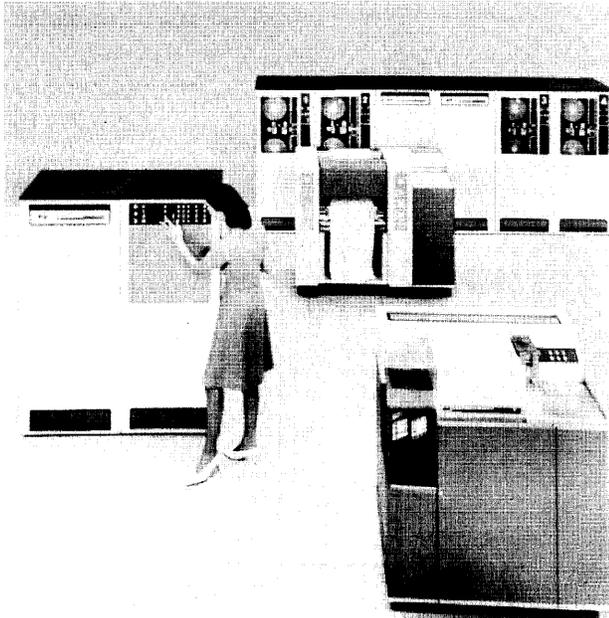


RCA Spectra 70



A four-tape 70/15 system, smallest of the Spectra 70 models.

MANAGEMENT SUMMARY

Spectra 70 is the third-generation computer product line from RCA Corporation. Its announcement in December 1964 startled the computer world because of RCA's bold new approach to the old problem of gaining a competitive foothold in the face of IBM's overwhelming dominance of the computer market.

RCA's product planning philosophy for the Spectra 70 line apparently was, in essence, "If you can't lick 'em, join 'em." Thus, RCA announced a line of computers and software that is designed to be largely compatible with the IBM System/360 line and to provide, in many though by no means all cases, significant price and or performance advantages over the System/360.

The Spectra 70 line initially included four central processor models: the 70/15, 70/25, 70/45, and 70/55. Since then, the 70/35, 70/46, 70/60, and 70/61 have been announced and the 70/25 withdrawn, so that the current line-up includes seven processors.

Despite these seven processors, dozens of peripheral devices, and a wide array of software facilities, the Spectra 70 lines does not span nearly as broad a range of processing capabilities as the System/360. The top-of-the-

RCA's third-generation product line includes 7 central processors, more than 30 peripheral devices, and a broad array of software. It features a high degree of program compatibility with the IBM System/360 and a strong emphasis on communications and time-sharing.

CHARACTERISTICS

MANUFACTURER: RCA Corporation, Information Systems Division, Camden, New Jersey 08101.

MODELS: Spectra 70/15, 70/35, 70/45, 70/46, 70/55, 70/60, and 70/61.

DATA FORMATS

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

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

FLOATING-POINT OPERANDS: 1 word, consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 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 Spectra 70 processors can alternatively use 8-bit USASCII, but little software support is provided for this code.

MAIN STORAGE

STORAGE TYPE: Magnetic core.

CAPACITY: See table.

CYCLE TIME: See table.

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

STORAGE PROTECTION: Optional Memory Protect feature guards against inadvertent overwriting of data in specified 2048-byte blocks of storage (not available for Spectra 70/15). 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: None in 70/15 Processor. In the larger models, the programmer has access to sixteen 32-bit

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▷ line Spectra 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, RCA has shown little interest in serving the small-scale computer user; the small Spectra 70/15 Processor is sold almost exclusively for use in conjunction with larger computers.

RCA's strength 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, RCA displays an even stronger hand. The Spectra 70 line includes a versatile array of communications controllers, terminals, and software, and the company has been placing a strong emphasis on time-sharing since the April 1967 introduction of the Spectra 70/46.

Most Spectra 70 users seem fairly well satisfied with the RCA hardware, software, and support. Yet, from the all-important marketing standpoint, the Spectra 70 has been only modestly successful at best and has not significantly increased RCA's market penetration. The unavoidable conclusion seems to be 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 an alternate supplier—even when the other supplier is a nationally-known manufacturer whose product line offers (in many cases) significant performance advantages.

PROCESSOR MODELS

The characteristics and orientation of the current Spectra 70 processor models and the systems built around them are summarized in the following paragraphs and in the accompanying table.

The Spectra 70/35, 70/45, 70/55, and 70/60 Processors constitute the heart of RCA's third-generation computer line. All four are general-purpose computers suitable for a wide range of applications, and all four 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 Spectra 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 Spectra 70 line, announced in December 1964. The great

▶ 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: None.

INSTRUCTION REPERTOIRE: Models 70/35 and above have 144 or 145 standard instructions, 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 70/46 and 70/61 Processors can include up to 128 microprogrammed special functions.

The Spectra 70/15 has a limited repertoire of 26 instructions, including decimal and binary addition and subtraction, but no multiply, divide, or floating-point facilities.

INSTRUCTION TIMES: See table; the times shown are for 1-address binary addition of 32-bit fields and for 2-address decimal addition of signed 5-digit (3-byte) fields.

