UNIVAC Series 70

MANAGEMENT SUMMARY

With the formal takeover of RCA's American, Canadian, and Mexican computer customer base on January 1, 1972, for $70 million plus on-going royalties, UNIVAC culminated more than three months of intricate negotiations that followed RCA's announcement to withdraw from the general-purpose computer business. At the time of the takeover, the installed Series 70 base consisted of some 520 accounts with nearly 900 computer systems. About 260 of these accounts had second-generation (RCA 301, 501, 601, and 3301) equipment; about 15 had out-of-production small-scale systems (70/15 and 70/25); and about 40 others had the special-purpose 1600. Of the remaining 575-plus Series 70 computers, the overwhelming majority were Spectra systems, while just about 10% were RCA's "new" Series 70/2, 3, 6, or 7 computers.

UNIVAC's basic marketing strategy for the Series 70 was formulated prior to the effective takeover, and is not likely to change well into the future: (1) keep the Series 70 customers happy and keep them on Series 70 equipment as long as they remain satisfied; (2) when they outgrow the Series 70 systems, provide "bridge" products and other conversion aids to move them to the existing UNIVAC 9700 or 1100-type systems or to other yet-to-be-announced UNIVAC products. A major feature of this strategy includes the upgrading of installed systems with additional higher-performance Series 70 products during the life of the Series 70 installations. Under agreements in ▷

The Series 70 product line consists of 18 processor models spanning two generations. It includes both general-purpose and special-purpose computers, as well as some well-proven virtual memory systems. To protect the former RCA customer base, UNIVAC is emphasizing a consolidated position on peripheral availability, streamlined software support and development, and "bridge" products to ease conversion to other UNIVAC systems.

CHARACTERISTICS

MANUFACTURER: UNIVAC Division, Sperry Rand Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19422. Telephone (215) 646-9000.

MODELS: UNIVAC Series 70/2, 70/3, 70/6, 70/7, 70/35, 70/45, 70/46, 70/55, 70/60, and 70/61. (Note that the 70/15, 70/25, 1600, and older RCA 301, 501, 601, and 3301 computers are also part of the Series 70 customer base and are described briefly in the Management Summary of this report.)

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two consecutive bytes from a "halfword" of 16 bits, while four consecutive bytes form a 32-bit "word." ▶
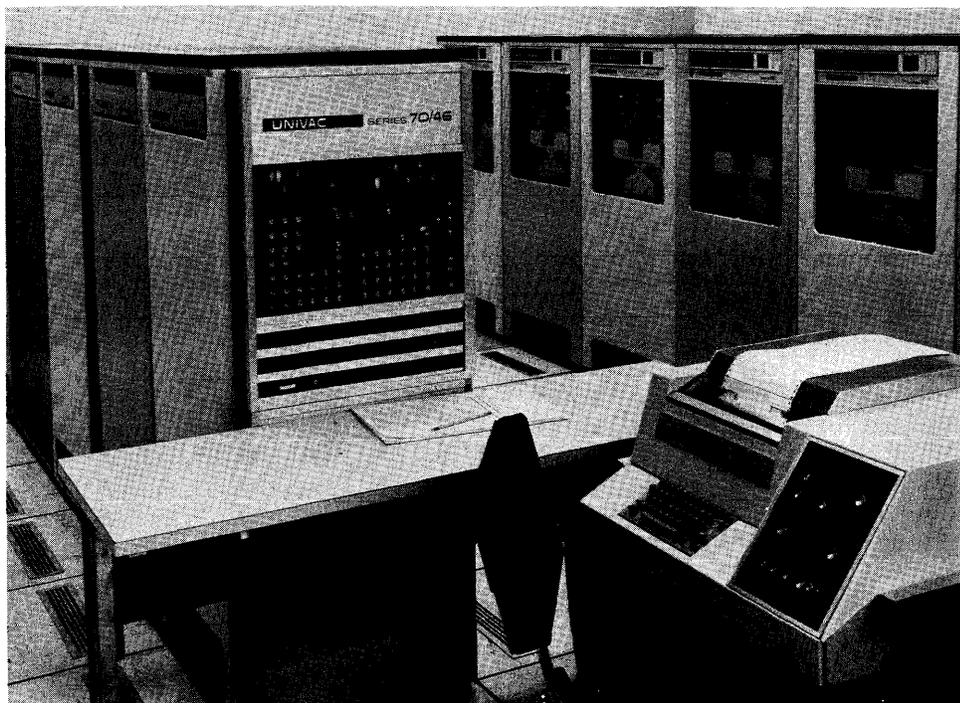
The Series 70/46 Time-Sharing System is the virtual-memory version of the medium-scale 70/45 system. A 70/46 can service up to 48 users at remote terminals while concurrently processing up to 14 independent batch-mode jobs.

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force between RCA and UNIVAC, RCA will continue to manufacture Series 70 hardware for the next several years under a complicated structure of royalty payments, OEM relationships, service agreements, etc.

During the first nine months of 1972, UNIVAC issued new releases of each of the three main Series 70 operating systems, added several software applications packages, substituted high-performance UNIVAC tape and disc drives for several undelivered RCA peripherals, staffed up with about 2500 former RCA employees (experiencing better than a 90% acceptance rate on job offers to key personnel), and announced a series of conversion aids from Series 70 systems to other UNIVAC computers. Each of these moves had some effect in the retention of more than 90% of the customer base during this initial period. Altogether, the number of installed Series 70 systems has decreased by less than 1%, while the revenue base has remained essentially unchanged because many Series 70 users have upgraded their installations with new equipment. In fact, nearly 70 RCA-built computers worth over $90 million were shipped during the first 9 months of Series 70 operations; about half of these replaced previously installed equipment, while the rest were additions to existing installations. By balancing the number of returned systems against the number shipped, it becomes evident that UNIVAC's Series 70 operations have come within an eyelash of a net *increase* in installed value—a potentiality that may yet come to pass, at least over the short term.

The full Series 70 product line includes two generations of computer systems that are represented by 18 different processors designed by RCA Corporation from 1958 through 1970. Second-generation systems include the small-scale 301, the medium-scale 501 and 3301, and the large-scale 601. Third-generation Series 70 gear includes members of three distinct families: Spectra 70, RCA Series, and the 1600 System. Each of these systems is discussed briefly below, followed by detailed discussions of the Spectra 70 and RCA Series.

The medium-scale 501 was RCA's first widely used commercial computer and was also one of the industry's first fully transistorized general-purpose computers. The 501 was announced in 1958 and delivered the following year; more than a dozen 501 systems currently remain installed.

The 501 was followed by the 301, a small-scale business data processing system that competed quite effectively against the IBM 1401; more than 160 of the 301 systems are still operating. Rounding out the Series 70 second-generation computer line were the 3301, a medium-scale processor that has been used effectively in numerous real-time and data communications systems, and the 601, a large-scale computer that made a negligible impression in the EDP marketplace. No active 601 installations exist today, but about 75 of the 3301's are still in use. Many,

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; or 2 words, consisting of 56-bit fraction and 7-bit hexadecimal exponent, in "long" 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). The Series 70 processors can alternatively use 8-bit ASCII, but little software support is provided for this code.

MAIN STORAGE

STORAGE TYPE: Magnetic core.

CAPACITY: See table. On the newer processors (70/2, 3, 6, 7, 60, and 61), the basic unit of standardized main memory is a free-standing, independently testable bank of 262,144 bytes. Each of these banks consists of two 131,072-byte modules. (The 65KB 70/2 memory consists of one effective half of one 131KB module.) In a multiple-processor installation, each 262KB bank can be manually switched from one processor to another processor of the same or a different model.

CYCLE TIME: See table.

CHECKING: Parity bit with each byte is generated during writing and checked during reading.

STORAGE PROTECTION: Protection against both unauthorized reading and writing, in 2048-byte blocks, is standard in the 70/2, 3, 6 and 7. The optional Memory Protect feature for the 70/35 or larger processors guards against inadvertent overwriting of data in specified 2048-byte blocks of storage. Store and Fetch Protection, which protects against unauthorized reading as well as writing, is available for the 70/45 Type II Processor.

CENTRAL PROCESSORS

INDEX REGISTERS: The programmer has access to sixteen 32-bit general registers, used for indexing, base addressing, and as accumulators, plus four 64-bit floating-point registers. (There are four sets of registers in all—one for each processor state—but only one set is normally accessible to the programmer.)

INDIRECT ADDRESSING: Up to three levels for the "real" memory systems, with a fourth level provided for virtual systems to address into the "backing store."

INSTRUCTION REPERTOIRE: Each Series 70 system has from 140 to 154 standard instructions (see table), including add, subtract, multiply, and divide in four different modes: fixed-point binary, variable-length decimal, and "short" and "long" floating-point. Other instructions handle loading, storing, comparing, shifting, branching, radix conversion, code translation, editing, packing, unpacking, logical operations, etc. In addition, the time-sharing or virtual storage 70/3, 70/46, 70/7 and 70/61 Processors can include up to 128 microprogrammed special functions.

INSTRUCTION TIMES: See table. Note that the instruction execution timings can be improved through changes in the microprograms for the 70/3, 70/46, 70/7, or 70/61.

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CHARACTERISTICS OF THE CURRENT UNIVAC SERIES 70 SYSTEMS

	70/2	70/3	70/6	70/7	70/35	70/45 Type I	70/45 Type II	70/46	70/55	70/60	70/61
SYSTEM CHARACTERISTICS											
Maximum no. of central processors supported by standard software	1	1	1	1	1	1	1	1	1	1	1
Principal operating systems	DOS, TDOS	VMOS	DOS, TDOS	VMOS	TOS, DOS, TDOS	DOS, TDOS	DOS, TDOS	VMOS	DOS, TDOS	DOS, TDOS	VMOS
Typical system monthly rental*	$14,000	$25,000	$25,000	$40,000	$10,000	$18,000	$21,000	$33,000	$30,000	$34,000	$46,000
Date of announcement	Sept. 1970	Sept. 1970	Sept. 1970	Sept. 1970	Sept. 1965	Dec. 1964	July 1968	April 1967	Dec. 1964	April 1969	Sept. 1969
Date of first delivery	May 1971	Aug. 1971	Sept. 1971	Nov. 1971	Mar. 1967	April 1966	Sept. 1969	Nov. 1968	Jan. 1967	July 1970	Feb. 1971
Number currently installed**	61	6	19	5	105	196	115	33	13	13	8
MAIN STORAGE											
Cycle time, microseconds	1.440	1.440	0.765	0.765	1.440	1.440	1.440	1.440	0.840	0.765	0.765
Bytes accessed per cycle	2	2	4	4	2	2	2	2	4	4	4
Minimum capacity, bytes	65,536	131,072	131,072	131,072	32,768	65,536	65,536	262,144	65,536	131,072	262,144
Maximum capacity, bytes	262,144	262,144	2,097,152	2,097,152	65,536	524,288	524,288	262,144	524,288	1,048,576	1,048,576
Main storage type	core	core	core	core	core	core	core	core	core	core	core
Interleaving	none	none	none	none	none	none	none	none	none	none	none
Storage protection	standard	standard	standard	standard	optional	optional	optional	optional	optional	optional	standard
CENTRAL PROCESSOR											
No. of hardware instructions	145	151	153	159	144	144	145	151	144	153	159
Registers, total/general-purpose	128/16	128/16	128/16	128/16	128/16	128/16	128/16	128/16	128/16	128/16	128/16
Read-only memory (ROM) size, 54-bit words	2,048	2,048	3,072***	3,072***	1,024	2,048	2,048	2,048	none††	3,072***	3,072***
ROM cycle time, microseconds/word	480	480	255	255	480	480	480	480	none	255	255
Max. virtual memory size, bytes	none	6,500,000	none	13,000,000	none	none	none	6,500,000	none	none	13,000,000
No. of interrupts	32	32	32	32	32	32	32	32	32	32	32
Floating-point hardware	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Decimal instructions	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Divide hardware	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Indirect addressing	3 levels	3 levels†	3 levels	3 levels†	3 levels	3 levels	3 levels	3 levels†	3 levels	3 levels	3 levels†
Processor states	4	4	4	4	4	4	4	4	4	4	4
INSTRUCTION TIMES (decimal, in microseconds):											
Add, unsigned, unpacked (5 digits)	72.54	83.94	45.41	48.39	134.28	72.54	72.54	83.94	40.40	45.41	48.39
Add, signed, packed (5 digits)	22.02	22.50	12.07	12.07	47.64	22.02	22.02	22.50	9.72	12.07	12.07
Multiply, unsigned, unpacked (5 digits)	134.80	136.72	51.83	54.46	273.96	134.80	134.80	136.72	78.20	51.83	54.46
Multiply, signed, packed (5 digits)	84.28	84.76	23.51	24.11	187.32	84.28	84.28	84.76	47.52	23.51	24.11
Divide, unsigned, unpacked (5 digits)	134.47	136.39	53.11	55.74	239.28	134.47	134.47	136.39	47.48	53.11	55.74
Divide, signed, packed (5 digits)	83.95	84.43	24.79	25.38	152.64	83.95	83.95	84.43	16.80	24.79	25.38
I/O CONTROL											
Maximum aggregate I/O data rate, bytes/second	1,388,000	1,388,000	5,240,000	5,240,000	694,000	520,000	1,388,000	1,388,000	775,000	5,240,000	5,240,000
No. of selector channels	2-4	2-4	2-6	2-6	0-2	0-3	0-4	0-4	0-6	2-6	2-6
Trunks per selector channel	2	2	3	3	2	2	2	2	2 or 3	3	3
Max. selector channel data rate, bytes/second	694,000	694,000	900,000	900,000	694,000	465,000	694,000	694,000	700,000	900,000	900,000
No. of multiplexer channels	1	1	1	1	1	1	1	1	1	1	1
Trunks per multiplexer channel	9	9	16	16	8	9	9	9	9	16	16
Max. devices on multiplexer	256	256	248	248	192	256	256	256	256	248	248
Max. multiplexer channel data rate, bytes/second	72,000	72,000	216,000	216,000	33,000	72,000	72,000	72,000	163,000	216,000	216,000
EMULATOR OPTIONS AVAILABLE											
IBM 1401/1440/1460	yes	yes	yes	yes	yes	yes	yes	no	no	no	no
IBM 1410/7010	no	no	yes	yes	no	yes	yes	no	no	yes	no
RCA 301	no	no	yes	yes	yes	yes	yes	no	no	no	no
RCA 501	no	no	yes	yes	no	yes	yes	no	no	no	no

*Includes maintenance.
**As of October 1972.
***72-bit words.
†One additional level of indirect addressing is provided for the virtual memory or "backing store."
††Hard-wired control logic only.

