PLUG COMPATIBLE MAINFRAMES

INPUT

# ABOUT INPUT

## THE COMPANY

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed
services are provide
of computers, comn
products and services

The company carries
depth research.
clients on importar
members analyze
data, then devel
innovative ideas
Clients receive
access to data on
and continuous cc

Many of INPUT's
have nearly 20
areas of special
senior manageme
marketing, or
enables INPUT t
to complex busin

Formed in 197
leading interna
Clients include
largest and m
companies.

## UNITED STATES, West Coast
2471 East Bayshore Blvd.
Suite 600
Palo Alto, California 94303
(415) 493-1600
Telex 171407

## UNITED STATES, East Coast
a West-1
, New Jersey 07662
71

GDOM
be
e
High Road
TF

RL

Service Company, Ltd.
ng, No. 12-7 Kita Aoyama
o-Ku

lia
e, 7-9 Merriwa Street
ordon N.S.W. 2072

# PLUG COMPATIBLE MAINFRAMES

Prepared For

Mitsubishi Electric Corporation

MAY 1979

Digitized by the Internet Archive
in 2015

# PLUG COMPATIBLE MAINFRAMES

## TABLE OF CONTENTS

# PLUG COMPATIBLE MAINFRAMES

## LIST OF EXHIBITS

I INTRODUCTION

# I    INTRODUCTION

- The primary objective of this study was to provide basic information to Mitsubishi that will be useful in developing a PCM strategy that will be sustained through the 1980s.

- Information for ths study was obtained from several sources.

    - Interviews with personnel from IBM, Amdahl, Itel, CDC, and National CSS.

    - Interviews with larege users and other industry professionals who had knowledge of IBM's future plans.

    - INPUT's analysis of trends in the industry and forecasts of IBM's strategies for the 1980s.

    - A review of available literature in the PCM field and that of other "IBM-watch" organizations.

    - INPUT's internal information derived from other studies.

INPU

II  EXECUTIVE SUMMARY

## II    EXECUTIVE SUMMARY

## A.    CONCLUSIONS

- IBM will make it increasingly difficult for PCM's to compete over the next several years.

    - Beginning with the 4300, IBM has leapfrogged into the forefront of new technology, making it very difficult if not impossible for PCMs to achieve a technological advantage over IBM as they have been able to do in the past.

    - INPUT believes IBM's 4300 Series announcement is the "tip of the iceberg." Many new announcements are expected shortly, including:

        - Two more models in the 4300 series.

        - "H" Series, high-end machines, at least four separate models.

        - A new family of rotating magnetic memory devices with four times the density of any of today's disc drives and several times the transfer rate.

    - Major portions of the operating system (MVS in the "H" Series) will be implemented in firmware.

- The "H" Series will be announced together with a new relational model data base management system (called System R) which will largely be implemented in firmware.

- Documentation on new machines and software including the System 38, 8100, 4300 and "H" Series will not be released until first customer ship. Even then, IBM plans to release documentation only to the customer.

- Although IBM operating systems are supposed to be in the public domain (by consent decree) the software/firmware implementation will make it extremely difficult to copy.

  . Amdahl, who realizes this, has already begun to develop its own version of MVS which will not be precisely compatible with "H" Series versions.

  . National, who does not have the competence to develop its own operating systems is purchasing software. National may drop out of the PCM business after selling the System 400 to Nixdorf and selling out its excess AS/3, 4 and 5 to end users.

- With very little competition to be faced in the PCM and storage area, IBM will pursue an aggressive pricing strategy which will emphasize the "pay for what you use" philosophy. That is, IBM will price all aspects of a system separately including hardware, software, software support, and maintenance.

  - IBM recognizes that the most value-added (profit) will come from support rather than hardware sales. Hardware will be relatively inexpensive. Software and support, including maintenance will be very expensive.

  - PCM vendors, who emphasize hardware (with a few exceptions such as National CSS), will find it difficult to compete with this pricing strategy.

- The U.S. Government Justice Department has clearly relaxed its attitude towards IBM's potentially monopolistic position.

  - IBM has won every private case in court (Greyhound, Memorex, Telex).

  - IBM accounts for a major portion of the U.S. balance of payments to offset foreign oil costs. The government is not inclined to disturb this situation.

- IBM will not, as a matter of policy, enter into any technology exchange agreements as they had previously done with Amdahl. IBM would make an exception only in the event that the agreeing party could clearly demonstrate that it had a superior technology that IBM could use.

- All 4300 series and impending "H" Series machines will be fully software compatible with 370 class systems as far as applications software is concerned.

  - American users will not accept any system that will not run existing applications software.

  - Existing 370 systems software will run on new IBM systems. However, development of existing systems software (for example, IMS) will be frozen. All new development work will be directed toward new systems that will take advantage of the firmware microcode capabilities of the 4300 and "H" Series. Thus, while the old system software will run on the new machines as well as the old, new system software will run only on the new machines.

- IBM's maintenance policies will be flexible according to the customer. For large customers, IBM will be more cooperative vis-a-vis PCMs than for small ones.

  - IBM will not maintain any equipment other than its own systems.

- Systems software maintenance and hardware maintenance are now integrated into one division organizationally at IBM. Because of the increased reliability of the new systems, the maintenance focus will increasingly be placed on software.

- Reports from IBM senior personnel lead INPUT to believe that IBM fears Japanese competition in its markets more than that of would-be American or European PCMs. Thus, IBM will likely do everything it legitimately can to prevent potential Japanese competitors from receiving information about its plans and the technical details of its systems.

## B.    RECOMMENDATIONS

- Mitsubishi should not consider entry as a PCM for 370 class systems unless:

    - IBM can be forcibly kept out of Japanese markets.

    - Mitsubishi has clear leadership in both software and hardware technology.

- Should Mitsubishi decide to enter the market, the company should immediately order at least one of every new IBM system announced and do everything possible to obtain a priority delivery schedule.

- If Mitsubishi has a technology advantage which it believes IBM needs, it should approach IBM with a proposed technology exchange agreement. The approach should be made to the office of the President.

- There is a great risk associated with such an approach to IBM, because Mitsubishi will have to reveal its plans. If IBM cannot use Mitsubishi's technology, IBM will be on its guard to prevent Mitsubishi from obtaining the data it is seeking.

- Mitsubishi should form alliances with a few major IBM <u>USERS</u> in order to obtain from them the documentation information and experience they will have that Mitsubishi will not be likely to obtain otherwise.

- Mitsubishi should open an office in the U.S. staffed with competent technologists, whose purpose is to keep abreast of IBM developments. The people should be U.S. Nationals with strong contacts throughout the U.S. information processing industry. Recent ex-IBM employees are the best bet.

- Palo Alto is an ideal West coast area for such a research post.

    - Amdahl, Itel's SDD, Magnuson, Microcomputer System Corporation, National Semiconductor, and Two Phi (Philips) are all within four mile of each other, ten miles south of Palo Alto.

    - Stanford University's Electrical Engineering, Computer Science, and Computer Research Laboratories are among the top five in the U.S.

    - Groups affiliated with Stanford are working with Burroughs, Hitachi, Honeywell, I.C.L. (U.K.), Nixdorf and others on PCM products for the IBM marketplace.

    - Relational data base software research for IBM worldwide is headquartered and conducted in San Jose. IBM intends to make its SQL data definition language the standard and profit generator of the 1980s.

    - VLSI will play a dominant role in designing a low cost high reliable computer (4300 and/or 8100). Silicon Valley, adjacent to Palo Alto, is the best place for this development.

    - Experienced, bright, aggressive engineers and marketing people are available in Palo Alto. Attracting additional talents from outside the area to move to Palo Alto is relatively easy compared to many parts of the U.S.

- Culturally, although North America is very different from Asia and Japan, the Bay Area has more cultural similarities to Japan than other U.S. locations. There is also a higher availability of English to Japanese to English translation services.

III  IBM SCENARIOS

# III  IBM SCENARIOS

## A.  INTRODUCTION

- In 1960, IBM was faced with two financial pressures:

    - 1401s were starting into production.  The vast majority (90%) were sold on a monthly availability charge (MAC) and only recovered manufacturing and marketing costs after approximately 20 months.

    - Corporate commitments to new semiconductor research, computer developments (360), expanded manufacturing facilities, and hiring additional field hardware/software support staff caused cash flow problems.

    - For the first time in IBM's history, salesmen were assigned purchase targets.  These were confined to older electronic accounting machines (EAM 402, 407, 602...).  Their notion of customers owning their computers and accounting machines was encouraged.

- Customers began to analyze the 45 months rental and maintenance revenue ratio to purchase price. Even with maintenance costs factored in, it was clear that the pay out was 60 months. Clearly many accounting machines and computers would have a useful life beyond five years. Management Assistance Inc. (MAI) became IBM's first direct competitor as a leasor of IBM's computers.

- MAI would find customers who had earned purchased credits (50% of MAC) and could use those to purchase equipment at a discount. MAI would arrange to purchase the computer from the customer within 24 hours of his purchase from IBM. MAI would then lease the system back to the customer. MAI would use the lower acquisition cost and ten year useful life to figure its acquisition costs.

  . MAI added its own marketing costs and profit requirement back to the low cost basis.

  . MAI could lease (not rent) the equipment to the user at 75% of the price of IBM's MAC.

  . IBM countered these moves by raising its maintenance charges. Thus, purchased equipment became "expensive to maintain."

  . MAI then hired its own maintenance staff.

  . Used IBM equipment became IBM's first direct PCM competition.

- Honeywell announced the H200 in November 1963. The price/performance was approximately 2.5 to 1 over the 1401 and 1410.

  - The H200 was not instruction set compatible, however, all IBM source and object programs could be recompiled with the aid of Honeywell's "Liberator."

INPU

- Honeywell had to supply the operating system; in reality, disk and tape monitoring system.

- IBM prematurely announced the 360 series in April 1964, largely as a reaction to Honeywell's 200 series. Initial versions of the operating systems came out over a two year period.

  - By mid 1966, IBM's 360 systems software was operational but highly inefficient.

  - During this two year period, Honeywell replaced many IBM 1401s and 1410s where prospects were interested in cost savings, performance and delivery.

- RCA recognized the opportunity to produce a functionally similar computer and fill the demand vacuum created by IBM's delivery and software problems.

  - RCA initiated a much less ambitious operating system (similar to IBM's DOS).

  - RCA, starting a year after IBM's announcement, designed with a more advanced integrated chip.

  - By the time RCA's Spectra Series became readily available, IBM could deliver 360s in reasonable time and IBM's O.S. was more efficient.

  - RCA's attempts at technological innovations caused RCA to lose the "window of opportunity" during that valuable year of 1967.

  - Because RCA's Spectra was not identical at the instruction set level and because a few conversion problems were encountered, RCA's sales tended to be less "replacement of 360 sales" and more "new computer or extra capacity" type sales.

- These sales turned out to be primarily montly rentals, some two-year leases, but few purchases. RCA's top management was dominated by people from electronics research and consumer retailing. Neither background afforded an appreciation for financing and marketing commercial computers. RCA continued putting money and resources into the wrong areas of computer development.

- IBM announced new operating systems and more modular computers (370/135,...165) in June of 1970. By this time, used 360/40s and 50s with PCM peripherals on third party leases were far more cost effective than offerings from RCA, Honeywell, and others.

- The lesson that should have been learned by IBM's competitors was analyze "make or buy" opportunities across the entire computer spectrum. Engineers in firms competitive to IBM had "not invented here" syndromes. If part of a computer system was "not invented here," it was not acceptable.

- In the early 1970s, the leasing companies and peripheral PCMs prospered. They had no computer designers preventing them from buying IBM CPUs. The leasing firms could perform "make or buy" decisions across the entire spectrum of offerings.

- Minicomputers with systems software limited to specific tasks began to encroach on IBM's 360/20 and 30 marketplaces. Using new emulator technology, Digital Scientific of San Diego, in 1972, developed a high performance IBM 1130 and 1800 minicomputer emulator. This Meta computer appealed to firms that already had a large investment in 1130 and 1800 based software. Amdahl corporation was formed at this time.

- 1972 was also a year of major legal problems for IBM. Both control Data Corpration (CDC) and the U.S. Justice Department brought suit against IBM.

- 1967, IBM tried to win a computer order at Northwestern University against a CDC 6400.

  - IBM provided a written comparison of the System/360 Model 75 and CDC 6400 to the university.