OPTIONAL FEATURES: The following features are available for Models 70/35 and above.

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 up to six Spectra 70 Processors, located up to 500 feet from one another, to exchange information in a multiprocessor installation.

70/97 Operator Console and Typewriter provide system control facilities by means of switches and an I/O typewriter.

EMULATORS: The Spectra 70/35 and 70/45 Processors can be equipped with extra-cost "emulators" that enable them to execute programs written for earlier IBM or RCA computers. 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 Spectra 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 tape units, readers, punches, and printers) can be emulated.

Specifically, a 70/35 Processor can be equipped to emulate either the IBM 1401/1440/1460 or the RCA 301. The 70/45 has room for two Emulator Microprograms and can execute programs written for one or two of the following: IBM 1401/1440/1460, IBM 1410/7010, RCA 301, or RCA 501. Internal speeds of the Spectra 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.

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CHARACTERISTICS OF THE SPECTRA 70 PROCESSOR MODELS

	70/15	70/35	70/45 Type II	70/46	70/55	70/60	70/61
MAIN STORAGE							
Cycle time, microseconds	2.0	1.44	1.44	1.44	0.84	1.0	0.765
Bytes fetched per cycle	1	2	2	2	4	4	4
Minimum capacity, bytes	4,096	32,768	65,536	262,144	65,536	131,072	262,144
Maximum capacity, bytes	8,192	65,536	262,144	262,144	524,288	1,048,576	1,048,576
PROCESSOR							
Integrated circuit logic	no	yes	yes	yes	yes	yes	yes
Control technique	wired logic	read-only memory	read-only memory	read-only memory	wired logic	read-only memory	read-only memory
Add time, microseconds (32-bit binary fields)	—	19	8.9	8.9	2.6	2.04	2.25
Add time, microseconds (5-digit decimal fields)	56	48	16.5	17.0	9.0	11.20	11.63
CHANNELS							
No. of selector channels	1	0-2	0-4	0-4	0-6	2-6	2-6
Trunks per selector channel	6	2	2	2	2 or 3	3	3
No. of multiplexer channels	0	1	1	1	1	1	1
Trunks per multiplexer channel	—	8	9	9	9	16	16
Max. devices on multiplexer	—	192	256	256	256	248	248
EMULATORS							
IBM 1401/1440/1460	no	yes	yes	no	no	*	*
IBM 1410/7010	no	no	yes	no	no	*	*
RCA 301	no	yes	yes	no	no	*	*
RCA 501	no	no	yes	no	no	*	*

* Not announced to date.

➤ majority of currently installed Spectra 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, with deliveries scheduled to begin in 1970. Customer deliveries of the other general-purpose Spectra 70 systems began late in 1965.

The Spectra 70/15 is the smallest member of the line. Although it has modest general-purpose computing capabilities, it is marketed almost exclusively as an I/O processor or remote communications terminal. The 70/15 has a severely restricted instruction set, a maximum core storage capacity of only 8192 bytes, and only one I/O channel. Moreover, no mass storage devices can be connected to the 70/15 Processor. Despite these limitations, which rule it out as a serious entry in the free-standing computer market, the 70/15 is capable of functioning quite effectively in its intended supporting role.

➤ INPUT/OUTPUT CONTROL

I/O CHANNELS: One multiplexer channel, which can accommodate a number of simultaneous low-speed I/O operations, is standard in Model 70/35 and above. Selector channels, which can handle one I/O operation at a time, can be used in Models 70/35 and above. The Spectra 70/15 has a single data channel with 6 trunks. See the table for details of the I/O channel possibilities.

CONFIGURATION RULES: Most Spectra 70 peripheral devices can be connected to either a multiplexer or selector channel of any Spectra 70 processor. (The principal exceptions are the mass storage units, which cannot be used with the 70/15 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 Spectra 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 Spectra 70 can control a maximum of one high-speed I/O operation per selector channel and one

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▷ The original Spectra 70 line included a processor called the 70/25, which is no longer in production. The 70/25 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, RCA soon decided to replace the 70/25 with the fully compatible and similarly priced Spectra 70/35.

The Spectra 70/46 Time-Sharing System, announced in May 1967, was billed as the first "four-dimensional" data processing system. It is designed to handle 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 main memory is divided into pages of 2048 or 4096 bytes each. Dynamic address translation facilities enable each user to program as if he had a 2-million-byte virtual memory at his disposal. A magnetic drum permits rapid swapping of program segments into and out of core memory.

The Spectra 70/46 is a later and less ambitious contender for the time-sharing market than the GE-645 and IBM System/360 Model 67 systems, both of which encountered severe developmental problems. RCA's entry lacks the power and complexity of the GE and IBM systems, but stresses a good balance between interactive and batch-mode processing capabilities in a medium-scale system that is fast and flexible enough to satisfy all the computing needs of many companies and institutions.

The Spectra 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. Initial customer deliveries of the 70/61 are scheduled for the first quarter of 1971.

HARDWARE FEATURES

Designed to provide compatibility with the IBM System/360, the Spectra 70/35 thru 70/61 Processors naturally have many hardware characteristics in common ▷

▶ 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.