▷ though not all, of the remaining second-generation Series 70 systems are installed in various government accounts.

THE SPECTRA 70 SERIES

RCA's Spectra 70 announcement in December 1964 rocked the industry with a family of computer systems and software that offered a high degree of data and program compatibility with the IBM System/360. These "carbon copies" of IBM computers that had been introduced just eight months earlier offered significant price and/or performance advantages over the corresponding IBM products in most (though not all) cases. The product planning philosophy for the Spectra 70 line was, in essence, "If you can't lick 'em, join 'em." ▷

► **OPTIONAL FEATURES:** The following features are available:

The Elapsed Time Clock provides a program-controlled timer which is counted down at a constant rate and generates an interrupt when the count reaches zero.

Direct Control permits control and synchronizing information to be transferred between up to six Series 70 Processors and/or special external devices located up to 500 feet from one another. The feature consists of two special instructions and six external-signal lines.

VIRTUAL MEMORY: Dynamic address translation facilities enable users of the 70/3 or 70/46 and 70/7 or 70/61 Processors to program as if they had 6.5 million and 13 million bytes, respectively, of main memory at their disposal. The drum-type 70/560 Virtual Memory Storage Systems hold 2048-byte or 4096-byte "pages" of data, permitting rapid swapping of program segments into or out ►

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The Spectra 70 line initially included four central processor models: the 70/15, 70/25, 70/45 Type I, and 70/55. During the next five years, the 70/35, 70/45 Type II, 70/46, 70/60, and 70/61 were announced, so that the full line-up of Spectra models includes nine processors.

Despite the large number of processors, dozens of peripheral devices, and a wide array of software facilities, the Spectra 70 line did not span nearly as broad a range of processing capabilities as the System/360. The top-of-the-line 70/60 and 70/61 Processors are slower than the System/360 Model 65—not to mention IBM's still faster Models 75, 85, and 195. At the other end of the size range, little interest was shown in serving the small-scale computer user; the small 70/15 and 70/25 were dropped from new production by 1970 and were generally marketed only for use in conjunction with larger Spectra 70 computers.

The strength of the Spectra 70 (as well as the newer RCA Series, for that matter) is in the medium-scale area, where the general-purpose Spectra 70 processors are well suited to handle a broad range of business and scientific applications. For medium-scale installations that require data communications or time-sharing, the Spectra segment of the Series 70 displays an even stronger hand with a versatile array of communications controllers, terminals, and software.

Unfortunately, from the all-important marketing standpoint, the Spectra 70 was only modestly successful at best and did not accomplish its primary objective of significantly penetrating IBM's System/360 market. As a spur to the then-growing RCA sales force, and as part of a grand design aimed at the planned 1972 introduction of a powerful new series of computers, the RCA Series was announced.

THE RCA SERIES

The biggest surprise about this new family of four medium-scale computers, announced on September 15, 1970, was the fact that comparatively little of the hardware and software was really new.

The almost unavoidable conclusion to have been drawn from the Spectra 70 sales performance was that IBM's position in the marketplace is so strong that most users who want IBM-style equipment will elect to buy it from IBM rather than from an alternate supplier—even when the alternate supplier is a nationally-known manufacturer with a product line offering (in many cases) significant price/performance advantages. The RCA Series market strategy, however, consisted primarily of reducing the prices on Spectra 70 equipment that was, for the most part, already available and proven in use, based on RCA's assumption (or hope) that "the progress of the computer business in the 1970's will be determined more by the

of main memory. The 70/3 or 70/46 uses a translation memory, consisting of an integrated-circuit array of 512 two-byte words with a 90-nanosecond access time, to translate virtual addresses used by the programmer into effective main memory addresses. The 70/7 or 70/61 uses an 8-register associative memory to perform the translation function.

INTERRUPT SYSTEM: 32 levels of priority interrupts, individually maskable in each processor state. Each of the four processor states has an independent set of operating registers.

EMULATORS: The Series 70/2, 3, 6, 7, 35, 45, and 60 processors can be equipped with extra-cost "emulators" that enable them to execute programs written for earlier IBM or RCA computers. See the table for the specific emulation capabilities of each processor. Each emulator consists of an Emulator Control Program in core storage and an emulator Microprogram that resides in the processor's read-only memory. In general, emulation requires a Series 70 system with I/O devices equivalent to those of the system to be emulated, and with more core storage capacity and processing power. Only the more common peripheral devices (such as magnetic tape units, card readers, punches, and printers) can be emulated.

Internal speeds of the Series 70 processors in emulation mode range from about 0.9 to 4.2 times as fast as the original computers, depending upon the pair of machines involved.

70/97-20 KEYBOARD AND PRINTER CONSOLE: Provides system control facilities by means of an I/O typewriter and a set of control switches packaged in a free-standing unit. Connects to the multiplexer channel of any Series 70 processor. A run-time recorder is an optional feature.

INPUT/OUTPUT CONTROL

I/O CHANNELS: One multiplexer channel, which can accommodate a number of simultaneous low-speed I/O operations, is standard. Selector channels, which can handle one I/O operation at a time, can also be used with any Series 70 model. See the table for details of the I/O channel possibilities.

CONFIGURATION RULES: Most Series 70 peripheral devices can be connected to either a multiplexer or selector channel on any Series 70 processor. Each channel has a number of trunks, and each trunk can accommodate one peripheral device or control unit. See the table for details.

Switching devices are available to connect a standard I/O trunk on each of two to four Series 70 processors to one I/O device, or to connect two to four devices to one trunk.

SIMULTANEOUS I/O OPERATIONS: Concurrently with computing, a Series 70 can control a maximum of one high-speed I/O operation per selector channel and one low-speed I/O operation per multiplexer trunk. Alternatively, the multiplexer channel can operate in the "burst" mode and handle a single higher-speed operation.

MASS STORAGE

70/560 DIRECT ACCESS STORAGE SYSTEMS: Provide fast, drum-type direct-access storage for the 70/3 or 70/7 virtual memory systems. Three models are available. Model 70/560-005 has 512 tracks and stores up to 2.097 million bytes. Model 70/560-008 has 800 tracks and stores up to

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specific needs of the user than by further radical changes in technology." That the fundamental premise in that strategy was questionable was pointed out with deft finality just one week after the new series was announced: IBM introduced the 370/145, exhibiting radical improvements in technology that ended all hopes that the RCA Series might buy two years of time for RCA. The subsequent release of the 370/135 in March 1971 sent the marketing efforts for the RCA Series into a tailspin from which no recovery could be made.

The new line included four central processor models, currently designated simply 70/2, 70/3, 70/6, and 70/7 (originally the RCA 2, 3, 6, and 7). Although some architectural changes had been made, the four newer processors had essentially the same functional characteristics as the earlier Spectra 70/45, 70/46, 70/60, and 70/61, respectively. The 70/45 Processor had been by far the most popular member of the Spectra 70 line since its introduction in 1964, while the 70/46, 70/60, and 70/61 were gaining only moderate market acceptance. Prices for the new processors and main memories ranged from about 15 to 35 percent lower than their Spectra 70 counterparts. Deliveries of the 70/2 began in May 1971, while the 70/3, 6, and 7 were initially delivered in the fall of 1971, during and after the period of time when RCA pulled out of the general-purpose computer business.

Along with the new central processors, most of the same peripheral equipment was offered at the same prices as in the Spectra 70 product line. The peripherals had been renumbered by changing the "70/" prefix to an "8". The largely unchanged peripheral equipment prices, coupled with the large reductions in processor and memory prices, typically led to overall system rental and purchase prices from 8 to 25 percent below those of the equivalent Spectra 70 configurations.

The RCA Series and Spectra Series equipment shared the same software support. Prior to the takeover by UNIVAC, that support consisted of the Disc, Tape, Tape/Disc and the planned OS/70 Operating Systems for "real" memory computers, and the Time-Sharing Operating System and Virtual Memory Operating System for "virtual" memory computers, as well as a wide selection of language processors and application packages.

One novel aspect of the RCA Series release was the Guaranteed Conversion Program for certain IBM computer users. Under that plan, RCA proposed to convert a given set of user programs for a stipulated price and within a specified time. Liquidated damages up to a maximum of $45,000 would be paid to the customer over a 90-day period if the conversion was not made as required. As a stratagem, this policy did its share to stimulate interest in the RCA Series computers, but almost no work was done directly under Guaranteed Conversion contracts.

3.277 million bytes. Model 70/560-016 has 1600 tracks and stores up to 6.554 million bytes. For all three models, average rotational delay is 8.6 milliseconds and data transfer rate is 333,000 bytes per second. Each system includes the required controller and attachments.

70/564 DISC STORAGE UNIT: Provides interchangeable disc-pack storage. Each disc pack contains six 14-inch discs, weighs 10 pounds, holds up to 7.25 million bytes of data, and is compatible with the IBM 1316 Disk Pack used in IBM 2311 Disk Storage Drives. One read/write head serves each of the 10 recording surfaces. Up to 36,250 bytes (10 tracks) can be read or written at each position of the comb-type access mechanism. Average head movement time is 75 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 156,000 bytes/sec. Record lengths are variable. Up to eight 70/564 units can be connected to a 70/551 Random Access Controller. A dual-channel switch, cylinder overflow, and file scan are optional features.

70/567 DRUM MEMORY UNIT: Provides fast random-access storage and retrieval for program segments, file directories, tables, etc. Two models store up to 4.13 million or 8.26 million bytes in 800 or 1600 tracks with a maximum data capacity of 5161 bytes each. Record lengths are variable. Average access time is 8.6 milliseconds, and data transfer rate is 333,000 bytes per second. Up to 8.26 million bytes of drum storage can be connected to a 70/551 Random Access Controller. A dual-channel switch, cylinder overflow, and file scan are optional features. (Note that the 70/560 is a packaged 70/567 plus controller.)

70/568 MASS STORAGE UNIT: Provides economical large-capacity storage at the expense of slow access times and mechanical complexity. Stores up to 537 million bytes of data on magnetic cards 16 inches long by 4.5 inches wide. The 70/568 unit accommodates 8 removable magazines, and each magazine contains 256 cards. Each card has 128 tracks capable of holding up to 2,048 bytes each. Record lengths are variable. Average random access time is 508 milliseconds, and data transfer rate is 70,000 bytes per second. Up to eight 70/568 units can be connected to a 70/551 Random Access Controller. A dual-channel switch, cylinder overflow, and file scan are optional features.

70/590 DIRECT ACCESS STORAGE SYSTEM: Provides high-speed, medium-to-large-capacity random-access storage in interchangeable 11-disc packs which are compatible with the IBM 2316 packs used in the IBM 2314 Direct Access Storage Facility. Consists of a controller and from 4 to 16 independent on-line disc pack drives, each capable of storing up to 29.17 million bytes. Total on-line storage capacity of the 16-drive 70/590-16 unit is 466.8 million bytes. Each drive has a comb-type access mechanism that can read or write up to 145,880 bytes (20 tracks) at 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/sec. Record lengths are variable. An optional Multi-Channel Switch allows the 70/590 System to be shared by two selector channels on the same or different processors. A spare drive is provided with each group of eight units. The 70/590 attaches to a standard interface trunk on the selector channel.

8519 DIRECT ACCESS STORAGE SYSTEM (DASS): Provides high-speed, medium-to-large-capacity random-access storage in interchangeable 11-disc packs which are compatible with the IBM 2316 packs used in the IBM 2314 Direct Access Storage Facility. Consists of a controller, a self-contained selector channel, and from 2 to 8 indepen-

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▷ Rounding out the Series 70 is the 1600 Communications System. Although used primarily for special-purpose dedicated processing requirements, the 1600 is a very flexible system with extensive potential. Its core memory sizes range from 8K to 65K bytes, and the cycle time for an 18-bit word operation is 1.6 microseconds. Twenty-nine flexible instructions and 16 general-purpose registers are available for programming use. Instruction execution times range from 1.7 to 4.1 microseconds. A variety of console typewriters, magnetic tape devices, and random access units, as well as Standard Interface Converters, can be attached to the system.