  - IBM fired the salesman and manager and withdrew from the sale.

  - This provided CDC with ammunition for a suit against IBM.

- During the 1950's IBM had reached consent decrees with the Justice Department.

  - IBM sold license agreements for the equipment that manufactured punched cards.

  - IBM agreed that all its computers could be purchased, not just rented.

- 1972 the computer service industry was the fastest growing segment. IBM temporarily solved both the CDC and Justice Department legal actions.

  - IBM sold its U.S. Service Bureau Corporation to CDC.

  - CDC agreed to drop all charges and to destroy its "evidence of IBM predatory pricing."

  - The Justice Department was only partially satisfied.

- Dr. Eugene Amdahl had been in IBM development labs for almost 20 years. He viewed the 370/168 as stretching "slow semiconductor" and design technology more appropriate for the 158. He and some other IBM designers decided to design a semiconductor logic family that would be aimed at very large

INPUT

computer architecture without regard for mid computer range economics. Working with Motorola, Amdahl designed a small set of proprietary ECL chips. These custom gate arrays and sequencers enabled Amdahl to implement the 370 instruction set directly without micro code.

- IBM now had two tiny competitors offering instruction set compatible computers; each at the extreme end of the computer line, Amdahl and Digital Scientific.

- Used IBM computers in the hands of the leasing companies with PCM peripherals were impacting the middle of IBM's 370 line.

- IBM now had competition on a PCM basis across the entire line.

• Future Systems (FS) was conceived by a top management team balanced between development, engineering, finance, marketing, and software. FS would, presumably, stop the PCM competitors across the board.

- FS would not be constrained by previous 360 and 370 architecture nor by concerns over customer migration through instruction set compatibility.

- FS would be the new generation of computer architecture that would provide:

    • Wide range of performance (beyond 10 MIPS).

    • Data base management requirements.

    • Distributed data processing needs.

    • Relative ease of programming and better programmer productivity.

- Market control for IBM's peripherals and software through integrated file adapters and O.S. firmware.

- By 1976, it was apparent that FS was in trouble with too many conflicting design and marketing constraints. To have a computer family that was modular and expandable from .5 to 10 MIPS, as well as to provide design hooks to move controllers into internal CPUs, became effectively impossible.

  - The 3031, 2, 3 were introduced as price/performance and re-packaged upgrades of the 370/158, 168.

  - In 1978, Frank Carey of IBM explained to the financial community that FS was too ambitious in too many dimensions. FS would not be a total research write-off, rather, parts of FS would appear in new products in 1979 and 1980.

  - Parts of FS development were re-packaged as narrower range product family groupings: 8100, System/38, E Series (4300), and "H" Series (high end of IBM's line).

## B.    PCM SCENE, APRIL 1979

- Amdahl's success was due to his ability to deliver computers on 30 days notice in 1976 when IBM was quoting over a year. The 25% price/performance advantage also helped sales. However, Amdahl's "superior technology" had little to do with success. This is today's consensus of the U.S. business community. Thus, IBM's principle counter thrust has to be in superior manufacturing technology, not advanced CPU design.

- IBM's top management is beginning to realize the impact microprocessors can make in office products and "medium scale" computers.

  .

- 15 -

-       The semiconductor companies tend to price their products on a
        "manufacturing cost plus basis."   Computer companies price their
        products on a "value to the customer" basis.  If the customer's current
        costs are $X, he will pay ($X - $\triangle$ X) for a new computer.  If the
        computer system only costs the computer company $Y to manufacture
        and support, then the price would be based on the customers willingness
        to pay.  That yields a higher margin than $Y +$\triangle$Y, manufacturing cost
        plus small profit.  Thus <u>value pricing</u> yields higher margins:  ($X -$\triangle$X) -
        $Y; e.g., value to customer minus manufacturing cost.  IBM feels that
        as the semiconductor companies vertically integrate and produce
        computer subsystems, their pricing mentality will result in significantly
        lower prices, cost plus pricing ($Y +$\triangle$Y) and lower profits per computer.

-       IBM had a choice:  1) Stay with older technology (138, 148) and maintain
        high profits per computer but loose market share or 2) Impose new
        manufacturing technology, new LSI, and fewer printed circuit boards
        (pcb) upon current CPU design.  The resultant lower manufacturing
        costs and previously amortized software allowed IBM to reduce prices
        by 75% on a price performance basis with the "E" Series (4300).

●   IBM will maintain old levels of profitability and also will achieve product
    differentiation through software.

-       4300 announcements on January 30, 1979, included:

        .       DOS/VS support will be dropped as of January 1981.

        .       DOS/VSE (extended) will be the new standard.

        .       More program products will be charged than before and at high
                prices, ultimately generating ten times more software revenues
                than today.

- 4300 will use primarily DOS/VSE. This extension is facilitated through extra micro code.

- MVS will be the surviving large computer operating system. Extensions to MVSE will be implemented in micro code.

- For the 8100, System/38 and 4300, profits will shift to software.

    - The 8100 represents old technology, bipolar based CPU design, but totally new software.

    - The 4300 represents the same technology and old software but with microcode assist potential.

    - System/38 represents both new CPU architecture and new comprehensive software (announced as well as potential).

- During the fall of 1978, IBM's top management changed both E Series pricing and tentative "H" Series pricing. IBM's principal fears were not Burroughs, DEC,... Univac. IBM's concerns were:

    - Japanese (Fujitsu) relations with Amdahl.

    - Japanese (Hitachi) relations with Itel.

    - IBM fears the technology and marketing agreements among the above may result in turning the computer business into a form of semi conductor pricing warfare.

INPUT

- IBM's concerns were proved by the Japanese government's refusal to allow the 4300 announcement in Japan. After severals weeks of negotiations the 4300 pricing for Japan was set at 30% above normal to protect native Japanese computer companies. IBM uses this as ammunition in appealing to the U.S. government for protection against "Japan, Inc."

- The new manufacturing technology has significantly reduced the chip count and number of printed circuit boards. A preliminary understanding to the 4300 is shown in Exhibit III-1. The 4331 does not require air conditioning (cooling).

- National Semiconductor is now desperately trying to recoup its computer investments and to keep its EXYSCO San Diego facility going.

  - Nixdorf will probably purchase NS 400 computers (.35 MIPS) for resale in Europe. After purchasing 300 computers Nixdorf may have manufacturing rights.

  - National is hiring a U.S. end user field maintenance force. To keep the EXYSCO facility producing the AS 3, 4, 5, after Itel stops purchasing in June, National is going directly to the end user.

  - National is offering extraordinary high sales and service salaries.

  - National is acquiring a Relational Data Base Management System and other software products.

  - National will emphasise systems, not raw computing.

INPL

## C.    IBM's FUTURE DIRECTIONS

- The projections given in this section are based upon logical analysis of IBM's past performance coupled with INPUT's informed opinion of data derived from current and former IBM employees, professional product marketing analysts and computer design and marketing consultants.

  - It should be noted that IBM's top management may approve a computer strategy. However, only five people finally approve a product pricing announcement. Thus it is very difficult to know precise pricing in advance.

  - The "E" Series (4300) pricing was lowered in late September 1978. IBM needed large order volumes to justify the lower prices. Internally the IBM product manager has full responsibility for market planning, product specification, design, manufacturing liason and financial planning. This last function is subjected to continuous review by IBM's top management. Every IBM product plan is expressed as a mini business plan examined by computer financial modeling. The product financial model then interacts with all other IBM product financial models. These then work against both the IBM corporate financial model and IBM's global economic model. Conceptually you can view these as four levels of DO Loops in a FORTRAN program, or as four subroutines:

    . Proposed product plan financial model.

    . Adjacent products' financial models.

    . IBM corporate financial model.

    . World econometric model.

- Antitrust and predatory pricing concerns for new products are handled by a system which pressures the product manager to increase sales volume forecasts and to lower prices.

o    Sales prices are <u>not</u> just purchase prices. Sales prices are: monthly rental prices, two year lease prices (15% lower), hardware purchase prices with rental credit considerations, maintenance pricing with various levels of service and responsibilities, software license fees both one time use and maintenance, and field software support pricing. Typically peripheral products and software have longer "lease revenue lifetimes" than hardware. This is because IBM rarely reduces monthly rental prices as equipment ages.

- The theories and forecasts for E & "H" Series were tested in advance by applying the same algorithms to 8100 and S/38 pricing.

  - Low memory prices per 1 MB: $18K, 8100 versus $75K, 3031.

  - 4331 and 370/138 processing power (.25 MIPS) for $50K.

  - New price performance of disks 2:1.

  - New price performance of CPU and memory 5:1.

  - Maintenance pricing 33% for same computing power.

  - New peripherals slightly more profitable to IBM.

  - Significant software unbundling and profits.

  - Greater customer responsibility for software support.

  - Relational DBMS on S/38 uses special nano memory.

  - Query language on 8100 and S/38 for users, not programmers.

- 100,000 orders representing a 30 month backlog were received in four months for 8100's and S/38.

- 8100 has been a most significant announcement for users because IBM blessed <u>no-host computing</u> and <u>charges 20% to 33% for software</u> as a percentage of total price.

- 8100, project Orbit, was originally conceived as a replacement for the 3790 as well as a vehicle for Satellite Business Systems (SBS). During the summer of 1978, IBM's top management kept forcing the 8100 product manager to lower his pricing algorithms, increase forecasted volumes and still maintain original profitability levels. Expanding the software offerings and charging more for them permitted abnormally low CPU and memory pricing.

  - Engineering and manufacturing complained that they could not hit the required memory yields and manufacturing costs until mid 1981.

  - Software development programs were increased and planned delivery dates moved forward. These extra costs were written off against considerably larger forecasts.

  - IBM top management <u>never</u> directly said: "let's engage in predatory and forward pricing." Rather, they pushed the product manager through many iterations to emphasize <u>software pricing, low manufacturing costs</u>, and <u>large volumes</u>.

INPUT

- IBM's SNA had always presupposed a central 370 until the 8100 announcement. The 8100 permits 8100's to communicate with each other and build a distributed data processing DDP network with <u>no host</u> (no central 370). Since all large companies have central data processing facilities, these 8100 users will initially communicate with centrally located files. A new DP user could, in theory, get along with no host, multiple 8100's but no 370 nor 4300.

    - Datapoint, Sycor, Tandem and others now can point to IBM's blessing of distributed data processing, DDP.

    - Large companies can put together an information processing strategy and provide for migration of some files to physically distributed 8100 locations.

- IBM's offensive strategies are:

    - Lower pricing through parts commonality and high volumes.

    - Much use of microcode for I/O search and compares which enhances performance and also discourages attachment of non IBM controllers and peripherals.

    - Lower ratio of rental to purchase prices (now 32:1 was 40:1) thus encouraging end users to purchase, not lease.

    - Operating systems software beyond and outside the public domain.

        - IBM has made the S/38 package relatively hard to emulate. All programmer addressing is virtual. All I/O control, logical to physical address translation for main and auxiliary memory is completely under control of the service control program. No assembler language will be released. There will be no field releases of: Principles of Operations, Theory of Operation,

INPI

microcode, micro diagnostics, fault isolation diagnostics within printed circuit boards. If someone reverse engineers the S/38 and its peripheral controllers and disks, the software will still cost $500/month payable to IBM.

- IBM's Data Products Division regards General Systems Division's S/38 as a competitor to 4331 and 8100. S/38 appeals to current System/3, System/34 users who want a logical upgrade. IBM will keep these relatively unsophisticated customers far away from any knowledge of S/38 logics.

## D.    IBM STRATEGIES AND COUNTER STRATEGIES

- IBM views cache memory on computers as the probable preserve of systems residence. The high cache hit ratio (95%) is largely due to the frequency of supervisor execution relative to various appliction codes. The cost of a cache memory may be close to write control store. If appropriate micro code can be developed (extended instructions) to handle parts of the operating system, it will be migrated from cache to write control store. Both 4300 and "H" Series have this potential. INPUT's preliminary information suggest eight instructions (370) have been replaced by 12, thus yielding four extra instructions available on the 4300 to accommodate DOS/VSE.

- This suggests an operations register of $2^{12}$ bits, which could ultimately support an additional 4,000 micoinstructions. Some of these bits could also be used for addressing a high speed "nano-memory."

  - An obvious counter move from a PCM's viewpoint is to design a very soft CPU. The CPU should be capable of accepting the PCM's versions of extended instructions. This pre-supposes the PCM's ability to implement software and extra instructions as he reacts to IBM's changes.

