THE IBM 370 PAPERS

1971-1980

IBM's internal "Grey Book" reports to top management,
as revealed in Federal Court,
with companion commentary by Alan Taylor, CDP, CDE

Volume I, System 370/135

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ABOUT THE COMMENTATOR

Alan Taylor, CDP, CDE, is an independent consultant in the computer field specializing in concept evaluation. He has worked on both hardware and software areas, and has been in the field since 1955. An early developer of English language compilers, and operating systems, his primary work since 1962 has been in the publications area. Here he is well-known as an evaluator and critic.

His first published critique of IBM 360 equipment was in April, 1964, when he reviewed the programming codes of the System 360 from the point of view of their usefulness as a working computer language. At the time he forecast that their complexity would involve the swift popularization of high level languages. In 1965 he reviewed the development of the IBM 360 Time-Sharing machine, the third and fourth memory modules; as well as the invalidities of the throughput calculations which were being used by IBM to claim that performance was 8 times that of the 7090. Subsequently the additional third and fourth memories were withdrawn by IBM and more conservative performance claims were substituted.

In 1968, taking the other side of the coin, he commented on the development of the CMS System for the same machine which made it a practical system. (CMS later became, in a modified form, the basis of the virtual storage on the IBM 370s).

In 1969 he covered the developments of the Cache Memory with the then 360/85. A prime point of Taylor's attention here was the claim made by IBM that the system had a speed of "up to 12 million instructions per second." Using IBM figures, Taylor calculated that a commercial user would be lucky to get one third of this.

Another 1972 investigation involved covering the IBM Field Maintenance area. IBM was proclaiming that their field engineers were not able to handle the maintenance of the add-on memories on System 360. During this incident, he arranged for his twelve-year-old daughter Alison to receive appropriate training. She was then photographed turning the switch which was all that was necessary to revert the system to IBM standards. Shortly after the publication of this photograph, IBM withdrew most of their objections to maintaining systems which have add-on memory installed - perhaps the biggest user advantage that has so far been obtained.

Currently Taylor is working on further publications involving the 370 peripherals and the 370 software. These are expected to be ready before the end of the year.

Taylor has been professionally active for some years, and was the first chairman of the Cobol Survey Group for the American National Standards Committee, the first editor of Computerworld, and the first president of the Society of Certified Data Processors. In 1973 he received an award for his work on the Computer Foundation Organizing Committee in helping to create the Institute for Certification of Computer Professionals. His basic belief that computers should be thoroughly described to users so that they are able to understand data processing risks as well as the opportunities is brought out in his weekly Computerworld column, "The Taylor Report."

He lives in Framingham, Massachusetts with his wife, Heather, and one daughter.

INTRODUCTION

The documents reproduced here are the IBM Grey Books. These describe the product cycle of the 370s, as planned in IBM management operations during the past few years. Some changes will have taken place in the past few months since these were updated, but comparatively few judging by the 1972 Management Committee Reports.

Under normal circumstances, computer users would not see these documents, and indeed most IBM sales employees, although they are the authorized contact between the corporation and the user, will not have seen them either. Owing to the various legal cases now proceeding, however, this data has become part of the public record, and are now available to users and salesmen alike.

In this User Edition of the IBM Grey Books, the parts that are of most interest to users have been highlighted. It was not written for users -- and so some care in reading can be expected. But the reality behind the data -- to use IBM's famous advertising slogan -- needs to be known by users. The books are, however, intended for non-technical people -- and particularly for financial review by management. No great knowledge of computer technology is required, and they should be reviewed by user financial management separately from user hardware, software and operational areas.

The material appearing on the right-hand side is taken straight from the IBM Grey Books, as they have been placed in the public record by IBM Corporation. However, the emphasis in this area has been added to make the task of user review easier.

The material on the left-hand side is commentary added by myself, hopefully to bring out various user characteristic appearing in the IBM material, while permitting the user to reveiw the original wording, so as to evaluate the points made for himself.

Numbers are used to connect the points within the commentary to the points within the material. Comments always appear opposite the page to which they apply.

This is the first time that this material, or any equivalent, has been available to users, and the formats used may well not be the best. They are designed to be useful to users. Readers are invited to suggest alterations, either to the commentary itself, or to the format used to connect commentary with original material for use in forthcoming editions.

Alan Taylor, CDP, CDE
Framingham, Massachusetts
August, 1973

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THAT PRICE/PERFORMANCE INCREASE

The analyst claims here to be giving a significant price/performance improvement for Model 25 and Model 30 users. But, while he cites performance improvement, he does not mention the price increases. Later, (page 17) we will find that the official price increase is 15%-29%, by comparison with IBM rental prices for the systems.

The genuine price jump - from the present day market price of Model 25's and 30's - is however considerably more. Assuming a rather high market price of about 65% of the IBM original price, the real 1973 jump appears to be around 80%.

Performance improvements should therefore be considered as having to balance the approximately 80% price increase just to stay even in the Price/Performance game.

The one area where the IBM analyst hits upon real potential performance advantages is in his discussion in the fourth paragraph of the increased functions owing to adding new input/output, and being able to move into applications such as graphics, teleprocessing, time-sharing, sensor-based and data-based operations.

The value of these is however related to the question as to whether the particular user wants these new functions, and to what extent he really needs that increased processing power.

I. DESCRIPTION

The System/370 Model 135 was the fourth processor to be announced as a replacement product for the highly successful System/360 line. Its worldwide announcement on March 8, 1971, signalled a significant price/performance improvement for Model 25 and Model 30 users as will be described in the following paragraphs.

Basically, the M135 provides a customer with a computer whose internal speed is nearly four times faster than an M30. In fact, in terms of speed and performance, the M135 is considered to be most similar to the M50.

Besides processing speed, the M135 offers M25 and M30 users increased capacity and function. Whereas the M25 and M30 were limited to 48K and 64K of memory, respectively, the M135 ranges from 96K to 240K with even larger memory capacities planned for the 1973-1974 time period. The memory, packed within the processor's frames, consists of "Phase 21" bi-polar devices which are faster than core storage as well as more reliable, easier to service and much more compact in terms of space requirements. These monolithic devices are built on silicon chips each less than 1/8" square with 128 storage cells and 46 supporting circuits.

Increased function has been designed into the M135 and its features, as well as into the many new I/O products that attach to it. Starting with the new instruction set, 14XX emulators, DOS and OS enhancements and continuing with two high speed selector channels, an integrated attachment of the 2319 file, an integrated communications Adapter, an integrated 1403 printer attachment and reloadable control storage, the M135 gives the user many ways to enlarge his DP applications in an economical manner. Additional improvements in throughput will occur when the M135 is configured with such advanced I/O devices as the already announced 3330 disk facility, the 3211 printer subsystem and the 3505/3525 card reader/punch. And lastly, by virtue of having more main storage, the M135 user will have the ability to execute more or larger jobs concurrently and to move more easily into applications such as graphics, teleprocessing, time-sharing, sensor-based and data-based operations.

Key to making the M135 function properly is the reloadable control store. The instruction set and features which are in microcode are preserved on magnetic disks and are read into the processor via the console file located in a corner of the control panel. Pre-written and customized for each configuration shipped, the microcode disk also contains a set of microdiagnostics which verifies that the system is operating correctly. Having been read into the CPU, the microcode is stored in Phase 21 memory designated "control storage." 24K bytes come standard with each M135, with two 12K increments available when certain optional features and emulators are selected. The amount of control storage utilized on any given CPU has no effect on the memory available for main storage.

FIELD ENGINEERING COSTS

The description in the third and fourth paragraphs about the new Field Engineering tools provided for diagnosing problems on the 135, is very reminiscent of some almost identical descriptions given in 1964 about the capability of the retry circuitry that was to be in the 360's. However, while there is some strong advantage in maintaining a low cost diagnostic for systems, isn't it a pity that some of this is not passed on to the user?

A review of the purchase price and maintenance prices indicates that the cost of maintenance - or rather the charges for maintenance in 1973 for the Model 135- are substantially above those for the Model 30 or Model 25.

THE "HOLD-BACK" STRATEGY

The area about new features is interesting in that it does confirm that IBM holds information back from its users for "strategic" purposes.

This fact has been no real secret. Indeed it has often been used as an IBM selling point. The argument has been raised that unless you go to the latest IBM machine, you will be missing out on the new features which will be produced later.

Perhaps the most important fact about placing this IBM Model 135 Greybook into the public domain has been that, for the first time, people considering the 135 are able to see ahead just what the planned "goodies" are, and so be able to make a reasonable judgement as to whether or not they are worth jumping their market prices by 80% over the 1973 marketplace.

We will, therefore, be watching considerably for the planned later developments of the 135 as mentioned in these documents. We don't have long to wait - as they are listed on the next page.

A prerequisite feature for each M135 is the 3046 Motor Generator Set. Packaged in a separate box because there was no space available for it in the CPU, the MG set very accurately regulates the incoming power flow to the required frequency need by the sensitive CPU logic and memory.

In parallel with the other S/370 systems, the M135 was designed with RAS (Reliability, Availability, and Serviceability) in mind. Besides the more reliable monolithic circuitry, microdiagnostics and MG set already mentioned, downtime is reduced by 1) automatic retry procedures for failing operations instructions; 2) ECC (Error Checking and Correction) hardware to automatically correct all single-bit errors and detect multiple-bit errors in memory; and 3) retry procedures for failing channels and control units.

In addition to these internal RAS features, new FE tools have been provided. For instance, RETAIN/370 enables the on-site FE to describe the symptoms of either hardware or software problems to a remote technical support center. Fed through a communications network, these symptoms often lead to quick problem identification and repair suggestions.

The organizational structure responsible for the M135 deserves mention because of its geographic dispersal. The following locations have involvement with this system:

- Endicott has the SDD Systems Manager, marketing and business planners and Group Staff Pricing.
- Hursley, England has the engineering mission.
- Kingston has the SDD cost estimating functions and domestic manufacturing responsibility.

II. FOLLOW-ON PLANS

The March, 1971 announcement of the M135 did not include many key elements of the total system package. These follow-on items were left for later announcements either for strategic purposes or lack of currently available resources.

Several enhancements were dependent on other divisions and SDD locations. Most prominent of these was CD where the development of FET-CP was going on. Intended as a four times denser memory technology than Phase 21, FET-CP, when housed in the M135, would offer two distinct advantages:

1. Its density would enable considerably more than 240K of memory to fit under the covers of the CPU. Expanded memory in Phase 21, on the other hand, would have to be placed in a separate main storage frame.

HAIL & FAREWELL PLANNING

The items that are planned to improve the Model 135 performance in its lifetime are indicated in the table opposite. The two dates - Announcement and First Customer Systems - indicate the planned datings for the enhancement of the system, and also in the sentence immediately under the table, indicate the timing of the successor system to the 135.

Model 30 or 25 users now contemplating the 135 can see that there are a few additional features planned that have not already been announced in 1973 (although some of the dates were not, in fact, kept) and that in fact

- the consideration of virtual memory
- of a scientific accelerator - if the user needs an accelerator for their scientific work
- the capability of putting a real-time channel with a priority interrupt

are the hardware functions which IBM is relying on to encourage users to migrate from the Models 25 and 30 to the Model 135.

These then are the real performance items (together with the 4-times faster processing) that have to be considered when thinking of the 80% over market that a 1973 decision to migrate from the Model 30 to the 135 involves.

RENT VS. PURCHASE

Another interesting item here, based on the dating of the successor systems, is that it permits a user to consider (if it decides to go to a 135) as to whether to rent or buy it. As each user varies in its own philosophies as to whether or not it takes systems that are already proved out, or instead takes the latest available system, each firm will have to consider when it would really be likely to move to the successor system, the FS-O, and then make its decision.

PLANNING ON SOFTWARE OBSOLETE

The comments about the compatibility of the 135 with DOS and OS, while in general correct, do not present a real picture of the current users of the Model 30. Model 30's have been running the full operating systems since January, 1973 and extended functions, over and above the IBM provided ones on their DOS systems for over a year.

2. Its low cost would provide a $30M-$40M cost savings to the M135 if all new builds after 12/73 used it instead of Phase 21.

While it was definitely planned to increase the M135's maximum memory from 240K to 496K, it was questionable whether a crossover to FET-CP could be accomplished. Dependencies were the timing and quantity of FET-CP availability, other users' demands for it, and its eventual cost projections.

Because of these uncertainties, it was assumed for pricing purposes that Phase 21 would be used in all M135 new builds. While this was the more conservative approach it was also the only one to which all divisions would make commitments at announcement time.

The complete follow-on plan for the M135 was assumed to be as follows:

Description	Ann.	FCS
1403 Native Attachment	6/71	5/72
Model 20 Emulator (DOS)	9/71	6/72
Relocate	9/71	6/72
3210-2 Attachment	6/72	6/73
368K and 496K of Memory	12/72	12/73
Winchester Native Attachment	12/72	12/73
Scientific Accelerator	12/72	12/73
Real Time Channel/Priority Interrupt	12/72	12/73

The successor system to the M135, designated FS-O, was assumed to have a 12/76 announcement and 12/77 first customer shipment.

III. SOFTWARE

To the customer one of the most attractive features of the M135 will be its programming compatibility with DOS and OS. These two operating systems have been improved and updated for the latest trends in data processing, such as:

- increased multiprogramming activity
- increased use of high-level languages
- more intricate teleprocessing applications
- larger on-line data base systems
- increased use of emulators

They have also been made current for recently announced I/O products such as the 3330/3830, 2319, 3803/3420, 3211/3811, and the 3505/3525.

FORCED-CONVERSION FOILED

The information that IBM was proposing to obsolete the DOS operating system but decided against it just before the announcement of the 135 is not surprising. There was, of course, a fair amount of comment and rumor on this matter at the time, but the solid fact remains that DOS, rather like Cobol, is now a very well-entrenched system, with many hundreds of millions of dollars invested into DOS programs. Traditionally, IBM has attempted to use its marketing of hardware to force conversions and to effectively destroy users' investments in programming. There have been a number of such unsuccessful attempts during the past fifteen years - the 1960 attempt to prevent any IBM user having Cobol, the 1964 and 1967 attempts to displace both Cobol and Fortran with PL/1. In fact the only case where IBM has been successful in forcing the abandonment of large programming investments was in the conversion to the system 360. Here the investment in machine language programs on the 7000 and 1400 series was effectively destroyed. Trying to obsolete DOS while attractive to the planners, was not being very realistic!

VIRTUAL MEMORY CLEARLY KEY

We also get a definition of the role of virtual storage. As IBM says "The major enhancement to be made... is the virtual memory or relocate feature."

In the internal IBM documents, as opposed to the published ones, relocate is used much more than the phrase virtual memory and in order to prevent confusion we will try to use it in this analysis.

The analyst brings out certain claims for virtual memory, that, for instance, it provides for better utilization of main storage, improved programmer productivity, under certain circumstances, and improved teleprocessing capability. Noticeably no definition or study of these is included nor is it defined as to what the claims of improvement were made by comparison to.

THE MISSION OF THE M135

The final point on this page is the definition as to what exactly the M135 is. Its mission, says the IBM analyst, was "to migrate M25's and M30's."

In fact it would appear that in IBM's eyes the mission of the M135 was to stop the use of these two very valuable and still operational systems. Similarly it can be assumed that the mission of the successor system - the FS-O to be announced in 1977 - is to stop the use of the M135. It seems a pity that users are being asked to spend millions of dollars for a system which is being designed for obsolescence.

Since most of the users in the M25 and M30 marketplace run with DOS today, it is logical to assume that the M135 will initially be a DOS system also. However, as customers grow into larger memories and more sophisticated applications, conversions to OS will become more numerous. The ability to emulate DOS in OS should reduce the effort and expense involved in converting.

In the months preceding the M135 announcement, a new programming strategy was developed which would significantly enhance DOS itself as well as provide upward compatibility to OS. Thus, while the conversion from "DOSE" to OS or AOS should be easier to achieve, it may not be as necessary, i.e., the customer can continue to grow in DOSE well beyond the upper limits of performance existing in the current DOS package. The following SCP usage forecast reflects the heavy dependence on DOSE, even as the average memory size of the M135, including PCM memory, grows beyond 200K by the mid-seventies.

	1972	1973	1974	1975	1976
DOS %	96	20	0	0	0
DOSE %	0	77	94	90	87
OS/MFT %	0	1	2	2	1
AOS 1%	0	2	4	8	12
OTHER	4	0	0	0	0

Functionally, the major enhancement to be made to DOS and OS is the virtual memory or relocate feature. Assumed for 4th Q/'71 announcement and 2nd Q/'72 shipment, relocate would allow the user to dynamically expand his real memory to a "virtual" 16 million bytes. Planned as a standard feature with the hardware included in the price of the CPU, virtual memory would have the following advantages:

- Better utilization of main storage.
- Improved programmer productivity once real memory limitations become secondary.
- Improved teleprocessing capability.

Other planned enhancements to both DOS and OS will concentrate on advanced applications, access methods, partitioning and user flexibility.

IV. MARKETING CONSIDERATIONS

Since the mission of the M135 was to migrate M25's and M30's, it was necessary to ascertain what these users were currently paying for their systems and how much of an increase in price would be represented by a M135 proposal.

1 PRINTER SYSTEMS

The situation of the comparative systems that IBM expects its Model 25 and Model 30 customers to go to is interesting in a number of ways. On the one hand, they are pointing out the improved price/performance of 5.5 times the internal speed in one case, 2 or 3 times memory, etc., etc. Realistically, however, the power of a system, so far as throughput is concerned, is measured by its output capability. In none of the configurations shown here or on the next page does the IBM analyst expect to use more than an 1100 line per minute printer. In fact, the same 1100 line per minute printer is shown all the way from the 48K M25 and the 144K M135.

From the point of a user, this indicates that the system he has, if not limited by its printer in some substantial way, is potentially capable of being used to produce the same volume of output as the M135 planned for him.

THE BASIS OF M135 DECISIONS

Making a decision then between the current market systems and the M135 involves two major factors: 1. What is the impact of virtual memory? 2. What is the amount by which the lack of central processing power or some other defined facilities is preventing the printer being able to be kept in operation, or application from being used?

Again, remembering the 80% or more over Model 30 market price, it is clear that a substantial (and certainly an identifiable) group of items will be needed to justify the M135 decision.

A typical M25 configuration might consist of the following:

32K M25	$3.9K Monthly Rental
2415-1 2-15KB	.8
2311-1(3) 22MB	1.7
2540 1000R-300P	.7
1403-2 600 LPM	.8
TOTAL	$7.8 K

However, a larger M25 that would be more inclined to move up to a M135, might look like this:

48K M25	$4.7K Monthly Rental
2415-4 2-30KB	.9
2311-1(3) 22MB	1.7
2540 1000R-300P	.7
1403N1 1100 LPM	1.0
TOTAL	$9.0K

It was expected that a M135 such as the following would be bid to these customers:

96K M135	$7.0K Monthly Rental
Winterpark 4-40KB	1.5
2319 87MB	1.0
2540 1000R-300P	.7
1403N1 1100 LPM	1.0
TOTAL	$11.2K

In this comparison, the customer would be getting a CPU with approximately 5.5 times the internal speed of his M25, two to three times as much memory and substantial increases in speed and capacity on his tapes and files for a 24%-43% increase in price. While migration patterns being experienced by the previously announced S/370's indicates that customers will jump this much in price, less expensive systems than the one outlined above could be configured and bid to M25 customers.

In addressing the M30 base, two configurations were studied:

32K M30		
32K M30		$5.4K
2401-1	2-30KB	.7
2311-1	22MB	1.7
2540	1000R-300P	.7
1403-2	600 LPM	.8
TOTAL		$9.2K

64K M30		
64K M30		$6.7K
2401-2	4-60KB	1.9
2311-1	29MB	2.3
2540	1000R-300P	.7
1403N1	1100 LPM	1.0
TOTAL		$12.6K

PRICE CONSCIOUS CUSTOMERS EXPECTED TO BE RESISTANT!

The IBM selling ploy of the 135, although said to be based originally upon better price/performance, is shown in the paragraph opposite as not genuinely being based on price. Indeed, the comment is that a customer will be "not be difficult to sell unless the customer is strictly price conscious and has no requirements for throughput improvement.

How many customers exist who are not strictly price conscious is of course not known. Few installations would like to feel that they themselves are not strictly price conscious. The reliance then is upon the requirement for throughput improvement.

THE LEASING COMPANIES

Later on we will notice that no consideration of leasing companies as part of the competition is taken into account. Noticeably the analysts don't make any comments about user advantage here, merely talking about "leasing company game." The lack of detailed analysis of the competition offered by leasing companies is particularly noticeable here in view of the very detailed financial comparison of the leasing company structures that are a large part of the IBM Management Review Committee meetings (now in the public domain).

When proposing M135's as replacements for M30's, the configured M135 should reflect the obvious differences in customer sophistication implied in the two samples above. Thus, the M135 systems bid might consist of the following:

96K M135		
96K M135		$7.0K
Winterpark	4-40KB	1.5
2319	87MB	1.0
3505/3525	1200R-300P	1.4
1403N1	1100 LPM	1.0
TOTAL		$11.9

144K M135		
144K M135		$7.9K
3420	5-120KB	2.2
2319	174MB	2.0
3505/3525	1200R-300P	1.4
1403N1	1100 LPM	1.0
TOTAL		$14.5

In these cases, the customer obtains nearly a fourfold increase in internal speed, twice the memory he has today and more advanced peripheral equipment for a monthly price increase of 15% - 29%. Such increases should not be difficult to sell unless the customer is strictly price conscious and has no requirements for throughput improvements.

The M135 marketing objective is to migrate as many of our leased M25 and M30 installations as possible during 1972 and 1973 and then encourage them to enlarge their S/370 in the mid-seventies by adding new applications, such as communications, and more memory.

Some migrations to the M135 were also anticipated from M20i and M40 users. From the former, this would represent a very large increase in price, while for the latter only a minimal price change would result. It was more logical to assume that the T55 would pick up most of the 20I's and the M145 would meet the higher performance needs of the M40 customer set.

The leasing company migrations would be from M30's and 40's. Judgements on how much M135 business they would generate depended on projections of LC discount practices, the availabiaity of new capital, and S/360 horsepower improvements using PCM products. By discounting the sample M30 configurations, the price jumps necessary to move up to a M135 become greater. This is the leasing company game, for it tends to keep their machines installed until paid for or obsolescence occurs. However, by the very size of their inventory (1700 M30's and 600 M40's), it would be reasonable to expect considerable interaction with the M135.

Acceptances from purchase S/360 customers and new business should add balance to the inventory over time. The first group will probably buy early to maximize their investment while the latter will be sold when new applications such as sensor-base are available.

MORE PERFORMANCE--IF MORE WORK

The price/performance calculations of the IBM analyst at the bottom of the page show a clear picture of where IBM believes the 135 falls. It looks as though they believe that with a throughput index of 2.1 times a normal Model 30 - that is, a Model 30 such as was described on the previous page with 154K of core - the 135 can provide a price/performance of nearly twice the quality of the Model 30.

This anticipates that the user has doubled the load of work. Obviously if he only has 50% additional work, then his price/performance, instead of being about 1.9, will be somewhere around 1.4. If he is able to get his work on the Model 30 as it is, then the price/performance of the 135 even by comparison to the IBM 360 Model 30 will be unfavorable being below 1.

A more realistic analysis would have taken into account the competition from the market. But IBM planners are consistently refusing to consider the open market throughout the book!

V. COMPETITION

At the time of its announcement, the M135 was viewed as being superior in price and performance to all competitors in the Model 30 segment of the market. Although concern was expressed early in the Phase III cycle about expected systems announcements from RCA, Honeywell and Burroughs, by March, 1971, enough information was available to reach the following conclusions:

1. Most of the anticipated competitive announcements did not turn out to be as dramatic as expected; some even resembled repricing of old equipment.

2. The RCA-2 came the closest to the M135 in performance comparison. However, it was not as price competitive as had been expected.

3. The NCR-200 bettered the M135 in price at the low end but could not match it in performance, especially when Winchester became available. IBM would have to rely on the T55 to more effectively compete with the NCR-200 on price.

4. It appeared that many competitors were focusing on protecting and growing their own inventory bases and were not prepared in the near term to get around the M135 in pursuit of IBM's lease base.

The following schedule represents a price/performance comparison of the machines competing in the M30 market. Using the M30 as the base, indeces were developed on internal speed, throughput and price/performance. The higher the numbers alongside a machine, the better its competitive rating.

COMPETITIVE EQUIPMENT

	Int. Perf. X M50	Throughput Index	P/P Index
M30	.2	1.0	1.0
Honeywell 1015	.2	1.2	1.0
Honeywell 2015	.5	1.6	1.3
Sperry Rand 9400	.4	1.7	1.4
NCR 200	.4	1.2	1.3
RCA 2	.7	2.0	1.6
Burroughs 3500	.3	1.4	1.2
M135	1.0	2.1	1.9

The situation of the rest of the IBM Greybook, so far as it contains relevent points for user consideration, consists of a number of charts, and then a description of some of the IBM problems. Readers are reminded that these charts were not prepared from the idea of doing other than giving IBM management the best available view of how the system would work in the marketplace that IBM expected in the years ahead. It should however be noticed that this study was said by the IBM analysts to be the most detailed study that any of IBM's new products had been given prior to announcement. The price averages for the various systems during the years to come, the use of current and new input/output operations, can still be thought of then as providing users with valuable guides as to what is likely, but not certain, to happen to their considerations in the years ahead.

BUDGETARY USE OF DATA

Certainly from the point of view of conservative financing of the installation, and providing for budgetary support for the corporate data processing function, the information included in the charts is as valuable as it is unprecedented. How accurate the forecasts will be is something that only time alone can tell, but the fact of the forecast and their source is data which, now that it is in the public record, can not be ignored by a conscientious data processing department considering a Model 135 decision.

Although the RCA 2 comes closest today to matching the M135's capabilities, it would not be surprising if in the long run Honeywell became the most effective competitor. This judgement is based on their merger with GE, their large inventory base, strong marketing force, long-term lease plan and bundled services. Announcement of a high performance system a few years hence would make them a very strong competitor indeed.

VI. FORECAST RESULTS

The following charts summarize the M135 announcement level forecast. These charts are intended to help the reader understand the following:

- the relationship of this system to its neighboring S/370 systems
- the magnitude and timing of the lease and purchase business
- the source of acceptances to the M135 from other processors
- the amount of IBM memory installed on the M135 over time
- the projected annual point value of the complete system, including the I/O functions
- the usage of charge-for features
- the mix of specific I/O boxes on the system

The charts shown on Page 21 are primarily interesting from the point of view of analysts studying the marketplace, and are not relevent to the interests of the normal user. They do indicate that for one reason or another the Model 135 is not regarded by IBM as being particularly attractive to the purchase customer and by comparing the average IBM memory size in the peak year (which is 1976 for the 135) with figures given later as to the expected total memory size. They also give an indication that IBM does expect the user to put outside memory on his system. Otherwise, however, no comments are necessary here. (Except again to notice that the obsoleting of the 135 will start - according to these plans - in just three years' time).