Available since 1968 on a special-order basis, the 1600 was not formally released for commercial marketing until 1970. With direct interfaces to other Series 70 processors, the 1600 is well suited to handling communications front-end requirements. Typical system rentals span a wide range—from about $1,700/month to more than $5,000/month—because of the many uses to which this versatile system has been put. As a front-end machine or as the nucleus of various special-purpose systems (controller for the former RCA Videocomp, etc.), the 1600 has been extensively installed. Based upon operating statistics taken from these installations, the 1600 currently sports one of the commercial computer industry's best track records for reliability. The 1600 continues to be available from UNIVAC. Although marketing plans for the system are not clear, the rate of field returns has been practically zero, and it seems certain that most of the 100-plus 1600's that have been shipped since 1968 will remain in use considerably into the future.

PROCESSOR MODELS

The characteristics and orientation of the current Series 70 processor models and the systems built around them are summarized in the following paragraphs and in the accompanying table. The four RCA Series central processor models (70/2, 70/3, 70/6, and 70/7) have the same basic data structure and instruction sets as the older, Spectra Series processors. Monolithic integrated-circuit logic is used, as one would expect, together with conventional magnetic core main memories. Processor operations are controlled by microprograms in read-only memories.

The principal hardware characteristics of the newer RCA Series products can be summarized as follows:

● Standardized main memory modules replace the integrated main memories of the Spectra processors. These modules can be manually switched from one processor to another of the same or different models. (For example, a single 262K-byte module could be switched between a 70/2 and a 70/6 Processor.) UNIVAC maintains that this standardization has led to lower manufacturing costs, greater system flexibility, and improved maintainability. ▷

▶ dent on-line disc pack drives. Total on-line storage capacity of the 8-drive 8519 unit is 233.4 million bytes. Each drive is functionally similar to those of the 70/590 DASS above, except that the 8519 Controller checks the parity bits instead of stripping them off as in the 70/590 Controller. The 8519 is Series 70's answer to IBM's 2319 DASD, and is available only for the 70/2, 3, 6, and 7.

8440 DISC SUBSYSTEM: Provides fairly rapid access to extremely large quantities of data stored in interchangeable 11-disk packs. Each of the 19 data recording surfaces has 406 addressable tracks, and each track holds 14,503 bytes, for a total capacity of 112 million bytes per pack. Up to 275,557 bytes (19 tracks) can be read or written at each position of the comb-type access mechanism. Average head movement time is 35 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 624,000 bytes per second.

An 8440 subsystem consists of a UNIVAC 5033 control unit and from one to eight 8440 disc drives. The optional F1482 Dual Access feature allows dual controllers to handle concurrent read/write, read/read, or write/write operations on two of the drives in a subsystem. The F1470 Dual Channel option (multi-channel switch) permits non-simultaneous operation on two selector channels of one processor, or operation on one selector channel on each of two processors. File scan and record overflow are included as standard features on the 8440. The disc packs used with the 8440 are not compatible with those with the IBM 3330, IBM 2314, or UNIVAC 8414 drives.

The 8440 subsystem can be connected only to the 70/6, 7, 60, or 61 Processors through use of a Standard Interface Converter (SIC). Each SIC connects to a trunk on a standard selector channel and can handle up to three 5033 controllers. A second SIC is required for dual channel capability.

INPUT/OUTPUT UNITS

70/432, 70/442, 70/445 MAGNETIC TAPE UNITS: Available in 9-track and 7-track versions, both of which record on standard 1/2-inch tape in IBM-compatible formats. Characteristics of the 9-track versions are as follows:

70/432: 800 bpi; 30,000 bytes/sec at 37.5 inches/sec.

70/442: 800 bpi; 60,000 bytes/sec at 75 inches/sec.

70/445: 800 bpi; 120,000 bytes/sec at 150 inches/sec.

The 7-track versions have the same tape speeds and offer a choice of three recording densities: 200, 556, or 800 bpi. Thus, they offer data rates ranging from 7,500 to 120,000 characters/second.

The 70/432 and 70/442 are dual-drive models (two tape drives per unit), while the 70/445 is a single-drive unit. All models can read in both the forward and reverse directions, and no pinch rollers are used. Controllers capable of handling up to 8 or 16 tape drives and either 1 or 2 I/O channels are available:

Controller	Number and Type of Tape Units	Characteristics
70/472	eight or sixteen 70/432, 70/442, or 70/445 units	9-track only; dual access option
70/473	eight or sixteen 70/432, 70/442, or 70/445 units	7- or 9-track mixed modes; dual access option ▶

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▷ • High-speed drum-type storage units, with capacities ranging from 2.1 million to 6.5 million bytes, provide fast random-access storage that facilitates page-swapping operations in the "virtual" systems.

• The 70/6 and 70/7 Processors can have up to 2 million bytes of core memory, whereas the 70/60 and 70/61 Processors were limited to a maximum of 1 million bytes.

• The Uniservo 16 and 20 Magnetic Tape Units have data transfer rates of 192,000 and 320,000 bytes per second, respectively, bettering the speeds of the IBM 2420 drives while costing substantially less.

• New horizontal-train printers, with speeds of 600 and 1200 lines per minute, offer improved vertical alignment and sharper print quality.

• Emulators for the IBM 1401, 1440, and 1460 are available for all four processors, and the 70/6 and 7 can also be equipped to emulate the IBM 1410/7010, RCA 301, or RCA 501.

• The 8519 Direct Access Storage Facility is available to give large-capacity random-access storage similar in capacity and configuration rules to IBM's 2319 facility.

The 70/35, 70/45-II (or 70/2), 70/55, and 70/60 (or 70/6) Processors constitute the heart of the Series 70 line. All are general-purpose computers suitable for a wide range of applications, and all are fully compatible at the hardware level. With respect to their internal speeds and prices, these processors generally fall into the gaps between the IBM System/360 processors where their model numbers might lead one to expect them to fall. (For example, the 70/45 is faster and slightly more expensive than the System/360 Model 40, but slower and less costly than the Model 50.)

The 70/45 and 70/55 were members of the original Series 70 line, announced in December 1964. The great majority of currently installed Series 70 processors are 70/45's. The 70/35, a slowed-down version of the 70/45 at a substantially lower price, was introduced nine months later. The 70/60 was announced as a top-of-the-line general-purpose processor in March 1969.

Two models in the original Spectra line—the 70/15 and 70/25— have since been discontinued, although nearly two dozen of these systems are still actively in use. The 70/15 is the smallest member of the line. Although it had modest general-purpose computing capabilities, it was marketed almost exclusively as an I/O processor or remote communications terminal. The 70/15 had a severely restricted instruction set, a maximum core storage capacity of only 8K bytes, and only one I/O channel. Moreover, no direct-access devices could be connected to the 70/15 ▷

▶ **70/451, 70/453 MAGNETIC TAPE UNITS:** These models record on standard 1/2-inch magnetic tape at 1600 bpi in the IBM-compatible phase-encoded mode. Each unit contains two tape drives. Peak data rates are 60,000 bytes/sec for the 70/451 and 120,000 bytes/sec for the 70/453. Both models can read in both the forward and reverse directions, and no pinch rollers are used. Several models of 70/476 controllers capable of handling up to 8 or 16 tape drives and either 1 or 2 I/O channels are available.

70/441 MAGNETIC TAPE UNIT: This dual-drive unit provides compatibility with the RCA 381 and 382 Hi-Data Magnetic Tape Groups. It uses 1200-foot reels of 1/2-inch tape. Tape speed is 50 inches per second. In the 381 mode, density is 333 bpi and data rate is 16,600 characters per second. In the 382 mode, density is 500 bpi and data rate is 25,000 characters per second. Several models of 70/463 Controllers capable of handling up to 8 or 16 tape drives and either 1 or 2 I/O channels are available. The 70/441 is out of new production and is provided on an "as available" basis only.

UNISERVO 16 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard 1/2-inch tape in IBM-compatible formats. Available in both 9-track and 7-track versions. Tape speed is 120 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 192,000 bytes per second; the optional Dual Density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 96,000 bytes per second.

A Uniservo 16 subsystem on the Series 70 consists of up to 16 tape units in any combination of Uniservo 16 and 20 models that are connected to a single or dual Uniservo 20 Model 5034 control unit. Optional features include Dual Access (F1319) for simultaneous read/read, read/write, or write/write operations by two controllers. The Uniservo 16 subsystem can be connected only to the 70/6, 7, 60, or 61 Processors through use of a Standard Interface Converter (SIC). Each SIC connects to a trunk on a standard selector channel and can handle up to three controllers. A second SIC is required for dual-channel capability.

UNISERVO 20 MAGNETIC TAPE UNIT: A high-performance tape drive that uses standard 1/2-inch tape and matches the performance of the IBM 2420 Model 7. Data is recorded in the 9-track mode at 1600 bpi. Tape speed is 200 inches per second, forward or backward, yielding a data transfer rate of 320,000 bytes per second. Operational conveniences include a power window, automatic tape threading, and wrap-around tape cartridge loading.

A Uniservo 20 subsystem on the Series 70 consists of 1 to 16 Uniservo 16 or 20 Tape Units. One Uniservo 20 Tape Unit must be present in the first position when connecting Uniservo 16 drives. The subsystem can be connected to a single- or dual-channel control unit. The Uniservo 20 subsystem can be connected only to the 70/6, 7, 60, or 61 Processors through use of a Standard Interface Converter (SIC). Each SIC connects to a trunk on a standard selector channel and can handle up to three Model 5034 controllers. A second SIC is required for dual-channel or dual-access capabilities.

70/232 CARD READER: Reads 51- or 80-column cards serially at 300 cpm, or at 600 cpm when an optional feature is installed. EBCDIC is the standard code, and column binary is optional. Other optional features permit optical reading of either vertical or slanted pencil marks. ▶

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▷ Processor. The 70/25, on the other hand, was a general-purpose computer, but its marketability was hampered by a restricted instruction set that precluded full compatibility with the larger Spectra 70 processors. As a result, the 70/25 was replaced in the Series 70 lineup by the fully compatible and similarly priced 70/35.

The 70/46 Time-Sharing System, announced in May 1967, was billed as the first "four-dimensional" data processing system. Its design facilitates the handling of local batch processing, remote batch processing, interactive time-sharing, and intercommunication among the remote terminals. It can service up to 48 remote users while concurrently processing up to 14 independent batch-mode jobs. The 70/46 Processor is an upgraded version of the 70/45. It includes built-in logic that facilitates program segmentation and paging. The 262K-byte main memory is divided into pages of 2K or 4K bytes each. Dynamic address translation facilities enable each user to program as if he had a 6.5-million-byte virtual memory at his disposal. A magnetic drum permits rapid swapping of program segments into and out of core memory. The 70/46 design provided a good balance between interactive and batch-mode processing capabilities in a medium-scale system that is both fast and flexible.

The 70/61, announced in September 1969, provides all the facilities of the 70/46 plus about three times its processing power. Like the 70/46, the 70/61 is oriented toward users who need both interactive and batch-mode processing capabilities. The 70/61 Processor bears the same relationship to the general-purpose 70/60 Processor as the 70/46 bears to the 70/45. Despite its three-fold speed advantage over the 70/46, the 70/61 is still not a really large-scale computer; its internal speeds are substantially lower than those of the System/360 Model 65, for example.

COMPATIBILITY

The Series 70 compatibility picture has four important dimensions:

- Compatibility with the IBM System/360 and 370.

- Compatibility within the Series 70 family.

- Compatibility with older RCA and IBM computers.

- Compatibility with other UNIVAC computers.

Designed to provide compatibility with the IBM System/360, the Series 70/2 through 70/7 and 70/35 through 70/61 processors naturally have many hardware characteristics in common with the System/360. They have a large, complex instruction repertoire that enables them to perform four different types of arithmetic: fixed-point arithmetic in either fixed-length binary or variable-length decimal mode, and floating-point arithmetic on either ▷

▶ 70/234 CARD PUNCH: Punches and read-checks 80-column cards at 100 cpm. Contains a full-card buffer. EBCDIC is the standard code, and column binary is optional.

70/236 CARD PUNCH: Punches and read-checks 80-column cards at up to 300 cpm. Contains a full-card buffer. EBCDIC is the standard code, and column binary is optional. A 1000-card input hopper and two 850-card stackers can be loaded and unloaded while the punch is operating.

70/237 CARD READER: Reads 80-column cards serially, on demand, at up to 1435 cpm. EBCDIC is the standard code, and column binary is optional. A 2000-card input hopper and two stackers can be loaded and unloaded while the reader is operating. Optional features permit reading of either vertical or slanted pencil marks.

70/221 PAPER TAPE READER/PUNCH: Reads 5-, 6-, 7-, or 8-level punched tape at 200 characters per second and punches it at 100 characters per second. Handles strips or 1000-foot reels. Can read and punch simultaneously by time-sharing one multiplexer trunk. Available options include EBCDIC mode and 6-level advanced sprocket holes.

70/224 HIGH-SPEED PAPER TAPE READER: Reads 5-, 6-, 7-, or 8-level punched tape at up to 1000 characters per second. Handles 1000-foot reels. Offers same options as the 70/221, above.

