IBM SERIES 1

INPUT

ABOUT INPUT

Formed in 1974, INPUT has rapidly grown to become a leading business consulting company in the information processing industry. It specializes in market research, planning services, and special analyses for users and vendors of computer, and communications, and office products and services.

The company carries out continuous and in-depth research with vendors and users in the industry. Our staff analyze and interpret the complex and voluminous data derived from this research, based on their experience and the needs of clients. This information is presented concisely and understandably through reports and presentations. Useful recommendations and access to back-up data are strong points of our client relations.

INPUT's professional staff have, on average, nearly 20 years experience in the information processing industry. Most have had senior management experience in operations, marketing, or planning roles. This expertise provides INPUT with unique strengths attested to by the company's client base, which includes many of the world's largest companies.

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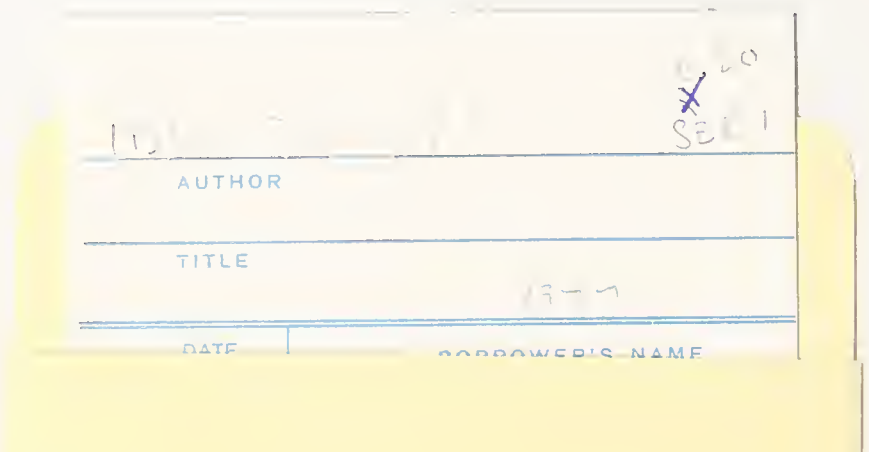

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IBM SERIES/1

USER ATTITUDES, PERIPHERAL OPPORTUNITIES, PRODUCT PLANS & COMPETITIVE IMPACT

SEPTEMBER 1977

SERIES/1

ERRATA:

SEPTEMBER 26, 1977

1. Page iv — Figure V-3, change BACKLOG to FUTURE REQUIREMENTS.

2. Page 6 — First bullet Section 'B' - First paragraph should read:

"Forty Series/1 users (about one third of the estimated total as of August 1, 1977) were interviewed. This group had a total of 64 units installed, 755 on order, and an anticipated need for 3132 additional units over the next five years."

3. Page 12 — Exhibit II-3, columns 5 and 7, all figures are in millions (M) of dollars.

4. Page 15 — Total of table should read 86% instead of 76%. On line below table, change 24% to 14%.

5. Page 39 — Under first bullet, Section 'B', change 457 to 293.

6. Page 41 — First bullet, Section 'B', change 2% to 18.9.

7. Page 42 — Exhibit V-3, change the word BACKLOG to FUTURE REQUIREMENTS.

SERIES/1

USER ATTITUDES, PERIPHERAL OPPORTUNITIES, PRODUCT PLANS & COMPETITIVE IMPACT

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SERIES/1

USER ATTITUDES, PERIPHERAL OPPORTUNITIES
PRODUCT PLANS & COMPETITIVE IMPACT

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I. INTRODUCTION

I INTRODUCTION

- The objectives of this Series/1 study were to:

  - Evaluate the users' reception (OEM as well as ultimate consumer) of the Series/1 and obtain his opinions about the product's strengths and weaknesses.

  - Forecast the product growth and market share through 1981.

  - Describe IBM's marketing organization.

  - Project IBM's product strategies.

  - Assess the impact of Series/1 on IBM plug-compatible peripheral suppliers, software and service companies, and direct Series/1 competitors.

  - Forecast the evolution of Series/1 hardware and software enhancements and expansions.

  - Comment on production rates and manufacturing costs.

  - Describe how competitors have reacted to the Series/1 thus far.

  - Report on how present users feel about using non-IBM supplied peripherals and software.

- Research for this report was based upon a series of telephone and on-site interviews as specified in Exhibit I-1.

- All interviews were conducted in July and August 1977.

EXHIBIT I-1

INTERVIEW SAMPLE BY TYPE OF INTERVIEWEE

TYPE	DESCRIPTION	INTERVIEWS
User A:	Purchased Series/1 from IBM for either in-house use or providing invoices to others	15
User B:	Purchased Series/1 from hardware integrator for process control application	1
System House:	Provides Series/1 software or turnkey system to the user	16
Hardware Integrator:	Provides Series/1 interface and/or sensor or control electronics and markets to the user	8
	Purchasers of Series/1:	40
IBM:	Marketing or Sales Representative specializing in Series/1 planning, sales or support	6
Competitor:	Minicomputer manufacturers who are presently or will likely in the future compete against the Series/1	7
Peripheral Manufacturers:	Potential suppliers of peripheral equipment and add-on memory for the Series/1	3
	Total Interviews	56

II. EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. ASSESSMENT OF THE SERIES/1: IMPACT ON THE MARKET

- Market pressures forced IBM to enter the minicomputer market with the Series/1. Internal pressures initially limited the scope of the Series/1 product line to minimize the financial impact on other IBM product lines.

- IBM's recently announced enhancements to the Series/1 as well as the systems and applications software developed by systems houses provide a very competitive product in the minicomputer market.

- As of August 1, 1977, IBM delivered approximately 200 Series/1 systems to external customers and almost an equal number internally for development, demonstration, and control applications.

- As of this same date, IBM's Series/1 backlog was approximately 5,000 systems. Almost 80% were from OEMs.

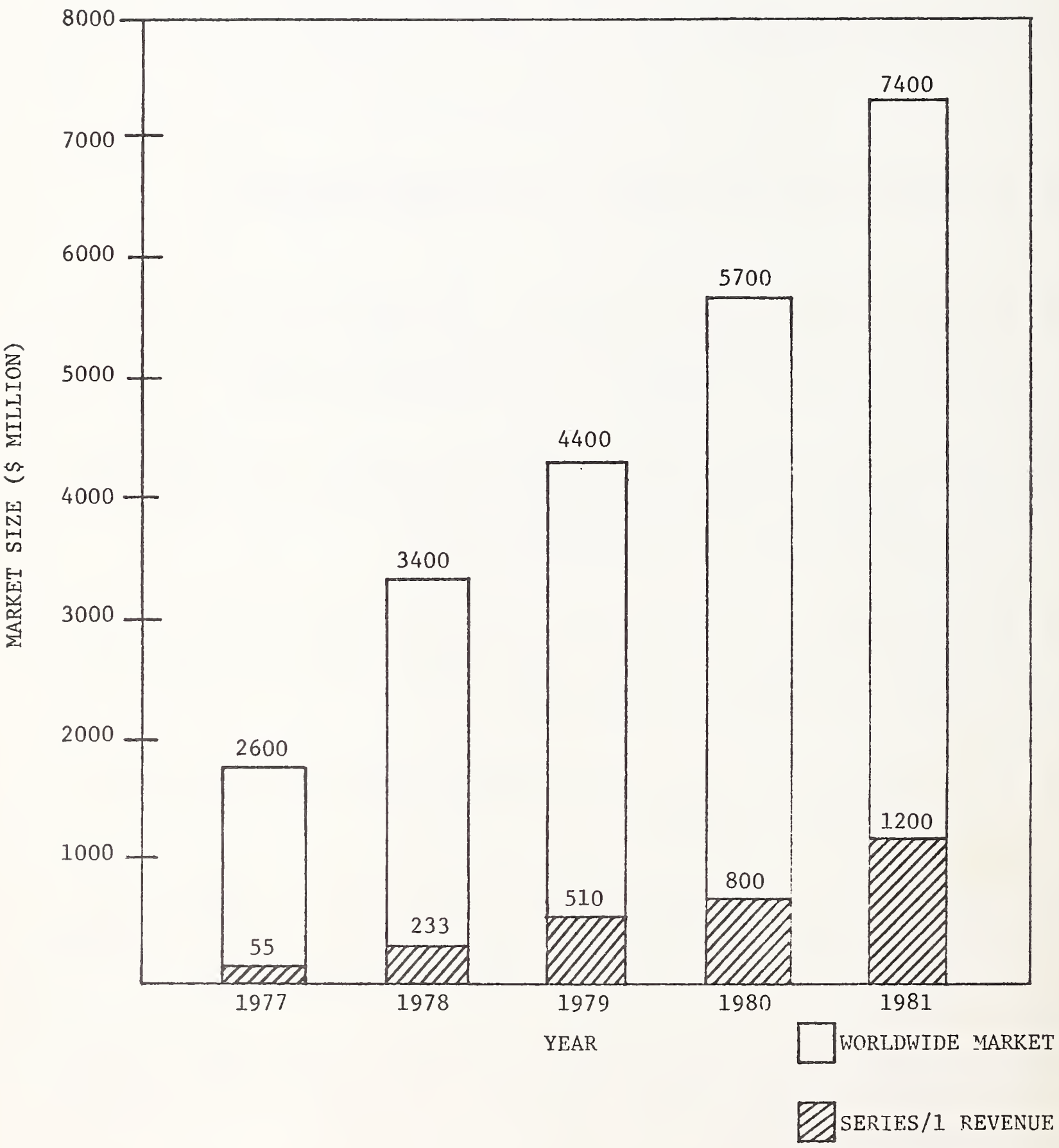
- As shown in Exhibit II-1, INPUT forecasts the value of IBM's Series/1 shipments to grow from $55 million in 1977 to $1.2 billion in 1981, a 16% share of worldwide minicomputer shipments of all U.S. based companies.

- This shipment rate will place IBM in the "top tier" of minicomputer vendors along with Digital Equipment Corporation (DEC), Data General (DG), and Hewlett Packard (HP).

EXHIBIT II-1

IBM SERIES/1 GROWTH IN THE

WORLDWIDE MINICOMPUTER MARKET



- INPUT estimates that, in 1977, the Series/1 will expand the total minicomputer market approximately 1%,and in 1981, approximately 8% because:

  - Some of the processing now done on large mainframes will be off-loaded to the minicomputers in a network configuration (e.g., "distributed processing").

  - The market will be opened up by the development of new applications.

- The Series/1 will gradually reduce the market share of the other minicomputer vendors.

B. USER REACTIONS TO THE SERIES/1

- Forty Series/1 users (about one third of the estimated total as of August 1, 1977) were interviewed. This group had a total of 63 units installed and a total of 3,134 on order.

  - 8 end users with 14 units presently installed are performing such applications as:

    . Electronic Fund Transfer (EFT).
    . Paper Mill Control
    . Energy Management Control

  - 16 systems houses with 16 systems installed are developing:

    . New languages.
    . Generalized application software.
    . Special systems.

- 16 hardware integrators with 33 systems installed developing applications such as:

  . Power management systems.
  . Interface boards for non-IBM peripherals.
  . Accounting systems.

- All 40 of the users interviewed were pleased with their Series/1s. A surprising reaction from the respondents (who were mostly OEMs) was their lack of concern that IBM does not offer a quantity discount on the Series/1.

- The most important reason voiced by the respondents for selecting the Series/1 was IBM's extensive maintenance capability. One user reported making an analysis of maintenance facilities and concluded that, on the average, IBM had a maintenance facility within 16 miles of its hotels, whereas DEC and Data General averaged 260 miles.

- Other important reasons (cited by interviewees) for selecting the Series/1 were:

  - Advanced architecture.

  - Excellent price/performance.

  - Interrupt capabilities.

  - The IBM name.

- Weaknesses as reported by respondents include the lack of software and a large capacity disk drive . However, these "weaknesses" are providing opportunities to software houses, peripheral manufacturers, and system integrators to develop software packages and interfaces for the Series/1.

- Users are more willing to consider non-IBM peripherals if their Series/1 is located in a large urban center where third party maintenance is readily available.

  - The more remote the system locations, the less willing the user is to consider non-IBM peripherals.

  - The non-IBM peripherals most likely to be purchased, in descending order are: CRTs, printers, magnetic tape drives, disk drives, and add-on memories.

C. IBM's SERIES/1 MARKETING ORGANIZATION

- In August 1977, there were approximately 250 IBM Series/1 field salesmen and 75 to 100 support engineers.

- The Special Systems Group, which initially reported directly to Atlanta, has now been decentralized into regions reporting to the General Systems Division.

- Salesmen's compensation, which was initially straight salary, has been modified and is currently set up to be about 80% salary and 20% commission.

- Salesmens' compensation includes base salary plus commissions based on a $500K annual quota.

- IBM's campaign to recruit non-IBM minicomputer salesmen met with limited success. Only 10%-15% of the total Series/1 marketing force was recruited from other manufacturers. However, the quality of these recruits is reported to be very high.

- There is a high level of enthusiasm and dedication among the Series/1 marketing team and some concern among the Series 32 and 34 salesmen who are worried about losing business to their Series/1 counterparts.

- Delivery time on the Series/1 is officially 6 months; however, it is possible to receive a system 60 to 90 days after ordering.

D. COMPETITOR ATTITUDES AND RESPONSES

- Generally, there was a lack of concern among the competitors interviewed about the Series/1. The reason for this attitude appears to be that the impact of a few lost orders has not yet been felt.

- In addition, some minicomputer vendors are quoting product deliveries of more than six months and therefore expect to lose business to the Series/1.

- Some of the competitors interviewed reported that they had not changed any products or prices due to the Series/1. Further, they felt that the Series/1 would have some competitive impact in the future, but all reported that they believed the impact will not be serious.

E. SERIES/1 SHIPMENTS

- Assuming IBM continues to support and enhance the Series/1 , shipments will increase from 2,000 units in 1977 to 37,000 units in 1981. Cumulative shipments by 1981 will be over 90,000.

- The largest cumulative share, 46%, of the shipments will go to OEM hardware integrators (41,000). End users will account for almost 33% of the cumulative shipments while system houses will take 21%.

- As Series/1 shipments increase from $55 million in 1977 to $1.2 billion in 1981.

  - End-user shipments will grow from $14 million (25%) in 1977 to $540 million (45%) in 1981. (Exhibit II-2).

  - The average end user system will have a higher value than the system shipped to OEMs because OEMs often integrate non-IBM hardware with their systems.

  - The reason for the shift to end user is the increased level of support provided by IBM for the Series/1 and the consequent ability of the end users to procure their equipment directly from IBM.

F. SERIES/1 IMPACTS AND POTENTIAL ADVANTAGES

- Each minicomputer company has one or more product lines which will be impacted by the Series/1. The greater the dependence on one product line, the more serious the potential impact.

- As shown in Exhibit II-3, the total Series/1 market for peripherals and main memories from all sources, including IBM, is about $3 billion for the period 1977-81. The non-IBM plug compatible market portion is projected to be:

-	Main memory:	30% of requirements, $100M
-	Disk drives:	20% of requirements, $160M
-	Tape drives:	20% of requirements, $ 90M
-	Line printers:	25% of requirements, $110M
-	CRTs:	40% of requirements, $180M

EXHIBIT II-2

SERIES/1 SHIPPING FORECAST TO

OEM'S AND END USERS

(1977-1981) ($ MILLIONS)

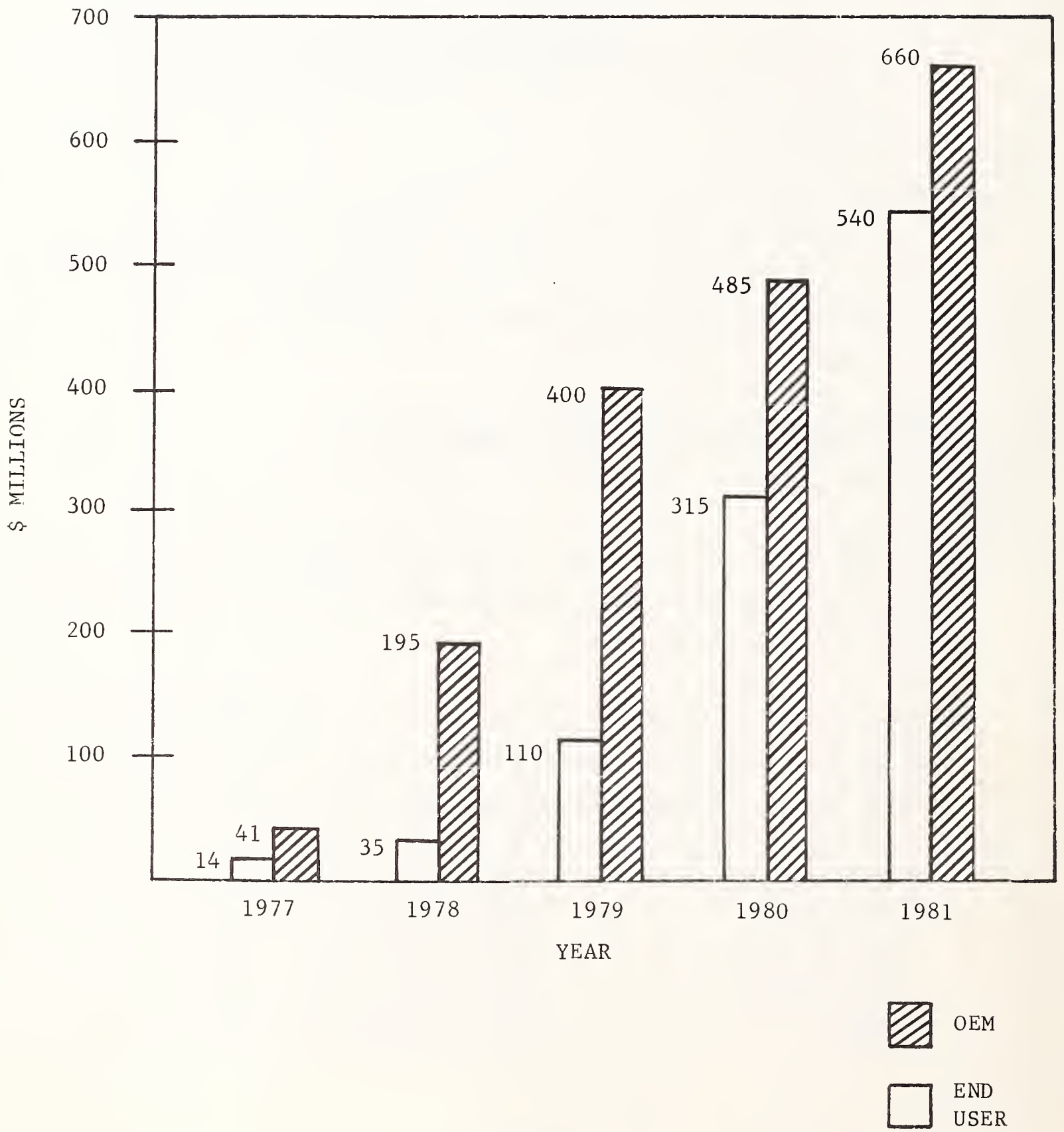


EXHIBIT II-3

PROJECTED SERIES/1 PERIPHERALS AND MEMORY SHIPMENTS FROM ALL SOURCES

PERIPHERAL	1977		1981		TOTAL 1977-1981	
	UNITS	$	UNITS	$	UNITS	$
MAIN MEMORY	64M BYTES	$ 5.6M	2,350M BYTES	$111.M	5,750M BYTES	$360.M
DISK DRIVES	2.0 K	17. M	37 K	370.M	90K	810.M
DISKETTE DRIVES	2.0 K	.5M	30 K	70.M	80K	150.M
TAPE DRIVES	.2 K	.7M	35.K	120.M	70K	245.M
PRINTERS, CHARACTER	2.0 K	5.6M	30.K	95.M	80K	240.M
PRINTERS, LINE	.2 K	2.5M	16 K	200.M	36K	430.M
CRTS	3.2 K	5.5M	130 K	220.K	265K	450.K
SENSORS (ALL)	1.8 K	2.7M	33.K	65.K	81K	160.K

- Non-IBM plug compatible low cost magnetic tape drives and disk drives for the Series/1 will be a $250 million market opportunity between now and 1981.

  - The primary opportunity is with systems installed either at central sites or in cities where third party maintenance is readily available.

  - The discount required to attract buyer interest ranges from 25% to 35% less than the IBM price.

- CRTs and character printers are the most acceptable non-IBM peripherals.

- Add-on memories will start selling in 12 to 18 months as additional applications are placed on existing systems. The more advanced software will require larger mainframe memories.

- Interfaces, sensors and special purpose devices will be installed by hardware integrators placing the Series/1 into process control and environmental control installations. This market will continue to grow steadily as increased emphasis is placed on energy conservation.

- The market for software and systems houses is $350 million between 1977 and 1981.

  - Programming development will have the largest revenue potential during the developmental stages of the Series/1.

  - As more software products become available and as the installed base of systems grows, the revenues of software products will overtake the programming services revenues.

- Processing services vendors having a large base of batch oriented small users, will be adversely impacted by the systems houses marketing the Series/1 as a small business computer. Competition will intensify as the quality and number of applications packages increases.

- Manufacturers and distributors of small business computers will be impacted by the Series/1 because of the product's excellent hardware features, the proliferation of installed systems and applications software, the IBM name, and IBM's substantial support and maintenance facilities.

G. SERIES/1 SELF IMPACT ON IBM

- The initial self-impact of the Series/1 on IBM is minor compared to the rate at which IBM is capturing OEMs from the other minicomputer vendors. The users surveyed reported the following "switches" to the Series/1.

From:	Percent of Sample
Other IBM Products	5%
DEC Products	30%
Data General Products	25%
Others	26%
	76%

(The other 24% have Series/1 only)

- As IBM and others continue to provide additional peripherals and applications software, the Series/1 will not only off-load applications from IBM central sites but will also impact the sales of Systems 32 and 34.

- INPUT believes that IBM will announce new hardware and/or software for the Series/1 every six months with the following products to be announced over the next 12-18 months:

- Increased mainframe memory capacity.
- Enhanced communications module.
- Larger disk capacity.
- Low cost magnetic tape transport.
- Direct memory access.
- Higher speed line printers.

- The rate at which IBM will announce new products will be based on considerations internal to IBM.

  - Competitive products from other minicomputer manufacturers as well as product announcements from vendors of plug-compatible peripherals and add-on memories will tend to accelerate the IBM product announcement timetable.

  - A greater than forecasted shift of customers from other (higher priced) DPD and GSD products will tend to decelerate the rate of the Series/1 announcements.

- IBM's strategy is to provide users with a choice:

  - Fully supported "ALL IBM" Systems such as Systems 32, 34 and 3 at a price 20% to 30% higher than the equivalent "unsupported" system. (Including a full complement of IBM application software and peripherals).

  - An "unsupported" system such as the Series/1 which is modular and can be easily interfaced with IBM or non-IBM peripherals and software. IBM will, however, only maintain system components of its own manufacturers.

- The series/1 is one of the most flexible and price competitive products announced by IBM to date. It is possible that it will be used as a building block in other systems. One possibility is that GSD will provide DPD with its own version of the Series/1, equipped with special instructions and software to facilitate interconnecting 370 series computers with terminals in an SNA environment.

H. RECOMMENDATIONS

- Minicomputer Vendors

  - The maintenance availability issue is the most important reason for selection of series/1 over the competition. Therefore, competitors should minimize this competitive advantage by: improving stocking and distribution of spares at the peripheral and board levels; simplifying diagnostic routines; establishing network facilities for running remote diagnostics; improving reliability (and, more importantly, become known for it); extending product warranties.

  - Establish expertise in specific software applications areas. Set up user groups built around these chosen specialties.

  - Keep one step ahead by offering the most advanced languages and other software tools.

  - Offer data base management software and/or firmware for larger users in distributed processing applications.

  - Stay ahead in the peripheral "features race".

  - Offer flexible lease/rental plans.

- Plug Compatible Peripheral Suppliers

  - Recognize that there may be a narrow "window" for a specific device prior to an IBM product announcement.

  - Establish relationships with large buyers of Series/1 such that devices can be "tailored" to fit particular applications requirements. Get into the procurement cycle very early.

  - Maintain a price/performance advantage of 30% to 40% over comparable IBM products.

  - Have superior spares stocking and distribution facilities.

  - Develop excellent diagnostics.

- Add-On Memory Suppliers

  - Orient marketing to multiple systems buyers.

  - Maintain a price/performance advantage of 30% to 40% over equivalent Series/1 memory.

  - Be able to show superior mean time between failures (MTBF).

  - Consider offering Series/1 plug-compatible CPUs.

  - Consider offering other peripherals to obtain marketing leverage.

  - Consider offering specialized back-end processors for functions such as data base management.

- Systems Houses

  - Systems houses should move as quickly as possible to become familiar with the Series/1 and to be ready to offer it in their products. The IBM name and maintenance facilities will open up previously unavailable new gerographic markets.

  - Generalized products based on series/1 that should be considered for development by systems houses include small business computers (stand alone), intelligent terminals, communications preprocessors and concentrators, batch terminals, data logging systems, and realtime (analog/digital) processing systems.

- Software Firms

  - There are several systems software products that will find market acceptance among Series/1 users, including:

    . Hi-level languages.
    . Data Base Management Systems.
    . Emulators for other minis, especially DEC, Data General, and Hewlett Packard systems.
    . Compilers and debugging systems that run on large computers and generate object code for the Series/1.
    . Communications software.
    . Programs for software conversion.

- This area is likely to become extremely competitive.

  - Applications software packages will not find ready market acceptance for another 12-18 months because most eary buyers of the Series/1 are developing their own software. Applications software firms should concentrate initially on developing custom software for single clients in their area of specialty.

- Processing services Vendors

  - Batch services firms who serve the business processing market should consider offering Series/1 based turnkey hardware as an upgrade to their present clients, becoming in effect "system houses".

  - RCS vendors should develop interface software with Series/1 so that Series/1 users can easily utilize their available networks and large scale processing and storage facilities.

  - RCS vendors who are planning to offer hardware systems as stand alone or satellite computers should offer Series/1-based units in their product line.

  - RCS vendors should sell on-line program simulation and debugging facilities for Series/1. Vendors who have these facilities could also offer professional programming and system design support services to Series/1 users.

III. DEFINITIONS

III DEFINITIONS

- **DATA PROCESSING DIVISION (DPD)**

  - IBM's division responsible for the design, manufacturing and marketing of IBM's medium and large size data processing systems.

- **END USERS**

  - Buys system from IBM and does his own programming, interfacing and installing.

  - Buys turnkey system from systems house or hardware integrator.

- **GENERAL SYSTEMS DIVISION (GSD)**

  - IBM's division responsible for the design, manufacturing, and marketing of IBM's small business computer systems and the Series/1.

- **HARDWARE INTEGRATOR**

  - Develops Series/1 interface electronics and controllers for non-IBM peripherals.

- Develops control system software and sensor electronics and integrates them with Series/1 hardware. Installs the total control system at end user sites.

- **MICROCOMPUTER**

  - 8 Bit computer on a chip used as a component.

- **MINICOMPUTER**

  - 16 Bit computer (could be on a chip) with limited application software and support.

- **SMALL BUSINESS COMPUTER SYSTEM**

  - Minicomputer based system used for general business data processing and for specialized industry oriented business applications.

- **SYSTEMS HOUSE**

  - Develops system software products for license to end users.

  - Develops turnkey systems, combining software, Series/1 hardware, and possibly non-IBM peripherals for sale to end users.