M135 ANNOUNCEMENT FORECAST

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Lease Accepts	607	1141	786	526	492	466	199				
Purchase Accepts	144	248	158	84	44	19					
TOTAL ACCEPTS	751	1389	944	610	536	485	199				
REMOVALS	0	29	157	325	442	489	861	679	535	434	266
Lease Inventory	607	1719	2348	2549	2599	2576	1914	1235	700	266	0
Purchase Inventory	144	392	550	634	678	697	697	697	697	697	697
TOTAL INVENTORY	751	2111	2898	3183	3277	3273	2611	1932	1397	963	697

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FORECAST SUMMARY OF M135 AND BOUNDARY SYSTEMS

	M145	M135	T55	T54
Total Accepts	3428	4914	5797	4999
Peak Inventory Quality	2268	3277	3880	3512
Peak Inventory Year	1976	1976	1977	1977
Purchase % of Peak Inventory	34	21	13	11
Avg. System Pts.- Peak Year	$29.8K	$18.0K	$9.8K	$4.9K
Avg. IBM Memory Size - Peak Year	334K	181K	112K	46K

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1973 -- MISSION COMPLETION DATE

The chart shows the expected sources of customers for the Model 135. The chart shows that the analyst expects to successfully migrate some 332 Model 30 users in the leasing company market, and some 441 users from the current IBM base, together with 299 Model 25 users entirely from the IBM base by the end of 1973.

At this stage (4 Quarter 1973) the mission of the Model 135 is therefore accomplished. It is noticed that this (1973) is also the time at which the planners ceased to plan for further enhancement to the system - thus making it possible to start planning for the obsolescence of the system by the 1977 announcement of the FS-O.

This gives more credence to the idea that only incidental enhancement - beyond the ones already known - should be counted on during the life of the IBM Model 135.

A point in regard to the competition mentioned earlier is that it assumes a steady price/performance. In the case of the market systems this is not a valid comparison. On the one hand, the additions and changes in enhancement are driving the performance up, while the market structure is bringing the price down annually. Thus the price/performance of a market 360/30 in 1973 is considerably above the same system in 1972 and in 1974 it will again increase.

M135 SOURCE OF ACCEPTS

	1972	1973	1974	1975	1976	1977	1978	TOTAL	%
NEW	82	472	419	310	207	156	69	1715	34.9
LC 30	123	209	156	70	38	12	0	608	12.4
LC 40	24	112	137	46	27	6	0	352	7.2
Sub-total	229	793	712	426	272	174	69	2675	54.5
Lease Base - 360									
1130	12	30	23	7				72	1.5
1800	0	6	17	24	18			65	1.3
20I	30	29	8					67	1.3
25	145	154	15					314	6.4
30	230	211	78					519	10.6
40	105	166	38					309	6.3
Sub-total	522	596	179	31	18			1346	27.4
T55	0	0	53	153	246	311	130	893	18.1
TOTAL	751	1389	944	610	536	485	199	4914	100.0

The M135 average system price table is of direct interest to users planning the future of their data processing. Here we see the best estimates of some of the top analysts (with more information than anyone else) as to how much the rental on the system will grow over the years.

M135 AVERAGE SYSTEM PRICE

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	1972	1973	1974	1975	1976	1977
CPU, Memory	$6082	$6451	$6639	$6750	$6795	$6898
Features	1640	1819	1943	1976	2050	2068
Sub-total	7722	8270	8582	8726	8845	8966
Tape	2243	2262	2316	2323	2325	2325
DASD	2248	2762	2906	3186	3568	3962
Printers	1832	1820	1883	1928	2001	1070
Card	906	1031	1050	1061	1065	1070
Communications	57	79	106	133	151	169
TOTAL	15008	16224	16843	17357	17957	18497

PERCENTAGE DISTRIBUTION OF INVENTORY BY MEMORY SIZE (AFTER PCM IMPACT)

Model	Memory Size	1972	1973	1974	1975	1976	1977
FE	96K	48.2%	30.3%	28.7%	27.6%	27.9%	27.4%
CD	144K	27.0	30.6	30.2	30.0	28.7	28.0
CF	192K	9.0	14.5	13.6	12.9	12.3	11.8
DH	240K	15.8	24.6	24.8	25.3	26.3	26.4
	368K			.9	1.4	1.8	2.5
	496K			1.8	2.8	3.0	3.9
Average Memory Size		140K	160K	169K	174K	176K	181K

SUMMARY OF FEATURE RATIOS (Percentage of Inventory)

	Rental	1972	1974	1977
Announced 3/71				
2319 IFA	$475	92.6%	90.3%	55.1%
Selector Channel 1	175	84.9	92.6	95.4
Selector Channel 2	150	13.8	29.9	50.9
3210-1 Attach.	100	38.7	41.6	39.1
3215 Attach.	170	61.3	58.4	60.9
Ext. Precision Fltg. Pt.	25	20.0	34.1	39.6
Direct Control	110	2.2	8.1	9.3
Communications ICA	400	25.5	30.0	36.8
Control Store Incr. 1	225	36.2	61.9	81.9
Control Store Incr. 2	225	20.0	31.0	38.0
Unannounced				
1403 IPA	400	88.0	88.8	90.4
Winchester IFA	275	0	12.7	39.0
Scientific Accelerator	500	0	22.9	38.8
3210-2 Attach.	100	0	9.2	6.4
Real Time Channel	200	0	2.0	5.0
Priority Interrupt	100	0	2.0	5.0

Again, a warning is perhaps appropriate here as to the function of providing the data to the users in the current form. These documents were not produced for users. Much of the material included in them is irrelevent to users' needs. However, there are certain facts - such as the lack of planned training for Field Engineers to support the hardware or the software of the 135 - which has a definite impact on a user's plans.

Unfortunately it is not practical to simply extract these details without giving a potentially misleading character to the data. Moreover, a user reading the full document will be able to judge their credibility for himself and only use the commentary to point out areas of potential interest. It is for these reasons that these now public documents are presented and should be considered by users of data processing equipment during the next decade.

With this warning again said there are a number of pieces of information in the forecast comments and risks section that a user should be aware of. A leasing company system is singled out - in a polite way - in the next to last paragraph. It would appear that most of the planned migrations from leasing company Model 30's and Model 25's have no strong price/performance analysis supporting the assumption that these users will in fact find a 135 giving better price/performance.

Moreover, the maintenance of a steady 135 price indicates that from a financial point of view the attractions of the 135 become less and less as the years roll on. Just why, under these considerations, the leasing companies were not considered as competition is not clear, but this does provide confirmation of the previous commentary that the price/performance of leasing company systems would appear even under the terms of this analysis to be directly comparable to, or perhaps superior to the price/performance of the Model 135 even when a user is able to use the additional throughput.

Certainly this indicates that where the doubling of the throughput (envisaged by the IBM planners) is not necessary, or where through other skills the doubling of throughput can be obtained without doubling the central processor power user, under our ways - the decision to go to a 135 in the place of a leasing company Model 30 would appear to be against financial recommendation.

VII. FORECAST COMMENTS AND RISKS

Perhaps no other product forecast in recent IBM experience was subjected to as many man-months of preparation, scrutiny, and review as was the case with the M135. Prior to announcement, price sensitivity received the most attention from SDD, DPD, Finance and Forecasting because of the influence it bore on the price-setting process. After prices were determined, however, and the announcement level forecast was published, attention shifted to achieving the quantities committed to management, quantities that were the foundation of the program's projected revenue.

If the marketing success of the M135 is such that it exceeds the forecast, the financial effects would be most welcome. In contrast, failure of such a large program to meet the forecast could have a dampening effect on IBM's growth and profitability objectives. The purpose of this section is to identify those parts of the forecast that contained risk in the hope that a continuing awareness of them might minimize their impact in the future.

Areas of potential risk were perceived to be:

1. Dependence on new business
2. Migrating Leasing Company M30's
3. M40 net down potential
4. T55 price level in relation to the M135
5. T55 memory price slope in relation to the M135
6. PCM penetration of memory and I/O
7. Adverse economic conditions

The high percentage of new business forecasted assumed an aggressive strategy in the advanced function and application areas. Relocate, sensor-base, terminal usage, etc., were all expected to create demand from customers whose old equipment could not perform these functions. If these strategies get delayed or otherwise deteriorate, customers may decide to bypass the M135 and make do with some functional enhancements to their existing installations.

The ability to migrate 608 Leasing Company M30's to the M135 would appear to be a very challenging objective if the LC's can successfully enhance their machines with additional memory and I/O capabilities, while offering large price discounts over time. The potential price/performance ratios derived from such a strategy would not only compare favorably to the M135 but would require a much more sizeable price jump by the customer to move a M135. For these reasons, Finance, in particular, felt the LC M30 sources were exposed by several hundred acceptances.

A third risk to the forecast would be the M40 customer's decision to migrate to a M135 rather than a M145. In so doing, he could get a S/370 machine with the equivalent internal speed of a M50 and more memory without any increase in his monthly rental.

The references to the price slope on the Memory indicate that the retail price - which is estimated to provide a 36% profit for IBM on a four-year life, while the plans indicate an anticipated 6-year life, is being determined more by the impact of the systems upon other members of the IBM family rather than by costs. This in turn indicates that any users offered outside memory at reduced costs do not have to assume that the quality of the memory is any less.

Clearly, IBM is aware that there are other cheaper technologies that can provide Memory for the Model 135, and that peripheral companies offering such memories will be technically able to do a reliable job.

The same risk applies to the M30 customer opting for the less expensive T55 than for a M135. In fact, the lower the T55 is priced, the more orders it is likely to take away from the M135. The risk here is not one of quantity to the IBM Company but of revenue producing points.

Another possible exposure to the M135 forecast is the price slope announced on the T55 memory. The M135 forecast assumed that both systems would charge $19.2K per megatype of storage, even though the T55 was planning to use FET-CP, a much cheaper technology to manufacture than Phase 21. Lower costs for FET-CP might, in fact, lead to a flattening of the T55 memory slope. For the memory conscious M25 or M30 customer, the T55 might then appear as a more attractive alternative than the M135. So, again, while quantity is not lost when looking across the X/370 line, the risk of getting less revenue from these units should be noted.

Memory sizes installed on the M135 are partially a function of projected PCM memory penetrations. While it was assumed that PCM impact could occur from the 96K model on up, Forecasting's understanding of this recent PCM phenomenon was still based on limited data, much judgement and wide confidence limits. As this part of the industry matures and starts to offer a larger supply of cheap monolithic memory to the marketplace, it is possible that the impact to IBM's memory would be greater than originally thought. Additional PCM penetration in the Tape and DASD areas, plus any that develops in the Printer and Card areas would also expose the M135's average system points.

The last risk perceived at announcement time related to the economic downturn of 1971. If the trends of consolidations, straight discontinuances, cancellations and supersedes did not ease up shortly, it would further shrink the S/360 base, delay installations of M135's and create more fallbacks to the T55 when it gets announced.

The forecast risks discussed above can be categorized in terms of units and/or points. Another type of risk - program life - could materialize if the FS dates are moved in from 12/76, 12/77 or if a strong competitive product suddenly appears on the scene. The adverse financial effects of such an exposure have been muted, however, by assuming for pricing purposes a program life of 48 months.

Most of the material here is irrelevent to the user except for the continued emphasis on the memory prices and the capability of these to fall.

VIII. PRICING CONSIDERATIONS

As discussed in the marketing section of this Greybook, the objectives of the M135 were to provide a growth system for the M25 and M30 customer set and to provide IBM with a strong, competitive price/performer for the next several years. Pricing the M135 too high would risk losing M25's and M30's to either the T55 or competition. Pricing it too low would not generate a high enough yield in terms of incremental rental business to sustain historical growth, nor would it leave enough room to properly price the T55 and T54 machines beneath it.

Within this framework, the financial objectives were to maximize profitability across the IBM line as well as to structure a financial posture for the M135 that best balanced return and risk.

While no one case evaluated clearly surpassed all of the others in satisfying the objectives just mentioned, a few trends did emerge:

1. The higher the prices, the higher the profit dollars and per cents obtained on the CPU's (excluding features).

2. The higher the prices, the less the reliance placed on memory and I/O where PCM exposure was strongest.

3. The higher the prices, the greater the reliance placed on the T55 and T54.

As background to understanding the first trend, it should be noted that the memory prices were pre-determined by the slope of the already-announced M145 ($19.2K per megabyte). Since the M135 shared Phase 21 technology with the M145, it was felt that different prices could not be cost justified. For the sake of consistency, it was assumed that the T55 and T54 memory slopes, for the time being, should also be priced at $19.2K, even though they utilized FET-CP storage.

Hindsight indicates that alternative memory prices might have been considered because:

1. The M135 memory was much more profitable than the M145's(36% vs. 26%) which had to absorb most of the Phase 21 learning costs, while the M135, coming a year later, got a "free ride."

2. The relatively low cost of FET, as mentioned previously, might shift the T55/T54 memory prices downward from $19.2K and thereby alter the acceptance patterns projected for the M135.

The situation of the Memory and I/O from outside manufacturers has, according to the analysis shown on Page 17, second paragraph, become the more "risky and vulnerable part of the system." From the point of view of the user who is only concerned with obtaining the best available equipment it would indicate that in IBM's best judgement much of the equipment outside the IBM framework is suitable for the M135, and may have serious user advantages. Under these circumstances, it would indicate that the type of evaluation which simply selects one main frame and then proceeds to obtain all the peripherals from the same supplier, is not either a necessary or an economically sound assumption, even though in any one particular case this may be the best final decision. In short, evaluations should never be limited to the simple IBM offerings.

Since memory prices were fixed, however, only the price of the bare CPU could be varied. Not surprisingly, the more price put on the CPU, the better its financial return. Since the basic CPU remains IBM's forte, its profitability was emphasized and a high price was encouraged.

The more risky and vulnerable parts of the system, due to PCM, were the memory and the I/O. Since their contribution to overall profit was most directly related to CPU quantity, a higher CPU price would result in less quantity and thus less memory and I/O dependency. The tradeoff then was whether to put price into the CPU to achieve profit from it instead of from large quantities of memory and I/O obtained with a low price (and profit) on the CPU.

While Finance favored the higher CPU price, lower quantity rationale, the MRC had a third way of looking at the problem. They felt that raising the M135's minimum entry model from 72K to 96K of memory made strategic sense without losing the company many orders -- either the customer needed 96K to run his applications, diagnostics, etc., or he would accept a T55 instead. To make the 96K model easier to afford and ensure a minimum loss of acceptances, the MRC decided to lower the price level of the CPU by $300.

The effect of this decision countered one of the M135's financial objectives for it yielded a CPU profit of only 18%, whereas memory profitability stood at 36%. This imbalance was reduced somewhat when, five months after announcement, an 8% increase on the CPU ($420) was released.

A third consideration in pricing the M135 was its relationship to the T55. The pattern that emerged from the cases evaluated indicated that as prices went up, the T55 took quantity away from the M135. While this waterfall effect bolstered the T55's profitability, it also meant that some of IBM's revenue and profit flows would be deferred from May, 1972, (FCS for the M135) until 12/72 or later (FCS for the T55).

The final major factor in determining prices for the M135 was the WTC contribution to the program. Their forecast indicated a less sophisticated, less growth-oriented marketplace than domestic's, compounded by more price sensitivity than the U.S. Forecasts revealed. Consequently, the WTC financial organization could not recommend prices as high as the ones domestic pricing favored. Since the final prices turned out to be even less than WTC's recommended level, the M135 should be a strong price/performer internationally as well as domestically.

A summary of the WTC P&L at Pricing Life follows:

	Revenue	Profit	%
M135 CPU, Mem., Feat.	$1298M	$395M	30.4
I/O	1064	310	29.1
TOTAL	$2362	$705M	29.9

A cost breakdown of the Pricing Life P&L for the M135 CPU and memory gives the reader a fairly good idea of what the major cost areas are and where the key profit levers reside.

	Dollars	% of Revenue
Manufacturing	$222 M	18.5%
Reconditioning	5	.5
Engineering	14	1.1
CE	87	7.2
Scrap & Rework	4	.3
Other Direct	8	.7
Apportionments	465	38.7
Profit Contingency	65	5.4

MANUFACTURING

Although manufacturing is easily the largest single area of directly estimated expense in the M135 program, responsibility for approximately 75% of this cost rests with CD and not SMD. The memory technology, Phase 21, absorbs about 50% of each new build cost, while the MST-2 logic cost accounts for another 25%. Both technologies are cost sensitive to quantity variations and yield percentages. The performances of East Fishkill, Burlington, and Endicott CPM are, therefore, as vital to the financial success of the M135 as the effectiveness of Kingston in providing the power and the assembly and test functions.

To improve the profit margin of the CPU and Memory P&L by one percentage point would require an immediate cost reduction of about $2500 per unit. Improving the margin by one point after new shipments had already begun becomes progressively more difficult to accomplish since the per unit savings on the remaining builds would have to increasingly exceed $2500.

Perhaps conversion to a denser memory technology, such as FET, would generate enough savings to enhance the profitability of the M135 by a few percentage points. However, the timing of its introduction, any offsetting costs (re-engineering, scrapping of Phase 21, inventory management problems,

Perhaps the most important part of this area is the reference made to the Field Engineering effort. It should be noted that the $1 is only being compared with the cost of building a 135, not the cost incurred by a user. The total cost of Field Engineering as planned in the analysis is only 7.2% of the rental of the CPU and of Memory.

The concept of providing for no new hires and no back-fill training for the life of the M135 cannot be other than a major worry to users of the system. In spring, 1973, the breaking of the Equity Fund scandal has put major new requirements upon software and hardware reliability on many users, and more and more will be impacted as the auditing profession begins to understand what is needed in providing reliable hardware and software. This is particularly unfortunate in view of the high maintenance prices being charged by IBM for maintaining the M135 and its colleagues. Serious consideration should be given to the services of independent system engineers who are capable of maintaining 135's or other systems. These now have offices in most parts of the country, and do not appear to be under the economic constraints that will be governing the IBM force according to this plan.

etc.) and its potentially lower rental price make it impossible at this time to measure the net effect on the bottom line.

The conclusion to be reached is that if product cost is to be successfully used as a profit enhancement level, (1) the engineers will have to redesign cost out of the CPU without trading it for Scrap and Rework dollars; and (2) the participating plants, especially CD, will have to perform better than expected over an extended period of time.

FIELD ENGINEERING

For every $2.50 spent to build an M135, $1.00 will be expended over 48 months to maintain it in the field. The cost of this Field Engineering effort can be sub-divided into five elements. Shown as per cents of CPU and memory revenue, they break down as follows:

Hardware Labor	1.5%
Software Labor	3.4
Installation & Removal	1.0
Training	.7
Parts	.6
TOTAL	7.2

While FE is a direct cost area traditionally appropriate for cost reduction programs, the consensus of opinion at announcement time was that the M135's maintenance projections could, in fact, be overly optimistic, especially as regards software labor and training. The former was dependent on several new diagnostic and correction tools to be made available to the CE, while the latter assumed no new hires and no backfill training for the life of the M135. Additionally, the yet-to-be announced EDOS and relocate packages, as well as the new MST and Phase 21 componentry leave the cost estimate potentially exposed.

OTHER DIRECT COSTS

The impacts of Engineering, Scrap and Rework, Recon and Product Test on profitability appear to be slight compared to Manufacturing and Field Engineering. However, their importance should not be overlooked, inasmuch as they can have a direct and significant bearing on the far larger expenditures incurred in building new M135's and maintaining them thereafter. The fact that most of these other costs are shared by Hursley and Kingston, while the Systems Manager is located in Endicott, also bespeaks the need for continuous review and re-evaluation of these resources.

Again, notice the potential for improving price/performance in the 1970's technology through the use of cheaper memory.

X. FINANCIAL RISKS

Most of the risks identified prior to announcement were quantified and included in the Profit Contingency (5.4% of Revenue). These included:

1. Forecast Confidence - Consideration was given to the financial effects of a 25% reduction in quantity. The specific risks to the forecast were discussed in Section VII.

2. CD Costs - Phase 21 cost projections, known to be quite sensitive to volume changes, assumed high levels of production in addition to a gap of unidentified users. The contingency tried to cover the increase in costs resulting from lower volumes of Phase 21 as well as potential yield problems, re-missioning expenses and MST overruns.

3. FE Training & Software - As discussed in Section VIII, these items appeared understated. The contingency provided some cushioning for new hires and/or backfill training and for new software aids that prove less than 100% effective.

4. Scrap and Rework - Covered several redesigning projects that surfaced after the Phase III Estimate had been completed, as well as the possibility that the M135 might encounter some of the same unanticipated S&R problems experienced by the previously announced S/370's.

Other financial risks were thought to exist for the M135 but lack of information made their quantification very difficult. For instance, PCM penetration of IBM memory and I/O could always exceed the rates factored into the announcement level forecast; however, at the time there was very little to go on except personal judgment in assessing the future of the PCM phenomenon. Then, too, the pricing of the T55 could impact the M135 P&L by the level of its CPU price, the slope of its memory price and the amount of memory initially offered. As a last example of non-quantified risks, the trend toward higher apportionments and FE rates could be perpetuated as future revisions are made to the Strategic Plan.

XI. SUMMARY

From all indications, the M135 should prove to be a marketing and financial success for IBM. It is aimed at the midsection of the market where IBM has a very large base and where considerable growth in computer power and applications is expected. Those customers that need or desire more function, will find that the M135 can provide plenty of it without imposing that much

of a price increase over their present equipment. Enthusiastic reports from the sales force and the very high order rate following announcement were viewed as confirmation that a good price/performer was indeed being offered to the M25 and M30 marketplace.

Financially, the M135 should also perform well. On a worldwide systems basis, it was expected to generate $5.5 billion of revenue over its Pricing Life and earn $1.6 billion in pre-tax profits. The program has the potential of earning considerably more for the Corporation if its life can be extended beyond 48 months per build. The likelihood of this occurring is good based on the Forecast's life per build of 70 months. The salutary effects of the Forecast Life P&L's can be observed in the following section of this Grey-book.

The greatest obstacle to the M135's financial performance also rests with the Forecast. Just as a longer life certainly helps the P&L, the quantity and point risks associated with the Forecast can definitely detract from its profitability. Capturing a high degree of new business, migrating leasing company M30 machines, avoiding excessive T55 supersedes, and meeting the PCM memory and I/O problem all entail considerable risk. The realization of these risks could have a dramatically adverse effect on the P&L and could easily offset the benefits of a longer life.

In the cost area, the CD factor, while offering the best opportunity for profit enhancement, is also the most risk-prone. In this sense, it shares the duplicity of the Forecast. Better yields and other efficiencies which might lower cost could be offset by reduced quantities, re-missioning, etc., which would tend to raise cost.

Also key to the M135's ability to meet its financial commitments is the matter of follow-on announcements. These "kickers", which have been included in the P&L's shown to Management, will enlarge main storage to a maximum of 496K, permit attachments of new I/O boxes such as Winchester and provide new applications such as sensor-base.

If the indicators at announcement time pointed to success for the M135, the reader should also be left with the impression that it will only come to pass through deft manipulation and control over an extremely complex internal environment as well as a carefully planned strategy to cope with an extremely dynamic external environment.

THE IBM 370 PAPERS

1971-1980

IBM's internal "Grey Book" reports to top management,
as revealed in Federal Court,
with companion commentary by Alan Taylor, CDP, CDE

Volume II, System 370/145

Published by Alan Taylor & Associates
633 Central Street
Framingham, Massachusetts 01701

INTRODUCTION

The documents reproduced here are the IBM Grey Books. These describe the product cycle of the 370s, as planned in IBM management operations during the past few years. Some changes will have taken place in the past few months since these were updated, but comparatively few judging by the 1972 Management Committee Reports.

Under normal circumstances, computer users would not see these documents, and indeed most IBM sales employees, although they are the authorized contact between the corporation and the user, will not have seen them either. Owing to the various legal cases now proceeding, however, this data has become part of the public record, and are now available to users and salesmen alike.

In this User Edition of the IBM Grey Books, the parts that are of most interest to users have been highlighted. It was not written for users -- and so some care in reading can be expected. But the reality behind the data -- to use IBM's famous advertising slogan -- needs to be known by users. The books are, however, intended for non-technical people -- and particularly for financial review by management. No great knowledge of computer technology is required, and they should be reviewed by user financial management separately from user hardware, software and operational areas.

The material appearing on the right-hand side is taken straight from the IBM Grey Books, as they have been placed in the public record by IBM Corporation. However, the emphasis in this area has been added to make the task of user review easier.

The material on the left-hand side is commentary added by myself, hopefully to bring out various user characteristic appearing in the IBM material, while permitting the user to reveiw the original wording, so as to evaluate the points made for himself.

Numbers are used to connect the points within the commentary to the points within the material. Comments always appear opposite the page to which they apply.

This is the first time that this material, or any equivalent, has been available to users, and the formats used may well not be the best. They are designed to be useful to users. Readers are invited to suggest alterations, either to the commentary itself, or to the format used to connect commentary with original material for use in forthcoming editions.

Alan Taylor, CDP, CDE
Framingham, Massachusetts
August, 1973

ABOUT THE COMMENTATOR

Alan Taylor, CDP, CDE, is an independent consultant in the computer field specializing in concept evaluation. He has worked on both hardware and software areas, and has been in the field since 1955. An early developer of English language compilers, and operating systems, his primary work since 1962 has been in the publications area. Here he is well-known as an evaluator and critic.

His first published critique of IBM 360 equipment was in April, 1964, when he reviewed the programming codes of the System 360 from the point of view of their usefulness as a working computer language. At the time he forecast that their complexity would involve the swift popularization of high level languages. In 1965 he reviewed the development of the IBM 360 Time-Sharing machine, the third and fourth memory modules; as well as the invalidities of the throughput calculations which were being used by IBM to claim that performance was 8 times that of the 7090. Subsequently the additional third and fourth memories were withdrawn by IBM and more conservative performance claims were substituted.

In 1968, taking the other side of the coin, he commented on the development of the CMS System for the same machine which made it a practical system. (CMS later became, in a modified form, the basis of the virtual storage on the IBM 370s).

In 1969 he covered the developments of the Cache Memory with the then 360/85. A prime point of Taylor's attention here was the claim made by IBM that the system had a speed of "up to 12 million instructions per second." Using IBM figures, Taylor calculated that a commercial user would be lucky to get one third of this.

Another 1972 investigation involved covering the IBM Field Maintenance area. IBM was proclaiming that their field engineers were not able to handle the maintenance of the add-on memories on System 360. During this incident, he arranged for his twelve-year-old daughter Alison to receive appropriate training. She was then photographed turning the switch which was all that was necessary to revert the system to IBM standards. Shortly after the publication of this photograph, IBM withdrew most of their objections to maintaining systems which have add-on memory installed - perhaps the biggest user advantage that has so far been obtained.

Currently Taylor is working on further publications involving the 370 peripherals and the 370 software. These are expected to be ready before the end of the year.

Taylor has been professionally active for some years, and was the first chairman of the Cobol Survey Group for the American National Standards Committee, the first editor of Computerworld, and the first president of the Society of Certified Data Processors. In 1973 he received an award for his work on the Computer Foundation Organizing Committee in helping to create the Institute for Certification of Computer Professionals. His basic belief that computers should be thoroughly described to users so that they are able to understand data processing risks as well as the opportunities is brought out in his weekly Computerworld column, "The Taylor Report."

He lives in Framingham, Massachusetts with his wife, Heather, and one daughter.