- Microcomputer Systems Corporation is developing a 370 instruction set computer using a horizontal microcode organization (200 bits wide). The microcode addressing is 2 E 12 = 4K; only 2K is required for the 370 instruction. This leaves 2K for extra instructions.

- Nanodata Corporation is developing a cost reduced version of their general purpose emulator. Although the microcode is vertical on the low cost emulator, micro instruction word width is entirely variable on the higher cost general purpose emulator.

- Both of the above have completely soft, micro programmable channel emulators with flexible data and address paths.

- IBM's manufacturing technology has yielded a low manufacturing cost design for the 4331. INPUT believe's IBM's 1980 cost on fully tested memory will be $2,000 per 1MB.

• Exhibit III-1 is INPUT's preliminary understanding of 4300 architecture.

- As illustrated, IBM has combined the functions of the ALU, write/control store, and back/plane (mother board) all on one board; enabling significant reductions in manufacturing costs. A rough estimate of cost reductions in the 4331 CPU compared to a 370/138 CPU is $20,000-40,000. Memory packaging saves more money.

• IBM will introduce new channel interface standards (two bytes wide). In addition to new channels, the 4300 has some new integrated file adapters.

- The fastest growing segment of the business is communcations and terminals. The "old" 3704 and 3705 communications processors are relatively expensive and clumsy. IBM may adopt special "communication channels," CC's, to accommodate a new family of communications processors. These new CC's may be relatively

EXHIBIT III-1

# PRELIMINARY 4300 ARCHITECTURE

IBM 4300 ASSEMBLY (FORM FACTOR)

Integrated File (disk) and Common Adapters

Combined CPU & mother board

CPU chips: 704 gates/chip
approx 5 chip per carrier.

Multi-Carrier: 23 layer chip,
last 3 levels etched to specific requirement

Memory Boards

Four 64K bit RAM chips per substrate (IBM 8100)

Each substrate is approximately 1" by 1"

IBM 4300, IBM trying to get piggyback (one 64K chip on
top of bottom 64K chip) effect, thus 8 64K chips
per substrate or carrier.

Note:  Third party sources tell us that IBM is experiencing
production fabrication problems with the Multi-Carrier
chip.  Problems may be in bonding and/or etching.

INPUT

intelligent and perform some of the communications processor's functions.

- Anyone wishing to interface to communctions channels will have to have relatively <u>soft</u> and <u>fast</u> adapters.

- PCM's will have to design into their data and address busses the ability to handle parallel bytes from the buss through the current standard channel interface out to controllers and peripherals.

- "H" Series will probably have "back end processors" and/or intelligent disk controllers.

  - System R, Relational Data Base Management System (RDBMS), was originally intended for announcement with "H" Series. System/38 is a low cost market test as it offers virtual addressing, "channel" and I/O commands cohabiting with write control store and firmware control of physical data storage. As IBM measures initial customer reaction in the fall of 1979, final plans for implementing these concepts in H Series will be made.

- Counter strategies to IBM's possible RDBMS and "back end" processors are:

  - Purchase RDBMS software.

  - Purchase content addressable memory processors.

  - Purchase very soft, intelligent disk controllers.

  - Fabricate a "back end" processor.

- This represents a significant hardware/software engineering effort. The system's user interface, data definition language, query commands, search parameters, etc. could be almost software identical to IBM's. With the

- 26 -

appropriate channel interface the "back end processor" could attach to either the PCM's computer or an IBM manufactured 370. This would permit selling high performance data retrieval systems.

- IBM's world view and concerns are changing.

    - Operating systems are in the public domain, but not future software.

    - IBM has successfully beaten Telex, Greyhound, Memorex et al in court.

    - The U.S. Department of Justice stands little chance of affecting any major changes.

    - IBM's advertising is emphasizing a 100:1 drop in computing costs, fighting inflation, increasing management productivity, saving the world's economy.

    - IBM is now viewed in Washington as:

        . Good corporate citizen.

        . Contributor to balance of payments when the U.S. is buying much foreign oil.

        . A technological leader: 64K RAM,....

        . Victim of Russian technology pirating (stealing).

    - Japan is subsidizing its computer industry with public tax money. Japan does not allow equal treatment of computer importing, pricing, and goverment procurement. Politicans in the U.S. would never condone direct subsidies to manufacturers as happens in Canada, France, Japan, U.K., etc. The U.S. government, other than the Justice Department, is increasingly protective of IBM.

INPL

IV  HISTORY OF IBM PLUG COMPATIBLE
MANUFACTURES

# IV    HISTORY OF IBM PLUG COMPATIBLE MANUFACTURERS

- PCM s are defined as manufacturers and/or marketers of IBM 370 instruction set compatible central processing units (CPU's), memory, and channel interfaces.

- IBM developed one <u>real 360</u>, the 360/75.  All other 360s used limited instructions and microcode to emulate the 360/75.  Thus a 360/65 could run as a 360 or emulate a 7070 or 7094.  The 360/75, the only true 360, only ran as a native 360.  These notions of application software migration via microcode emulation are now widespread in the U.S.

- Amdahl, NCSS and Itel have been choosen for brief reviews.

    - All three firms have entered the PCM business from entirely different routes and view themselves as indirect competitors, not direct competitors.

    - Some information exchange has taken place between them at the corporate and engineering levels.

- This PCM cooperation is ending.  As Itel's large Hitachi computers compete in the future with Amdahl, there will be less cooperation.

- Amdahl's company was initially technically driven.  It took Amdahl approximately $42 million and almost five years before first delivery.  Marketing,

software, and financial considerations were a secondary concern during this period. Today they are equal with engineering.

- Itel's founders and initial employees came from Transamerica (financial) and IBM (sales). Itel became a "Sears Roebuck" of the computer business. Itel could purchase used IBM computers, peripheral devices from other plug compatible sources, package the financing, and re-sell or re-lease the entire system to a new customer. Because Itel had no investment in engineering development nor in manufacturing, Itel could "skim the cream" of business deals in the marketplace. Itel became opportunists, jumping into sales opportunities on rapid notice. Itel "phased out" of business situations where trends turned negative. Itel's only assets for ten years were people - highly paid enterpreneurs.

- Amdahl's business and technology were push-pull.

    - Amdahl developed technology and pushed it into the marketplace.

    - Because IBM's 370/168 production schedule could not keep up with the demand in 1975-77, the markeplace pulled Amdahl's computer to market.

- Itel's entrepreneur's approach was pull-push (reverse of Amdahl).

    - With a minimal investment in technology but a substantial investment in marketing, Itel constantly feels out the market. Where large opportunities became apparent, Itel pulled technology from engineering firms.

    - As the marketplace accepted Itel's packaged technology (finance, hardware, and software), Itel vertically integrated. After Itel developed its markets, Itel pushed technology.

- NCSS represents a middle ground between Amdahl and Itel. More significantly NCSS represents a unique marketing and software approach. NCSS is not just a compromise between Amdahl and Itel.

    - NCSS has the best product differentiation of any IBM marketplace competitor.

    - NCSS started with relatively expensive computer hardware, 360/67s in 1969, when IBM's special operating system, T.S.S., was a financial disaster.

- NCSS determined that people wanted both time sharing and IBM compatibility.

    - NCSS recognized that the distinction between "character at a time" time sharing (XDS Sigma 7, PDP-10, GE-635) and fast turn around remote batch (Univac 1108, IBM O.S.) would eventually merge on common data bases and common computers.

    - NCSS started with the Cambridge Monitoring System (CMS), developed in conjunction with MIT and IBM. CMS provided a starting point, a technology nucleus around which to build a business.

    - Although the 360/67 as priced by IBM in 1960s and 1970s was relatively high priced, third party vendors of add-on memory (Fairchild) and disks (Memorex), eventually improved the cost performance.

- As a result of CDC taking over the IBM Service Bureau Corporation, NCSS was left alone to pursue their unique service offering.

    - Like Amdahl, NCSS developed and pushed its software and services into the marketplace.

- Like Itel, NCSS was opportunistic in recognizing market potentials that pulled their technology. NCSS then found hardware vendors competing with each other to get NCSS's business.

- Today NCSS buys all of its computer hardware, usually from two sources of supply. However, NCSS is entirely self sufficient in software.

- A summary of a hypothetical business posture for anyone today to stay in the IBM PCM arena would be:

  - Twenty-five percent marketing and entrepreneurial.

  - Twenty percent operating systems and applications software.

  - Twenty percent field support: hardware, software, customer training.

  - Fifteen percent unique computer system design (CPU, memory, terminals....).

  - Ten percent manufacturing technology: high quality and low cost.

  - Five percent manufacturing facility to achieve: quality and low cost.

  - Five percent financial resource: work in process and leasing.

- Tandem computer, although not an IBM PCM, is the archetype of how a company balances its resources after successfully starting a new product.

  - Tandem competes against System/38.

  - Tandem's stock market price has gone from $26 in fall of 1978 to $34 as of April 1979.

- During this period IBM announced the 8100, System/38, and 4300. Amdahl's and Itel's stock has fallen to one-third. Wall Street correctly recognizes the future value of a balanced company, and unique proprietary software.

- Tandem's initial business thrust was fault tolerant and fail safe computing. This is of secondary importance today.

- Tandem's major technological attractions are:

  - No host computing (distributed data processing) similar to multiple 8100s with no central 370.

  - Relational Data Base software with both global and local data set compability. This is functionally similar to linking multiple geographically dispersed System/38s but with an integrated global relational data base.

- NCSS more closely resembles Tandem's business thrust than does Amdahl or IBM.

  - NCSS is a blend of computer services, unique operating system software and computer hardware (systems integration and creative financing).

  - NCSS is vertically integrating after ten years of selling services and software.

  - More detailed views of the three firms follow. All three views are from current and former employees and represent unique insights to their respective characters, business thrusts, and probable future direction.

  - A brief view of all the participants and their products positions is shown in Exhibit IV-1.

## EXHIBIT IV-1
## IBM PCM PARTICIPANTS

| IBM CPU Plug Compatible Manufacturers and/or Marketers | .3 to .6 MIPS | .6 to 1. MIPS | 1 to 2 MIPS | 2 to 3 MIPS | 3 to 5 MIPS | 5 to 9 MIPS | 9 to 13 MIPS |
|---|---|---|---|---|---|---|---|
| AMDAHL | | | Design not sold | V5,6 | V7,8 | | |
| CAMBRIDGE MEM. INC, CMI | 1/79 | from IPL | | | | | |
| CONTROL DATA CORP, CDC | | 78 from | IPL | | | | |
| HITACHI | | | | AS6 | sold by ITEL | AS8 | |
| ITEL | | AS3 NS | AS5.3 NS | AS6 Hit | AS7 1/80 | | |
| IPL, 40% Owned by CMI | to CMI NCSS | to CDC | to ITEL | | | | |
| MAGNUSON | 1/79 | 9/79 | 9/80 | | | | |
| NANODATA | 7/79 to Nixdorf | 7/80 | | | | | |
| NATIONAL CSS | 2 Pi CMI | | | . | . | | . |
| NATIONAL SEMICONDUCTOR | TO NIXDORF 400 DIRECT | | AS3 DIRECT AS5.0 TO ITEL | 9/79 Lightning | | | |
| NIXDORF (Scrapped in-house) | 7/79 NS400 | | | | | | |
| TWO PI (Philips) | 9/78 | 9/80 | | | | | |
| Being Developed: MICROCOMPUTER SYSTEMS | | | | 6/79 R1 | 1/81 R2 | . | |

INPU

V AMDAHL

# V   AMDAHL: COMPANY HIGHLIGHT

## A.   PRODUCT INFORMATION AND POLICIES

- Currently Amdahl markets three different 370 architecture CPU's. These are the V5-II, V6-II, and the V7. These three CPU's, along with some insignificant software offerings, constitute Amdahl's entire product line. In fact, all three of the CPU's listed above are slightly different versions of their original V6 machine. The V5-II is a scaled down version of the V6, while the V6-II and V7 have critical path logic reworked and cache and memory size increased to improve performance. None of these machines are microcoded so hardware changes are required to add instructions and otherwise respond to IBM extensions to the current 370 architecture.