IV. BACKGROUND AND PROGRESS TO DATE

IV BACKGROUND AND PROGRESS TO DATE

A. IBM AND THE MINICOMPUTER MARKET

- The minicomputer market has grown 33% compounded annually over the last five years, while sales of large mainframes have grown at less than half that rate.

- The value of minicomputer shipments worldwide has increased from $500 million in 1972 to $1.9 billion in 1976 and is expected to reach $7.4 billion by 1981.

- The average pretax return on revenues of companies in the minicomputer industry was 16% in 1976.

- The distinction between minicomputers and small general purpose business data processing systems is becoming blurred as an increasing number of minicomputer manufacturers penetrate (either directly or through a distributor network) the small business computer market. Thus, minicomputer manufacturers are obtaining a larger share of the small business data processing system market, traditionally a preserve of the major mainframe manufacturers such as IBM, Burroughs and NCR.

- The minicomputer manufacturers have evolved in the last five years from supplying single function, special purpose low cost processors to providing the total computing needs of all types of organizations (except for the large mainframes).

- The continually growing integration of new, lower cost, more reliable components and memories have produced products with constantly improving price/performance.

- The minicomputer market continued to grow at over 30% per year and its products were beginning to penetrate into traditional "all IBM" accounts, winning competitively against the System 3, 32 and 7,and replacing the lower levels of the System 370. Thus, IBM had to react by introducing a competitive minicomputer product line.

B. REASONS FOR THE MARKET SUCCESS OF THE MINICOMPUTER

- Following is a summary of the major factors which have contributed to the success of the mincomputer industry.

  - Technical Reasons

    . Availability and utilization of new lower cost components.
    . Improvement in product reliability, throughput and maintainability.
    . Development of sophisticated operating systems, languages and applications software.
    . Development of multiclient interupt levels and higher speed modems.
    . Development of higher price performance peripherals.

- Economic Factors

  . Rapid decline in minicomputer prices.
  . Aggressive marketing practices by minicomputer manufacturers.
  . Favorable economic climate.
  . Growth of a support infrastructure of OEMs, Software houses, turnkey system houses and manufacturers of miniperipherals.
  . Profitability of the major suppliers encouraged investment in new companies.
  . Entry of new companies into the market helped maintain a price competitive invironment within the industry.

C. THE ORIGINS OF SERIES/1

- IBM's entry into the minicomputer market was neither sudden nor spectacular. IBM has had special purpose "minis" in the market for over 10 years.

  - The 1800, 1130, 5100, and System 7 for process control, scientific and engineering processing.

  - The System/3 and the Systems 32 and 34 for business data processing and the 4π for government work.

- What IBM has not had was a fully competitive general purpose minicomputer.
- In the well organized world of IBM, Series/1 could prove to be a two-edged sword which could impact not only IBM's competition but also the growth and revenues of other products produced and sold by the General Systems Division.

- However, IBM believed they had to make an agressive move into the minicomputer market place.

- Minicomputers were beginning to erode traditional IBM markets.

- The System 7 was overpriced and obsolete and its sales force was becoming discouraged.

- IBM was not participating in the phenomenal growth of the minicomputer market which was growing at 30% to 40% per year and approaching annual sales of $2 billion.

- In 1976 there were several "minicomputer" projects within IBM.

  - "Peachtree" with its offspring "Cling" and "Alberta" (GSD code names for their new minicomputer family).

  - A project to replace and upgrade the System 7.

  - A project to replace and upgrade the IBM 370 terminal controller.

  These projects were competing with one another. It was GSD vs. Special Systems vs. DPD.

- A minicomputer proposal went before the corporate committee 13 times before it was approved. To receive approval, the Series/1 would be introduced without software as a "bare bones" processor. The original objective was to provide potential Series/7 customers with a lower cost option.

  - The Series/1 was announced as an 8 bit addressable, 16 bit minicomputer with limited peripherals but a powerful I/O interrupt scheme designed for real time control applications.

- After receiving approval as a System/7 replacement to be marketed by the special systems group, GSD adopted the Series/1. The market targeted by GSD are the sophisticated large system customers for applications in distributed processing networks.

  - In this environment, minicomputers are used as concentrators, message switchers, and terminal controllers.

- Despite its announced System Network Architecture (SNA), IBM was losing market share to the minicomputer and intelligent terminal suppliers.

D. MARKET DEVELOPMENT OF THE SERIES/1

- GSD offered the Series/1 to 17 large IBM customers (some whom had previously requested price quotes on minicomputers) on a non-disclosure basis.

- Of the 17 potential customers originally contacted by IBM, 14 agreed to take the Series/1. Among them; Citibank, Quaker City Motor Parts, Champion International Paper, and Standard Oil of Indiana. These customers are developing special purpose software for their in-house requirements and will integrate the Series/1 into their networks as a concentrator, communications controller or remote tab entry processor.

- The preannouncement and test marketing started in April 1976, and the official announcement and initial shipments began in November 1976.

- There are indications that IBM was forced into announcing the Series/1 sooner than originally planned by Citibank (a test market site) intending to exhibit the product at a banking show in Honolulu.

- The Series/1 overseas announcement and shipments took place in May 1977, six months after its introduction into the U.S. market.

- Initially, IBM maintained control over Series/1 installations, however, OEM's have started buying Series/1, beginning a new phase in the product life cycle.

- Knowledgeable OEMs have recognized that the Series/1 is:

  - A powerful minicomputer.

  - A competitively priced product.

  - An opportunity to ride the IBM bandwagon.

- A large number of system houses and software vendors have decided to market the Series/1 and began ordering systems.

  - In fact, 75% of early orders were to OEMs to IBM's complete surprise. (IBM's planners expected the ration to be reversed).

E. SERIES/1 PRODUCT ANNOUNCEMENTS

- IBM has announced both new products and lower prices (e.g.; lower priced main memory, an enchanced CRT, a higher speed printer, PL/1, a 3790 emulator and a very powerful real time operating system (See Exhibit IV-1,2,3).

- Additional Series/1 product announcements are expected in September/October 1977. Probable introductions are a low cost magnetic tape transport (project Matterhorn), and a Winchester technology (3340) removable disk storage drive.

- Thus, within the period of 1 year, IBM will have expanded its product scope from a bare bones, competitively priced minicomputer to an industry-supported system with an excellent operating system, good higher level languages (PL/1, Fortran), established maintenance, excellent user "uptime" records and an expanding array of peripherals.

EXHIBIT IV-1

SERIES/1 PRODUCTS ANNOUNCED AS OF APRIL 1977

HARDWARE		OLD PRICE $		NEW PRICE $	
OLD	NEW	PURCHASE	MAINT.	PURCHASE	MAINT.
4953 Processor A-16 KB Max 64KB Max 4 I/O		4,360	80.00	4,360	80.00
B-16KB Max 64KB Max 13 I/O		5,190	78.00	5,190	78.00
	C-32 KB-Max 64KB Max 4 I/O Locations	-	-	*5,870	88.00
	D-32KB-Max 64KB Max 13 I/O Locations	-	-	*6,700	88.00
	6316 32KB Storage	-	-	*2,425	22.00
4955 A 16KB Max 64KB Max 8 I/O		6,165	77.00	6,165	77.00
B 16KB Max 64KB Max 3 I/O		6,165	77.00	6,165	77.00
	C 32KB Max 64KB Max 10 I/O	-	-	*7,195	87.00
	D 32KB Max 128KB Max 7 I/O	-	-	*7,915	87.00
	6326 32 KB Storage	-	-	*2,850	14.00
6315-for 4953 Processor 16KB Memory Module		1,800	10	**1,510	10
6325-for 4955 Processor 16KB Memory Module		2,040	8	**1,750	8

* NEW PRODUCTS
** NEW PRICES

EXHIBIT IV-2

SERIES/1 PRODUCTS ANNOUNCED IN APRIL 1977

	HARDWARE DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
5630	4973 Line Printer Attachment	940.00	5.00
5700	4973 Printer Attachment Cable Increment	13.00	—
5701	4973 Printer Attachment Cable Basic	82.00	—
5720	4978 Display Attachment Cable Increment	13.00	—
5721	4978 Display Attachment Cable Basic	82.00	—
5740	4979 Display Attachment Cable Increment	13.00	—
5741	4979 Display Attachment Cable Basic	82.00	—
6335	Storage Address Relocation	805.00	9.00
4973	1 Printer 150 LPM	8,624.00	85.00
	2 Printer 400 LPM	12,425.00	158.00
4999	2 Battery Backup 208, 230V	1,875.00	18.00
4978	Display Station-Screen	1,350.00	
	KB	835.00	
	RP	1,350.00	

EXHIBIT IV-3

SERIES/1 SOFTWARE PRODUCTS ANNOUNCED APRIL 1977

PROGRAM TYPE	DESCRIPTION	MONTHLY PAYMENT
5719-SC2	Stand Alone Utilities (SCP)	No Charge
5719-PA1	Base Program Preparation Facilities	$90.00/month (payment waived after 24 months)
PRPQ P82508	Control Program Support	$15.50/month (payment waived after 24 months)
PRPQ 5799-TAE	4979 Display - CPS Support	$ 1.50/month (payment waived after 24 months)
PRPQ 5799-TAF	Binary Synchronous Communications - CPS Support	$ 3.50/month (payment waived after 24 months)
PRPQ 5799-TAH	Indexed Access Method - CPS Support	$ 5.00/month (payment waived after 24 months)
PRPQ 5799-TAK	4978 Display Station - CPS Support	$ 6.00/month (payment waived after 24 months)
PRPQ 5799-TAL	CPS Extension I	$ 1.50/month (payment waived after 24 months)
PRPQ 5799-TAQ	CPS Extension II	$ 1.50/month (payment waived after 24 months)

EXHIBIT IV-3 (CONT'D)

SERIES/1 SOFTWARE PRODUCTS ANNOUNCED APRIL 1977

PROGRAM TYPE	DESCRIPTION	MONTHLY PAYMENT	or	ONE-TIME CHARGE
5719-PC1	Realtime Programming System (RTPS)	$20		$1,200
5719-AS1	Program Preparation Subsystem (PPS)	18		1,104
5719-PL1	PL/1 Compiler and Resident Library	46		2,784
5719-PL3	PL/1 Transient Library	5		288
5719-F01	FORTRAN IV Compiler and Object Support Library	14		864
5719-F03	FORTRAN IV Realtime Subroutine Library	5		288
5719-LM1	Mathematical and Functional Subroutine Library	7		408

F. SERIES/1 HARDWARE AND SOFTWARE DESCRIPTION

- IBM's Series/1 is currently a family of small computers, capable of economically performing real time and commercial applications for multiple systems users.

- Series/1 offers a modular approach to general purpose computing; a user selects the storage size, processing speed and assortment of equipment that best meets his needs...including attachment up to 256 individual devices, both standard and custom built.

- With the exception of printers and display terminals, all Series/1 units fit into a standard 19-inch rack enclosure.

- The Series/1 is designed to attach equipment a user may already have (e.g.; non-IBM terminals...plotters...teletype units...sensor type devices).

- The Series/1 features realtime 16-bit architecture, bipolar LSI logic circuitry, up to 1.6 megabyte per second cycle steal channel, MOSFET N-channel memory, 4 level priority interrupt structure, microprocessor device control and up to 207 instructions.

- To enhance programmer productivity, IBM provides a real time operating system to manage systems resources. Real time and batch applications in a multiprogramming environment can be processed simultaneously.

- PL/1 and Fortran offer programming support for such applications as scientific computing, commercial jobs, and sensor-based data handling.

- Service is emphasized by IBM by utilizing built-ins, like microverification, internal parity checking, and status reporting for signal input and output, and a variety of portable diagnostic tools designed to quickly pinpoint equipment problems.

- The Series/1 has two basic processor models; the 4953 and the 4955. Both are 16 bit processors capable of addressing up to 128K bytes of main memory (using the optional storage address relocation translator feature) and have the capability to address up to 256 I/O devices. Their basic throughput rates are, however, not equivalent on a benchmark basis because of the differences in I/O channels and software support.

- The average instruction execution rate in the 4955 is three times that of the 4953. The memory cycle time is 800 nanoseconds in the 4953 and 660 nanoseconds in the 4955. Maximum data transfer rate is 1.2 megabytes per second in the 4953 and 1.6 megabytes per second in the 4955.

- Standard features of the central processors include hardware byte manipulation, hardware multiply/divide, parity checking, eight general purpose registers, and four levels of priority interrupt. Options include floating point hardware, add-on memory, programmer consoles, memory mapping, timers and power fail safe.

- Peripherals include a disk storage unit, a diskette unit, two printers, and two display stations.

  - The 4962 disk storage unit is a moving arm non-removable media disk drive with storage capacity of 9.3 megabytes and an optional 122 kilobytes of head per track storage.

  - Another model of the same disk utilizes the fixed head area and thus provides 13.8 MB of moving head storage.

  - The 4964 diskette unit stores from 492 to 606 kilobytes of data depending on format on a dual sided removable diskette.

  - The 4974 printer has a speed of 120 CPS and is a wire matrix printer.

  - The 4973 impact printer has two models whose print speed varies from 155 to 414 lines per minute.

- The 4979 display station has a keyboard with 66 keys and a CRT capable of displaying 1920 characters (24 lines of 80 characters per line).

- The 4978 display station provides up to 256 keyboard codes. Keyboard code and display character generator format are user definable and RAM loadable from processor storage.

- Sensor I/O is based on the 4982 unit into which a variety of sensor cards are mounted. The major sensor I/O functions supported are digital input/output, process interrupt, analog input/output, multiplexing, and external synchronization. The user is required to construct all cables to these cards to ensure that appropriate voltage levels and time durations are met.

- Communications I/O consists of asychronous, bisynchronous and synchronous data link control. All functions are implemented on cards which can be plugged into either the processor or the I/O expansion chassis. Data links which are supported inlcude point-to-point, switched, non-switched and multipoint. Half-duplex lines are supported while full duplex lines are not.

G. NINE MONTHS ACCOMPLISHMENTS WITH THE SERIES/1

- In nine months from the date of the Series/1 introduction, IBM has:

  - Entered the rapidly growing general purpose 16 bit minicomputer market.

  - Strengthened the corporate commitment to the distributed processing concept.

  - Developed a system that can be used for process control, energy management, manufacturing data collection, data communication control, and local and remote information processing-among the more significant applications.

- Delivered a processor whose instruction set is microprocessor controlled enabling users to change the instruction set in order to meet specific application requirements.

- Manufactured a product having factory margins of 80%-85%. This is achieved because IBM can utilize the same peripherals for the Series/1 as those utilized on the System 32 and 34.

- Offered a lower cost alternative to the System 7.

- Delivered between 150 and 250 Series/1 systems as of August 1, 1977 to external customers and 150-200 internal to IBM.

- Achieved a backlog of approximately 5,000 Series/1 systems without offering either an OEM volume discount or a rental/leasing program.

V. RESULTS OF THE SURVEY-ANALYSIS OF USERS

V RESULTS OF THE SURVEY - ANALYSIS OF USERS

A. DISTRIBUTION OF ORDERS AND SHIPMENTS

- Exhibit V-1 shows the surprisingly strong order rate of OEMs, particularly hardware integrators.

  - Of the 64 systems installed by respondents, 75% have been delivered to OEM purchasers: 36% to system houses and 39% to hardware integrators.

  The backlog statistics are even more dramatic. Of the 755 systems reported on order, :

  - End users account for only 22%.

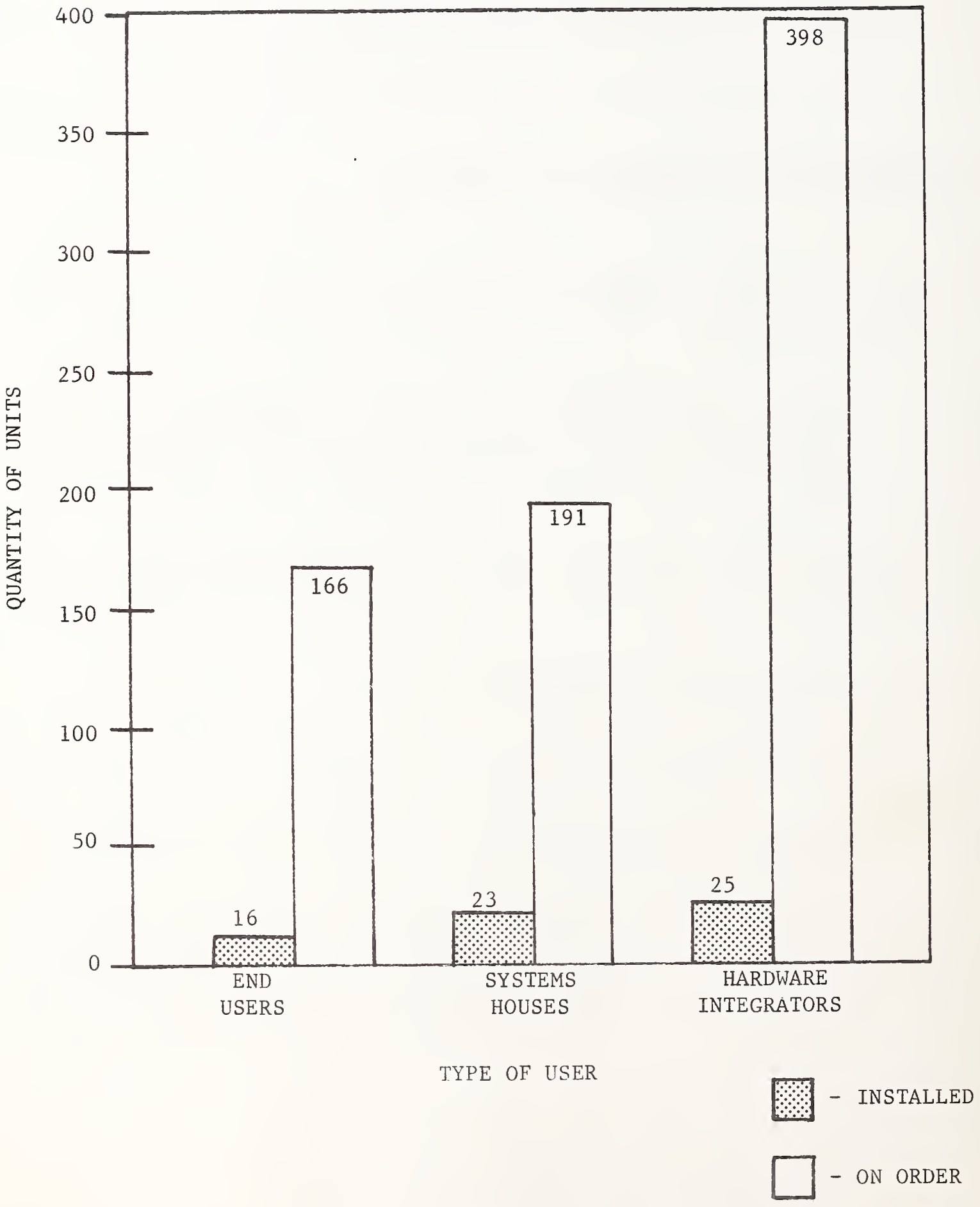
  - Systems houses for 25%.

  - Hardware integrators for 55%.

- The initial order and sales pattern for the Series/1 indicates that this product is having a greater immediate impact on the minicomputer manufacturers than they are either aware of or willing to admit. (From INPUT's survey).

EXHIBIT V-1

SERIES/1 SYSTEMS: INSTALLED AND ON ORDER AS REPORTED BY RESPONDENTS AS OF AUGUST 1, 1977



- Since the market for minicomputers is growing at a 30% annual rate and Series/1 marketing efforts have just begun, it is probable that the major minicomputer manufacturers' competitive analysis and lost sales reports are just beginning to register losses to the Series/1.

  - This still represents a small proportion of their sales and is therefore probably not yet attracting a great deal of attention, especially in view of the fact that DEC's delivery schedules have stretched out to six months on certain products.

- End users, on the other hand, seem to be responding more slowly than forecasted by IBM. The user survey found this is primarily due to the fact that the higher level language software for the Series/1 will not be available until November 1977.

B. CONFIGURATION ANALYSIS OF SYSTEMS INSTALLED AND ON ORDER

- As shown in Exhibit V-2, over half (56%) of the Series/1 installed to date and on order are for the #4953 processor which is the smaller, slower model.

  - Of all the #4953s installed or on order, 457 or 64% of the respondents have only 16K of memory.

- The interview results indicate that when the Series/1 was first introduced it sold primarily in the process control environment as a System 7 replacement.

- Whereas the 4953s are primarily ordered with 16K bytes, most of the faster 4955 processors have a main memory of 64K.

  - Of the 362 4955 processors installed and on order, 94% have been ordered with 64K bytes of memory or larger.

EXHIBIT V-2

ORDERS PLACED BY RESPONDENTS

SERIES/1 CONFIGURATION SUMMARY

MAIN MEMORY (K BYTES)

PROCESSOR MODEL	16K	32	48	64	96	128	TOTAL
4953	293	138	3	23	-	-	457
4955	-	21	1	276	63	1	362

- The improved IBM software, including Real Time Programming Systems (RTPS) and PL/I, requires a minimum memory of 64K.

C. FUTURE PRODUCT REQUIREMENTS

- Twenty-eight of the forty (70%) companies interviewed had additional Series/I systems on order. The average number of on-order systems per company is 2%.

- Respondents report Series/I orders are, at present, heavily dominated by the control system application.

- Based on the user interview sample, over half the systems on order are from system integrators and 78% of all backlog is from OEMs. However, end users who represent only 22% of the total now will account for almost 37% by 1980. (See Exhibit V-3).

D. SHORT DELIVERY CYCLE

- Twenty-six of the 40 firms interviewed stated that IBM promised delivery of the Series/I within less than 90 days from receipt of order.

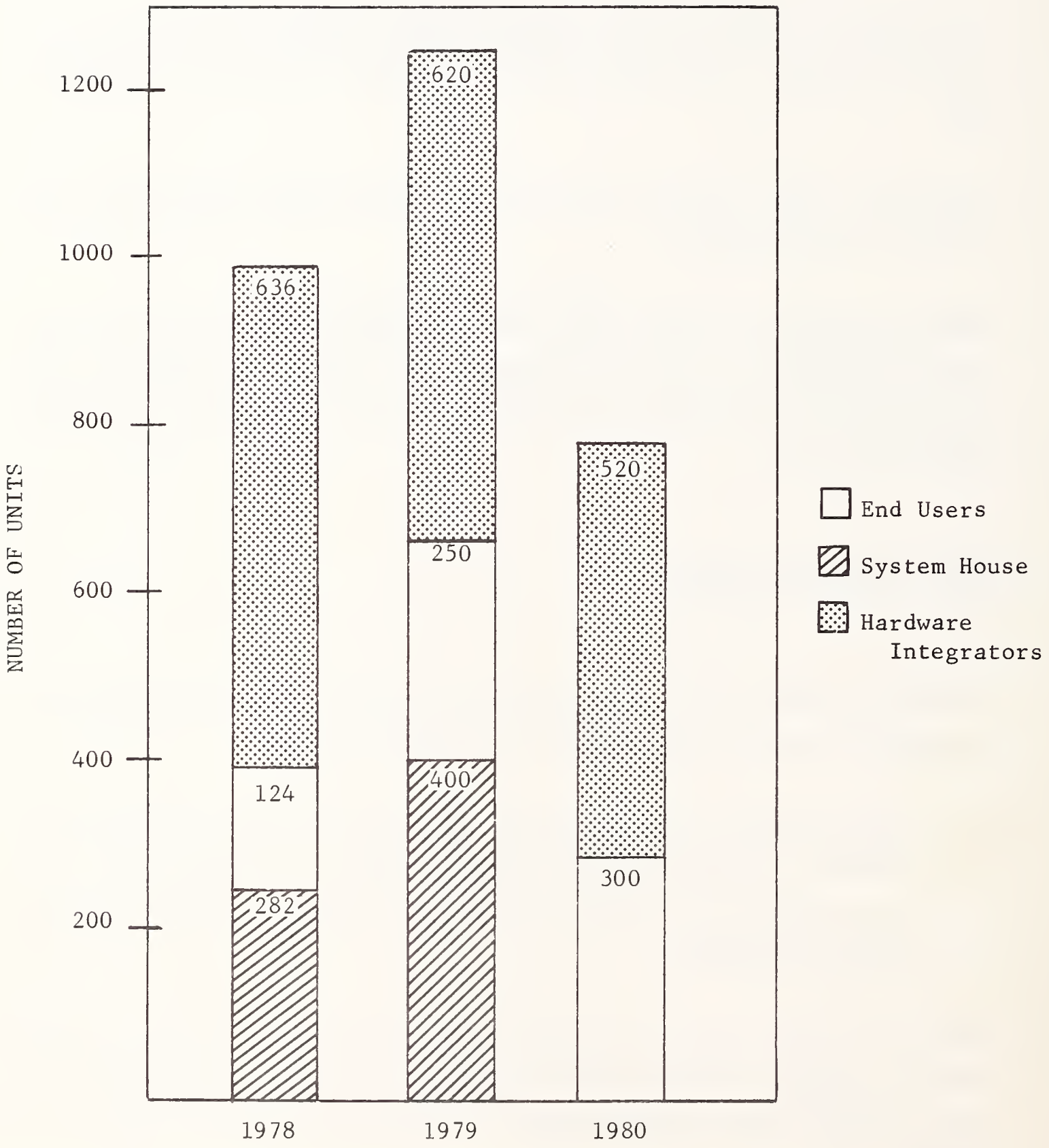
  - This information was verified by interviews with IBM employees who said that although the official Series/I delivery is 6 months, shipments are currently 60 to 90 days, and for a "special situation", 45 day delivery is possible.

- IBM will, in fact, meet the market demand for fast deliveries with the Series/I, especially important when considering some of the extended delivery cycles currently being quoted by DEC and Data General-on the order of 6 months.

EXHIBIT V-3

CURRENT SERIES/1 BACKLOG AS REPORTED

BY RESPONDNETS (1978, 1979, 1980)



E. APPLICATIONS FOR CURRENT AND FUTURE SYSTEMS

- The range of actual and projected applications for the Series/1 is extremely broad. Exhibit V-4 and Exhibit V-5 segment the applications by user and system house.

- One surprising aspect about the planned applications is that many users are implementing a variety of applications without systems software or higher level programming tools.

- End users respondents are planning to use the Series/1 both for new applications (53%) and to off load applications from other minis and central computer sites (47%).

  - Power/energy management control of laboratory instruments, petroleum product bulk stations, hospital and medical information systems and wholesale order entry/inventory and sales management were the most frequently mentioned applications.

- Systems houses have recognized the potential attractiveness of the Series/1 product line, as well as the support offered by IBM. The variety of applications developed by system houses(See Exhibit V-5) shows that many firms are willing to risk their development dollars on an IBM-supported minicomputer product, even in the absence of adequate development software.

- Of the 22 applications mentioned by system houses, 55% are off loaded from other minicomputers or from central data processing systems. Thus, the Series/1 is impacting not only the traditional minicomputer market but also the large scale CPU market.

- The largest number of systems houses are developing applications for in-house accounting including general ledger, accounts payable and receivable and inventory control.