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FORCED GROWTH THROUGH MIGRATION

THE STATEMENT IN THE FIRST PARAGRAPH IS ONLY HALF THE TRUE STATEMENT. THE PARAGRAPH REASONABLY STATES THAT "IT WAS A GENERAL PURPOSE PROCESSOR INTENDED AS A GROWTH VEHICLE FOR SYSTEM 360, MODEL 40 AND LARGE MODEL 30 USERS." IN A LATER SUMMARY (PAGE 22) A SLIGHTLY DIFFERENT VERSION OF THE MISSION OF THE MODEL 145 IS GIVEN. THIS STATES "IT WAS INTENDED AS A VEHICLE FOR MIGRATING MODEL 40'S AND LARGE MODEL 30'S TO THE SYSTEM 370 LINE....."

THE DIFFERENCE BETWEEN THE TWO STATEMENTS IS SIGNIFICANT. WHERE A MODEL 40 USER HAS A NEED FOR A GROWTH SYSTEM - THAT IS TO SAY WHERE HIS REQUIREMENTS HAVE GONE BEYOND THE CAPABILITY OF THE MODEL 40, THE USER WOULD BE LOOKING FOR A POWER-EQUIVALENT SYSTEM TO THE MODEL 50. IN THIS ROLE THE MODEL 145 SHOULD BE DIRECTLY COMPARED WITH THE MODEL 50 FROM BOTH FACILITIES, COST, AND PERFORMANCE ATTRIBUTES.

IN THE OTHER ROLE, HOWEVER, - THAT OF MIGRATING MODEL 30 AND LARGE MODEL 40 USERS - WHICH APPEARS TO BE A CORPORATE OBJECTIVE OF IBM, A WHOLE CLASS OF PEOPLE OR INSTALLATIONS ARE BEING ASKED TO MOVE TO A LARGER SYSTEM THAN THEY NEED. THIS IS PARTICULARLY EVIDENT IN THE CASE OF THE 128K MODEL 40 USERS, OF WHOM 85% ARE ESTIMATED TO MOVE UP IF THE IBM OBJECTIVES ARE TO BE UPHELD. ARE 85% OF THESE USERS REALLY UNDERPOWERED?

IT BECOMES NECESSARY THEN TO DIFFERENTIATE BETWEEN THE ADVANTAGES OF THE MODEL 145 WHICH GENERALLY MAKE IT SUITABLE AS A GROWTH MACHINE, AND THE GIMMICKS WHICH CAN MAKE MODEL 40 AND LARGE 30 USERS DISSATISFIED WITH THEIR CURRENT SYSTEMS, AND PERSUADE THEM TO GO TO THE 145 DESPITE THE EXISTENCE OF OTHER MORE PRICE/PERFORMANCE EFFECTIVE FOR THEM.

USERS SHOULD THROUGHOUT THIS DISCUSSION BEAR THESE TWO CLASSES OF SITUATION IN MIND.

ADVANTAGES CLAIMED FOR THE 145

THE ONLY TWO ADVANTAGES SPECIFICALLY CLAIMED FOR THE 145 ARE AN INCREASED PERFORMANCE AND AN INCREASED CHANNEL CAPABILITY. NOTICEABLY WHILE A DISCUSSION OF THE PHASE 21 MEMORIES - THE WELL-PUBLICIZED MONOLITHIC TECHNOLOGY - DOES EXIST, NO CLAIM IS MADE THAT THESE ARE GOOD FROM A PRICE/PERFORMANCE VIEWPOINT. IN FACT AS WILL BE LATER NOTED, THE PHASE 21 TECHNOLOGY PUTS 1973-4-5-6 USERS OF THE 145 AT A PRICE DISADVANTAGE BY COMPARISON WITH OTHER AVAILABLE TECHNOLOGIES SUCH AS FET. AS 50% OF THE MANUFACTURING COST OF THE SYSTEMS IS ESTIMATED TO GO INTO THE MEMORY, THIS IS BY NO MEANS AN INSIGNIFICANT ITEM.

I. DESCRIPTION

The S/370 M145 was announced on September 23, 1970 as the third system in the S/370 line. It was a general purpose processor intended as a growth vehicle for S/360 Model 40 and large Model 30 users.

The M145 offers the Model 40 user three to five times the internal performance for a typical instruction mix. Transition can be easily accomplished because most current S/360 user programs, I/O devices and programming systems are compatible with the new M145. In addition the M145 is upward compatible with the previously announced Models 155 and 165.

The M145, in common with the Models 155 and 165, offers vastly expanded channel capabilities. Standard features are a byte multiplexor channel and one high-speed selector channel which can operate at a data rate of .82 megabytes. Three additional selector channels are optional features. Through the use of the channel word buffer feature the data rate on a selector channel can be expanded to 1.85 megabytes allowing attachment of very high-speed devices such as the 3330 and 2305 Model 2 direct access facilities. An optional feature on the selector channels is the block multiplexor mode of operation which can support interleaved, concurrent execution of multiple high-speed I/O operations. This results in greater systems data input and output and thus leads to expanded throughput.

The M145 is available in storage sizes ranging from 112K to 512K of main storage. Up to 256K is available under the processor frame. To expand to 384K or 512K the 3046 motor alternator and either the 3345 or 3346 main storage units must be added. The M145 is the first IBM system to use all monolithic technology storage. The phase 2I bi-polar devices feature storage speeds much faster than core storage as well as improved reliability, easier serviceability, and significant reductions in space requirements.

Reloadable, writable control store used to contain the microcode necessary for systems operation is also monolithic storage. 32K of control store is standard but expansion to 64K in 2K increments is possible. Control storage is loaded directly from a small read-only disk device located beneath the operator's console table. The console file is also used for loading and executing diagnostic routines and is an integral part of the reliability intrinsic in the M145.

Reliability, availability, and serviceability or RAS are items of particular stress in the S/370 line and the M145 is no exception. RAS is enhanced by the following features on the M145:

CAREFUL READING ALWAYS NEEDED

ONE OF THE PROBLEMS OF READING IBM DOCUMENTATION IS THAT IT MUST BE READ VERY CAREFULLY. FOR INSTANCE IN THE DISCUSSION ON THE INTEGRATED FILE ADAPTER FOR THE DISKS, A QUICK READING OF IT INDICATES THAT IT GIVES THE SAME SERVICE AS THE PREVIOUS CONTROLLER BUT AT LOWER COST. A MORE CAREFUL READING SHOWS THAT IT USES TWO RATHER THAN ONE SELECTOR CHANNEL POSITION. THIS OF COURSE MEANS THAT THE EVALUATION OF LESSER COST WITH REGARD TO THE NEW DISKS, AND THE PREVIOUS COMMENT OF MUCH SUPERIOR CHANNEL CAPABILITY, ALTHOUGH THEY CAN BE DOCUMENTED FROM PRICE LISTS, ENGINEERING SPECIFICATIONS, ETC. DO NOT NECESSARILY ADD UP TO COMPARABLE UTILITY. IN SHORT - THE USER IS IN THE SITUATION OF "BUYER BEWARE" WITH A VENGEANCE.

WORSE YET - IT CAN OFTEN BE FOUND THAT SOMEWHERE IN THE TECHNICAL DOCUMENTATION WILL BE A NICE LITTLE STATEMENT WHICH, IF THE MATTER IS RAISED LATER, CAN BE USED TO SHOW THAT IN FACT THE INFORMATION WAS AVAILABLE TO THE BUYER, AND THAT THEREFORE IF HE CARED TO MAKE A MISTAKE IN EVALUATION, THAT WAS SIMPLY HIS BAD LUCK.

a. More reliable monolithic memory and logic circuits

b. Recovery facilities to reduce systems downtime
   1. CPU retry of failing operations
   2. ECC validity check to correct single bit errors
   3. Channel and control unit retry operations

c. Expanded repair facilities
   1. On line test facilities for diagnosis of I/O device errors
   2. Microdiagnostics to isolate the malfunctioning unit for quick field replacement.

To aid conversion for the current S/360 user the M145 offers integrated relocatable 1401, 1410, 1440, 1460 and 7010 emulators. These emulators can be executed concurrently with S/370 programs in a multiprogramming mode and are available at no charge.

Another conversion aid is integrated DOS emulation under OS. This is the same DOS emulator provided for the Model 155 and allows the user to convert to OS much more smoothly than has previously been possible. This feature is also available at no charge.

Additional features available to the Model 145 user are:

1. The integrated File Adapter
2. Channel to Channel
3. Direct Control
4. 3210-1, 3210-2, 3215 Console attachment

The integrated file adapter is a native mode controller for either the new 2319 or the 2314-A type direct access storage facilities. Up to eight drives may be controlled via the IFA. The 2319, which was announced simultaneously with the M145, is functionally compatible with the 2314A series drives but at a much lower cost. The IFA performs the function of a selector channel and a control unit at a significant reduction in user cost and space requirements. Customers who order the IFA can have a maximum of two selector channels rather than the four available to non-IFA users.

The channel to channel and direct control features are the equivalent of the same features available on S/360. The channel to channel feature allows communications between two CPU's via their channels. The direct control feature transfers word at a time between an external device and main processor storage on a "per instruction" basis.

(5) THE REPLACEMENT OF THE 145

ALTHOUGH THE ACTUAL STATEMENT OCCURS ON THE NEXT PAGE (PAGE 4), READING THE FOLLOW-ON PLANS SHOULD START WITH THE FACT THAT FS-1 IS TARGETED FOR BEING ANNOUNCED IN 1976 AS A REPLACEMENT FOR THE 145. THIS DEFINITION OF THE LIFE OF THE SYSTEM IS NATURALLY IMPORTANT TO USERS DURING THE PERIOD 1973-1976.

(6) RELOCATE OR VIRTUAL MEMORY

THE LIST OF FOLLOW-UP POTENTIAL ANNOUNCEMENTS IS HEADED BY THE WORD "RELOCATE." MANY 145 USERS MAY NOT BE FAMILIAR WITH THIS TERM, KNOWING IT INSTEAD UNDER THE HEADING "VIRTUAL STORAGE."

IT IS INTERESTING NOTICING THAT IBM THEMSELVES USES THE MORE ACCURATE PHRASE "RELOCATE" WHICH BRINGS OUT SO MUCH MORE THE COST OF HAVING VIRTUAL STORAGE AS OPPOSED TO THE ADVANTAGE AIMED WORD "VIRTUAL."

USERS ARE THEREFORE WARNED NOT TO ATTEMPT TO EVALUATE VIRTUAL STORAGE WITHOUT CONSIDERING THE COST INVOLVED IN CONSTANT RELOCATION OF PARTS OF PROGRAMS.

IN PARTICULAR IT IS NOTED THAT AS THE AMOUNT OF RELOCATION INVOLVED IS A FUNCTION OF THE LOADING OF THE SYSTEM THERE IS REALLY NO HARDWARE METHOD OF SAYING THAT THE FULL ADVANTAGES CAN BE DESIGNATED BY A SUPPLIER, OR EVEN BY A USER AHEAD OF THE ACTUAL SITUATION OCCURRING. TO THAT EXTENT, THEN, THE EFFECTIVENESS OF VIRTUAL STORAGE, EVEN IF KNOWN, IN 1973 IS NOT A SOLID MEASUREMENT OF ITS EFFECTIVENSS IN, SAY, 1975.

NOTICEABLY IN THE DISCUSSION OF VIRTUAL MEMORY NONE OF THE PROBLEMS OF THE RESULTANT DEGRADED PROCESSOR PERFORMANCE ARE MENTIONED, ALTHOUGH PREVIOUSLY THE ADDITIONAL POWER OF THE 145 WAS BROUGHT UP AS AN ADVANTAGE.

(7) INCOMPLETE SPECIFICATIONS

PERSONS WHO ARE OFFERED THE MODEL 145 DURING ITS ORIGINAL SALES PERIOD WILL BE INTERESTED IN THE POINT THAT THE SYSTEM THEY WERE OFFERED INCLUDED COSTS FOR HARDWARE THAT THEY WERE NEITHER TOLD ABOUT NOR ABLE TO USE. THIS BRINGS OUT THE POINT THAT THE SPECIFICATIONS OF COMPUTER SYSTEMS ARE NOT CURRENTLY BEING REVEALED EVEN TO PURCHASES AND THAT THEREFORE THE INFORMATION UPON WHICH A BUY/RENT DECISION IS MADE MAY BE ONLY PART OF THE INFORMATION THAT IS NEEDED BY THE USER.

The console attachment features allow attachment of the three new consoles introduced with the S/370 line. These consoles are the 3201-1 - a 15 c.p.s. main console, the 3215 - a high-speed (85 c.p.s.) main console, and the 3210-2 - a 15 c.p.s. remote console which can also be used as backup to either of the two main consoles.

II. FOLLOW ON PLANS

At announcement time there were three substantial enhancements planned for the Model 145. These were as follows:

1. Relocate
2. Expanded Memory
3. Sensor Base

Relocate by allowing the user to dynamically page 2K byte segments of an application program from main storage to a direct access storage facility and back would expand real memory to a "virtual" 16 million bytes. It was anticipated that this virtual memory capability would provide the following advantages:

1. Better utilization of main storage
2. Improved programmer productivity
3. Improved teleprocessing capability

It was planned that virtual memory capability across the entire S/370 line would constitute one of the major advantages of S/370 over S/360.

The planned virtual memory capability consisted of two parts - hardware registers and software support. On the Model 145 the hardware was a standard part of the machine design. This fact was not announced in September of 1970 because of the unavailability of SCP support. The targeted dates for this SCP support were 9/71 Announce and 6/72 FCS.

The maximum memory capability announced on the 3145 was 512K of real storage. Since market planning projections had indicated that one of the major customer requirements for S/370 versus S/360 would be vastly expanded main storage requirements, it was clear that this would not long be an adequate maximum. Plans at the time of the M145 announcement called for 768K and 1024K byte memory sizes to be announced on the M145 on 12/73 with a FCS of 12/74.

One of the major shortcomings perceived in the S/360 line was the extremely limited sensor-base capability (2044 and 1800). It was felt that the market need existed for sensor base support across all the systems sizes in the S/370 line. On the M145 the sensor base capability plans called for two new features - a real time channel for high speed data transfer and priority interrupt for quick response to a sensor message. These features plus programming support were targeted for announcement on 6/72 with FCS 6/73.

As mentioned, the 3145 was the third processor announced in the new S/370 line. Plans at announcement time called for the introduction of three more processors.

Processor Name	Internal Speed x M50	Announce Memory Range	Ann	FCS
3155	3.5	256K-2048K	6/70	2/71
3145	1.9	112K-512K	9/70	8/71
C-86	.9	64K-192K	2/71	5/72
T-55	.5	24K-128K	12/71	12/72
T-54	.3	16K-64K	6/72	6/73

The successor system to the M145, designated FS-1, was targeted for announcement on 12/76 and FCS on 12/77.

(i) THE DISCUSSION OF THE PROPOSED DROPPING OF DOS, AND THE LATER REVOCATION OF THIS DECISION IS INTERESTING. (A MORE DETAILED REVIEW OF THE IBM SOFTWARE POSTURE IS INCLUDED IN THE IBM PRODUCT QUARTERLY REVIEWS. THESE ARE BEING PREPARED FOR SEPARATE PUBLICATION WITH COMMENTARY IN A FORTHCOMING REPORT "IBM EVALUATIONS OF IBM SOFTWARE - A COMMENTARY DOCUMENTATION.")

LEOS, REFERRED TO OPPOSITE, WAS TO HAVE BEEN THE LOW ENTRY OPERATING SYSTEM. THE CONCEPT HERE WAS TO BRING EVERYONE INTO THE USE OF THE FULL 370 OPERATING SYSTEM, INCLUDING A CONVERSION AS NECESSARY FROM DOS.

NO EXPLANATION OF THE REASON FOR THIS DECISION IS GIVEN, BUT IT MAY WELL REPRESENT THE SECOND MAJOR VICTORY OF IBM COMPUTER USERS AGAINST CORPORATE PLANNERS. (THE FIRST WAS THE 1967 REVOLT THAT SAVED COBOL.).

(ii) VIRTUAL STORAGE CALLED RELOCATION

THE IMPORTANCE PLACED ON VIRTUAL STORAGE - (OR, AS IT IS MORE ACCURATELY REFERRED TO IN THE IBM DOCUMENTS, -"RE-LOCATE" IS THAT IT WAS THE MAJOR PLANNED IMPROVEMENT FOR THE 145 OPERATING SYSTEMS.

USERS WILL FIND THIS OF INTEREST, INSOFAR AS ESTIMATING FUTURE PROBABLE IMPROVEMENTS IN IBM'S PROVISION OF OPERATING SYSTEM FACILITIES. THE POSSIBLE DEVELOPMENT OF MULTIPLE VIRTUAL MEMORIES IN A LATER ADVANCED OPERATING SYSTEM, STILL SEEMS TO BE THE MOST LIKELY IBM-PROVIDED IMPROVEMENT. TO WHAT EXTENT SUCH A PROVISION IS SUFFICIENTLY ADVANTAGEOUS TO OVERCOME THE ADDITIONAL DEGREDATIONS CAUSED BY THE OPERATING SYSTEMS SERVICING OF THE FACILITY IS NOT CLEAR.

(iii) THE USE OF AN IBM - EDOS EXTENDED DOS - SHOULD NOT BE CONFUSED WITH THE SIMILARLY NAMED EDOS SYSTEM, DEVELOPED INDEPENDENTLY, AND NOW AVAILABLE ON A COMMERCIAL BASIS. THE ANNOUNCEMENTS OF DOS IMPROVEMENTS, SINCE AUGUST, 1972, APPEAR TO BE A REFLECTION OF THIS THINKING.

SOFTWARE

IBM supported the 145 with two major operating systems - DOS/360 and OS/360 at announcement time. DOS was designed for the smaller systems with typical nucleus sizes of 10-14K. OS was designed to operate on the larger memory systems (128K and up) with typical nucleus sizes running 46K-80K. Chart A illustrates the major functions provided by DOS and OS. It should be noted that although both DOS and OS may provide support for the same basic function, the OS support is generally superior.

Chart B illustrates the programming languages supported by OS and DOS.

Until just prior to announcement the programming strategy called for the gradual phase-out of DOS/360 and the enhancement of OS. It was anticipated that DOS would be replaced by LEOS which would be functionally far superior to DOS and have the added advantage of upward compatibility to OS. This was the strategy implicit in the software service costs used in the announcement evaluations.

However, this strategy was reversed just prior to announcement when the determination was made to drop LEOS and enhance DOS. The planned enhancements to DOS and OS included new device support, e.g., 3330 support in DOS, as the devices are announced.

Functionally, the major enhancement to be made to DOS and OS was support of the standard dunamic address translation feature (relocate) previously discussed.

OS was to provide support for a 16M byte virtual memory operating MFT-like. The development name for this operating system was AOS-1. It was to be announced in September 1971 and first customer shipment was to be in June 1972. A later extension was to be support of multiple virtual memories. The development name for this operating system is AOS-2. AOS-2 would initially support an MVT-like 16M byte virtual memory (SVM option) and later multiple virtual memories (MVM option). AOS-2 was to be announced in September 1971 and first customer shipment was to be in December 1972.

DOS was to be extended to support virtual partitions. This virtual partition support would not be equal in function or flexibility to AOS-1 however. In addition, two additional partitions were planned, as well as integrating POWER into the nucleus. EDOS, as it was known in development, was to be announced in December 1971 and first customer shipment was to be in December 1972.

THE TABLE OF SOFTWARE SHOWN HERE SHOWS THE IMPORTANT POINTS OF EACH OF THE OPERATING SYSTEMS - AS THOUGHT OF BY IBM. THE QUALITY OF THE VARIOUS FUNCTIONS - SUCH AS SPOOLING UNDER POWER, IS NOT CONSIDERED HERE. IN GENERAL, IBM ANALYSES SEEM TO PUT A GREAT DEAL MORE ATTENTION ON THE FACT THAT SOME FACILITY EXISTS THAN ON ITS PERFORMANCE OR ITS EASE OF USE (60% TO 25% TO 15% RESPECTIVELY).

PERHAPS THIS EXPLAINS THE COMPLEXITIES AND PROBLEMS OF SO MANY IBM SOFTWARE MANUALS!

CHART A

Basic Functions Supported by DOS and OS

Function		DOS	OS
Multiprogramming		3 partitions	15 partitions/regions
Data Management	ISAM	X	X
	DAM	X	X
	SAM	X	X
	PAM		X
TP Access Methods	BTAM	X	X
	QTAM	X	X
	TCAM	X	Announced
Time-Sharing		ITF, APL, ATS	ITF, APL, ATS ATS, TSO (announced) CALL/360-OS
Emulation		1401/1440/1460	1401/1440/1460
Spooling		via POWER	X
Remote Job Entry		via POWER	X
Multiple Console Support			X
Sensor Base Support			via RTM
Sub-tasking		X	X
Special Device	Graphics		X
	MICR	X	X
Support	OCR	X	X
	Paper Tape	X	X
Job Accounting		Announced	X

THERE ARE LOTS OF LANGUAGES - OR ARE THERE?

AT FIRST SIGHT THE LANGUAGES AVAILABLE TO 145 CUSTOMERS SEEM TO BE VERY NUMEROUS. HOWEVER, FEW INSTALLATIONS TAKE ANY REAL ADVANTAGE IN HAVING MORE THAN ONE FORTRAN, OR COBOL COMPILER. A MUCH SIMPLER DISPLAY SHOWING SIMPLY ASSEMBLER, COBOL, FORTRAN, PL/1, APL, AND BASIC FOR BOTH SYSTEMS, WITH ALGOL NOTED AS BEING ONLY FOR THE OS SYSTEM, WOULD HAVE BROUGHT THE IMPORTANT POINTS OUT TO A GREATER EXTENT.

CHART B

Languages Available to 145 Customers

Language	DOS	OS
Algol F		X
Assembler D*	X	
Assembler E*		X
Assembler F*		X
Assembler H		X
APL	X	X
ITF Basic	X	X
Cobol D*	X	
Cobol E*		X
Cobol F*		X
ANS Cobol*	X	X
Full ANS Cobol V3	X	X
ANS Subset Cobol	X	
Fortran IV* (basic)	X	
Fortran IV E*		X
Fortran F*	X	X
Fortran G*		X
Fortran IV G1		X
Fortran IV H*		X
Fortran IV H Extended		X
Code & Go Fortran		X
PL/I-D*	X	
PL/I-F*		X
ITF PL/I	X	X
PL/I Optimizer	X	X
PL/I Checkpoint		X

* Type I program (free)

13 MINOR ENHANCEMENTS AND THEIR EVALUATION

THE LIST OF OTHER MINOR ENHANCEMENTS SHOWS USERS WHERE THEY CAN REASONABLY EXPECT IBM PERFORMANCE IN THE FUTURE. CERTAINLY THE CURRENT ACCESS METHODS USED BY MUCH OF IBM SOFTWARE DO NOT APPEAR TO USE DISKS EFFICIENTLY, SO THE NEED OF IMPROVED ACCESS METHODS IS VERY IMPORTANT. THIS EMPHASIZES THE VALUE OF BUYING SOFTWARE FROM QUALITY VENDORS WHO DO KNOW HOW TO HANDLE DISKS.

HOWEVER, PROBLEMS MAY ARISE HERE WITH REGARD TO EVALUATING THE VALUE OF CLAIMED IMPROVEMENT. RECENT EXAMINATIONS OF ACTUAL OPERATING SYSTEMS INDICATE THAT THE IMPORTANCE OF IMPROVEMENTS (SUCH AS REDUCING THE SEEK-TIME) CAN BE VERY GREATLY OVERESTIMATED.

DEMONSTRATION OF IMPROVEMENTS ON YOUR WORK - OR GOOD PROFESSIONAL ADVICE - SHOULD BE SOUGHT RATHER THAN RELYING ON "BUZZ WORDS" - LIKE VIRTUAL STORAGE - THAT CAN CONCEAL THE AMOUNT OF OVERHEAD INVOLVED IN CONSTANT RELOCATION.

Other planned enhancements to both OS and DOS were:

1. Improved access methods
2. Expanded sensor base support
3. Improved telecommunications support

Since most of the early M145 users were coming from a lease base that was heavily committed to DOS/360, it was planned that initial usage of DOS would be quite high. However, it was expected that the demand for greater function would gradually lead users to make the conversion to OS. Chart C shows this trend and also exhibits the usage assumed in the software service estimate.

FORECAST RESULTS

Chart E shows the forecasted inventory activity in the announcement forecast. Chart F shows acceptances by source for the same announcement level forecast.

Chart G shows the forecasted distribution of inventory by memory size. This forecast was not of anticipated PCM memory activity. The assumption in the forecast was that the PCM penetration would take the form of displacement of the 3345 and 3346 main storage frames and not memory under the covers.

Chart H shows the forecasted average systems points by year and the I/O that makes up the forecast.

FORECAST RISKS

The risks inherent in the announcement level forecast fall into two categories, units and points. A major risk from the standpoint of acceptance units appears to be the expectation that over 85% of the 128K M40 will move to the M145 rather than the M135 which would probably offer sufficient performance.

A second major risk to acceptance quantity is the judgment that about 70% of the present M40 leasing company machines will move to the M145. It is anticipated that the leasing companies will increase their current discounts and displace IBM lease S/360's lower in the line. However, there is the risk that these customers may be offered a discount sufficient to hold them in place.

Another risk to M145 acceptance quantity is the heavy dependence on the recently announced 3330 and the Phase 21 memory. There is a very strong possibility that production constraints on these key system components could result in excessively long delivery schedules which would expose the M145 to lost volume.

EVALUATION OF ENHANCEMENTS

THE VALUES THAT IBM ANTICIPATE IN PROVIDING THEIR ADVANCED OPERATING SYSTEM, AS OPPOSED TO THE 1971/72 VERSION OF THE OLD OPERATING SYSTEM DOS, CAN BE EXTRAPOLATED FROM CHART C. EVEN WHEN THE USAGE OF DOS WAS TO BE CURTAILED BY POLICY, AND LACK OF DEVELOPMENT, WITH 20% OF THE ORIGINAL PERCENTAGE OF USERS WAS EXPECTED TO STAY WITH IT, FEW WERE EXPECTED TO WANT MORE THAN THE FACILITIES OF AOS/1, OR THE LOW ENTRY OPERATING SYSTEM.

THIS PROVIDES AN ALTERNATIVE WAY OF EVALUATING THE FACILITIES OFFERED BY, SAY, AOS/2, MVT, AS OPPOSED TO MFT, AND EVEN THE CURRENT, IMPROVED, DOS. IT SEEMS TO INDICATE IBM'S ACKNOWLEDGEMENT THAT THERE ARE SUBSTANTIAL NUMBERS OF USERS TO WHOM THE ADDITIONAL FACILITIES - EVEN WHEN AVAILABLE - WILL NOT BE WORTH THE BOTHER OF CONVERTING TO, DESPITE THE BLANDISHMENTS OF THE SYSTEM REPRESENTATIVES.

FROM THE USERS POINT OF VIEW IT AGAIN INDICATES THAT EXTREME CAUTION IN EVALUATING THE ADVANTAGES OF FACILITIES, WHICH MAY NEVER BE USED OUTSIDE EXPERIMENTAL PURPOSES, IS NECESSARY.

CHART C

Programming Systems Usage Percentage of Installed Systems

	1971	1972	1973	1974	1975	1976
OS-MFT	45	31	22	15	10	6
OS-MVT	--	8	2	--	--	--
DOS	55	41	33	27	22	20
AOS-1	--	20	29	41	48	47
AOS-2	--	--	10	9	8	10
LEOS	--	--	4	8	12	17

THE PLANS FOR DEATH

THE REALLY IMPORTANT NEWS IS IN CHART E, WHICH SHOWS THAT REMOVALS - THAT IS DISCONTINUANCES OF 45'S ARE EXPECTED TO START IN 1974 AND TEMPORARILY DROP AFTER 1976. EQUALLY THE NUMBER OF PURCHASE ACCEPTANCES, AFTER PEAKING IN 1972, IS EXPECTED TO DROP TO ZERO BY 1977, AND ALREADY IN 1974 BE AT LESS THAN 40% OF THE LEVEL TWO YEARS EARLIER.