- Amdahl is also in the process of developing an entirely new machine. The machine is targeted to be three to four times faster than the V7 (15 to 20 MIPS versus 5 MIPS). The design is similar to the Cray machines in that it uses only a few different types of chips. This basic set of chips are used as building blocks as they are combined together in various ways to perform different logic functions within the CPU. Additionally, Amdahl has abandoned one of his design philosophies in that this machine will be "soft." That is, the machine will be microcoded allowing for architectural extension, movement of software into firmware, and other changes designed to reflect IBM's past and anticipated future moves.

INPUT

- Amdahl's current policy is to remain IBM compatible and respond quickly to IBM enhancements. However, there are some factions within Amdahl that see the possibility of following IBM "exactly" as being a difficult and not the most profitable course. Therefore, Amdahl is developing an alternative strategy that involves supporting its own version of MVS and offering major software products to go along with it.

## B. TECHNICAL CAPABILITIES

- Amdahl is the most experienced and most capable CPU PCM. They have been innovaters in the areas of LSI technology and logic design. Their new machine design indicates a continuation of this trend. Amdahl will be a leader in technology and design while being a follower of IBM architecture for the obvious marketing reasons.

- While Amdahl has superior capability in hardware design it has no comparable capability in software. Amdahl's emphasis has been to support IBM operating systems and other software running on Amdahl hardware. Amdahl has also licensed a few minor software products aimed only at its own customers.

- Amdahl has no significant internal capability to develop software. It is talking to a number of independent vendors of software products such as Data Base Management Systems and Teleprocessing systems in hopes of purchasing or sub-licensing this capability.

- Internally, Amdahl is increasing its capability to maintain existing IBM software. PL/I, Programming Language I is used as the operating system development language for some computers. PASCAL, FORTH, and "C" (Bell Labs) are popular minicomputer compiler compilers. PLS, (Programming Language System) is the 370 and 303X macro-assembler used for system development.

- The use of a PLS is a way of obtaining compatibility at the user level even though the command structure of the hardware is different from IBM's. Amdahl is writing a PLS compiler to assemble the IBM MVS operating system in anticipation of IBM restricting its use in the future. While this may sound simple on the surface, the project will cost millions of dollars and take two years. Writing the PLS compiler is just the beginning. IBM has distributed most but not all of the MVS source code. Filling in the missing areas will be a major task. Another will be the assembly, integration and test of MVS, easily the largest and most complex operating system ever written.

## C.  MARKETING STRATEGIES

- Amdahl entered the CPU PCM business successfully by competing with IBM on several levels. They offered better price/performance than IBM. Amdahl delivery schedules took advantage of IBM inability to produce its largest machines fast enough to meet market demand. Perhaps most important, however, was the fact that Amdahl, not IBM, offered the fastest 370 architecture CPU that could be purchased. This high-end market with its sophisticated customers with their enormous processing requirements was the ideal place to begin marketing.

- Amdahl offered at a competitive price what IBM could not offer at any price, the fastest 370 CPU available. With a firm foothold in this segment of the market, Amdahl is expanding its market by slowing down its machine and offering it as the lower priced V5-II.

## D.  ANTICIPATED BUSINESS PROBLEMS

- While Amdahl has always designed its own chips, carriers, etc., they have no capability to make the chips themselves. Amdahl has relied on Fujitsu to manufacture the machines while Amdahl has been responsible for system

integration and test. Both these factors could be a problem in the near future. The semiconductor houses are overloaded. Amdahl is attempting to insulate itself for this problem by building a semiconductor manufacturing facility in Santa Clara, near its Sunnyvale headquarters. Additionally, the Amdahl/Fujitsu relationship is in jeopardy because both partners are beginning to view each other as competitors rather than collaborators. Fujitsu is preparing to enter the U.S. market and Amdahl is assuming more and more of the system manufacturing load. The state of this situation could greatly effect Amdahl's ability to provide optimum delivery times to take advantage of IBM's current inability to deliver the 3033.

• Amdahl is extremely vulnerable to IBM's impending announcement of the 'H' series. Amdahl has always marketed at the top of the IBM line by offering more power than any current IBM CPU. That position is very marginal at the present with the V7 being at most 10% faster than the 3033. Amdahl is continuing to sell as well as it is only because it can offer better delivery. The 'H' series will challenge Amdahl on price, manufacturing ease, and most importantly, performance. The time between the beginning of deliveries of the top end of the 'H' series, which could be announced as early as the third quarter 1979, to the introduction of Amdahl's new 15 MIPS CPU, scheduled for the second quarter 1981, could be a difficult period for Amdahl. For the first time IBM will offer a machine faster than any Amdahl has to offer. During this period, Amdahl will be forced to sell in the same way IBM's other CPU competitors do.

E.    EXPECTED COUNTERMEASURES TO IBM ACTIONS

• Amdahl will respond to the IBM 'H' series with the announcement of its own 15 to 20 MIPS supermachine. The machine is microcoded and can be easily and quickly enhanced to respond to IBM changes. Amdahl is developing its "own" version of the MVS operating system in anticipation of its removal from the public domain. Amdahl is seeking partners and/or acquisitions in the area of

major software products to counter IBM increased emphasis on software as a source of revenue.  All of these strategies seem to constitute a sound plan for competing with IBM during the 1980s.
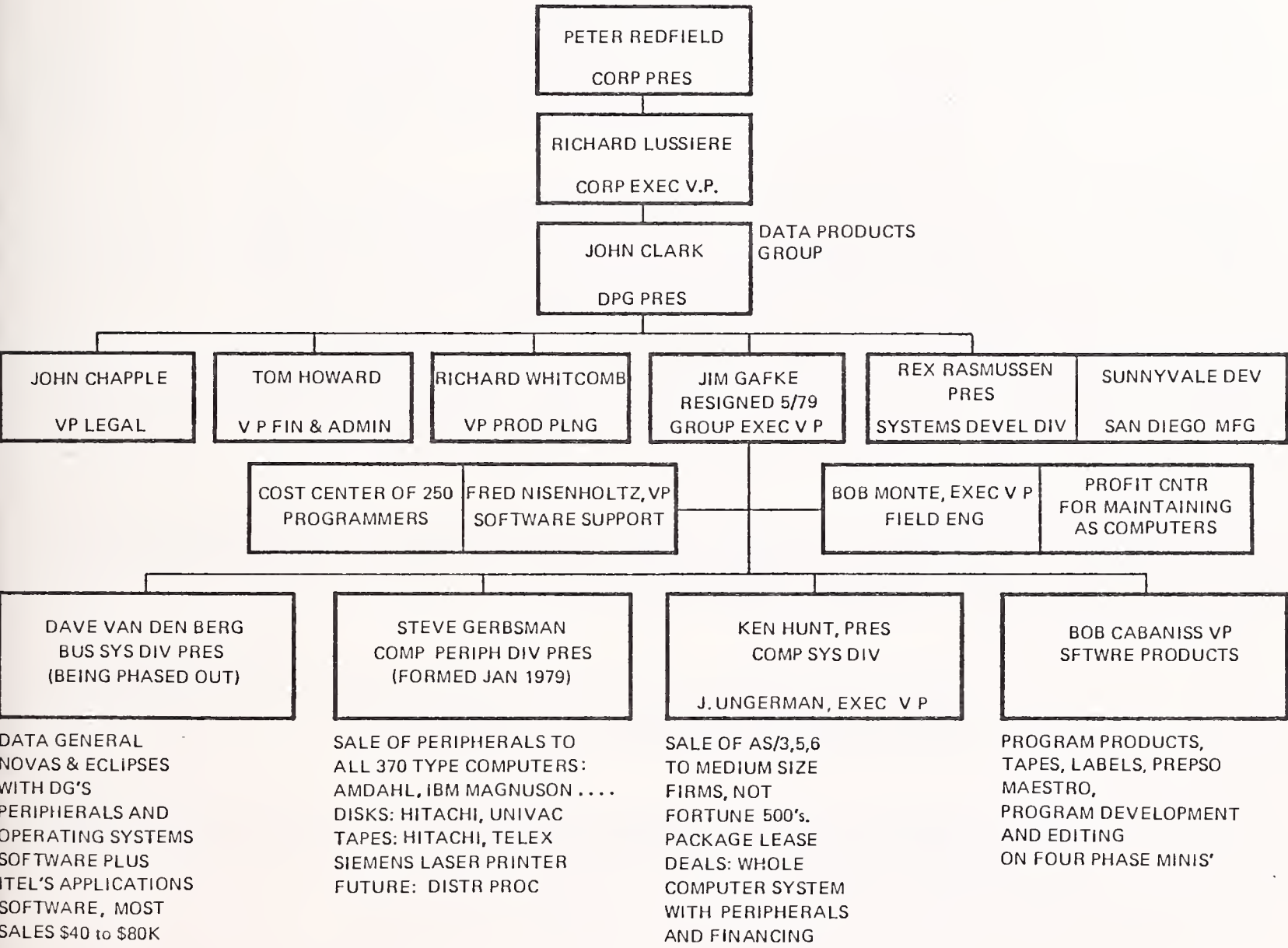
INPU

VI ITEL

# VI    ITEL, COMPANY HIGHLIGHTS

- Itel was founded in 1968 as a financial intermediary between suppliers of large capital equipment (airplanes, computers, railway cars) and users.

- Today Itel can be viewed as several separate operating companies but with centralized treasury and financial services.

    - Financial and transportation leasing groups borrow money from banks and other institutions to finance railway cars, airplaines, etc.

    - Only railway cars are sold on operating leases.  All other products including computers are sold on full pay out financial leases.

- Computer marketing activities in Itel are handled by two autonomous groups: Data Products Group (DPG) and Data Services Group (DSG).  A third group, Computer Financial Services, has recently been reduced to a handful of people and is not a major factor.

    - Data Products Group has 3,600 people in sales, service, software support, and development (not manufacturing).  Manufacturing of Itel's Hawk computer will add 300 employees to the new San Diego facility.

- Data Services Group, headquartered in White Plains, New York, is divesting several divisions and is moving to San Francisco. Thus sales from recurring sources may be $20 million to $40 million. In spite of the reorganization, DSG is still interested in acquisitions.

- The financial position of Data Products Group is characterized by rapid growth but has been severely impacted by IBM's 4300 announcement.

  - January 1979's revenue forecast for the coming year was $600 million. Even with additional expenses due to manufacturing start-ups and expanded software marketing, the pretax profit planned was $25 million to $35 million.

  - AS/3.5 and AS/5 sales are less than 50% of forecast in 1979 due to both the anticipation and actual announcement of the 4300 series. As a result, revenue will not likely exceed $500 million..

  - Itel Corporation as a whole is reducing its lines of revolving bank credit from $500 million to $300 million, but increasing its 5 to 7 year term debt correspondingly.

  - Itel may increase net assets from $1.3 billion to $1.7 billion in 1979, depending upon computer manufacturing costing (expense versus capitalized costs, etc.).

- Product information and policies can be likened to IBM.

  - After referring to the organization chart, Exhibit VI-1, brief divisional descriptions are as follows.

  - Business Systems Division (BSD) was an outgrowth of the Computer Services Group. CSG was experiencing a slow migration of customers away from time sharing services to micro and minicomputer based systems. BSD was moved over from CSG to Data Products Group in

INP

# EXHIBIT VI-1

## ITEL ORGANIZATION AND PRODUCTS

```
                    ┌─────────────────────┐
                    │   PETER REDFIELD    │
                    │     CORP PRES       │
                    └─────────────────────┘
                    ┌─────────────────────┐
                    │  RICHARD LUSSIERE   │
                    │   CORP EXEC V.P.    │
                    └─────────────────────┘
                    ┌─────────────────────┐  DATA PRODUCTS
                    │    JOHN CLARK       │  GROUP
                    │     DPG PRES        │
                    └─────────────────────┘
```

| JOHN CHAPPLE VP LEGAL | TOM HOWARD V P FIN & ADMIN | RICHARD WHITCOMB VP PROD PLNG | JIM GAFKE RESIGNED 5/79 GROUP EXEC V P | REX RASMUSSEN PRES SYSTEMS DEVEL DIV | SUNNYVALE DEV SAN DIEGO MFG |

| COST CENTER OF 250 PROGRAMMERS | FRED NISENHOLTZ, VP SOFTWARE SUPPORT | BOB MONTE, EXEC V P FIELD ENG | PROFIT CNTR FOR MAINTAINING AS COMPUTERS |

| DAVE VAN DEN BERG BUS SYS DIV PRES (BEING PHASED OUT) | STEVE GERBSMAN COMP PERIPH DIV PRES (FORMED JAN 1979) | KEN HUNT, PRES COMP SYS DIV  J. UNGERMAN, EXEC V P | BOB CABANISS VP SFTWRE PRODUCTS |

| DATA GENERAL NOVAS & ECLIPSES WITH DG'S PERIPHERALS AND OPERATING SYSTEMS SOFTWARE PLUS ITEL'S APPLICATIONS SOFTWARE, MOST SALES $40 to $80K | SALE OF PERIPHERALS TO ALL 370 TYPE COMPUTERS: AMDAHL, IBM MAGNUSON .... DISKS: HITACHI, UNIVAC TAPES: HITACHI, TELEX SIEMENS LASER PRINTER FUTURE: DISTR PROC | SALE OF AS/3,5,6 TO MEDIUM SIZE FIRMS, NOT FORTUNE 500's. PACKAGE LEASE DEALS: WHOLE COMPUTER SYSTEM WITH PERIPHERALS AND FINANCING | PROGRAM PRODUCTS, TAPES, LABELS, PREPSO MAESTRO, PROGRAM DEVELOPMENT AND EDITING ON FOUR PHASE MINIS' |

INPUT

August 1978. BSD purchased Data General (DG) based systems at 35% to 50% off DG's listed price, added applications software and resold the systems to firms in the garment trade, automobile dealerships, medical clinics, distributors (eletrical, plumbing,...) and others.

