

IBM System/370 Model 135

▷ current price/performance gap between the largest System/3 and the smallest System/370 model, it seems clear that at least one more member of the System/370 family (Model 125?) remains to be announced.

Users of the System/360 Model 40 are certain to view the Model 135 with great interest. For them, the new model offers significantly higher performance together with modest reductions in equipment costs. Needless to say, IBM will not encourage this type of conversion.

The appeal of the System/370 Model 135, like that of the Model 145, is by no means limited to current users of the System/360. The Model 135 offers a combination of virtues that few buyers of small-to-medium-scale computers can afford to ignore: impressive price/performance, advanced hardware technology, high-performance peripheral equipment, and proven software—all this, and an IBM nameplate, too. Against these virtues, the prospective buyer must weigh the disadvantages of IBM's unbundled support and relatively inefficient software. On balance, it's absolutely safe to conclude that a great many computer buyers will choose the Model 135 during the next few years. □

▶ for the System/370 Model 135, however, is provided at only two basic levels: the Disk Operating System (DOS) and the MFT (Multiprogramming with a Fixed Number of Tasks) version of the Operating System/360 (OS).

All of the following facilities are supported under both DOS and OS for the Model 135: the new System/370 instructions, byte boundary alignment, extended precision floating-point, interval timer, integrated emulation of the IBM 1401/1440/1460, processing of ASCII-mode tapes, Integrated File Adapter, Integrated Communications Adapter, 3210 Model 1 and 3215 Console Printer-Keyboards, 3211 Printer, 3505 Card Reader, 3525 Card Punch, 3330 Disk Storage, 3803/3420 Magnetic Tape Subsystem, Recovery Management Support (RMS), and the On-Line Test Executive Program (OLTEP).

The following facilities are supported only under OS for the Model 135: Block Multiplexer Channels, the Time-of-Day Clock, and the DOS Emulator Program.

Since the System/370 is compatible with the System/360 and operates under control of essentially the same software, the great variety of system/360 DOS and OS compilers, assemblers, utilities, application packages, etc., is also available, for the most part, for use with the System/370. Complete descriptions of the DOS and OS software facilities can be found in Report 70C-491-03.

Along with its introduction of the System/370 Models 155 and 165 in June 1970, IBM announced a number of new and enhanced software products, all of which are also usable on Model 135. These are described in Report 70C-491-04. Most of the new software products are offered for use under a licensing agreement at separate monthly charges ranging from \$40 to \$1,060.

PRICING

EQUIPMENT: The following systems illustrate typical Model 135 configurations. All necessary control units and adapters are included in the indicated prices, and the quoted rental prices include equipment maintenance.

SMALL DISK SYSTEM: Consists of 98K Model 135 Processing Unit with Integrated File Adapter, 2319 Disk Storage Facility (3 drives, 87 million bytes total), 3505 Model B1 Card Reader, 3525 Model P2 Card Punch, 1403 Model 2 Printer, and 3210 Model 1 Console Printer-Key-board. Monthly rental and purchase prices are approximately \$10,300 and \$476,000, respectively.

TAPE/DISK SYSTEM: Consists of 245K Model 135 Processing Unit with Integrated File Adapter, two Selector Channels, and 12K Control Storage Expansion, 2319 Disk Storage Facility with one additional 2312 Disk Drive (4 drives, 116 million bytes total), eight 3420 Model 3 Magnetic Tape Units (120KB) and dual tape controls, 3505 Model B2 Card Reader, 3525 Model P3 Card Punch, 1403 Model N1 Printer, and 3210 Model 1 Console Printer-Key-board. Monthly rental and purchase prices are approximately \$19,700 and \$869,000, respectively.

SOFTWARE: System/360 software which was being distributed by the IBM Program Library as of June 23, 1969, will be available to System/370 users at no additional charge. All subsequent IBM programming announcements (except for certain modifications and improvements of existing IBM programs) are designated as either System Control Programming or Program Products.

System Control Programming provides functions which are fundamental to the operation and maintenance of a system (e.g., loading, scheduling, supervising, and data management) and is available without charge.

Program Products are related to the application of a system to user tasks (e.g., compilers, utility programs, and application programs). These are offered on an individual-charge basis (see Report 70C-491-03).

SUPPORT: IBM Systems Engineering assistance is available to Model 135 users at a basic rate of \$28 per hour.

EDUCATION: IBM "Professional Courses" are now individually priced. System Features Instruction is offered to users of IBM data processing equipment at no charge. Customer Executive Seminars, Industry Seminars, and promotional sessions are still offered at no charge by IBM invitation.

CONTRACT TERMS: The standard IBM rental contract includes equipment maintenance and entitles the customer to up to 176 hours of billable time per month. Time used in excess of that amount is charged for, on all machines equipped with meters, at an extra-use rate. This rate, for most System/370 components, is 10% of the basic hourly rate (i.e., 10% of 1/176 of the monthly rental for each hour of extra use).

IBM's new fixed-term lease plan, introduced on June 1, 1971, offers price reductions of 8 or 16 percent from the short-term monthly rental rates to users willing to sign a 12-month or 24-month rental rates to users willing to sign a 12-month or 24-month contract, respectively. The fixed-term leases apply to nearly all of the System/370 magnetic tape, disk, drum, and printer units and to the associated control units and features, but not to the mainframes or other types of peripheral devices. Extra-use charges are eliminated under these leases, and up to two years of purchase option accruals are available. ■

IBM System/370 Model 135
EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (short-term lease)*</u>
PROCESSOR AND MAIN STORAGE				
3135	Processing Unit			
	Model FE; 98,304 bytes	281,230	570.00	5,670
	Model GD; 147,456 bytes	325,255	610.00	6,570
	Model GF; 196,608 bytes	369,280	650.00	7,470
	Model DH; 245,760 bytes	413,305	690.00	8,370
3046	Power Unit (required for 3135)	15,550	33.00	324
PROCESSOR FEATURES				
1421	Block Multiplexer Channel	No charge	No charge	No charge
3274	Direct Control	5,830	1.00	118
3840	Extended Precision Floating-Point	1,330	1.00	27
3900	Floating-Point	No charge	No charge	No charge
3905	48 Additional Multiplexer Subchannels	No charge	No charge	No charge
4457	IBM 1401/1440/1460 Compatibility	No charge	No charge	No charge
4650	Integrated File Adapter (IFA)	25,340	14.00	510
4640	Integrated Communications Adapter (ICA)	10,670	26.00	216
4722	Second Line on ICA	2,130	6.00	43
4723	Third Line on ICA	4,265	11.00	86
4724	Fourth Line on ICA	2,130	6.00	43
4725	Fifth Line on ICA	6,365	17.00	129
4726	Sixth Line on ICA	2,130	6.00	43
4727	Seventh Line on ICA	2,130	6.00	43
4728	Eighth Line on ICA	2,130	6.00	43
4662	Integrated Printer Adapter for 1403 Model 2	17,785	25.00	360
4667	Integrated Printer Adapter for 1403 Model 7	17,785	25.00	360
4668	Integrated Printer Adapter for 1403 Model N1	17,785	25.00	360
6981	Selector Channel No. 1	9,335	5.00	189
6982	Selector Channel No. 2	8,000	5.00	162
7861	Control Storage Expansion; 1st 12K Increment	11,005	23.00	225
7862	Control Storage Expansion; 2nd 12K Increment	11,005	23.00	225
7844	Adapter for 3210-1 Console Printer-Keybaord	5,335	4.00	108
7845	Adapter for 3215 Console Printer-Keybaord	9,040	6.00	183
3210-1	Console Printer-Keybaord; 15 char/sec	5,600	85.00	175
3215	Console Printer-Keybaord; 85 char/sec	8,000	55.00	200
INPUT/OUTPUT UNITS				
3505	Card Reader			
	Model B1; 800 cpm	28,250	85.00	565
	Model B2; 1200 cpm	29,250	115.00	670
5450	Optical Mark Read (for 3505)	7,950	35.00	185
6122	Read Column Eliminate (for 3505)	No charge	No charge	No charge
6555	Selective Stacker (for 3505)	2,250	7.00	50
6777	Special Feature Adapter (for 3505)	250	0.50	5
8103	3505 Punch Adapter (for 3505)	4,750	3.00	95
8105	3525 Read/Punch Adapter (for 3505)	5,250	3.50	120
8101	3525 Multi-Line Print Control (for 3505)	3,000	4.00	60
8107	3525 Two-Line Print Control (for 3505)	3,000	4.00	60
3525	Card Punch			
	Model P1; 100 cpm	20,000	60.00	400
	Model P2; 200 cpm	20,800	80.00	505
	Model P3; 300 cpm	21,600	100.00	610
1533	Card Read Feature (for 3525)	6,000	15.00	120
5272	Multi-Line Card Print (for 3525)	14,220	83.00	350
8338	Two-Line Card Print (for 3525)	13,920	68.00	290