EXHIBIT V-4

SUMMARY OF APPLICATIONS BEING DEVELOPED BY END USER RESPONDENTS

APPLICATION DESCRIPTION	DP*	** PC	*** NEW	**** OFF LOAD	NUMBER OF END USERS
POWER/ENERGY MANAGEMENT		1	1	1	3
GASOLINE BULK SALES AND INVENTORY CONTROL		1	1		2
LABORATORY INSTRUMENTATION		1	1		2
HOSPITAL MEDICAL INFORMATION SYSTEMS		1		1	2
WHOLESALE ORDER ENTRY/INVENTORY/SALES	1		1	1	2
PULP MILL DATA COLLECTION		1	1		1
RETAIL OUTLET SALES/INVENTORY/ORDER/REPORTING USING DISTRIBUTED PROCESSING	1		1	1	1
IN-HOUSE REMOTE COMPUTING USING DISTRIBUTED PROCESSING MIS/RJE AND SCIENTIFIC INTERACTIVE	1			1	1
IN-HOUSE EDUCATIONAL REMOTE COMPUTING	1			1	1
PRODUCTION CONTROL LABOR DATA COLLECTION	1		1		1
FINANCIAL TRANSACTION DISTRIBUTED PROCESSING	1		1		1
STATE AND LOCAL GOVT. DISTRIBUTED PROCESSING NETWORK	1			1	1

*DP = DATA PROCESSING
**PC = PROCESS CONTROL
***NEW - NEW APPLICATIONS
****OFF LOAD = FROM OTHER SYSTEMS

EXHIBIT V-5

SUMMARY OF APPLICATIONS BEING DEVELOPED BY SYSTEM HOUSE RESPONDENTS

APPLICATION DESCRIPTION	DP	PC	NEW	LOAD	NO. OF COMPANIES	COMPANY NAME
Accounting Systems - In-House General Ledger, Accounts Receivable Accounts Payable, Inventory	1			4	4	SPAN Management Systems COMPUDATA National Systems Frederic R. Newton Co.
Communications Packages	1		1	1	3	Applied Computer Sys. Conversational Systems System Design & Devel.
On Line Processing for Credit Unions Distributed Processing	1		2		2	System Selection, LTD CUNADATA Corp.
Distributors Information Systems - In-House Wholesale & Distributors	1		2		2	Professional Computer Service Inc. COMPUDATA
Order Entry - Inventory Control In-House	1		1	1	2	COMPUDATA Transportations Systems and Software
Management Information Systems using Distributed Data Processing	1			1	1	SPAN Management Systems
Medical Information Systems - Using Distributed Data Processing	1			1	1	SPAN Management Systems
Educational Instruction Interactive	1			1	1	University of Waterloo

EXHIBIT V-5 (CONT'D)

SUMMARY OF APPLICATIONS BEING DEVELOPED BY SYSTEM HOUSE RESPONDENTS

APPLICATION DESCRIPTION	DP	PC	NEW	LOAD	NO. OF COMPANIES	COMPANY NAME
Cotton Dealers Management Information Systems - In House	1			1	1	Frederick R. Newton Co.
Financial Transaction Distributed Processing	1		1		1	Conversational Systems
BASIC	1		1		1	Graham Computer Associates
COBOL	1		1		1	Advanced Software Products, Inc.
Word & Text Processing - In House	1			1	1	System Design & Development
Property Management Information System - In House	1			1	1	Kreisel Co.

- Three OEMs are developing communications-related packages.

- Others mentioned were order entry for wholesale and on-line processing for credit unions.

- Many of these turnkey systems will be directly competitive with existing IBM products such as the Systems 3, 32 and 34 as well as the stand alone small business computers of other manufacturers.

- Following is a series of quotations from respondents describing their specific Series/1 applications:

"Series/1s are connected to System 7s which are connected to 370/158. The System 7 is in the loop to provide backup for the 370/158 in case of crashes."

"Using Series/1 to replace IBM 1130 to do test scoring and for teaching Basic - 5 terminals on the system - Much more powerful than PDP/11."

"We expect to use Series/1 as a network processor to interconnect System 7s, 34s, and 3s for distributed processing - user will not know where his job is being executed - we expect to have the capability of larger time sharing nets at much lower cost."

"We'll come up with our own interactive software system - like BASIC but it will take up less space" (Memory)

"Will use Series/1 to replace 3270/3770 terminal systems - allowing users to do distributed processing with us and to use the Series/1 for other hospital applications."

"We had a System 7 - it could only handle 10 stores - the new Series/1 will handle up to 80 stores. We have a CPU and leased lines to monitor lighting, air conditioning, and refrigeration 24 hours a day. We use disks to record events and a printer to print exceptions or emergencies. We will provide service to other stores in shipping centers where our store is lcoated to handle entire complex with one leased line."

"The flexible configuration lets us off load our central processor to be able to get better response time for our interactive systems. The Series/1 will reduce our CPU usage by 40% or more."

F. PROGRAMMING SUPPORT

- End Users

  - Only one of the 16 end users interviewed has programming support from IBM; 11 are doing their own programming, and four have contracted for outside programming services.

  - Half the users interviewed reported that they would have used a high level language rather than the assembler had it been available.

- System Houses

  - Of the systems houses interviewed, 70% indicated that they plan to user PL/1 when it becomes available. One reason cited was that PL/1 can facilitate the implementation of "structural programming techniques".

- Only one hardware integrator and one end user indicated that they had a need for PL/1. End users exhibited the highest level of interest in higher level languages and none of the hardware integrators indicated interest. (See Exhibit V-6).

G. THE BUYING DECISION

- The president was the key decision maker selecting the Series/1 for 70% of the respondent system houses and 62% of the hardware integrators.

EXHIBIT V-6

SUMMARY OF INTEREST EXPRESSED BY RESPONDENTS

IN HIGHER LEVEL LANGUAGES

RESPONDENT BY CATEGORY	HIGHER LEVEL LANGUAGES			
	PL/1	COBOL	FORTRAN	BASIC
END USERS (16)	1	2	3	2
HARDWARE INTEGRATOR (16)	1	0	0	0
SOFTWARE HOUSE (8)	0	0	0	0

- Among end users, the key decision maker who selected the Series/1 in over 50% of the cases was the corporate or division director of data processing. This is a higher level decision maker than the engineering, manufacturing, or project manager who traditionally purchased a minicomputer for process control without any involvement by the EDP group. This conclusion about "selling at the top" is further reinforced by the fact that 14 out of 16 of the early Series/1 end users were IBM shops, indicating that IBM probably used its contacts "at the top" to sell the Series/1.

- The trend is for companies to centralize decision making for equipment procurement. IBM will be a major beneficiary of this trend because of its ability to supply integrated information systems consisting of processors, terminals, communication, and office equipment.

- The results of the survey show (Exhibit V-7) however, that 5 out of the 16 system houses and 5 out of 8 hardware integrators were not IBM shops and "Switched" from other brands of minicomputers. Thus, IBM seems to be simultaneously attacking its competitors on both the end user and OEM fronts.

- The following comments illustrate three different user buying concerns:

  "Discounts don't make much difference to us-our price is for a complete installed system."

  "We are the largest designer of interface boards in the country, and decided to use the Series/1 to expand our business."

  "We were reticent to order the Series/1 without a good operating system but knew the new operating system announced in April is OK for our needs. The processor is very fast and we will use only 7% for initial applications. We also have Honeywell control computers."

EXHIBIT V-7

RESPONDENT USERS OF HARDWARE SYSTEMS

(IBM VERSUS MIXED SHOPS)

TYPE OF RESPONDENT	EXCLUSIVE IBM SHOP	MIXED SHOP	TOTAL
END USERS	12	4	16
SYSTEM HOUSES	2	14	16
HARDWARE INTEGRATORS	3	5	8
TOTAL	17	23	40

H. SERIES/1 STRENGTHS

- As shown in Exhibit V-8, users were uniform in their reasoning for selecting the Series/1. The major factor is IBM's ability to service and maintain equipment in remote locations.

- Additional reasons cited were:

  - Powerful architecture permitting significant system expansion.

  - High reliability.

  - Ease of interfacing.

  - Favorable price.

  - Good packaging.

- From respondents replies, it does not appear that IBM offered any special inducements to persuade prospective buyers to select the Series/1. Of the 40 respondents, 37 indicated that no special incentives were offered. Three stated they were under a "non disclosure" agreement and would not comment.

- Most respondents perceive the Series/1 to be very powerful. Some comments were:

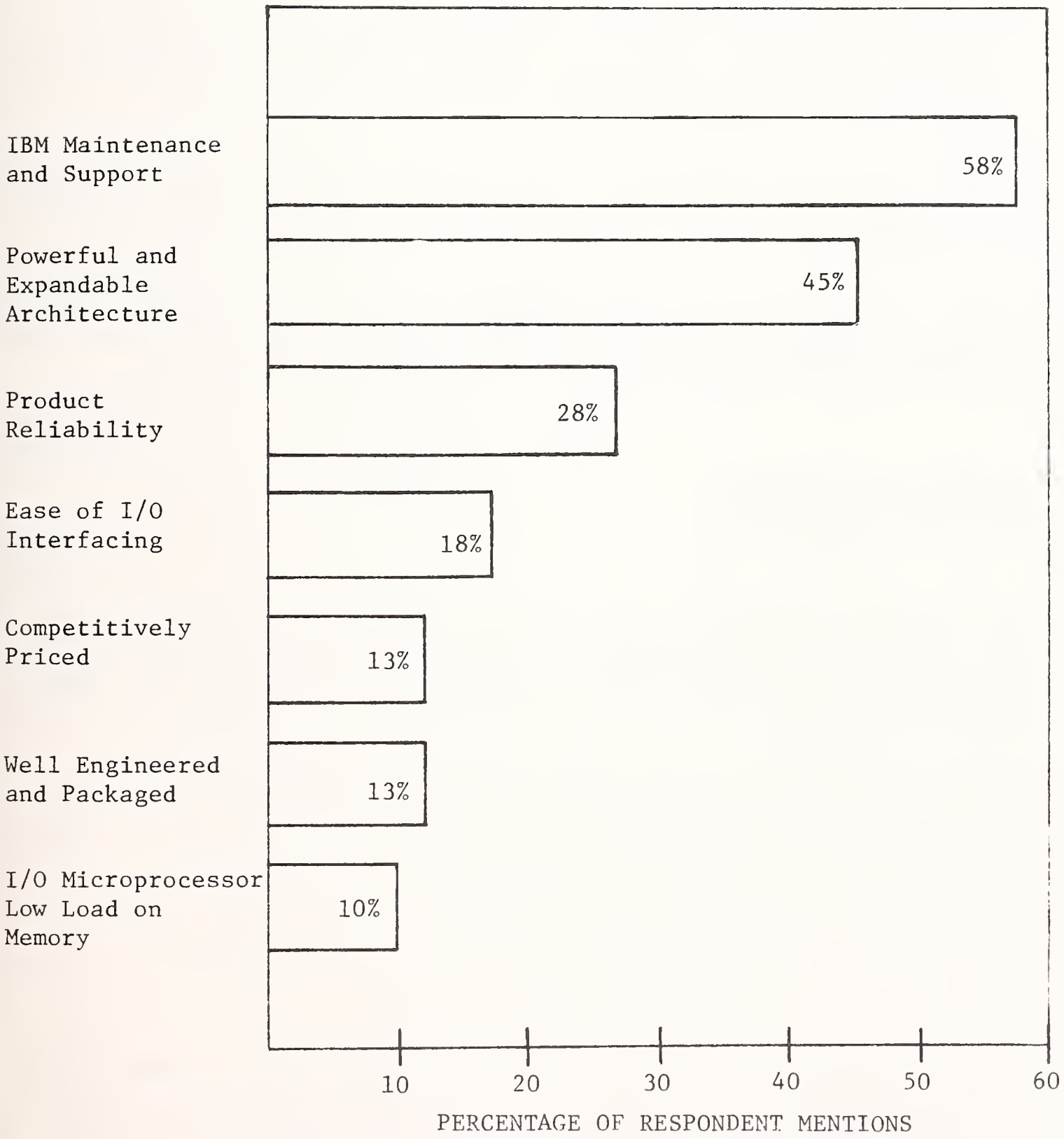
  "We have yet to have a failure. Our first installation was January 28, 1977. We have 5 installed (as of 7/21/77) at remote locations. No service call yet!"

  "The System 7 has more raw computer power but the Series/1 is more effective because it has:

EXHIBIT V--8

RESPONDENT ATTITUDES TOWARDS

SERIES/1 PRODUCT STRENGTHS



- Better interrupt system.

- Character orientation saves I/O overhead.

- "Its the best process control and message switching processor around."

"It is ideal for teleprocessing. We could displace an IBM 370/138 with 3 Series/1s, one of which would be used as backup. The 370/138 isn't built to pull all day, whereas the Series/1 I/O can."

"People don't know it but Series/1 has better throughput capability than the IBM 370/138."

"Series/1 combines process control and EDP capability. DPD doesn't know how to handle shop floor problems."

I. SERIES/1 WEAKNESSES

- The end users interviewed reported that the greatest Series/1 weakness was the lack of software, resulting in a potential advantage for systems houses. (Exhibit V-9).

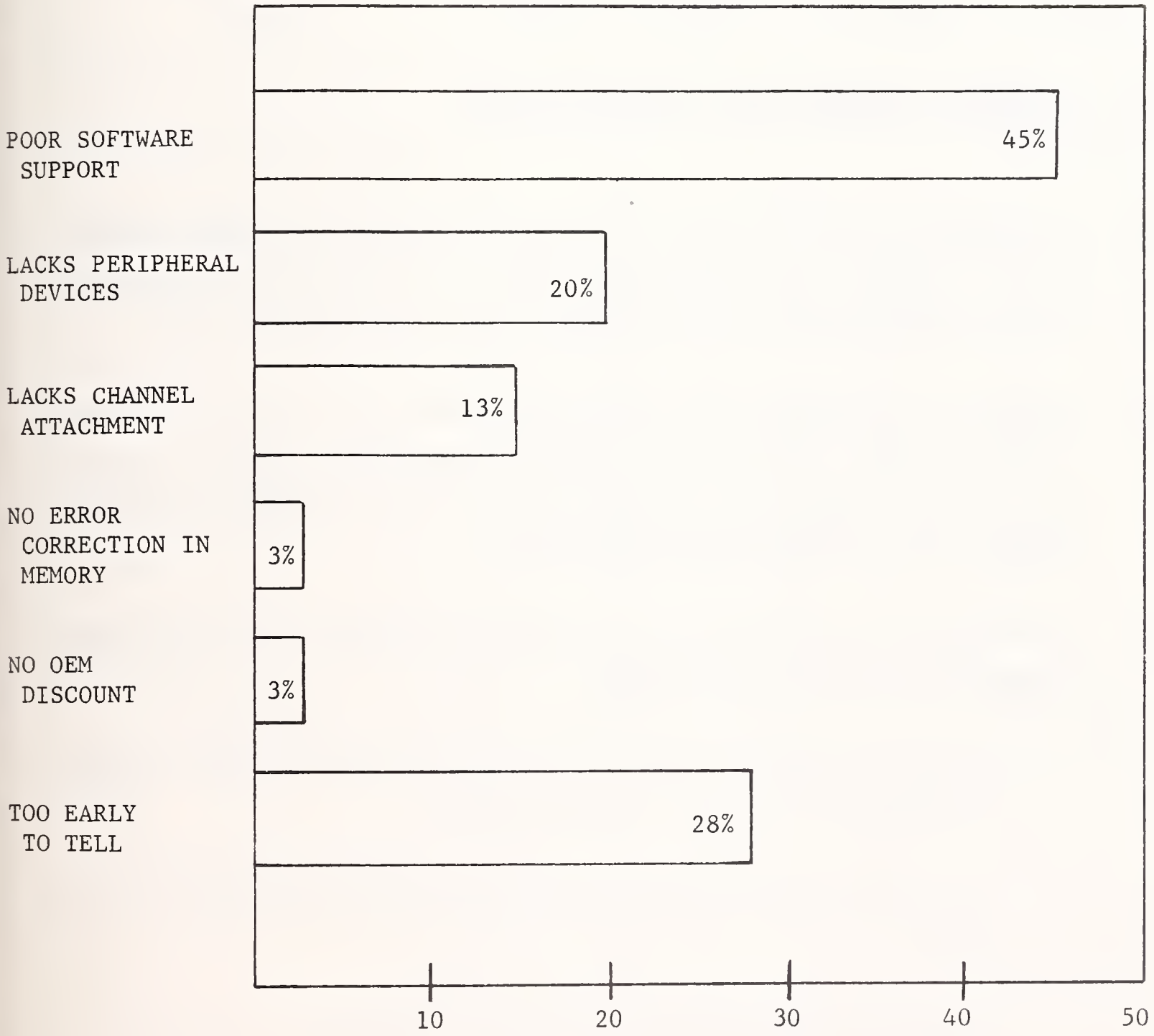
- The lack of peripheral devices such as magnetic tape drive for backup or a removeable disk were also cited.

- Respondents believe a disk drive capacity of more than 100M bytes will be required.

- Only one respondent, a system house, stated that the lack of OEM volume purchase discounts was a weakness. Other system houses and hardware integrators believed the absence of OEM discounts were more than offset by IBM service and maintenance capabilities.

EXHIBIT V-9

RESPONDENT REPORTINGS OF SERIES/1 WEAKNESSES



- Respondents did not believe there were glaring long term weaknesses in the product line and none indicated any strong disappointments; however, two comments referring to product weaknesses were:

  - "Don't believe IBM can deliver an effective PL/1."

  - "Current limitation-peripherals can only go 150 feet from CPU."

J. PRODUCT ENHANCEMENTS AND UPGRADES

- Respondents expressed a variety of opinions concerning future IBM announcements. The most prevalent being that IBM will be upgrading and strengthening the disk drive peripherals for the Series/1 product line. (Exhibit V-10).

- Magnetic tape drives are also on the high priority list of desired announcements from IBM. One user and one potential competitor indicated awareness of a "Project Matterhorn" at IBM's Colorado facility, whose objective is to develop a low cost tape drive for the Series/1.

- To establish an information source measurement for the respondents, INPUT questioned the basis of their opinions.

  - 24 of the 40 interviewees said that either direct or indirect contacts with IBM were the source of their opinions.

  - Of the 24, 8 indicated that either the IBM salesman or CE had informed them.

  - Other comments were often also directly to IBM:

    "I talked to people within IBM working on RTPS."

EXHIBIT V-10

SERIES/1 PRODUCT ANNOUNCEMENTS ANTICIPATED BY RESPONDENTS
OVER THE NEXT 18 MONTHS

	FREQUENCY			
HARDWARE	END USERS	SYSTEM HOUSE	HARDWARE INTEGRATOR	TOTAL
Double Density Disc	7	6	2	15
Removable Disc Pack Drive	5	5		10
Multiterminal Controller/ Channel Adaptor	5	1	2	8
Printer 600-800 LPM	5	1	1	7
Tape Drive	1	2	3	6
CRT	3		1	4
Series 3 Peripherals (within 1 year)	1	1	2	4
Memory 7 128K	3	1	1	4
Communications Protocols For System 370		2		2
SOFTWARE				
COBOL	2	5		7
Communications Software	2	2	1	5
Enhanced O/S That Works	2	2		4
RPG II	1	1		2
Applications Packages		1		1

"IBM will support product- IBM has a habit of making planned product announcements to support their product line."

- 10 users said they had no idea what IBM's future plans are or product announcements will be.

K. SERIES/1 POSITION IN THE MARKETPLACE

- Exhibit V-11 provides some insight into the environment in which the Series/1 successfully competed, based on our interview sample:

  - Series/1 sales come primarily from former or potential customers of DEC or Data General.

  - These two companies cumulatively accounted for 55% of the business lost to the Series/1.

- DEC's PDP 11 was the most frequently mentioned competitive minicomputer evaluated by respondents prior to selecting the Series/1. Following DEC were products from Data General and Hewlett Packard.

- Analyzing the impact of the Series/1 on IBM to date, the positive factors outweigh the negative. The forty Series/1 users interviewed evaluated a total of 64 minicomputers. (Some evaluated more than 1 product). Only five respondents may have selected other IBM products had the Series/1 not been available (see exhibit V-12), whereas 26 would have selected a non-IBM minicomputer.

EXHIBIT V-11

OTHER MINICOMPUTER VENDORS AND PRODUCTS EVALUATED

BY RESPONDENTS

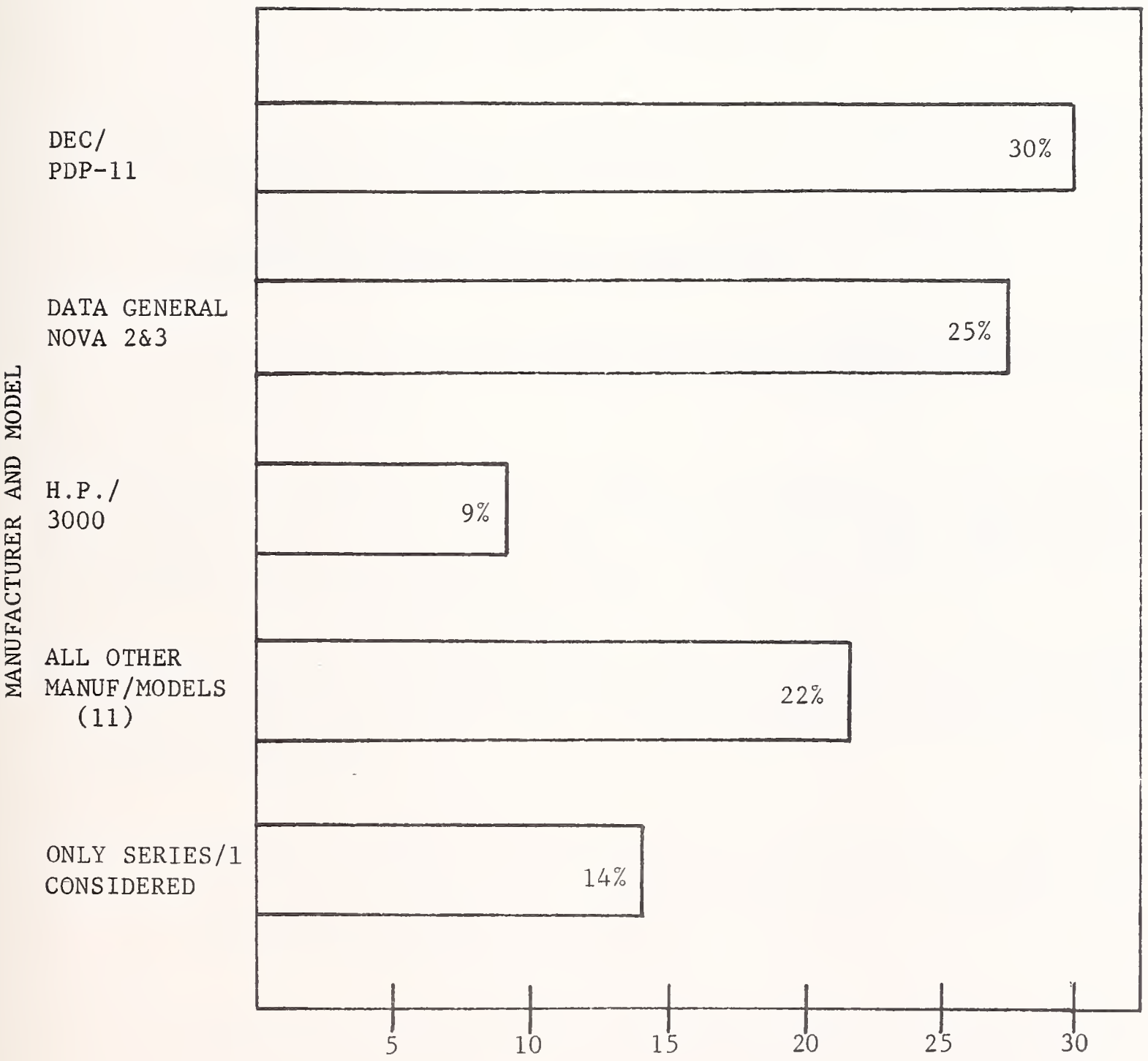


EXHIBIT V-12

SELF IMPACT OF SERIES/1 ON IBM

PRODUCTS EVALUATED	NO. OF RESPONDENTS WHO SELECTED SERIES/1
SYSTEM 7	2
SYSTEM 34	2
3790	1
ONLY SERIES/1	9
NON-IBM PRODUCTS	26
TOTAL:	40

- Much more significant is the impact on other minicomputer manufacturers, with DEC, Data general, and Hewlett Packard the biggest losers.
- 63% of the end user respondents (10 of 16) report having minicomputers other than Series/1 installed within their company. 75% of the systems houses have other minicomputers. (Exhibit V-13).

  - Of the total survey groups, 52% do not have minicomputers other than Series/1 installed.

- As shown in Exhibit V-14, 19 of the 40 interviewed companies have a total of 213 minicomputers installed and 21 have none.

  - Most of the installed units are with end users.

  - DEC is the leader in the number of existing installations accounting for 38% of the total.

- This exhibit verifies the conclusions reached by analyzing the previous table, namely that the Series/1 is directly impacting the major minicomputer manufacturers more than IBM's own sales.

- However, based on some of the quotes from the interviewed sample, the self impact on IBM will grow as the Series/1 becomes integrated into the customers' networks:

  - "Series/1 for $20K is a very good terminal replacement. With a 500 LPM printer, a terminal costs $500 per month now. The Series/1 could do so much more than the terminal."

  - "We had an IBM System 32 on order. We cancelled it after the Series/1 was evaluated. We have 13 Series 32 installed and may replace them with Series/1 in 1978. Plant managers can user Series/1 for plant operations and DP can justify the system and recover costs in 2 years based on price and energy cost savings."