I/O INTERFERENCE: Selector channel operations impose only modest demands upon the Spectra 70 processors. The control of multiplexer channel operations, however, can impose substantial demands upon the processors.

MASS STORAGE

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 is optional.

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 is optional.

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 is optional.

70/590 DIRECT ACCESS STORAGE SYSTEM: Provides large-capacity random-access storage in interchangeable 11-disc packs which are compatible with the IBM 2316 Disk 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 466.6 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 75 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. ▶

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▷ 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 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 Spectra 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 Spectra 70 processors have four sets—one for each of four processor states. As a result, the RCA 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 Spectra 70/35, and in a high-speed “scratchpad” memory unit in all the larger Spectra 70 processors.

The Spectra 70/35 thru 70/61 Processors use monolithic integrated circuits. Two complete logic circuits (equivalent to 15 transistors and 13 registers) are packed on a single 0.05-inch-square silicon chip. The 70/15 and the out-of-production 70/25 Processors utilize conventional discrete-component circuitry. A read-only control memory is used in all the Spectra 70 processors except the 70/15, 70/25, and 70/55, which use wired logic. Conventional magnetic core main memories are used in all models.

SOFTWARE

RCA furnishes a broad array of supporting software for the Spectra 70 line. There are four distinct general-purpose operating systems, and extensions of two of these are available to support communications-oriented installations. In addition, specially-tailored software is available

▶ 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. 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.

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. Optional “Bi-Modal” versions of each unit can operate at 800 as well as 1600 bpi. Both 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.

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. Controllers capable of handling up to 8 or 16 tape drives and either 1 or 2 I/O channels are available.

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 pencil-marked data and 51-column stub cards.

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.

70/221 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.

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▷ for users of the small-scale 70/15 and the time-sharing 70/46 and 70/61 Processors. At each software level, RCA furnishes appropriate supervisory programs, language translators, service programs, and utility routines.

Much of RCA's software, quite naturally, is patterned after the corresponding IBM facilities. RCA has made a point of maintaining the highest practical degree of source-language compatibility with the IBM Assembler, COBOL, FORTRAN, and RPG languages.

In the early days of the Spectra 70 line, RCA was criticized for not offering a number of the more advanced System/360 software facilities, such as time-sharing, communications control, disc-oriented operating systems, and compilers with random-access facilities. Since then, RCA's determined development efforts have largely closed the "software gap." RCA now offers software that provides nearly all of the System/360 facilities except those of the large-scale (and highly complex) Operating System/360.

The Time-Sharing Operating System (TSOS) for the Spectra 70/46, and OS61, its upgraded counterpart for the new Spectra 70/61, are interesting because of the emphasis RCA is placing upon achieving an optimum balance between interactive and batch-mode processing.

▶ **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.

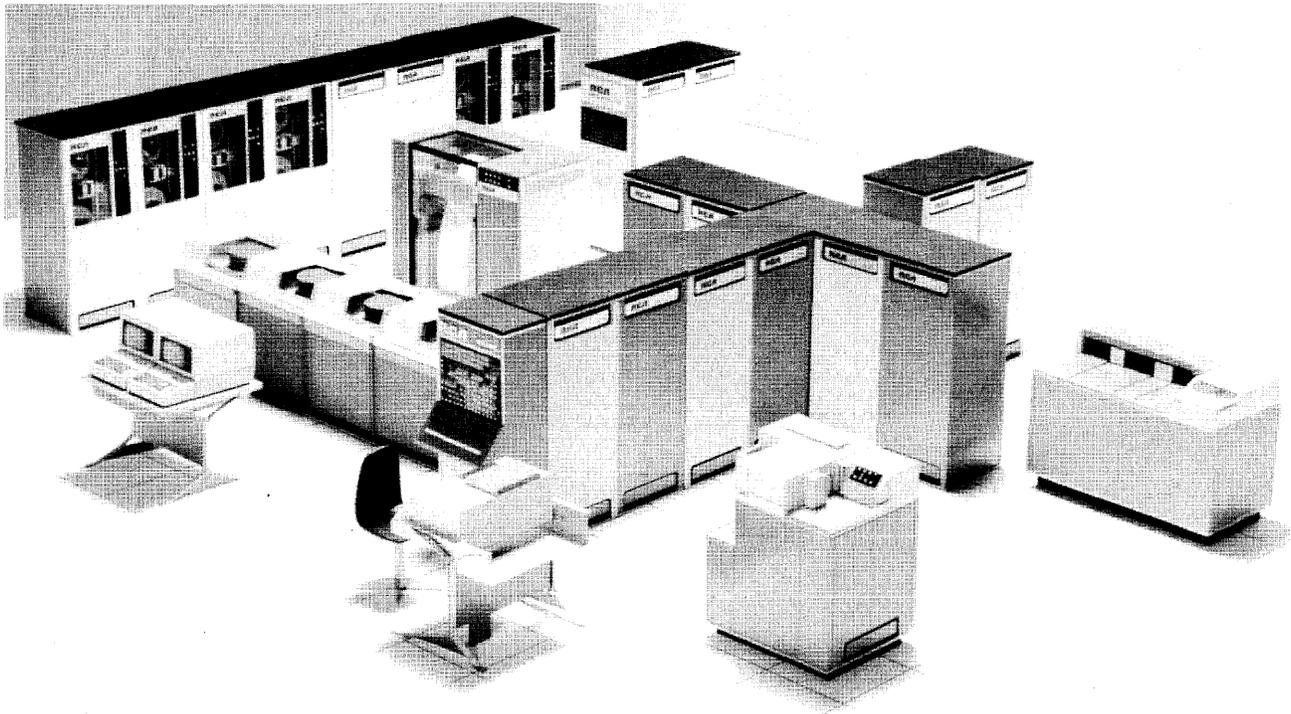
70/242 MEDIUM-SPEED PRINTER: Prints up to 625 lpm using the standard 64-character print drum. Available with either 132 or 160 print positions. Skipping speed is 27 inches per second. Contains a full-line buffer.