* Rental prices include equipment maintenance.

NOTE: Please refer to the IBM System/360 Equipment Prices (Report 70C-491-03) for prices of the other peripheral equipment and IBM Program Products that can be used with a System/370 Processing Unit.

2319 A1 A3

IBM System/370 Model 135

NEW PRODUCT ANNOUNCEMENTS

INTEGRATED PRINTER ADAPTER: In June 1971, IBM announced an Integrated Printer Adapter that permits one 1403 Printer (Model 2, 7, or N1) to be connected directly to a Model 135 Processing Unit. The new adapter, which is field-installable, sells for \$17,765 or rents for \$360 per month. (The 2821 Model 2 Control Unit, which the new adapter replaces, sells for \$23,040 or rents for \$600 per month.) Customer deliveries of the Integrated Printer Adapter are scheduled to begin in November 1972.

NO-CHARGE ENHANCEMENTS: In July 1971, IBM announced four new features that can be field-installed on a Model 135 Processing Unit to extend its capabilities at no additional purchase or rental cost:

- *Integrated File Adapter Extension:* The IFA Extension increases from five to eight the maximum number of 2314-type disk drives that can be connected to a Model 135 via the IFA. The capacity increase is achieved by adding a new model of 2319 Disk Storage, Model A3, to the basic 2319 Model A1 unit. The 2319 Model A3 is a 3-drive unit with an on-line storage capacity of 87,528,000 bytes; it rents for \$1,050 per month and sells for \$38,475, with maintenance priced at \$220 per month. Deliveries of the IFA Extension and the 2319 Model A3 will begin in July 1972.
- *128 or 256 Multiplexer Subchannels:* These features extend the number of multiplexer subchannels from 64 (the previous maximum) to either 128 or 256. With 128 subchannels, up to 8 of the subchannels can be shared. With 256 subchannels, however, there are no shared subchannels. Deliveries of these features will begin in May 1972. OS (MFT) supports the full complement of 256 subchannels, whereas DOS supports a maximum of 222.
- *2711 Attachment:* This feature permits an IBM 2711 Line Adapter Unit to be connected to a Model 135 through the Integrated Communications Adapter (ICA). One IBM Line Adapter (#4647) is required in the 2711 for each start/stop line connected to the ICA. Transmission speeds of up to 600 bits per second can be accommodated. The 2711 Attachment feature will become available to Model 135 users in July 1972.
- *System/360 Model 20 Compatibility:* This new emulation feature will enable users of an IBM 360/20 (or a 360/25 in Model 20 mode) to run most of their existing programs on a Model 135 as part of a DOS job stream. Prerequisites for the emulating Model 135 system are: (1) the I/O devices required by DOS; (2) the I/O devices required to emulate the Model 20 I/O units; (3) sufficient main storage to hold the DOS Supervisor (at least 12K bytes), the emulator routines (8K to 17K), and the emulated Model 20 storage (4K to 32K); and (4) sufficient Reloadable Control Storage to hold the Model 20 Compatibility feature. The feature and the associated DOS software support are scheduled for delivery in December 1972. □

IBM System/370 Model 135



This view of the Model 135 console shows the small, read-only disk drive (top center) that is used to load the system control microprograms into reloadable control storage.

MANAGEMENT SUMMARY

The Model 135 is the fourth member of IBM's new System/370 product line and the smallest announced to date. Introduced on March 8, 1971, the Model 135 has most of the same distinctive features as the faster Model 145: semiconductor main memory, reloadable control storage, integrated disk control logic, improved reliability, and a high degree of compatibility with the earlier IBM System/360 computers. In addition, the Model 135 offers an Integrated Communications Adapter that provides low-cost control facilities for up to eight data communications lines.

The Model 135 is designed to serve as an effective upgrade machine for current users of the System/360 Models 25 and 30. For these users, the Model 135 provides greatly increased internal speed, memory capacity, and input/output capabilities with little or no need for reprogramming.

Initial customer deliveries of the Model 135 are scheduled for May 1972. Developed at the IBM laboratory in ▷

The Model 135 features semiconductor main memory, flexible microprogrammed control, low-cost disk storage, and an integrated communications control. It offers dramatic performance improvements over the System/360 Model 30 at a modest increase in price, and requires little or no reprogramming.

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, 1133 Westchester Avenue, White Plains, New York 10604.

MODELS: System/370 Model 135.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two consecutive bytes form a "halfword" of 16 bits, while 4 consecutive bytes form a 32-bit "word."

FIXED-POINT OPERANDS: Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; 1 halfword (16 bits) or 1 word (32 bits) in binary mode.

FLOATING-POINT OPERANDS: 1 word, consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 2 words, consisting of 56-bit fraction and 7-bit hexadecimal exponent, in "long" format; or 4 words in "extended precision" format.

INSTRUCTIONS: 2, 4, or 6 bytes in length, specifying 0, 1, or 2 memory addresses, respectively.

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

TYPE: Monolithic integrated circuits (bipolar LSD).

CAPACITY: Four models of the 3135 Processing Unit are available:

Model FE	—	98,304 bytes
Model GD	—	147,456 bytes
Model GF	—	196,608 bytes
Model DH	—	245,760 bytes

CYCLE TIME: 770 nanoseconds per 2-byte access for reading, 935 nanoseconds per 2-byte access for writing, and 660 nanoseconds for a "cycle steal" operation.

CHECKING: All data paths between the central processor and main storage are parity-checked by byte. When data is stored, an error-correcting code is substituted for the parity bits. (An 8-bit modified Hamming code is appended to each 8-byte "doubleword" of data.) When the data is retrieved, single-bit errors are detected and corrected automatically, and most multiple-bit errors are detected and signalled so that appropriate program action can be taken.

STORAGE PROTECTION: The Store and Fetch Protection features, which guard against inadvertent overwriting and/or unauthorized reading of data in specified 2048-byte blocks of storage, are standard in Model 135. ▶

IBM System/370 Model 135

▷ Hursley Park, England, the Model 135 will be manufactured in Kingston, New York, Havant, England, and Fujisawa, Japan.