EXHIBIT V-13

ANALYSIS OF RESPONDENTS' NON-SERIES/1

MINICOMPUTER INSTALLATIONS

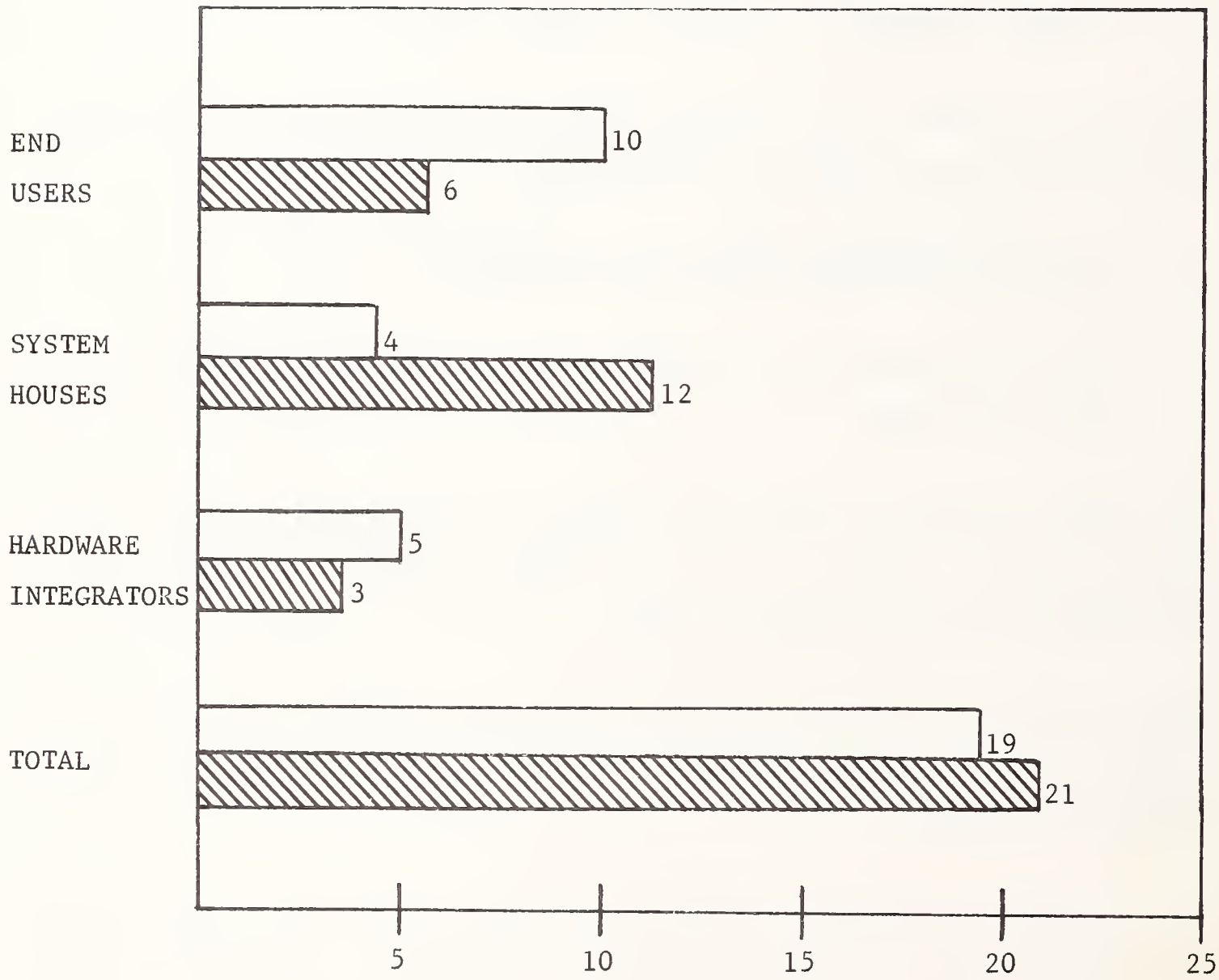


EXHIBIT V-14

OTHER MINICOMPUTERS INSTALLED BY RESPONDENTS

MANUFACTURER	MODEL	FREQUENCY				
		END USERS	SYSTEMS HOUSE	HARDWARE INTEGRATOR	TOTAL	% OF TOTAL
DEC	PDP 11	70	7	2	79	37
INTERDATA	—	40		1	41	19
DATA GENERAL	NOVA 2/3	21	1	2	24	11
SINGER	SYSTEM 10	20			20	9
IBM	SYSTEM 3	15			15	7
HEWLETT PACKARD	—	10		1	11	5
DATA 100	—	11			11	5
IBM	SYSTEM 7	4		2	6	3
IV PHASE	—	4			4	2
DEC	PDP 8	1	1		2	1
TOTAL:	—	196	8	8	213	100

- "We will replace an IBM 3775 system with a Series/1. We had an IBM System 34 on order but cancelled it."

- "There is rivalry within GSD among the Series/1 and the System 32 and 34 salesmen. The System 32 and 34 salesmen feel threatened by the Series/1 aggressive sales tactics."

- "We will shift from PDP-11s to Series/1 as time goes on. We are the largest DEC OEM in the country. Our policy is to get away from multi-vendors because of service problems."

- "Our concern is that IBM will not "share the wealth" with software houses as does DEC, etc. If they develop and lease our packages we could get hurt. They could also microcode BASIC and severely hurt the systems houses."

L. ATTITUDES TOWARDS PURCHASING NON-IBM PERIPHERALS

- Overall, about 50% of respondents stated that they would have interest in using non-IBM peripherals on their system at this time (Exhibit V-15).

- Only 2 (5%) respondents stated that they would now consider alternatives to the IBM supplied semiconductor main memory; however, most said it was too early to properly comment on this question.

- As shown in Exhibit V-16:

  - Almost half of those interviewed stated that they plan to obtain additional memory in the future.

  - Many end users will upgrade memory by 16K to be able to utilize the new operating system.

EXHIBIT V-15

SUMMARY OF RESPONDENTS'

WILLINGNESS TO USE NON-IBM

PERIPHERALS OR MEMORY

PERIPHERAL TYPE	NUMBER OF RESPONDENTS CONSIDERING USE			
	END USERS NO(16)	SYST. HOUSES NO(16)	HDW INT NO(8)	TOTAL
MAIN MEMORY	0	1	1	2
LINE PRINTERS	6	10	4	20
TAPE DRIVES	5	7	5	17
DISK DRIVES	5	7	5	17
OTHER (CRT)	12	16	7	35

EXHIBIT V-16

SUMMARY OF USER REQUIREMENTS

FOR ADDITIONAL MEMORY

MEMORY SIZE	END USER	SYSTEM HOUSE	HDWR. INTEG.	TOTAL
16K	88	1	0	89
32K	2	23	3	28
64K	16	128	0	144
NUMBER OF RESPONDENTS	7	9	3	19

- System houses plan to order additional 64K of memory as soon as the IBM software system supports the address translator, enabling the software to utilize the full 128K memory.

- Twenty respondents (50%) indicated a willingness to consider non-IBM printers. The major objection was the high cost of the IBM product.

- Only 43% of the system house respondents, traditionally non-IBM customers, stated that they would consider purchasing non-IBM tape or disk drives. These firms are in part responding to their perception of customer preferences.

- Users indicate that their willingness to utilize non-IBM peripherals is highly dependent on the geographic location of the system.

  - If located in a remote area, the "All IBM" installation is preferred because of IBM's demonstrated ability and willingness to provide service.

- 88% of the respondents would consider the selection of a non-IBM CRT which is thought to be the most trouble free peripheral. This judgement is reinforced by the fact that CRTs are plentiful and relatively inexpensive with spare units readily available and cheap to stock.

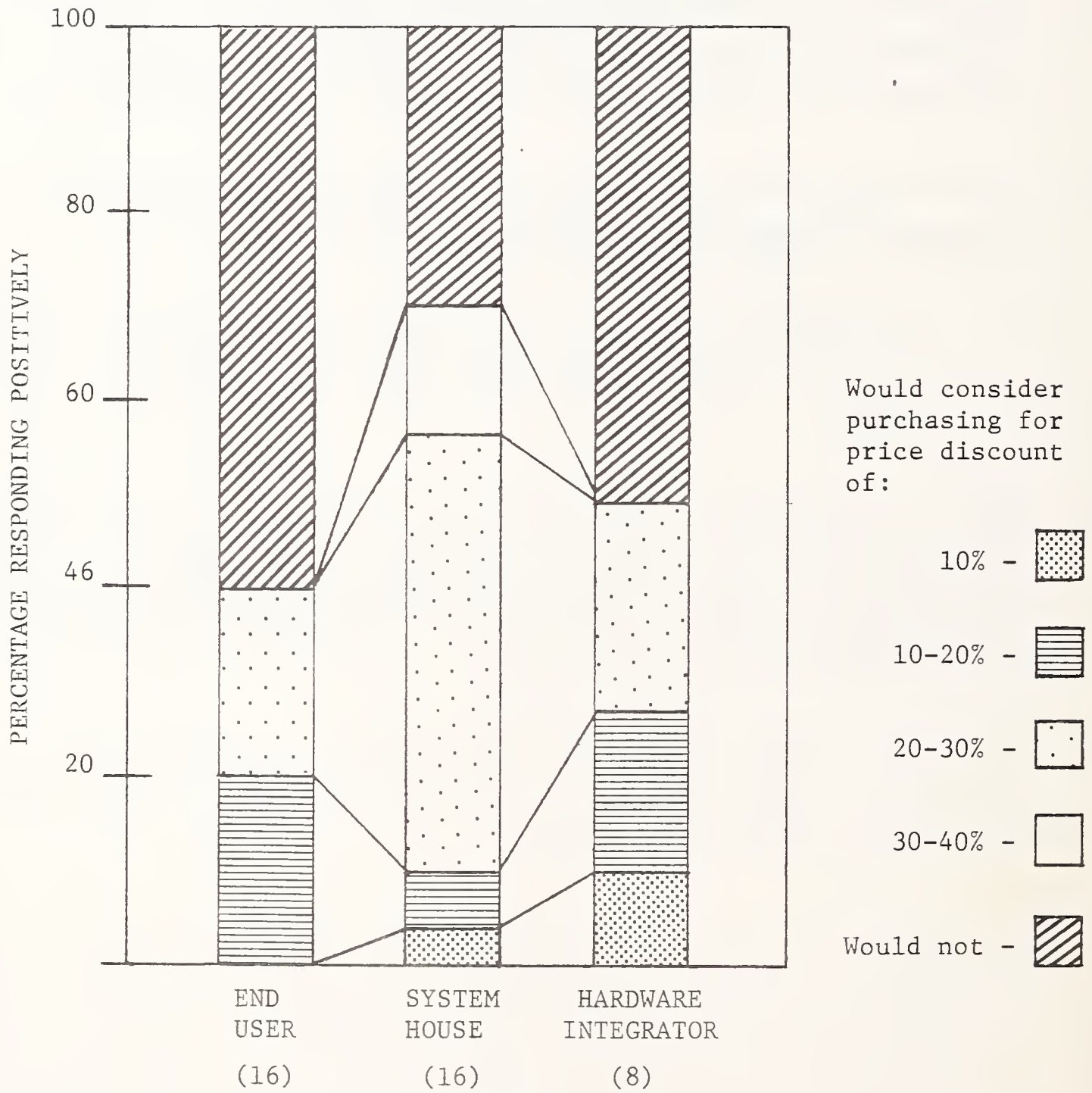
- As shown in Exhibit V-17, 22 of the 40 respondents (55%) would consider purchasing non-IBM peripherals at a price, discounted on average, 20%-30% less than the equivalent IBM product.

- Sixty-two percent of the interviewed end users indicated that they want IBM maintenance and service and were willing to pay for it. A third of the systems houses and 50% of the hardware integrators felt that the IBM name, service and maintenance offset the loss of OEM discounts. These same OEMs believe that end users are willing to pay extra to have someone develop and install a complete system.

EXHIBIT V--17

TREND OF RESPONDENT ATTITUDES ON PRICE DISCOUNTS

FOR NON-IBM PERIPHERALS



- Users expressed their feelings as follows:

  - "We are concerned that there will be competitive finger pointing with a proliferation of foreign peripherals on Series/1. If there is a problem, who will fix it?"

  - "We'd like a memory that does error correction. If non-IBM, it would have to be done in a separate control unit."

  - "IBM supports OEMs, holds outstanding seminars, clearly spells out interfaces."

  - "Our hotel chain with 55 units found IBM service located an average of 16 miles away. DEC and Data General Service are 280 airline miles away."

  - "Would insist on IBM only for remote areas but would use other peripherals at data centers."

M. PURCHASING FROM FOREIGN MANUFACTURERS

- Only five of the 40 respondents had been approached by salesmen from foreign suppliers (NEC, Phillips, ICL and Sharp).

  - About 70% of the respondents stated they would not consider purchasing a non-U.S. manufactured minicomputer under any circumstances.

  - Thirty percent would evaluate a foreign made product similarly as one manufactured in the U.S.

  - OEM purchasers were sensitive about service and end user acceptance.

N. USER INTERVIEW SUMMARIES

1. SUMMARY OF INTERVIEWS WITH SERIES/1 END USERS

- Using the Series/1 for control of bulk sales - An early IBM System 7 type application - Looks as if Series/1 will be used in place of Interdata and DEC equipment for control processors from here on out.

- Got Series/1 to replace Singer 10's when Singer backed off - Are using Series/1 as node in distributed network in cluster concept to handle order-entry, inventory control, etc. - Will develop terminal to RJE station and use for interactive transaction processing - They have their own compiler and operating system - Operates interpretive mode like "BASIC" for ease of program transferrability.

- A System 3 user - Looks as if IBM tried an experiment on distributed processing - IBM helped with programming. The application is into processing for auto parts stores - Series/1 polled at end of day by System 3. Series/1 used with video terminals (Beehive) during the day in stores.

- A paper mill - Using Series/1 to replace IBM 537 and to automate other data acquisition/ control operations - Will communicate with IBM System 3 via diskette.

- Uses Series/1 to control bulk sales operations - 3 CRTs and flow recording and ticket printing in operation - Data transferrd to System 3 at end of day by diskette - Much better than IBM System 7 - Better service than from DEC or Data General.

- A user of the "CHART" medical system - Will use Series/1 as a terminal first as a replacement for IBM 3775 - Then as a distributed processor and also to do other hospital applications.

- Is using Series/1 for data acquisition - Labor management system -Production workers check-in/check-out - Series/1 tied to Series 7 to summarize and control each plant - Series 7 tied to 370/158 - Keeps Series 7 because need high reliability 24 hours a day - 370s crash every so often - Will replace System 7 when Series/1 line fully developed.

- A chain of supermarkets - Uses one Series/1 at home office to do power and energy management via leased telephone lines to stores - The system controls lights, A/C, heat, and refrigeration - They are replacing System 7 - Which can handle only 10 stores - With Series/1 whose I/O can handle up to 80 stores - Getting system from system house (Interface System, Inc.).

- Developing a distributed network for an EFTS transaction system for leased services to other financial institutions - A cluster concept going into a national communications network - The system is in a development stage for at least another year - They are convinced that Series/1 has the processing and I/O range to cover a spectrum of financial system users.

- User Series/1 to replace System 7 - Order taking, polling MS 1 order equipment - has Pertec tapes for transfer to 370/145 - Will go channel to channel when available - Dual Series/1s for backup - Less expensive than System 7 with greater expansion capability.

- Has a System 3 for D.P. - Had an IBM 1130 for instruction multiterminals - Replacing 1130 with Series/1 and also using Series/1 as a test scoring center for Indiana.

- Using Series/1 to replace Data 100's as intelligent terminals - IBM RJE terminals an som IBM 1130s - To standardize on Series/1 for distributed processing within the company for R&D labs.

- A user owned medical services processing company - Is developing Series/1 as a terminal replacement for IBM 3270/3770s at hospitals - Will implement distributed processing - Thinks Series/1 is good for teleprocessing (good I/O) and is also better than IBM System 34.

- User will justify Series/1 for energy management/plant management then use it for D.P. replacing T/S functions done on corporate 370/158. Indicates that IBM developed product for plant operations and didn't intend it for D.P. or terminal operations

- Got Series/1 from systems integrator (Interface Systems) for central "cluster concept" control of power etc. for 32 stores - one Series/1 from systems integrator (Dennis White) for order entry for 32+ stores - sensor based systems

- The D.P. center is also the center for the State of South Carolina - using Series/1 for power management and for college T/S - He will use the System 3 in a distributive network to all state agencies - The Series/1 will be a node + a cluster computer in remote locations.

2. SUMMARY OF INTERVIEWS WITH SERIES/1 SYSTEMS HOUSES

- A systems house specializing in the manufacturing area - Is using the Series/1 in place of PDP/11s in stand-alone and distributed network systems - Believes that there are only 6 commercial institutions in New England thus far.

- A systems house - Will specialize in placing Series/1s with customers in-house to replace timesharing services using BASIC, PL/1 and FORTRAN - later COBOL.

- A systems house specializing in distribution accounting systems - Believes that Series/1 is a product that will cover a large range of small user applications - Is also developing a retail clothing system.

- A system house - Is developing turnkey system for in-house operation of credit unions - Will develop system for Toronto Star News and then market it elsewhere - Has other applications under development.

- Using Series/1 for distributed data processing applications - Particularly in the area of word and text processing - They have had a Series/1 since March and will not disclose who they plan to sell turnkey systems and network services to at this time -They may be under "non-disclosure".

- Got Series/1 for parent for special data acquisition systems - weighs and labels wholesale meat - Series/1 was 1/3 cost of System 7 - Believe the Series/1 will become a threat in 2 years to Systems 32/34.

- Developing COBOL for Series/1 - Will get GSA validation - Knows a design engineer at IBM Florida - The users will license the product from him - A former IBM SE - Lots of contact with other Series/1 users.

- Developing BASIC interpreter to sell with applications done in BASIC - Is also developing and installing oil sales and inventory systems -One of the first Series/1 users - Believe he has well over 50 systems on order.

- Got Series/1 early to evaluate and train staff - Impression that there are not many commercial installations yet (only 3-4 NYC) - believes will see lots of them after better software is available.

- A service organization for credit unions - Are using Series/1 as a front end processor to System 3 in "3270" mode - Are going to use Series/1 in a distributed credit union processing network - One system is evaluated and developed.

- A real estate management firm - Wants to sell service in corporation with applications packages - Wanted IBM name - Will sell turnkey system to other RE management firm.

- Using Series/1 as a communications processor to replace System 7 in user network - Faster than System 7 because of interrupt system and character orientation and communications adapters and less costly - Using second Series/1 for data collection for general business sytems.

- Is developing a turnkey system for cotton merchants order - sales contracts - market portion, etc. - Replace an on-line service from an RCS vendor.

- Is shifting from Data General line to Series/1 - Thinks the Series/1 is a terrific product.

- Developing Series/1 educational T/S system using Waterloo compilers and language systems - this effort is an extension of what was done on the 360s and PDP/11s in the past - Expects wide educational use of IBM Series/1 systems - Says IBM is now giving 10% educational discount.

- "Largest DEC OEM in country" - Is shifting employees to Series/1 because its "IBM" - Product is powerful and reliability is high - Says operating system poor and PL/1 will probably be inefficient to use."

3. A SUMMARY OF INTERVIEWS WITH SERIES/1 HARDWARE INTEGRATORS

- Installing Series/1 for power management/energy management and room accounting and control/energy management for hotels, stores, etc. - Believes the product will quadruple his business - Expects to sell 100s of them.

- Creates electronics to interface with sensors - Does software development and integrates systems in areas of energy management and order entry - The Series/1 has greatly expanded their marketplace - Believe IBM expects long market life for this mini product line.

- Doing the work for Citibank - They feel that the Series/1 will greatly expand the mini market. Applications will be across the board from control and processing to distributed processing.

- They believe IBM offered Series/1 in response to Citibank RFP - May have been 6-9 months early in announcing - Just another IBM mini - Better than 1170 processor for System 3 - Not SNA processor - Lacks communications ability to 370s - GSD.

- Specialist in automating control systems - Uses Series/1 to replace System 7 market - An early user of Series/1 - 6 systems installed -130 on order - Believes that Series/1 has expanded his market by an order of magnitude.

- A systems engineering group - Will use Series/1 in place of System 7 for energy management systems - Are enhancing IBM package and providing sensor interfaces.

- An interface board designer and manufacturer - Does work for all major minis - Series/1 will greatly enhance his market position.

- A hardware integrator - develops controllers for printer, tapes, discs for minis - Is getting geared up to do the same thing for Series/1.

- A systems integrator - Is using G.A. Nova 3 for access control system - Is using Series/1 for energy management to compliment sales of access control and for independent applications - Thinks Series/1 the lowest price CPU for his applications - Will look at replacing Nova 3 when peripherals are available for Series/1.

VI. IBM MARKETING ORGANIZATION AND STRATEGY

VI IBM - MARKETING ORGANIZATION AND STRATEGY

A. OVERVIEW

- INPUT interviewed 6 IBM field marketing and support personnel. Two interviews were conducted in person and 4 by telephone. The purpose of the interviews was to verify the findings of the user studies and to explore in some depth the salesman's perceptions of the minicomputer market and the success to date of the Series/1. In no case did any of the IBM personnel reveal information of a confidential (to IBM) nature.

B. "GUNG HO" ATTITUDE

- There was general agreement among the IBM personnel interviewed that the Series/1 was aimed at:

  - The control market formerly served by the System 7.
  - The commercial, knowledgeable, multiple machine end user.
  - The data collection and data communications markets.
  - The OEM market.

- One salesman called the Series/1 the "anything you want it to be in a box".

- All IBM respondents were extremely enthusiastic about the Series/1 and there seemed to be a "gung ho" atmosphere prevailing.

- The product is viewed as providing an opportunity to:

  - Market in an unstructured manner.

  - Open new frontiers (for IBM).

  - Get back at the "pesky" minicomputer manufacturers who through their OEMs have been impacting the System 3s and 32s.

  - One respondent said "GSD is now known as 'the other computer division'.

- Respondents report that as of August 1, there were relatively few installations.

  - "Only 5 or 6 in Philadelphia."

  - "Three in Dallas"

  - "Maybe 20 in the Western Region."

- Enthusiasm ran high.

  - "Expect tremendous growth."

  - "Have one order for 250 units in the region."

  - "Have an order for 30 units."

- "Looking at some very large orders."

- "IBM has already added 1 million square feet of manufacturing space to the facility in Boca Raton."

- Respondents confirmed the 6-month officially quoted delivery with currently a 60-day availability.

- A Series/1 technical support center is maintained in Boca Raton where technical people are available for marketing and proposal support activities.

- The Series/1 salesmen interviewed did not provide any user names beyond those officially released by IBM, nor did they venture to estimate future shipment rates or future product announcements. They did report:

  - That orders, like inquiries, can come from anywhere; however, "the OEMs are the best short-term prospects because they have the best programming talent."

  - The Series/1 will be easier to sell when RPG (10/77) and PL/1 (4/78) are available.

  - "Customers and OEMs like PL/1-wish I had it sooner."

- A user indicated that:

  - "IBM released a 10% discount policy for educational institutions recently."

C. OEMs - THEIR POSITIVE AND NEGATIVE IMPACTS

- The Series/1 is a "bare bones" machine and IBM provides a list of local OEMs or software houses to qualified prospects who are interested in obtaining applications software, programming or system integration support.

- IBM reports that when it provides a list of system houses, potential customer frequently asks:

  - "How long are these OEM firms going to be in business/"

  - "What happens if they go out of business?"

  - "Who is going to support my hardware/software/firmware which attaches to your Series/1?"

  IBM has no ready answer to these questions.

D. THE FIELD SALES ORGANIZATION FOR SERIES/1

- The original IBM Series/1 organization which reported directly to GSD in Atlanta had 7 regions. These have now been incorporated into the divisions field marketing organization.

  - Each "special systems" group (Series/1 sales), as any other branch, reports to the GSD regional manager.

  - The geographically oriented branches are responsible for the System 32, 34 and 7; whereas, the Series/1 branch manager has one or more marketing managers and a systems engineering manager to whom the SEs report.

- In certain geographic areas, ther are unit managers to whom both the sales reps and the SEs report.

- INPUT estimates that IBM had 150-200 Series/1 salesmen in the field or training as of August 2, 1977 and 75-100 SEs, a ratio of 2-3 sales reps for each support engineer. The reason for the light proportion of SEs to sales reps is that the Series/1 is considered to be "a bare bones" system, requiring little support as compared to the Systems 3, 32 and 34.

- IBM currently has less than 10% of the 2000-2500 minicomputer salesmen in the United States.

- The IBM campaign to recruit salesmen from other minicomputer companies has not been very successful to date.

  - INPUT estimates that 10%-15% of the currentl Series/1 sales force came from other minicomputer companies.

  - IBM considered the DEC or Hewlett Packard salesman more desirable than those from Data General, who are thought to be "less professional".

- Only one out of 6 interviewees believe that IBM may provide an OEM discount on the series/1 in the future.

- Two users commented on their impression of the IBM Series/1 marketing effort.

  - "IBM didn't know what it had when it announced the Series/1. They were selling it through technicians on a fixed salary. "IBM is finding out that users want to use the Series/1 both for control and for EDP. They will add peripherals to do this."

- "Very impressed with sales force. they are working weekends-putting together things in 6-8 weeks which used to take a year.

E. SALESMEN COMPENSATION PLAN

- Series/1 salesmen are compensated on a "straight salary" basis for the first three months.

- A typical Series/1 salesman's compensation plan consists of:

  - Base salary.

  - Compensation for attaining quota of $500K shipment value per twelve month period.

  - Commission based on the total number of units ordered by the customer (e.g.: the commission payment per unit for a 50 machine order is higher than that for a 10 machine order).

- The successful Series/1 salesman earns at least $30K from salary and commissions on an 80%/20% split.

- Annual shipments per salesman will average 15-20 units, based on an average price per system of $30-$35K.

VII. SERIES/1 COMPETITORS - ATTITUDES AND RESPONSES

VII COMPETITORS - ATTITUDES AND RESPONSES

A. COMPETITORS OBSERVATIONS

- Most of the interviewed minicomputer manufacturers expressed a lack of concern about the Series/1 and IBM's entry into the minicomputer market. The collective attitude, as of July 1977, among the interviewed companies was: "We haven't seen the Series/1 yet, but we know that it could be trouble in the future."

- Of the 7 competitors interviewed, 5 reported that they had not competed against IBM, nor were they aware of having lost any business to the Series/1.

  - Data General indicated that it expected to compete against IBM in the large data processing installations, large financial institutions, big manufacturing companies, and small OEMs. Data General was unaware of losing any accounts to the Series/1, but believed it had won in a dozen directly competitive situations.

  - DEC stated it had probably won some and lost some accounts to the Series/1.

  - None of the interviewed companies admitted issuing any new product announcements or changing any prices in response to IBM's Series/1 announcements.

- Four of the 7 responding competitors said that they believed that the Series/1 competition would be most severe in the large end user market.

  - One competitor thought that the process control (System 7) and the scientific and engineering markets would be most seriously impacted.

  - Another thought that his OEM business may also be affected.

- As shown in Exhibit VII-1, most of the competitors believed that a larger capacity disk would be announced soon. Other Series/1 products anticipated by competitors are larger and denser mainframe memories as well as two software products, a data base management system (DBMS) and one or more cross-compilers.

- Only 3 competitor respondents commented on the Series/1 PL/1.

  - "The provision for structured programming allows the supervisor to split up tasks." (A characteristic of all PL/1s).

  - The efficiency and execution time seem competitive.

  - Good multitasking and real time capabilities, interrupt driven but limited file management capability and currently limited (because of previous memory restrictions) in its ability to run large programs.

  - "PL/1 appeals to relatively small, sohpisticated segment of the computer market, namely individuals who generally have used large mainframes in an academic or large company environment."

EXHIBIT VII-1

SERIES/1 PRODUCT ANNOUNCEMENTS

ANTICIPATED BY INTERVIEWED COMPETITION

ANTICIPATED PRODUCT ANNOUNCEMENTS	FREQUENCY OF MENTIONS
Larger Capacity Disk Drive	3
Larger (Denser) Mainframe Memory	2
Data Base Management System (DBMS)	2
Cross Compilers	1
Magnetic Tape Drives	1
Screen Formatting (on CRT)	1
High Level Sensor Language(s)	1
Algol (For Europe)	1
Business Oriented Language	1
Application Packages	1

B. IMPACT ON COMPETITORS

- The interviewees believed that the Series/1 had no effect on their business to date. Three respondents indicated that their business would be increasingly negatively impacted as IBM's Series/1 acquired business data processing and data base management software and better peripherals.

- The opinions of respondents concerning IBM's minicomputer marketshare by 1981 ranged from 5% to 25% with the average approximately 18%.

  - The low percentage estimate was justified on the basis that:

    "IBM has never been successful with the Systems 7."

    "The industry will announce new products so fast it will run circles around IBM."

  - The high percentage estimate was justified on the basis:

    "IBM will join the "first tier" companies because of its large business base, its low product price and its nationwide maintenance capability."

C. PRODUCT STRENGTHS AND WEAKNESSES

- The strengths of the Series/1 as perceived by the interviewed competitiors are shown in Exhibit VII-2. The competitors' perceptions focus on the hardware characteristics and on the "IBM name" whereas users who have bought the system are much more concerned with maintenance and service. This divergence of perception indicates that IBM's competitors may need to reorient their marketing and sales strategy when competing against IBM.

