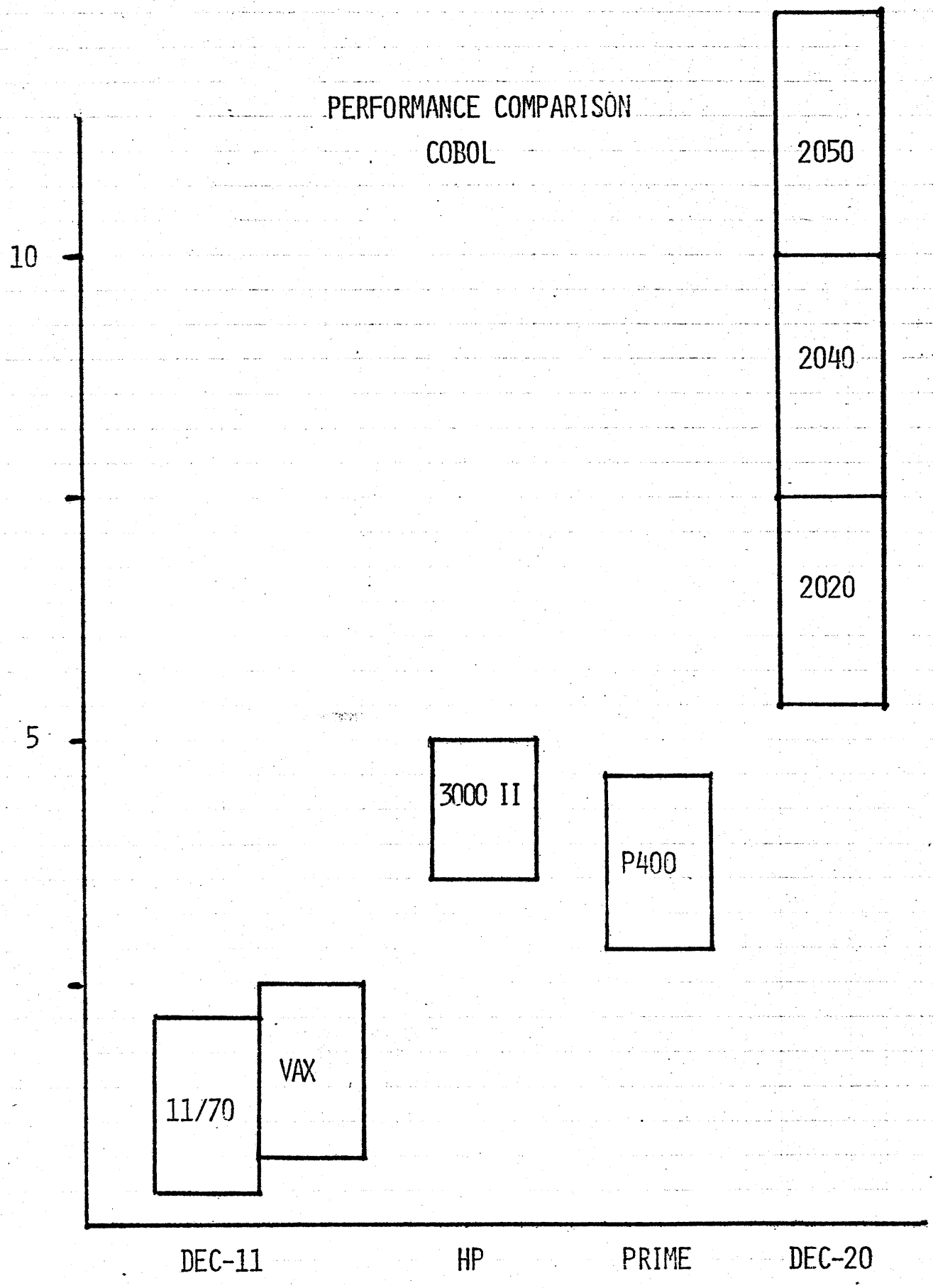
VAX	BEATS	PRIME	ON FORTRAN

2020 CLOSES PRICE GAP VS. H.P. AT CLOSE TO DOUBLE COBOL PERFORMANCE

CONCLUSION

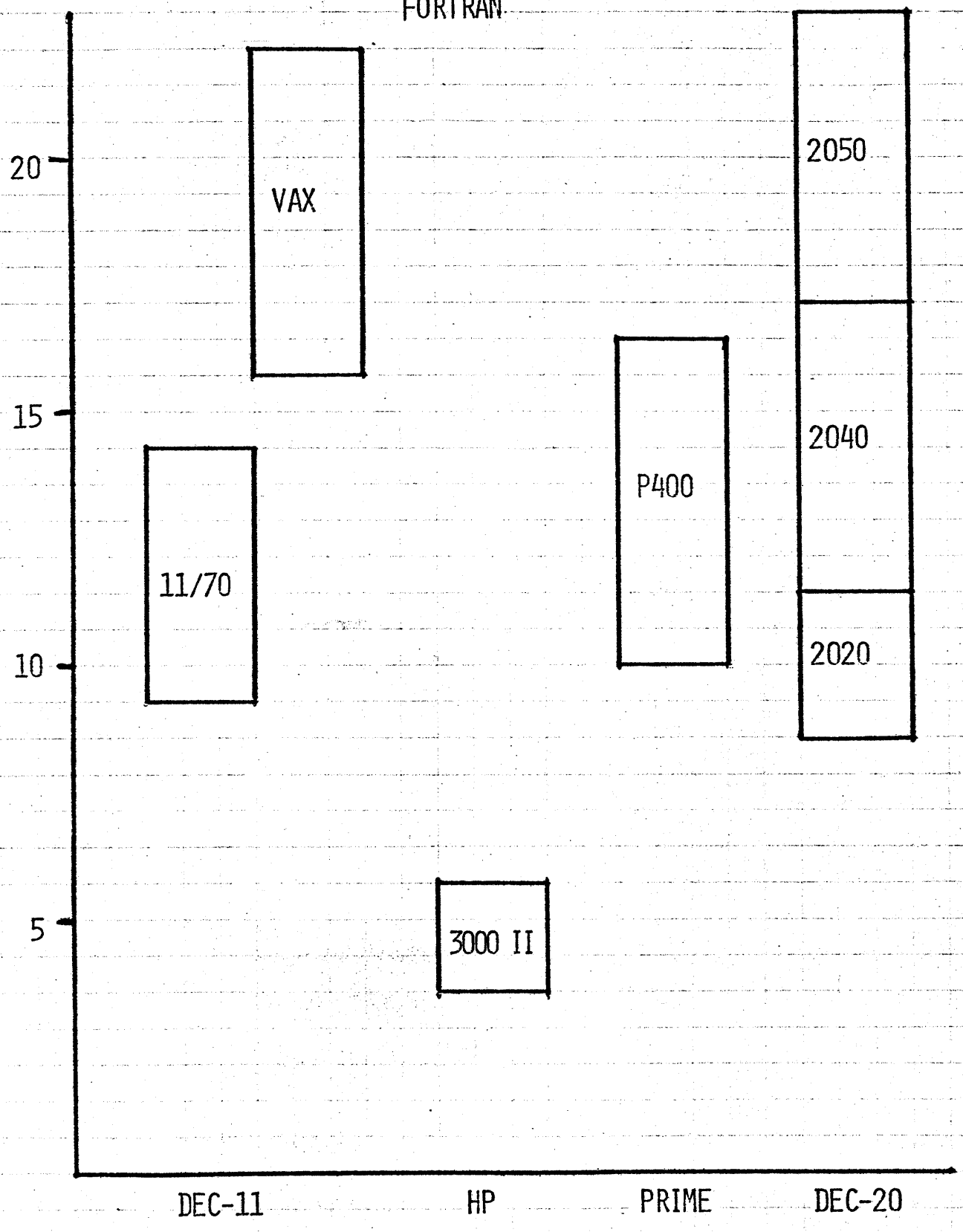
VAX	IS	FORTRAN	WINNER
2020	IS	COBOL	WINNER
11/70	IS	BASIC	WINNER


PRICE COMPARISON
TYPICAL SYSTEM RANGE
400K
300K
200K
100K
11/70
VAX
3000 II
P400
2050
2040
2020
DEC-11
HP
PRIME
DEC-20


PERFORMANCE COMPARISON
COBOL
10
5
2050
2040
2020
3000 II
P400
VAX
11/70
DEC-11
HP
PRIME
DEC-20

PERFORMANCE COMPARISON

FORTRAN



PERFORMANCE COMPARISON

BASIC