Monthly rentals for typical Model 135 configurations range from about \$9,800 to \$22,600, with purchase prices ranging from about \$467,000 to \$1,068,000. Thus, the Model 135 is priced between System/360 Models 30 and 40, while its performance substantially exceeds that of the Model 40.

Concurrently with the Model 135, IBM announced three significant new peripheral devices; the 3505 Card Reader, 3525 Card Punch, and 3735 Programmable Buffered Terminal. The new card reader and punch, which offer expanded capabilities and improved reliability, are described in the "Input/Output Units" section of this report. The 3735 "intelligent terminal" is analyzed in Peripherals report 70D-491-10.

MONOLITHIC STORAGE

Probably the most significant hardware feature of the Model 135 is its "monolithic main memory," which makes use of bipolar LSI (large-scale integration) technology in place of conventional magnetic cores. A Model 135 system can have from 98,304 to 245,760 bytes of main storage in 49,152-byte increments. Cycle times are 770 nanoseconds per 2-byte read and 935 nanoseconds per 2-byte write operation.

A Model 135 storage array chip is about one-eighth of an inch square and contains 1434 microscopic circuit elements forming 174 interconnected circuits. Each chip holds 128 storage bits and the associated decoding, addressing, and sensing circuitry. Two storage array chips are mounted on a half-inch-square substrate, and two of the substrates are packaged into a 512-bit storage array module. Twenty-four of the modules are then mounted on a storage array card, which is about 3.50 by 4.75 inches in size and holds 12,288 storage bits. Finally, the cards are placed in Basic Storage Modules. Each module is about 13.25 inches long, 5.5 inches deep, and 9 inches wide and contains 49K bytes of storage plus its associated circuitry.

IBM claims three important advantages for its monolithic storage:

- Higher storage speeds can be obtained because of (1) the shorter physical distances between the memory components, and (2) the nondestructive readout capability of the monolithic storage, which eliminates the need for a regeneration cycle after each read operation.
- Storage serviceability is improved because each 12,288-bit storage array card is a complete functional component that can be replaced within a few minutes.

▶ CENTRAL PROCESSORS

INDEX REGISTERS: Sixteen 32-bit general registers, used for indexing, base addressing, and as accumulators, plus four 64-bit floating-point registers.

INDIRECT ADDRESSING: None.

INSTRUCTION REPERTOIRE: Consists of all of the instructions that comprise the System/360 "commercial instruction set" (i.e., the standard System/360 set plus the decimal arithmetic instructions), together with 13 new "enhancement" instructions. Floating-point arithmetic is an optional feature.

The basic Model 135 instruction set includes complete arithmetic facilities for processing variable-length decimal and fixed-point binary operands, as well as instructions which handle loading, storing, comparing, branching, shifting, editing, radix conversion, code translation, logical operations, packing, and unpacking. In addition, a group of "privileged instructions", usable only by the operating system, handle input/output and various hardware control functions.

The 13 new instructions are:

- Compare Logical Characters Under Mask (CLM)
- Compare Logical Long (CLCL)
- Halt Device*
- Insert Characters under Mask (ICM)
- Load Control (LCTL)*
- Move Long (MVCL)
- Set Clock (SCK)*
- Shift and Round Decimal (SRP)
- Store Channel ID (STIDC)*
- Store Characters under Mask (STCM)
- Store Clock (STCK)
- Store CPU ID (STIDP)*
- Store Control (STCTL)*

*Privileged instruction.

These new instructions facilitate programming and reduce execution times for record blocking and unblocking, long move and compare operations, decimal arithmetic, and various hardware control functions.

INSTRUCTION TIMES: Average execution times, in microseconds, for some representative instructions are as follows:

Add (32-bit binary):	4.21
Multiply (32-bit binary):	25.52
Divide (32-bit binary):	41.92
Load (32-bit binary):	3.08
Store (32-bit binary):	3.30
Add (5-digit packed decimal):	40.92
Compare (5-digit packed decimal):	37.57
Add (short floating-point):	13.73*
Multiply (short floating-point):	32.24*
Divide (short floating-point):	49.39*
Add (long floating-point):	17.73*
Multiply (long floating-point):	51.32*
Divide (long floating-point):	79.21*

*With optional Floating-Point Instructions.

OPTIONAL FEATURES: The Floating-Point Arithmetic feature, a no-cost option, provides instructions to perform floating-point arithmetic operations on both short (1-word) and long (2-word) operands.

The Extended Precision Floating-Point feature provides 7 instructions for performing floating-point arithmetic on 4-word (16-byte) operands that provide a precision of up to ▶

IBM System/370 Model 135

- ▷ • Storage space requirements are reduced to less than half the space required for equivalent amounts of core storage in the System/360 Model 30.

The volatility and “newness” of IBM’s monolithic storage, which may cause some concern among prospective users, are discussed in the Management Summary of the Model 145 report, 70C-491-05.

RELOADABLE CONTROL STORAGE

The microprograms which control all the internal operations of the Model 135 Processing Unit reside in a separate monolithic memory unit called reloadable control storage (RCS). The microprograms are loaded into RCS by means of a small read-only disk unit called the Console File. Located in the upper left-hand corner of the system control panel, the Console File reads special single-disk cartridges at the rate 33,300 bits per second. Each cartridge can hold approximately 75,000 bytes. IBM will supply prewritten disk cartridges containing all the control microprograms required for a specific Model 135 installation.

The Model 135 RCS has a minimum cycle time of 275 nanoseconds, and the time required to execute each microinstruction ranges from 275 to 1430 nanoseconds, depending upon the operation. The basic RCS capacity of 24,576 bytes can be expanded to either 36,864 or 49,152 bytes. Expansion is required when certain optional features or combinations are selected. Thus, many of the “no-charge” optional features for the Model 135 (including Block Multiplexing, 1401/1440/1460 Compatibility, and Extended Precision Floating-Point) will in fact require the user to spend an additional \$225 or \$450 per month for the required RCS expansion.

Reloadable Control Storage, as implemented in the Model 135, has several significant advantages:

- Different versions of the system microcode, supporting different features and options, can be readily interchanged. In fact, at some appropriate future date, the Model 135 could conceivably assume a radically different instruction repertoire and functional characteristics. Many of the functions now performed by software could be “built into the hardware” through the development of suitable control microprograms (the much-discussed “firmware” concept).
- Many of the capabilities which formerly required specialized hardware (floating-point arithmetic, emulators, block multiplexing, etc.) can now be implemented through microprogramming, at no extra cost to the user except for the RCS required to hold the microcode. ▷

- ▶ 28 hexadecimal or 34 decimal digits. The Floating-Point Arithmetic feature is a prerequisite.

The Control Storage Expansion features extend the capacity of the Reloadable Control Storage (RCS) from the basic 24,576 bytes to either 36,864 or 49,152 bytes. One or both of these 12K expansion increments are necessary to hold the microprograms required for certain optional features. Specifically, the first 12K increment must be installed when any of the following features is used:

Extended Precision Floating-Point
48 Additional Byte Multiplexer Subchannels
Block Multiplexing*
Integrated Communications Adapter*
1401/1440/1460 Compatibility*
Floating-Point Arithmetic along with 3215 Console

*Second 12K increment may also be required.

Combinations of two or more of the above features will, in many cases, require the maximum 49K bytes of RCS.

The Direct Control Feature provides six external interrupt lines which are independent of the normal data channels, plus two instructions which provide for single-byte data transfers between an external device and main storage.

Other processor options are described in the following sections on Compatibility Features, Input/Output Control, and Communications Control.