EXHIBIT VII-2

SERIES/1 STRENGTHS AS PERCEIVED BY THE

INTERVIEWED COMPETITORS

COMMENT	FREQUENCY OF RESPONSE
GOOD ARCHITECTURE (SYSTEM BUILDERS MACHINE)	3
IBM NAME AND POSITION IN INDUSTRY	2
RICH INSTRUCTION SET	1
SERVICE AND MAINTENANCE	1
DELIVERY (FAST)	1
PRICE COMPETITIVE	1
GOOD REAL TIME OPERATING SYSTEM	1
GOOD INTERRUPT STRUCTURE AT LOW SPEEDS	1
"CYCLE STEAL"	1

- A competitor (former IBM employee) commented: "This is the kind of up-to-date, fairly priced product the market should expect from IBM."

- The weaknesses of the Sereis/1 as perceived by competitors are shown in Exhibit VII-3. Except for a (temporary) defficiency in software, the weaknesses seem to be few. One competitor indicated that he felt that there were "not many" weaknesses and conceded that the Series/1 may turn out to be a tougher competitor than he had originally envisioned.

- Respondent competitors believed that IBM had only moderate success in recruiting salesmen from other minicomputer companies.

  - Three of the competitors interviewed indicated they lost marketing people to the IBM Series/1 marketing recruiting program. DEC, who lost 3 marketing people to IBM, indicated that all 3 were former IBM employees who "returned to the fold". One respondent stated: "IBM talked to more than 800 potentials and hired 17."

D. NON-IBM MANUFACTURERS OF PERIPHERAL EQUIPMENT

- INPUT performed 3 unstructured interviews with computer miniperipheral manufacturers for the Series/1 study.

- One respondent who analyzed the Series/1 disk drive believes that the manufacturing cost to be $1.5K-$2K.

  - The unit sale price of $6.8K provides a gross margin of 71%-78% permitting a price umbrella for a non-IBM peripheral manufacturer.

- Technology used on the disk is 3340, "Winchester", also used on the Series 32 and 34. In the controller there are many functions packed efficiently into a small area. Because the disc is used on the other GSD products, manufacturing costs for IBM is probably lower than $1.5K.

EXHIBIT VII-3

SERIES/1 WEAKNESSES AS PERCEIVED BY THE INTERVIEWED COMPETITORS

COMMENT	FREQUENCY OF RESPONSES
DEFICIENT IN SOFTWARE	4
NOT ENOUGH DISK CAPACITY	1
NO DMA CHANNEL	1
NO COMPETITION FOR MEGAMINIS	1
IBM IS NOT GIVING IT ITS FULL SUPPORT	1
LIMITED PERIPHERALS	1
NARROW PRODUCT RANGE	1
NOT A TRUE PRODUCT FAMILY	1
SOFTWARE CURRENTLY SUPPORTS ONLY PARTIAL MEMORY	1
"NOT MANY"	1

- Respondents state that IBM will be offering common peripherals in conjunction with its various small mainframes in order to take advantage of maximum volume and a minimum number of models.

- One peripheral vendor interviewed believes that his floppy disk drive business will improve as more minicomputer vendors start competing against the Series/1.

- One of the competitiors interviewed was familiar with the existance of the "Project Matterhorn" within IBM in Colorado. The objective is to develop a low cost magnetic tape drive for the Series/1.

- It is current policy on the Series/1 not to sell or support non-IBM peripherals.

- Although many Series/1 users are capable of interfacing foreign peripherals (either directly or through hardware integrators) to the Series/1, IBM's unwillingness to maintain such hardware will be a strong deterrent against installing non-IBM peripherals in remote locations.

VIII. THE MINICOMPUTER BUSINESS AND IBM

VIII THE MINICOMPUTER BUSINESS AND IBM

A. PROJECTED MINICOMPUTER SHIPMENTS

- As shown in Exhibit VIII-1, INPUT estimates that the total value of minicomputers shipped worldwide by U.S. manufacturers will grow from $2.6 billion in 1977 to $7.4 billion in 1981, a 30% average annual growth rate.

  - Shipments into the international market will increase from 32% in 1977 to 37% in 1981.

  - Although decreasing in percentage of total market, the value of domestic minicomputer shipments will increase from $1.8 billion in 1977 to $4.7 billion in 1981.

- The total number of minicomputers shipped will increase from 77,000 in 1977 to 188,000 in 1981 (Exhibit VIII-2).

- The average system value is forecasted to continue increasing between 1977 and 1981, from approximately $34K to $39K.

EXHIBIT VIII-1

FORECASTED VALUE OF MINICOMPUTERS

SHIPPED WORLDWIDE BY U.S. MANUFACTURERS

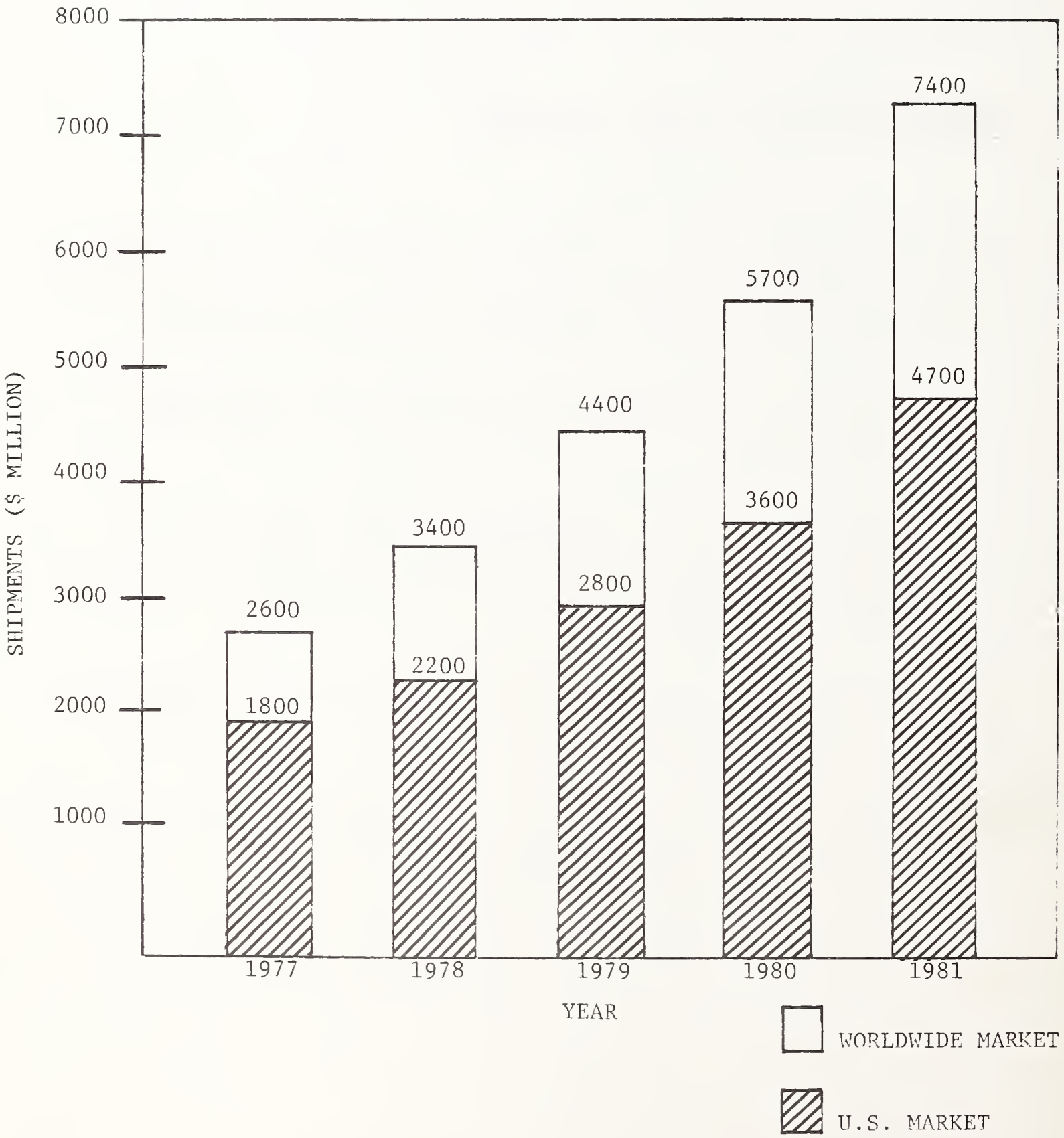
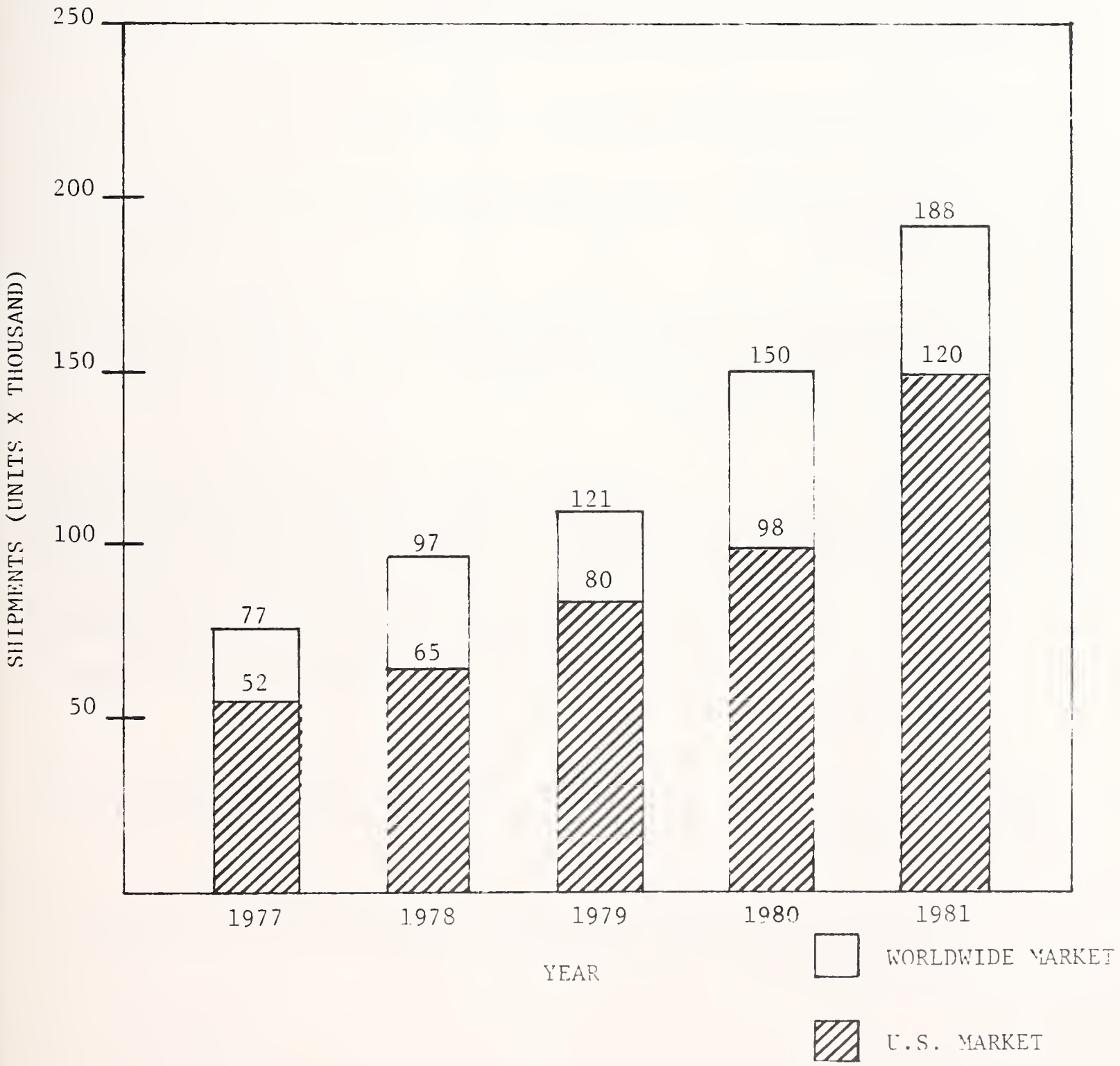


EXHIBIT VIII-2

FORECASTED NUMBER OF MINICOMPUTERS TO BE SHIPPED

WORLDWIDE BY U.S. MANUFACTURERS



B. IBM's MINICOMPUTER MARKET SHARE WILL GROW

- In 1976, IBM had only 2% of the worldwide minicomputer market primarily comprised by the System 7. (Exhibit VIII-3).

- INPUT forecasts IBM Series/1 shipments will increase from $40 million in 1976 to $1.2 billion (Exhibit VIII-4) in 1981 and (as shown in Exhibit VIII-5) will account for 16% of the worldwide minicomputer market. This dramatic five year growth is attributed to the following factors:

  - The Series/1 is price/performance competitive.

  - IBM has the most extensive worldwide product maintenance and support capability.

  - The product provides the "all IBM" installation, a flexible and powerful minicomputer system which can be used in a wide variety of central or distributed applications.

  - Unlike the other minicomputer manufacturers, IBM provides a total information processing array of products including large mainframes, terminals, application software, copiers, typewriters.....and now a choice between a fully supported application oriented small business computer system (e.g.: System 32) or unsupported minicomputers (Series/1).

- IBM's Series/1 shipments will grow from 2,000 units in 1977 to 37,000 units in 1981 (Exhibit VIII-6).

  - Worldwide revenues for the Series/1 will increase from $55 million in 1977 to $1.2 billion in 1981.

EXHIBIT VIII-3

1976 WORLDWIDE MINICOMPUTER REVENUES

OF AMERICAN MINICOMPUTER MANUFACTURERS

MANUFACTURER	% OF MARKET	TOTAL REVENUE	UNITS	VALUE/UNIT
D.E.C.	38%	$ 738M	20.2K	$ 36.4K
H.P.	15	303	5.5	55.1
DATA GENERAL	9	180	6.3	28.6
IBM *	2	40	1.5	26.7
ALL OTHER	36	701	27.0	26.1
TOTAL	100%	$1962M	60.5K	$ 32.4K

* SYSTEM 7 AND SERIES/1

EXHIBIT VIII-4

IBM SERIES/1 GROWTH IN THE

WORLDWIDE MINICOMPUTER MARKET

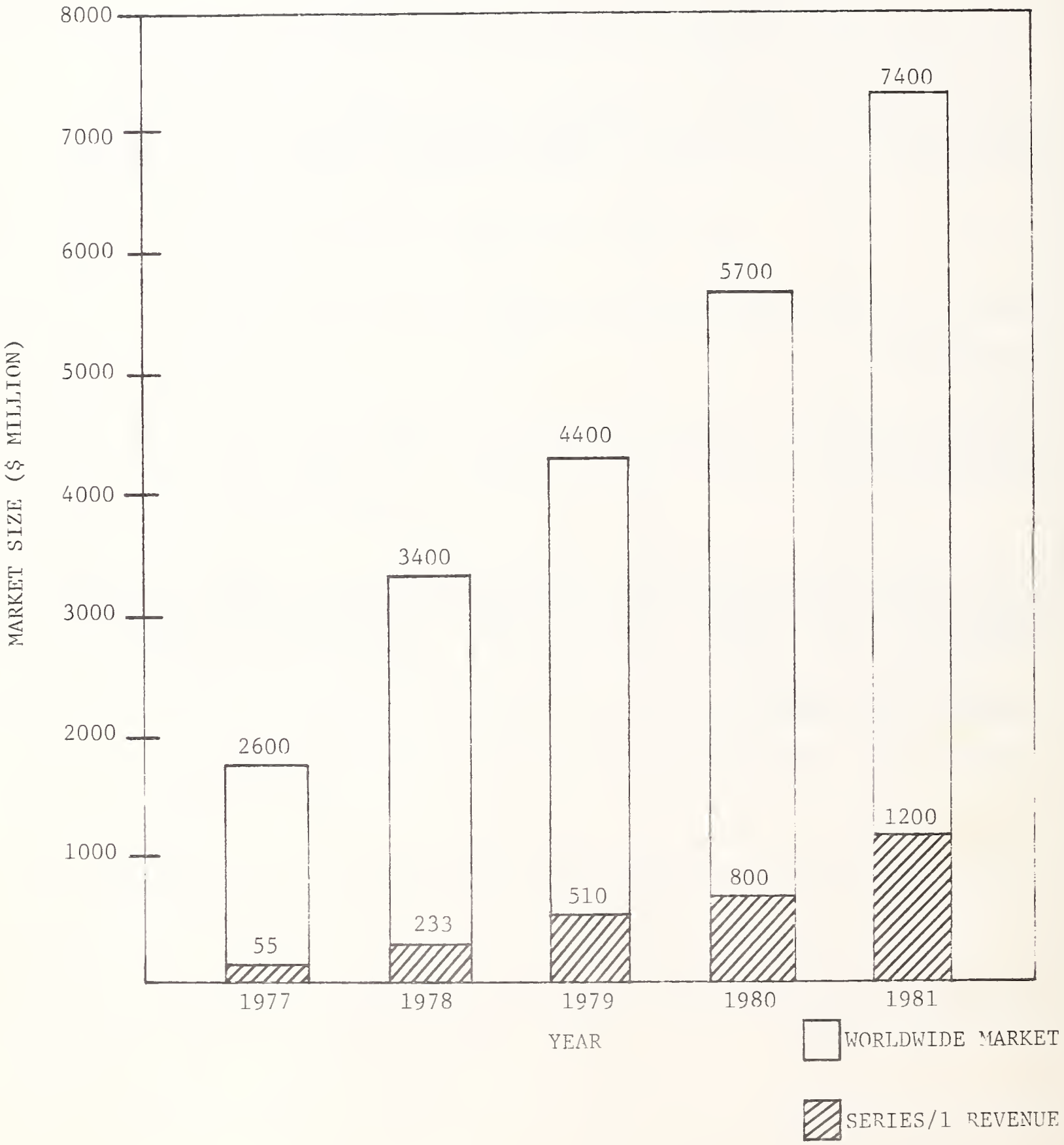


EXHIBIT VIII-5

FORECASTED WORLDWIDE MINICOMPUTER

MARKET SHARE OF "FIRST TIER"

MANUFACTURERS FOR 1976 AND 1981

(PERCENTAGE)

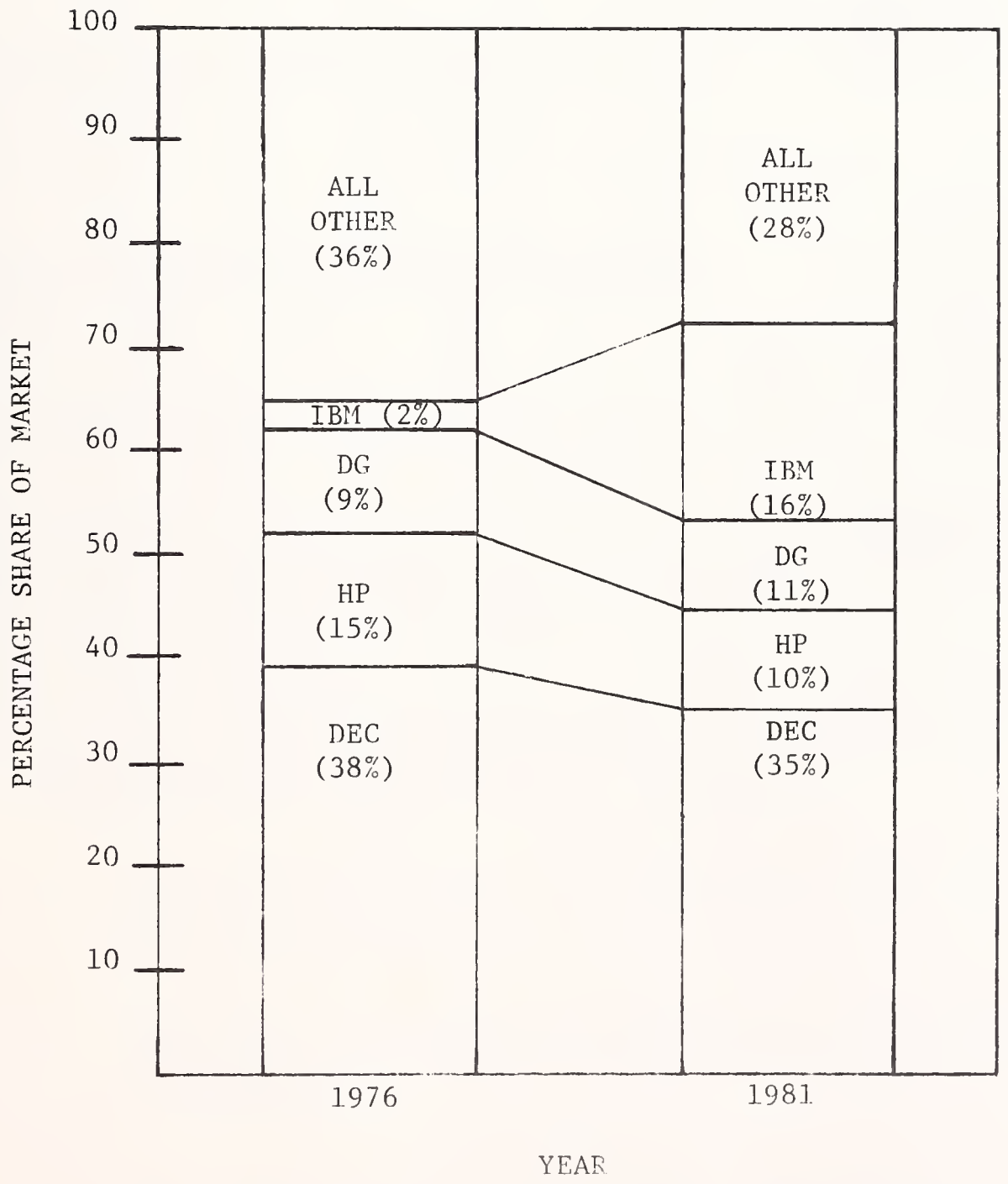


EXHIBIT VIII-6

SERIES/1 SHIPPING AND REVENUE

FORECAST

	1977	1978	1979	1980	1981
A) SHIPMENTS (Thousands of units)					
--Annual	2	8	17	26	37
--Cumulative	2	10	27	53	90
B) REVENUE ($ Million)					
--U.S.	38	160	310	450	600
--Worldwide	55	230	510	800	1200
--Worldwide (Cum)	55	285	795	1595	2795
C) % OF MARKET Worldwide	2%	7%	12%	14%	16%
D) AVERAGE PRICE SYSTEM ($ Thousands)	27.5	29.0	30.0	31.0	32.5

- By 1981 the installed base is forecasted at 90,000.

- The average price of the IBM system shipped will grow from $27.5K to $32.5K between 1977 and 1981. The average price of the IBM system is expected to be about $6K lower than the industry average because of two major reasons:

  - The process control configurations are less costly systems.

  - The multiple units purchased for network applications are usually smaller configurations.

- It is interesting to note that the forecasted value of IBM's 1981 Series/1 shipments exceeds DEC's total revenues for FY 1976.

C. SOURCES OF IBM's INCREASING MARKET SHARE

- Although the Series/1 is currently aimed at a relatively narrow market segment, it has the potential to be expanded upward into multiprocessor configurations and downward towards lower cost control systems. As the product scope widens, the Series/1 will increasingly impact a broader spectrum of the market. Hewlett Packard (HP) and some of the "second tier" companies will be most directly affected.

  - The IBM Series/1 will primarily impact HP because:

    . Both IBM and HP appeal to users willing to pay a premium for quality and service.

    . HP's field marketing force is less aggressive than IBM, DEC or Data General.

    . HP does not have the broad industry market base of the other "first tier" minicomputer manufacturers.

- Data General, the most aggressive of the group, is forecasted by INPUT to increase its market share from 9% in 1976 to 11% in 1981. Data General, offering a system with the lowest average price of the first tier group, will not be as adversly impacted by the Series/1 as HP.

- INPUT forecasts that DEC's market share will decline from 38% in 1977 to 35% in 1981. The decline is due to 2 major factors:

  . DEC, the minicomputer leader, will find it difficult to react simultaneously in all the minicomputer submarkets including those specifically targeted by IBM with the Series/1.

  . DEC has been having delivery problems caused by rapid growth and expansion into a multiplant company.

- The companies forecasted to be most severely impacted by IBM's Series/1 will be the "all others" who are estimated to lose 8% of their market between 1976 and 1981.

  . Included are many established companies such as Interdata, General Automation, Honeywell, Raytheon and Systems Engineering Laboratories, as well as the many small companies with less than $20 million in annual revenues.

  . As the pressure on the profits of the smaller companies increases, INPUT expects more mergers, acquisitions or fallouts to occur.

- IBM has made a total commitment to the market. this view is supported by users who comment:

  - "IBM has hired best marketing people in the mini business. The sales people are better than IBM's systems people who come from the System 7."

- "IBM is committed to sell over 60,000 units-expect sales to go over 100,000 in 5 years."

D. IBM's SERIES/1 MARKET AND BUSINESS STRATEGY

- With the Series/1, IBM:
  - Fills a gap in its product line.
  - Enters one of the most rapidly growing submarkets in the computer industry.
  - Develops a less monopolistic image (by participating in a market where its share was only 2% in 1976).
  - Utilizes its existing field marketing, maintenance and manufacturing strenths.
  - Maintains traditional profit margins.
  - Minimizes risks, since cost of market entry was not significant to the corporation.
  - Minimizes self-impact.
- To date, IBM has accomplished all of these objectives; however, the most difficult objective in the long run is to "minimize self-impact".
- Potentially, the Series/1 system is sufficiently powerful to impact not only the GSD's System 32, 34 and 3, but also the low ends of DPD's 370 family.

- The Series/1 has virtually displaced the System 7, but the other small systems from GSD will continue to evolve as fully supported systems aimed at specific applications of industry segments.

- A user said: "IBM's most successful early sales have been replacing or extending down the control and energy management market. The packages written by IBM are below par and have been greatly modified by independent software houses."
- IBM will provide users with a choice:

  - A fully supported "all IBM" system at a higher price, including a full complement of peripherals and applications software, or

  - An unsupported system built around an IBM processor with an opportunity to include either IBM or non-IBM peripherals and software.

- As both IBM and OEM vendors announce or develop software and peripherals for the Series/1, the "bare bones" connotation wil gradually disappear.

- As more capability is added to the Series/1, IBM will develop sufficient flexibility in its unbundled pricing to provide either a fully supported or a totally unsupported product, depending on what the user wants to buy.

- The timing of Series/1 product announcements and availabilities for new hardware and software if not done carefully, may have dramatic financial impacts within the corporation. factors to be considered by IBM are:

  - Penetration of Series/1 into existing GSD and DPD markets.

  - Penetration by plug compatible competitors into the System 3, 32 and 34 markets.

  - Penetration by peripheral manufacturers into the Series/1 market.

- Success of the Series/1 in the minicomputer market.

- A user noted that: "The Series/1 will greatly expand the mini market. It will drastically change the word processing market. I can see a Series/1 in every major office and in many control operations. The existing market will guadruple in six years."

E. SERIES/1 MANUFACTURING COSTS

- Total manufacturing costs (direct labor, materials, and factory overhead) for the Series/1 are estimated to be 15% to 20% of the selling price.

- IBM will maintain this cost to selling price ratio because of its high production volume and consequent economics of scale.