THE AVERAGE MACHINE BUILT BY IBM FOR THE LEASE INVENTORY APPEARS TO BE EXPECTED UNDER THIS PLAN TO GENERALLY GO TO TWO USERS, THUS ACQUIRING TWO SETS OF ACCEPTANCES. THIS IS WHY THE CHART SHOWS A TOTAL NUMBER OF ACCEPTANCES OF 3,428, WHILE THE MAXIMUM TOTAL INVENTORY IS ONLY 2,268.

ARE USER GROUPS REPRESENTATIVE?

ANOTHER INTERESTING POINT IS THAT THE PURCHASED MODEL 45'S ARE EXPECTED TO BE 30% OF THE INVENTORY BY 1973, AND TO MOVE UP STEADILY TO BEING 50% OVER THE NEXT FIVE OR SIX YEARS. IN VIEW OF THE DIFFERENCE IN INTERESTS BETWEEN LEASED MODEL 45 USERS, AND PURCHASED USERS, THIS INDICATES THAT SERIOUS ATTENTION SHOULD BE GIVEN TO FORMING USERS GROUPS WHERE THE INTERESTS OF THE PURCHASED USERS ARE NOT OUTNUMBERED DURING THE PERIOD 1973 THRU 1978. CLEARLY THE CONTINUATION OF GENERALIZED GROUPS MIXING LEASED AND PURCHASED USERS, EVEN AT A PARTICULAR MODEL LEVEL, MEANS THAT THE PURCHASED USER IS NOT GETTING THE BALANCED REPRESENTATION TO WHICH HIS DOLLARS ENTITLE HIM.

CHART E

ANNOUNCEMENT FORECAST - 3145

	71	72	73	74	75	76	77	78	79	80
Lease Accepts	193	620	379	377	326	364	249	152	0	0
Purch. Accepts	72	293	168	115	78	37	0	0	0	0
Total Accepts	270	913	547	492	404	401	249	152	0	0
Removals	0	21	79	160	190	309	277	645	583	401
Lease Inv.	198	797	1097	1314	1450	1505	1477	984	401	0
Purch. Inv.	72	365	533	648	726	763	763	763	763	763
Total Inv.	270	1162	1630	1962	2176	2268	2240	1747	1164	763

TOTAL ACCEPTS 3428

DOS USERS EXPECTED TO PREDOMINATE

IT IS INTERESTING TO NOTE THAT EVEN AT ANNOUNCEMENT IT WAS ANTICIPATED THAT MOST 145 USERS COULD COME FROM DOS AREAS. THE FIGURES IN CHART F SHOWS THAT THEY EXPECTED ALTOGETHER TO OBTAIN 3,428 ORDERS, MOST OF THEM BEING FROM NEW BUSINESS AND ADDITIONAL INCLUDING LEASE COMPANY BUSINESS. THE MAJORITY OF LEASE COMPANY SALES ARE IN THE DOS-ORIENTED MODEL 30, AND MODEL 40 AREA. IF THIS PLAN IS TO BE CARRIED OUT, HOWEVER, IT DOES NOT SEEM TO BE IMPORTANT TO A USER NO MATTER HOW IMPORTANT IT MAY BE TO A FINANCIAL ANALYST.

CHART F

SOURCE OF ACCEPTS - M145
ANNOUNCEMENT FORECAST

	Quantity	%
Lease Base - 360		
M30	109	3.2
M40	812	23.7
M44	11	.3
M50	166	4.8
Subtotal	1098	32.0
New & Add. (Incl. Lease Co.)	1746	51.0
M135	584	17.0
Total	3428	100.0

8% ANNUAL GROWTH IN AVERAGE MEMORY?

(20) THE CHART OPPOSITE INDICATES THE EXPECTED CHANGES IN MEMORY SIZES BETWEEN THE ORIGINAL ANNOUNCEMENT IN 1971 AND 1976. APPROXIMATELY A 50% INCREASE OVER THE 6 YEARS IS ANTICIPATED BY IBM. OR AN INCREASE OF APPROXIMATELY 8% A YEAR.

(21) USERS PLANNING AHEAD CAN USE AN EQUIVALENT PERCENTAGE INCREASE IN THE ABSENCE OF HAVING DEVELOPED THEIR OWN MEMORY CHANGE PLANS. LOOKING AT THIS FROM THE USERS POINT OF VIEW IS TO NOTE THAT THE 160 TO 256K IS EXPECTED ONLY TO MOVE TO A RANGE OF 208 TO 512 AREAS. AGAIN THIS INDICATES THAT THE VALUE OF HAVING MEMORY BEYOND THE 512 AREA, OR EVEN HAVING IT AVAILABLE, OR ALTERNATIVELY THE VALUE OF HAVING MEMORIES OF UNDER THE 160 AREA, DO NOT APPEAR TO BE GENERALLY IMPORTANT.

(22) THIS IS HOWEVER NOT A STATEMENT THAT THE INTEGRATION OF A LARGE (112K) MEMORY IN WITH THE BASIC PROCESSOR - THUS PREVENTING ITS LATER REPLACEMENT BY CHEAPER MEMORIES FROM INDEPENDENT PERIPHERAL MANUFACTURERS - CAN BE REGARDED AS MUCH BUT A PRICING GIMMICK. (SEE ALSO PAGE 29).

CHART G

M145 PERCENTAGE DISTRIBUTION OF INSTALLED INVENTORY BY MEMORY SIZE*

MODEL	MEMORY SIZE	71 RATIO	72 RATIO	73 RATIO	74 RATIO	75 RATIO	76 RATIO
FE	112K	.058	.066	.046	.038	.032	.025
G	160K	.135	.084	.066	.059	.055	.048
GF	208K	.231	.168	.158	.151	.139	.119
H	256K	.576	.437	.422	.406	.393	.392
HG	392K	.000	.102	.142	.166	.190	.202
I	512K	.000	.143	.166	.180	.176	.186
IH	765K	.000	.000	.000	.000	.010	.017
J	1024K	.000	.000	.000	.000	.005	.011
Avg. Memory		224K	281K	297K	306K	319K	334K

*Not including Std. 32K Control Store

WHERE THE DOLLARS ARE GOING TO GO

AGAIN FOR A USER INTERESTED IN PLANNING AHEAD WITH MINIMAL SURPRISES, THE IBM FORECASTS AS TO HOW MUCH A 145 USER WILL BE PAYING, AND WHAT HE WILL BE PAYING IT FOR IN 1976, AS COMPARED WITH CURRENT TIME, IS OF GREAT INTEREST. IT PROVIDES A FACILITY OF FORECASTING AHEAD, BOTH FOR FINANCIAL AND OPERATIONAL AREAS, WITHOUT HAVING TO TRY TO DETERMINE THE TECHNOLOGICAL SITUATION IN THESE YEARS - WHICH IS AN IMPOSSIBLE TASK ANYWAY.

THE BIGGEST PERCENTAGE INCREASE IN EXPENDITURE IS PERHAPS UNEXPECTED BY MOST USERS COMING FROM MAGNETIC TAPES, AS OPPOSED TO EITHER THE MUCH MORE TALKED ABOUT DISK STORAGES, OR COMMUNICATION AREAS (ALTHOUGH FROM A PERCENTAGE SITUATION COMMUNICATIONS IS EXPECTED TO DOUBLE IN COST). THE 1972-1973 INCREASE COSTS OF CARD I/O IS ALSO INTERESTING.

WIDE TAPES COMING

INDICATIONS ARE THAT THE FORECASTS ARE PARTLY BASED UPON THE ANTICIPATED INCLUSION OF HIGH DENSITY TAPE DRIVES, WITH THE PRESENT HALF-INCH TAPE, AND LATER IN THE 1975/6 AREA, THE INTRODUCTION OF THE NEW WIDE TAPES CURRENTLY BEING DEVELOPED BY IBM.

THE EXACT SITUATIONS OF THESE DEVELOPMENTS AFTER THE TROUBLES OF THE COMANCHE PROGRAM ARE STILL A SUBJECT FOR SPECULATION, BUT THE IBM PRODUCT MANUALS DO INDICATE THAT THE PLANNING FOR ADVANCEMENTS IN THE HALF-INCH TAPE FACILITY HAS PRACTICALLY CEASED AT THIS POINT, AND THAT FUTURE DEVELOPMENT IS EXPECTED TO BE IN THE WIDER TAPE AREAS.

DEATH OF THE READ/PUNCH

THE CARD I/O CHANGES HAVE NO APPARENT REASON BEHIND THEM, UNLESS IT CAN BE EXPECTED THAT A NUMBER OF INSTALLATIONS WILL THROW OUT CARD-READ INPUTS AND REPLACE THEM WITH SEPARATE READERS AND PUNCHES.

CHART H

AVERAGE SYSTEM - M145
($000)

	71	72	73	74	75	76
CPU Mem & Feat.	12.5	14.3	14.4	14.7	15.0	14.7
23 Tape	3.4	3.6	3.7	3.7	4.0	4.4
DASD	4.3	4.8	5.2	5.6	5.6	5.5
Printers	2.6	2.6	2.6	2.7	2.7	2.7
24 Card I/O	.7	.6	1.0	1.0	1.1	1.1
Comm.	.6	.8	.9	1.0	1.2	1.4
Total	24.1	26.7	27.8	28.7	29.6	29.8

STRONGEST HARDWARE COMPETITION OMITTED

AS MENTIONED EARLIER, THE COMPETITIVE ENVIRONMENT USED BY IBM IN THESE REPORTS IS AN EXTREMELY RESTRICTED ONE. IT IS IN FACT SIMPLY THE COMPETITION PROVIDED BY NEW EQUIPMENT. THE STRONGEST COMPETITION FOR THE MODEL 145, AS FOR MOST COMPUTERS, DOES NOT HOWEVER COME FROM NEW EQUIPMENT, BUT INSTEAD FROM USED EQUIPMENT. IT IS A CHARACTERISTIC OF COMPUTERS THAT THEY CONTINUE TO BE USABLE FOR AN INDEFINITE PERIOD, AND THAT DURING THIS PERIOD INSTEAD OF THEIR POWER DECREASING IT NORMALLY INCREASES.

THE CHARACTERISTIC OF CONSIDERING THE MARKET COMPETITION (RATHER THAN THE TECHNICAL COMPETITION) PROVIDED BY IMPROVED SYSTEMS WITH REDUCED PRICES, CAN BE EXPLAINED WHEN IT IS CONSIDERED THAT THIS IS AFTER ALL THE DATA PROVIDED BY A MANUFACTURER TO ITS OWN MANAGEMENT.

BUYERS HAVE CHOICE - EASY ACCEPTING OR HARD-SEARCHING

THE FIGURES ARE INTERESTING BECAUSE THEY INDICATE THAT, IN THE AREA OF THE PRIME IBM'S STRENGTH - ITS STRONG MARKETING FORCE, THE PRICE/PERFORMANCE COMPETITION IS NOT YET SUFFICIENTLY WELL REPRESENTED EXCEPT BY OTHER NEW COMPUTER MANUFACTURERS. THIS RELIEVES THE USER OF SOME OF THE PROBLEMS OF ACQUIRING COMPUTERS, IF HE IS PREPARED TO RESTRICT HIMSELF TO NEW EQUIPMENT. IT ALSO INDICATES THAT IF HE IS NOT, THEN HE MUST BE PREPARED TO COME A CAREFUL BUYER IN THE MARKETPLACE.

WITH THE RECENT DEVELOPMENTS, AT THE 1973 NATIONAL COMPUTER SHOW, IT IS POSSIBLE THAT IN THE FUTURE A MARKETING FORCE OF THE USED COMPUTERS WILL BECOME STRONG ENOUGH FOR USERS TO EQUATE THEM ON A ONE-TO-ONE BASIS WITH THOSE OF THE LARGE MANUFACTURERS. IN THE MEANTIME, HOWEVER, IT WOULD APPEAR THAT USERS WILL HAVE TO BE PREPARED TO SPEND SOME MONEY THEMSELVES IN O-DER TO GET BEST PRICE PERFORMANCE, OR AT LEAST IN ORDER TO GET THE WIDER CHOICE THAT IS AVAILABLE BY CONSIDERING BOTH SOURCES OF SUPPLY.

CURRENT IBM USER CHOICES

THE OUTSIDE NEW-SYSTEMS COMPETITION IS PARTICULARLY IMPORTANT WHERE A USER FINDS HIMSELF COMMITTED TO IBM-TYPE FACILITIES, EITHER THROUGH PROGRAM INCOMPATIBILITY, FILE INCOMPATIBILITY, OR CORPORATE POLICIES.

IN SUCH CASES THE ONLY VIABLE COMPETITION TO IBM IS TO BE FOUND IN THE USED MARKET, AND A FAILURE TO TAKE THIS INTO ACCOUNT WILL OFTEN INVALIDATE THE RECOMMENDATION OF ACQUIRING NEW IBM EQUIPMENT. AS THE FIGURES OF ACCEPTANCES VS. BUILDS SHOWED EARLIER TECHNICALLY THERE IS NO SERIOUS DIFFERENCE BETWEEN THE SO-CALLED NEW AND USED EQUIPMENT. INDEED IBM THEMSELVES HAS IN THE PAST POINTED THIS OUT AS THE JUSTIFICATION OF THEIR POLICY OF CHARGING NEW PRICES FOR USED EQUIPMENT INDEFINITELY.

The risk to points comes primarily from two sources - PCM and SCP conversion. The PCM risk is simply that the penetration by our competitors in the peripheral area will be greater than forecasted. Since penetration to this point has been consistently heavier than forecasted this is a significant risk. It is particularly so in the area of main storage where PCM competition is first starting to be felt and little experience is available on which to project.

The risk to points associated with SCP conversion is that this conversion will not take place. The forecast assumed that the M145 would be the vehicle for extensive conversions from DOS, which most of the customer base was currently using, to OS-MFT. It was further assumed that the conversion to OS-MFT would result in expanded customer applications and, thus, more I/O and more memory. Therefore, to the extent that this conversion activity is exposed it appears that the average systems points are exposed.

COMPETITIVE ENVIRONMENT

At announcement time, the Model 145 had superior performance and price performance to all announced competition. It was also believed to be equal or superior to all unannounced competitive products that we could foresee being announced during the first 2 years after the 145 announcement. The following were the assessments of competition:

RCA

Considered to be the most effective competitor. The RCA 60 had announced capability approximately equal to the 145, but without the 3330 type file. The RCA 61 had virtual memory capability at approximately $3000.00 additional per month. Both the RCA 60 and 61 system were priced considerably above the Model 145 but were being heavily discounted - up to 35%.

The evaluation was that RCA would not announce another system, but would discount the RCA 60 approximately 25% to provide the same price performance, add a 3330 type file and attempt to use the marketing approach of emphasizing the virtual memory, terms and conditions, operating system and offer an alternative to IBM.

HONEYWELL

Did not have any system competitive with the Model 145 in performance or price performance but was considered a threat because of their large inventory base and obvious need for new products to maintain their revenue growth.

The evaluation was that if Honeywell could announce a high performance system, they would be a very strong competitor. This was based on their

EVALUATING IBM OPERATING SYSTEMS

THROUGHOUT THE IBM DOCUMENTS CONSIDERABLE ATTENTION IS PAID TO THE BURROUGHS OPERATING SYSTEMS. THE REFERENCE TO THEIR STRONG OPERATING SYSTEM IS TYPICAL IMPLYING THAT THE BURROUGHS SYSTEM IS OFTEN SUPERIOR TO THE IBM OFFERING.

IT CERTAINLY INDICATES THAT WHERE THE FACILITIES OF THE IBM OPERATING SYSTEMS ARE REGARDED AS BEING THE REASON FOR A DECISION TO GO ONE-WAY, OR ANOTHER, IT IS TECHNICALLY NECESSARY TO TAKE A VERY SERIOUS AND PRODUCTIVE LOOK AT THE BURROUGHS OPERATING SYSTEM. FACILE COMPARISONS, WHICH JUST COMPARE THE SIMPLICITY OF CONTROL OF THE BURROUGHS SYSTEM, OR THE NUMBER OF FUNCTIONS (WHICH MAY, OR MAY NOT BE USEFUL TO THE USER) OF THE IBM SYSTEM DO NOT REALLY HELP, OR QUALIFY AS ADEQUATE OPERATING SYSTEM COMPARISONS.

large inventory base, proven marketing skills, long term lease plan, and bundled service. The proposed Honeywell GE merger was considered in this evaluation and was not considered to have an impact until 1971 at the earliest.

NCR

At 145 announcement time, NCR had just announced their model 300 which was the only NCR computer capable of competing with the 145. The NCR 300 was in the performance range at a slightly lower price but was not considered a major competitor because (1) it lacked a workable operating system; (2) NCR had not yet developed a base capable of migrating to the 300; and (3) NCR did not yet have any proven ability to market large systems. We concluded that NCR would be a future competitor of 145 type systems but not until they solved the problems just described.

BURROUGHS

Had no system that was price/performance competitive against the Model 145 but was nevertheless considered a dangerous competitor because of their excellent marketing force. At announcement time, the Burr 6500 was considered too expensive and the Burr 4500 not powerful enough to compete against the 145. We concluded that Burroughs would continue to be a very effective competitor, not because of price/performance, but because of strong marketing, excellent O/S, terms and conditions and their proven ability to sell large systems.

SPERRY RAND

Did not have any system directly competitive with the Model 145. The S/R 9400 was too small and the 1106 was too expensive to compete in most situations. We expected the announcement of the S/R 9500 to fill the competitive gap.

THE SUBJECT MATTER OF THIS BOOK IS NOT REALLY COMPETITION BETWEEN DIFFERENT MANUFACTURERS. FEW USERS OF IBM EQUIPMENT ARE REALLY FREE TO LOOK AT THE OFFERING OF THE OTHER MAIN FRAME PEOPLE, BECAUSE OF THE LOCK-IN OF THEIR PROGRAMS TO PARTICULAR OPERATING SYSTEMS AND COMPILER EXTENSIONS AND VARIATIONS.

EVEN SO, IT IS INTERESTING TO NOTE THE COMMENTS ABOUT THE BURROUGHS 700 SERIES. REALLY, WHAT BURROUGHS APPARENTLY DID IS EXACTLY WHAT THE LEASING COMPANIES ARE DOING WITH THE IBM 360 LINE. IF IT IS RIGHT FOR THE MAIN-FRAME MANUFACTURERS TO REPACKAGE SYSTEMS - WHY SHOULD NOT THE LEASING COMPANIES DO IT, IF THEY CAN PROVIDE THE APPROPRIATE SERVICES?

COMPETITIVE ENVIRONMENT
6 Months After the Model 145 Announcement

Six months after announcement, the competitive situation is very similar to that which was projected at announcement time. There have been no major surprises by any of our competitors. Each competitor will be briefly discussed below.

RCA

Repriced the 70/60 and 70/61 by about 25% and called them the RCA 6 and 7. Announced larger memory sizes and purchased some 3330's from IBM to sell on their systems. RCA has made a very strong sales effort, emphasizing their virtual memory capability. They have entered many competitive situations but so far, have won only a few competitive decisions according to our records.

HONEYWELL

Announced two systems in this period. HIS 2015 - not enough performance to compete against the 145. HIS 6030 and 6040 - approximately the same price performance as the 145, but has no IBM compatibility as yet. Neither Honeywell system has hurt the 145 sales.

NCR

The NCR 300 has not yet proved to be a successful competitor against the Model 145.

BURROUGHS

Repriced the 500 systems, calling them the 700 series but the low end system, the B-5700 has considerably less performance and much lower price performance than the Model 145. However, Burroughs is still a very effective competitor for the reasons already stated.

SPERRY RAND

The S/R 9500 has not yet been announced and the 1106 is the major S/R system bid against the 145. There have not yet been any decisions on which to judge its effectiveness.

THE POPULAR 256K

THE FORECAST SUMMARY OF 370/45 LEASE AND PURCHASE INVENTORY BETWEEN 1971 THRU 1980 SHOWN HERE, GIVES A DIFFERENT PICTURE OF THE SITUATION TO THAT SHOWN ON PAGE 11, OR PAGE 9. NO ACCOUNT OF REMOVALS AS SUCH, OR OF LEASE VS. PURCHASE IS INDICATED.

A FEW DISCREPANCIES OF A TRIVIAL NATURE DO OCCUR BETWEEN THE CHARTS, BUT PERHAPS THE MOST INTERESTING AND (DANGEROUS) DETAIL HERE IS THE ANALYSIS OF THE 763 MACHINES THAT IBM EXPECT TO BE PURCHASED.

THE LARGE NUMBER (606) OF 256K SYSTEMS DOES NOT INDICATE THAT THERE WILL BE 606 256K'S AT THAT POINT IN TIME. LARGER MODEL 145 SYSTEMS ARE CONFIGURED BY ADDING 3345'S, OR 3346'S WITH THE 3046 POWER SUPPLIES.

THE ANALYSIS DOES ACTUALLY INDICATE THAT THE 256K WILL, HOWEVER, BE THE MOST POPULAR SYSTEM, WITH ABOUT 40% OF THE PURCHASED BEING SYSTEMS IN THIS AREA, WITH THE LARGER SIZES BETWEEN 256K AND 512 ACCOUNTING FOR A FURTHER 40% OF THE INVENTORY, WHILE THE SMALLER SIZES ONLY ACCOUNTING FOR 20%.

FORECAST SUMMARY - LEASE & PURCH. INVENTORY

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
3145										
112K	15	77	74	74	71	62	61	49	34	24
160K	37	97	106	110	117	109	108	84	57	37
192K	63	194	255	293	298	275	272	213	144	96
256K.	155	795	1194	1482	1691	1821	1799	1400	930	606
Total	270	1163	1629	1959	2177	2267	2240	1745	1165	763
3345	---	121	238	333	423	466	460	361	243	162
3346	---	170	276	360	388	425	420	328	220	145
3046	---	291	514	693	811	891	880	689	463	307

29

SOURCE -

Forecast #412-05-30-DPG-726 9/10/70 Reduced by 100 3145

Acceptances Because of Avg. $300 Rental Increase Just Prior to Announcement

HERE COMES COMANCHE

THE DETAILS OF THE LACK OF DISK STORAGE IMPROVEMENTS AFFECTING BUDGETING PLANS, WHILE THE EMPHASIS ON TAPE AND CARD, (WHICH WAS DEVELOPED EARLIER) RECEIVES BOTH SOME CONFIRMATION. THE INCLUSION OF THE WIDE TAPE - HERE STILL UNDER THE DEVELOPMENT NAME OF COMANCHE - AS ONE OF THE TAPE AREAS DOES INDICATE THAT THE EXPECTED REASON FOR THE TAPE PRICE INCREASE IN 1974 WAS THE WIDE TAPE, AND ALSO THAT THE REASONS FOR CARD I/O INCREASES

APPEAR TO BE THE INCLUSION OF SEPARATE READERS AND PUNCHES. (THE RED-LAKE AND PIKE-LAKE SYSTEMS ARE APPARENTLY THE IBM 3505 CARD READER, AND 3525 CARD PUNCH.)

Some of the key I/O boxes and their average usage per system in 1976 are listed below:

DASD	
3330	1.95
3830	.65
Tape	
3420	3.52
3803	.87
Comanche	.16
Printer	
3211	.64
1403-N1	.34
Card I/O	
2540	.27
Redlake	.72
Pikelake	.66

As can be readily observed, the dependence on follow-on I/O is relatively small (especially since Redlake and Pikelake were announced 3/71).

10% UP FOR VIRTUALLY NOTHING

AN INTERESTING ILLUSTRATION OF IBM'S BELIEF - REASONABLY WELL JUSTIFIED AT THAT - OF THE POWER OF ITS MARKETING AS OPPOSED TO ITS SYSTEMS IS SHOWN HERE. THE MODEL 40 WAS ANNOUNCED AND PRACTICALLY PRICED IN 1964. NOW, EIGHT YEARS LATER, WHEN THE COST OF ELECTRONICS HAVING DROPPED BY HALF, THEY ARE STILL USING THE 1964 PRICE AND ARE INTERESTED IN PERSUADING USERS WHO WANT TO ECONOMIZE TO TAKE A 10% INCREASE FOR WHAT THEY THEMSELVES CALL "VIRTUALLY THE SAME SYSTEM AS HE CURRENTLY HAD"!

IS LOCK-IN COSTING USERS 50%?

AT THE SAME TIME IT MAY NOT BE THE MARKETING FORCE. IT COULD BE AN EXPRESSION OF THEIR EVALUATION OF THE LOCK-IN CHARACTERISTIC OF THE USE OF IBM HARDWARE AND SOFTWARE. CERTAINLY THE USE OF IBM COBOL - EVEN THE SO-CALLED IBM ANS COBOL - HAS MADE IT QUITE EXPENSIVE AND QUITE FRIGHTENING FOR AN INSTALLATION TO CONSIDER LEAVING THE IBM FOLD. HOWEVER, IF THE COST OF STAYING IN THE FOLD IS TO BE THE LOSS OF TAKING ADVANTAGE OF A DECADE OF DRAMATIC PRICE REDUCTIONS IN A NEW FIELD, PLUS A PAYMENT OF A 10% PREMIUM, IT LOOKS AS THOUGH THIS CAN BE QUITE AN EXPENSIVE LOCK-IN. NON-USERS CONSIDERING IBM AS A SUPPLIER SHOULD ALSO CONSIDER THE IMPLICATION OF THIS DELIGHTFUL STATEMENT.

IV. MARKETING CONSIDERATIONS

Chart D shows the M145 internal performance compared with the other S/370 machines and the S/360. In interpreting this chart it should be borne in mind that internal performance is simply a measure of CPU instruction execution speed and not necessarily throughput.

The primary marketing mission of the M145 was to migrate the S/360 lease base model 40's and large model 30's. At announcement time the typical model 40 was configured as follows:

131K of Main Storage
6 312KB Disk Drives (232MB Cap.)
5 60KB Tape Drives
1 1100 LPM Printer
1 Reader-Punch - 1000 CPM
Read, 300 CPM Punch

Monthly Systems Rental $18.4K

It was anticipated that the following M145 configuration might be bid to this customer:

256K of Main Storage
8 312KB Disk Drives (232MB Cap.)
5 320KB Tape Drives
1 2000LPM Printer
1 Reader-Punch - 1200 CPM
Read, 300 CPM Punch

Monthly Systems Rental $25.4

In this example the customer would get a system with three times the internal speed, twice the memory, 33% more file capacity, and much faster tapes and printers for a 38% increase in rental. If he were unwilling to spend that much he could get virtually the same system as he currently had for an increment of roughly 10%.

The large model 30's at the time of the M145 announcement looked as follows:

64K of Main Storage
3 156KB Disks (22MB Cap.)
5 60KB Tapes
1 1100 LPM Printer
1 Reader-Punch - 1000 CPM
Read, 300 CPM Punch

Monthly Systems Rental $12.9K

THE REAL LINE OF SUCCESSION

THE INTERNAL PERFORMANCE COMPARISON LISTED ALONGSIDE ALLOWS A REAL LINE OF SUCCESSION TO BE DEVELOPED, AS OPPOSED TO THE MARKETING ONE.