COMPATIBILITY FEATURES: OS/DOS Compatibility is a standard feature of the Model 135 Processing Unit. Used in combination with the DOS Emulator Program, it facilitates DOS-to-OS conversions by making it possible to run a DOS Supervisor and DOS programs under control of the Operating System/360 (MFT version). The DOS Emulator runs as a problem program under OS control. It can be multiprogrammed with other OS jobs, and it in turn can use the multiprogramming options of DOS. The DOS Emulator Program, the DOS Supervisor, and up to three DOS processing-program partitions are all executed in a single MFT partition of at least 38K bytes; the DOS Emulator Program alone requires 22K to 26K bytes of main storage.

The 1401/1440/1460 Compatibility Feature is a no-charge option that, in combination with special emulator routines, enables a Model 135 to execute programs written for the earlier IBM 1401, 1440, or 1460 computers. Emulated 1400 Series programs can be processed along with native-mode System/370 programs in a multiprogramming mix under either DOS or OS MFT control. Emulation requires a Model 135 system with I/O devices equivalent to those of the system to be emulated (plus the devices required by the operating system), and with considerably more storage capacity. Only the more common peripheral devices (card readers, punches, printers, magnetic tape units, disk drives, and consoles) can be emulated, and certain special and custom features are not supported.

The 1401/1440/1460 Compatibility Feature requires the installation of at least one 12K Control Storage Expansion increment, and the associated emulator routines require from 17K to 27K bytes of main storage under DOS or from 20K to 34K bytes under OS. Additional main storage is required to simulate the 1401/1440/1460 storage (on a one-byte-per-character basis) and to hold I/O buffers for tape, disk, and unit record operations.

CONSOLE INPUT/OUTPUT: Model 135 offers a choice of two Console Printer-Keyboards. The 3215 uses a matrix printing unit that operates at 85 characters per second. The 3210 is a newly designed unit that prints at 15 characters per second. ▶

IBM System/370 Model 135

- ▷ • Serviceability is enhanced because the basic system microcode can quickly be replaced by suitable diagnostic microprograms whenever maintenance is required.

PROCESSOR CHARACTERISTICS

As an upgrade machine for System/360 Model 25 and 30 users, the Model 135 offers these major advantages:

- Internal processing speed ranging from 2 to 4.5 times that of the Model 30 for commercial applications and from 3.5 to 7 times that of the Model 30 for scientific applications. As compared with the Model 25, the Model 135 offers from 3.5 to 6.5 times the internal speed for commercial applications and from 5.5 to 16 times the internal speed for scientific applications.
- Main storage capacities of up to 245K bytes—nearly four times the maximum capacity of the Model 30.
- Greatly increased I/O capabilities—a standard Byte Multiplexer Channel, an optional Integrated File Adapter for 2314-style disk storage, and up to two Selector Channels capable of handling a combined data rate of 2.4 million bytes per second.
- Numerous improvements in the processor facilities, as described below.

The Model 135 Processor shares many significant characteristics with the System/360 processors (Model 25 and above) and with the previously announced System/370 models. Reflecting its “all-purpose” design philosophy, the Model 135 has a large, complex instruction repertoire. Like Models 145, 155, and 165, it adds 13 new instructions to the System/360 instruction set. The new instructions can reduce execution time and program storage requirements by enhancing decimal arithmetic performance, eliminating the need for multiple “move” instructions, and facilitating the blocking and unblocking of records.

The Byte-Oriented Operand Feature, standard in the Model 135, allows users to ignore, in part, the System/360 restriction that non-decimal operands must be stored in core locations whose addresses are integral multiples of the operand length. It is important to note, however, that significant performance degradation is likely to occur if programmers are allowed to take advantage of this feature and ignore the usual boundary constraints on operand placement.

Two standard hardware features help to make the Model 135 a more “time-conscious” system. An improved interval timer with a resolution of 3.3 milliseconds facilitates the timing of short-duration tasks, while a new ▷

▶ INPUT/OUTPUT CONTROL

I/O CHANNELS: One Byte Multiplexer Channel is standard in the Model 135 Processing Unit, and one or two Selector Channels are optional. The Selector Channels can be equipped to operate as Block Multiplexer Channels. The optional Integrated File Adapter is functionally equivalent to a Selector Channel and disk control unit.

The Byte Multiplexer Channel is functionally compatible with the System/360 Multiplexer Channel. It has a single data path that can be shared by a number of simultaneously operating low-speed I/O devices (in “multiplex mode”) or monopolized by a single faster device (in “burst mode”). In either case, one byte of data at a time is transferred between main storage and an I/O device. Sixteen subchannels are standard, and a no-charge option expands the number of subchannels to 64. A maximum of 8 of the subchannels can be shared (i.e., assigned to an I/O control unit that can have several devices attached). Maximum data transfer rate is approximately 41,000 bytes/second in the multiplex mode and 149,000 bytes/second in the burst mode. Because of the likelihood of overruns, use of the Model 135 Byte Multiplexer Channel for unbuffered burst-mode devices is not recommended if there is any possibility of the burst-mode device operating concurrently with the Integrated File Adapter, the Integrated Communications Adapter, or a Selector Channel.

Each Selector Channel permits a high-speed data transfer operation by one peripheral device at a time. The channel remains busy throughout the time a channel program is in operation, even when no data is being transferred. Two bytes of data at a time are normally transferred to or from main storage. Maximum data transfer rates are 1,300,000 bytes/second for the first Selector Channel and 1,200,000 bytes/second for the second. The combined data rate for both Selector Channels, however, may not exceed 2,400,000 bytes/second. Moreover, when a Model 135 system includes the Integrated File Adapter and has 3330 Disk Storage Drives on one Selector Channel, the data rate on the second Selector Channel should not exceed 90,000 bytes/second.

The Block Multiplexer Channel feature, a no-charge option, permits either or both of the Selector Channels to operate as Block Multiplexer Channels. Each Block Multiplexer Channel provides a single data path that can be shared by a number of high-speed peripheral devices which transfer data alternately in burst-mode fashion. While the channel is interleaving blocks of data to and from various devices, it can also control non-data-transfer functions on other devices. Each Block Multiplexer Channel has 17 subchannels. The Block Multiplexer Channel feature requires the installation of at least one 12K Control Storage Expansion increment.

CONFIGURATION RULES: Most System/370 peripheral devices can be connected to any of the three types of channels on a Model 135 system. High-speed tape, disk, and drum units require either a Block Multiplexer or Selector Channel, and card readers, printers, and other low-speed devices will normally be connected to the Byte Multiplexer Channel.

SIMULTANEOUS OPERATIONS: Concurrently with computing, a Model 135 can control a maximum of one high-speed I/O data transfer operation on each Selector or Block Multiplexer Channel, one high-speed disk read or write operation via the Integrated File Adapter (if installed), and one low-speed I/O operation on each subchannel of the Byte Multiplexer Channel.

I/O INTERFERENCE: All Model 135 I/O channels are “integrated,” which means they share the use of the control ▶

IBM System/370 Model 135

▷ time-of-day clock with a 1-microsecond resolution provides a consistent measure of elapsed time for job accounting, communications, and real-time functions.

The Model 135 does not utilize the buffer memory concept which is the principal architectural feature of the larger Models 155 and 165. Cost/performance considerations apparently dictated the use of a single level of high-speed monolithic main storage instead of the more complex two-level memories employed in the larger System/370 processors.