- The 35% to 50% margin for marketing and support was not enough to yield much profit.

- There was very little marketing relationship of BSD to Itel's advanced system sales, peripheral sales, and large system software marketing.

- BSD purchased over $1 million per month from DG and was among DG's ten largest customers.

- Although BSD purchased and resold DG computers, DG was responsible for all field maintenance.

- BSD was ordered to disband themselves on 17 April by Itel's top corporate management.

- BSD's marketing staff are over 100 people will be folded into DPG's other three marketing divisions.

- The Software Marketing (Program Products) is the fastest growing and most increasingly profitable division in Itel.

- Program Product marketing sells Prepso (TSO replacement) and TAPS, a telecommunications monitor and data base manager.

  - Salesmen are being hired for the major cities in the free world (Australia, Europe, North America) to go to programming groups in major corporations and government agencies.

- TAPS is sold for $70K to $100K. Itel receives 70% for marketing and support.

    - Itel prefers to negotiate exclusive marketing agreements with a developer of IBM compatible software, rather than developing it internally.

    - Itel has developed a micro code assist feature for the 370/145, which is not available from IBM. This rents for $1,000 per month and is very profitable.

- The Computer Systems Division markets the AS 3, 4, 5, 6 (advanced system) computers. The AS 3, 4, 5 are manufactured by National Semiconductor and sold exclusively to Itel for resale. The AS/6 and AS/6 multiprocessor are manufactured by Hitachi. Itel has the exclusive rights to sell AS/6's in North America, and non exclusive rights elsewhere.

- The Field Engineering Division, headquartered in Palo Alto, is run as a profit center. FED has been trying to grow and still return 15% pre tax.

    - FED has approximately 110 offices worldwide.

    - It takes approximately three AS computers in a city at $2,500/month each for CPU and memory (not including peripherals' revenue) to break even on Itel's maintenance costs.

    - IBM's rates for the new 4300's set the maintenance break even at 12 computers per city for competitors.

    - The biggest problems FED faces are:

    1. Not enough qualified technicians.

2.  Low quality products getting out.

3.  Training and spare parts stocking.

- Itel International runs as a totally self contained firm, operating only in Europe, selling all products through one sales force.

- Itel South America and Itel Asia are run as sales extensions of Itel domestic.

- Itel's Systems Development Division (SSD) is run as a profit center with its own President. They are developing a mid range of computer families: Hawk 1 and Hawk 2.

  •   Most of the development staff were internal transfers from FED. Consequently there is no one "computer architect" or master designer.

  •   The consensus among competitors and others is that Itel has some good design people but no excellence.

  •   SSD put together an ambitious development program but with very conservative (easy) time and cost budgets.

  •   Including amortized development costs, land, and manufacturing facilities, the investment is $16 million. This comes after many years development, debugging, and field experience with AS.

  •   The target performance for Hawk 1 is 1.5 to 2 MIPS. Customer testing will be in November 1979.

  •   Product manufacturing cost, fully burdened, with 2 MB of memory and channels will be approximately $120,000.

- 46 -

- Hawk 2, targetted for late Spring of 1980, may be 2.5 to 5 MIPS. This will overlap the Hitachi AS6.

- 47 -

- SDD plans on moving from Palo Alto and Sunnyvale to San Diego in the Fall of 1979.

- On May 18th, Itel announced another reorganization. All computer sales have been combined into a new division headed by Mr. Gerbsman.

INPU

VII  NATIONAL NCSS

## VII    NATIONAL CSS

## A.    SERVICES AND PRODUCT STRATEGY

* National CSS (NCSS) was founded in 1966 as Computer Software Systems by
  Bob Bernard.  Legal problems with the firm's name were solved by putting
  National in front, hence NCSS.

    - NCSS is in the best position of the PCM's, relative to their size.

        . NCSS owns their operating system software, CMS (Cambridge
          Monitoring System).

        . NCSS purchases their PCM CPU's from two vendors:  Two Pi and
          Cambridge Memories, Inc.  Thus they can play off CPU and
          hardware vendors to achieve the best prices and terms.

        . Their    product    strategy    is    integrated    from    computer
          hardware/software sales through computer services, networks
          and proprietary data bases.

        . NCSS is in a relatively similar price posture to IBM:  Pricing and
          profits    from    user    installed    computers,    software    and
          communciations can be shifted around by NCSS.

- 49 -

- Robert Bernard, the founder, started developing interactive software for XDS 930's to be used by Perkin Elmer.

- The Cambridge Monitoring System was an outgrowth of IBM's Cambridge, MA., Scientific Center's developments. A requirement for an efficient 360/67 operating system other than TSS was met via CMS.

- NCSS's initial service offering was launched in December 1968:

  - Economical low speed access to 360/67.

  - Large memory (256 KB) per user.

  - First COBOL offering through timesharing.

- By 1970 NCSS started to emphasize applications for specific industries and deemphasized just offering computer resosurces.

  - Major customers were Fortune 500 firms.

  - Standard Oil of California in 1971 acquired an operating system license (CMS) to run on their own in-house computers. Several other firms also acquired CMS.

- NCSS spent two year (1970, 1971) getting RAMIS, relational data base management software (DBMS) up and running and profitable.

  - By 1972 most computer service firms realized that DBMS represented a high profit margin offering. Customers were more interested in programmer productivity than just computer costs.

  - NOMAD, available in early 1975, was NCSS's internally developed DBMS.

- NOMAD represented two years of development 1973, 74 by NCSS's best people.

- The investment was a few million dollars.

- Dun & Bradstreet acquired NCSS in March 1979, paying $48/share, 50% over the market price.

  - Sales are running at approximately $60 million of computer services revenues.

  - Sales of PCM CUP's and peripherals are targetted at $20 million to $30 million in 1980.

  - NCSS markets directly (their own marketing force) in North America and in the U.K.

## B.    NCSS SUPPLIERS' COMPUTER ARCHITECTURES

- Both Two Pi (Signetic/Philips) and National Semiconductor NS400 use Schottky bipolar 2901 four bit slices for their arithmetic logic units (ALU). NCSS purchases the Two Pi computer, not the NS 400 although the NS 400 is approximately 20% faster. NCSS's second supplier is Cambridge Memory, Inc., CMI. The CMI computer is a cost reduced version of IPL Corporation's Omega, which is sold by CDC.

- The CMI computer, using TTL logic and readily available parts, is a true maxi-computer with parity in registers throughout the arithmetic logic unit, ALU.

- The Two Pi CPU (.25 MIPS) uses eight bipolar 2901's, totaling 32 bits for its ALU. One reason for being classified as a large minicomputer is the lack of parity in registers. The PCB's are approximately 15" by 15." Each CPU

INPUT

consists of two PCB's. One is the ALU with sequencing logic. The second contains microcode; horizontal organization in ROM, not RAM. A third PCB contains memory control, addressing, and error correction coding, ECC. Each channel emulator is on a separate PCB.

- Integrated file adapters (bypassing the channel) were originally designed as two PCB's. Because of the engineering problems encountered, both Two Pi and NCSS turned to Microcomputer Systems and use their intelligent disk controller as the integrated file adapter.

- NCSS can run its CMS software on the Two Pi computer with Microcomputer's controller and Memorex disks.

- Both CMI and Two Pi sell their systems for two to four times manufacturing cost to OEM's, e.g., $56,000 and $46,000 respectfully for large contract.

- IBM compatible disk controllers from Micromputer cost $10,000 each at the channel interface or $6,000 as integrated file adapter.

- NCSS assumes systems responsibility for "systems integration," e.g., purchasing and interface engineering for all the subsystems. Thus NCSS gets 80% of the benefits of a PCM but only has 20% of the risks and costs.

VIII SOFTWARE: PROFITS OF THE FUTURE

# VIII    SOFTWARE: PROFITS OF THE FUTURE

## A.    OPERATING SYSTEMS

- IBM will stop support and enhancements of DOS/VS (Disk Operating System/Virtual Storage) as of January 1981. IBM will phase out support of most other "public domain" operating systems except VM and MVS. While VM will be in the public domain, IBM will add microcoded extensions to MVS resulting in MVSE for both 4300 and "H" Series. The 4300 will run DOS/VS extended, VMCMS or MVSE with microcode enhancements.

    - For example, one difference between DOS/VS and VSE is the treatment of the area that handles overlays and external interrupts. The 4300 has moved this area (called the "B" Transient") into micro program memory. The B transient area contains the I/O pointers and drivers used for swapping users from real to virtual memory.

    - It is estimated that a 12 partition DOS/VSE system running in January 1981, on a 4341 will perform close to a 370/158.3. If you only compare MIPS, the 4341 is .75 MIPS while the 158.3 is 1.0 MIPS. All things being equal (number of channels, controllers, disks, their data transfer rates, etc.) the 4341 with DOS/VSE performs almost equal to 158.3 with DOS/VS.

- Thus, the Extensions to operating systems using microcode enhancements may yield a 33.3% performance improvement.

- For comparison purposes an analyst should add 33.3% to 4300 and to "H" Series for <u>effective</u> 370 MIPS comparisons.

- Significantly higher profits will come from operating systems revenues. IBM may be willing to license these to PCM's but at high prices.

## B.    PROGRAM PRODUCTS

- Program products will become a larger source of revenue to IBM than new operating system fees.   Examples and approximate revenues of current program products are:

    - CICS, $600/month.

    - IMS, $500/month.

    - Language compilers: Fortran, COBOL, each approximately $50/month.

- The most important new program product will be an integrated Relational Data Base Management System (RDBMS), most likely a derivative of the System R project which currently completed beta tests at twelve key IBM customer sites.  The relational system is designed to mimimize programming effort and thereby reduce the customer's applications development costs; i.e., customer costs that don't contribute to IBM revenue.  The RDBMS will require increased CPU resources to run, thereby consuming the increased CPU/Price performance just announced by IBM.   The RDBMS can be considered a technological breakthrough and will serve as the basis of new applications for existing large DBMS customers and allow the introduction of computer data management to medium and small scale users.  This will be available as a <u>slow</u>

performance software package on 370's. INPUT believes microcode assist on "H" Series as well as intelligence in the disk controllers will provide excellent performance on that line.

- The RDBMS will allow IBM to develop industry application packages that are easily customized to specific user needs. It is the lack of flexibility of existing application packages that has prevented their wide spread use.

- The availability of flexible application packages will greatly increase the size of the market by allowing medium to small companies, who can now afford hardware, to acquire the software that justifies such hardware acquisition.

- INPUT's estimate of profit and revenue shifts from hardware to software due to S/38, 8100, 4300 and "H" Series are shown in Exhibits VIII-1 and VIII-2. These are estimates of IBM's total profit and revenue sources for all computers on an annual basis.

    - Software revenues are expected to grow from 5% in 1978 to 20% in 1982. Software profits may grow from 5% in 1978 to 25% in 1982.