THE DETAILS ARE SHOWN IN THE FOLLOWING TWO COLUMNS:

1960 VERSION	1970 VERSION	POWER DIFFERENTIAL
MODEL 25	NO SHOWN SUCCESSOR IN THE 1970'S	
MODEL 30	NO SHOWN SUCCESSOR IN THE 1970'S	
MODEL 40	370/125 (T55)	SAME POWER
MODEL 50	135	10% EXTRA POWER

CHART D

INTERNAL PERFORMANCE COMPARISON

	M25	M30	T-55	M40	M135	M50	M145	M155
M25	1.0							
M30	1.5	1.0						
T-55	2.6	1.7	1.0					
M40	2.6	1.7	1.0	1.0				
M135	5.5	3.7	2.1	2.1	1.0			
M50	5.6	3.8	2.2	2.2	1.1	1.0		
M145	10.6	7.3	4.2	4.2	2.0	1.9	1.0	
M155	19.5	13.4	7.7	7.7	3.7	3.5	1.8	1.0

Matrix Value = Internal Perf. of Row Mach./
Internal Perf. of Column Mach.

Thus M50 Internal Perf. = 3.8 Times M30

WHY MODEL 30's TO 145's?

IF YOU THOUGHT IT WAS BAD TO ASK THE MODEL 40 USER (PAYING $18.4 THOUSAND FOR HIS SYSTEM) TO PAY AN ADDITIONAL 10% FOR WHAT IBM CALLS "VIRTUALLY THE SAME SYSTEM", NOW CONSIDER THE SITUATION OF THE USER PAYING $12.9K FOR HIS MODEL 30 SYSTEM. IF HE IS TO BE SUCCESSFULLY "MIGRATED" TO THE 370 LINE AT THE 145 LEVEL IBM NOTES THAT HE DOES NOT HAVE THE OPTION OF KEEPING "VIRTUALLY THE SAME SYSTEM" AT ALL AND REALLY HAS TO JUMP A GOOD 50%!

WHY UNDER THESE CIRCUMSTANCES THE FORECASTS SHOW AS MANY MODEL 30' MOVING TO 145'S AS THEY DO IS NOT VERY CLEAR. OF COURSE IN THE EARLY DAYS THERE WAS NO WHERE ELSE TO GO UNLESS THEY WERE TO MOVE UP TO THE MODEL 40. PAYING IBM ITS 1964 PRICES FOR THE MODEL 40 MADE AS LITTLE SENSE AS PAYING THE 145 PRICE.

IT CAN BE ASSUMED THEN THAT THE DELAY BETWEEN THE ANNOUNCEMENT OF THE MODEL 145 AND THE MODEL 135 WOULD HAVE ASSISTED IN PRODUCING THE FLOW OF THE LARGE MODEL 30'S STRAIGHT TO THE 145'S. WHETHER OR NOT THEY WILL STAY THERE IS OF COURSE ANOTHER MATTER.

The M145 that might be proposed to this customer might be the following:

160K of Main Storage
3 312KB Disks (87MB Cap.)
5 160KB Tapes
1 1100 LPM Printer
1 Reader-Punch - 1200 CPM
Read, 300 CPM Punch

Monthly Systems Rental $19.3K

The M30 customer could substantially expand his tape file, CPU and memory, for a 50% increase in monthly expenditures. However, unlike the M40 customer he would not have the option of keeping virtually the same system and trading CPU's for a minimal price increase. Consequently it was anticipated that the M145 would not migrate substantial numbers of M30 customers.

Other anticipated sources of customer acceptances were as follows:

1. Model 50 users who wanted to cut back on DP expense.
2. Users of leasing company model 40's.
3. Customer purchase second and third generation.

BEWARE THE M/135!

THE MOST INTERESTING POINT ABOUT THE START OF THE ANALYSIS IS THE SUCCINCT SUMMARY OPPOSITE, WHICH DEFINES THE MISSION OF THE MODEL 145 - "A VEHICLE FOR MIGRATING MODEL 40'S AND LARGE MODEL 30'S TO THE 370 LINE..." AS WELL AS FINDING NEW USERS.

NOTE ALSO THE IMPORTANCE OF DOS TO OS CONVERSIONS. AFTER THE MODEL 145 WAS BROUGHT OUT IBM DECIDED TO CONTINUE TO DEVELOP DOS, ALTHOUGH THIS MADE IT MUCH LESS NECESSARY FOR USERS TO GO TO THE OVERHEAD OF THE FULL OS.

SUMMARY

The M145, a processor with roughly twice the internal speed of the M50, was the third S/370 announcement. It was intended as a vehicle for migrating model 40's and large model 30's to the S/370 line and generating new and additional business, primarily from S/360 and second generation purchase customers. The entry configurations were about $18K per month with a typical average system of $25K per month and a maximum of approximately $50K per month.

The major risks from a marketing standpoint at announcement seemed to be: (1) quantity degradation as a result of a M135 more attractive to the lease base, failure to migrate leasing company model 40's and long delivery schedules as a result of production constraints, and (2) point degradation resulting from a greater than forecasted PCM penetration and less than forecasted DOS to OS conversions.

THE USER WILL BE MOST INTERESTED IN THE COMMENTS ON MEMORY PRICING. UNDER THE CIRCUMSTANCES, ALTHOUGH THE LOWER OF TWO PRICES WAS ACTUALLY CHOSEN, THE ACTUAL COST OF THE MEMORY OF THE MODEL 145 WAS ONLY A MINOR POINT OF CONSIDERATION.

OTHER COMMENTS INDICATE THAT BY 1973 THE MARKET COST OF MEMORY FOR THE SYSTEM WAS CONSIDERABLY BELOW THE COSTS BEING USED BY IBM, AND WAS DROPPING ALL THE TIME.

USERS CONSIDERING THE 128K MODEL 145S WILL BE INTERESTED IN THE COMMENTS ON WHAT IS CALLED THE "LOSS OF ACCEPTANCES OF 128K M40 CUSTOMERS TO THE M135."

PUT MORE BLUNTLY, THIS INDICATES THAT THE IBM ANALYSTS WERE UNABLE TO FIND MANY CASES WHERE THE ADDITIONAL POWER OF THE MODEL 145 WAS ACTUALLY GOING TO HELP A USER, WHEN HE HAD THE CHOICE BETWEEN THE TWO SYSTEMS.

FINANCIAL COMMENTS

Chart I shows the profitability projected for the M145 at Announcement at the pricing life of 48 months and at forecast life.

I. PRICING CONSIDERATIONS

In assessing the question of what level to announce at, three price levels were assessed with regard to their impact on the M145 and the rest of the "SCAN" line. These levels ranged from $1100 per month above the announcement prices to $700 per month below announcement to $1900 per month below announcement. In evaluating these three levels, several things became apparent:

1. Overall volume sensitivity of the SCAN line to price changes was not too great.

2. The M145 showed a great deal of volume sensitivity between the Median price and the High price. This was not due so much to competitive inroads, as it was to loss of acceptances of 128K M40 customers to the M135.

3. Profit maximization of the SCAN line systems occurred at the High price. However, this result was heavily dependent on the T55 which, at the time, was considered a high risk program. Exclusion of the T55 still showed maximization of profit at the high price. However, the differences were quite small between all levels.

II. MEMORY PRICING

On the other hand, there was the question of whether pricing Memory at the $11200 per 512K would lower the prices of the smaller models enough to significantly increase acceptances versus the $9600 price. A sizing indicated there was a minimal difference in migration patterns and in overall profitability. Since the dependence on Memory profitability was greater with the High Memory price, it was clear that by pricing memory at $11200 we were accepting a greater risk. The fact that there was little difference in profitability as the result of going to $11200 did not indicate any reason to accept this risk.

HOW GOOD A MEMORY DEAL DID USERS GET?

THE MEMORY PRICING DECISION INDICATED HERE AT 96,000 PER 512K WITH A 26% PROFIT ON MEMORY, CERTAINLY WAS THE LOWER OF THE TWO MEMORY PRICING STRUCTURES CONSIDERED BY THE CORPORATION, AND TO THIS EXTENT THE 145 USER WAS BENEFITTED.

HOWEVER, IN LOOKING IN THE EQUIVALENT SHOWS THAT THIS MAY NOT BE QUITE CORRECT. APPARENTLY THE COSTS OF THE PROGRAM WERE MAJORLY CHARGED AGAINST THE 145 DEVELOPMENT, ALTHOUGH THE PROGRAM WAS THEN USED IN MANY OTHER PLACES INCLUDING THE 135. AS A RESULT, THE PROFIT YIELD QUOTED HERE - 26% - IS SUBSTANTIALLY BELOW THE EQUIVALENT PROFIT YIELD ON THE SAME BASIC UNITS ON THE MODEL 135, ALTHOUGH THIS IS BEING OFFERED AT A COMPATIBLE PRICE.

AS NOTED BELOW THE MOST SIGNIFICANT COST - ACCOUNTING FOR OVER 60% OF THE TOTAL - IS IN THE MEMORY AREA, SO THIS POINT CANNOT BE CONSIDERED AS BEING MINOR FROM THE USERS POINT OF VIEW.

FAULTY SYSTEMS NOT SCRAPPED

FOR USERS WITH 145'S, THAT WERE MANUFACTURED DURING THE PERIOD 1971/72 (AND PERHAPS LATER), AN INTERESTING PIECE OF INFORMATION IS INCLUDED IN THE DISCUSSION.

PHASE 21-N "UTILIZES MODULES WITH A SINGLE BIT ERROR IN ONE OF THEIR FOUR QUADRANTS." HOW THESE MODULES ARE UTILIZED INSTEAD OF BEING SCRAPPED IS NOT MADE CLEAR. OTHER DOCUMENTATION INDICATES THAT INTERNAL DELIVERIES OF THE SYSTEM 370'S DURING THIS PERIOD WERE RESTRICTED TO MARKET SUPPORT OPERATIONS, NOT FOR OPERATIONAL DATA PROCESSING.

IT THEREFORE APPEARS PROBABLE THAT THE UTILIZATION INCLUDED DELIVERY TO CUSTOMERS. NO DETAIL IS PROVIDED AS TO WHETHER OR NOT SUCH DELIVERY WAS MADE SOLELY TO CUSTOMERS OBTAINING MACHINE SERVICE, I.E., LEASE CUSTOMERS - OR WHETHER IT WAS ALSO MADE TO CUSTOMERS PURCHASING EQUIPMENT.

THE QUESTION AS TO WHETHER OR NOT SUCH MEMORY QUADRANTS SHOULD BE LABELLED AS BEING FAULTS BY ORIGINAL SPECIFICATION, IS AN OPEN ONE, AND ONE WHICH (UNLESS IT IS SETTLED) MAY EFFECT THE USED MARKET PRICE OF ALL 145'S.

USERS ARE THEREFORE RECOMMENDED TO CHECK MEMORY PERFORMANCE OF 145'S, BUILT IN THE 1971/72 PERIOD, WITH MORE CARE THAN USUAL.

The final price decided upon was $9600 per 512K. This price yielded approximately 26% profit on Memory. It was decided to go with a price that balanced profit margins between CPU and Memory since there seemed to be no advantage in accepting a lower margin on Memory or in seeking a higher margin on Memory to allow a lower CPU price.

III. POTENTIAL PROFIT ENHANCEMENT

Chart J shows the breakdown of total costs at Pricing Life for the M145 Processor.

A. Manufacturing

It is apparent that the most significant area of Potential Profit leverage is Manufacturing Cost inasmuch as this is the largest directly estimated cost as a percentage of revenue. By far, the most significant cost, accounting for over 60% of the total contained in this manufacturing cost total is the Phase 21 Memory. As of announcement a potentially significant cost reduction for Phase 21 was being considered which would also have the effect of partially alleviating a Memory constraint problem in 1971 and 1972. This program, known as Phase 21-A, utilizes modules with a single bit error in one of their four quadrants. In the Phase 21 program, as originally conceived, these modules would be rejected and scrapped. The potential savings from this program were not considered in the pricing evaluations.

The second most significant area of cost of the MST logic cost which accounts for approximately 20% of the total. This cost consists of MST modules, cards, boards, and tri-lead cables. No cost reduction efforts of the magnitude of the Phase 21-A program have been proposed and it appears that any reduction of MST cost will have to be as a result of the Endicott CPM, East Fishkill, and Owego facilities performing better than plan.

The rest of manufacturing cost consists of the traditional hardware costs such as power, frames, etc., and SMD assembly and test. Again, it appears that in this area any reduction of cost will be the result of SMD performing better than plan.

It is apparent that any significant hardware cost reduction will have to come from Components Division costs. It is also apparent that the CD costs which must be emphasized are the Phase 21 costs.

MANUFACTURING COSTS DISCLOSED

USERS ARE NOT PARTICULARLY INTERESTED IN THE COST OF MODEL 145'S EXCEPT IN ONE ASPECT. ONE OF THE ARGUMENTS THAT IS OFTEN RAISED BY IBM, AND OTHERS, IS THAT THE MANUFACTURING COST ON IBM EQUIPMENT MUST BE SUBSTANTIALLY LOWER BECAUSE OF THE VOLUME OF PRODUCTION. THIS CHART GIVES USERS AN IDEA AS TO WHAT EXTENT SUCH MANUFACTURING ECONOMIES CAN EFFECT THE PRICE OF THE MODEL 145.

THE COST OF MANUFACTURING A SINGLE UNIT CAN BE FOUND BY DIVIDING THE 368 MILLION DOLLARS LISTED HERE BY THE 2,267 ITEMS THAT WERE PLANNED AT THE TIME THIS DOCUMENT WAS CREATED TO BE BUILT. THE RESULTING FIGURE - ABOUT $160,000 SPREAD OVER THE PLANNED 48 MONTH LIFE USED FOR PRICING - BRINGS THE FIGURE DOWN AROUND $3,000 PER MONTH.

IN VIEW OF THE COMPARATIVE SMALL SIZE OF THIS FIGURE, BY COMPARISON WITH THE 370/45 RENTAL AND PROFIT MARGINS, IT IS CLEAR THAT MANUFACTURING SAVINGS, OR COSTS, DO NOT NECESSARILY PREVENT OTHER MANUFACTURERS OFFERING AS GOOD, OR BETTER, EQUIPMENT AT A LOWER RETAIL PRICE.

CHART J

BREAKDOWN OF TOTAL CPU, MEM. & FEAT. COST - PRICING LIFE
($000,000)

	COST	PERCENT OF REVENUE
MFG	368	20.3
FE	170	9.4
ENG	37	2.0
INDIRECT	601	33.1
PROD. CONT	96	5.3
TOTAL	1272	70.0

42 FIELD ENGINEERING COST IS FOR SOFTWARE

ONE OF THE MOST INTERESTING AND HARDEST TO OBTAIN DATA ON AREAS THAT EFFECT USERS, IS FIELD ENGINEERING. ON THE ONE HAND USERS OF THE 370/145, WHICH IS AN EXPENSIVE AND POWERFUL PIECE OF EQUIPMENT, NATURALLY WANTS TO OBTAIN THE BEST SUPPORT THEY CAN FROM FIELD ENGINEERING, NOR DO THEY GRUDGE MONEY PAID FOR THIS.

ON THE OTHER HAND THE IMPORTANCE OF CONTINUED PRODUCTION IS SUCH THAT ONCE A SYSTEM IS IN, FIELD ENGINEERING COSTS CAN BE JUMPED ALMOST ARBITRARILY WITHOUT GOOD CUSTOMER CONTROL. CUSTOMER DOES NOT REALLY KNOW WHETHER OR NOT A SUDDEN BREAKDOWN SHOULD TAKE FIVE MINUTES TO REPAIR, OR FIVE HOURS. HE DOES NOT REALLY KNOW HOW MUCH MAINTENANCE IS NECESSARY, ETC. AND HE DOES NOT REALLY KNOW HOW MUCH TRAINING OF ENGINEERS IS NEEDED IN ORDER TO KEEP HIS MODEL 145 LOOKED AFTER PROPERLY.

MOREOVER, THE RECENT ARGUMENT ABOUT WHETHER IBM ENGINEERS CAN PRACTICALLY BE TRUSTED TO MAINTAIN SYSTEMS, INCLUDING CORE, OR OTHER MEMORY, FROM OTHER USERS, CONNECTED TO TAPE UNIT, PROVIDED FROM NON-IBM SOURCES, ETC., TOGETHER WITH THE MAINTENANCE INCREASES INCLUDED IN THE IBM 370/145 PRICING STRUCTURES, HAVE RAISED MANY QUESTIONS IN THE MINDS OF USERS - AND SHOULD HAVE RAISED MORE DEMANDS FOR A TOTAL REFORM IN THIS AREA.

THE DATA OPPOSITE SHOWS THE BASIS UPON WHICH IBM MADE THEIR ORIGINAL DECISIONS. THE PREVIOUS CHART SHOWED THAT, FAR FROM MAINTENANCE COSTS HAVING GONE UP, THEY WERE, IN FACT, REDUCED 25% IMMEDIATELY PRIOR TO OPERATIONS. IT ALSO SHOWS THAT TRAINING ONLY ACCOUNTS FOR 15% OF THE FE COSTS, AND PARTS ABOUT 8%. THE BASIC MAJORITY OF THE COSTS INVOLVED ARE THE NORMAL FIELD ENGINEER LABOR.

IN ITSELF THIS SIMPLY PROVIDES CONFIRMATION THAT ANALYSES EMPLOYING LABOR - AND NOT THE TRAINING OR THE PARTS - ARE VALID.

43 MAINTENANCE COSTS CAN BE INCLUDED

IT ALSO INDICATES THAT A FINANCIAL ANALYSIS OF THE COSTS OF A PARTICULAR SYSTEM SHOULD TAKE INTO ACCOUNT THE POSSIBILITY THAT MAINTENANCE IS BEING USED BY IBM, AS PART OF THE REVENUE MAKING OPERATION. THE USE OF A FOUR-YEAR LIFE IN THE REVENUE PROJECTIONS AND INCLUDING THE PAYMENT FOR MAINTENANCE DURING THAT PERIOD, AT THE SAME LEVEL AS MANUFACTURING AND OTHER DIRECT COSTS, SUGGESTS ONE WAY IN WHICH SUCH AN ANALYSIS WOULD BE PROVIDED. IN VIEW OF THE COSTS INVOLVED ON MAINTAINING 370'S BY IBM, BEING SUBSTANTIALLY HIGHER, IN MANY CASES THAN THE COSTS INVOLVED IN MAINTAINING 360 COMPUTERS, EITHER BY IBM, OR BY INDEPENDENT MAINTENANCE FORCES, THE OMISSION OF SUCH AN AREA IN AN EVALUATION ANALYSIS CAN WRECK THE VALIDITY ANALYSIS.

B. Field Engineering

The other major direct expenditure in the M145 is Field Engineering cost. This cost represents slightly less than ten per cent of revenue. The costs break down roughly as follows:

Hardware labor	1.8%
Software labor	4.4%
Installation	1.1%
Training	1.4%
Parts	.7%

It is evident that the area of FE cost on which (data omitted in public records) in this cost exists. This is especially true since this cost was reduced by approximately 25% just prior to the Phase III estimate by use of a problem determination package which helps to speed diagnosis of software failures. Development of other diagnostic tools should certainly be pursued. It also seems likely that more extensive testing of software releases might be of benefit.

It seems unlikely that any major cost breakthroughs are likely to occur in the service area with the exception of software simply because there is not that much cost associated with the other areas. However, potential reductions do exist. Among the avenues that have been explored is cutting the intrinsic failure rate of the MST-2 cards. Although the benefit is of small size relative to the total cost this should continue to be explored.

C. Other Costs

Other potential cost levers, primarily engineering, appear to be small by comparison to the two major areas - FE and Manufacturing. As a matter of fact, the magnitude of the Phase 2I and software service costs might warrant additional engineering for cost reduction.

D. Other Profit Enhancement Levers

The major potential for profit enhancement other than reducing cost appears to be extending the life of the machine beyond the pricing life. Reference to the series of forecasts during the six months or so prior to announcement would lead one to believe that the chances of doing this should be good since the forecast lives all were in excess of 65 months and the pricing life is 48 months. However, the extent to which life does or does not exceed pricing life is primarily a function of how quickly competition develops and markets an effective alternative to the M145 and, thus, may not be subject to control.

WAS MONOLITHIC TECHNOLOGY A MISTAKE?

ONE OF THE MAJOR ARGUMENTS IN FAVOR OF LARGE MANUFACTURING FACILITIES SUCH AS IBM IS THAT THEY ARE THE ONLY ONES CAPABLE OF PRODUCING THE RESEARCH AND PRODUCTION NECESSARY FOR THE LARGE VOLUME OF PRODUCTION BELIEVED TO BE APPROPRIATE. HOWEVER, THE DATA SHOWN OPPOSITE, READ IN CONJUNCTION WITH OTHER STATEMENTS THAT THE MONOLITHIC TECHNOLOGY IS CONSIDERABLY MORE EXPENSIVE THAN THE FET PROGRAMS, SUGGESTS THAT THE LARGE INVESTMENT REQUIRED IN PRODUCING LOW-COST VERSIONS OF THE MEMORY HAVING TO BE RECOVERED FROM A COMPARATIVELY SMALL TIME WINDOW OF IT BEING ECONOMIC MAY HURT, RATHER THAN HELP USERS. THE HURT CAN BE PASSED BY ASKING USERS TO CONTINUE TO PAY PREMIUMS FOR OBSOLETE TECHNOLOGIES.

IN THIS CASE IT WOULD APPEAR THAT USERS PURCHASING SYSTEMS BUILT IN THE 1973 ONWARDS AREA SHOULD DISCOUNT THE VALUE BY THE DIFFERENCE BETWEEN THE TWO MEMORY TECHNIQUES AS SPECIAL DEPRECIATION METHOD.

There are some follow-on programs which hopefully should enhance the program profitability. These are:

(1) sensor based support
(2) multiprocessing
(3) expanded storage capability

At this time it is difficult to tell how significant these enhancements will turn out to be.

RISES

If one ignores potential increases in FE rates and apportionments, the major risk to the M145 program seems to be the costs of manufacturing the Phase 21 Memory.

There are two parameters to this risk - yield and quantity. As of this writing CD was experiencing difficulty in getting their yields up to the level upon which the M145 announcement costs are predicated. If CD is unable to achieve their yields, it is doubtful that, even with the Phase 21-A program, they will be able to meet their costs.

The second area that represents a significant exposure to the Phase 21 costs is the fact that of the quantity upon which they were projected only about 35% could be identified to using boxes. Since it appears that most future programs will utilize FET-CP, it is dubious that this "gap" will ever be filled by Phase 21. Inasmuch as CD costs have traditionally been quite volume sensitive, there is an abvious exposure, although it is difficult to obtain agreement on the magnitude of this exposure.

This exposure to missing the Phase 21 costs was the major item contained in the product contingency. Areas covered by product contingency were as follows:

Item	% Revenue
CD Costs	3.3
SMD Costs	.8
FE Costs	.1
Additional Use Decrease	1.1
Other	.1

SUMMARY

Overall, the M145 appears to be a highly profitable box. The fact that the concentration of competition seems to be in other markets resulted in a pricing decision based primarily on the IBM base. The major competitive concern seemed to be OEH. The memory was priced with the realization that Phase

CHEAPER MEMORY KNOWN BUT NOT USED

IT IS INTERESTING TO NOTICE THAT USERS OF THE MODEL 145, WHICH ARE BEING TOLD THAT ONE OF THE ADVANTAGES IS THE MONOLITHIC TECHNOLOGY USED IN THE MEMORY, CAN OBTAIN CHEAPER MEMORIES BY TECHNOLOGIES THAT WERE AVAILABLE AT THE TIME THE SYSTEM WAS DESIGNED. WHY A USER SHOULD BE ASKED TO PAY A HIGHER THAN NECESSARY PRICE, AND A STRONG PROFIT IN ORDER TO OBTAIN A HIGH PROFIT ON AN ITEM WHICH WAS NOT PRICE COMPETITIVE WHEN IT WAS DESIGNED.

IT IS ALSO INTERESTING TO NOTE THAT THE ENGINEERING OF THE SYSTEM, WHILE PERHAPS PERFORMING TO DISCOURAGE THE CONNECTION OF OUTSIDE MEMORIES, STILL REGARDS IT SUFFICIENTLY TECHNICALLY AND PRICE ATTRACTIVE FOR USERS OF THE 145 THAT THIS AREA IS SINGLED OUT AS BEING THE KEY PLACE WHERE THE IBM PLANS MAY NOT BE FOLLOWED. PRACTICALLY THIS DESTROYS MANY OF THE TECHNICAL ARGUMENTS AIMED AT INDICATING THAT OUTSIDE MEMORIES CANNOT BE CONNECTED TO 145'S, OR IF CONNECTED AT A PRICE PERFORMANCE IMPROVEMENT OVER THE IBM PRICES, CANNOT BE ADEQUATE QUALITY. THE USER OF THE 145 THEN IS ABLE TO EVALUATE MEMORY SITUATIONS BY THE MUCH SIMPLER METHOD OF LOOKING AT RECORDS OF PREVIOUS INSTALLATIONS OF THE SAME SYSTEM.

45 21 is not a cost competitive technology with FET and that to the extent OEH manufacturers do develop FET boxes, the life of our memory is exposed. Enhancement of the profit appears to be a function of three areas:

(1) Reducing Phase 21 costs.
(2) Reducing FE software costs.
(3) Increasing life beyond pricing life.

The major financial risk appears to be missing the Phase 21 costs.

THE IBM 370 PAPERS

1971-1980

IBM's internal "Grey Book" reports to top management,
as revealed in Federal Court,
with companion commentary by Alan Taylor, CDP, CDE

Volume III, System 370/155

Published by Alan Taylor & Associates
633 Central Street
Framingham, Massachusetts 01701

ABOUT THE COMMENTATOR

Alan Taylor, CDP, CDE, is an independent consultant in the computer field specializing in concept evaluation. He has worked on both hardware and software areas, and has been in the field since 1955. An early developer of English language compilers, and operating systems, his primary work since 1962 has been in the publications area. Here he is well-known as an evaluator and critic.

His first published critique of IBM 360 equipment was in April, 1964, when he reviewed the programming codes of the System 360 from the point of view of their usefulness as a working computer language. At the time he forecast that their complexity would involve the swift popularization of high level languages. In 1965 he reviewed the development of the IBM 360 Time-Sharing machine, the third and fourth memory modules; as well as the invalidities of the throughput calculations which were being used by IBM to claim that performance was 8 times that of the 7090. Subsequently the additional third and fourth memories were withdrawn by IBM and more conservative performance claims were substituted.

In 1968, taking the other side of the coin, he commented on the development of the CMS System for the same machine which made it a practical system. (CMS later became, in a modified form, the basis of the virtual storage on the IBM 370s).

In 1969 he covered the developments of the Cache Memory with the then 360/85. A prime point of Taylor's attention here was the claim made by IBM that the system had a speed of "up to 12 million instructions per second." Using IBM figures, Taylor calculated that a commercial user would be lucky to get one third of this.

Another 1972 investigation involved covering the IBM Field Maintenance area. IBM was proclaiming that their field engineers were not able to handle the maintenance of the add-on memories on System 360. During this incident, he arranged for his twelve-year-old daughter Alison to receive appropriate training. She was then photographed turning the switch which was all that was necessary to revert the system to IBM standards. Shortly after the publication of this photograph, IBM withdrew most of their objections to maintaining systems which have add-on memory installed - perhaps the biggest user advantage that has so far been obtained.