For its logic circuits (as distinguished from its memory circuits), the Model 135 employs IBM's Monolithic Systems Technology (MST). Each MST logic chip is slightly over one-sixteenth of an inch square and contains more than 100 components forming up to 8 interconnected circuits. Thus, the circuit density is considerably lower than in the storage array chips, though the concepts employed are quite similar.

IBM is placing a strong emphasis on increased reliability and serviceability in the Model 135, as in the larger System/370 models. An automatic retry capability for central processor operations and error-correcting circuits for main and control storage will often make it possible to continue processing despite hardware faults. Expanded machine-check interrupt facilities will aid in error recording and recovery. And a variety of new software facilities, together with centrally located maintenance data banks, will facilitate equipment servicing. ▷

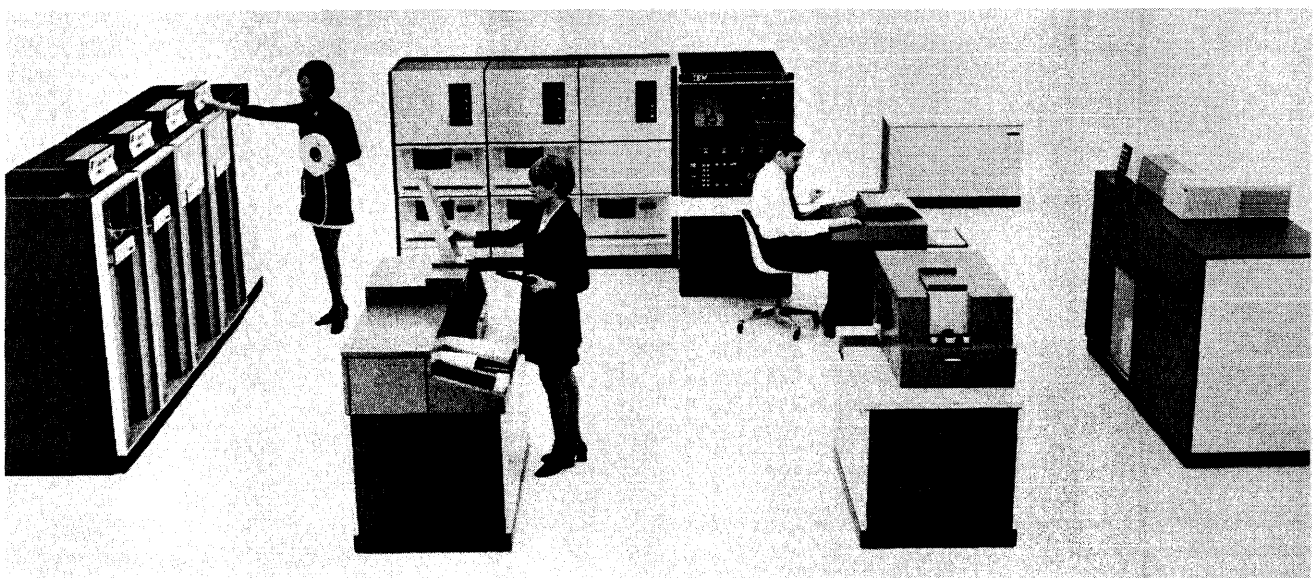
▶ storage and arithmetic/logic unit with the Processing Unit. Thus, the channels interfere with one another and with the Processing Unit whenever they initiate or complete an I/O operation, as well as whenever they require access to control storage or main storage. Selector Channels require one main storage cycle of 660 nanoseconds for each two bytes of data transferred to or from storage. For the Byte Multiplexer Channel, the times required to handle each one-byte transfer are 24 microseconds in the multiplex mode and 6.7 microseconds in the burst mode.

MASS STORAGE

2319 DISK STORAGE FACILITY: Provides fairly rapid access to moderately large quantities of data stored in interchangeable 2316 Disk Packs. Consists of three IBM 2314-style disk drives and integrated control logic. Each drive stores up to 29.17 million bytes of data, for a total storage capacity of over 87 million bytes per 2319 facility. One or two additional disk drives can be connected: either the single-drive 2312 Disk Storage Module or the two-drive 2318. Total on-line storage capacity with the maximum complement of five drives is 146 million bytes.

Each 11-disk 2316 Disk Pack has 200 data tracks on each of the 20 data recording surfaces. Each track can hold up to 7,294 bytes of data in variable-length records. Each disk has a comb-type access mechanism that can read or write up to 145,880 bytes (20 tracks) in each of its 200 positions. Average head movement time is 60 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 312,000 bytes per second.

The 2319 connects to a Model 135 via the Integrated File Adapter (IFA) rather than a standard I/O channel. The IFA is functionally equivalent to a Selector Channel and a 2314 Disk Storage Control but is considerably lower in cost, power consumption, and space requirements. The Record Overflow and File Scan features are standard on the IFA, but the Block Multiplexing Feature, Channel-to-Channel ▶



This Model 135 configuration includes most of the new System/370 peripheral units. A 3-drive 2319 and 2-drive 2318 disk storage facility are attached directly to the Processing Unit at center rear. In the foreground, from left to right, are the 3803/3420 Magnetic Tape Subsystem, 3505 Card Reader, 3525 Card Punch, and 3211 Printer.

IBM System/370 Model 135

▷ PERIPHERAL EQUIPMENT

The Model 135 can use most of the same peripheral devices as the System/360. The System/360 peripherals that will *not* be supported for use in a Model 135 configuration (mainly because of obsolescence or very limited user interest) are as follows:

- 1052 Printer-Keyboard
- 1231 Optical Mark Page Reader
- 1285 Optical Reader
- 1404 Printer
- 1412 Magnetic Character Reader
- 1418 Optical Character Reader
- 1428 Alphameric Optical Reader
- 1445 Printer
- 1827 Data Control Unit
- 2150 Console
- 2301 Drum Storage
- 2302 Disk Storage
- 2305 Fixed-Head Storage Facility
- 2361 Large-Capacity Core Storage
- 7340 Hypertape Drive
- 7772 Audio Response Unit

The key peripheral device for the Model 135 is the 2319 Disk Storage Facility, introduced with the Model 145 in October 1970. The basic 2319 provides three 2314-style disk pack drives and can be expanded to a maximum of five drives. Each drive stores up to 29 million bytes of data on an interchangeable 11-disk pack.

The 2319 interfaces with the Model 135 Processing Unit through the optional Integrated File Adapter (IFA) rather than through a standard disk control unit and I/O channel. The IFA uses microcode residing in RCS to perform most of the disk control functions that normally require expensive specialized circuitry. As a result, IBM can offer the IFA and the basic 3-drive 2319 for a total of just \$1,475 per month, whereas a 3-drive 2314-A Direct Access Storage Facility with the same functional specifications rents for \$2,935 per month—nearly twice as much. At this “bargain” price, it is clear that the 2319 will be included in nearly every Model 135 installation.

Model 135 systems can also make use of the newly announced 3505 Card Reader and 3525 Card Punch, as well as the 2000-lpm 3211 Printer and the high-performance 3330 Disk Storage Facility that IBM announced along with Models 155 and 165 in June 1970. All of these devices are software-supported under both OS and DOS for the Model 135. The Block Multiplexer Channel feature, a no-charge option supported only under OS, enables the Model 135 to take advantage of the Rotational Position Sensing and Multiple Requesting features that add to the power of the 3330 Disk Storage. ▷

▶ Adapter, Two-Channel Switch, and Auxiliary Storage Control cannot be used with the IFA.