    - CPU and memory revenue for 1978 was estimated at 45% (Exhibit VIII-1) and profit at 35% (Exhibit VIII-2). 1982 CPU and memory revenue are forecast to be 30% with profit at 20%.
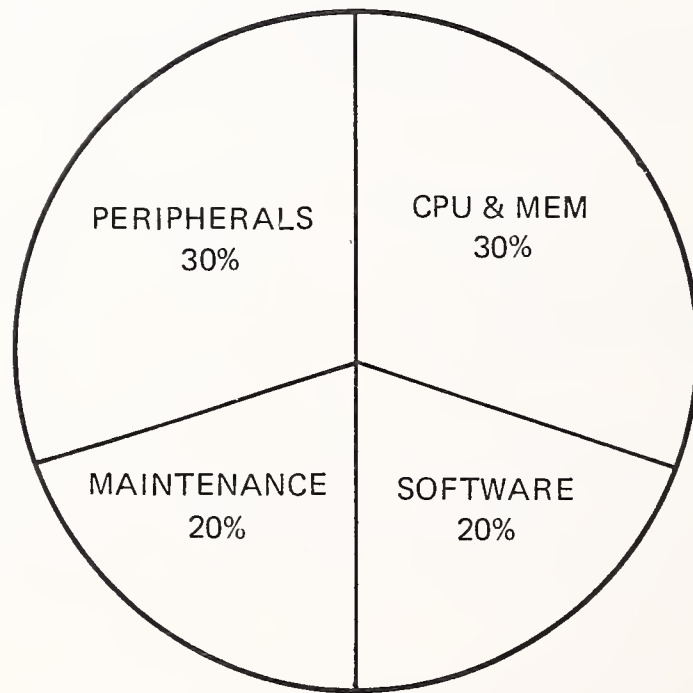
## C. IBM SOFTWARE SUPPORT

- IBM will sell softwre to any PCM user including operating system software, IUP (installed user programs), FDP/field developed program), and program products.

    - OS is in the public domain and may be obtained by anyone for the price of tape dulication.

EXHIBIT VIII-1

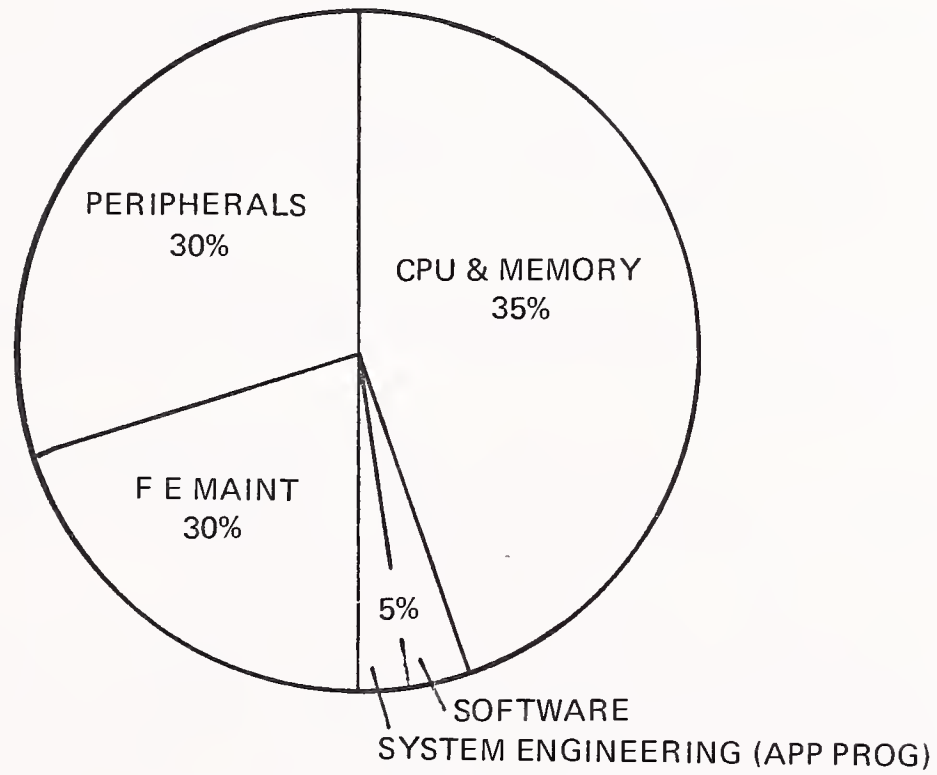# REVENUE SHIFT: HARDWARE TO SOFTWARE
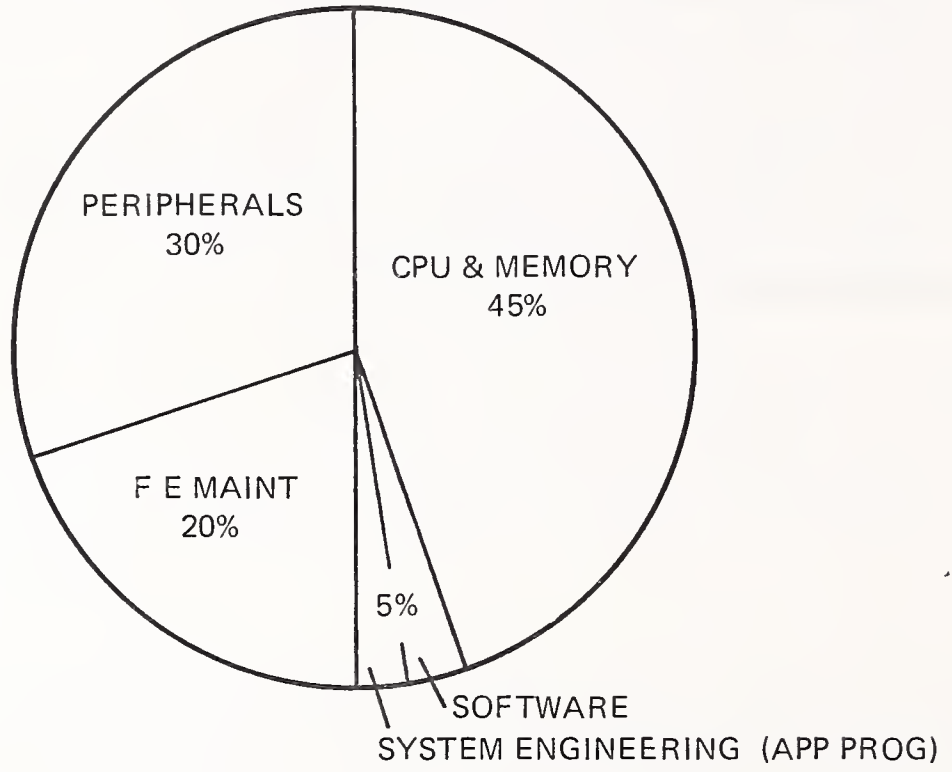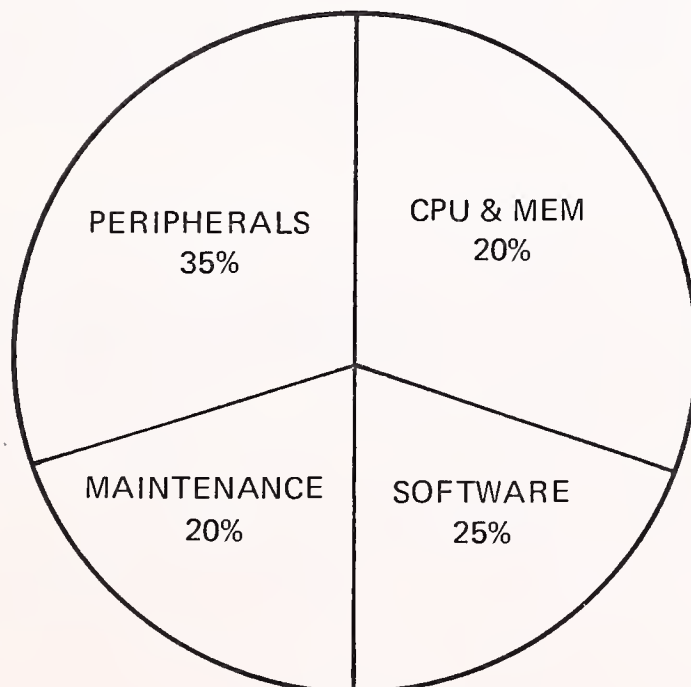


1978 IBM REVENUE SHARES



1982 IBM REVENUE SHARES

INP

# EXHIBIT VIII-2

## PROFIT SHIFT: HARDWARE TO SOFTWARE



1978 IBM PROFIT SHARES

PERIPHERALS 30%
CPU & MEMORY 35%
F E MAINT 30%
5%
SOFTWARE
SYSTEM ENGINEERING (APP PROG)



1982 IBM PROFIT SHARES

PERIPHERALS 35%
CPU & MEM 20%
MAINTENANCE 20%
SOFTWARE 25%

INPUT

- Other software is charged for separately.

  · A typical IUP license fee is $1,000/month. After 36 months the user owns the program.

  · A financial accounting and bill of material processing FDP sells for $500 per month for 12 months after which the user owns the progam.

- PCM users who also have IBM computers can apply software fixes and changes to both systems.

- IBM's minimum monthly maintenance charge (MMMC) allies only to IBM CPU's. Cost of these services are bundled.

- Amdahl provides the same support at Itel and also bundles support prices. If, however, Amdahl later provides its own versions of MVS and other programs such as a Data Base Management System, it may unbundle some software charges.

- Magnuson places full responsibility on the user to transfer IBM software to its systems.

- NCSS provides full software support since the operating system software is largely its own. Support to convert user applications programs is also provided on a negotiated basis.

- For both Itel and Amdahl, implementation of new releases and change orders are basically the customer's responsibility. However, both firms offer support via their central support centers. Change order notifications are sent to customers by the firms themselves who, as IBM customers, receive them from IBM.

INPL

- IBM's System Support Centers will provide over the phone consultation to users of IBM CPUs who have MMMC agreements in effect even if the problem is on the PCM CPU.

- IBM will provide on-site support charged at a rate of $45 to $75 per hour.

- IBM is willing to enter into a "no liability to IBM" agreement to help PCM users with software problems. These agreements provide no guarantees and are sold only on a time and materials basis.

## D.    PCM SOFTWARE SUPPORT PRACTICES

- Itel and Amdahl have software support representatives in the field who provide help to customers at no extra charge. Their costs are bundled into the lease price (or maintenance contracts in the case of purchased systems).

- Itel provides specialists to assist in the process of transferring software from an IBM system to an Itel system. If the customer is a first time user, Itel provides installation support and customer training in the field.

- Itel does not provide software support in Japan directly. All support comes from Itel U.S. If information is needed from IBM, Itel contacts the IBM Manager of Industrial Relations (MIR) in the U.S. and passes the information on to Japan.

## E.    LONG TERM SOFTWARE DIRECTIONS

- INPUT believes IBM will move aggressively to "take over" the software industry. The strategy is as follows:

- An end-user applications program will have three levels of software behind it.

    . The first level will be the system control program which will have in it microcode enabling the second level to operate.

    . The second level will include the so called advanced function systems such as data base and data communications software.

    . The third level will be the program product area which includes the applications enablers (subroutines).

    . The fourth level is the application product itself.

- This strategy will make it difficult if not practically impossible for vendors to compete with IBM at any but the fourth level of software, providing IBM obscures the software and microprogram interfaces as INPUT believes it will.

IX  TECHNOLOGY  ACQUISITION

# IX    TECHNOLOGY ACQUISITION

## A.    DOCUMENTATION

- Documentation release is becoming harder to get in advance of first customer shipment of a specific computer. There are no "Theory of Operations" nor "Principle of Operations" manuals for the S/38. The Principle of Operations manual for the 4331 may be available in June from the initial 4331 customers while the one for the 8100 will not be available until Fall '79.

  - Itel always orders at least one of every newly announced IBM computer. This allows Itel to also order all the pertinent manuals. When Itel received the 3033, Itel field engineers and Systems Development Division engineers spent 30 days probing and examining it. Their ability to learn was largely due to their in-depth backgrounds designing and maintaining similar IBM computers, some as former IBM employees.

  - IBM has a Manager of Industry Relations (MIR) who deals with all of a competitors technical questions. Specific detailed questions are submitted in writing to the MIR and receive oral or written responses in three to ten working days. There is no spirit of give and take or exchange of ideas. For instance if you are designing an interface to a standard channel for a device with a function unlike anything IBM has, you may exchange formal questions for months. IBM volunteers no information nor suggests areas worth further investigation. IBM is

concerned that a PCM may initiate legal action if IBM's suggestions cause added costs to a PCM.