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: An RCA adaptation of the IBM 1403 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 RCA adaptation of the IBM 1404 Printer. Prints on continuous forms (at up to 600 lpm) or on individual 50- to 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.

▶ **70/216 INPUT/OUTPUT TYPEWRITER:** Permits operator communication with a 70/15 Processor. (The larger Spectra 70 Processors use the 70/97 Operator Console, which includes an I/O typewriter.) Types 72 characters per line at a maximum speed of 10 characters per second.



A large Spectra 70/60 configuration.

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▷ Both systems provide all the batch-oriented facilities of RCA's general-purpose Tape/Disc Operating System plus the ability to service multiple conversational-mode users at remote terminals. No operating system with this mix of capabilities is available from IBM at present.

The complex internal architecture of the Spectra 70 line, like that of the System/360, makes programming at the assembly-language level unusually difficult and error-prone. For this reason, coupled with the other increasingly evident advantages of high-level languages, most Spectra 70 users are doing the bulk of their programming in COBOL, FORTRAN, or RPG.

COMPATIBILITY

The Spectra 70 compatibility picture has three important dimensions:

- Compatibility within the Spectra 70 family.
- Compatibility with the IBM System/360.
- Compatibility with older RCA and IBM computers.

Among the Spectra 70/35 thru 70/61 Processors, RCA has achieved a high degree of data and program compatibility at the hardware level. Any two of the general-purpose models 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 time-sharing 70/46 and 70/61 Processors can directly execute object programs written for the general-purpose models, though the converse is not necessarily true. Source-language programs can be freely interchanged between the time-sharing and general-purpose models. The Spectra 70/15, with its severely restricted instruction set, has only a limited degree of program compatibility with the larger processors.

Compatibility with the System/360 line is achieved through similar hardware and compatible source languages. The Spectra 70 Assembler, COBOL, FORTRAN, and RPG languages 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 Spectra 70 processor (70/35 or above) with little or no need for program changes. System/360 object programs, however, cannot be executed directly on a

▶ **70/272 MICR SORTER-READER CONTROLLER:** Permits any of the following magnetic ink character readers to be connected to a Spectra 70 system: Burroughs B103 or B116, IBM 1419, or NCR 407.

DIGITAL PLOTTERS: Incremental plotters that enable a Spectra 70 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: Connects two Spectra 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 Spectra 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 Spectra 70 selector or multiplexer channel.

70/656 COMMUNICATION CONTROLLER-SINGLE CHANNEL: Permits remote communication, in USASCII synchronous transmission mode, with any of the following equipment: another suitably equipped Spectra 70 computer, an IBM System/360 with a 2701 or 2703 controller, RCA 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 Spectra 70 selector or multiplexer channel.

70/658 AUTODIN COMMUNICATION CONTROLLER: Permits a Spectra 70/35, 70/45, 70/55, or 70/60 Processor to interface with the military Autodin network. Operates in Continuous Mode I USASCII at 2400 or 4800 bits per second. Includes a fixed stored program which controls its operation.

70/668 COMMUNICATION CONTROLLER-MULTI-CHANNEL: Permits connection of multiple low-speed and medium-speed remote terminals to the multiplexer channel of any Spectra 70 processor except the 70/15. 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.

70/510 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 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

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▷ Spectra 70 because of the differences in the "privileged" instructions; reassembly or recompilation is always necessary.

To facilitate conversions from older RCA and IBM computers to the Spectra 70 line, RCA has again followed IBM's lead by developing a series of emulators. These extra-cost features use a combination of microprograms in read-only memory and specialized software to enable a Spectra 70/35 or 70/45 to execute programs written for the second-generation RCA 301, RCA 501, or IBM 1400 Series computers.

SUPPORT

As of this writing (December 1969), RCA has not followed IBM's lead in "unbundling." All standard RCA software and all normal technical support and education are still included in the rental and purchase prices of the Spectra 70 hardware.

As a result of this important difference in pricing policies, every current or prospective System/360 user has more incentive than ever to investigate the comparative merits of the Spectra 70 line. The token 3 percent decrease in equipment prices that accompanied IBM's unbundling move will not come close to covering the additional software and support costs that most System/360 users will now incur. Therefore, the IBM pricing change will tend to tip the scales in RCA's favor in future price/performance comparisons between the two program-compatible lines. □

▶ 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.