Currently Taylor is working on further publications involving the 370 peripherals and the 370 software. These are expected to be ready before the end of the year.

Taylor has been professionally active for some years, and was the first chairman of the Cobol Survey Group for the American National Standards Committee, the first editor of Computerworld, and the first president of the Society of Certified Data Processors. In 1973 he received an award for his work on the Computer Foundation Organizing Committee in helping to create the Institute for Certification of Computer Professionals. His basic belief that computers should be thoroughly described to users so that they are able to understand data processing risks as well as the opportunities is brought out in his weekly Computerworld column, "The Taylor Report."

He lives in Framingham, Massachusetts with his wife, Heather, and one daughter.

INTRODUCTION

The documents reproduced here are the IBM Grey Books. These describe the product cycle of the 370s, as planned in IBM management operations during the past few years. Some changes will have taken place in the past few months since these were updated, but comparatively few judging by the 1972 Management Committee Reports.

Under normal circumstances, computer users would not see these documents, and indeed most IBM sales employees, although they are the authorized contact between the corporation and the user, will not have seen them either. Owing to the various legal cases now proceeding, however, this data has become part of the public record, and are now available to users and salesmen alike.

In this User Edition of the IBM Grey Books, the parts that are of most interest to users have been highlighted. It was not written for users -- and so some care in reading can be expected. But the reality behind the data -- to use IBM's famous advertising slogan -- needs to be known by users. The books are, however, intended for non-technical people -- and particularly for financial review by management. No great knowledge of computer technology is required, and they should be reviewed by user financial management separately from user hardware, software and operational areas.

The material appearing on the right-hand side is taken straight from the IBM Grey Books, as they have been placed in the public record by IBM Corporation. However, the emphasis in this area has been added to make the task of user review easier.

The material on the left-hand side is commentary added by myself, hopefully to bring out various user characteristic appearing in the IBM material, while permitting the user to reveiw the original wording, so as to evaluate the points made for himself.

Numbers are used to connect the points within the commentary to the points within the material. Comments always appear opposite the page to which they apply.

This is the first time that this material, or any equivalent, has been available to users, and the formats used may well not be the best. They are designed to be useful to users. Readers are invited to suggest alterations, either to the commentary itself, or to the format used to connect commentary with original material for use in forthcoming editions.

Alan Taylor, CDP, CDE
Framingham, Massachusetts
August, 1973

WERE THE MODEL 155 CUSTOMERS "LOCKED-IN"?

The IBM Grey Book on the Model 155 is unusual. Unlike the Grey Books for the later Model 135, and 145 systems, it contains comparatively little textual material or descriptions. The product description, in five parts, is comparatively routine. No definition of the mission of the 370/155 is included in the way that the product descriptions on the smaller system were. There the product description was not merely descriptive of what the systems contained, but also as to how this fitted into the mission that they had - to obtain customers for IBM.

On the surface this absence of detail may appear unimportant. I personally have the opinion that this is the most significant finding that the 155 user will discover from the Grey Books. There are two possible reasons as to why such descriptive material does not appear. It could be because IBM product planners were so powerful that they did now have to concern management with such matters. Anyone reading the other IBM material - such as the Management Review Committee data - knows that this is not true.

Alternatively, it could be because there was no need for either the planners, or the management to concern themselves appreciably with it. Because the planned buyers were already locked into IBM to such an extent that no genuine marketing was required. Before laughing at this item, let us take a look at it.

HOW LOCKED-IN WERE PROSPECTS?

The future users of the 155 were the Model 40, 30 and to a lesser extent the 50 users. Users of these systems were running programs primarily in two major languages, Cobol and Pl/1. (There were a few Fortran users, but Fortran was not used to any great extent as the main language for these systems.

COBOL PROGRAMMERS, NOT PROGRAMS, MOBILE

The PL/1 users, of course, had no way to go. The Cobol users also had effectively no where to go if they had used any of the IBM extensions. Although Cobol is called a machine-independent language it is not genuinely so. It is possible for a Cobol programmer to move from one machine to another, but as yet the source programs that are written in the installations are not movable between different vendor machines. This is because they are not movable between different vendor compilers. The so-called IBM ANS Cobol contains many lock-in features, anyone of which makes a conversion a problem to be avoided if possible. So Cobol users too were locked-in.

Under the circumstances it appears that the expected buyers were, in fact, locked-in. The only real danger that IBM management or planners had to handle was that advanced equipment elsewhere would give such a differential improvement (either in price or performance) that their users would be prepared to migrate away from IBM. This is included in the Grey Book. But otherwise the buyer appears to be taken for granted.

It therefore seems quite reasonable to have a product description that does not take into accout the needs of the users of the previous system.

The question that users of the IBM 155 really have to face now is as to how to avoid being again locked-in to the next IBM generation. A careful study of the Grey Book should assist a user's planning process. This book is therefore dedicated to 155 users. May they get the best value that is available to them.

Alan Taylor, CDP, CDE
Framingham, Mass.,
August, 1973

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MEET THE MULTIPLIERS

The product price information, shown opposite, will look quite familiar to most users - although it is a little bit lower than current day prices.

The one point that is interesting is the way that these figures are extended to show the relationship between the rental and purchase. Here we have the "purchase multipliers". For the 370/155 the purchase multipliers start off at 48, with all other areas below that, including all the various features, dropping as low as a 30-multiplier for the 32/74 direct control feature.

An analysis of these multipliers indicates the decisions were apparently made by general function - with the I/O controls being given a 35 multiplier, tne compatability features a 40 multiplier, etc.

I. PRODUCT DESCRIPTION

A. Price Information

Type/Model	Description	Rental	Purchase	MMMC	Purchase Multiplier
3155H	CPU- 256K Bytes	$18,500	$ 888,000	$2,160	48.0
3155HG	CPU- 384K Bytes	$18,525	$ 889,200	$2,160	48.0
3155I	CPU- 512K Bytes	$18,550	$ 890,400	$2,160	48.0
3155IH	CPU- 768K Bytes	$19,000	$ 912,000	$2,170	48.0
3155J	CPU-1024K Bytes	$19,050	$ 914,400	$2,170	48.0
3155JI	CPU-1536K Bytes	$20,650	$ 991,200	$2,240	48.0
3155K	CPU-2048K Bytes	$21,150	$1,015,200	$2,250	48.0

Feature	Description	Rental	Purchase	MMMC	Purchase Multiplier
1850	Channel to Channel Adapter	$ 350	$ 12,250	$ 10	35.0
3274	Direct Control	$ 100	$ 3,000	$ 5	30.0
3950	1401/40/60, 1410/7010 Compatibility	$ 400	$ 16,000	$ 20	40.0
4990	Second Byte Multiplexer Channel	$ 375	$ 13,125	$ 15	35.0
	Block Multiplexer Channel				
1433	Third	$ 375	$ 13,125	$ 15	35.0
1434	Fourth	$ 350	$ 12,250	$ 12	35.0
1435	Fifth	$ 175	$ 6,125	$ 6	35.0
3700	Extended Precision Floating Point	$ 175	$ 8,400	$ 20	48.0
7844	3210-1 Adapter	$ 150	$ 7,200	$ 10	48.0
7845	3210-2 Adapter	$ 170	$ 8,160	$ 10	48.0
7855	3215-1 Adapter	$ 200	$ 9,600	$ 10	48.0
5450	OS/DOS Compatibility	$ 250	$ 10,000	$ 20	40.0

"THOSE PERFORMANCE IMPROVEMENTS"

The reference to the performance improvements given to IBM internal management is handled in exactly the same way as it is given to users. No throughput improvements are suggested here, simply improvements in the internal execution times. The commentary about these is qualified with phrases like "most instruction streams", but gives no indication that any analysis has been done that indicates what type of user has what type of instruction streams, and what type of user does not.

As far as actual performance being handled to the user for throughput purposes, the key item is clearly the capability of the 370 to handle the 3330's and 2305's on-line. The prime point of the product description is the 1.5 million bytes per second figures for the block multiplexer channels.

B. Functional Information

The System/370 Model 155 is designed for general purpose use and provides a balanced, upward growth system for Medium System users. The internal speed for most instruction streams is approximately 3.5 to 4 times the System/360 Model 50.

Storage for the Model 155 consists of two parts. Processor storage (3360) ranges from 256K to 2048K bytes and has a 2.1 microsecond cycle time. The buffer control storage, which is the second level of the two level memory system, consists of a high speed monolithic technology having a cycle time of 60 nanoseconds. A very high percentage of data fetches are made from this 8K buffer storage, thereby allowing a dramatically reduced effective time to process data.

The buffer operation, which is transparent to the programmer, along with the high speed of the monolithic circuited processor (115 ns. cycle time) form the basis for improved performance of the Model 155. In addition, instruction processing performance has been improved because instruction fetching has been overlapped with instruction execution.

The system also offers improved channel operation. Two block multiplexer channels, each having a data rate in excess of 1.5 million bytes/second, are standard. Three more may be added. One byte multiplexer channel is standard and a second one may be added in place of the fourth block multiplexer channel. The increased speed of these channels allow for the attachment of the new 3330 Disk Storage and 2305 Fixed Head Storage thereby allowing for the faster access of data to accompany faster execution of instructions.

In addition to the above channels, standard features include:

- 69 ns. access read only storage
- new instructions
- interval timer
- time of day clock
- store and fetch product
- error checking and correction code
- instruction retry
- channel retry

PLANNING FOR THE 370's DEATH

It is noted here that the machine to which IBM anticipates using to replace the 155's, is to be announced in June, 1976. (This is not a reference to the 158, which is regarded simply as being a high speed memory with relocation of the 155.) The results of timing of the IBM replacement machine announcements, so far as users are concerned, seem to be the effect on its enhancements.

In general, it appears to be IBM policy not to enhance a machine which is destined to be replaced in two to three years. This gives users time to digest their system, and to become anxious to do more development into some new area.

In this case, the indications are that the last piece of enhancements - originally aimed for June, 1972 announcement - will be the sensor-based announcement. Sensor-based is simply being able to put 1800 systems to act as front-ends to the 370/155. The 1800's then control real-time data collection systems, such as process control, point of sale, recording, etc. These will be then handled by the 370/155, in addition to its ordinary work.

NO MENTION OF VIRTUAL..

The relocate capability (originally aimed for September, 1971) is the virtual memory system that was eventually announced on August 8, 1972. At that time it was matched up with the faster memory enhancement.

THAT RECOVERY MANAGEMENT SYSTEM

In the programming area perhaps the really interesting item is the reference to the recovery management support in that February, 1971 release. This was eventually scheduled for release with Release #21.7, of the Operating System, but in May, 1972 the management Review Committee of IBM ordered it withdrawn from general distribution. Instead an announcement was made that special software had been produced for the study of security, etc., by IBM in cooperation with MIT, Rand, and just one user (later TRW replaced Rand, and the State of Illinois was added to the study.)

The special software for this was produced by not issuing RMS.

HERE COMES ASPEN
AND THEN OAK

The real revolution of the 370 era receives its first mention here. Down at the bottom of the page there is the comment that the tape systems are to be replaced. The replacements of the tape by the 3400 series (ASPEN) did occur, but this is not going to be the only one. Later a new type of tape will feature in the 370 life.

C. Announcement Plans

	Announce	Ship
Base System with Features	June 30, 1970	February, 1971
Memory Enhancement	June, 1972	January, 1974
Relocate Capability	September, 1971	June, 1972
Multiprocessing	December, 1970	June, 1972
Sensor Based	June, 1972	June, 1973
Replacement Machine	June, 1976	June, 1977

D. Programming Support

OS/360 support is provided for MVT and MFT options. Access methods, language compilers, service programs, utilities and program products are supported on System/370. TSO, TCAM, ASP, HASP and Call/360 will be supported.

Availability dates are as follows:

- Assembly Language Support	February, 1971
- Recovery Management Support	February, 1971
- On-Line Test Executive Program(OLTEP)	February, 1971
- Console Support	February, 1971
- Time of Day Clock	February, 1971
- Real Time Monitor	May, 1971
- Extended Precision Simulation	March, 1971
- ASCII Support	March, 1971
- 1401/1440/1460 Integrated Emulator	February, 1971
- 1410/7010 Integrated Emulator	February, 1971
- DOS Emulator under OS	August, 1971

E. Typical Configuration

Type	Model	Quantity	Description
3155	1	1	Processing Unit
3360	3	1	512K Processor Storage
3215	1	1	Console Printer/Keyboard
3811	1	1	Printer Control Unit
3211	1	1	Printer
3216	1	1	Interchangeable Cartridge
3830	1	1	Storage Control
3330	1	4	Disk Storage Module
3336	1	8	Disk Pack
2803*	2	1	Tape Control
2420*	7	8	Magnetic Tape Unit

* To be succeeeded by "ASPEN"

THE PROBLEMS OF MAINTENANCE

No mention is made here, not even indirectly, of one of the most interesting bits of the 370/155, that is its use of the Model 50 memories from the 360 line. These memories, normally called M9 memories, were able to be used despite the age of their design because of the improved error-checking facilities mentioned here.

RETAIN? OR USER RESTRAINT?

Special Comment

Nor is any mention made of the control capabilities of RETAIN. As long as the system diagnostics have to be maintained on the site, a user can retain control of them. However, if they can be taken off site, and perhaps maintained in such a way that even the IBM engineers on the site do not know what they are using (as the routines in the RETAIN system are) it is possible to use the RETAIN system as a way of controlling outside maintenance of the 370 central processors. Users should be very conscious of such capabilities, before permitting price or function-sensitive decisions to be taken without considerations of lock-in dangers.

Similar comments can be made with regard to the OLTEP program mentioned previously. One of the factors I notice is that few installations, despite the great reliance they place on systems, arrange to have a member of their own staff trained in even elementary maintenance control (such as reading the results of diagnostics, knowing the preventitive maintenance schedules, etc.).

Many installations do have routine vendor coferences, which do mention the maintenance area, but whether these are an adequate substitute for using trained observers in the engineering area seems dubious.

F. Reliability, Serviceability, Availability (RAS)

OS (MFT and MVT) and DOS will be extended to enhance RAS. The Model 155 will offer Expanded Machine Check Facilities and Channel Retry. High productivity will be maintained because (1) CPU retry of most failing hardware is automatically handled without programming assistance, (2) Error Checking and Correction hardware automatically corrects all single-bit main storage errors and detects most multiple-bit errors, and (3) extensive hardware and programming systems error recovery and repair features are provided.

In addition, availability has been enhanced further by the introduction of RETAIN/370. This Remote Technical Assistance and Information Network uses an advanced teleprocessing system which enables CE's to more quickly diagnose system hardware problems.

THE JUMPING FROM THE 370/145

12 The entries here start off with the NS/0 and NS/1's. The NS/0 is now called the 135, and the NS/1 is the 370/145. Why the planners expect more people to come over from the 145 than from the Models 40, 50 and 65 put together is something of a mystery. No reason was given in the 145 Grey Book.

It may be explained, however, by the fact that at this stage the philosophy was to bring people up to OS, and it may have been thought that with the use of OS in a virtual environment users would automatically, in many cases, find themselves so over-loaded that they would want to come up to the 155.

THE CUT DOWN LIVES OF 370/155

13 The IBM philosophy uses two sets of lives - a purchase life (generally 4 years), and the forecast life. The forecast life is the anticipated length of time that a system, once built, will remain on rental. This life is often cumulative between 2 users installations, but does not take into account the three or four months that is expected to elapse after it is removed from one installation, and put into the other one.

14 The planned Future System is noted here to have reduced the 370/155 life, in the opinions of the planners.

MEMORY CHANGES

15 Note that the monolithic memory systems (later replaced by the 158 systems) are regarded as reducing the inventory, and indeed being losses.

40% INVENTORY=25% ACCEPTANCES

16 Note also the 25% domestic purchase given at the top, deals with the sources of acceptance. As a rented system normally goes to 2 users during its life-time, it has two acceptances, but only one build. Thus, this figure is not in contradiction with the lower comment that the purchase inventory will be 40% of the total installed.

However the logic of the IBM planners here is somewhat hard to follow. The concept of selling 47 of the systems in 1976 does indicate that there will be some form of a fire sale at that time. But why they really expect to sell more systems in the two preceding years than they did in 1972 and 1973 I cannot suggest.

The IBM planners do, however, have more facts than I have. They are perhaps able to make better judgements. Alternatively it may simply be that knowing how important the IBM management regards the purchases, and knowing how incorrect the purchase forecasts were on the 360 systems, they have simply upped the figures so as to protect themselves.

(The IBM Management Committee Reports say that during 1972 the purchase ration in domestic was running below the forecast purchase ratio, which tends to support the "self-protection theory".)

II. MARKET CONSIDERATIONS

A. Acceptances

Of the 1688 Domestic acceptances, 421 are purchase (25%). None of these acceptances include Model 155's with monolithic main memory. Multiprocessing CPUs are included in the total. Source of acceptance is as follows:

	Units	%
New and Additional	721	42
C86 (NS-0)	81	5
S68 (NS-1)	419	25
Model 30	8	--
Model 40	77	5
Model 44	17	1
Model 50	280	17
Model 65	85	5
Total	1688	100

B. Installed Position

Forecast life for lease builds is 56.5 months due primarily to the FS-2 First Customer Ship date being June, 1977. The rather flat shape of the installed inventory curve at peak is cuased by the shipment of faster (monolithic) memory systems in 1974. These systems are considered removals from the Model 155.

Purchase Inventory has been forecasted to run at about 40% of total installed through peak. The breakdown is as follows:

	Total Inventory	Lease Inventory	Purchase Inventory	PerCent Purchase to Total Inventory
1971	192	112	80	42
1972	663	401	262	40
1973	939	566	373	40
1974	984	583	401	41
1975	964	548	416	43
1976	904	483	421	47
1977	732	311	No further purchases forecasted	
1978	607	214		
1979	507	86		
1980	421	0		

C. Forecast Comments

The confidence range of the Model 155 forecast was not stated; however, informal expressions indicate a range not in excess of $\pm$ 20%.

USER GROUPS - DOES SHARE NEED COMPETITION?

Special Comment

These industry lists are useful in indicating to users which industries could reasonably band together, and what machines they should be able to concentrate on.

Manufacturing is at the top, as it is on a number of other systems. Finance and insurance, however, if put together (they have quite a few similarities, after all) would also have out-performed manufacuring. This suggests, another, reasonably compatible grouping, which could have some impact on IBM management thinking. Ditto Education, State and Local Government and Federal.

Special Comment

One of the features of IBM, in its new 1972 thinking, is to start paying attention to user interests, as opposed to providing a general purpose system with a few more gimmicks. Under these circumstances it now appears to be a good time for user groups to adopt a similar philosophy, and start grouping themselves by industry, rather than by the machine they happen to be using. If this means competing with Share - Why Not?

THE ANALYSIS OF THROUGHPUT COMPARISONS

The throughput analysis shown here is interesting because it breaks down the improvement into two components - a 1.2 to 3.0 range for the improved CP; and a 1.9 thru 3.2 for the 3330 with the improved CP.

More and more the impression gained is that the 3700, including the 370/155, are primarily vehicles for 3330's being sold. Yet the additional throughput indicated here (3.0 improved to 3.2) does not appear to be dramatic.

In fact experience has suggested that the 3330 does provide considerably greater improvement than this, particularly when it is accompanied by an intelligent reorganization of file usage. However, this lack of confidence

in throughput improvement by the 3330 may well be at the back of comments, such as at the one at the top of the page "acceptances are highly dependant upon the 3211, and 3330 I/O programs". It may be an indication that good file organization deserves the dollars, rather than new hardware.

The Model 155 forecast is dependent on the prices assumed for the Model 165, and the S68 system to be announced. In addition, acceptances are highly dependent on the success of the 3211 and 3330 I/O programs.

The forecast quantities assumed the existence of follow-on enhancements such as: relocate, faster memory, multiprocessing, and sensor-based capability.

The expected industry allocation is:

Service and consultants	2%
Distribution	6%
Education	6%
Finance	11%
State and Local Government	4%
Medical	1%
Printing and Publishing	2%
Manufacturing	19%
Insurance	10%
Process	11%
Transportation	5%
Utilities	12%
Federal	10%
SBC	1%
	100%

D. Thruput Comparison*

Based on jobstreams measured by SDD Medium Systems and/or Product Test, the Model 155 vs. Model 50 thruput ranges from approximately 1.2 - 3.0 times the Model 50 for 90% of all jobstreams having a CPU utilization of 30% or greater.

Since programming support is not yet available on new I/O, SDD has simulated the thruput times for the Model 155 using the 3330 as compared to the Model 50 using the 2314A. These thruputs range from 1.9 times the Model 50 (in an I/O dominant job) to about 3.2 times (in a CPU dominant job). The maximum 3330 effect estimated would put the Model 155 at 5.0 times the Model 50.

The internal performance of the 3155 vs. the 2050 is about 3.5 to 4.0 times.

* Source: SCAN Forecast Assumptions, Part B, Section 4.9, dated March 20, 1970.

37.2% PROFIT WITHIN FOUR YEARS - AND IBM GETS TO KEEP MOST SYSTEMS THAT THEY BUILD

The figures opposite indicate that IBM was planning to make 37.2% profit on the 145's, based on keeping each rented system out for four years. The total profit, $2.3 billion, was primarily to come from the use of the input/output $1.3 billion. As will be noted later this profit does not include the 6% contingency figures added to development and production, nor does it make any allowance for the fact that at the end of the 48 months IBM still owns more than half of the machines produced.

These, of course, can continue as revenue making assets. The IBM forecasts previously noted indicated at least an 8 month rental life for them, and it appears that it is only IBM's own actions which keep it this low. Certainly by offering them at a reduced price could increase the price performance.

III. FINANCIAL COMMENTARY

A. Summary P&L - Pricing Life (48 Months)

($ Millions)

	Announcement	
	Domestic	Worldwide
Revenue		
CPU & Features	$1103	$2527
I/O	$1607	$3695
Total	$2710	$6222
Profit		
CPU & Features	$ 340	$ 948
I/O	$ 550	$1364
Total	$ 890	$2312
%		
CPU & Features	30.8	37.5
I/O	34.2	36.9
Total	32.8	37.2

21

Note: I/O includes Memory (3360)

DOMESTIC PROFITS 34.2%

The domestic profits at the 56-month forecast life are shown here, and do shown an increase of 1.4% over the previous (domestic) figure of 32.8 The actual World Trade profits are not broken down here. However, no great analysis need to be undertaken to see that they must be considerably above 40%, if the World-Wide figures shown here are to be obtained, as these are a consolidation of the 32.8% domestic profit, and the unknown World Trade ones.

B. Summary P&L - Forecast Life (56 Months)

($ Millions)

	Domestic Announcement			
	Build Quantity	Revenue	Profit	Profit %
CPU & Features	1253	$1219	$ 389	31.9%
I/O	----	$1782	$ 637	35.7%
Total	1253	$3001	$1026	34.2%

22

Notes: 1) I/O includes Memory (3360)

2) All analyses to follow are based on Forecast Life

3) Announced Product Cost Commitment (Phase IIIA) estimates were not available in time for P&L preparation. Phase III estimates have been used.

4) I/O profitability obtained from the Business Effects Model (a subset of the Product Strategy Model).

HOW MUCH DID YOU SAY DEVELOPMENT COST?

This is one of the most detailed breakdowns of profit and loss shown in the Grey Books. The pattern of training with an expenditure of nearly $8 million in 1971, as the systems come in, and a total expenditure of $21 million (under 2% of revenue) is interesting again confirming the basic fact that it is the CE's time where the dollars are going.

Another low entry - product test and programming - which effectively stops after 1971, and is totally stopped after 1974, is also surprisingly low at 1% of revenue, or $10 million.

In the costs it can be seen that the apportionments, that is the overhead from other areas such as headquarters, marketing, etc. come to more than the direct costs, and the contingency is also substantial (being around 10% of direct, or 20% of apportioned product costs respectively).

The revenue figures include the anticipated maintenance charges, and it is interesting to see that while only 60% of the inventory is expected to be rented, which gives a 2 to 3 ratio between sales and leases, some 67% of the revenue is to come from the rentals. So purchases may well be financially advisable to at least 10%.

SYSTEM/370 MODEL 155
DETAILED CPU P&L

($ in Millions)

	Prior	1970	1971	1972	1973	1974	1975	1976	Bal	Total Program	% of Revenue
Revenue											
Lease	----	----	13.2	60.4	113.7	135.2	133.0	121.3	194.0	770.8	67.0
Purchase	----	-----	72.0	163.9	100.0	25.2	13.5	4.5	-----	379.1	33.0
Total	----	----	85.2	224.3	213.7	160.4	146.5	125.8	194.0	1149.9	100.0
Product Cost	10.0	19.3	30.2	44.0	27.0	13.2	1.6	0.5	----	145.8	12.7
Plant Recon	-----	-----	-----	0.1	0.5	2.3	3.3	2.1	1.0	9.3	0.8
CE											
Labor	-----	1.4	3.1	8.3	11.1	12.8	13.1	12.8	32.1	94.7	8.2
Parts	-----	2.3	2.8	3.2	2.9	1.9	1.8	2.4	4.1	21.4	1.8
Training	-----	1.8	7.9	3.2	2.5	3.4	2.8	----	----	21.6	1.9
Total	-----	5.5	13.8	14.7	16.5	18.1	17.7	15.2	36.2	137.7	11.9
Engineering(Note)	15.2	2.5	1.2	0.8	0.6	0.4	----	----	----	20.7	1.8
S&R Product Test &Programming	3.7	4.6	1.6	0.6	0.2	0.1	----	----	----	10.8	1.0
Total Direct Cost	28.9	31.9	46.8	60.2	44.8	34.1	22.6	17.8	37.2	324.3	28.2
Apportionments										385.7	33.6
Product Contingency										74.0	6.4
Total Cost										784.0	68.2
Profit										365.9	31.8

$74 MILLION IS GREATER THAN $2 MILLION

It is interesting to see that the product contingency is regarded as being adequate to cover an additional $2 million costs. It should be. As noted above the contingency figure was $74 million.

Note: Additional Product Engineering expenses totalling $2,008K have not been included in the P&L because they were received from Medium Systems Engineering too late to be considered for the charts presented to the MRC. In our opinion, the Product contingency is sufficient to cover this incremental estimate.

Breaking Down The Maintenance Costs

The maintenance costs shown opposite are comparatively straight forward.

F. Maintenance Price

	MODELS			
	H, HG, I	IH, J	JI	K
Labor				
Codes 01-18	$500	$505	$550	$555
Code 75	$420	$420	$420	$420
Training	$315	$315	$315	$315
	$1235	$1240	$1285	$1290
Parts	$ 925	$ 930	$ 955	$ 960
Total Price	$2160	$2170	$2240	$2250

Notes:
1) 12 month warranty
2) 01-18 Uplift - 5%
3) Prime Shift - 85%
4) GS selling price rates excluding education - 5/1/70
5) 37% of training per purchase build recovered in the MMMC; 63% in the purchase price
6) Training recovery period - 49 months
7) RETAIN/370 and problem determination effect included
8) Parts selling price markup - 7.0
9) Parts are net of rework credit
10) Spare parts - 9% uplift on gross maintenance parts
11) Parts reflect latest CD estimate of failure rates (5/15/)/

1975 MAINTENANCE RATE FORECAST

The figures indicate the method IBM uses to put together purchase, rental, and maintenance prices into a Revenue Expectation system. The precise meaning of "RESP" is not given in the Grey Book, but its use certainly appears to be a Revenue Expectation reference.