3330 DISK STORAGE: Provides fairly rapid access to extremely large quantities of data stored in interchangeable 3336 Disk Packs. Each 3330 Disk Storage Module contains two independent disk drives, each mounted in a powered drawer for operating convenience. Up to four 3330 modules (eight drives) can be connected to a 3830 Storage Control. Rotational Position Sensing and Multiple Requesting are standard features. A Command Retry facility enables the 3330 subsystem to recover from many errors without the use of time-consuming error recovery programs. Error correction coding circuitry in the control unit permits detection and correction of bursts of errors up to 11 bits in length on a single track.

Each 3336 Disk Pack contains 12 disks. Nineteen disk surfaces are used for data recording, and a 20th surface holds prerecorded data that controls seeking, position sensing, and clocking. Each disk pack holds up to 100,018,000 bytes of data, so an 8-drive 3330 subsystem can store over 800 million bytes on-line. Each data track has a capacity of 13,030 bytes, and each of the 404 data cylinders holds up to 247,570 bytes (19 tracks). Head movement time ranges from 10 to 55 milliseconds and averages 30 for random accesses. Average rotational delay is 8.4 milliseconds and data transfer rate is 806,000 bytes per second. Deliveries are scheduled to begin in August 1971.

OTHER MASS STORAGE DEVICES: In addition to the new units described above, the System/360 mass storage units listed below can also be used with the System/370 Model 135. Please refer to the IBM System/360 report (70C-491-03) for description of these units.

- 2303 Drum Storage
- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2321 Data Cell Drive

INPUT/OUTPUT UNITS

3505 CARD READER: Reads standard 80-column cards at either 800 cpm (Model B1) or 1200 cpm (Model B2). Contains its own fully buffered, microprogrammed control unit, and can be connected directly to any System/370 I/O channel (or to a System/360 Model 195). The 3505 reads cards photoelectrically, in column-by-column fashion, in either EBCDIC or card image mode. Vacuum-assisted friction feeding is used in place of the conventional “picker knife” feeding. If a card fails to feed, three retries are made automatically before a misfeed indication is given. The 3505 has a 3000-card file feed hopper and two 1750-card stackers. Whenever one stacker becomes full, cards are automatically directed to the other stacker while the operator empties the first one. A third, program-selectable 1750-card stacker is optional. First deliveries are scheduled for the second quarter of 1972.

The optional Read Column Eliminate feature for the 3505 suppresses the reading (and checking) of data from specified card columns. The Optical Mark Read feature permits the reading of up to 40 columns of information marked on the cards with ordinary pencils; both marked fields and punched fields can be read during a single pass.

3525 CARD PUNCH: Punches standard 80-column cards at 100 cpm (Model P1), 200 cpm (Model P2), or 300 cpm (Model P3). Punches a row at a time, in either EBCDIC or card image mode. Utilizes the buffered control unit and power supply in the 3505 Card Reader, to which the 3525 is connected via a 3525 Adapter on the 3505. The 3505/3525 subsystem can be connected to any System/370 I/O channel (or to a System/360 Model 195). First deliveries are scheduled for the second quarter of 1972. ▶

IBM System/370 Model 135

▷ The Integrated Communications Adapter (ICA) is another example of the flexibility and economy that can result from microprogrammed control. The ICA, an optional feature for the Model 135 Processing Unit, uses a combination of hardware logic and microcode to control up to eight communications lines operating at speeds of up to 4800 bits per second. Thus, the ICA will preclude the need for a separate 2701, 2702, or 2703 transmission control unit in most installations (although these control units can also be used with the Model 135 if desired). The ICA, like the other IBM transmission controls, places the communications processing burden squarely upon the associated central processor. Though numerous companies are now supplying "front-end" communications processors for use with the System/360, IBM has to date failed to endorse the concept by introducing a similar unit for either the System/360 or 370.

SOFTWARE

IBM has insured against a repetition of the software development crisis that plagued the industry during the mid-sixties by enabling the System/370 computers to use most of the software that is already in use with the System/360. Model 135 users can choose to operate under either the sophisticated and complex Operating System/360 (MFT version only) or the simpler but less powerful Disk Operating System. Associated with each of these operating systems in a broad range of compilers, utility routines, and application programs. After years of agonizing development work, the System/360 software has now reached a point where it can perform virtually all of the advertised functions—though its efficiency in many areas still leaves ample room for improvement.

Model 135 users can also make use of the new and enhanced software products that were announced along with Models 155 and 165 in June 1970 and during the following months.

COMPATIBILITY

As expected, the Model 135 will offer a high degree of program and data compatibility with the System/360 and with the previously announced System/370 models. Current System/360 users can run their application programs on a System/370 with little or no modification. Two minor changes to the System/360 architecture may be of significance to certain users: (1) the ASCII mode hardware facility is not implemented in the System/370, and (2) the handling of invalid signs on decimal operands is different.

Otherwise, virtually all of the new hardware features of the System/370 represent extensions, rather than modifications, of the System/360 architecture. As a result, it is fairly easy to execute existing System/360 programs on a ▷

▶ The 3525 has a 1200-card feed hopper, two program-selectable 1200-card stackers, and a 200-card reject stacker. When a punching error is detected, the error card is directed to the reject stacker and the contents of the punch buffer are automatically repunched into the next card. If the retry is successful, the correct card is also routed to the error stacker to aid in diagnosing the malfunction. Finally, a third card is punched with the same data and stacked normally.

An optional Card Print unit for the 3525 uses engraved type slugs to print data on the cards in either an EBCDIC or ASCII 64-character set. The Two-Line Card Print feature prints one or two lines of up to 64 characters on each card during a single pass at the rated punching speed. Alternatively, the Multi-Line Card Print feature permits up to 25 lines, each 64 characters in length, to be printed on each card during a single pass. Card speeds are considerably reduced when more than 2 lines are printed; when all 25 lines are printed, the speed drops to 24 cpm for Model P1 and 29 cpm for Models P2 and P3.

The optional Card Read feature for the 3525 provides a parallel photoelectric reading station ahead of the punching station. The feature includes the Read Column Eliminate capability, which permits suppression of the reading (and checking) of data from specified card columns. Reading, punching, and printing operations can be performed on each card during a single pass.

3211 PRINTER: Provides high-speed printed output by means of an endless "train" of 432 type characters that move horizontally in front of the print hammers. The standard character set, consisting of 48 graphic characters in 9 identical arrays, yields a single-spaced printing speed of 2000 lines per minute. Speeds of up to 2500 lpm can be obtained with smaller character sets, and a 120-character Text Printing set yields an expected printing speed of 906 lpm. The Universal Character Set feature is standard, permitting the use of character arrangements which are optimized for specific applications. Up to 254 different graphic characters can be used on a print train, and the train cartridges can be interchanged by an operator.

The 3211 Printer has a standard 132-character line that can be expanded to 150 print positions. Horizontal spacing is 10 characters/inch, and vertical spacing is 6 or 8 lines/inch. A 180-position forms control buffer, loadable from main storage, defines vertical format control operations, eliminating the need for a carriage control tape. Skipping speed is at least 30 inches per second, with acceleration to a maximum speed of 90 inches per second after 7 lines have passed. Forms ranging from 3.5 to 18.75 inches in width and from 3 to 24 inches in length can be handled. A powered forms stacker automatically compensates for the height of the paper stack, and a self-positioning platen adjusts itself to the thickness of the forms being used.

The 3211 Printer can be connected to a Model 135 Byte Multiplexer, Block Multiplexer, or Selector Channel via a 3811 Printer Control Unit. Deliveries are scheduled to begin in December 1971.