70/630 DATA GATHERING SYSTEM: An on-line data collection system that permits both fixed and variable data to be transmitted to a Spectra 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.

70/740 DATA TERMINAL: Provides remote batch printing capability, with optional card input capability via the 70/741 Card Reader (below). Prints up to 300 lpm, with a choice of either 80 or 132 print positions and either the RCA or USASCII character set. Transmission is in USASCII synchronous mode, at 250 char/sec over dialed lines or 300 char/sec over leased lines. Connects to a Spectra 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.

70/752 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 USASCII letters, numerals, and symbols. The 70/752 VDT is a self-contained, desk-top unit that is normally connected, via a remote communications link, to a 70/668 CCM at the Spectra 70 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.

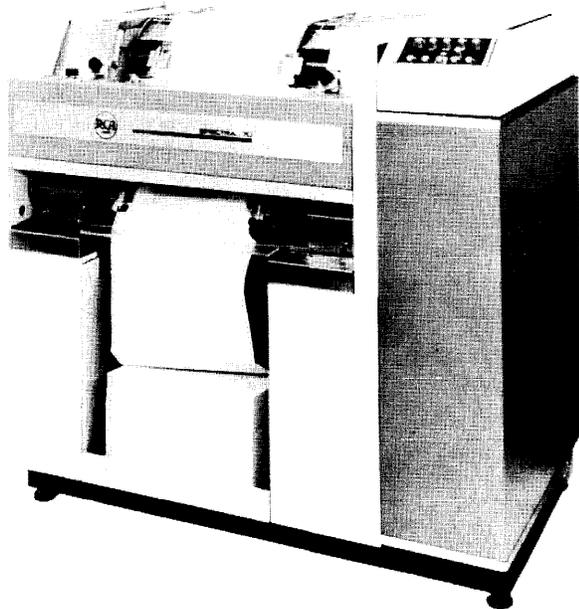
SOFTWARE

OPERATING SYSTEMS: Software support for the Spectra 70 line is furnished at a number of distinct levels. Users of the general-purpose Spectra 70/35, 70/45, 70/55, and 70/60 Processors can choose the Primary Operating System (POS), Disc Operating System (DOS), Tape Operating System (TOS), or Tape/Disc Operating System (TDOS). Extensions of two of these systems, POS and TDOS, are available to support communications-oriented installations. The Basic Time-Sharing System (BTSS) permits limited time-sharing operations on the general-purpose 70/45 and 70/55 systems.

Specialized software support is provided for the Spectra 70/15, 70/46, and 70/61. The 70/15 Programming System offers a modest set of card- and tape-oriented facilities for the smallest processor in the line. The Time-Sharing Operating System (TSOS) complements the time-sharing hardware facilities of the 70/46 Processor. An extended version of TSOS, called OS61, supports the larger Spectra 70/61 time-sharing system.

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

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The 70/243 Printer uses a conventional rotating-drum print mechanism and achieves a speed of 1250 lines per minute.

► **70/15 PROGRAMMING SYSTEM:** No integrated operating system is available for the Spectra 70/15 system. Instead, RCA supplies a set of interrelated software facilities that are appropriate for the 70/15's usual function as an auxiliary or I/O processor used in conjunction with larger computers. The facilities include an Assembly System, an Input/Output Control System (IOCS), a Report Program Generator (RPG), a Sort/Merge Generator, and a group of loaders, diagnostics, and data transcription routines. Any two data transcription functions (such as card to tape and tape to printer) can be performed concurrently.

Except for the Sort/Merge Generator, all of the 70/15 routines are designed to operate on a basic configuration consisting of 4K processor, card reader, punch, and printer. As a result, their capabilities are quite modest. The Sort/Merge requires an 8K processor and at least three magnetic tape drives. The other routines can take advantage of magnetic tape and increased storage capacity, when available, for improved performance.

PRIMARY OPERATING SYSTEM: POS is a tape-resident operating system for Spectra 70/35, 70/45, or 70/55 installations with at least the following equipment: 16K processor, card reader, punch, printer, and four magnetic tape drives (at least one of which must be a 9-track model). A program library can be maintained on either punched cards or magnetic tape.

The POS Control System, consisting of a Supervisor, Job Control, and Program Loader routines, controls and coordinates the execution of all programs. The Supervisor and other resident routines and buffer areas occupy approximately 4800 to 6800 bytes of core storage. The Supervisor handles interrupt analysis and processing, I/O scheduling, error recovery, operator communication,

program loading, and end-of-job processing. The Job Control routine, which the Supervisor normally calls into core storage between jobs, handles job-to-job transitions and I/O device assignments.

The POS File Control Processor (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. Logical control is provided by file definition and I/O control macros included within the POS Assembly System. Physical control of the actual data transfers between memory and I/O devices is handled by the Supervisor. 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). The Assembler and COBOL compiler require at least 32K bytes of core storage. 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. 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.

DISC OPERATING SYSTEM: DOS 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 reader, printer, and console typewriter. DOS 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 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.

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► The language translators available under DOS 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 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, 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).

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 the RCA software by means of macros.