- IBM does not distinguish between rental, lease or purchase customers insofar as documentation release policies are concerned.

- IBM will not train non-IBM employees on how to maintain IBM computers.

- IBM will not release microcode or microprogram documentation on any new computers. In fact, logic and microcode will be a highly guarded secret.

    - Details of logic and microcode will even be kept away from the IBM field service force. If maintenance is required at these levels, it will be provided by centralized diagnostic/repair centers. Only a bit-map will be released to the field.

- A mini computer firm is currently interfacing their computer to an IBM magnetic tape drive controller. To expedite this, they hired consultants with hardware/software backgrounds from a successful PCM.

- A Canadian firm developed special computer center operational displays, unlike any IBM offering. The Canadian IBM industry relations people only worked with specific written questions, some of which they declined to answer. The project was expedited by retaining two consultants: 1) a specialist at designing IBM channels, 2) a former IBM maintenance engineer who had access to the proper documentation.

- Past software releases are particularly difficult to get directly from IBM. IBM will sell documentation on a new changes. However, the original and earlier changes must be obtained from a third party.

# B.    COMPATIBILITY LEVELS

●    Compatibility levels vary from PCM to PCM.

  –    The closest compatability occurs where printed circuit boards may be interchanged with their 370/148 or 158 respective counterparts. This level of compatability exists outside the IBM market with several Data General and DEC PCM's. To the best of INPUT's knowledge, no IBM PCM has compatability at the printed circuit board level. Four levels of compatability are discussed below.

    .    Microcode compatability with 370/158 has been achieved by Itel. The genesis of the Advanced System, AS/3 and 5, goes back to 1974, when Digital Scientific tried to develop their 370 emulator. National Semiconductor and Itel then spent 6 months debugging what was assumed to be operational. The original design was more of a general purpose emulator than a specific 370 target.

    .    Itel had up to 20 design engineers and former IBM field mainte-nance people debugging the AS/5.

    .    National Semiconductor had several computer designers and manufacturing engineering people on the "finished" computer before it went into production.

    .    The resultant AS/3, a cost reduced version of the AS/5, with 2 MB of memory costs approximately $140,000 to manufacture. The AS/3 runs at almost 1 MIPS.

●    IPL was formed by a small design team from IBM who were working at Cambridge Memories, Inc., CMI. When CMI got into financial trouble in 1975, IPL broke off, with CMI owning 40% of the equity. IPL management owns the

remaining 60%. To finish their development IPL borrowed $2 million from Control Data Corporation with the understanding that CDC receive exclusive marketing rights in North America for IPL's M2, a .7 MIPS computer.

- After one year and approximately 50 sales to CDC, the $2 million loan was paid off. However, CDC only achieved a sales rate of six computers per month by the Fall of 1978.

  - IPL designed a cost reduced version of the M2 and sold the design to CMI for the M1, which runs at .3 MIPS. CMI assembles the M1, then rolls it through the building to IPL for final test. IPL and CMI share the same building.

  - IPL started an ECL version of the design in August 1978. This M3 is now in final test, running at 1.2 MIPS. Itel will sell this in Europe.

  - Internally the IPL CPU's are all general purpose micro engines. Channel emulation takes place in the same micro memory with 370 instructions.

  - CMI furnished NCSS with their .3 MIPS computers.

- Magnuson Corporation's computers have the least compatibility. Magnuson came from Amdahl Corporation where he was an average, not an excellent designer. He formed Magnuson Corporation with Gene Amdahl's son, Carl Amdahl, who had just finished his Ph.D. at University of California, Berkeley. Having little direct IBM design experience, the group of five started from the top down, with the Principles of Operations manual. Working in a "garage environment" for 11 months with only $350,000 they ran their first systems test in December of 1977. It took another nine months of debugging before they shipped their first computer, a .5 MIPS system to Fairchild. Fairchild put up $3 million in 1978 and owns approximately 25% of Magnuson with options on another 5%.

- Magnuson's computer bears the least resemblance to any 370.

- Magnuson can have several CPU's running in parallel on the same base for multi-way voting during factory testing.

- Former IBM maintenance and design engineers find the computer hard to understand.

- Maintenance diagnostics are designed for over the phone fault finding to the printed circuit board level.

- Senior computer design consultants who have seen the design are critical for cost and performance reasons.

- Microcomputer Systems Corporation is designing a high speed emulator, initially targeted at 370 instruction sets. The initial design target is 2.5 MIPS. Using four 18" by 18" printed circuit boards, pcb's laid out on one large plane (storm door layout) and Motorola's MECL 10K, the theoretical maximum is 4.5 MIPS. The design is based upon 1979 technology, uses 200 bit wide micro instruction words (horizontal), and is very soft. The 370 instruction set uses 2K words. The computer architect was on the IBM 370/158 design team.

  - The system bears little physical resemblance to a 370.

  - Computer design consultants have complemented its originality.

## C.    CROSS LICENSE AGREEMENTS

- IBM cross-licensed Amdahl several years ago for these reasons:

  - Amdahl was not viewed as a major threat.

- IBM was under pressure from the Justice Department to demonstrate other competitors viability.

- Amdahl had unique semiconductor design capability which yielded a 3033 class computer without the power and water cooling requirements of 370s.

- IBM top management needed added technology safety, a fallback position in case FS and "H" Series would not work.

- It is very unlikely that IBM will cross-license anyone in the near future.

• Serious consideration should be given to:

- Hiring or retaining a small U.S. based technical staff.

- Acquiring technology from one of the firms currently designing 370 instruction set computers.

INPU

X PCM STRATEGIES: OPPORTUNITY WINDOWS

# X    PCM STRATEGIES; OPPORTUNITIES WINDOWS

● After a major IBM announcement, there follows a two to three year demand vacuum. A PCM can move into this and deliver to some customers who cannot wait.

  - This provides a window in time to start a business.

  - Added functionality or price performance at least 20% over IBM is a requirement to sustain a business.

● Unique product offerings are required.

  - Hitachi's AS/6 is extremely reliable. However it is not fault tolerant; neither fail safe nor fail soft. The concept of a "Hypervisor" interfaced between O.S. and the ALU, where there are multiple ALU's similar to the Tandem computer concept, would be unique. This would also require redundant disk controllers and drives.

  - National Semiconductor started a VLSI development (System 200) which would have been a low cost and low performance, .2 MIPS 370. Such a product could be a low cost, more functional substitute for the 8100. This S200 could be the basis of a family of terminal controllers. Two defacto instruction sets are emerging as standards: 370 and PDP11. The S200 would have been attractive to firms that desire PDP11 price/performance and 370 instruction set compatability.

- The Zilog 8000 or Motorola 68,000 are candidates for this development.

- To replace the 8100 with a 370 will require DDP software.

● PCM's will have to become increasingly self-reliant in software. If there are opportunities for profits from PCM's, it is in the firmware, microcode, and software areas.

● Product and Opportunity Cycles are in Exhibit X-1. Alacrity of design and manufacturing may allow PCM's to get a product out when it is in "mid life product cycle." National Semiconductor's AS/5 was highly profitable for two years, then sales disappeared. PCM's will typically follow IBM in the future by one to two years.

- The top curve shows a four year IBM product life cycle.

- The bottom curve shows a two year PCM product life cycle.

● Price Performance curves for IBM, Amdahl and Itel are given in Exhibits X-2 and 3. These are plotted on log paper. The prices for entry level computers, 4331 ($72,500) are set at 2MB memory and include channels but not peripherals. The IBM internal code name for 4331 was Inca 1. More E Series (Incas and Mayas) are expected shortly, early Fall 1979. INPUT believes "H" Series will be announced sometime between the third quarter of 1979 and the first quarter of 1980.

- Exhibit X-2 shows only IBM labeled computers. These are superimposed on Amdahl V Series and Itel's Hawk and Hitachi AS6.

  . IBM's 370/115 through 168 are at the far left (low performance and high price).

  . IBM's 3031 through 3033 AP are the next line ($1 million to $6 million).

- 68 -

EXHIBIT X-1

# PRODUCT AND OPPORTUNITY CYCLES
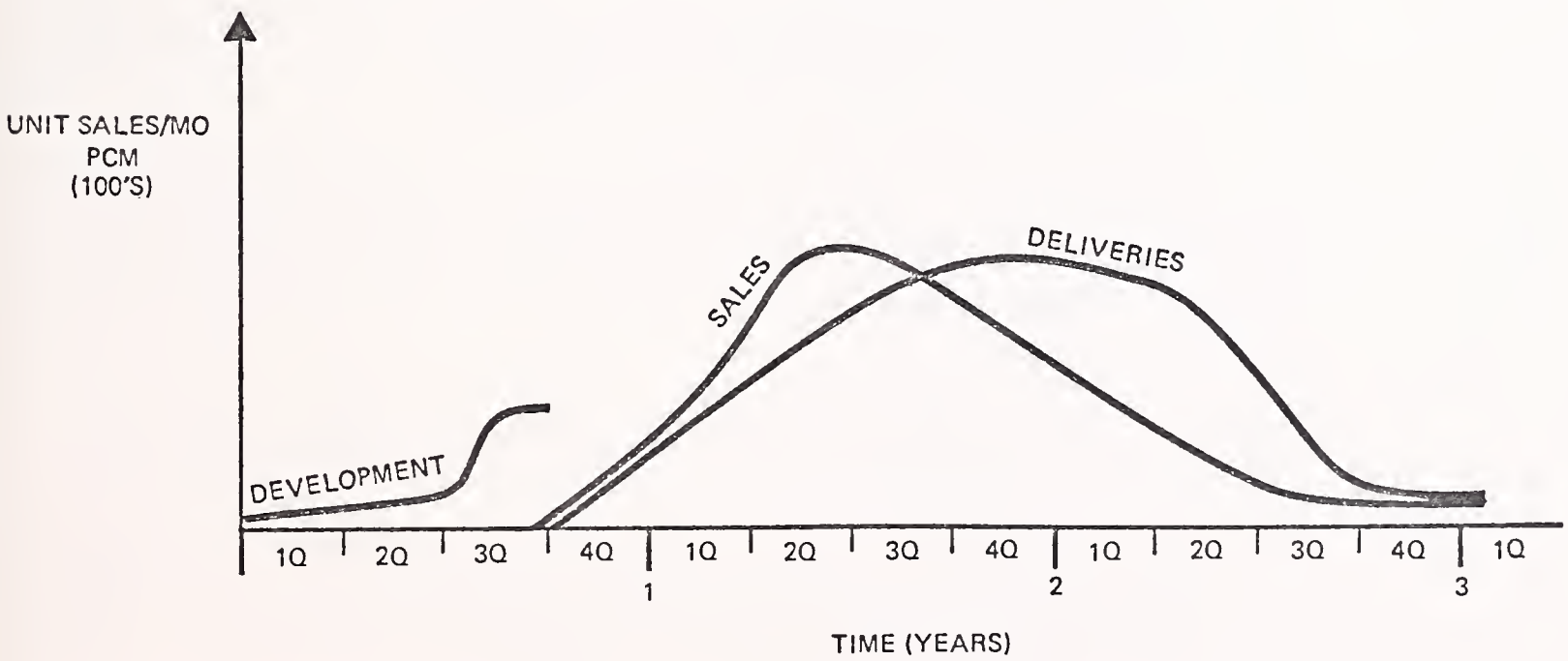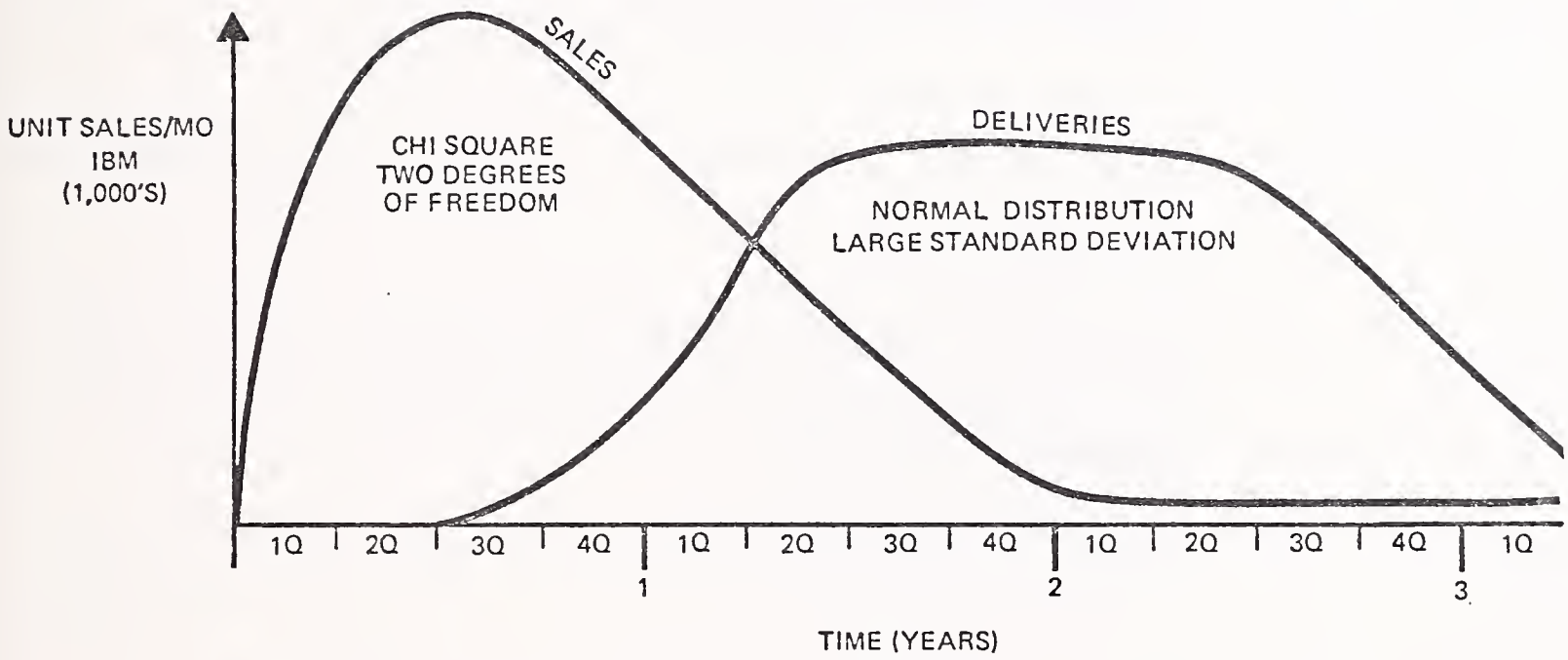
- IBM's 4300 (Inca 1 through Maya 2) are the line between $72,500 to $480,000.