- IBM will maintain its profit margins on the Series/1 over the next five years by:

  - Utilizing peripherals and components developed for other computer products.

  - The Series/1 and other product lines sharing the development cost of new peripherals.

F. THE SERIES/1 IS PRICE COMPETITIVE

- As shown in Exhibit VIII-7, the Series/1 is both price (no volume discounts) and performance competitive against similar configurations of the DEC PDP/11, the Data General S/100 Eclipse and the Hewlett Packard 21 MX-E in the 1 to 30 (approximate range) unit range.

EXHIBIT VIII-7

	IBM		D.E.C.		H.P.		D.G.	
	Unit	Price	Unit	Price	Unit	Price	Unit	Price
PROCESSOR :	#4955	$6,165	#11/35SE	$11,995	21MXE	$14,000	S/100 Eclipse	$11,200
ADDITIONAL MEMORY :	16K	1,750	--	--	--	--	--	--
DISK STORAGE UNIT :	9.3MB	7,710	2x5MB	13,000	15MB	12,000	10.0MB	10,100
CONTROLLER :	--	--	--	--		4,000	--	--
DISKETTE UNIT :	0.5MB	3,140	0.5MB	3,045	N/A	--	0.5MB	2,900
PRINTER :	130CPS	3,720	180CPS	3,585	200LPM	8,300	165CPS	4,500
CONTROLLER & I/O :	--	--	--	--	--	--		1,600
DISPLAY W/KEYBOARD:	1929CH	2,690	1920CH	2,095	1920CH+2 110KBYTE TAPE DRIVES	5,100	1920CH	2,550
BASE PRICE :		$25,175		$33,720		$43,400		$32,850
VOLUME	Discount	Price	Discount	Price	Discount	Price	Discount	Price
1 System	-0-	$25,175	-0-	$33,720	-0-	$43,400	-10%	$29,565
20 System	-0-	25,175	-26%	24,953	-29%	30,814	-31%	22,666
50 System	-0-	25,175	-32%	22,930	-34%	28,644	-36%	21,024
100 System	-0-	25,175	-35%	21,918	-35%	28,210	-38%	20,367

- IBM has priced the Series/1 competitively so that quantity discounts must be applied before these three competitors products begin to be comparable in price to the Series/1.

- IBM's Series/1 compares favorably with all three processors. All four machines have 16 bit word lengths and at least one parity bit. The Series/1 is character addressable. Hewlett Packard offers floating print as a standard-all the processors use a MOS memory.

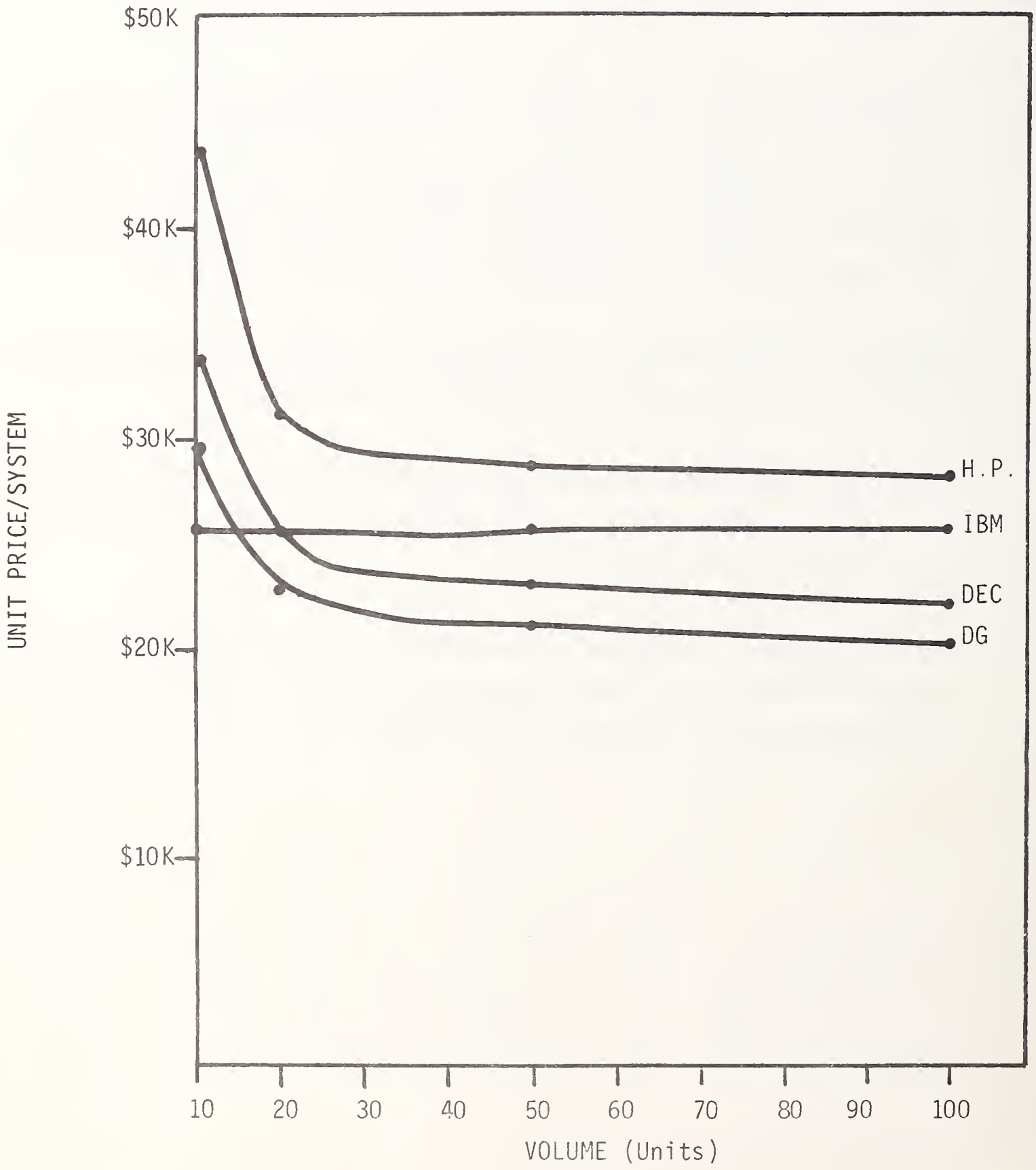
- The architecture of the machines are different and there is disparity on minimum and maximum memory size. All four machines have hardware multiply and divide as well as byte manipulation. Series/1 does not have the equivalent of a DMA, but the I/O channel has a potentially higher throughput. IBM is deficient in both I/O data rate and external interrupt levels.

- As shown in Exhibit VIII-8, a configuration price analysis graph was performed for each vendor's selected system based on current prices.

  - The results point out that all three vendors had a higher unit price to start with but two out of the three came down below the Series/1 as volume discounts were applied.

- Prices and discount schedules change frequently in the minicomputer business, therefore, these configurations are priced only as an illustration of the fact that there is no price umbrella over the Series/1.

EXHIBIT VIII-8



IX. SERIES/1: ITS IMPACTS AND POTENTIAL ADVANTAGES

IX SERIES/1: ITS IMPACTS AND POTENTIAL ADVANTAGES

A. THE SERIES/1 IN 1981

- Hardware Enhancements

  - INPUT believes IBM will be announcing new hardware and new software for the Series/1 at approximate six month intervals.

  - Announcements will be made over the next 48 months and will include both current and future technological developments. Exhibit IX-1 projects the timing and the types of enhancements as forecasted by INPUT.

  - The enhancements to the Series/1 will be across the board and will cover not only mainframe and peripheral developments, but also software and communications. INPUT forecasts that within the next two to three years, the Series/1 will become the most thoroughly supported minicomputer system on the market.

- Software Enhancements

  - All major languages are currently under development either by IBM or by one or more software houses.

EXHIBIT IX-1

TIME FRAME OF POTENTIAL IBM ENHANCEMENTS TO THE SERIES/1

ENHANCEMENT	LATE 1977	MID 1978	MID 1979	MID 1981
• MAINFRAME				
- Increase Mainframe Memory Capacity				
- 256K Bytes		•		
- 512K Bytes			•	
- 1,024K Bytes				•
- Smaller & Larger Members of Series/1 Family		•		•
- Direct Memory Access Channel	•			
- Enhanced Communication's Module			•	
- Modified Instruction Set to Facilitate Implementation of Special Functions				•
• LARGER DISK CAPACITY				
- Dual Drive Subsystem 27. MB	•			
- 3340 Winchester Technology 70 MB Disk Drive		•		
- 3330 Type-High Density 300 MB Disk Drive			•	
• OTHER PERIPHERALS				
- Low Cost Magnetic Tape Transport 800/1600 BPI 45/75 IPS.		•		
- Low Cost Magnetic Tape Transport 6250 BPI.				•
- Solid State Fast Access Memory				•
- Non Impact Line Printer	•			
- 1200 Line Per Minute Impact Printer			•	
- Full Peripheral Compatibility With				
- Current GSD Products				•

- In addition to PL/I and Fortran announced by IBM, software vendors are working on COBOL, RPG, BASIC, Extended BASIC and Multiuser BASIC. These languages will all be available within the next 12-18 months.

- Software houses are developing a large variety of applications packages ranging from general business (e.g.: accounts receivable, payroll, etc.) to specialized industry oriented packages (e.g.: multiuser system with message handling capabilities, a medical information system, a text processing system, an on-line processing system for credit unions, and cross assemblers).

- Cross assemblers or compilers being developed by firms such as Systems Management, Inc. will permit Series/1 users to supplement the software currently under development with software developed for the System 3, Systems 32 and 34.

- Process control, industry control, energy management, as well as scientific and engineering programs are being converted from the System 7, the 1130, and the 1800. This effort is being pursued both by IBM and by independent software houses.

B. THE FIRST TIER MINICOMPUTER MANUFACTURERS: DEC, DATA GENERAL, AND HEWLETT PACKARD

- IBM's Series/1 has impacted the major minicomputer manufacturers by capturing some of their traditional customer base.

- The impact level can be seen in Exhibits V-11 and V-14; one exhibit showing minicomputer vendors and products evaluated by the user respondents prior to selecting the Series/1; the other reporting non-IBM minicomputers installed prior to the selection of the Series/1. Both exhibits show that DEC is the vendor most impacted by the Series/1 (as would be expected due to DEC's size).

- The high level of awareness among the DEC technical personnel of the strengths and weaknesses of the Series/1 indicates that they are analyzing the market effects of series/1 on its minicomputer revenues.

- Data General is sensitive to the Series/1 threat and is sufficiently aggressive and flexible to minimize its losses. HP is not as aware and has not yet been impacted as sharply as some of the other vendors. However, as new software (Cobol, Realtime Monitor, etc.) becomes available, the Series/1 will pose as serious competition to HP's System 3000.

- Each of the other companies have one or more product lines which will be impacted by the Series/1. The more dependent the company is on one product line, the more serious the potential impact. For example:

  - Computer Automation's Sy/FA product line will be affected whereas its "naked mini" and its tester product line will not.

  - Four Phase will be feeling IBM's competitive pressure because of its product emphasis on distributed processing and marketing emphasis on large users.

  - Microdata's 'Reality' and 'Express' systems will increasingly encounter the Series/1 as it acquires more software and a larger disk drive capability.

- The minicomputer OEM volume discount offered by vendors other than IBM is still a powerful sales incentive for large customers purchasing more than 50 systems annually and to whom the cost savings outweigh the advantage of IBM maintenance support and the prestige of the IBM name.

C. DISTRIBUTED PROCESSING

- The Series/1 is an ideal vehicle to implement IBM's System Network Architecture (SNA) and the distributed processing functions based on the following:

  - SNA is a continually evolving concept which will be gradually implemented as new hardware and software are developed.

  - In SNA the application layer (programs) is separated from the transmission subsystem layer by the function management layer. This modularity allows new functions to be added or modified as new hardware options become available without disturbing the other layers.

  - The interrupt structure of the Sereis/1 coupled with the modular construction of the new real time operating system and the modifiable instruction set make the Series/1 a flexible subsystem within the SNA network. As a subsystem it can be a local or remote programmable controller, a remote terminal, a satellite processor or a communications controller. In fact, a device which can be described in the words of an IBM Series/1 salesman as the "anything box".

D. THE TOTAL IBM PRODUCT LINE

- The Series/1 architecture is sufficiently flexible to survive unchanged over the next eight to ten years, whereas the current generation of IBM systems, the 370 product line, will be modified and perhaps drastically changed over this same time period.

- Changes will occur gradually and many may not be evident except to the knowledgeable user. INPUT forecasts the following to occur by 1985:

  - Large systems will become architecturally more functional with enough redundancy built into the systems to insure fail safe operations.

  - Security of data access and function modification controls will be an inherent part of the large system architecture.

  - Firmware controlled data base oriented information processing systems will be at the core of each corporate information management network.

  - Functionally oriented public networks will serve the specialized requirements of the large and medium corporations as well as the general business needs of the small corporation and the individual.

  - Applications oriented terminals with programmable functions will be available to collect, edit, pre-process, pre-sort, and pre-format data locally and to access corporate, federal, financial or private data bases.

- The versatile Series/1, because of its superior price/performance and flexible architecture, is ideally suited for various communications control and terminal functions (e.g.: front end controller, concentrator, message switcher, etc.)

- More functions currently performed by the large systems will be distributed to the departments where the information is originated an/or utilized. the functions of todays free standing medium sized batch systems will be gradually absorbed by the network which will consist of functionally architected, modularly organized, large and small systems.

  - The Series/1 is a prime candidate for surviving and prospering in this environment at the expense of the low end of the 370 product line which will have to be upgraded in order to survive.

- IBM's current strategy for marketing the Systems 3, 32 and 34 compared to the Series/1 is quite distinct.

  - The Systems 3, 32 and 34 are sold to the small business or division of a larger company on an applications basis. The computer itself is not a strong sales feature. A systems engineer usually performs a work flow study, determines the monthly quantity of invoices, inventory description, etc. The user has and records the configuration and the applications packages required.

  - The Series/1 is sold to the experienced (large) user who orders what he needs and specifies the hardware and software required for the system.

- IBM can satisfy both types of users by offering the choice of a fully supported system or a lower cost system with limited OEM support.

- As the Series/1 product line acquires more software and peripherals, it will more actively compete against the fully supported small IBM systems.

  - For example: comparing on identically configured 64K IBM System 34 and a similarly equipped Series/1 (See Exhibit IX-2), a System 34 is $16K (20%) more expensive than the comparable Series/1 system.

- Another way to visualize the price difference is to note that a user ordering 10 Series/1s would have $160K to buy or develop his own programs while a 100 machine buyer would have $1.6 million to spend or save.

- If IBM doesn't provide additional software or peripherals for the Series/1 other vendors will, and if extensive software and peripherals are offered, eventually IBM's other small business systems will be impacted.

  - IBM's System 34 backlog is very high and deliveries are currently quoted at more than 12 months. Therefore, a higher number of system 34 users will have to switch to Series/1 before IBM needs to worry about its self impact.

EXHIBIT IX-2

SERIES/1

SAMPLE WORKSTATION CONFIGURATION WITH 6 CRT'S/3 PRI

MODEL	DESCRIPTION	SERIES/1 PURCHASE PRICE	SYSTEM 34 PURCHASE PRICE
4955-C	32K Bytes Processor	$ 7,915	$ 31,280
6326	32K Bytes Storage Addition	2,850	
2010	Communications Power	120	
3580	Disk Attach	(2X 815) = 1,630	
3581	Diskette Attach	(2X 730) = 1,460	
3585	Display Attach	(6X 955) = 5,730	
5620	Serial Printer Attach	(2X 930) = 1,860	
5630	Line Printer Attach	940	
5650	Programmer Console	460	
4962-4	13.9 MB Disk with Diskette	(2X 10,275)= 20,550	
4959-A	I/O Expansion Unit	2,515	
4974-1	Serial Printer	(2X 2,790)= 5,580	
4973-2	414 LPM Line Printer	12,425	
4979-1	Display Station	(6X 1,735)= 10,410	
4997-2B	Rack Enclosure*	1,315	
	TOTAL	$75,760	91,820

* Optional Equipment

E. SOFTWARE HOUSES

- The Series/1, announced as a "bare bones" system with limited software support, has provided software houses with a new business opportunity by creating a need for a variety of software tools and specialized applications programs; for example:

  - Languages

    . COBOL
    . RPG
    . BASIC
    . Extended BASIC
    . Multi User BASIC

  - Applications

    . Multiuser system with message handling capabilities.
    . TOTAL, a data base management system
    . Accounting systems
    . Management information system
    . Medical information system
    . Financial transaction system
    . Word and text processing system
    . On-line processing for credit unions, cross assemblers

- In addition to the products developed by software houses, IBM will probably convert applications packages written for the System 7 to the Series/1.

  - The Energy Management System has been converted.

  - Other candiates for conversion are:

- Fortran IV
- The Modular System Program for multiple users
- The Applications Program Generator
- The Automatic Telephone Call Monitoring Program
- The Transaction Generator System
- The Manufacturing Monitoring System
- The Process Control Program, etc.

- The development of cross compilers or assemblers by software houses will facilitate transferring industry oriented packages from the System 32 and 34 to the Series/1.

- The combination of software available for the Series/1 user, either from IBM or other software vendors, will create one of the most versatile systems available in the marketplace.

- As the price of computer hardware continues to decline, software will become an increasingly large portion of the total system cost. As the potential software revenue increases, new companies will enter the market and competition will intensify.

  - The small software house with a competitive software package establishing a marketing relationship with a company having a nation-wide distribution network (e.g.: remote computing vendor) will maximize its market penetration.

  - An agreement with IBM such as the one being negotiated by Advanced Software Products, Inc. to have IBM market and support its COBOL compiler is like "hitting the jackpot".

  - A large company with its own distribution network and application specialty will find the Series/1 an ideal vehicle for developing software systems with which to hold and expand its user base.

- The Series/1 is a new product, at the beginning of its life cycle, whose design is viable for the next eight to ten years. An investment in software for the Series/1 is likely to have an extended product life.

- The stronger a vendor's financial position, the easier it will be for him to persuade the end users who are the potential buyers of his software product.

F. REMOTE COMPUTING SERVICE (RCS) VENDORS

- The Series/1 represents a significant business opportunity for RCS vendors. The reasons are:

  - Its up-to-date architecture and IBM's support will insure that:

    . An investment in Series/1 software will not be rapidly obsoleted.
    . Customers ready acceptance.
    . Ease of interfacing with other IBM products.

  - The flexible instruction set permits quicker and less expensive programming.

  - IBM's nationwide maintenance support facilitates the servicing of remotely located clients and eases the marketing effort.

  - The flexible data communications capability and the four level interrupt system enable clients to integrate, with a smaller amount of programming, the Series/1 into their own network and share the facility with the RCS vendor.

- The Series/1 can be utilized by RCS vendors to:

- Develop or upgrade their own network.

- Interface to a users' network.

- Act as a remote batch terminal.

- Act as a concentrater or message switch.

- Act as an application oriented satellite processor.

- The potential downside risk to the RCS vendors is that IBM will provide firmware kernels within the Series/1 which will be required to take advantage of new operating system functions provided by IBM. These firmware kernels could be used by IBM to limit their competitors market.

G. THIRD PARTY VENDORS: MAINTENANCE AND LEASING

- Since IBM only sells the Series/1 there is an opportunity for third party leasing companies to provide operating or full payout leases. For operating leases, the potential dangers are many:

  - Because the product life cycle in the minicomputer industry tends to be shorter than in the large mainframe industry, the payout should be accelerated.

  - The residual value of the smaller Series/1 system will decline more rapidly than IBM's large systems.

  - IBM may introduce its own competitive leasing plan whenever marketing or financial conditions warrant it, reducing these opportunities in the future.

- Initially, there will be opportunities to provide the Series/1 to present customers. Later, the Series/1 can be part of a total financing package for a network including large mainframes, various peripherals, and software. Within this environment there is also an opportunity to furnish a lower cost plug compatible version of the Series/1 built by a semiconductor house.

- Third party maintenance companies will find ample business opportunites with the Series/1. The problem will be persuading the prospective user to abandon IBM for a potential savings in maintenance costs.

  - The low mean time between failures (MTBF) established by the Series/1 and the product's modular construction offer third party maintenance vendors an attractive and potentially lucrative opportunity.

  - The opportunities for third party maintenance vendors will be greatest:

    . In large metropolitan areas where economies of scale will allow him to price his service competitively.

    . With installations having non-IBM peripherals (which IBM is unwilling to maintain).

- A potential danger for third party maintenance companies is that IBM could develop remote diagnostic tools permitting rapid repairs while the users processing is switched into a network which takes over processing until the customers sytem is repaired.

H. COMPUTER PERIPHERAL AND MAINFRAME MEMORY VENDORS

- There is a billion dollar opportunity for peripheral, memory, and software vendors between 1977 and 1981 to sell product into the Series/1 market place.

- The largest number of users interviewed indicated they would buy non-IBM CRT terminals (88%). (Many of these users already have spare CRTs).

- Fifty percent of the users indicated they would buy non-IBM character printers.

- Forty percent of respondents reported they would consider buying non-IBM tape or disk drives.

- The potential market for add-on memories appears deceptively small on the basis of the respondents' answers; however, the answers must be interpreted in terms of historical purchases of add-on memories by the large IBM and the minicomputer users.

- Most of the interviewed users were at a very early stage in their installation cycle and had not yet considered the requirements for economies of add-on memory; However, when confronted with potential savings of 30%-50% during upgrading multiple sites, the reaction will be very different; especially since semiconductor memories are more reliable and require less maintenance than CRTs tape drives or disk drives.

- Another potential opportunity for peripheral and add-on memory vendors is to become a Series/1 plug compatible mainframe manufacturer. Since many users have indicated they would use non-IBM peripherals at a central site there is an opportunity to manufacture plug for plug Series/1 mainframe replacements.

- For example, a large user of multiple Series/1s expanding his network could ship his IBM Series/1s from his central site to his new remote locations and restock his central site with the lower priced plug compatible Series/1 mainframes.

- The market for sensors and interfaces will continue to grow as the Series/1 penetrates new control markets. Another market which the Series/1 will expand is the special purpose transaction oriented device market. For example, services interfacing with the Series/1 , such as the bulk terminal card readers used by Amoco.

- The demand for Series/1 plug compatible peripherals and memories will accelerate as the installed base grows and the quality and therefore the acceptance by the user of non-IBM peripherals increases.

- There may be additional movements among minicomputer manufacturers to organize a miniperipheral manufacturing joint venture similar to Computer Peripherals, Inc. (CPI) organized by Control Data, NCR and ICL to supply peripherals for their own as well as OEM and plug compatible markets. If this occurs, user acceptance of non-IBM peripherals will continue to grow.

APPENDIX I: LIST OF USER RESPONDENTS

APPENDIX-1

LIST OF SERIES/1 USERS INTERVIEWED SEGMENTED

BY TYPE AND GEOGRAPHIC LOCATION

	USER TYPE			GEOGRAPHIC LOCATION				
NAME	END USER	SYSTEM HOUSE	HARD INT.	NE	SE	MW	SW	W
SPAN MANAGEMENT SYSTEMS		X		X				
STANDARD OIL OF INDIANA	X					X		
SYSTEMS DESIGN AND DEVELOPMENT		X						X
KREISEL	X			X				
GRAHAM COMPUTER ENTERPRISES		X			X			
MAC MILLAN BLOEDEL CO.	X				X			
SOFTWARE DESIGN INC.		X		X				
MINE COMPUTER SYSTEM INC.			X				X	
MDB SYSTEMS INC			X					X
ADVANCED SOFTWARE PRODUCTS		X			X			
CONVERSATIONAL SYSTEMS INC.		X		X				
COLONIAL OIL INDUSTRIES	X				X			
COMPUDATA INC.		X		X				
QUAKER CITY MOTOR PARTS	X			X				
NATIONAL SYSTEMS CORP		X				X		
TELEDYNE CUSTOMER PRODUCTS	X							X
HOUSE OF GOOD SAMARITAN HOSP.	X			X				
CHBRT INC.	X			X				
CUNADATA CORP		X				X		
FREDERICK R. NEWTON CO.		X			X			

APPENDIX-1 (CONT'D)

LIST OF SERIES/1 USERS INTERVIEWED SEGMENTED

BY TYPE AND GEOGRAPHIC LOCATION

	USER TYPE			GEOGRAPHIC LOCATION				
NAME	END USER	SYSTEM HOUSE	HARD INT.	NE	SE	MW	SW	W
SYSTEMS ENGINEERING CO.			X		X			
CHAMPION INTERNATIONAL	X					X		
REVELON INC.	X			X				
INTERFACE SYSTEMS			X				X	
PROFESSIONAL COMPUTER SERVICE		X			X			
DATUM SYSTEMS INC.			X					X
MANCHESTER COLLEGE	X					X		
WACKENHUT ELECTRONICS SYSTEMS			X		X			
UNIVERSITY OF WATERLOO		X				X		
BLOCK ASSOCIATES			X				X	
SYSTEM SELECTION LTD		X				X		
GROCERS SUPPLY CO.	X						X	
TRANSPORTATION SYSTEMS AND SOFTWARE		X		X				
GENERAL MOTORS OF CANADA	X					X		
CITIBANK	X			X				
SENSOR BASED SYSTEMS			X			X		
RICE FOOD MARKETS	X						X	
H.E. BUTT GROCERY CO.	X						X	
CLEMSON UNIVERSITY	X				X			
APPLIED COMPUTER SYSTEMS INC.		X						X

APPENDIX 2: SERIES/1 HARDWARE DESCRIPTION

APPENDIX 2: SERIES/1 HARDWARE DESCRIPTION *

A. THE 4953 PROCESSOR

- Four models of the 4953 Processor are available.

  - Model A

    . 1/2 rack width unit
    . 16K bytes main storage
    . Additional storage in 16K byte increments
    . 64K bytes maximum

  - Model B

    . Full rack width unit
    . 16K bytes main storage
    . Additional storage in 16K byte increments
    . 64K bytes maximum

  - Model C

    . 1/2 rack width unit
    . 32K bytes main storage
    . Additional storage in 16/32K byte increments
    . 64K byte maximum

* Information contained in this appendix was supplied by or extracted from IMB publications.

- Model D

  - Full rack width unit
  - 32K bytes main storage
  - Additional storage in 16/32K byte increments
  - 64K bytes maximum

- The IBM 4953 Processor is a general purpose computer with the following characteristics:

  - Four priority interrupt levels-independent registers and status indicators for each level. Automatic and program controlled level switching.

  - Main storage-read and write time is 600 nanoseconds maximum (minimum 800 nanoseconds required between two storage access cycles). Odd parity by byte is maintained throughout storage.

  - TTL (transistor-transistor logic) processor technology

  - Microprogram control-microcycle time: 200 nanoseconds.

  - Instruction set that includes: stacking and linking facilities, multiply and divide, variable field-length byte operations, and a variety of arithmetic and branching instructions.

  - Supervisor and problem states.

  - Packaged in a 19-inch rack mountable unit-full width or half width.

  - Basic console standard in processor unit. Programmer console optional.

  - Channel capability

- Asynchronous, multidropped channel
- 256 I/O (input/output) devices can be addressed
- Direct program control and cycle steal operations
- Maximum burst data rate is 666K words per second (1.332 megabytes if transmitted in pairs). When multiple cycle stealing devices are interleaved, the aggregate data rate is also 666K words.

- The processor unit contains power and space for additional features and storage. The IBM 4959 Input/Output Expansion Unit is also available for additional features.