BASIC TIME-SHARING SYSTEM: BTSS is a software package that makes it possible to use a Spectra 70/45 or 70/55 Processor (128K bytes or larger) in a multi-console time-sharing system. It can support up to 32 remote users at teletypewriters and/or RCA Video Data Terminals. BTSS is a dedicated system, which means that batch processing cannot be performed simultaneously with time-sharing operations (though the two types of processing can be alternated). Billed as an "introductory" time-sharing system, BTSS offers far less power and flexibility than the Spectra 70/46 and 70/61 Processors and their associated software, which have been designed specifically for time-sharing.

BTSS components include a Command Language for communication between remote users and the system, a Text Editor for manipulating on-line files, and an interactive compiler that permits statement-at-a-time debugging and execution of programs written in a subset of the FORTRAN IV language. (FORTRAN is the only programming language supported under BTSS.) The system permits terminal-to-terminal conversations among its users, an unusual feature that could be of value in certain educational and research applications.

TIME-SHARING OPERATING SYSTEM: TSOS is a specialized operating system designed to control interactive time-sharing, local and remote batch processing, and data communications in a Spectra 70/46 system. It can support a maximum of 48 remote users and up to 14 concurrent batch-mode jobs. TSOS maintains upward compatibility with TOS and TDOS, so that programs which run in batch mode under either of those systems can be run under TSOS without change.

The TSOS Supervisor 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, and initiating error recovery procedures. "Spooling" of all card input and printer output on tape or disc drives is a standard feature of the system that improves hardware utilization. A Command Language is used for communication between the supervisor and the system's users, operator, and administrator.

The TSOS Data Management System handles file management and I/O control, offering a choice of several data access methods and either sequential or random processing. The Communications Access Method (CAM) permits multiple users at remote terminals to access a common data base and communicate with one another.

TSOS provides language translators for Assembly Language, COBOL, FORTRAN, BASIC, and RPG. FORTRAN and BASIC compilers are offered in both conversational and background versions, while the others operate in background mode only. A COBOL Syntax

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► Checker, however, provides statement-by-statement syntax validation for COBOL-coded programs. A File Editor permits interactive creation and updating of program and data files, and a Desk Calculator routine enables remote users to use the 70/46 to perform simple, one-time computations. A suitable complement of other utility routines rounds out TSOS.

OS61: Software support for the Spectra 70/61 Processor will be provided by a new operating system called OS61, scheduled for delivery along with the hardware in the first quarter of 1971. RCA states that upward compatibility will be maintained from the 70/46 and its TSOS to the 70/61 and its OS61. The new system will provide all the facilities of TSOS, plus improved task scheduling and paging algorithms and the ability to service up to 128 remote users simultaneously.

COBOL: RCA offers COBOL compilers under six of the Spectra 70 operating systems: POS, DOS, TOS, TDOS, TSOS, and OS61. 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 USASI 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.

FORTRAN: RCA offers FORTRAN compilers for operation under DOS, TOS, TDOS, TSOS, OS61, and BTSS. All use the FORTRAN IV source language, and all except the BTSS version include all the facilities of USASI FORTRAN. The BTSS version offers some useful extensions (such as recursive subroutine calls and several debug statements) but lacks the following USASI FORTRAN statements: ASSIGN, Assigned GO TO, BLOCK DATA, Labeled COMMON, DATA, DIMENSION, EQUIVALENCE, FUNCTION, LOGICAL, and Statement Functions.

BASIC: Compilers for the BASIC language are offered only under TSOS and OS61. The RCA compilers accept a source language similar to the version currently used in GE time-sharing systems.

REPORT PROGRAM GENERATORS: RCA offers RPG's at nearly all of the Spectra 70 software support levels: POS, DOS, TOS, TDOS, TSOS, OS61, and the 70/15 Programming System. 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 Spectra 70. RCA therefore furnishes Assembly Systems at all support levels except the special-purpose Basic Time-Sharing System. The 70/15's restricted instruction repertoire necessitates a specialized Assembly System that is not fully compatible with the ones for the larger processors. All of the other Assembly Systems use the same source language and

include facilities for defining and using macro-instructions.

UTILITY ROUTINES: Sort/merge programs are offered at all Spectra 70 support levels except BTSS. 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 but steadily growing complement of generalized business and scientific application programs is available for the Spectra 70 line. Among the principal ones are:

- APT (Numerical Control Language)
- Bill of Material Processor
- Biomedical Computer Programs
- Corporate Trust System
- Demand Deposit Accounting
- Distribution Accounting & Control System
- EXCEL Civil Engineering System
- Installment Loan System
- Linear Programming System
- Matrix Operations
- Multi-Division Payroll System
- On-Line Commercial Loan System
- Personnel Data System
- Proof and Transit System
- Sales Forecasting and Control System
- Square Root and Transcendentals
- SSS-70 Scientific Subroutines System
- Statistical System
- Systems Flow Simulator
- Time Deposit System
- Water and Gas Distribution System Analysis

PRICING

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

SPECTRA 70/15 TAPE SYSTEM: Consists of 8K 70/15 Processor, two 70/432 Magnetic Tape Units (each containing two 30KB tape drives), 70/237 Card Reader, 70/234 Card Punch, and 70/243 High-Speed Printer. Monthly rental and purchase prices are approximately \$5,400 and \$241,000, respectively.