70/242 MEDIUM-SPEED PRINTER: Prints up to 625 lpm using the standard 64-character print drum. Available with either 132 or 160 print positions. Skipping speed is 27 inches per second; an optional Dual-Speed Form Advance feature provides a skipping speed of 75 inches per second on skips of more than 8 lines. Contains a full-line buffer.

70/243 HIGH-SPEED PRINTER: Prints up to 1250 lpm using the standard 64-character print drum, or up to 833 lpm when equipped with an extended character set of 96 graphics (including lower-case letters). Available with either 132 or 160 print positions. Skipping speed is 75 inches per second. Contains a full-line buffer.

70/246 TRAIN PRINTER: Similar to the IBM 1403 Model N1 Printer. Rated printing speed is 1100 lpm with the standard 48-character horizontal "train" of engraved slugs. Contains 132 print positions and a full-line buffer.

70/248 BILL FEED PRINTER: An adaptation of the IBM 1404 Printer. Prints on continuous forms (at up to 600 lpm) or on individual 50- or 80-column cards fed one or two at a time. Peak speed is 800 cards per minute when printing 1 line per card on cards fed in "two-up" fashion. Has a 48-character set and 132 print positions. Can print up to 25 lines of data on a card. Requires a 70/249 Bill Feed Printer Control.

70/272-10 MICR SORTER-READER CONTROLLER: Permits either of the following magnetic ink character readers to be connected to a Series 70 system: Burroughs B 103 or B 116.

70/300 STANDARD INTERFACE SWITCHES: Manual or program-controlled devices used to switch standard Series 70 interface trunks. Can be used either to switch one I/O subsystem between two processors or to switch one processor channel position between two I/O subsystems ("one-by-two"). The 70/350 Switch Controller can operate up to eight 70/310 Basic Switches under program control, and can be shared by up to four processors. Up to four 70/350 ▶

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▷ one-word or two-word operands. In addition, they can perform radix conversions, code translations, and conversions between the packed (2 decimal digits per byte) and unpacked (1 digit per byte) data formats. They enable the programmer to make use of sixteen 32-bit general registers that can serve as accumulators, index registers, or base address registers. They use a base-plus-displacement addressing scheme that permits direct addressing of up to 16 million bytes of core storage. And finally, they have a comprehensive interrupt system that enables them to respond to a variety of special conditions, both internal and external.

There are, however, at least two significant hardware differences between the Series 70 and System/360 processors. First, although the machine instructions used by applications programmers are the same in both lines, the "privileged" instructions—which are normally reserved for operating system use—are quite different. Second, whereas the System/360 processors have one set of general registers, the Series 70 processors have four sets—one for each of four processor states. As a result, the Series 70 processors can service interrupt conditions more efficiently than the IBM processors, in which it is necessary to save and restore the contents of multiple registers each time an interrupt is processed. The general registers are located in an extension of core storage in the 70/35, and in a high-speed "scratchpad" memory unit in all the faster Series 70 processors.

Compatibility with the System/360 line is also achieved through compatible source languages that are all essentially the same as their System/360 counterparts. As a result, most System/360 source programs can be assembled or compiled and executed on a Series 70 processor with little or no need for program changes. System/360 object programs, however, cannot be executed directly on a Series 70 because of the differences in the "privileged" instructions; reassembly or recompilation is always necessary.

As a further step toward System/360 compatibility, a System/360 mode of operation (supplied as a no-extra-cost feature) enables a 70/2, 3, 6, or 7 Processor to directly execute most System/360 DOS object programs. This feature is an emulator that resolves the differences in privileged instructions that have previously precluded direct machine-level interchange of programs between System/360 and Series 70 computers.

Among the Series 70 Models 70/2 through 70/7 and 70/35 through 70/61, there is a high degree of data and program compatibility at the hardware level. Any two of the general-purpose processors equipped with equivalent storage, features, and peripheral devices can execute the same programs and produce the same results (provided only that the programs are valid ones and do not depend on any fixed relationships between internal processing and input/output times). The virtual-memory systems can ▷

▶ Switch Controllers can be attached to a Communication Line Switch Adapter (CLSA) Model 70/356 for manual or automatic switching of groups of communication lines to one of two sets of Series 70 buffers. With the 70/356 CLSA and 70/350 controller, a variety of different unit switches can be attached for teletypewriter units (70/325), data sets (70/326), or data gathering units (70/327).

DIGITAL PLOTTERS: Incremental plotters that enable a Series 70 computer to produce output data in graphic form are available from California Computer Products, Inc. and Benson-Lehner Corp.

COMMUNICATION DEVICES

70/627 DATA EXCHANGE CONTROL (DXC): Connects two Series 70 processors, up to 200 feet apart, permitting direct memory-to-memory data interchange via a selector or multiplexer trunk on each of the two processors. Either processor can originate transmission or request data.

70/653 COMMUNICATION CONTROL: Permits single-channel remote communication with another Series 70 computer or with an RCA 301 or 3301 computer equipped with data communications equipment. Transmission can be via the public telephone network at 250 char/sec, a leased voice-band line at 300 char/sec, or a broad-band channel at 5100 char/sec. Connects to a Series 70 selector or multiplexer channel.

70/656 COMMUNICATION CONTROLLER—SINGLE CHANNEL: Permits remote communication, in ASCII synchronous transmission mode, with any of the following equipment: another suitably equipped Series 70 computer, an IBM System/360 with a 2701 or 2703 controller, Series 70 standard synchronous devices, or the AT&T Collect Message Distribute System. Operates via either dialed public networks or private lines, at half-duplex transmission rates of 250, 300, 2400, 5100, 6250, or 28,800 char/sec. Connects to a selector or multiplexer channel. The processor program must handle all line and error control functions.

70/668 COMMUNICATION CONTROLLER—MULTICHANNEL (CCM): Permits connection of multiple low-speed and medium-speed remote terminals to the multiplexer channel of any Series 70 processor. Can be equipped, via appropriate buffers, to handle a broad range of communication services, speeds, and codes. Transmission speeds can range from 6 to 300 char/sec. Three models are available, with capacities for 16, 32, or 48 buffers. Each buffer handles one half-duplex line; a full-duplex line requires a pair of buffers. One 70/668 CCM can service a mixture of up to 16 different types of buffers with a maximum total data rate of 6000 bytes/sec.

70/700 SERIES COMMUNICATIONS BUFFERS: Provide the physical interfaces between the 70/668 CCM and the data set(s) or communications line(s). The buffers are located in the CCM cabinet and interface to Teletype Model 28, 32, 33, and 35 teletypewriters (70/710 or 70/712); AT&T 403A data sets or 70/510 VRU's (70/715); EIA asynchronous data sets (70/720); EIA synchronous data sets (70/721); Synchronous Transmit/Receive IBM-type terminals (70/722); EDGE Demodulator Line Concentrators (70/724); Data Gathering System Line Concentrators (70/725); and Time Generators (70/780).

70/510 VOICE RESPONSE UNIT: Provides audio responses, in recorded human-voice form, to digital inquiries from pushbutton telephones. The basic unit handles 10 lines and can be expanded, in 10-line increments, to a ▶

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▷directly execute object programs written for the general-purpose "real" memory models under TDOS, though the converse is not necessarily true. Source-language programs can be freely interchanged between the virtual and "real" systems, for the most part, with only minor changes required for Assembly-language programs under DOS.

To facilitate conversions from older RCA and IBM computers to the Series 70 line, RCA developed a series of emulators. These extra-cost features use a combination of microprograms in read-only memory and specialized software to enable various Series 70 processors to execute programs written for the second-generation RCA 301, RCA 501, or IBM 1400 Series computers (see accompanying table).

Recently, as a "bridge" for conversion to other UNIVAC products, a series of conversion aids has been released:

- The Series 70 Mode of Operation Through Hardware (SMOOTH) consists of two emulators that run on the UNIVAC 9700. One runs under a stand-alone Mini-Exec and fully supports TOS, TDOS, DOS, and COS operating under either TDOS or DOS. The other emulator runs under OS/7 on the 9700 and supports TOS, TDOS, and DOS batch operations only, while communications programs can be run under a version of COS that is fully incorporated into OS/7. RCA 301 and 501 emulation is also provided on the 9700 through a combination of microcode and software. The batch-only emulator and 301 capability will be available in the fourth quarter of 1973, the 501 emulator will be available in the second quarter of 1974, and the Mini-Exec emulator will be available in the first quarter of 1974.

- COS and COBOL have been placed directly under OS/7 as "native" software for the UNIVAC 9700. This capability is scheduled for availability during the first quarter of 1974.

- Translators for the UNIVAC 9700 will provide automatic Series 70 disc file data translation and ANS and Spectra COBOL, BAL, FORTRAN, and RPG language conversion. OS/7 on the 9700 will accept standard Series 70 magnetic tapes. These translators will be available during the first quarter of 1974.

- A Series 70-compatible Front End Processor (FEP) for the 1100 Series will execute the functions of a subset of Series 70 software products. The FEP connects through an Inter-Processor Control Unit (IPCU) and can run COS and be used for spooling and Remote Job Entry (RJE). A message simulator for the 1100-type processor will be provided to help convert Series 70 COS/MCS users. The FEP will be available during the first quarter of 1974. ▷

▶maximum of 50 lines. Two models are available, with 31 or 63 sound tracks for storage of recorded words or phrases. Each track can be used to store either one phrase (up to 1.5 seconds in length), the same word recorded three times, or three different words. Thus, a vocabulary of up to 189 words, selected by the user, can be stored in either male or female voice form. The 70/510 VRU works in conjunction with a 70/668 CCM. The 70/510 is out of new production and is provided on an "as available" basis only.

70/630 DATA GATHERING SYSTEM: An on-line data collection system that permits both fixed and variable data to be transmitted to a Series 70 system from multiple remote input stations. Transmission speed is 120 char/sec over either twisted-pair conductors (up to 30 miles long) or leased voice-grade lines. A variety of input stations permit data to be entered from plastic badges, 80-column cards, keyboards, and/or scales or counters. A total of up to 384 on-line DGS input stations can be serviced by a single 70/668 CCM. Alternatively, up to 256 input stations can be connected to a 70/674 DGS Controller, an off-line unit that records the transmitted data on magnetic tape for later computer processing. The 70/630 is out of new production and is provided on an "as available" basis only.

70/740 DATA TERMINAL: Provides remote batch printing capability, with optional card input capability via the 70/741 Card Reader (below). Various models provide a choice of peak printing speeds (either 300 or 600 lines per minute), with a choice of either 80 or 132 print positions and either the Series 70 or ASCII set of 64 printable characters. Transmission is in ASCII synchronous mode, at up to 9600 bits per second. Connects to a Series 70 processor via a 70/656 or 70/668 Communication Control. Facilities for unattended operation are standard.

70/741 CARD READER: Provides remote 80-column card input at up to 300 cpm when used with a 70/740 Data Terminal (above). Off-line data transcription from cards to printer is also possible.

70/750 MODULAR VIDEO DATA SYSTEM: Consists of a 70/759 Video Data Controller, up to six 70/756 Video Data Generators, and from two to eight 70/751 Video Data Terminals connected to each 70/756 VDG by up to 500 feet of cable. The 70/759 VDC can be connected either directly to a Spectra 70 multiplexer channel or via a remote communications link that terminates in a 70/668 CCM at the computer site. The 70/751 VDT displays alphanumeric data on the face of a 12-inch rectangular CRT. Display capacity is 270 to 1080 characters, depending upon the number of VDT units connected to the 70/756 VDG. Ninety-six different characters, including both upper and lower case letters, can be displayed. Input data can be entered from either a keypunch-style or typewriter-style keyboard.

8752-100 VIDEO DATA TERMINAL: Displays alphanumeric data on the face of a 12-inch rectangular CRT. Can display up to 1080 characters at a time, in 20 lines of 54 characters each. Character set consists of 64 ASCII letters, numerals, and symbols. The 8752-100 VDT is a self-contained, desk-top unit that is normally connected via a remote communications link, to a 70/668 CCM at the computer site. Transmission speed is 120 char/sec over either the public telephone network or private voice-grade lines. Messages can be entered via the unit's keyboard and verified on the display screen before transmission.

8752-200 VIDEO DATA TERMINAL: This improved stand-alone CRT display unit incorporates all the features of the earlier 8752-100 VDT (above) plus such new

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▷ ● 1100 Series language translators will be provided for Series 70 ANS and Spectra COBOL, BAL, FORTRAN, and RPG. A debug and documentation tool will also be provided for Assembly-language programs. The BAL translator will be available in the third quarter of 1973, while the other language translators will be available in the first quarter of 1974.

● Data Translation via magnetic tape will be provided for conversion of user files from the Series 70 to the 1100 Series. First release of the data translator will be in the third quarter of 1973, with a more comprehensive data translator available in the first quarter of 1974.

SOFTWARE

UNIVAC furnishes a well-tested complement of supporting software for the Series 70 line. There are four distinct general-purpose "real" operating systems and extensions of two of these to support communications-oriented installations. In addition, a virtual memory operating system is provided that extends common code to each of the virtual systems. At each software level, UNIVAC furnishes appropriate language translators, service programs, and utility routines. The highest practical degree of source-language compatibility with the IBM Assembler, COBOL, FORTRAN, and RPG languages has been maintained.