The use of 1975 figures is interesting indicating that the IBM, in 1970, were planning to charge a $45.70 maintenance rate in 1975. More details of this rate is given later.

There is, however, no indication of any expenditure to justify such a rate. Presumably this would have had to have occurred in product development, in training, or what have you, and as we noted on the previous page, no such expenditures were shown.

This is one of the areas which a user group, like the utilities or the manufacturing groups, could well put together, and then start questioning IBM management about. It is time that users were able to get better answers.

G. RESP

The following factors relate either to all models, or the average of all models of the 3155. Since the only difference between model sizes is storage protect and core adapter hardware and related service, RESP by model size was not calculated. Variations from the average presented below are judged to be less than one month's rental.

Committee Rental Life	72 Months
Maintenance Hours (1975)	15.8
Maintenance Parts (1975)	$127
Maintenance Rate (1975)	$45.70
Cost Markup	4.7
Capitalized Cost Average	$113,168
Average Point Value	$18,875
Average Purchase Price	$906,000
Purchase Months	48
Average RESP	$1,125,492
RESP Months	59.6

THE IBM ASSUMPTIONS

The last portion of the Grey Book deals with various assumptions that the analysts made. It often gives the source of these assumptions, although not always. It does not generally give details of the impact of them. Apparently IBM management is able to appreciate these for themselves. Sometimes they may indeed have knowledge as to why some particular set of figures is the way it is, although the planners themselves merely have to accept it on the basis of some memorandum, or other.

Particularly of user interest in this area are the FE matters. The problems involved in maintenance are major. They are also complicated. Whether it is really good to have a maintenance contract - or whether it is better to have a time, and materials agreement, is capable of long discussion.

In the decision, one of the parts that will have to be considered is the probable future of the rates. It so happens that this is one of the details included in this section of the Grey Book, as we will see, but first we must look at some of the other factors.

CONTINGENCY DETAILS

One of the points included here is a little bit misleading. The purchase option of 55% does not apply to all the rental payments. If it did, the purchase figures, in the forecast, would probably be considerably higher in the period 1974 thru 1975.

INFLATION

The reference to labor and burden, being 5% compounded annually, starting in 1971, appears to refer to a figure of inflationary factors that IBM considers appropriate. An inflationary growth of 5% seems to be perfectly reasonable.

The other contingencies - which are apparently for costs that are not known to occur, but which are allowed for, do not appear to be unusual, so far as this page is concerned.

IV. ASSUMPTIONS AND PRICING FACTORS (27)

A. Announcement Statistics

- Rental Plan: A (10%)
- Purchase Option: 55% (28)
- Maintenance Group: D
- Metering: Base Unit
- Warranty: A
- Per Call: 3
- Education Allowance: 10%

B. Apportionments

	Lease	Purchase
Product Cost	.1236	.1236
Engineering	.3684	.3684
Revenue	.2846	.3300

C. Labor and Burden - 5% compounded annually starting in 1971 (29)

D. Contingencies

Estimating

Hardware	9.5%
Fourth Element	12.9%
Plant Reconditioning	9.5%
Engineering 1970-71	10.0%
Engineering 1972-74	15.0%
Scrap and Rework	10.0%

30% DIRECT PROGRAMMING CONTINGENCY

The programming costs, related to the system, actual costs were aimed at being some 25% less than the figure. In estimating then, how important direct costs are, this should be taken into account.

THE GROWTH OF FE RATES

Here we see an increasing rate of FE labor, apparently to be jumped at that stage from $24.29 in 1971, to $39.15 in 1977. Other Grey Books indicate that the rate will continue to increase, if these plans are followed, for some years after that. The increase is considerably higher than the 5% compounded annually, previously mentioned. 5%, for instance, would leave the 1972 figure at a $1.22 above the $24.29, whereas the actual figure ($1.91) is considerably more.

No justification for this additional increase is known to have been provided, although we do not have a copy in the papers,now public, of the memorandum that authorized it.

As this is obviously of major interest to users, this is something that the users should investigate in detail.

Product Test	10.0%
Direct Programming	30.0%
CE Labor	
01-18, 20 and 29	20.0%
71, 72, 75	15.0%
CE Parts	20.0%

Product 6.4% of Revenue

E. Cost Source

Name	Estimate Number	Date
Hardware and Service	C-460-BY	6/10/70
Hardware and Service	C-460-BZ	6/10/70
Product Test	Memo from Mr. T. H. Sullivan	4/2/70
Programming	C-460-BY	6/10/70
Programming	D-810-FF	4/6/70

F. FE Rates

Year	Labor	Training	
		Education Center	F.I.S.
1971	$24.29	$161	$ 78
1972	$26.20	$179	$ 84
1973	$27.93	$201	$94
1974	$30.22	$226	$104
1975	$32.95	$249	$115
1976	$35.92	$272	$125
1977	$39.15	$296	$136

THE IBM 370 PAPERS

1971-1980

IBM's internal "Grey Book" reports to top management,
as revealed in Federal Court,
with companion commentary by Alan Taylor, CDP, CDE

Volume IV, System 370/165

Published by Alan Taylor & Associates
633 Central Street
Framingham, Massachusetts 01701

ABOUT THE COMMENTATOR

Alan Taylor, CDP, CDE, is an independent consultant in the computer field specializing in concept evaluation. He has worked on both hardware and software areas, and has been in the field since 1955. An early developer of English language compilers, and operating systems, his primary work since 1962 has been in the publications area. Here he is well-known as an evaluator and critic.

His first published critique of IBM 360 equipment was in April, 1964, when he reviewed the programming codes of the System 360 from the point of view of their usefulness as a working computer language. At the time he forecast that their complexity would involve the swift popularization of high level languages. In 1965 he reviewed the development of the IBM 360 Time-Sharing machine, the third and fourth memory modules; as well as the invalidities of the throughput calculations which were being used by IBM to claim that performance was 8 times that of the 7090. Subsequently the additional third and fourth memories were withdrawn by IBM and more conservative performance claims were substituted.

In 1968, taking the other side of the coin, he commented on the development of the CMS System for the same machine which made it a practical system. (CMS later became, in a modified form, the basis of the virtual storage on the IBM 370s).

In 1969 he covered the developments of the Cache Memory with the then 360/85. A prime point of Taylor's attention here was the claim made by IBM that the system had a speed of "up to 12 million instructions per second." Using IBM figures, Taylor calculated that a commercial user would be lucky to get one third of this.

Another 1972 investigation involved covering the IBM Field Maintenance area. IBM was proclaiming that their field engineers were not able to handle the maintenance of the add-on memories on System 360. During this incident, he arranged for his twelve-year-old daughter Alison to receive appropriate training. She was then photographed turning the switch which was all that was necessary to revert the system to IBM standards. Shortly after the publication of this photograph, IBM withdrew most of their objections to maintaining systems which have add-on memory installed - perhaps the biggest user advantage that has so far been obtained.

Currently Taylor is working on further publications involving the 370 peripherals and the 370 software. These are expected to be ready before the end of the year.

Taylor has been professionally active for some years, and was the first chairman of the Cobol Survey Group for the American National Standards Committee, the first editor of Computerworld, and the first president of the Society of Certified Data Processors. In 1973 he received an award for his work on the Computer Foundation Organizing Committee in helping to create the Institute for Certification of Computer Professionals. His basic belief that computers should be thoroughly described to users so that they are able to understand data processing risks as well as the opportunities is brought out in his weekly Computerworld column, "The Taylor Report."

He lives in Framingham, Massachusetts with his wife, Heather, and one daughter.

INTRODUCTION

The documents reproduced here are the IBM Grey Books. These describe the product cycle of the 370s, as planned in IBM management operations during the past few years. Some changes will have taken place in the past few months since these were updated, but comparatively few judging by the 1972 Management Committee Reports.

Under normal circumstances, computer users would not see these documents, and indeed most IBM sales employees, although they are the authorized contact between the corporation and the user, will not have seen them either. Owing to the various legal cases now proceeding, however, this data has become part of the public record, and are now available to users and salesmen alike.

In this User Edition of the IBM Grey Books, the parts that are of most interest to users have been highlighted. It was not written for users -- and so some care in reading can be expected. But the reality behind the data -- to use IBM's famous advertising slogan -- needs to be known by users. The books are, however, intended for non-technical people -- and particularly for financial review by management. No great knowledge of computer technology is required, and they should be reviewed by user financial management separately from user hardware, software and operational areas.

The material appearing on the right-hand side is taken straight from the IBM Grey Books, as they have been placed in the public record by IBM Corporation. However, the emphasis in this area has been added to make the task of user review easier.

The material on the left-hand side is commentary added by myself, hopefully to bring out various user characteristic appearing in the IBM material, while permitting the user to reveiw the original wording, so as to evaluate the points made for himself.

Numbers are used to connect the points within the commentary to the points within the material. Comments always appear opposite the page to which they apply.

This is the first time that this material, or any equivalent, has been available to users, and the formats used may well not be the best. They are designed to be useful to users. Readers are invited to suggest alterations, either to the commentary itself, or to the format used to connect commentary with original material for use in forthcoming editions.

Alan Taylor, CDP, CDE
Framingham, Massachusetts
August, 1973

WERE THE MODEL 165 CUSTOMERS "LOCKED-IN"?

The IBM Grey Book on the Model 165 is unusual. Unlike the Grey Books for the later Model 135, and 145 systems, it contains comparatively little textual material or descriptions. The product description, in five parts, is comparatively routine. No definition of the mission of the 370/165 is included in the way that the product descriptions on the smaller system were. There the product description was not merely descriptive of what the systems contained, but also as to how this fitted into the mission that they had - to obtain customers for IBM.

On the surface this absence of detail may appear unimportant. I personally have the opinion that this is the most significant finding that the 165 user will discover from the Grey Books. There are two possible reasons as to why such descriptive material does not appear. It could be because IBM product planners were so powerful that they did now have to concern management with such matters. Anyone reading the other IBM material - such as the Management Review Committee data - knows that this is not true.

Alternatively, it could be because there was no need for either the planners, or the management to concern themselves appreciably with it. Because the planned buyers were already locked into IBM to such an extent that no genuine marketing was required. Before laughing at this item, let us take a look at it.

HOW LOCKED-IN WERE PROSPECTS?

The future users of the 165 were the Models 50, 65, and to a lesser extent the 75 users. Users of these systems were running programs primarily in two major languages, Cobol and Pl/1. (There were a few Fortran users, but Fortran was not used to any great extent as the main language for these systems.

COBOL PROGRAMMERS, NOT PROGRAMS, MOBILE

The PL/1 users, of course, had no way to go. The Cobol users also had effectively no where to go if they had used any of the IBM extensions. Although Cobol is called a machine-independent language it is not genuinely so. It is possible for a Cobol programmer to move from one machine to another, but as yet the source programs that are written in the installations are not movable between different vendor machines. This is because they are not movable between different vendor compilers. The so-called IBM ANS Cobol contains many lock-in features, anyone of which makes a conversion a problem to be avoided if possible. So Cobol users too were locked-in.

Under the circumstances it appears that the expected buyers were, in fact, locked-in. The only real danger that IBM management or planners had to handle was that advanced equipment elsewhere would give such a differential improvement (either in price or performance) that their users would be prepared to migrate away from IBM. This is included in the Grey Book. But otherwise the buyer appears to be taken for granted.

It therefore seems quite reasonable to have a product description that does not take into accout the needs of the users of the previous system.

The question that users of the IBM 165 really have to face now is as to how to avoid being again locked-in to the next IBM generation. A careful study of the Grey Book should assist a user's planning process. This book is therefore dedicated to 165 users. May they get the best value that is available to them.

Alan Taylor, CDP, CDE
Framingham, Mass.,
August, 1973

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PROCESSOR PRICES INCREASED

The prices shown, however, are considerably below those currently in operation. The 3165 (I), for instance, now being $1,710,720, an increase of some $125,000-odd. The rental increase on the same system was $2,640, or about 7%.

The increase has been in the central processor, as can be seen by comparing the memory figures, the final price of the KJ system being $1,803,840 as opposed to the listed one of $1,670,400. Again the increase is $133,440.

The features similarly have shown an increase.

I. PRODUCT DESCRIPTION

A. Price Summary

TABLE 1

Description	Type No.	Model	MAC	Purchase	MMMC
Processing Unit	3165	I (512K)	$33,000	$1,584,000	$3,960
Processing Unit	3165	J (1024K)	$33,100	$1,588,800	$3,970
Processing Unit	3165	JI (1536K)	$33,500	$1,608,000	$4,000
Processing Unit	3165	K (2048K)	$33,800	$1,622,400	$4,050
Processing Unit	3165	KJ (3072K)	$34,800	$1,670,400	$4,150
Features		**Feature #**	**MAC**	**Purchase**	**MMMC**
Buffer Expansion (16K)		1432	$1,500	$ 72,000	$ 75
High Speed Multiply		4520	$2,600	$124,800	$150
Extended Channels		3850	$ 450	$ 21,600	$ 90
7070/7074 Compatibility		7117	$2,910	$139,680	$250
7080 Compatibility		7118	$2,910	$139,680	$250
709/7090/7094/7094II Compatibility		7119	$2,910	$139,680	$250
Motor Generator Set 208/230VAC, 60 Cycle		9447		$ 15,000	
440VAC, 60 Cycle		9449		$ 15,000	
*System Console		3066	$3,100	$148,000	$460
*Cooling & Power Dist. Unit		3067	$2,300	$110,400	$110

B. FUNCTION AND DESIGN

The System 370/Model 165 is a large scale processor designed for general scientific and commercial use. Its internal performance is approximately 2.5 to 5 times that of the Model 65 and 80 to 90% of the Model 85, depending on job and feature mix. It is compatible with the concurrently announced System 370/ Model 155 and is upward compatible from System 360 and thus provides a growth vehicle for Model 65 and 75 customers as well as large Model 50 customers.

The Model 165 Central Processing Unit (CPU) consists of an Instruction Unit, an Execution Unit, a Storage Control Unit (SCU), a High-Speed Buffer Storage and a Storage Control Unit.

The operation of the instruction and execution units are overlapped, permitting execution to proceed while succeeding instructions are being prepared. As many as three instructions can be in preparation while one instruction is being executed in program sequence. The instruction unit is implemented with logic circuits and the execution unit is micro-program controlled.

The Model 165 has been designed with a hierarchical storage system which combines an 80 nanosecond cycle internal buffer storage with a much larger, 2 microsecond, 4 way interleaved, stand alone main storage (Type 3360).

Processor storage is connected to the SCU via an 8 byte data path. As a result of 4 way interleaving, up to four references may be in process simultaneously.

A buffer storage capacity of 8,192 or 16,384 bytes is provided. As blocks of data are addressed in processor storage, they are brought into the buffer. The CPU can obtain 8 bytes from the buffer in 160 nanoseconds and a request can be initiated every 80 nanosecond cycle. Use of the buffer storage is transparent to the program.

Control storage consists of a Read Only Storage (ROS) and Writable Control Storage (WCS) with associated logic. Micro-programs reside in both RPS and WCS.

The Model 165 incorporates all functions of the System 360/Models 85 and 195 including:

Universal Instruction Set
Direct Control
Byte Oriented Operand
Extended Precision Floating Point
Halt Device

EMULATORS REMAIN SLOW

It is interesting to see that the emulators still are only slightly faster than the emulated systems, although now they are apparently two generations behind them. The power of old programs to lock an installation into a vendor is, of course, noted by the persistence with which IBM 7000 series computer programs continue to be used, and continue to require people to have emulators.

Also included are a new group of standard features, instructions and functions such as:

Shift and Round Decimal
Insert Characters Under Mask
Compare Logical Characters Under Mask
Store Characters Under Mask
Move Characters Long
Compare Logical Long
Time of Day Clock (1 microsecond)

Optional features consist of:

An additional 8K byte buffer than can be added to the standard 8K bytes in order to improve internal performance for programs that address storage in a more random fashion.

An extended channel feature which allows for the attachment of an additional five channels up to a total of twelve. This increases the potential data rate transfer and provides for the attachment of more I/O units.

A High Speed Multiply feature which speeds up the execution of fixed or floating point multiplications by a factor of 2 or 3.

707X, 7080 and 709X Integrated Emulators are also available with performances ranging from 1.5 to 3 times the emulated system.

Five field convertible models of the 165 are available corresponding to the five allowable processor storage configurations with 3360 Model 4's (256K Bytes) and/or Model 5's (512K Bytes).

The 3066 System Console and the 3067 Power and Coolant Distribution Unit are stand alone boxes required with each CPU. The System Console, in addition to normal control keys and switches, features a cathode-ray-tube with a 4K buffer. This gives the operator the ability to enter messages and to accept and display them, giving him full communication with the operating system. Also integrated into the console is an Indicator-Viewer, with which to display status and control indicators, and a Document Viewer for Maintenance Reference Materials.

A Motor Generator Set is required for each system. These units are not manufactured or serviced by IBM but can be ordered through IBM on a purchase-only basis.

OUTSIDE MAINTENANCE COULD ENHANCE MACHINE VALUE ENCOURAGE PURCHASE

It is noticeable that two logs of intermittants is maintained for maintenance action. Few installations are aware of the existance of these logs, and are being prepared to provide it to the customer as machine documentation. They would materially assist in the customer later selling a system. The cooperation in obtaining this enlightening detail might well make it more advisable to use an outside maintenance service, rather than IBM. This in turn would cause users to look favorably on purchase, rather than rental decisions.

Special Comment

CAN RENTAL BE ILLEGAL?

In view of the express opposition that IBM has to using the 165 for more than about five years - or one-half of its useful life (see later) a careful user will realize that he has a choice between:-

(a) Trying to reduce his current costs through maintaining the value of his system.

(b) Being prepared to accept unnecessarily high costs due to the concept that the system will be dumped before its useful life is over.

Which philosophy should be adopted is, of course, not a matter for technical decision making. For instance, local governments and corporations, and many other organizations have a duty to taxpayers, shareholders, etc., to minimize their costs.

In such cases it would appear that failing to care enough to keep records of the maintainability of the system (rather like failing to keep up with the warranty protection provided by car firms) could result in reducing unnecessarily the value of the system. This in itself could well become actionable if losses later ensue.

C. PROGRAMMING SUPPORT

The Model 165 is supported under OS/360 MFT and MVT. All OS supported language processors, data management access methods, utilities and program products will execute.

In addition to the integrated emulator programs, other highlights of the programming support include:

Recovery Management Support (RMS) to increase availability by minimizing the effect of machine malfunctions on jobs in process.

On-Line Test Executive Program (OLTEP) to provide a means for testing most input/output hardware devices concurrent with the execution of customer jobs.

D. RELIABILITY, AVAILABILITY, AND SERVICEABILITY

Reliability enhancement features are as follows:

1. CPU Hardware Instruction Retry - is effective for all instructions except Diagnose, Test and Set, Read Direct and Write Direct and reduces the unscheduled interruptions and bypasses the effect of approximately 75% of the logic intermittents. A log of these intermittents is maintained for later maintenance action.

2. ECC - (Error Checking and Correction) - in the storage units eliminates the effect of both solid and intermittent single-bit failures. ECC also detects all double bit errors and most multiple bit errors. A log of these errors is maintained for later maintenance action.

3. Buffer Delete - Hardware is provided to delete the buffer after the error threshold is exceeded. The deletion is performed by the RMS (Recovery Management Support) program.

4. Storage Reconfiguration - a manual means is provided on the System Console to logically remove a box of storage for servicing.

5. On-Line Ripple - A feature of maintenance controls that allows some off-line service capability of the storage units without requiring the system to be dedicated to maintenance.

6. Recovery Management Support - A combination of transient and resident OS/360 programs that render most intermittent and some solid hardware failures transparent to the user.

7. Hang Detector - Hardware is provided within the CPU to cause an interrupt for RMS recovery for most CPU operations which have not been completed within 16.6 MS (60 Hertz system).

FREQUENCY OF LOCK-INS SHOWN

(5) In some ways the comments about the power of lock-in are illustrated here. IBM figures note that nearly half the model 65's shipped maintain emulators, some 5 1/2 years after the announcement of the Model 360. This means that they are still dependent on programs obsoleted six years, or so ago.

Monthly expenditures continue to be made simply to avoid re-writing costs. In the meantime understanding of the programs must be dropping. I wonder how many of the installations have staff that can even read the original instructions.

(6) LEASING COMPANY SYSTEMS GIVING BETTER PRICE/PERFORMANCE

Note leasing company comment. Another factor is the indication that the function of the 370/165 is simply to replace those 360's that are being valued at the IBM prices. It is noted that the market value of these systems is less, and this apparently leads simply to a reduction of the sales of the 370's. It does not lead to a mission change of the 370's, at least not the 165's to be competitive with the replaced machines now in leasing company hands.

From this a user can reasonably conclude that IBM is not currently too concerned if users can get better value from leasing companies, than from IBM. They seem to expect it, but have taken the wider viewpoint. They have realized that their marketing forces are so much better (or at least so much bigger) than those of the leasing companies and that IBM stands to gain by ignoring any price/performance superiority of the leasing company market. That may be correct for IBM - but it certainly is not correct for the user.

BURROUGHS AGAIN PRAISED

(8) Burroughs again comes out as a star of the competitive area, with an interesting and potentially misleading comment that it is weak in the large scientific area.

The comment does not say that it is any weaker than IBM is. In fact, comments in the IBM Product Analysis book indicate that the weakness of IBM's Fortran compilers were known to significantly inhibit the use of 360's and 370's in this area.

UNIVAC SHOULD ALSO BE CONSIDERED

(7) Users, or prospects, considering the 165 are clearly put on notice here that they should consider Univac, as well as Burroughs, as alternative suppliers. As one of the big problems for any user is determining who to consider as front-runners when they are considering changing systems, it is always useful to know who the supplier of their selected system believes is directly competitive.

MARKETPLACE AND FORECAST

A. CUSTOMER SET

The Model 165 addresses the general markets served by System 360/Models 65, 67, 75, 85, 91, 195, large Model 50's and their competitive equivalents. Most Model 65 and 75 users may be expected to upgrade their installations to the 165 and these upgrades will result in large core storages. The inclusion of 7000 Series Integrated Emulators is designed to attract the users of similar emulators who amount of 321 out of 683 Model 65Is shipped worldwide through December 1969.

Multiple system installations of Model 40's and 50's, as well as those in the Model 65 class, should find it advantageous to migrate to the 165. Absorption, purchase economics and leasing company discount action will, of course, partially offset the favorable price and performance characteristics of the 165 versus the systems it is designed to replace.

B. COMPETITION

1.	Burroughs 6500	Nine (9) orders in 1969, strong in multiprogramming and multiprocessing but weak in large scientific area.
2.	CDC* 6500, 6600 & 6700	Concentrated in scientific systems as opposed to commercial.
3.	Honeywell/General Electric*	Honeywell had not been considered a significant factor in the large systems marketplace, but has been strengthened by the recent merger with General Electric's Computer Operations.
4.	RCA - Spectra 70/60 & 61	Timesharing strengths but no significant experience in high-end.
5.	Univac* - 1108	Major competitor with largest installed and on-order base.

* Expected to make announcements in the 165 range, but not before 1973

PLANNING FOR THE DEATH

The chart opposite shows that IBM was not expecting any acceptances from the 360 line, after the beginning of 1975. (Some upgrading of 155's however was expected.) This coincides with the date of the planned announcement of the successor of the 165, which, as we shall see, was for the second quarter of 1975.

LEASING COMPANY MODEL 65s

It is interesting also to note that while they expect some sales to current users, the proportion of "new and additional sales" of the 165 goes up through the years. Thus, in 1971 nearly 85% of the systems will be replacing other systems, whereas by 1974 this is down to 65%. Overall nearly 28% of the systems are expected to be expansions, rather than anything else.

WHERE ARE THE OTHER 65's?

Another interesting point, that is worth watching, is as to where the Model 65s have gone. Admittedly this is mainly a domestic chart, but the much larger number of 65s that are known to be out (683), than are down here to be converted (221), seems to call for some explanation. Where does IBM think the other 65 users will prefer to go?

PURCHASE PERCENTAGES MAKE OBSOLESCENCE WATCH NEEDED

The early purchase percentages given here (going up to 51% in 1972) are much higher than 360 purchase records. The IBM management aim is to keep purchases at a low level, approximately 10 to 14%. The incidence of such an expected high level is bound to have caused considerable consideration within the corporation.

It would appear then that it is most likely that such a percentage would be accompanied by planning, and even design decisions made as to how to inhibit the further use or value of these early purchases.

There is nothing here that indicates that such action has taken place. However, it is something that users should watch for when considering, the 155s, produced in the period 1971 thru 1973.

ACCEPTANCES BY SOURCE - DOMESTIC

Source	1971	1972	1973	1974	1975	1976	1977	Total
370/155	-	8	28	43	36	20	10	145
370/155*					5	12	5	22
360/50	9	10	2					21
360/65	34	52	16	5				107
360/67	5	11	17	12				45
360/75	5	3						8
LC 75	4	5						9
LC 65	25	48	27	12	2			114
New and Additional	15	43	56	40	38	11	—	203
Total	97	180	146	112	81	43	15	674
% Purchase	47	51	40	12	9	0	0	32

* with High Speed Memory

IBM THROUGHPUT COMPARISONS MAY BE INADEQUATE

(12) The IBM internal performance details shown here now define that they work on the Laser set of programs. As internal performance measurements are distinctly program dependant, it would appear appropriate for users of the 360 and 370 lines to band together and ask IBM for a copy of this Laser set of programs. The characteristics could then be chosen by the user group rather than by IBM.

It is particularly important for users and prospects to get genuine throughput comparisons. In such comparisons consideration should be given both to the virtues, and to the vices of the new systems.

The very slow storage speed of the 165, and the high importance of not having more than about a 10% reject rate on the cache memory, can only be tested by a set of programs that takes these points into account.

There is no evidence here that such points are taken into account by Laser. Indeed the traditional method of benchmarking is to take what appears to be a standard set of programs from the old machine, and then put them on the new machine. If anything, these programs are specifically chosen to show the virtues of the new machine. I have not seen them designed to bring out the new vices, although this is what is needed.

The validity of both the Laser programs themselves are in question until this matter is a lot more public than currently is the case.

THE COMMERCIAL THROUGHPUT

(13) In the job-stream comparison it would be noted that the 3330 has been substituted for the 2314 type disks. The job-stream itself appears to be optimized for about an JI system.

E. Performance and Thruput

Internal execution speed of variously featured Model 165's based on the LASER set of programs is as follows:

TABLE 2

	Standard M165 x M65	Standard M165 + H.S. Mult. x M65	Standard M165 + 16K Buffer x M65
Commercial (High Storage)	2.8	2.8	3.3
Scientific (High Compute)	3.8	4.4	4.1

TABLE 3

Commercial Job Stream Thruput Comparison

Base System is a Model 65-I using 2314, 2420-7 I/O Devices

CPU/Memory	I	J	J-I	K	K-J
Model 65	1.0	1.2			
Model 65*	1.3	1.5			
Model 155*	1.2	1.4	1.5	1.5	
Model 165*	2.0	2.7	3.0	3.1	3.2
Model 165 (16K Buffer)*	2.1	2.9	3.3	3.5	3.6
Model 85 (Basic)*	2.1	2.9	---	3.6	---

*Assumes 3330, 2420-7

3330 MORE IMPORTANT THAN PROCESSOR?

Here we see examples of throughput comparisons. The validity of these continues to be questionable. About the only figure that seems to be valid are those for a 165 with a 3330. This is known to be 2.3 times the power of a 65 with a 2314 at the I Model.