SPECTRA 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 \$8,800 and \$418,000, respectively. ►

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► **SPECTRA 70/45 TAPE/DISC SYSTEM:** Consists of 64K 70/45 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 \$15,300 and \$688,000, respectively.

SPECTRA 70/46 TIME-SHARING 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 \$27,700 and \$1,260,000, respectively.

SPECTRA 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 \$29,100 and \$1,310,000, respectively.

SPECTRA 70/60 TAPE/DISC SYSTEM: Consists of 256K 70/60 Processor and the same peripheral equipment as in the "Spectra 70/55 Tape/Disc System" above. Monthly rental and purchase prices are approximately \$31,100 and \$1,400,000, respectively.

SPECTRA 70/61 TIME-SHARING 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), 70/590-8 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 \$45,600 and \$2,090,000, respectively.

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

CONTRACT TERMS: The standard RCA equipment rental agreement allows unlimited use of the equipment (exclusive of the time required for remedial and preventive maintenance). There are no extra-use charges. The standard agreement covers maintenance of the equipment for nine consecutive hours a day, Monday through Friday. Extended periods of maintenance are available at extra cost. ■

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EQUIPMENT PRICES

	<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>	
PROCESSORS AND MAIN STORAGE				
Spectra 70/15 Processors:				
70/15-A	Processor; 4,096 bytes	38,000	60.00	752
70/15-B	Processor; 8,192 bytes	47,500	75.00	940
Spectra 70/35 Processors:				
70/35-D	Processor; 32,768 bytes	145,500	232.00	2,375
70/35-DC	Processor; 49,152 bytes	180,700	300.00	3,170
70/35-E	Processor; 65,536 bytes	203,700	324.50	3,731
Special Features for 70/35 Processors:				
70/97-20	Console	17,250	27.50	343
5001-35	Memory Protect	6,100	8.00	121
5002-35	Elapsed Time Clock	2,450	3.00	49
5003-35	Direct Control	9,700	12.00	194
5005-35	RCA 301 Emulator	19,400	25.00	390
5006-35	IBM 1401 Emulator	15,800	20.00	80
5030	Selector Channel (1 channel)	8,550	11.00	170
5031	Selector Channel (2 channels)	13,400	17.00	266
Spectra 70/45 Processors (Type II):				
70/45E	Processor; 65,536 bytes	261,900	417.00	5,227
70/45F	Processor; 131,072 bytes	339,500	540.75	6,778
70/45FE	Processor; 196,608 bytes	439,000	697.50	8,742
70/45G	Processor; 262,144 bytes	523,800	834.50	10,458
Special Features for 70/45 Processors:				
70/97-20	Console	17,250	27.50	343
5003-45	Direct Control	9,700	12.00	194
5005-45	RCA 301 Emulator	24,250	31.00	484
5006-45	IBM 1401 Emulator	24,250	31.00	484
5007-45	RCA 501 Emulator	31,550	40.00	630
5019-45	Elapsed Time Clock	5,900	7.00	118
5026-45	IBM 1410 Emulator	26,700	34.00	531
5036-45	RCA 301/501 Emulator	41,250	52.00	823
5043-45	Selector Channel (2 channels)	56,500	72.00	1,128
5044-45	Selector Channel (3 channels)	84,750	108.00	1,692
5045-45	Selector Channel (4 channels)	113,000	144.00	2,256
5046-45	IBM 1401/1410 Emulator	38,800	49.00	776
5056	Store and Fetch Protection	9,400	12.00	188
Spectra 70/46 Processor:				
70/46-G	Processor; 262,144 bytes	665,300	1,060.00	13,277
Special Features for 70/46 Processor:				
70/97-20	Console	17,250	27.50	343
5001-46	Memory Protect	6,100	8.00	121
5002-46	Elapsed Time Clock	2,450	3.00	49
5003-46	Direct Control	9,700	12.00	194
5019-46	Elapsed Time Clock	5,900	7.00	118
5040	Selector Channel (2 channels)	44,700	57.00	893
5041	Selector Channel (3 channels)	65,900	84.00	1,316
5042	Selector Channel (4 channels)	84,800	108.00	1,692
Spectra 70/55 Processors:				
70/55-E	Processor; 65,536 bytes	405,000	645.00	8,084
70/55-F	Processor; 131,072 bytes	482,600	768.75	9,635
70/55-G	Processor; 262,144 bytes	666,900	1,062.50	13,315
70/55-H	Processor; 524,288 bytes	1,093,700	1,742.00	21,832
Special Features for 70/55 Processors:				
70/97-20	Console	17,250	27.50	343
5001-55	Memory Protect	7,300	9.00	146
5002-55	Elapsed Time Clock	2,450	3.00	49
5003-55	Direct Control	12,150	15.00	243
5019-55	Elapsed Time Clock	5,900	7.00	118
5020	Selector Channel (2 channels)	21,850	28.00	437
5022	Selector Channel (4 channels)	38,800	49.00	776
5024	Selector Channel (6 channels)	55,800	71.00	1,114
Spectra 70/60 Processors:				
70/60-F	Processor; 131,072 bytes	549,900	585.00	11,232
70/60-G	Processor; 262,144 bytes	733,200	780.00	14,967
70/60-H	Processor; 393,216 bytes	893,000	950.00	18,240
70/60-J	Processor; 524,288 bytes	1,034,000	1,100.00	21,120
70/60-K	Processor; 655,360 bytes	1,212,600	1,290.00	24,768
70/60-L	Processor; 786,432 bytes	1,353,600	1,440.00	27,648
70/60-M	Processor; 917,504 bytes	1,522,800	1,620.00	31,104
70/60-N	Processor; 1,048,576 bytes	1,663,800	1,770.00	33,984