With the takeover by UNIVAC, Series 70 software development plans were carefully re-evaluated. In the light of this close scrutiny, UNIVAC decided to drop the heavily-touted OS/70, RCA's answer to IBM's full OS/MFT and OS/MVT. In place of OS/70, Disc Operating System (DOS) users have been given DOS/RMS, an advanced version of DOS; Tape/Disc Operating System (TDOS) users have been given upgraded versions of TDOS that promise nearly all of the functional capabilities of OS/70; and Virtual Memory Operating System (VMOS) users continue to receive the benefits of on-going virtual memory development efforts. No development plans were in force at the time of the UNIVAC takeover for the Primary Operating System (POS) or Tape Operating System (TOS), and the availability of these systems continues unaffected.

OUTLOOK

As the results of the first year of Series 70 operations begin to appear, it is increasingly evident that the purchase of this computer customer base from RCA has become a brilliant success for UNIVAC. During their remaining lives, the Series 70 systems will prove to be eminently more financially rewarding for UNIVAC than its own gear, and the entire Series 70 acquisition shapes up as a windfall by anybody's definition. ▷

▶ capabilities as: transmission speeds from 300 to 2400 bits per second in either asynchronous or synchronous mode; a separate buffer for printing, which frees the display screen and keyboard and accommodates fast serial printers; an optional upper-and-lower case keyboard (96 characters); optional expanded display capacities of 1620 or 1782 characters; and simplified maintenance features.

SOFTWARE

OPERATING SYSTEMS: Software support for the Series 70 line is furnished at a number of distinct levels. Users of the general-purpose Series 70/2, 70/6, 70/35, 70/45, 70/55, and 70/60 Processors can choose the Disc Operating System and Resource Management System (DOS/RMS), Tape Operating System (TOS), or Tape/Disc Operating System (TDOS). Extensions of the most widely used of these systems, TDOS, are available to support communications-oriented installations.

Specialized Virtual Memory Operating System (VMOS) software support is provided for the Series 70/3, 70/7, 70/46 and 70/61. (Note that each of these virtual memory machines can also be run in a "real" mode and can operate under the "real" operating systems listed above.)

A Primary Operating System (POS) is provided for the 70/15 and 70/25 with Type III (local) programming support.

The facilities provided at each of these support levels are summarized in the following paragraphs.

PRIMARY OPERATING SYSTEM: POS is a tape-resident operating system that consists of a Control System and a File Control Processor (FCP). The Control System controls and coordinates the execution of all programs, while the FCP is a generalized I/O control system. In conjunction with the Supervisor, the FCP controls I/O operations at both the logical and physical levels. An assembly-language programmer can choose to work at either the logical record level or at the physical level; in the latter case, he must specifically provide for all blocking, buffering, and I/O device functions.

The language translators available under POS are an Assembly System, a COBOL compiler, and a Report Program Generator (RPG). Other POS facilities include a tape Sort/Merge routine and a useful complement of library maintenance, diagnostic, and utility routines. The Peripheral Control Program (PCP) permits concurrent operation of up to three data transcription routines under POS.

PRIMARY COMMUNICATIONS ORIENTED SYSTEM: PCOS is closely related to POS and is designed specifically to control data communications processing on a 70/15 or 70/25 system by allowing the user to write his own communications programs. It consists of a Supervisor, a Peripheral Control Program, Snapshot Macros, and Program Loaders. Language translators and other required software facilities are "borrowed" from POS as needed. PCOS, directed by macros, controls a single user-written communication Program utilizing up to eight 70/668 CCM controllers. Concurrently, it can control the execution of up to six independent data transcription routines. PCOS is provided with Type III (local) programming support.

DISC OPERATING SYSTEM AND RESOURCE MANAGEMENT SYSTEM: DOS/RMS is a disc-resident operating system that provides multiprogramming control of up to six concurrent programs. Minimum configuration requirements are a 32K processor, two disc drives, card ▶

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▷ While the role of these systems in the marketplace as viable contenders for new business is not necessarily ended, the main focus of UNIVAC's Series 70 operations is to derive from the RCA-built hardware the maximum potential revenue and then move the satisfied customers over to UNIVAC-built gear.

UNIVAC's top management has set a goal of retaining at least 50% of the Series 70 customer base into the mid-1970's, and at the current level of customer loyalty that objective should be met handily. The carefully thought-out and implemented program of systems software development and peripheral availability has kept the customers happy so far, and UNIVAC hopes that an equally well-planned conversion program will satisfactorily "bridge" the users into other UNIVAC computers upon their departure from the Series 70 line.

In an environment such as the one currently surrounding the Series 70, stability rather than a progressively competitive edge is the condition most to be sought after. Thus, many of the problems formerly experienced by RCA when it was struggling against IBM et al have ceased to be pertinent, and the same equipment that formerly hung as a millstone around the neck of one of the nation's top corporations is now proving to be some of the most lucrative in the industry.

Based upon the record thus far, UNIVAC has committed enough of all the right ingredients necessary to accomplish its objectives for the Series 70 as outlined above. With no lessening of the corporate commitment in sight, it appears certain that UNIVAC will derive still more success in the future from its happily adopted Series 70 customers. □

► reader, printer, and console typewriter. Among the distinguishing features of DOS/RMS over its unaided DOS predecessor are input/output spooling, priority job scheduling, automatic resource allocation, and dynamic memory management. DOS/RMS consists of three groups of components: a Control System, which monitors and controls the processing environment; a Language System, which provides a choice of four programming language translators; and a Utility System, which simplifies testing and production operations.

The DOS/RMS Control System consists of an Executive, a File Control Processor, and a Monitor. The Executive requires 10,000 bytes of core storage and handles interrupt control, I/O scheduling, error recovery, program loading and termination, memory allocation, and console control. The Executive permits concurrent execution of up to six independent programs, provided that sufficient memory space and peripheral devices are available. The File Control Processor is a generalized I/O system that works in conjunction with the Supervisor to control I/O at both the logical and physical levels. The generated FCP occupies approximately 4000 bytes and can handle both sequential and random processing. The Monitor is a non-resident routine that controls stacked-job processing of successive programs, without operator intervention, on the basis of control statements in an input job stream. Up to six such job streams can be handled concurrently if the necessary hardware facilities are available.

The language translators available under DOS/RMS are an Assembly System, COBOL and FORTRAN compilers, and a Report Program Generator. The DOS Utility System includes a disc Sort/Merge program and routines to perform library maintenance, system service, data transcription, diagnostics, and job accounting functions. Four different types of libraries can be maintained: core image, relocatable modules, source statements, and macro instructions.

TAPE OPERATING SYSTEM: TOS is a magnetic tape-resident operating system with Type I (centralized) programming support that can control the concurrent operation of up to six independent programs. TOS, however, provides no support for random access or data communications. Minimum configuration requirements are a 64K processor, five tape drives, card reader, and console typewriter. Like DOS/RMS, TOS consists of a Control System, a Language System, and a Utility System.

The TOS Control System consists of an Executive, a File Control Processor, and a Monitor. The Executive requires 16,000 bytes of core storage and handles interrupt control, I/O scheduling, error recovery, program loading and termination, memory allocation, and console control. It can also supervise the concurrent execution, under a priority system, of up to six programs, provided that sufficient memory space and peripheral devices are available. The File Control Processor (FCP) is a generalized I/O system that requires approximately 4000 bytes and handles the processing of sequential files at both the physical and logical I/O levels. The Monitor controls all program preparation runs, including assembly, compilation, linkage edits, and/or library maintenance. Activated by an operator type-in, the Monitor operates under control of the Executive and initiates the operations specified by control cards in an input job stream. The Monitor can also be used to control the execution of production programs.

The language translators available under TOS are an Assembly System, COBOL and FORTRAN compilers, and a Report Program Generator.

The TOS Utility System includes a tape Sort/Merge program, an Automatic Integrated Debugging System (AIDS) that facilitates program testing, and routines to perform data transcription, diagnostic, and library maintenance functions.

TAPE/DISC OPERATING SYSTEM: TDOS is an extended and considerably more powerful version of the Tape Operating System described above. Minimum configuration requirements are a 64K processor, one disc drive, three magnetic tape drives, card reader, printer, and console typewriter.

TDOS provides all the facilities and functions of TOS, and a TOS user can move up to TDOS without reprogramming or recompiling. In addition, TDOS provides: (1) support for mass storage devices; (2) more efficient operation, particularly in a multiprogramming environment, through the use of discs as library storage media; and (3) a sophisticated data communications control system (the MCS, described below). TDOS is provided with Type I (centralized) programming support.

TDOS provides the capability to run up to 14 independent jobs concurrently. (A TDOS "job" is defined to be a job stream or "monitor session" consisting of any number of job steps or programs.) Input spooling with priority job scheduling or simple first-in/first-out scheduling is a standard feature of TDOS, with optional concurrent output spooling for up to three printers and three card punches. ►

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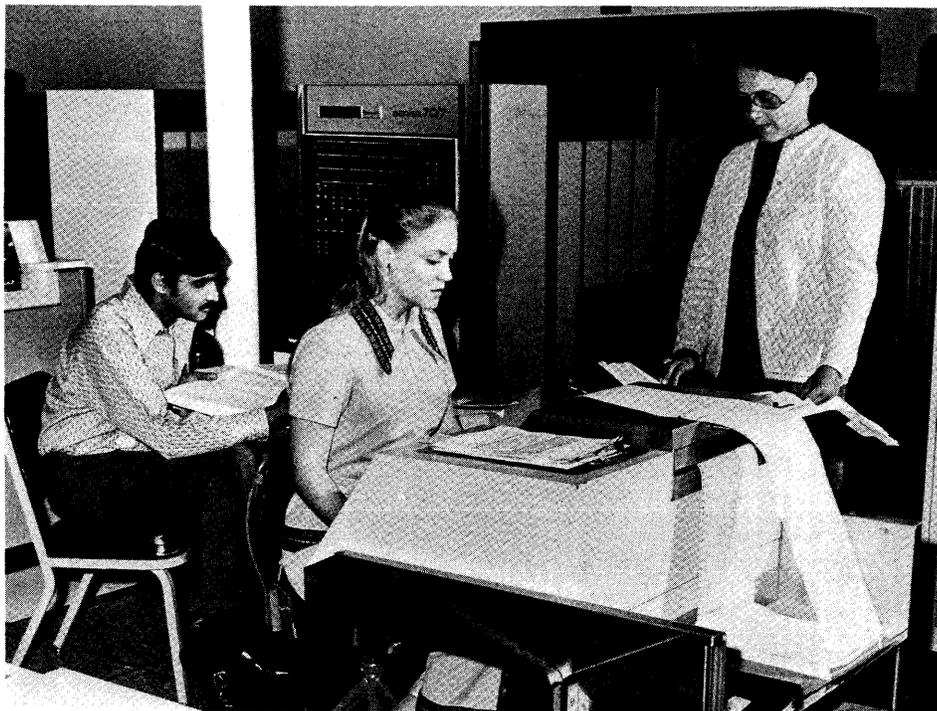
At the top of the Series 70 line is the 70/7, which offers up to 1 million bytes of real main memory and 13 million bytes of virtual memory. It uses an 8-register associative memory to perform the virtual-to-real address translations.

► Other features include: detailed job accounting statistics on the number of I/O commands issued to each device by job step; cataloged Job Control Language; disc library maintenance routines for the disc compilers; expanded data edit facilities for random-access devices; multiple configuration support for up to three versions of the Resident Executive on SYSRES; and six useful enhancements to the Source Library (SLU).

Also, 501 emulation on the 70/6, 70/7 (in 70/6 mode), or 70/45 and 301 emulation on the 70/6 or 70/7 (in 70/6 mode) can be performed under control of TDOS instead of in standalone fashion.

MULTICHANNEL COMMUNICATIONS SYSTEM: MCS is a modular software system designed to operate under control of the TDOS Executive and facilitate the implementation of a data communications system. It consists of three major components: Communications Interrupt Analysis (CIA), Multichannel Communication Program (MCP), and Communications User Program (CUP). CIA and MCP are software subsystems, supplied by RCA, that perform the functions of interrupt analysis, line servicing, message acknowledgement, buffering, queuing, error handling, code translation, and logging. The CUP is a user-written application program that interfaces with TDOS by means of macros.

VIRTUAL MEMORY OPERATING SYSTEM: VMOS is the primary operating system for the Series 70/3, 7, 46, and 61 Virtual Memory Computers. Designed to control concurrent local and remote processing in the batch, interactive, and communications modes, VMOS is an outgrowth of RCA's earlier Time-Sharing Operating System (TSOS) that features a data management system, better RPG, COBOL and FORTRAN compilers, additional utility routines, "spooled" remote input and redirectable output capabilities, and a text processing routine called Autoform.

VMOS controls the overall processing environment by allocating the system's resources, controlling the scheduling and execution of all tasks, servicing all interrupts, managing virtual memory by controlling the "swapping" of pages between main and drum memory, and initiating error recovery procedures. Spooling of card input and printer output on disc or tape drives improves hardware utilization; additional spooling facilities permit input from remote terminals to be spooled and processed in batch mode and give a high degree of control to the operator for redirection of "spoolout" files as well as flexible forms control commands. A Command Language is used for communication between VMOS and the system's users, operator, and administrator.