OTHER INPUT/OUTPUT UNITS: In addition to the three new devices described above, the numerous System/360 I/O units listed below can also be used with the System/370 Model 135. Please refer to the IBM System/360 report (70C-491-03) for descriptions of these units.

- 1017 Paper Tape Reader, Models 1 and 2
- 1018 Paper Tape Punch
- 1259 Magnetic Character Reader, Model 2
- 1287 Optical Reader, Models 1-4
- 1288 Optical Page Reader
- 1403 Printer, Models 2, 3, 7, N1

IBM System/370 Model 135

▷ System/370. In most cases, little or no program modification is necessary, though recompilation will usually be required. Conversely, it will not be possible to directly execute System/370 programs on a System/360 if they make use of the System/370's new instructions or other new hardware features—but this type of downward compatibility is of far less importance to most users.

Integrated emulation is an important Model 145 option—offered at no extra cost—that will enable users to run most IBM 1401, 1440, and 1460 programs on a Model 135 without change. The Model 135 emulator runs under control of the regular operating system, enabling emulator jobs to be processed as part of a multiprogramming mix. Thus, IBM has granted another reprieve to the thousands of users who have not yet gotten around to converting their second-generation programs—and simultaneously ensured that a high percentage of these users will stay “locked in” to IBM for several more years.

Another Model 135 compatibility feature facilitates conversions from DOS to OS by making it possible to run DOS jobs under OS control. No emulator for the IBM 1410 and 7010 computers, however, is currently available for the Model 135.

SUPPORT

The System/370 computers will receive essentially the same “unbundled” support as the System/360, which means that users must now pay separately for most of the educational courses and technical support that were formerly included in IBM's equipment prices.

Most of the existing System/360 software facilities were delivered prior to IBM's unbundling announcement in June 1969 and are therefore available to System/370 users at no additional cost. But most System/370 users will find it advantageous to use the improved assembler, compilers, sort routines, and other software products that were announced along with the System/370—and these new products are separately priced.

GOOD . . . BUT NOT FOR EVERYONE

From virtually every angle, the Model 135 shapes up as exactly what IBM designed it to be: a highly suitable upgrade machine for System/360 Model 30 installations looking for dramatically improved performance at a modest increase in cost.

But for most Model 25 users, the jump to a Model 135 is a large and expensive one—probably well beyond their economic means and performance needs. The IBM System/3, even with its numerous recent extensions and improvements, is not powerful enough to satisfy the upgrading needs of these Model 25 users. To fill the

- ▶
- 1419 Magnetic Character Reader
 - 1442 Card Read Punch, Model N1
 - 1442 Card Punch, Model N2
 - 1443 Printer, Model N1
 - 2250 Display Unit, Models 1 and 3
 - 2260 Display Station, Models 1 and 2
 - 2285 Display Copier
 - 2401 Magnetic Tape Unit, Models 1-6
 - 2415 Magnetic Tape Unit and Control, Models 1-6
 - 2420 Magnetic Tape Unit, Models 5 and 7
 - 2495 Tape Cartridge Reader
 - 2501 Card Reader, Models B1 and B2
 - 2520 Card Read Punch, Model B1
 - 2520 Card Punch, Models B2 and B3
 - 2540 Card Read Punch
 - 2671 Paper Tape Reader
 - 3420 Magnetic Tape Units

COMMUNICATION CONTROL

INTEGRATED COMMUNICATIONS ADAPTER: This optional feature permits up to eight communications lines to be connected directly to a Model 135 Processing Unit, without the need for the usual 2701, 2702, or 2703 Transmission Control. When the ICA is installed, each line appears to the Model 135 to be a subchannel of the Byte Multiplexer Channel. An external modem is required for each line. The ICA is controlled by a combination of microcode and hardware logic. The amount of control storage required for the ICA microcode varies with the number of lines, the types of terminal adapters, and the features employed.

The ICA supports private, leased, or switched half-duplex communications lines. Data rates of up to 4800 bits/second can be handled when self-clocking modems are used. When the ICA does the clocking, it can provide a data rate of 1200 bits/second or any rate between 0 and 600 bits/second.

The ICA provides up to eight line adapters in any combination of the following three types:

IBM Terminal Adapter Type I, Model II—supports communication, at either 134.5 or 600 bits/second, with an IBM 1050, 2740, 2741, or System/7.

IBM Terminal Adapter Type III—supports communication, at either 1200 or 2400 bits/second, with IBM 2260 or 2265 Display Stations and their associated control units.

Synchronous Data Adapter Type II—supports communication, in BCS mode at up to 4800 bits/second, with an IBM 2770, 2780, 2790, 3735, or any of the following IBM computers equipped for BSC transmission: System/3, System/360, System/370, 1130, or 1800. Each BSC line can operate in any of three codes: EBCDIC, ASCII, or Six-Bit Transcode. The Autoanswer feature is available for the ICA, but the Autocall feature is not.

The IBM 2701 Data Adapter Unit, 2702 Transmission Control, and/or 2703 Transmission Control can be used in a Model 135 system instead of, or in addition to, the ICA. These control units support certain terminals which cannot currently be connected to the ICA, including the Teletype Models 33 and 35, AT&T 83B2/83B3, Western Union 115A, and IBM 1030, 1060, and 1070 terminals. Please refer to the IBM System/360 report (70C-491-03) for descriptions of the 2701, 2702, and 2703.

SOFTWARE

Software support for the System/370 is basically the same as that provided for the earlier IBM System/360. Support

IBM System/370 Model 135

▷ current price/performance gap between the largest System/3 and the smallest System/370 model, it seems clear that at least one more member of the System/370 family (Model 125?) remains to be announced.

Users of the System/360 Model 40 are certain to view the Model 135 with great interest. For them, the new model offers significantly higher performance together with modest reductions in equipment costs. Needless to say, IBM will not encourage this type of conversion.

The appeal of the System/370 Model 135, like that of the Model 145, is by no means limited to current users of the System/360. The Model 135 offers a combination of virtues that few buyers of small-to-medium-scale computers can afford to ignore: impressive price/performance, advanced hardware technology, high-performance peripheral equipment, and proven software—all this, and an IBM nameplate, too. Against these virtues, the prospective buyer must weigh the disadvantages of IBM's unbundled support and relatively inefficient software. On balance, it's absolutely safe to conclude that a great many computer buyers will choose the Model 135 during the next few years. □

► for the System/370 Model 135, however, is provided at only two basic levels: the Disk Operating System (DOS) and the MFT (Multiprogramming with a Fixed Number of Tasks) version of the Operating System/360 (OS).

All of the following facilities are supported under both DOS and OS for the Model 135: the new System/370 instructions, byte boundary alignment, extended precision floating-point, interval timer, integrated emulation of the IBM 1401/1440/1460, processing of ASCII-mode tapes, Integrated File Adapter, Integrated Communications Adapter, 3210 Model 1 and 3215 Console Printer-Keypboards, 3211 Printer, 3505 Card Reader, 3525 Card Punch, 3330 Disk Storage, 3803/3420 Magnetic Tape Subsystem, Recovery Management Support (RMS), and the On-Line Test Executive Program (OLTEP).

The following facilities are supported only under OS for the Model 135: Block Multiplexer Channels, the Time-of-Day Clock, and the DOS Emulator Program.

Since the System/370 is compatible with the System/360 and operates under control of essentially the same software, the great variety of system/360 DOS and OS compilers, assemblers, utilities, application packages, etc., is also available, for the most part, for use with the System/370. Complete descriptions of the DOS and OS software facilities can be found in Report 70C-491-03.