What percentage of this improvement is involved in the 3330's, the use of the 2420's-7, and the 2305's is not stated, nor can be estimated from the data given. (These are some figures in the IBM 155 Grey Book.)

What the improvement of the Model 65 is when it uses larger memories than the I-size is not stated. Conceivably the 2.3 figure is lower than when apples-to-apples comparisons are made. Intreguingly NO figures of pure CP performance are included.

In brief, it is clear from this that the performance of the 65 central processor is not, and never was, tne real point that IBM management was interested. By comparison what they were interested in was the performance of tne total system.

Special Comment

PRICE-PEFORMANCE BREAK-EVEN IS DERIVABLE

The total system in their estimation has a performance of 2.3 times the total 360 system with the same memory. This means to say that if the Model 165, with new peripherals costs more than 2.3 times the cost of the equivalent Model 65 with earlier peripherals, then the price-performance has gone down, rathern than up.

Later we will find what tne estimated cost of a 370/165 full installation is. This can then be compared with the market price of the Model 65, and 360 peripherals. As the market price of 360's with 2314's is reducing, at some point it will fall (if it has not already fallen) below the 2.3 factor. At this point, it will become more expensive, even on IBM's figures, to buy performance by using IBM's 370/165, rather than staying with 360's.

This is particularly useful when it is considered in the light of the details of timing given in the next page.

TABLE 4

Technical Job Stream Thruput Comparison

Base System is a Model 65-I using 2314, 2301, 2401 I/O Devices

CPU/Memory	I	J	J-I	K	K-J
Model 65	1.0	1.2			
Model 65*	1.4	1.8			
Model 155*	1.0	1.1	1.1	1.1	
Model 165*	2.3	3.4	3.7	3.8	3.8
Model 165 (H.S. Mult.)*	2.4	3.8	4.1	4.3	4.3
Model 165 (16K Buffer)*	2.4	3.8	4.1	4.3	4.3
Model 85 (Basic)*	2.4	4.0	---	4.5	---

*Assumes 2305, 3330, 2420-7

THE 165 LEADS WAY TO 370 OBSOLESCENCE

16 The table opposite may be a bit confusing, but in fact it is one of the most informative of the whole area. It shows the order in which the Future Systems (which are planned to obsolete the 370 line) are to be announced. This is of particular interest to Model 165 users, as their replacement systems are to be announced in the second quarter of 1975, and delivered a year later. These will be the first of the large quantity FS systems. The 165 user has been elected to be the pioneer into the new way.

NO TIMELY CHOICE PLANNED

At the time the IBM salesmen came pounding at the door to replace your 165, the only choice they will be offering will be the follow-on of the 195, a 195 itself, or the Future System replacing the 165, at whatever increased price IBM feels that the 165 users will be prepared to pay.

The natural actual successor to the 165 - the Future System that has the power, but a reduced rental, will not be announced (according to this) until halfway through 1977, nearly two years later.

17 1975/77 DANGER OF IBM OVERSELLING

Special Comment

This indicates that Model 165 users should plan for not being rushed into making decisions during the 1975/77 period, and also should expect rushing to occur. IBM may be planning for your account from the Chairman of the Boards angle, and including a study of your power structure. This was instructed as policy in 1972. It uses a 5-7 year time-frame. (See MRC Minutes)

Perhaps you should now alert your management about the 75/77 danger period, so that they can be learned beforehand.

F. Announcement Calendar

Figure 2.

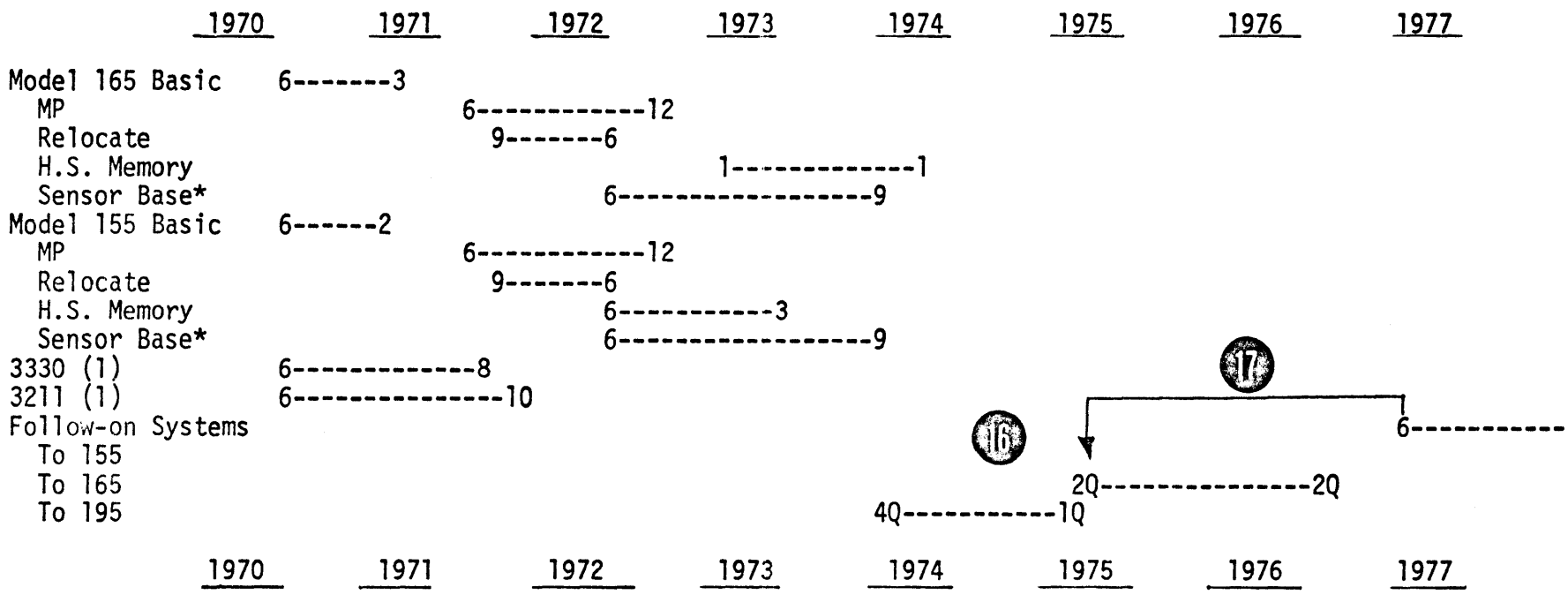
Major hardware announce and ship dates affecting the Model 165 are shown below:

Legend

1970 1971

6----------9

This representa an announcement in 6/70 followed by a first customer shipment in 9/71



*Priority Interrupt and Basic Channel Adapter features; 18XX attachable to 165
(1) Availability on Model 165

165 DEVELOPMENT PRACTICALLY OVER

18 One other point of considerable interest is noticing that the 165 development has practically ceased. The major development still to come is adding the 1800 systems as a front-end to permit process control, and other real-time operations to be carried on on the Model 165, above the normal time-sharing and batch operations.

To what extent this is a reasonably economical way of handling real-time systems is not clear, even in those installations which have this need.

For other installations, it is fairly obvious that the 370 scene that they see now (including the 168's, which are placing together of the RELOCATE and high speed memory announcements) is now being allowed to be followed, so that it can be replaced by the Future System.

SOFTWARE ENHANCEMENTS PRACTICALLY OVER

19 The software picture merely brings out the same story as the hardware enhancements. Enhancement of the use of the 370/165 appears now to have practically ceased, with the releasing of a multiprocessing system with virtual support of the MFTR.

Major software announce and ship dates affecting the Model 165 are tabulated below.

TABLE 5

	Announce	Ship
Multiprocessing Support		
MVT	6/71	4/73
Time Sharing and Relocate Support		
TSS	9/71	6/72
CP67	9/71	12/72
MFTR	9/71	6/72
Multiprocessing with Relocate Support		
MVTR	12/72	12/73
MFTR	6/73	6/74

USER GROUPS STRENGTHS LISTED

(20) Manufacturing, utilities, and Federal systems can see that there is sufficient known interest in the 165, for each of them to have a responsible position, as representative users. Model 165 committees in each of these groups should be formed to protect their interests.

Special Comment

(21) INDEPENDENT INDUSTRY USER GROUPS NEEDED

Equally other user-areas now see how they stand. While manufacturing, etc., can probably stand alone, it would look as though it would be more efficient if the other areas joined together. (It is also important to notice here that in 1972 - after this Grey Book was published - the IBM philosophy started to change. The new systems that are being talked about are said to be designed for users. The concept seems to be that although they are to be made from standard modules they are to be marketed separately. This has many dangers for the user groups, and makes the development of industry-organized user groups independent of Share, an urgent user necessity.

G. INDUSTRY ALLOCATION

TABLE 8

	%
Service and Consultants	2.4
Distribution	2.9
Education	5.2
Finance	8.1
State and Local Government	1.4
Medical	---
Printing and Publishing	2.3
Manufacturing	23.0
Insurance	10.7
Process	9.7
Transportation	6.3
Utilities	13.9
Federal	13.1
SBC	1.0
	100.0

WHO CARES ABOUT FASTER CP'S?

The subject included in these comments in the Grey Book are themselves often interesting. However it is the odd pieces of information incorporated into the material which often make even stronger reasons to study the Grey Books.

For instance, note the order of priorities of expected user interests listed here. The new input/output, and better channels, apparently a reference to the 3330 type drive, is at the head of the list. The faster CPU is at the bottom!

If these are genuinely IBM's reasons for thinking that the 165 is a saleable item - as it has turned out to be - it really does not make too much sense. After all that could be a description of why people should have gone to the 155, as opposed to the 165. It has the same I/O, reasonable channels, and a cheaper "CPU".

H. FORECAST COMMENTARY

The forecast is based on Plan 26 System/360 levels and assumes 1971 manufacturing constraints of 97 acceptances for the Model 165. The 1971 constraint of 490 3330 facilities has also been assumed.

The relocate and multiprocessing features were assumed to be available to all customers equally. Thus, customers who purchased early systems requiring extensive engineering changes to accomplish the feature attachments will not pay a premium price.

The forecast assumed that customer motivations for installing the Model 165 were, in order of priority:

1. New I/O and better channels
2. Integrated Emulators
3. More and cheaper core
4. Faster CPU

System drag-along included in the forecast was:

TSS and CP 67	20 accepts including both 360/67's and New and Additional
Sensor Base	16 accepts
Relocate	Included but not identified
Multiprocessing	Included but not identified

Forecast confidence limits were $\pm$ 20%.

TAPE, COMMUNICATION CHANGES PLANNED

(23) For planning purposes the details in these tables are extremely interesting. Whether it can be really regarded as being accurate, even for planning for users, depends upon how much you believe there will be decreased core requirement resulting from the implementation of RELOCATE (which is the IBM way of referring to virtual storage). I do not.

(24) Even so, there are some very interesting points here. Note imparticular the increase in the tape usage, nearly doubling from 19,919 in 1971 to 19,326. The key point here may be the development of the Oak project, with its wide tape cartridges.

Outside the tape changes, also note the increase in communication facilities, which doubles in the five years.

USING THE FIGURES

(25) The details used here can be used in planning your own installation, and budgeting for future expenses. It certainly should be shown to your financial people to help indicate which pieces of equipment to be purchased, as opposed to which should be rented, approximately what areas are expected to have revolutionary changes, and where the current equipment styles are apparently going to stay stable during the period.

III. FINANCIAL COMMENTARY

I. System Point Value

TABLE 7

Average System Point Value

Year	1971	1972	1973	1974	1975	1976
CPU, Memory	52,534	52,400	52,014	49,866	49,751	49,505
Features	3,526	3,604	4,870	5,965	6,502	6,930
Channels	8,730	10,000	10,660	11,300	11,400	11,400
Sub-total	64,610	66,004	67,544	67,131	67,653	67,835
Tape	9,919	9,834	10,308	13,038	16,677	19,326
DASD	18,965	21,816	22,095	22,753	22,596	22,115
Printers	3,350	4,744	4,755	4,885	4,953	5,020
Card I/O	810	1,005	1,082	1,142	1,238	1,234
Communications	1,419	1,739	2,030	2,269	2,627	2,976
Sub-total	34,463	39,138	40,270	44,087	48,091	50,671
Total	99,073	105,142	107,814	111,218	115,744	118,506

Notes:

(1) Decline in CPU, Memory point value results from migration of larger core to the High Speed Memory version of the 165 and to a decreased core requirement resulting from the implementation of Relocate.

(2) Average Feature point values in the 1972 thru 1976 period include unannounced features - MP, Relocate, Sensor Base amounting to: 1972 - 100 points, 1973 - 1492 points, 1974 - 2690 points, 1975 - 3298 points, 1976 - 3710 points.

26 The commentary included in the 7 parts of the financial comentary is not directly of great interest to the users, but includes some financial characteristics that are worth noticing - in the same way that the previous chart did. It can therefore be used as a basis for budgeting.

INPUT/OUTPUT SHOWS 35% PROFIT

27

Here we see what the actual profits that IBM expects to make on the system are. The fact that the sales suggest under 4 billion dollars, and still leaving IBM in free possession of nearly half the 165's in the world, is only of minor interest. What is of direct user interest is noticing that the input/output is making a 35% profit, after all development and other costs have been paid in a period of four years.

A. SUMMARY P & L - Pricing Life (48 Months) (26)

($ Millions)	Announcement	
	Domestic	Worldwide
Revenue		
CPU & Features	$1031	$1680
I/O	$1442	$2211
Total	$2473	$3891
Profit		
CPU & Features	$ 235	$ 423
I/O	$ 508	$ 784
Total	$ 743	$1207
%		
CPU & Features	22.8	25.2 (27)
I/O	35.2	35.5
Total	30.0	31.0

Note: CPU includes Console (3066) and PDU/CDU (3067)
I/O includes Memory (3360)

THE TWO LIVES OF IBM SYSTEMS

(28) Before reading further, the difference between pricing life, and forecast life, should be understood.

The pricing life of a system in IBM balance is the kind that they expected to be profitable in with regard to calculated time. The forecast life is the time that they expect to continue to rent it. Thus, the figure here of 36.9% profit for I/O being (some 1.7% higher than the figure shown on the previous page) simply indicates that in the additional six months that the planners expect the system to remain on rental after the four years pricing life has (29) been completed, a further profit of some 1.7% will accrue on the total reserve picture, including the 4 years revenues. (I have not checked the math here, but this figure seems to be inconsistent with other data.)

B. Summary P & L - Forecast Life (54.9 Months)

	Domestic Announcement			
	Build Quantity	Revenue	Profit	Profit %
CPU & Features	592	$1110	$278	25.0%
I/O	-	$1572	$580	36.9%
Total	592	$2682	$858	32.0%

Notes:

1) CPU includes Console (3066) and PDU/CDU (3067)
   I/O includes Memory (3360)

2) All analyses to follow are based on Forecast Life

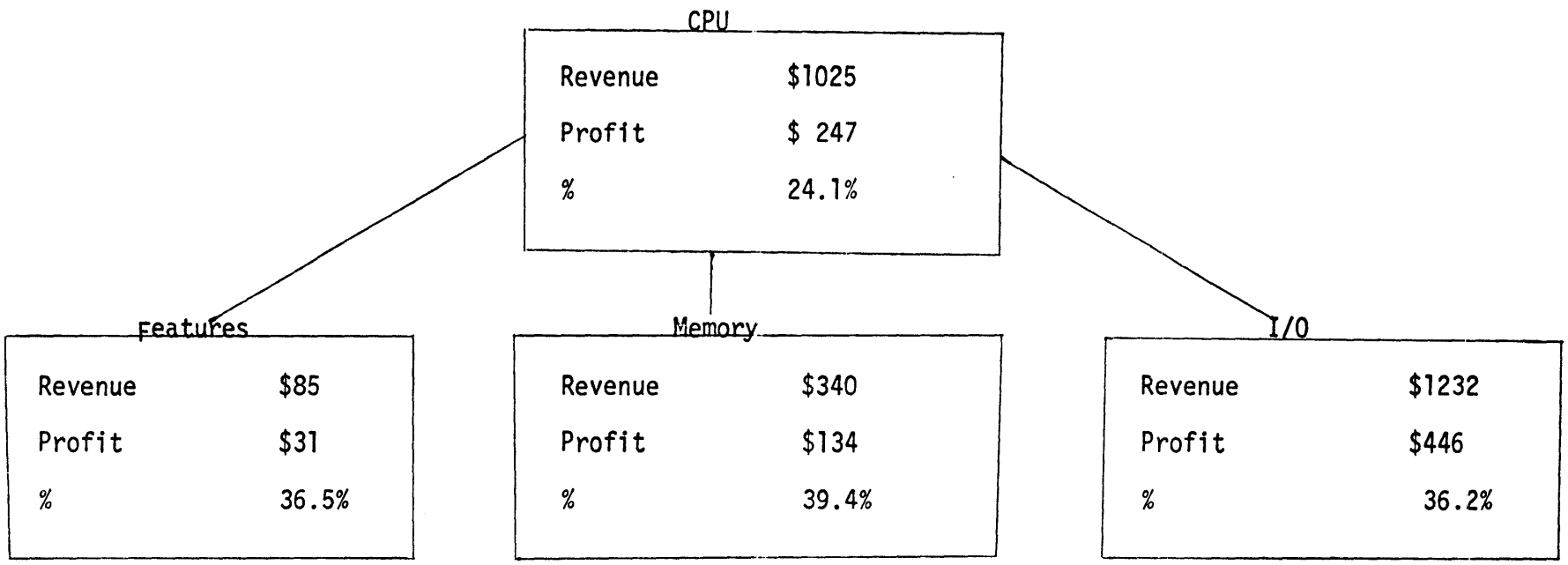
3) Announced Product Cost Commitment (Phase 3A) estimate not available for Greybook Analysis. Phase III estimates have been used.

4) I/O Profitability obtained from the Business Effects Model.

NET EARNINGS SHOWN

The chart does not mention it, but these figures actually refer to the domestic area only. They are simply a re-statement of the previous figures with additional showing of the net before taxes on the revenue.

30 System 370 Model 165
($ in Millions) Forecast Life



Percent of Total	Revenue	NBT
CPU	38.2	28.8
Features	3.2	3.6
Memory	12.7	15.6
I/O	45.9	52.0
	100.0	100.0

Total System	
Builds	592
Revenue	$2682
Profit	858
%	32.0%

HOW MUCH DID YOU SAY IT COST?

One of the IBM arguments that has always been raised to counter claim of high profits, or high prices, has been the fact that development of CPU's costs a great deal, and that so do product tests, and other such items.

Here we see the actual figures.

The total direct cost of the system is 37.6% of the expected revenue.

The development and product engineering costs were of the entire program, were less than 2% of the revenue, totalling $18 million.

Programming tests, and product tests, were only 1% of revenue - $9 million.

So bang, goes the idea that there is any serious large scale investment, so far as development, etc. is concerned. In fact, looking at the figures it can be seen that by 1971 IBM had already recovered all its direct cost of the program, plus half again towards its overhead.

Detail CPU P & L

	Prior	1970	1971	1972	1973	1974	1975	1976	Balance	Total Program	% of Revenue
Revenue											
Lease	-	-	12.1	44.8	82.7	110.9	122.2	112.5	149.7	634.9	62.0
Purchase	-	-	83.0	164.2	106.5	23.5	12.7	-	-	389.9	38.0
Total	-	-	95.1	209.0	189.2	134.4	134.9	112.5	149.7	1024.8	100.0
Direct Cost											
Product Cost	1.5	9.0	42.3	67.8	58.9	37.2	10.4	-	-	227.1	22.
Plant & Field Recon.	-	-	-	.1	.5	2.1	3.8	2.6	.9	10.0	
Field Engineering											
Labor	-	-	3.9	9.6	11.6	12.1	11.0	9.7	16.4	74.3	7.1
Parts		-	.6	3.6	3.1	3.4	5.7	6.3	4.5	27.2	2.8
Training		1.6	5.0	4.8	4.5	2.2	1.0	-	-	19.1	1.9
Total	-	1.6	9.5	18.0	19.2	17.7	17.7	16.0	20.9	120.6	11.8
Dev. & Prod. Eng.	5.4	4.3	3.7	2.2	1.5	1.0	.4	-	-	18.5	1.8
Prog., S & R, Prod. Test	.4	2.0	3.7	1.7	.8	.6	.1	-	-	9.3	.9
Total Direct Cost	7.3	16.9	59.2	89.8	80.9	58.6	32.4	18.6	21.8	385.5	37.6
Apportionments										330.9	32.3
Profit Protection										61.5	6.0
Total Cost & Expenses										777.9	75.9
Net Profit Before Tax										246.9	24.1

SOME DETAIL ON MAINTENANCE PRICE BREAKDOWN

The maintenance prices here are simply that - actual prices. They do not relate to the actual costs.

At the same time Model 165 users have certain advantages over smaller 370's. To start with the planners included training, even though some of the training is charged in the maintenance costs. Some of the other 370 systems had no provision for back-fill training! Apparently the FE's were expected to pick everything on the job.

Happy days.

Most of the other areas here are of no great interest to the user.

F. Maintenance Prices - 3165, 3066, 3067

	3165 Model					3066	3067
	I	J	JI	K	KJ	Console	PDU/CDU
Labor							
Code 01-18	$965	$970	$985	$1010	$1060	$165	$ 40
Code 75	$555	$555	$555	$555	$ 555	-	-
Training	$470	$470	$470	$470	$ 470	$ 30	$ 39
	$1990	$1995	$2010	$2035	$2085	$195	$79
Parts	$1970	$1975	$1990	$2015	$2065	$265	$31
Total Price	$3960	$3970	$4000	$4050	$4150	$460	$110

Notes:

(1) 12 month warranty
(2) 01-18 Uplife - 5%
(3) Prime Shift - 80%
(4) General System selling price rates excluding education (Dated May 1, 1970)
(5) 33% of Training per purchase build recovered in the MMMC, 67% in the purchase price
(6) Training Recovery period - 47 months
(7) RETAIN/370 and problem determination effect included.
(8) Parts Selling Price markup 3165-6.95 3066/3067 - 6.0
(9) Parts are net of rework credit
(10) Spare Parts - 9% uplift on Gross maintenance parts
(11) Parts and Hours reflect CD May 15, 1970 estimate of failure rates (MST-4 .0050 @75K hrs.)

MAINTENANCE FIGURES FOR 1975

The committee rental life of 6 years is not understood, but certainly the concept of obsoleting the systems starting in 1976, or pricing them based on a four year life when they have an economic life of 7 1/2 years, indicates that automatic leasing is something that users should be aware of.

G. RESP

	CPU 3165	Console 3066	PDU/CDU 3067
Committee Rental Life (Mos)	72	72	72
Maintenance Hours (1975)	22.2	2.5	.6
Maintenance Parts (1975)	$258	$51	$6
Maintenance Rate (1975)	$45.70	$45.70	$45.70
Cost Mark Up	4.7	4.2	4.2
Capitalized Value	$339,800	$38,750	$37,400
Average Point Value	$32,400	$3,100	$2,300
Average Purchase Price	$1,555,200	$148,800	$110,400
Purchase Months	48	48	48
RESP	$1,909,677	$177,401	$138,887
RESP Months	58.9	57.2	60.4

THE IBM ASSUMPTIONS

This material has in general been available to users. It is included here simply because it is in the Grey Books, rather than for any other purpose.

IV. ASSUMPTIONS AND PRICING FACTORS

A. Announcement Statistics

	3165 CPU	3066 Console	3067 PDU/CDU
-Rental Plan:	A (10%)	A (10%)	A (10%)
-Purchase Option:	55%	55%	55%
-Maintenance Group:	D	D	A
-Metering:	Base Unit	Base Unit*	Base Unit
-Warranty:	A	A	B
-Per Call:	3	3	3
-Education Allowance:	10%	10%	10%

* Meters both 3165 and 3067

B. Apportionments

	Lease	Purchase
Product Cost	.1246	.1236
Engineering	.3684	.3684
Revenue	.2576	.3300

C. Labor and Burden

5% Compounded Annually Starting in 1971.

THE BREAKDOWN OF CONTINGENCIES

The details here, while apparently of importance to IBM management, have no real interest to users of the system.

D. Contingencies

Estimating

Hardware - Base CPU	12%
Hooks	25%
Console - PDU/CDU	15%
Fourth Element	15%
Plant Reconditioning	20%
Engineering	18%
Scrap & Rework	12%
Product Test	10%
Direct Programming	20%
CE Labor	
Codes 01-18	10%
Codes 20, 29, 31	15%
Codes 71, 72, 75	15%
CE Parts	10%

Product

6.0% of Revenue

THE PLANNED 10% ANNUAL FE INCREASE

The increasing cost of FEs, as planned here to go from $24/hour to $39/hour or 62% in 6 years is a point that is mentioned in the other Grey Books only there the increases can continue into the 1980s.

At the time the IBM management policy was assumming no major inflation in the US. Exactly what is behind these long-term steeply increasing rates, is a mystery. It is, of course, another reason why users should be considering the advantages of purchasing IBM systems if they want to use IBM systems, or else considering alternative vendors.

E. Cost Source

Name	Estimate Number	Date
Hardware - Bundled	C-460-BU	May 18, 1970
Unbundled	C-460-BX	May 18, 1970
Hardware - Hooks	C-460-BV	April 17, 1970
Service	C-460-BU	May 18, 1970
Service	C-460-BV	April 17, 1970
Product Test	Memo from T. H. Sullivan	March 19, 1970
Programming	C-460-BU	May 18, 1970

F. FE Rates - Letter from R. P. Ten Dyke, dated May 5, 1970

Year	Labor	Training Education Center	F.I.S.
1971	$24.29	$161	$ 78
1972	$26.20	$179	$ 84
1973	$27.93	$201	$ 94
1974	$30.22	$226	$104
1975	$32.95	$249	$115
1976	$35.92	$272	$125
1977	$39.15	$296	$136

THE FIVE LIVES OF THE MODEL 165

Previously we have noted two different rental lives of the Model 165, Pricing and Forecast lives. There are other lives, however, which are not mentioned so much. Yet these are of greater interest to users than the others, as they involve the life of the equipment itself, rather than the impact of pricing decisions, replacement machines, etc.

These include the physical life, and the economic life - shown opposite. Planning without knowing these lives is missing some vital material - and here are the IBM statements about them now, public for the first time ever, so far as I am aware.

They show that prices are based upon the idea that the rented systems will only be kept on rental for 53% of their economic life - and for 33% of their physical life. Clearly, users who are able to arrange that the usage of systems comes to a little more than 53% of the economic life will be able to obtain better value for themselves through avoiding rental.

G. Mark Ups

Maintenance Parts	1.64
Engineering Change Parts	1.18

(Applied to Gross Parts Cost, include Spare Parts mark-up)

H. Other

Forecast Life	54.9 months
Pricing Life	48.0 months
Physical Life	12.0 months
Economic Life	90.0 months
Committee Rental Life	72.0 months
Additional Use Activity	5.0% of Regular Shift

40

Builds

Lease	293
Purchase	216
Internal	83
Total	592