The VMOS data management system features improved catalog management techniques for faster access, improved channel utilization through queuing of requests for seek operations on random-access devices, use of the same physical block size in all random-access devices, handling of errors on an exception basis, and the ability to pass files from program to program. The VMOS Information Processing System (IPS/70) permits integration of all user data into a data base and controls accessing of the data base by multiple user programs.

A priority task scheduler designed to allow multiple levels of prioritization is included in VMOS. A basic central processor time-slice is given to each batch task in the input queue, and a special longer time-slice is given to the highest-priority task, in addition to putting that task at the head of the queue. A percentage-of-core parameter or a relative-frequency parameter can be used to divide the basic system resources between batch and interactive jobs and establish relative priorities between the batch and interactive workloads. Interactive jobs can be subjected to a fixed delay period specified at Sysgen time to limit CPU-bound interactive jobs from excessive use of the system resources. ►

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► Other noteworthy features of VMOS include: Dynamic Alternate Track Assignment, used in conjunction with the File Reconstruction System (FRS) and Error Recovery to recover from disc errors; a Random Access Volume Initializer (VOLIN); Tape Mark Positioning Control with non-standard and omitted label options; Catalog Display Program; dynamic step-down of dual-channel disc and tape controls for maintenance; and Remote Batch Processing features designed for error recovery, orderly terminal shut-down, and accounting statistics.

VMOS provides language processors for both batch and conversational use. The batch-mode Assembler and COBOL and FORTRAN compilers are themselves pageable and produce pageable object programs. The RPG and Sort/Merge programs operate in conventional batch (non-paged) mode. Also usable in the background batch processing mode are a number of applications modules, including PERT, Simscript, Network Analysis, Transportation Model, ECAP, and civil engineering, statistical-biomedical, and mathematical routines.

Conversational languages supported under VMOS include Extended BASIC, IFOR (an interpretive, compile-and-go FORTRAN IV processor), PI-FORTRAN (a fast "short-hand" FORTRAN), and Desk Calculator. A COBOL Syntax Checker (COBSYN) permits rapid detection and correction of COBOL programming errors by users at remote terminals. An Interactive Debugging Aid (IDA), usable in either conversational or batch mode, facilitates testing and modification of programs written in Assembly Language, COBOL, or FORTRAN. Code II (COBOL Test File Generator) is used to create test files on public disc as part of the COBOL program development subsystem. Finally, for the larger 70/7 computer only, UNIVAC offers two additional compilers: FAST FORTRAN, designed to provide rapid compilation and effective diagnostic facilities in a conversational environment; and Interactive COBOL, designed to enable terminal users to construct, check, test, and modify programs using the full ANSI COBOL language plus IBM extensions.

Extended VMOS communications capabilities, also available only for the larger 70/7 computer, include: (1) dynamic message buffering; (2) bulk message storage and a store-and-forward capability; (3) an intercept facility that returns undelivered messages to the sender; (4) a tape logging capability that enables a record of all message traffic to be maintained; and (5) extended terminal support facilities.

COBOL: UNIVAC offers COBOL compilers under six of the Series 70 operating systems: POS, DOS, TOS, TDOS, and VMOS. All except the POS version use essentially the same source language as IBM's OS/360 COBOL F, which includes many of the facilities of ANS COBOL but also has numerous incompatibilities and restrictions with respect to the standard language. POS COBOL uses a subset of the language elements supported in the larger compilers; among the features excluded from the POS version are the Sort, Report Writer, and Random Access modules. An ANS COBOL Level D is also provided for use with either DOS/RMS or TDOS.

FORTRAN: UNIVAC offers FORTRAN compilers for operation under DOS, TOS, TDOS, and VMOS. All use the FORTRAN IV source language, and all include all the facilities of ANS FORTRAN.

BASIC: Compilers for the BASIC language are offered only under VMOS. The UNIVAC compilers accept a source language similar to the version currently used in Honeywell (formerly GE) time-sharing systems.

REPORT PROGRAM GENERATORS: UNIVAC offers RPG's at nearly all of the Series 70 software support levels: POS, DOS, TOS, TDOS, and VMOS. Upward compatibility at the source-language level is preserved among all versions. The RPG's use data from user-prepared specification sheets to generate object programs which perform common business data processing functions. In addition to their basic report-writing functions, RPG programs can update files, perform various types of calculations, and accommodate user-coded routines to handle functions that cannot be programmed efficiently in the RPG language.

ASSEMBLERS: Assembly Language is the standard symbolic programming language used to write machine-oriented programs for all models of the Series 70. UNIVAC therefore furnishes Assembly Systems at all support levels.

UTILITY ROUTINES: Sort/merge programs are offered at all Series 70 support levels. All are generalized programs which are controlled by user-supplied parameters, and all can accommodate either fixed or variable-length records in blocked or unblocked form. Magnetic tape and/or disc drives are used, depending upon the orientation of the particular operating system.

Each software level also includes an appropriate complement of data transcription, diagnostic, and other utility routines.

APPLICATION PROGRAMS: A modest complement of generalized business and scientific application programs is available for the Series 70 line. Among the principal ones are:

Type I*	TDOS	DOS/RMS	VMOS
Biomedical Programs	X		X
Coordinate Geometry	X		
Digital Terrain Model	X		
Flow Simulator	X		
Hardy Cross Gas Distribution Analysis	X		
Hardy Cross Water Network Program	X		
IBM 1401 Simulation Program	X		
Scientific Subroutine Series 70 (with more than 400 programs and subroutines)	X	X	X
Curved Beam Analysis	X		
Rigid Frame Analysis	X		X
Structural Section Properties	X		X
Variable Inertia Beam Analysis	X		
Test of Hypothesis Series			X
VMOS Applications Library (with about 600 programs and subroutines)			X

*Type I software is provided with full UNIVAC centralized programming support. (Former Type II software is now considered to be Type I.)

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Type III**	TDOS	DOS/RMS	VMOS
Highway Profile Program	X		
NASA PERT Time II	X		
OCRCA Data Management System	X		
Sales Forecasting and Control	X		
Series 70 Linear Programming	X		
Statistical Series	X		X
Traffic Progression Analysis	X		X
User Language/1 (UL/1)	X		
500 Bus Transient Stability	X		
1000 Bus Fault Analysis	X		
Automatic Conversion Routine		X	
Educational Accounts Payable		X	
Educational Accounts Receivable		X	
Educational Payroll System		X	
Manufacturing Data Base System		X	
Statistical Analysis of Test Answers		X	
Student Scheduling Application System		X	
Continuous Systems Simulation			X
Electronic Circuit Analysis Program			X
FORTRAN Sort			X
Interactive Linear Programming			X
Princeton Interactive Programmed Tools			X
Princeton Interactive Programmed Tools			
Princeton Interactive FORTRAN			X
Transportation Linear Programming			X

**Type III software is supported by local Series 70 personnel and has no centralized maintenance support.

PRICING

EQUIPMENT: The following systems are representative of the types of Series 70 configurations that are being widely installed and are supported by the standard UNIVAC software. Obviously, they comprise only a small sampling of the many configuration possibilities within the Series 70 line. All necessary control unit and adapters are included in the indicated prices. The quoted rental prices include equipment maintenance and are for standard 1-year leases.

70/2 TAPE/DISC SYSTEM: Consists of 65K 70/2 Processor with two Selector Channels, two 70/564 Disc Storage Units, three 70/442 Magnetic Tape Units (each containing two 60KB tape drives), 70/237 Card Reader, 70/236 Card Punch, 70/243 Printer, and 70/97 Console. Monthly rental and purchase prices are approximately $10,767 and $587,760, respectively. For purchased systems only, monthly maintenance is $1,951.

70/3 VIRTUAL MEMORY SYSTEM: Consists of 262K 70/3 Processor with two Selector Channels, 70/560-005

Direct Access Storage System, 70/590-004 Direct Access Storage System (4 drives), two 70/442 Magnetic Tape Units (each containing two 60KB tape drives), 70/237 Card Reader, 70/236 Card Punch, 70/243 Printer, and 70/97 Console. Monthly rental and purchase prices (exclusive of the data communications and remote terminal equipment normally used in a system of this type) are approximately $17,590 and $916,085, respectively. For purchased systems only, monthly maintenance is $2,627.

70/6 TAPE /DISC SYSTEM: Consists of 262K 70/6 Processor with four Selector Channels, 8519-004 Direct Access Storage System (4 drives), eight 70/445 Magnetic Tape Units (each containing one 120KB drive) and dual-channel tape control, 70/237 Card Reader, 70/236 Card Punch, 70/243 Train Printer, and 70/97 Console. Monthly rental and purchase prices are approximately $23,813 and $1,240,440, respectively. For purchased systems only, monthly maintenance is $3,472.

70/7 VIRTUAL MEMORY SYSTEM: Consists of 524K 70/7 Processor with four Selector Channels, 70/560-016 Direct Access Storage System, 8519-008 Direct Access Storage System (8 drives), two 70/442 Magnetic Tape Units (each containing two 60KB tape drives), 70/237 Card Reader, 70/236 Card Punch, 70/243 Printer, and 70/97 Console. Monthly rental and purchase prices (exclusive of the data communications and remote terminal equipment normally used in a system of this type) are approximately $33,375 and $1,739,485, respectively. For purchased systems only, monthly maintenance is $4,251.

70/35 DISC SYSTEM: Consists of 32K 70/35 Processor with one Selector Channel, four 70/564 Disc Storage Units, 70/237 Card Reader, 70/236 Card Punch, 70/243 High-Speed Printer, and 70/97 Console. Monthly rental and purchase prices are approximately $6,431 and $357,090, respectively. For purchased systems only, monthly maintenance is $994.

70/45 (Type II) TAPE/DISC SYSTEM: Consists of 64K 70/45-II Processor with two Selector Channels, two 70/564 Disc Storage Units, three 70/442 Magnetic Tape Units (each containing two 60KB tape drives), 70/237 Card Reader, 70/236 Card Punch, 70/243 High-Speed Printer, and 70/97 Console. Monthly rental and purchase prices are approximately $13,339 and $697,080, respectively. For purchased systems only, monthly maintenance is $2,115.

70/46 VIRTUAL MEMORY SYSTEM: Consists of 256K 70/46 Processor with two Selector Channels and Memory Protect feature, 70/567 Drum Memory Unit (4.13 million bytes), four 70/564 Disc Storage Units, two 70/442 Magnetic Tape Units (each containing two 60KB tape drives), 70/237 Card Reader, 70/236 Card Punch, 70/243 High-Speed Printer, and 70/97 Console. Monthly rental and purchase prices (exclusive of the data communications and remote terminal equipment normally used in a system of this type) are approximately $24,570 and $1,267,720, respectively. For purchased systems only, monthly maintenance is $3,278.

70/55 TAPE/DISC SYSTEM: Consists of 256K 70/55 Processor with four Selector Channels and Memory Protect feature, four 70/564 Disc Storage Units, eight 70/445 Magnetic Tape Units (each containing one 120KB drive) and dual-channel tape control, 70/237 Card Reader, 70/236 Card Punch, 70/243 High-Speed Printer, and 70/97 Console. Monthly rental and purchase prices are approximately $26,141 and $1,345,255 respectively. For purchased systems only, monthly maintenance is $3,821.

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► **70/60 TAPE/DISC SYSTEM:** Consists of 256K 70/60 Processor and the same peripheral equipment as in the "70/55 Tape/Disc System" above. Monthly rental and purchase prices are approximately $29,946 and $1,518,505, respectively. For purchased systems only, monthly maintenance is $3,659.

70/61 VIRTUAL MEMORY SYSTEM: Consists of 512K 70/61 Processor with four Selector Channels and Elapsed Time Clock and Memory Protect features, two 70/567 Drum Memory Units (4.13 million bytes each), 8519-008 Direct Access Storage System (233.4 million bytes), two 70/442 Magnetic Tape Units (each containing two 60KB tape drives), 70/237 Card Reader, 70/236 Card Punch, 70/243 High-Speed Printer, and 70/97 Console. Monthly rental and purchase prices (exclusive of the data communications and remote terminal equipment normally used in a system of this type) are approximately $41,142 and $2,107,200, respectively. For purchased systems only, monthly maintenance is $4,576.

SOFTWARE AND SUPPORT: UNIVAC has not "unbundled" to date, so the equipment prices listed in this report include all of the Series 70 software described in this report and all normal educational courses and professional assistance.

CONTRACT TERMS: The standard UNIVAC use and service agreements allow unlimited use of the equipment (exclusive of the time required for remedial and preventive maintenance). There are no extra-use charges. The basic maintenance charge (included in all rental prices quoted above) covers maintenance of the equipment for nine consecutive hours a day, Monday through Friday. Extended periods of maintenance are available at extra cost.