- IBM's "H" Series is the forecasted line $H_o$ to $H_4$ ($1 million to $8 million).

- Exhibit X-3 plots Amdahl and Itel.

  - Amdahl's V5, 6, 7, 8 form the line ranging from $2 million to $4 million.

  - IBM's "H" Series, to the right of Amdahl, will be better price performance.

  - Itel's AS/6 and AS/6.2 from Hitachi are shown. AS/6.2 is 3 MIPS. The price was $2 million. A recent reduction to $1.6 million has not helped sales much.

  - Itel's Hawk pricing will be set at 70% of IBM's equivalent models.

- The pending "H" Series announcement is affecting Amdahl's purchase sales, but is helping Amdahl's two year lease sales.

- An opportunity will exist in the mid range: 2 to 6 MIPS before and after H is announced. To enter this market in the U.S. will require offering two year leases.

- Amdahl and Itel costs are explained in Exhibit X-3. These overlay IBM.

  - IBM will probably reduce purchase prices on 3031, 2, 3 by 30% in Summer 1979. This will lower the purchase to lease price ratios to be closer to these ratios on the 4300's.

- Typically, Amdahl and Itel set their purchase prices at 70% of IBM's. Itel strives to keep its acquisition or manufacturing costs at half of Itel's selling price.

● IBM will continue to offer major improvements in the memory area. Estimates for RAM in the top end of the "H" Series range from 40 MB to 64 MB, if the 128K memory chip can be perfected in time.

- Technology leadership in mass memory and RAM price/performance could open the door for a PCM.
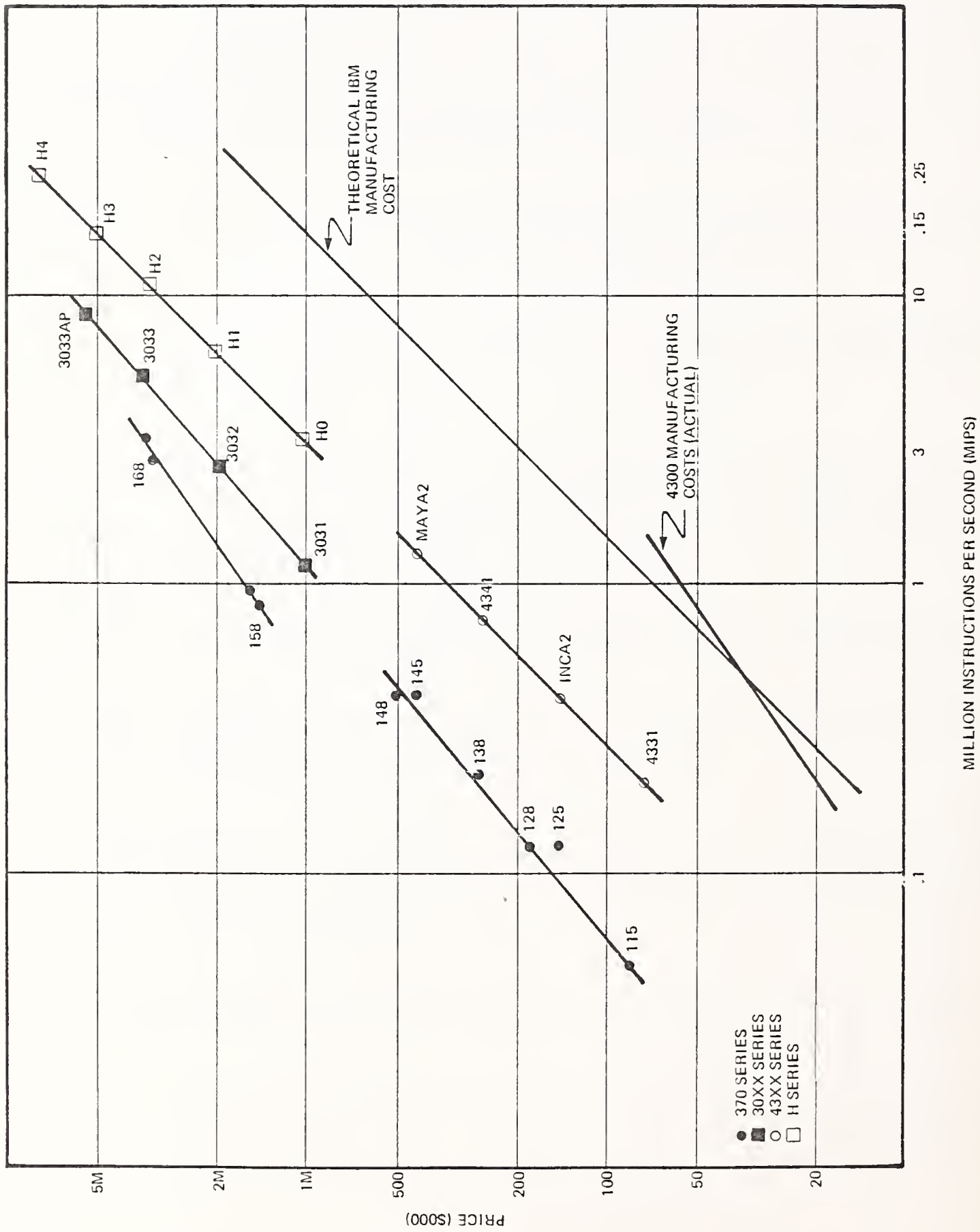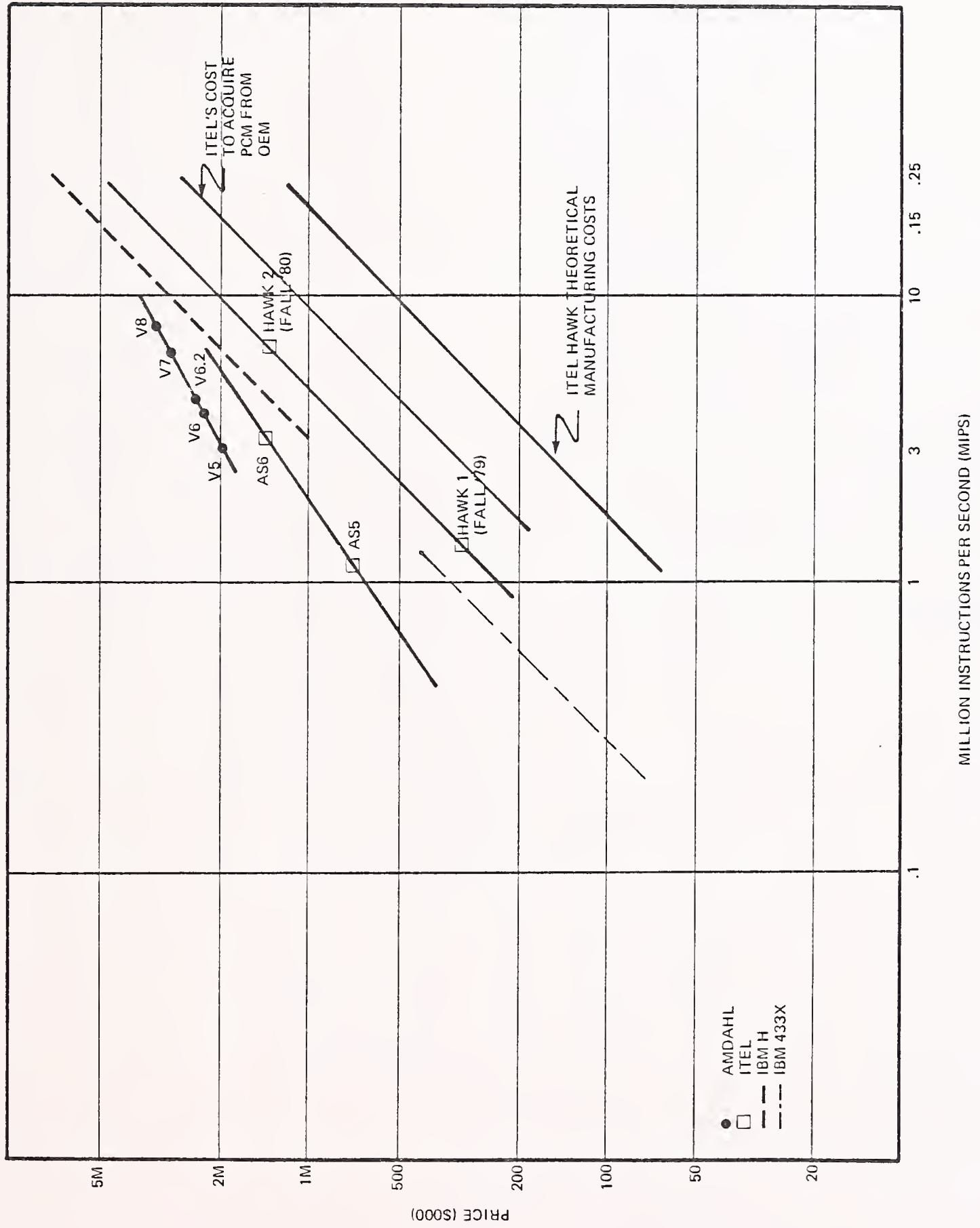
EXHIBIT X-2

PRICE/PERFORMANCE:IBM CURRENT AND FUTURE

EXHIBIT X-3

PRICE/PERFORMANCE:AMDAHL AND ITEL

- 74 -

ADDENDA

## ADDENDA

## MAGNUSON HIGHLIGHT

- Through communications confusion in the specification to this study, INPUT did not do a full highlight on Magnuson, but instead chose to study Itel because of their new Hawk computers which should have a much greater impact than Magnuson. It should be noted that INPUT believes Magnuson is an unimportant factor in the PCM business.

- Some information on Magnuson is included in Chapter IX. Some additional points of interest are as follows:

    - Magnuson recently received an additional $8 million put up by a private investment syndicate.

    - Employment is currently on the order of 200 people.

    - They have 12 sales offices, each staffed with a salesman and a systems support specialist.

    - Magnuson claims that by mid-1979 they will be able to produce five systems per month.

    - Shipments to-date are less than 20 systems.