Along with its introduction of the System/370 Models 155 and 165 in June 1970, IBM announced a number of new and enhanced software products, all of which are also

usable on Model 135. These are described in Report 70C-491-04. Most of the new software products are offered for use under a licensing agreement at separate monthly charges ranging from \$40 to \$1,060.

PRICING

EQUIPMENT: The following systems illustrate typical Model 135 configurations. All necessary control units and adapters are included in the indicated prices, and the quoted rental prices include equipment maintenance.

SMALL DISK SYSTEM: Consists of 98K Model 135 Processing Unit with Integrated File Adapter, 2319 Disk Storage Facility (3 drives, 87 million bytes total), 3505 Model B1 Card Reader, 3525 Model P2 Card Punch, 1403 Model 2 Printer, and 3210 Model 1 Console Printer-Key-board. Monthly rental and purchase prices are approximately \$9,815 and \$468,000, respectively.

TAPE/DISK SYSTEM: Consists of 245K Model 135 Processing Unit with Integrated File Adapter, two Selector Channels, and 12K Control Storage Expansion, 2319 Disk Storage Facility with one additional 2312 Disk Drive (4 drives, 116 million bytes total), eight 3420 Model 3 Magnetic Tape Units (120KB) and dual tape controls, 3505 Model B2 Card Reader, 3525 Model P3 Card Punch, 1403 Model N1 Printer, and 3210 Model 1 Console Printer-Key-board. Monthly rental and purchase prices are approximately \$19,280 and \$900,000, respectively.

SOFTWARE: System/360 software which was being distributed by the IBM Program Library as of June 23, 1969, will be available to System/370 users at no additional charge. All subsequent IBM programming announcements (except for certain modifications and improvements of existing IBM programs) are designated as either System Control Programming or Program Products.

System Control Programming provides functions which are fundamental to the operation and maintenance of a system (e.g., loading, scheduling, supervising, and data management) and is available without charge.

Program Products are related to the application of a system to user tasks (e.g., compilers, utility programs, and application programs). These are offered on an individual-charge basis (see Report 70C-491-03).

SUPPORT: IBM Systems Engineering assistance is available to Model 135 users at a basic rate of \$28 per hour.

EDUCATION: IBM "Professional Courses" are now individually priced. System Features Instruction is offered to users of IBM data processing equipment at no charge. Customer Executive Seminars, Industry Seminars, and promotional sessions are still offered at no charge by IBM invitation.

CONTRACT TERMS: The standard IBM rental contract includes equipment maintenance and entitles the customer to up to 176 hours of billable time per month. Time used in excess of that amount is charged for, on all machines equipped with meters, at an extra-use rate. This rate, for most System/370 components, is 10% of the basic hourly rate (i.e., 10% of 1/176 of the monthly rental for each hour of extra use). ■

IBM System/370 Model 135

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
PROCESSOR AND MAIN STORAGE				
3135	Processing Unit			
	Model FE; 98,304 bytes	260,400	570.00	5,250
	Model GD; 147,456 bytes	304,425	610.00	6,150
	Model GF; 196,608 bytes	348,450	650.00	7,050
	Model DH; 245,760 bytes	392,475	690.00	7,950
3046	Power Unit (required for 3135)	14,400	33.00	300
PROCESSOR FEATURES				
1421	Block Multiplexer Channel	No charge	No charge	No charge
3274	Direct Control	5,435	1.00	110
3840	Extended Precision Floating-Point	1,235	1.00	25
3900	Floating-Point	No charge	No charge	No charge
3905	48 Additional Multiplexer Subchannels	No charge	No charge	No charge
4457	IBM 1401/1440/1460 Compatibility	No charge	No charge	No charge
4650	Integrated File Adapter (IFA)	23,465	14.00	475
4640	Integrated Communications Adapter (ICA)	9,880	26.00	200
4722	Second Line on ICA	1,975	6.00	40
4723	Third Line on ICA	3,950	11.00	80
4724	Fourth Line on ICA	1,975	6.00	40
4725	Fifth Line on ICA	5,925	17.00	120
4726	Sixth Line on ICA	1,975	6.00	40
4727	Seventh Line on ICA	1,975	6.00	40
4728	Eighth Line on ICA	1,975	6.00	40
6981	Selector Channel No. 1	8,645	5.00	175
6982	Selector Channel No. 2	7,410	5.00	150
7861	Control Storage Expansion; 1st 12K Increment	11,005	23.00	225
7862	Control Storage Expansion; 2nd 12K Increment	11,005	23.00	225
7844	Adapter for 3210-1 Console Printer-Keyboard	4,940	4.00	100
7845	Adapter for 3215 Console Printer-Keyboard	8,400	6.00	170
3210-1	Console Printer-Keyboard; 15 char/sec	5,600	85.00	175
3215	Console Printer-Keyboard; 85 char/sec	8,000	55.00	200
MASS STORAGE				
2319	Disk Storage Facility; 87 million bytes (requires IFA on 3135)	45,000	210.00	1,000
2312	Disk Storage; 29 million bytes (1 drive)	24,105	75.00	535
2318	Disk Storage; 58 million bytes (2 drives)	41,640	135.00	920
3330	Disk Storage; 2-drive module; 200 million bytes	61,100	200.00	1,300
3830	Storage Control (for up to four 3330 modules)	112,800	170.00	2,400
8170	Two-Channel Switch (for 3830)	9,400	10.00	200
3336	Disk Pack (for 3330)	1,000	Time & Mat'ls.	Purchase only
NOTE: Please refer to the IBM System/360 Equipment Prices (Report 70C-491-03) for prices of other mass storage equipment that can be used in a System/370.				
INPUT/OUTPUT UNITS				
3211	Printer; 2000 lpm	81,600	380.00	1,700
3216	Interchangeable Train Cartridge (for 3211)	11,550	170.00	350
5554	18 Additional Print Positions (for 3211)	2,640	8.00	55
3811	Control Unit (for 3211 Printer)	36,000	120.00	750
5553	18 Additional Print Positions (for 3811)	960	5.00	20
2821-6	Control Unit (for single 2540 Card Read Punch)	14,960	90.00	440
3505	Card Reader			
	Model B1; 800 cpm	28,250	85.00	565
	Model B2; 1200 cpm	29,250	115.00	670
5450	Optical Mark Read (for 3505)	7,950	35.00	185
6122	Read Column Eliminate (for 3505)	No charge	No charge	No charge
6555	Selective Stacker (for 3505)	2,250	7.00	50
6777	Special Feature Adapter (for 3505)	250	0.50	5
8103	3505 Punch Adapter (for 3505)	4,750	3.00	95
8105	3525 Read/Punch Adapter (for 3505)	5,250	3.50	120
8101	3525 Multi-Line Print Control (for 3505)	3,000	4.00	60
8107	3525 Two-Line Print Control (for 3505)	3,000	4.00	60
3525	Card Punch			
	Model P1; 100 cpm	20,000	60.00	400
	Model P2; 200 cpm	20,800	80.00	505
	Model P3; 300 cpm	21,600	100.00	610
1533	Card Read Feature (for 3525)	6,000	15.00	120
5272	Multi-Line Card Print (for 3525)	14,220	83.00	350
8338	Two-Line Card Print (for 3525)	13,920	68.00	290
NOTE: Please refer to the IBM System/360 Equipment Prices (Report 70C-491-03) for prices of other input/output and communications equipment that can be used in a System/370.				

*Rental prices include equipment maintenance.