LONG-TERM LEASES: In addition to the basic 1-year agreement, UNIVAC offers extended-term leases for the Series 70 systems at significantly lower monthly rates. All Series 70 equipment except the 70/2, 3, 6, and 7 Processors are eligible for the long-term leases. Under a 3-year "level-payment" agreement, the monthly equipment charge is 85% of the 1-year rental rate shown in the accompanying price list. Under a 5-year "level-payment" agreement, the monthly charge is 75% of the 1-year rental rate. Under a 5-year "reducing-payment" agreement, the monthly charge is 85% of the 1-year rental rate during the first year, 80% the second year, 75% the third year, 70% the fourth year, and 65% the fifth year. UNIVAC offers a standard purchase option credit that is the lower of 75 percent of the monthly rentals paid to date or 9 months system rental. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
70/2 PROCESSORS AND MAIN STORAGE				
70/2-001	Processor (for 65K Memory)	175,000	250	3,100
70/2-002	Processor (for 131K or 262K Memory)	212,500	300	4,250
5003-002	Direct Control Feature	9,700	12	194
5043-002	Selector Channels 1 & 2	12,500	50	250
5044-002	Selector Channels 1, 2, & 3	18,750	75	375
5045-002	Selector Channels 1, 2, 3, & 4	25,000	100	500
5006-002	1401 Emulator	6,300	10	90
8000-011	Memory; 65,536 bytes	37,500	50	750
8000-013	Memory; 131,072 bytes	75,000	100	1,500
8000-015	Memory; 262,144 bytes	150,000	200	3,000
70/3 PROCESSORS AND MAIN STORAGE				
70/3-001	Processor (for 131K Memory)	282,500	400	5,150
70/3-002	Processor (for 262K Memory)	282,500	400	5,650
5003-003	Direct Control Feature	9,700	12	194
5040-003	Selector Channels 1 & 2	12,500	50	250
5041-003	Selector Channels 1, 2, & 3	18,750	75	375
5042-003	Selector Channels 1, 2, 3, & 4	25,000	100	500
5006-003	1401 Emulator	6,300	10	90
8000-013	Memory; 131,072 bytes	75,000	100	1,500
8000-015	Memory; 262,144 bytes	150,000	200	3,000
70/6 PROCESSORS AND MAIN STORAGE				
70/6-001	Processor (for 131K Memory)	435,000	500	8,100
70/6-002	Processor (for 262K Memory)	435,000	500	8,700
Expansion Features for 70/6-002 Processor:				
5073	For expansion from 262K to 393K	120,000	—	1,800
5074	For expansion from 262K to 524K	120,000	—	2,400
5075	For expansion from 262K to 655K	180,000	—	3,000
5076	For expansion from 262K to 786K and above	180,000	—	3,600
5003-006	Direct Control Feature	9,700	12	194
5057-406	Selector Channels 3 & 4	67,500	80	1,350
5058-606	Selector Channels 3, 4, 5, & 6	135,000	160	2,700
5064-006	301 Emulator	25,200	40	360
5065-006	501 Emulator	25,200	40	360
5026-006	1410/7010 Emulator	25,200	40	360
5081-006	1401 Emulator	25,200	40	360
8000-013	Memory; 131,072 bytes	75,000	100	1,500
8000-015	Memory; 262,144 bytes	150,000	200	3,000
70/7 PROCESSORS AND MAIN STORAGE				
70/7-001	Processor (for 262K Memory)	525,000	700	10,500
Expansion Features for 70/7-001 Processor:				
5077	For expansion from 262K to 393K	120,000	—	1,800
5078	For expansion from 262K to 524K	120,000	—	2,400
5079	For expansion from 262K to 655K	180,000	—	3,000
5080	For expansion from 262K to 786K and above	180,000	—	3,600
5003-007	Direct Control Feature	9,700	12	194
5057-407	Selector Channels 3 & 4	67,500	80	1,350
5058-607	Selector Channels 3, 4, 5, & 6	135,000	160	2,700
5064-007	301 Emulator	25,200	40	360
5065-007	501 Emulator	25,200	40	360
5026-007	1410/7010 Emulator	25,200	40	360
5086-007	1401 Emulator	25,200	40	360
8000-013	Memory; 131,072 bytes	75,000	100	1,500
8000-015	Memory; 262,144 bytes	150,000	200	3,000
70/35 PROCESSORS AND MAIN STORAGE				
70/35-D	Processor (32K)	152,775	244	2,494
70/35-DC	Processor (49K)	189,735	315	3,329
70/35-E	Processor (65K)	213,885	341	3,918
5001-35	Memory Protect	6,405	8	127
5002-35	Elapsed Time Clock	2,575	3	51
5003-35	Direct Control	10,185	13	204
5005-35	301 Emulator	20,370	26	410
5006-35	1401 Emulator	16,590	21	84
5030	Selector Channel (1 channel)	8,975	12	179
5031	Selector Channel (2 channels)	14,070	18	279

*Rental prices do not include equipment maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
70/45 (Type II) PROCESSORS AND MAIN STORAGE				
70/45-E	Processor (65K)	274,995	438	5,488
70/45-F	Processor (131K)	356,475	568	7,117
70/45-FE	Processor (196K)	460,950	732	9,179
70/45-G	Processor (262K)	549,990	876	10,981
70/45-H	Processor (393K)	717,780	1,055	14,438
70/45-J	Processor (524K)	865,830	1,213	17,430
5002-45	Elapsed Time Clock	2,575	3	51
5003-45	Direct Control	10,185	13	204
5005-45	301 Emulator	25,465	33	508
5006-45	1401 Emulator	25,465	33	508
5007-45	501 Emulator	33,130	42	662
5019-45	Elapsed Time Clock	6,195	7	124
5026-45	1410 Emulator	28,035	36	558
5036-45	301/501 Emulator	43,315	55	864
5043-45	Selector Channel (2 channels)	59,325	76	1,184
5044-45	Selector Channel (3 channels)	88,985	113	1,777
5045-45	Selector Channel - (4 channels)	118,650	151	2,369
5046-45	1401/1410 Emulator	40,740	51	815
5056	Memory Store and Fetch Protection	9,870	13	197
70/46 PROCESSORS AND MAIN STORAGE				
70/46-G	Processor (262K)	698,565	1,113	13,941
5001-46	Memory Protect	6,405	8	127
5002-46	Elapsed Time Clock	2,575	3	51
5003-46	Direct Control	10,185	13	204
5019-46	Elapsed Time Clock	6,195	7	124
5040	Selector Channel (2 channels)	46,935	60	938
5041	Selector Channel (3 channels)	69,195	88	1,382
5042	Selector Channel (4 channels)	89,040	113	1,777
70/55 PROCESSORS AND MAIN STORAGE				
70/55-E	Processor (65K)	425,250	677	8,488
70/55-F	Processor (131K)	506,730	807	10,117
70/55-G	Processor (262K)	700,245	1,116	13,981
70/55-H	Processor (524K)	1,148,385	1,829	22,924
5001-55	Memory Protect	7,665	9	153
5002-55	Elapsed Time Clock	2,575	3	51
5003-55	Direct Control	12,755	16	255
5019-55	Elapsed Time Clock	6,195	7	124
5020	Selector Channel (2 channels)	22,945	29	459
5022	Selector Channel (4 channels)	40,740	51	815
5024	Selector Channel (6 channels)	58,590	75	1,170
70/60 PROCESSORS AND MAIN STORAGE				
70/60-F	Processor (131K)	577,395	614	11,794
70/60-G	Processor (262K)	769,860	819	15,715
70/60-H	Processor (393K)	937,650	998	19,152
70/60-J	Processor (524K)	1,085,700	1,155	22,176
70/60-K	Processor (655K)	1,273,230	1,355	26,006
70/60-L	Processor (786K)	1,421,280	1,512	29,030
70/60-M	Processor (917K)	1,598,940	1,701	32,659
70/60-N	Processor (1,048K)	1,756,990	1,859	35,683
5002-60	Elapsed Time Clock	2,575	3	51
5003-60	Direct Control	10,185	13	204
5019-60	Elapsed Time Clock	6,195	7	124
5057	Selector Channel (2 channels)	71,085	90	1,422
5058	Selector Channel (4 channels)	142,170	182	2,842
5059	Memory Protect	9,870	13	197
5026-60	1410-7010 Emulator	54,705	67	1,092
5062	Virtual Memory Feature	148,050	158	3,029
70/61 PROCESSORS AND MAIN STORAGE				
70/61-G	Processor (262K)	917,910	977	18,748
70/61-H	Processor (393K)	1,085,700	1,155	22,176
70/61-J	Processor (524K)	1,233,750	1,313	25,200
70/61-K	Processor (655K)	1,421,280	1,512	29,033
70/61-L	Processor (786K)	1,569,330	1,670	32,057
70/61-M	Processor (917K)	1,746,990	1,859	35,684
70/61-N	Processor (1,048K)	1,895,040	2,016	38,708
5002-61	Elapsed Time Clock	2,575	3	53
5003-61	Direct Control	10,185	13	205

*Rental prices do not include equipment maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
70/61 PROCESSORS AND MAIN STORAGE (continued)				
5019-61	Elapsed Time Clock	6,195	7	126
5057	Selector Channel (2 channels)	71,085	90	1,422
5058	Selector Channel (4 channels)	142,170	182	2,842
CONSOLES				
70/97-10	Console	16,850	27	336
5051	Keyboard Interlock	495	1	10
70/97-20	Console	18,110	29	360
5060	Run Time Recorder Interface	263	0	N/A
5260	Special Type Slug and Key	53	0	N/A
70/216	Input/Output Typewriter	9,240	54	151
5259	Form Supply Box	53	0	N/A
5276-1	Paper Tape Reader	1,260	7	21
5276-2	Paper Tape Reader	1,525	9	24
5277-1	Paper Tape Punch	4,250	24	70
5277-2	Printing Paper Tape Punch	4,515	26	74
MASS STORAGE				
70/560-005	Virtual Memory Storage System (2.64M Bytes)	105,000	400	2,100
70/560-008	Virtual Memory Storage System (4.1M Bytes)	166,150	609	3,041
70/560-016	Virtual Memory Storage System (8.2M Bytes)	301,950	1,154	5,490
70/564	Disc Storage Unit	26,785	72	562
70/567-8	Drum Memory (4.13M Bytes)	142,590	572	2,571
70/567-16	Drum Memory (8.26M Bytes)	285,180	1,145	5,143
70/568-11	Mass Storage Unit (Mag. Cards)	136,500	722	2,756
70/590-2	Direct Access Storage System (2 Drives)	95,340	206	1,945
70/590-3	Direct Access Storage System (3 Drives)	120,190	300	2,420
70/590-4	Direct Access Storage System (4 Drives)	115,040	393	2,895
70/590-5	Direct Access Storage System (5 Drives)	169,890	487	3,370
70/590-6	Direct Access Storage System (6 Drives)	194,740	581	3,845
70/590-7	Direct Access Storage System (7 Drives)	219,590	675	4,320
70/590-8	Direct Access Storage System (8 Drives)	244,440	768	4,795
70/590-9	Direct Access Storage System (9 Drives)	273,790	881	5,355
70/590-10	Direct Access Storage System (10 Drives)	298,640	975	5,830
70/590-11	Direct Access Storage System (11 Drives)	323,490	1,068	6,305
70/590-12	Direct Access Storage System (12 Drives)	348,340	1,162	6,780
70/590-13	Direct Access Storage System (13 Drives)	373,190	1,256	7,255
70/590-14	Direct Access Storage System (14 Drives)	398,040	1,350	7,730
70/590-15	Direct Access Storage System (15 Drives)	422,930	1,443	8,205
70/590-16	Direct Access Storage System (16 Drives)	447,740	1,537	8,680
5519	Multichannel Switch	5,770	14	133
5520	Dual Access	87,500	190	1,750
8519-002	Direct Access Storage System (2 Drives)	69,850	200	1,270
8519-003	Direct Access Storage System (3 Drives)	79,895	260	1,390
8519-004	Direct Access Storage System (4 Drives)	100,000	340	1,845
8519-005	Direct Access Storage System (5 Drives)	113,800	420	2,150
8519-006	Direct Access Storage System (6 Drives)	123,895	500	2,195
8519-007	Direct Access Storage System (7 Drives)	142,725	590	2,595
8519-008	Direct Access Storage System (8 Drives)	158,950	680	2,890
8440-00	Disc Drive (1 Drive)	27,840	145	609
5033-00	8440 Controller	75,600	410	1,575
F1470-00	Dual Channel	3,700	15	85
F1482-00	Dual Access (requires two 5033-00 Controllers)	2,160	5	45
MAGNETIC TAPE				
70/432-1	Magnetic Tape Units (30KB) 800 BPI, 9 track, single channel	28,720	145	534
70/432-2	Magnetic Tape Units (30KB) 800 BPI, 9 track, dual channel	28,720	145	534
5465	7/9 Channel Tape Feature (For 70/432-1, -2)	945	5	18
70/441-1	Magnetic Tape Unit, 7 track, single channel	35,965	180	665
70/441-2	Magnetic Tape Unit, 7 track, dual channel	35,965	180	665
70/442-1	Magnetic Tape Units (60KB) 800 BPI, 9 track, single channel	43,105	217	798
70/442-2	Magnetic Tape Units (60KB) 800 BPI, 9 track, dual channel	43,105	217	798
5464	7/9 Channel Tape Feature (For 70/442-1, -2)	945	5	18
70/445-1	Magnetic Tape Station (120KB) 800 BPI, 9 track, single channel	37,065	188	690