I. PROCESSOR DESCRIPTION

- Exhibit A2-1 shows a block diagram of an IBM 4953 Processor and an IBM 4959 Input/Output Expansion Unit.

The processor is microprogram controlled, utilizing a 200 nanosecond micro-cycle. Circuit technology is TTL.

Four priority interrupt levels are implemented in the processor. Each level has an independent set of machine registers. Level switching can occur in two ways: (1) by program control, or (2) automatically upon acceptance of an I/O interrupt request. The interrupt mechanism provides 256 unique entry points for I/O devices.

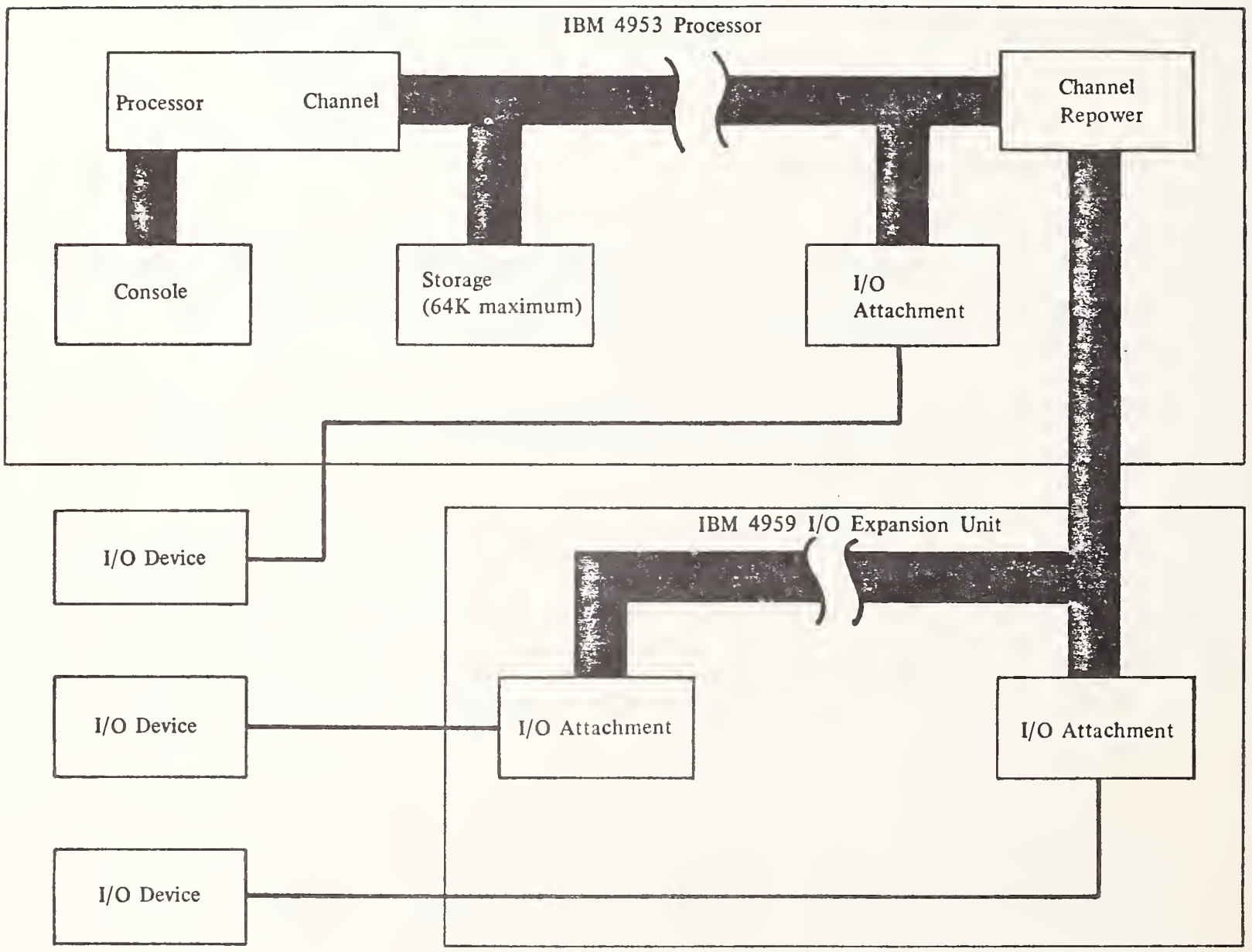
The processor instruction set contains a variety of instruction types. These include: shift, register to register, register immediate, register to (or from) storage, bit manipulation, multiple register to storage, variable byte field, and storage to storage. Supervisor and problem states are implemented, with appropriate privileged instructions for the supervisor.

APPENDIX-2

EXHIBIT II-1

BLOCK DIAGRAM OF IBM 4953 PROCESSOR AND AN

IBM 4959 I/O EXPANSION UNIT



The basic console is intended for dedicated systems that are used in a basically unattended environment. Only minimal controls are provided. A programmer console can be added as a feature; this console provides a variety of indicators and controls for operator-oriented systems.

Basic storage supplied is 16K bytes for models A and B; 32K bytes for models C and D. Models A and B can add additional storage in 16K byte increments up to 64K bytes maximum. Models C and D can add additional storage in 16K and/or 32K byte increments up to 64K bytes maximum. The maximum read/write access time for main storage is 600 nanoseconds. However, the minimum duration of time between successive storage cycles is 800 nanoseconds.

I/O devices are attached to the processor through the processor I/O channel. The channel directs the flow of information between the I/O devices, the processor, and main storage. The channel accommodates a maximum of 256 addressable devices. The channel supports:

- Direct program control operations. Each Operate I/O instruction transfers a byte or word of data between main storage and the device. the operation may or may not terminate in an interrupt.

- Cycle steal operations. Each Operate I/O instruction initiates multiple data transfers between main storage and the device (65, 535 bytes maximum). Cycle steal operations are overlapped with processing operations and always terminate in an interrupt.

- Interrupt servicing. Interrupt requests from the devices, along with cycle steal requests, are presented and polled on the interface concurrently with data transfers.

2. INPUT/OUTPUT UNITS AND FEATURES

- IBM 4962 Disk Storage Unit (4 models)
  - Requires 4962 Disk Storage Unit Attachment Feature
- IBM 4964 Diskette Unit
  - Requires 4964 Diskette Unit Attachment Feature
- IBM 4979 Display Station
  - Requires 4979 Display Station Attachment Feature
- IBM 4973 Line Printer (2 models)
  - Requires 4973 Printer Attachment Feature
- IBM 4974 Printer
  - Requries 4974 Printer Attachment Feature
- Timers Feature (2 timers)
- Teletypewriter Adapter Feature
- Customer Direct Program Control Adapter Feature
- The feature cards for attaching the I/O units can be housed in either the processor unit or the I/O expansion unit.

3. COMMUNICATIONS FEATURES

- Asynchronous Communications Single Line Control
- Binary Synchronous Communications Single Line Control/High Speed

- Synchron Data Link Control Single Line Control
- Asynchronous Communications 8 Line Control
- Asynchronous Communications 4 Line Adapter
- Binary Synchronous Communications 8 Line Control
- Binary Synchronous Communications 4 Line Adapter
- Communications Power Feature
- Communications Indicator Panel

4. SENSOR INPUT/OUTPUT OPTIONS

- IBM 4982 Sensor Input/Output Unit
  - 4982 Sensor Input/Output Unit Attachment Feature
- Features for the 4982 Sensor I/O Unit
  - Digital Input/Process Interrupt Non-Isolated
  - Digital Input/Process Interrupt Isolated
  - Digital Output Non-Isolated
  - Analog Input Control
  - Amplifier Multirange
  - Analog Input Multiplexer-Reed Relay
  - Analog Input Multiplexer-Solid State
  - Analog Output

- The integrated digital input/output non-isolated feature provides digital sensor I/O and simple attachment for non-IBM equipment. This feature card can be housed in either the processor unit or the I/O expansion unit.

  The 4982 sensor input/output attachment unit feature card is housed in either the processor unit or the I/O expansion unit.

5. PACKAGING AND POWER OPTIONS

- IBM 4959 Input/Output Expansion Unit
- IBM 4999 Battery Backup Unit
- IBM 4997 rack Enclosure (1-metre) - 2 models
- IBM 4997 Rack Enclosure (1.8-metre) - 2 models

- The IBM 4959 Input/Output Expansion Unit is available for adding I/O feature cards beyond the capacity of the processor unit. Te capacity of the I/O expansion unit is either (1) fourteen I/O cards, or (2) thirteen I/O cards plus a channel repower card. a channel repower card is required to power each additional I/O expansion unit.

  The IBM 4999 Battery Backup Unit permits the processor unit (excluding external devices) to operate from a user-supplied battery when a loss or dip in line power occurs.

6. OTHER OPTIONS

- Additional options such as communications cables, customer access panel, and a channel socket adapter are also available.

7. STACK OPERATIONS

- A notable feature of the series/1 is its stack operations capability. A brief description of this capability follows:

  - The processing unit provides two types of stacking facilities. Each facility is briefly described. the two types of stacking facilities are:

    . Data Stacking. This facility provides an efficient and simple way to handle last-in first-out (LIFO) queues of data items and/or parameters in main storage. The data items or parameters are called stack elements. For a given queue (or stack), each element is one, two, or four bytes wide. Instructions for each element size (byte, word, or doubleword) are provided to:
      a. Push an element into a stack (register to storage).
      b. Pop an element from a stack (storage to register).

    . Linkage stacking. This facility provides an easy method for linking subroutines to a calling program. A word stack is used for saving and restoring the status of general registers and for allocating dynamic work areas. The Store Multiple (STM) instruction stores the contents of the registers into the stack and reserves a designated number of bytes in the stack as a work area. the Load Multiple and Branch (LMB) instruction reloads the registers, releases the stack elements, and causes a branch back to the calling program.

B. THE 4955 PROCESSOR

- The IBM 4955 Processor is a compact, general purpose computer and has the following general characteristics:

- Four priority interrupt levels-independent registers and status indicators for each level. Automatic and program controlled level switching.

- Four processor models are available:

  . Model A: 16K bytes basic storage. Additional storage in 16K byte increments up to 64K bytes maximum.

  . Model B: 16K bytes basic storage. Additional storage in 16K byte increments up to 128K bytes maximum.

  . Model C: 32K bytes basic storage. Additional storage in 32K* byte increments up to 64K bytes maximum.

  . Model D: 32K bytes basic storage. Additional storage in 32K* byte increments up to 128K bytes maximum.

- FET (field effect transistor) main storage. Read or write time is 300 nanoseconds (660 nanoseconds required between two storage access cycles). Odd parity by byte is maintained throughout storage.

- TTL (transistor-transistor logic) processor technology.

- Microprogram control-microcycle time: 220 nanoseconds.

- Instruction set that includes: stacking and linking facilities, multiply and divide, variable field-length byte operations, and a variety of arithmetic and branching instructions.

- Supervisor and problem states.

- Packaged in a 19-inch rack mountable unit-full width.

- Basic console standard in processor unit. Programmer console optional.

- Channel capability.

  . Asynchronous, multidropped channel.
  . 256 I/O (input/output) devices can be addressed.
  . Direct program control and cycle steal operations.
  . Maximum burst data rate is 1.8 megabytes per second for storage input cycles, and 1.5 megabytes per second for storage output cycles. When multiple cycle stealing devices are interleaved, the maximum aggregate data rate is 1.65 megabytes per second.

- The processor unit contains power and space for additional features and storage. The IBM 4959 Input/Output Expansion Unit is available for additional features.

The processor unit is described in the following sections of this chapter:

1. IBM 4955 PROCESSOR

- Processor Optional Features/Storage Addition

  - Storage Address Relocation Translator (permits addressing of main storage larger than 64K bytes).

  - Storage Addition - 16,384 bytes.

    . providing storage in 16K byte increments for all processor models.
    . Model A has a limit of four 16K cards (64K bytes total).
    . Model B has a limit of eight 16K cards (128K bytes total).
    . Models C and D have a limit of one 16K card and it must be installed as the last storage card. that is: any 32K cards would be installed between the 16K card and the processor cards.

- Storage Addition - 32,768 bytes.

  . provides storage in 32K byte increments for processor Models C and D.
  . Model C has a limit of two 32K cards (64K bytes total).
  . Model D has a limit of four 32K cards (128K bytes total).

- Programmer Console

- Floating-Point.

• Processor Desription

- The basic IBM 4955 Processor includes the processor, basic storage, and a basic console. these items are packaged in a unit, called the processor unit. Exhibit A2-2 shows a block diagram of an IBM 4955 Processor and an IBM 4959 Input/Output Expansion Unit.

- The processor is microprogram controlled, utilizing a 220 nanosecond microcycle. Circuit technology is TTL (transistor-transistor logic).

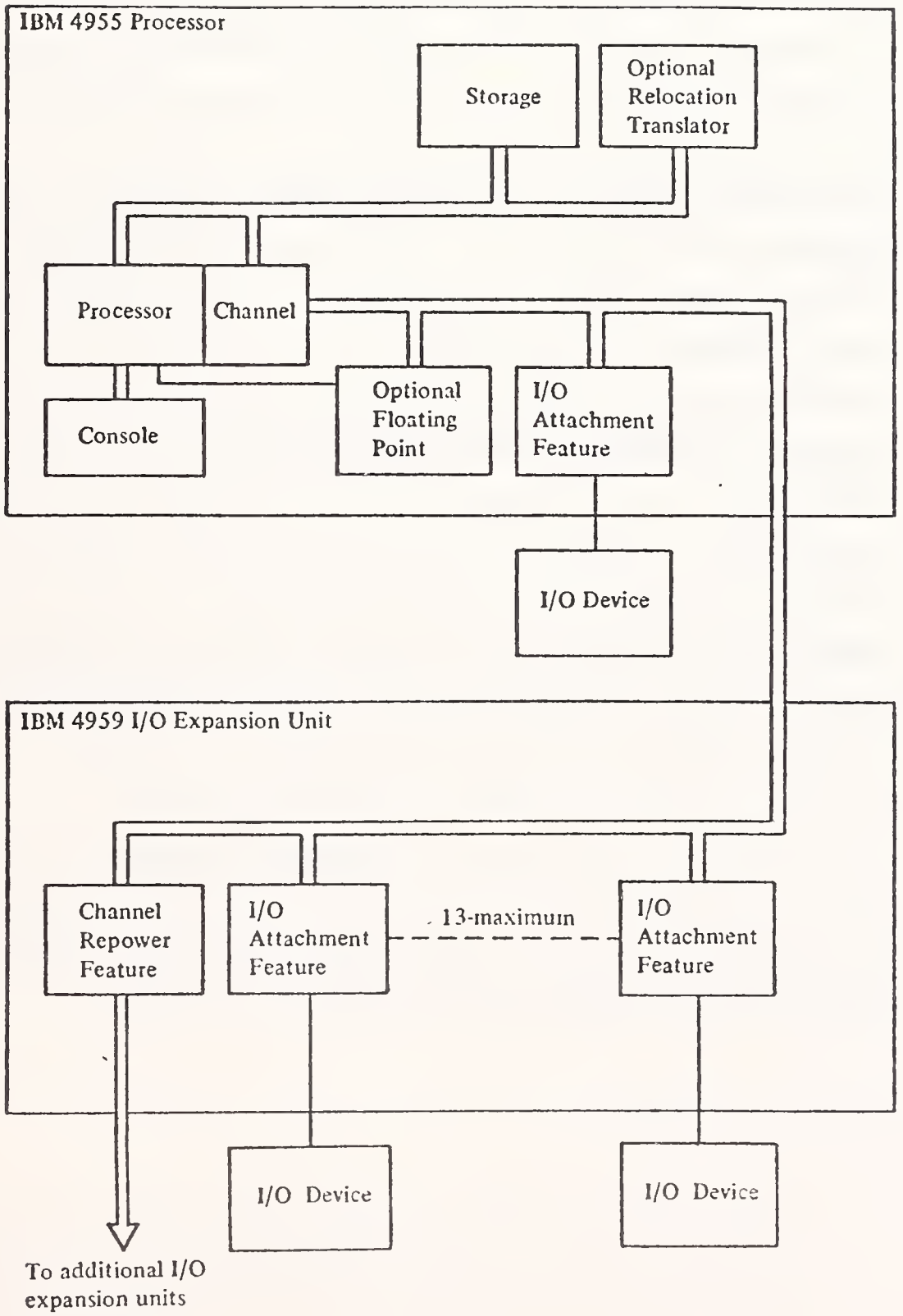
- Four priority interrupt levels are implemented in the processor. Each level has an independent set of machine registers. Level switching can occur in two ways: (1) by program control, or (2) automatically upon acceptance of an I/O iterrupt request. The interrupt mechanism provides 256 unique entry points for I/O devices.

- The processor instruction set contains a variety of instruction types. These include: shift, register to register, register immediate, register to (or from) storage, bit manipulation, multiple register to storage, variable byte field, and storage to storage. Supervisor and problem state are implemented, with appropriate privileged instructions for the supervisor.

APPENDIX-2

EXHIBIT II-2

BLOCK DIAGRAM OF AN IBM 4955 PROCESSOR AND AN IBM 4959 INPUT/OUTPUT EXPANSION UNIT



- A floating-point feature available that supplements the standard instruction set. The floating-point instructions include single and double precision types for: add, subtract, multiply, divide, compare, and move.

- The basic console is intended for dedicated systems that are used in a basically unattended environment. Only minimal controls are provided. A programmer console can be added as a feature; this console provides a variety of indicators and controls for operator-oriented systems.

- Min storage technology is FET (field-effect transistor). Basic storage supplied is model dependent. Two storage additions provide additional storage in 16K or 32K byte increments. The maximum total storage is model dependent. Beyond 64K bytes the storage address relocation translator feature is required. This feature increases the addressing capability beyond 64K bytes and allows a maximum total storage of 128K bytes. The read/write access time for main storage is 300 nanoseconds. However, the minimum duration of time between successive storage cycles is 660 nanoseconds. Storage protection is standard. It protects against (1) access (reading and writing) to defined blocks of storage by software or by an I/O operation, and (2) writing in an undesired location within a defined block by software.

- I/O devices are attached to the processor through the processor I/O channel. The channel directs the flow of information between the I/O devices, the processor, and main storage. This channel accommodates a maximum of 256 addressable devices.

- The channel supports:

  . Direct program control operations. Each Operate I/O instruction transfers a byte or word of data between main storage and the device. The operation may or may not terminate in an interrupt.

- Cycle Steal operations. Each Operate I/O instruction initiates multiple data transfers between main storage and the device (65,535 bytes maximum). cycle steal operations are overlapped with processing operations and always terminate in an interrupt.

- Interrupt Servicing. Interrupt requests from the devices along with cycle steal requests, are presented and polled concurrently with data transfers.

- The processor is packaged in a standard 48.3 cm (19 in) rack-mountable unit, called the processor unit. All processor units contain an integral power supply, fans, and the basic console. Four processor models are available.

IBM 4955 PROCESSOR MODELS

Model	A	B	C	D
Storage capacity (bytes)*	64K	128K	64K	128K
I/O feature cards**	8	3	10	7

* Relocation translator feature is required when the total storage exceeds 64K bytes.

** The folating-point feature can be substituted for one of the I/O feature cards and must be installed adjacent to the processor.

- Storage Protection

  - The storage protection mechanism is provided as a basic part of the IBM 4955 Processor. This description of the oepration of the storage protection mechanism applies only when the Storage Address Relocation Translator Feature is not installed or is disabled and, therefore, applies only to the first 64K bytes of storage. When the relocation translator feature is installed and enabled, the storage protection mechanism, as described in this chapter, is disabled and all storage protection is controlled by the relocation translator.

  - The state of the storage protection mechanism is controlled by the Enable (EN) and the Disable (DIS) instructions described in Chapter 8. when enabled, it protects against: (1) access (reading and writing) to defined blocks of storage by software or by an I/O operation, and (2) writing in an undesired location within a defined block by software.

  - Storage is divided into blocks of 2048 bytes (Exhibit). Thirty-two storage key registers are installed; one for each block of storage up to the maximum storage size of 64K bytes. Each block has an associated 8-bit storage key register containing a three-bit storage key and a read-only bit. the storage key and the read-only bit are set into a storage key register.

- Storage Address Relocation

  - The Storage Address Relocation Translator Feature is an optional feature for the IBM 4955 Processor Model B or D.

- The relocation translator feature permits addressing of main storage locations beyond 64K bytes. The first 64K bytes can be directly addressed when the translator is disabled. Therefore, the feature is required when main storage is larger than 64K bytes. The reason for this requirement is that addresses, without this feature, are 16 bits long and provide an addressing capability of:

Hexadecimal	Decimal
0000	0
to	to
FFFF	65,535

- Addresses generated in relocation mode are 24 bits long. The 24-bit address provides an addressing capability of:

Hexadecimal	Decimal
000000	0
to	to
FFFFFF	16,777,215

- This addressing range should not be confused with main storage size, which is a maximum of 128K bytes for the IBM 4955 Processor Model B or D.

- Besides address generation, storage protection also functions differently in relocation mode. When the translator feature is installed and enabled, the storage protection mechanism is desabled and all storage protection is under control of the translator.

C. COMMUNICATION FEATURES

- The Series/1 communications features are designed to provide a variety of communications options. the features are the Synchronous Data Link Control Single-Line Control feature (SDLC), the Binary Synchronous Communications feature (BSC), and the Asynchronous Communications Control feature (ACC).

  The three features provide a capability to communicate with telecommunication terminals and host systems. Only the single-line BSC features are capable of receiving an Initial Program Load (IPL) from a host system.

SUMMARY DESCRIPTION

- The features provide a variety of single-line and multiple-line telecommunications capability. In addition, there is a variety of line speeds, line configurations, clocking sources and data codes to choose from. All communications features described in this manual are cycle-stealing devices.

COMMUNICATIONS FEATURES

Asynchronous Communications Single-Line Control Feature. This feature provides circuitry for one half duplex line. It can operate at speeds up to 9,600 BPS (bits per second). It can be used as either a primary station or a secondary station. The ACC makes no provisions for station-address recognition. Therefore, when aCC is used as a secondary station on a multipoint network, the software must provide the ability to recognize station-sddresses. No IPL capacity is provided.

Asynchronous Communications 8-Line Control and Asynchronous Communications 4-Line Adapter Features. A maximum of eigght lines operating half duplex may be controlled by these features. the bit-rate for each of these lines is a maximum of 2,400 bits per second.

Binary Synchronous Communications Single-Line Control Feature. This feature provides circuitry for one half-duplex, medium speed (up to 9,600 bits per second) line. It also provides the ability to IPL (initial program load) the processor from a host system. This feature can be used as either a primary (control) of secondary (tributary) station.

Binary Synchronous Communications Single-Line Control/High Speed Feature. This feature provides circuitry for one half-duplex, high speed (up to 56,000 BPS) line. It also provides the ability to IPL the processor from a hose system. This feature can be used as either a primary or secondary station. this feature is for use in leased-line applications only.

Binary Synchronous Communications 8-Line Control and Binary Synchronous Communications 4-Line Adapter Features. These features can control up to eight half-duplex communications lines at medium speeds. the maximum aggregate bit-rate possible through the 8-line control feature is 33,600 BPS. the ability to IPL from a host system is not provided on multiple-line BSC features.

Synchronous Data Link Control Single-Line Control Feature. this feature provides circuitry for on half-duplex line. this line can handle bit-rates up to 9,600 bits per second (BPS). The SDLC feature operates as a primary station or a secondary station but provides no IPL capacity.

Interfaces. In all features except the high speed BSC, an EIA* RS232-C and CCITT (Consultive Committee on International Telephone and telegraph) V.24 interface is provided for each line. The interface directly drives or terminates an external modem. The high speed BSC provides interfaces compatible with the Western Electric 303 Data Set (or equivalent), and CCITT recommendation V.35.

APPENDIX 3: SERIES/1 SOFTWARE DESCRIPTION

APPENDIX 3: SERIES/1 SOFTWARE DESCRIPTION*

IBM Series/1 Realtime Programming System

The Realtime Programming System is an operating system through which a user can install, operate, and maintain system programs, application programs, and data. realtime Programming System manages all physical resources-processor, storage (up to 64K bytes), and I/O devices. Its supervisor and data management services are a high-level, controlled interface between application programs and the Series/1 hardware, It inlcudes supervisory routines for communications applications as well as a set of utilities for installation and maintenance of application programs and data. Realtime Programming System in conjunction with the Program Preparation Subsystem supports both realtime and batch program environments.

Highlights

- Multiprogramming-Processor storage is divided into multiple fixed partitions; programs execute in partitions based on their priority. Programs in two or more partitions are processed concurrently.

- Multitasking-The operating system allows multiple concurrent task operations in the same partition with synchronization and communication between them. In addition, single reenterable programs can be used by more than one task.

* Information contained in this appendix was supplied by or extracted from IBM publications.

- Event-driven-Programs are queued for execution in partitions based on these types of events:
  - External (process interrupt)
  - Time of day
  - Time interval, either single or repetitive
  - Operator request
  - Program request
- Disk-bases-The system program library and transients must reside on disk. User program libraries and application program overlays can reside on disk or diskettes.

IBM Series/1 Program Preparation Subsystem

The IBM Series/1 Program Preparaion Subsystem provides program preparation or general purpose batch computing concurrent with realtime program execution. It consists of four program components which run as task sets under control of the Realtime Programming System. These components include the Job Stream Processor, the Text Editor, the Macro Assembler, and the Application Builder.

Highlights

- Job Stream Processor-This facility provides a convenient method of invoking programs and defining the data sets and devices that the programs use. The Job Stream Processor reads, analyzes, and processes job control statements, and provides transition from one batch program to the next.

- Text Editor-The Text Editor is used to create and modify text datra sets containing source code or job control statements. Source code data sets created witht he Text Editor can be assembled by the Program Preparation Subsystem's Macro Assembler, or compiled by the Series/1 FORTRAN IV or series/1 PL/1 compilers.

- Macro Assembler-The Macro Assembler processes the user's source statements consisting of machine, assembler and macro instructions. It produces object modules on disk/diskette as well as program listings, symbol dictionaries, cross reference tables, and diagnostic messages on the printer.

- Application Builder-The Application Builder processes one or more object modules that result from assembly or compilation and converts them into executable load modules or task sets.

IBM Series/1 PL/1

PL/1 provides a single high-level language for programming commercial, scientific, and realtime applications. It has FORTRAN-like facilities for processor-oriented applications and COBOL-like facilities for input/output and data manipulation-oriented applications. The Series/1 PL/1 language is extensive in function, aimed at allowing the user to quickly develop efficient application programs that can easily be extended or changed.

Series/1 PL/1 consists of two products: (1) a compiler with a resident library and (2) a transient library. the resident library consists of commonly used subroutines which ar ecombined with the user's program at execution of the Application Builder. The transient library consists of routines loaded dynamically into a shared task set during objective program execution.

Highlights

- Stream and record I/O capabilities-Stream I/O statements read and write data with a minimum of programming effort, because automatic formattin and conversion are provided. Specific options are list-directed and edit-directed I/O.

A variety of record I/O options provide improved I/O control. Included are consecutive synchronous I/O, direct I/O, sensor I/O, and transient files.

- Data Types and Organizations-Series/1 supports arithmetic data, string data, and program control data. Arithmetic data can be represented in either binary or decimal radix and can be either fixed or floating point. Fixed point word and doubleword precisions are supported. decimal fixed point data can have up to 15 digit positions, with up to 15 fractional positions. String data can be either bit or character, with fixed or verying length attributes. Program control data can be label, event, activation, lock, or pointer. Entry and file parameters are also supported.

  PL/1 data may be organized into arrays of up to 15 dimensions or in structures (hierarchical collections of data, not necessarily of the same type). A structure can also be dimensioned.

  This wide variety of data types and organizations allows the user to operate on data in the manner that most naturally matches the problem conception.

- Data Manipulation Features-Series/1 PL/1 provides both ease of expression and programmer productivity, since it supports all major PL/1 operations, data types, and statements. Of particular interest are:
  - Powerful string operations, including substrings, concatenation, and general boolean operations
  - Full set of language built-in functions, including mathematicl functions, string functions, and array functions
  - Structure assignment
  - Automatic data conversions in expressions

- Genralized subscriptin
- Full support for internal and external procedures
- Control structures including IF-THEN, IF-THEN-ELSE, DO-WHILE.

- Language Extensions-Series/1 PL/1 is a subset of ANS PL/1 plus language extensions which provide users with utilization of the Series/1 hardware and operating system environment. Language extensions allow starting ofasychronous tasks and programs, and synchronization of their execution. Powerful event handling and resource control statements allow the user to easily code applications that involve response to realtime events and resolution of resource contention. The ability to handle sensor I/O is also provided.

- Productivity Features-PL/1's natural syntax permits the expression of many functions without the use of CALL statements. Additional features include:
  - Extensive compile-time diagnostic messages
  - Compile-time listing aids
  - Execution-time diagnostic messages
  - User Programming and control of error conditions via the PL/1 ON-handling language.

- Additional Features-Included int his category are those aspects of Series/1 PL/1 that make it uniquely suitable as a general application development tool. Of particular interest are
  - Storage efficiency gained by the generation of reentrant code and support for automatic storage allocation
  - Program modularity and interface checking provided by the PL/1 block structure and scope rules and the ENTRY attribute.
  - The ability to build and manipulate chained data lists, rings, and plexes using the PL/1 list processing support (pointer data type and based storage)

IBM Series/1 FORTRAN IV

FORTRAN IV is a high-level, mathematically-oriented language designed to manipulate numerical data and format input/output operations. In addition to being easily learned and understood, applications can be programmed without knowledge of the series/1 assembler language. Programming productivity is increased since high-level languages require less coding than assembler languages.

Series/1 FORTRAN IV consists of two products: (1) a compiler and object support library and (2) an optional realtime subroutine library. FORTRAN IV with the prerequisite Mathematical and Functional Subroutine Library includes American National standard Basic FORTRAN x 3.10-1966 and is a subset of ANS FORTRAN x 3.9-1966. Series/1 FORTRAN IV has been enhanced with IBM extensions to adapt FORTRAN to Series/1 environment and provide greater programming flexibility.

Highlights

- Multiple Program Support
- Logical and relational operations
- Bit-level operations
- Direct-Access Input/Output
- Device-Independent Input/Output
- List-Directed Input/Output
- Double precision
- Syntax checking mode
- Dynamic debug facility
- Reentrant library routines

Realtime Subroutine Library Features-FORTRAN IV Realtime Subroutine Library, an optional licensed program, contains subroutines which conform to ISA S61.1-1976. Subroutines are available to programs via the CALL statement.

- Executive function subroutines provide the ability to start, stop, or delay the execution of programs
- Process I/O subroutines access analog and digital points for both input and output
- System service interface subroutines access system services, such as task set management, queue management, and interrupt management
- Time subroutine determines current time of day
- Date subroutine determines current calendar date

IBM Series/1 Mathematical and Functional Subroutine Library

The Series/1 Mathematical and Functional Subroutine Library (MFSL) is a set of commonly used mathematical and data conversion subroutines. The MFSL subroutines are required with the IBM Series/1 FORTRAN IV Licensed Program. Allroutines are reentrant.

Highlights

- Mathematical functions to aid the application programmer including sine, cosine, logarithms and exponentiation functions, maximum and minimum functions, modular arithmetic and others.

- Conversion routines to convert numerical data between EBCDIC format and Series/1 internal data format that is suitable for mathematical operations.

- Error checking routines to detect error conditions during processing mathematical and conversion routines, including checking illegal arguments and invalid conversion data inputs, testing floatingpoint divide exceptions and testing floating-point overflow and underflow conditions.

- Subroutine library services allow assembler users to initialize and release a library work area and to specify an abnormal termination processing routine which allows a user to receive control on program interrupts or abnormal execution of system MACRO instructions.

Control Program Support Enhancements

Control Program Support is a set of object modules which provide Task Management and data Processing I/O Support for users who wish to develop tailored control programs. IPL/Loaders for both disk and diskette are also provided. The object modules must be link-edited with a user application by using the Linkage Editor which is part of the Series/1 Base Program Preparation Facilities. Six important extensions to Control Program Support are:

- IBM Series/1 4979 Display Station Control Program Support
  - Provides READ/WRITE support for the IBM 4979 Display Station

- IBM Series/1 4978 Display Station Control Program Support
  - Provides READ/WRITE support for the IBM 4978 Display Station

- IBM Series/1 Binary Synchronous Communications Control Program Support

- Provides READ/WRITE support for the following communications features:
  - Bisynchronous Single Line Control (#2074)
  - Bisynchronous Single Line Control/High Speed (#2075)
  - Bisynchronous 8-Line Control (#2093)
  - Bisynchronous 4-Line Adapter (#2094)

- IBM Series/1 Indexed Access Method Control Program Suppoet
  - Provides an Indexed Access Method for the Control Program Support user

- IBM Series/1 Control Program Support Extensions I
  - Provides a set of functional modules for I/O queuing, data file integrity, and buffer pooling

- IBM Series/1 Control Program Support Extensions II
  - Provides a set of functional modules for data editing, EBCDIC/Binary conversion, time/date reference, and task scheduling

IBM Series/1 Standalone Utilities Enhancement

The IBM Series/1 Standalone Utilities include utilities to initialize and service the 4962 Disk Storage Unit and the 4964 Diskette Unit and perform basic functions necessary for the operation of the system.

Error logging facilities are provided to log execution time errors. the facilities offer the user the ability to format a printable error record for porcessor errors, device I/O request errors, and device interrupt errors. the user provides the area in which the record will be built. The user must also provide his own I/O routine to display the record on a console or printer device, or may write it to a disk or diskette device for intermediate storage. When the log is on disk or diskette, the Standalone Utilities provide facilities for printing the log on the console or printer device.

APPENDIX 4: PRICE LISTS

APPENDIX-4

*SERIES/1 PRICE LIST

HARDWARE PRODUCTS

(April, 1977)

Machine Type	Model Number	Description	Purchase Price	Monthly Maintenance
4953	A	Processor, 16KB (maximum of 64KB, maximum 4 I/O locations, 1/2 width module)	$ 4,360	$ 80.00
	B	Processor, 16KB (maximum of 64KB, maximum 13 I/O locations, full width module)	5,190	78.00
	6315	16KB Additional Storage	1,510	10.00
	C	Processor, 32KB, (maximum of 64KB, maximum of 4 I/O locations, 1/2 width module)	5,870	88.00
	D	Processor, 32KB (maximum of 64KB, maximum of 13 I/O locations, full width module)	6,700	88.00
	6316	32KB Additional Storage	2,425	22.00
4955	A	Processor, 16KB (maximum of 64KB, maximum 8 I/O locations, full width module)	6,165	77.00
	B	Processor, 16KB (maximum of 128KB, maximum 3 I/O locations, full width module)	6,165	77.00
	6325	16KB Additional Storage	1,750	8.00
	C	Processor, 32KB (maximum of 64KB, maximum of 10 I/O locations, full width module)	7,915	87.00
	D	Processor, 32KB (maximum of 128KB, maximum of 7 I/O locations, full width module)	7,915	87.00
	6326	32KB Additional Storage	2,850	14.00

* Information contained in this appendix was supplied by or extracted from IBM publications

Machine Type	Model Number	Description	Purchase Price	Monthly Maintenance
4959	A	I/O Expansion Unit	$ 2,515	$ 37.00
4962	1	9.3MB Disk	6,895	44.00
	1F	Disk with 8 Fixed Heads	7,760	60.00
	2	Disk Plus Diskette Unit	8,575	60.00
	2F	Disk plus Diskette with 8 Fixed Heads	9,440	76.00
4964	1	Diskette Unit, .5MB	2,410	17.00
4973	1	Printer, 150LPM	8,624	85.00
	2	Printer, 400LPM	12,425	158.00
4974	1	Printer, 120CPS	2,790	34.00
	4450	Forms Stand	54	------
4979	1	Display Station	1,735	25.00
4982	1	Sensor I/O Unit	1,655	11.00
4997	1A	Rack Enclosure, 1 meter	870	2.00
	2A	Rack Enclosure, 1.8 meters	1,160	5.00
	1B	Rack with Covers, 1 meter	1,025	2.00
	2B	Rack with Covers, 1.8 meters	1,315	5.00
4999	1	Battery Backup, 115V	1,895	18.00
	2	Battery Backup, 208V, 230V	1,875	18.00

* Information contained in this appendix was supplied by or extracted from IBM publications.

SERIES/1 PRICE LIST

FEATURES AVAILABLE FOR LOCATIONS IN THE I/O SLOTS OF THE 4953 AND 4955 PROCESSORS

Feature Number	Description	Purchase Price	Monthly Maintenance
1060	Analog Input Control	$ 800	$ 4.50
1065	Analog Output Control	525	5.00
1070	Amplifier Multirange	915	5.00
1560	Integrated Digital I/O Non-Isolated	825	14.00
1565	Channel Repower	520	2.00
1595	Channel Socket Adapter	73	50
1610	Asynchronous Communications Single Line Control	1,090	17.00
2000	Communications Indicator Panel	250	3.00
2010	Communications Power (Except 4953-A)	120	3.00
2055	Teletypewriter Cable	52	.50
2056	Asynchronous Local Attachment Comm. Cable	47	.50
2057	EIA Dataset Cable	70	.50
2058	BSC/HS Cable	125	.50
2059	Teletypewriter Cust. Access Panel Cable	40	.50
2060	BSC V.35/HS DDN Cable	122	.50
2074	Binary Synchronous Communications Single Line Control	1,190	19.00
2075	Binary Synchronous Communiciations Single Line/High Speed	1,380	21.00
2090	SDLC Single Line Control	1,420	19.00
2091	Asynchronous Communications	975	13.00
2092	Asynchronous Communications 4 Line Adapter	1,005	30.00
2093	Binary Synchronous Communications 8 Line Control	1,215	13.00
2094	Binary Synchronous Communications 4 Line Adapter	1,245	35.00

* Information contained in this appendix was supplied by or extracted from IBM publications.

Feature Number	Description	Purchase Price	Monthly Maintenance
3525	Digital Input/Process Interrupt Non-Isolated	$ 410	$ 4.00
3530	Digital Input/Process Interrupt Isolated	695	46.00
3535	Digital Output, Non-Isolated	355	4.00
3580	4962 Disk Storage Attachment	815	8.00
3581	4964 Diskette Unit Attachment	730	8.00
3585	4979 Display Station Attachment	955	10.00
3920	Floating Point (4955 only)	1,190	11.00
4940	Multiplexer/Reed Relay	650	16.00
4950	Multiplexer/Solid State	715	8.50
5430	Customer Direct Program Control Adapter	660	11.00
5620	4974 Printer Attachment	930	3.50
5630	4973 Line Printer Attachment	940	5.00
5650	Programmer Console	460	6.00
5700	4973 Printer Attachment Cable Increment	13	-----
5701	4973 Printer Attachment Cable Basic	82	-----
5720	4978 Display Attachment Cable Increment	13	-----
5721	4978 Display Attachment Cable Basic	82	-----
5740	4979 Display Attachment Cable Increment	13	-----
5741	4979 Display Attachment Cable Basic	82	-----
6305	4982 Sensor I/O Attachment	650	11.00
6335	Storage Address Relocation	805	9.00
7840	Timers	570	4.00
7850	Teletypewriter Adapter	560	11.00

* Information contained in this appendix was wupplied by or extracted from IBM publications.

*SERIES/1 PRICE LIST

SOFTWARE PRODUCTS

Program Type	Description	Monthly Payment
5719-SC2	Stand Alone Utilities (SCP)	No Charge
5719-PA1	Base Program Preparation Facilities	$90.00/month (payment waived after 24 months)
PRPQ P82508	Control Program Support	$15.50/month (payment waived after 24 months)
PRPQ 5799-TAE	4979 Display - CPS Support	$ 1.50/month (payment waived after 24 months)
PRPQ 5799-TAF	Binary Synchronous Communications - CPS Support	$ 3.50/month (payment waived after 24 months)
PRPQ 5799-TAH	Indexed Access Method - CPS Support	$ 5.00/month (payment waived after 24 months)
PRPQ 5799-TAK	4978 Display Station - CPS Suport	$ 6.00/month (payment waived after 24 months)
PRPQ 5799-TAL	CPS Extension I	$ 1.50/month (payment waived after 24 months)
PRPQ 5799-TAQ	CPS Extension II	$ 1.50/month (payment waived after 24 months)

		Monthly Payment	or	One-Time Charge
5719-PC1	Realtime Programming System (RTPS)	$20		$1,200
5719-AS1	Program Preparation Subsystem (PPS)	18		1,104
5719-PL1	PL/1 Compiler and Resident Library	46		2,784
5719-PL3	PL/1 Transient Library	5		288
5719-FO1	FORTRAN IV Compiler and Object Support Library	14		864
5719-FO3	FORTRAN IV Realtime Subroutine Library	5		288
5719-LM1	Mathematical and Functional Subroutine Library	7		408

* Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX 5: SAMPLE CONFIGURATIONS

APPENDIX-5+

EXHIBIT 5-1

SERIES/1

SAMPLE PROGRAM PREPARATION CONFIGURATION

MODEL	PRODUCT	PURCHASE	MMMC*
4953-C	Processor 32K Bytes	$ 5,870	$ 88.00
3580	Disk Attachment	815	8.00
3581	Diskette Attachment	730	8.00
5620	Printer Attachment	930	3.50
5650	Programmer Console	460	6.00
7850	TTY Adapter**	560	11.00
2055	TTY Adapter Cable	52	.50
4962-2	Disk Storage with Built-In Diskette	8,575	60.00
4974-1	Printer	2,790	34.00
4997-1B	Rack Enclosure	1,025***	2.00
5719-PA1	Base Program Preparation Facilities $90/Month for 24 Months	2,160	---
	TOTAL	$23,967	$221.00

* Minimum Monthly Maintenance Charge.

** This feature provides for attachment of a standard teletype ASR 33, 35 or equivalent device. This device must be supplied by the customer.

*** Optional Equipment - Customers may supply their own 19" rack enclosure.

The prices stated are for information purposes only and are subject to change. Applicable taxes and freight charges are not shown. Purchase of IBM Machines will be by agreement subsequently signed by the purchaser and IBM, with the prices governed by the price protection provisions therein.

+ Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX-5 (CONT'D)+

EXHIBIT 5-2

SERIES/1

SAMPLE PROGRAM PREPARATION CONFIGURATION

MODEL	PRODUCT	PURCHASE	MMMC*
4955-A	Processor	$ 6,165	$ 77.00
6325	Additional 16K Bytes	1,750	8.00
3580	Disk Attachment	815	8.00
3581	Diskette Attachment	730	8.00
5620	Printer Attachment	930	3.50
5650	Programmer Console	460	6.00
7850	TTY Adapter**	560	11.00
2055	TTY Adapter Cable	52	.50
4962-2	Disk Storage with Built-In Diskette	8,575	60.00
4974-1	Printer	2,790	34.00
4997-1B	Rack Enclosure	1,025***	2.00
5719-PA1	Base Program Preparation Facilities $90/Month for 24 Months	2,160	---
	TOTAL	$26,012	$218.00

* Minimum Monthly Maintenance Charge.

** This feature provides for attachment of a standard teletype ASR 33, 35 or equivalent device. This device must be supplied by the customer.

*** Optional Equipment - Customers may supply their own 19" rack enclosure.

The prices stated are for information purposes only and are subject to change. Applicable taxes and freight charges are not shown. Purchase of IBM Machines will be by agreement subsequently signed by the purchaser and IBM, with the prices governed by the price protection provisions therein.

\+ Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX-5 (CONT'D)+

EXHIBIT 5-3

SERIES/1

SAMPLE FACILITY CONTROL/POWER MANAGEMENT CONFIGURATION

MODEL	PRODUCT	PURCHASE	MMMC*
4953-A	Processor 16K Bytes	$ 4,360	$ 80.00
4540	Rack Mounting Fixture	55	N/C
1590	Customer Access Panel**	180	1.00
1593	Customer Panel DI/DO Cable	385	.50
7840	Timers	570	4.00
7850	TTY Adapter***	560	11.00
2059	TTY Customer Access Pan. Cable**	40	.50
1560	Integrated DI/DO	825	14.00
3581	Diskette Attachment	730	8.00
4964-1	Diskette Unit	2,410	17.00
4997-1A	Rack Enclosure**	870	2.00
5719-U11	Facility Control Power Management Program $130/Month for 48 Months	6,240	N/C
	TOTAL	$17,225	$138.00

* Minimum Monthly Maintenance Charge.

** Optional Equipment

*** This feature provides for attachment of a standard teletype ASR 33, 35 or equivalent device. This device must be supplied by the customer.

The prices stated are for information purposes only and are subject to change. Applicable taxes and freight charges are not shown. Purchase of IBM Machines will be by agreement subsequently signed by the purchaser and IBM, with the prices governed by the price protection provisions therein.

\+ Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX-5 (CONT'D)+

EXHIBIT 5-4

SERIES/1

SAMPLE RTPS CONFIGURATION WITH TP AND CRT'S

MODEL	PRODUCT	PURCHASE	MMMC*
4955-C	Processor 32K Bytes	$ 7,915	$ 87.00
6326	32K Storage Add.	2,850	14.00
2010	Communications Pwr.	120	3.00
3585	Display Attach (4)	(4X 955) = 3,820	(4X 10) = 40.00
5630	Line Printer Attach	940	5.00
3580	Disk Attach	815	8.00
3581	Diskette Attach	730	8.00
2093	BSC 8 Line Control	1,215	13.00
2094	BSC 4 Line Adapter	(2X 1,245) = 2,490	(2X 35) = 70.00
4962-2	Disk Storage With Diskette	8,575	60.00
4973-2	414 LPM Printer	12,425	158.00
4979-1	Display Station	(4X 1,735) = 6,940	(4X 25.00) = 100.00
4997-1A	Rack Enclosure**	870	2.00
5719-PC1	Real Time Programming System $20/Month or	1,200	N/C
5719-AS1	Program Preparation Subsystem $18/Month or	1,104	N/C
	TOTAL	$52,009	$568.00

* Minimum Monthly Maintenance Charge.

** Optional Equipment

The prices stated are for information purposes only and are subject to change. Applicable taxes and freight charges are not shown. Purchase of IBM Machines will be by agreement subsequently signed by the purchaser and IBM, with the prices governed by the price protection provisions therein.

\+ Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX-5 (CONT'D)+

EXHIBIT 5-5

SERIES/1

SAMPLE WORKSATION CONFIGURATION WITH 6 CRT'S/3 PRINTERS

MODEL	PRODUCT	PURCHASE	MMMC*
4955-C	32K Bytes Processor	$ 7,915	$ 87,00
6326	32K Bytes Storage Addition	2,850	14.00
2010	Communications Power	120	3.00
3580	Disk Attach	(2X 815) = 1,630	(2X 8) = 16.00
3581	Diskette Attach	(2X 730) = 1,460	(2X 8) = 16.00
3585	Display Attach	(6X 955) = 5,730	(6X 10) = 60.00
5620	Serial Printer Attach	(2X 930) = 1,860	(2X 3.50) = 7.00
5630	Line Printer Attach	940	5.00
5650	Programmer Console	460	6.00
4962-4	13.9 MB Disk with Diskette	(2X 10,275) = 20,550	(2X 89) = 178.00
4959-A	I/O Expansion Unit	2,515	37.00
4974-1	Serial Printer	(2X 2,790) = 5,580	(2X 34) = 68.00
4973-2	414 LPM Line Printer	12,425	158.00
4979-1	Display Station	(6X 1,735) = 10,410	(6X 25) = 150.00
4997-2B	Rack Enclosure**	1,315	5.00
	TOTAL	$75,760	$810.00

* Minimum Monthly Maintenance Charge

** Optional Equipment

The prices stated are for information purposes only and are subject to change. Applicable taxes and freight charges are not shown. Purchase of IBM Machines will be by agreement subsequently signed by the purchaser and IBM, with the prices governed by the price protection provisions therein.

\+ Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX- 5 (CONT'D)+

EXHIBIT 5-6

SERIES/1

SAMPLE REMOTE TERMINAL CLUSTER CONFIGURATION

MODEL	PRODUCT	PURCHASE	MMMC*
4953-C	32K Byte Processor	$ 5,870	$ 88.00
9154	Remote IPL	--	--
2074	BSC Single Line Control	1,190	19.00
3585	Display Attach	(3X 955) = 2,865	(3X 10) = 30.00
4540	Rack Mounting Fixture	55	--
4997-1B	Rack Enclosure	1,315	5.00
4979-1	Display Station	(3X 1,735) = 5,205	(3X 25) = 75.00
	TOTAL	$16,500	$217,00

* Minimum Monthly Maintenance Charge

The prices stated are for information purposes only and are subject to change. Applicable taxes and freight charges are not shown. Purchase of IBM Machines will be by agreement subsequently signed by the purchaser and IBM, with the prices governed by the price protection provisions therein.

\+ Information contained in this appendix was supplied by or extracted from IBM publications.

APPENDIX 6: USER QUESTIONNAIRE

CONFIDENTIAL

INPUT QUESTIONNAIRE

CATALOG. NO. | | | | | | |
SIC. CODE | | | | | | |
SIZE CODE | | |
AREA CODE | | |
STUDY CODE | | |
DATE | 0 | | | | 7 | 7 |
MM DD YY

STUDY TITLE: IBM SERIES/1 - USERS (SER-1B)
TYPE OF INTERVIEW: Phone ☐ On-Site ☐

INTERVIEWER: _____

COMPANY: _____ CO. TYPE: _____

ADDRESS: _____ SALES: _____

_____ # EMPL: _____

_____

_____

INDUSTRY

☐ DISCRETE MANUFACTURING ☐ UTILITIES ☐ INSURANCE

☐ PROCESS MANUFACTURING ☐ RETAIL ☐ GOVERNMENT – FEDERAL

☐ TRANSPORTATION ☐ BANKING ☐ GOVERNMENT – STATE & LOCAL

☐ MEDICAL ☐ WHOLESALE ☐ EDUCATION

☐ SERVICES ☐ OTHER

INTERVIEWS

NAME	TITLE	TELEPHONE NO.

SUMMARY

_____

_____

_____

_____

_____

REFERENCES

_____

_____

SER-1B; 7/77

Cat. No._____

USER QUESTIONNAIRE

IBM SERIES/1 SURVEY

1. Are you or did you buy Series/1 Systems from:

   ☐ a) IBM

   ☐ b) A systems or integration house

   ☐ c) Other (explain)

2. As of 7-1-77, how many Series/1s are:

   a) installed: _____

   b) on order: _____

3. What is the installation schedule of those on order?

	Quantity	Scheduled Date	Location
a)			
b)			
c)			
d)			

4. What Series/1 configuration(s) have you ordered?
(Indicate if any are non-IBM plug or non-plug compatible peripherals.)

Quantity	Main Memory (Bytes)	Disk or Diskette (Bytes)	Printer (120 cps)	CRT Display	Communi-cations (Describe)	Other	Total Unit Cost

5. What are your estimated Series/1 requirements over and above those on order?

a) 1977: _____ units

b) 1978: _____ units

c) 1979: _____ units

d) 1980: _____ units

e) 1981: _____ units

6. What delivery time are you being quoted on the Series/1? (months):

7. What applications are being performed? (Indicate "new" (N) or "off-load" (O).)

a)

b)

c)

d)

e)

8. In order of priority, what will be the new applications you will develop or require? (Indicate "new" (N) or "off-load" (O).)

Priority	Date Required	Application
a)		
b)		
c)		
d)		

9. Was your programming done:

a) ☐ in-house

b) ☐ by IBM

c) ☐ outside software house

d) ☐ other (describe)

10. Who will do future programming?

11. If programming was done by an outside software house:

a) Name:

b) Location:

c) Who recommended:

d) Degree of satisfaction: 1 2 3 4 5
(1 = poor, 5 = outstanding)

12. What was the programming cost? $_____

13. If programming <u>was</u> done in-house (Ref. #9a):

a) What software was used? (assembler, operating system, languages processor, distributed processing, etc.)?

b) Would you have preferred using another type of software?

c) Are you concerned about the system's limit on memory size?

d) Are you concerned about the lack of instruction set compatibility between the Series/1 and other IBM equipment?

14. If future programming will be done in-house (Ref. #10), do you plan to use IBM's recently announced <u>PL 1</u>?

☐ Yes

☐ No

a) Why?

b) What features do you like?

c) What features do you dislike?

15. a) Who made the final decision on buying the Series/1? (Title)_____

b) Are you an IBM shop? ☐ Yes ☐ No

c) Why do you think IBM is committed to the minicomputer business?

16. a) Why was the Series/1 selected?

b) Were any buyer incentives offered (e.g., engineering assistance, software development, royalties on software you developed, publicity, discounts or other financial incentives, machine loan, other)?

17. What other products did you consider or evaluate and how did you rank them?

	Manufacturer	Product
a)	IBM	Series/1
b)		
c)		
d)		

18. Were you contacted by a Japanese or European competitor of the Series/1?

a) ☐ Yes

b) ☐ No

c) If yes, which companies:_____

19. What is your attitude toward buying from a foreign manufacturer (e.g., Japanese or European)?

☐ a) Would not consider them as a vendor.

☐ b) Would consider and evaluate them as if they were a U.S. source.

☐ c) Comments

20. a) What other Series/1 users/references did you talk to?

Individual	Company	City

b) What other users do you know of in addition to the above?

21. Are you happy that you selected the Series/1?

☐ a) Yes

☐ b) No

☐ c) Too early to tell

d) Evaluate IBM's local support capability: 1 2 3 4 5
(1 = poor, 5 = outstanding)

e) What do you like best? (strengths)

f) What do you like least? (weaknesses)

22. Since your selection of the Series/1, have any other minicomputer vendor announcements (product or price) had any effect on your decision?

☐ a) Yes

☐ b) No

If "yes", describe:

23. Would you consider purchasing non-IBM peripherals for your Series/1 system:

	Yes	No	Comment
a) Mainframe memory	☐	☐	
b) Line printers	☐	☐	
c) Disk drives	☐	☐	
d) Other (describe)	☐	☐	

24. Will you require additional mainframe memory capacity on presently installed system(s)?

Yes ☐

No ☐

25. If "yes",

a) quantity of units involved:_____

b) size of additional memory:_____

26. What percentage price reduction do you require for buying non-IBM mainframe memory or peripherals? (circle)

a) <10% c) 20-30% e) 40-50%

b) 10-20% d) 30-40% f) >50%

27. What additional Series/1 product announcements do you think IBM will make over the next 18 months?

a) Hardware

b) Software

c) Other

28. What is the basis for your opinion?

☐ a) IBM salesman said so.

☐ b) Read it in a journal or magazine.

☐ c) Other (identify).

29. What other minicomputers have you in place?

Quantity	Manufacturer	Model & Configuration	Year of Installation	Applications