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
MAGNETIC TAPE (continued)				
70/445-2	Magnetic Tape Station (120KB) 800 BPI, 9 track, dual channel	37,065	188	690
5463	Auto. Run to BT Marker (For 70/445-1, -2)	470	2	8
70/451-1	Magnetic Tape Unit (60KB) 1600 BPI, phase enc., single ch. (9 Track)	37,695	188	679
70/451-2	Magnetic Tape Unit (60KB) 1600 BPI, phase enc., dual ch. (9 Track)	38,745	192	697
70/453-1	Magnetic Tape Unit (120KB) 1600 BPI, phase enc., single ch. (9 Track)	52,605	260	947
70/453-2	Magnetic Tape Unit (120KB) 1600 BPI, phase enc., dual ch. (9 Track)	53,550	265	964
70/463-108	Tape Controller Single Channel 1x8 (7/9 tracks)	43,260	92	845
70/463-116	Tape Controller, Single Channel 1x16 (7/9 tracks)	71,295	151	1,391
5414-1	381/382 Tape Mode	785	2	15
5415-1	Pack/Unpack Feature	2,575	6	50
70/463-208	Tape Controller, Dual Channel 2x8	57,330	122	1,120
70/463-216	Tape Controller, Dual Channel 2x16	92,975	197	1,817
5414-2	381/382 Tape Mode	1,525	3	30
5415-2	Pack/Unpack Feature	4,355	9	85
70/472-108	Tape Controller, Single Channel 1x8 (9 track)	35,650	76	696
70/472-116	Tape Controller, Single Channel 1x16 (9 track)	68,775	146	1,343
70/472-208	Tape Controller, Dual Channel 2x8 (9 track)	49,720	106	971
70/472-216	Tape Controller, Dual Channel 2x16 (9 track)	89,145	189	1,739
70/473-108	Tape Controller, Single Channel 1x8 (7/9 track)	38,220	81	744
70/473-116	Tape Controller, Single Channel 1x16 (7/9 track)	71,295	151	1,391
70/473-208	Tape Controller, Dual Channel 2x8 (7/9 track)	53,550	114	1,044
70/473-216	Tape Controller, Dual Channel 2x16 (7/9 track)	92,975	197	1,817
5402-1	Pack/Unpack Feature for 70/473-108 or 116	2,575	6	50
5402-2	Pack/Unpack Feature for 70/473-208 or 216	4,355	9	85
70/476-108	Tape Controller, Single Channel 1x8 (9 track, 1600 BPI)	40,845	87	797
70/476-116	Tape Controller, Single Channel 1x16 (9 track, 1600 BPI)	74,340	158	1,449
70/476-208	Tape Controller, Dual Channel 2x8 (9 track, 1600 BPI)	60,270	127	1,174
70/476-216	Tape Controller, Dual Channel 2x16 (9 track, 1600 BPI)	99,855	213	1,948
5431-1	Bi-Modal for 70/476-108, -116	12,915	27	251
5431-2	BiModal for 70/476-208, -216	15,435	33	299
0862-04	Uniservo 16 Tape Unit	18,675	110	450
F0937-01	Dual Density (Bi-Modal)	2,175	0	50
F1319-00	Dual Access (requires two 5034-00 controllers)	2,175	10	50
0864-00	Uniservo 20 Tape Unit	23,447	125	565
F1510-00	Dual Access (requires two 5034-00 controllers)	2,175	10	50
5034-00	Uniservo 20 (and 16) Control Unit	31,125	90	750
F0826-99	9-Tack NRZI (Bi-Modal)	6,240	20	130
CARD INPUT/OUTPUT UNITS				
70/232	Card Reader (300 CPM)	18,585	86	308
5340	600 CPM Feature	2,415	13	40
5341-1	Mark Read—Vertical	7,350	35	123
5341-2	Mark Read—Slant	7,350	35	123
5204-2	Column Binary	1,525	9	26
70/234-10	Card Punch (100 CPM)	22,945	140	376
70/234-11	Card Punch (100 CPM) Col. Binary	28,825	173	470
5213	Scored Card Feature	525	3	8
70/236-10	Card Punch (300 CPM)	38,220	234	622
5215-1	Scored Card Feature	525	3	8
5261-1	Programmed Stacker Select	1,050	5	17
70/236-11	Card Punch (300 CPM) Col. Binary	44,100	268	720
5215-1	Scored Card Feature	525	3	8
5261-2	Programmed Stacker Select	1,050	5	17
70/237-10	Card Reader (1435 CPM)	33,130	189	552
70/237-21	Card Mark-Reader (Vertical)	42,055	239	701
70/237-22	Card Mark-Reader (Slant)	42,055	239	701
5269	Column 81 Inhibit (all 237's)	53	0	N/A
5202	51 Column Card Feature (all 237's)	525	3	8
5204-1	Column Binary Feature (all 237's)	1,525	9	26
5211-1	End of File Feature (all 237's)	N/C	N/C	N/C
5309	Inhibit Leading Edge Check (all 237's)	53	0	N/A

*Rental prices do not include equipment maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
PRINTERS				
70/242-10	Printer, Medium Speed (625 LPM)	45,835	236	567
70/242-20	Printer, Medium Speed (625 LPM)	61,110	315	830
70/242-30	Printer, Medium Speed (Drum, 625 LPM) 132 Col.	48,405	249	557
70/242-40	Printer, Medium Speed (Drum, 625 LPM) 160 Col.	63,685	327	820
70/243-10	Printer, Hi-Speed (1250 LPM)	50,925	259	875
70/243-20	Printer, Hi-Speed (1250 LPM)	66,200	337	1,137
70/243-30	Printer, Hi-Speed (Drum, 1250 LPM) 132 Col.	53,500	272	917
70/243-40	Printer, Hi-Speed (Drum, 1250 LPM) 160 Col.	68,775	349	1,180
70/243-51	Printer, Hi-Speed (833 LPM) 132 Col.	63,685	324	1,095
70/243-61	Printer, Hi-Speed (833 LPM) 160 Col.	78,960	400	1,355
5221	Dual Speed Form Advance	5,090	22	90
5333-1	Form Stacker (for Models 70/242-30, -40 & 70/243-30, -40, -50, -51, -61)	1,525	5	26
70/246-050	Printer (Train 450 LPM)	74,600	440	460
70/246-100	Printer (Train 750 LPM)	76,100	470	830
70/246-200	Printer (Train 1200 LPM)	77,600	495	1,290
6746	Print Train	3,500	Time & Materials	125
70-248-11	Bill Feed Printer	88,985	518	1,397
5216	Interchangeable Print Chain	3,280	Time & Materials	79
70/249-11	Bill Feed Printer Control	52,765	112	1,029
MISCELLANEOUS INPUT/OUTPUT UNITS				
70/221-10	Paper Tape Reader/Punch (200/100 CPS)	25,465	145	425
5219-10	Advanced Sprocket 6-Level Read	2,365	13	38
5256	Long Block Indicator (All 221's)	995	5	18
5292	4-N Terminate (All 221's)	1,995	11	34
5296	Read Kleinschmidt Format (All 221's)	1,995	11	34
5297	End of Tape (All 221's)	500	3	8
5298	Gapless Mode (All 221's)	500	3	8
5299	Punched Kleinschmidt Format (All 221's)	1,735	9	29
70/221-11	Paper Tape Reader/Punch (Read/Write EBCDIC)	26,775	152	445
5219-11	Advanced Sprocket 6-Level Read	2,365	13	38
70/221-20	Paper Tape Reader/Punch (Advanced Sprocket Punch)	28,300	161	469
5219-10	Advanced Sprocket 6-Level Read	2,365	13	38
70/221-21	Paper Tape Reader/Punch (Advanced Sprocket Punch EBCDIC)	29,665	168	490
5219-11	Advanced Sprocket 6-Level Read	2,365	13	38
70/224-10	Paper Tape Reader (1000 CPS)	28,035	160	466
70/224-11	Paper Tape Reader (1000 CPS EBCDIC)	29,350	166	487
5264	Long Block Indicator	995	5	18
5273	Supply Reel Reverse	995	5	18
5293	4-N Terminate	1,995	11	34
70/272-10	MICR Sorter-Reader Controller for Burroughs B 103 or B 116	30,555	65	600
DATA COMMUNICATIONS				
70/310-21	Standard Interface Switch (one 1x2)	4,410	9	85
70/310-22	Standard Interface Switch (two 1x2)	8,765	18	170
70/310-23	Standard Interface Switch (three 1x2)	13,125	28	255
70/310-24	Standard Interface Switch (four 1x2)	17,535	37	338
70/310-25	Standard Interface Switch (five 1x2)	21,895	46	425
70/310-26	Standard Interface Switch (six 1x2)	26,305	55	507
70/310-27	Standard Interface Switch (seven 1x2)	30,660	64	594
70/310-28	Standard Interface Switch (eight 1x2)	35,020	74	676
5305	Cascaded Switch Connector	210	0	N/A
70/325-2	Telegraph Switch Unit	1,310	3	24
70/326-2	Data Set Switch Unit	4,935	11	97
70/326-3	Data Set Switch Unit	4,935	11	97
5303	Cable Set	525	1	9
70/327-2	Data Gathering Switch Unit	5,435	14	104
70/350-2	Switch Controller (2 processors)	24,255	51	474
70/350-3	Switch Controller (3 processors)	29,350	60	571
70/350-4	Switch Controller (4 processors)	34,440	71	673
5304	Extended Cable	63	0	N/A
70/356	Communication Line Switch Adapter	3,885	8	75

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
DATA COMMUNICATIONS (continued)				
70/510-11	Voice Response Unit	25,465	68	487
5514-11	Voice Line Expansion	7,925	21	151
70/510-21	Voice Response Unit	30,555	81	586
5514-21	Voice Line Expansion	10,185	27	195
70/510-26	Voice Response Unit	40,740	108	780
5514-26	Voice Line Expansion	13,545	36	258
70/627-10	Data Exchange Control	22,995	49	449
70/653-25	Communication Control	15,275	33	299
70/653-26	Communication Control	15,275	33	299
70/653-34	Communication Control	15,275	33	299
70/656	Communication Control—Single Channel	21,735	60	414
5628	Auto Call Feature	1,235	3	24
5630-1	Line Adapter	N/C	N/C	N/C
5630-2	Line Adapter	N/C	N/C	N/C
70/668-11	Communication Controller—Multi-Channel (16 lines)	35,650	114	666
70/668-21	Communication Controller—Multi-Channel (32 lines)	45,835	146	855
70/668-31	Communication Controller—Multi-Channel (48 lines)	56,020	179	1,049
5617-1	Telex Operation	2,470	7	47
5618	ANSCII Block Check Character	985	3	19
5620	Timer Restart/Interval Selector	735	2	15
5622	Message Separation	495	1	9
5623	OW-Unshift and Transmit Ignore	495	1	9
5624	Time Reset	735	2	15
5634	DGS Operation	N/C	N/C	N/C
5635	Synchronous Call Duplex Operation	985	3	19
70/710	Telegraph Buffer	1,365	4	25
70/712	Telegraph Low Level Buffer	1,945	5	36
70/715	Parallel Buffer	1,945	5	36
70/717	Parallel Data Set Buffer	4,935	14	95
5717	Auto Call Feature	995	3	19
70/720-11, 21,22,&23	ADS Buffer	2,156	6	41
5705	Auto Call Feature	995	3	19
70/721	SDS Buffer	2,155	6	41
5714-1	Full Duplex Operation	500	1	9
5714-2	Full Duplex Operation	500	1	9
70/722	STR Buffer	8,975	23	166
70/724	EDGE Demodulator/Buffer	2,575	7	49
70/725	DGS Buffer (Metropolitan)	5,435	14	104
70/740-11	Data Terminal, 300 LPM, 80 Col.	38,980	171	730
70/740-12	Data Terminal, 600 LPM, 80 Col.	48,825	197	914
70/740-21	Data Terminal, 300 LPM, 132 Col.	42,525	184	798
70/740-22	Data Terminal, 600 LPM, 132 Col.	52,290	210	982
5642	Mark Read (ANSCII/BINARY)—Vertical	7,915	21	152
5643	Mark Read (ANSCII/BINARY)—Slanted	7,915	21	152
70/741	Card Reader, 300 CPM (for 70/740)	9,450	41	177
5753	Card Reader Adapter	1,180	5	22
70/751-10	Video Data Terminal, Std. Keyboard	2,960	13.00	50
70/751-11	Video Data Terminal, Keypunch Keyboard	2,960	13.00	50
70/751-12	Video Data Terminal, Upper and Lower Case Alphas	3,255	14.00	56
70/751-12	Video Data Terminal, Upper and Lower Case Alphas	3,255	27.00R	55
5770-2	Connector Kit	42	0	N/A
70/752	Video Data Terminal	6,720	42.00M	116
5707	Station Selection	785	3.00	16
5710	Data Format	785	3.00	16
5711	Printer Adapter	1,050	4.00	21
70/755	Video Data Switch	6,195	18.00	117
70/756-11	Video Data Generator (8 VDT's)	10,855	42.00	189
70/756-21	Video Data Generator (4 VDT's)	8,885	37.00	152
70/756-31	Video Data Generator (2 VDT's)	7,895	32.00	137
5716	Data Format	395	2.00	6
70/759-11	Video Data Controller; multiplexer connection only	23,690	84.00	415
70/759-21	Video Data Controller; communications connection	15,790	53.00	278

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