* Rental prices do not include equipment maintenance.

RCA Spectra 70 EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
PROCESSORS AND MAIN STORAGE (cont)				
Special Features for 70/60 Processors:				
70/97-20	Console	17,250	27.50	343
5002-60	Elapsed Time Clock	2,450	3.00	49
5003-60	Direct Control	9,700	12.00	194
5019-60	Elapsed Time Clock	5,900	7.00	118
5057	Selector Channel (2 channels)	67,700	86.00	1,354
5058	Selector Channel (4 channels)	135,400	173.00	2,707
5059	Memory Protect	9,400	12.00	188
Spectra 70/61 Processors:				
70/61-G	Processor; 262,144 bytes	874,200	930.00	17,855
70/61-H	Processor; 393,216 bytes	1,034,000	1,100.00	21,120
70/61-J	Processor; 524,288 bytes	1,175,000	1,250.00	24,000
70/61-K	Processor; 655,360 bytes	1,353,600	1,440.00	27,650
70/61-L	Processor; 786,432 bytes	1,494,600	1,590.00	30,530
70/61-M	Processor; 917,504 bytes	1,663,800	1,770.00	33,985
70/61-N	Processor; 1,048,576 bytes	1,804,800	1,920.00	36,865
Special Features for 70/61 Processors:				
70/97-20	Console	17,250	27.50	343
5002-61	Elapsed Time Clock	2,450	3.00	50
5003-61	Direct Control	9,700	12.00	195
5019-61	Elapsed Time Clock	5,900	7.00	120
5057	Selector Channel (2 channels)	67,700	86.00	1,354
5058	Selector Channel (4 channels)	135,400	173.00	2,707
5059	Memory Protect	9,400	12.00	188
MASS STORAGE				
70/551	Random Access Controller	25,500	54.25	497
5508	I/O Attachment for 70/567 Drum Memory	4,850	10.00	95
5502-1	I/O Attachment for 70/568-11 Mass Storage Units	8,550	18.25	166
5511	File Scan Feature (for 70/551)	1,750	3.75	33
5512	Record Overflow Feature (for 70/551)	500	1.00	9
5513-2	Multichannel Switch (for 70/551)	4,850	10.50	95
70/564	Disc Storage Unit	25,510	68.75	535
70/567-8	Drum Memory (4.13 million bytes)	135,800	545.00	2,449
70/567-16	Drum Memory (8.26 million bytes)	271,600	1,090.00	4,898
70/568-11	Mass Storage Unit	130,000	687.50	2,625
70/590	Direct Access Storage System:			
70/590-2	Controller and 2 on-line disc drives	95,340	206.25	1,945
70/590-3	Controller and 3 on-line disc drives	120,190	300.00	2,420
70/590-4	Controller and 4 on-line disc drives	145,040	393.75	2,895
70/590-5	Controller and 5 on-line disc drives	169,890	487.50	3,370
70/590-6	Controller and 6 on-line disc drives	194,740	581.25	3,845
70/590-7	Controller and 7 on-line disc drives	219,590	675.00	4,320
70/590-8	Controller and 8 on-line disc drives	244,440	768.75	4,795
70/590-9	Controller and 9 on-line disc drives	273,790	881.25	5,355
70/590-10	Controller and 10 on-line disc drives	298,640	975.00	5,830
70/590-11	Controller and 11 on-line disc drives	323,490	1,068.75	6,305
70/590-12	Controller and 12 on-line disc drives	348,340	1,162.50	6,780
70/590-13	Controller and 13 on-line disc drives	373,190	1,256.25	7,255
70/590-14	Controller and 14 on-line disc drives	398,040	1,350.00	7,730
70/590-15	Controller and 15 on-line disc drives	422,890	1,443.75	8,205
70/590-16	Controller and 16 on-line disc drives	447,740	1,537.50	8,680
5519-2	Multichannel Switch (for 70/590)	5,770	14.50	133
MAGNETIC TAPE				
70/432-1	Magnetic Tape Unit; 800 bpi, 30KB	27,350	138.50	509
70/432-2	Magnetic Tape Unit; 800 bpi, 30KB	27,350	138.50	509
5411	7-Track Tape Feature	0	0	0
5465	7/9-Track Tape Feature	900	4.50	17
70/441-1	Magnetic Tape Unit; 333/500 bpi; 16.6/25KC	34,250	171.25	633
70/441-2	Magnetic Tape Unit; 333/500 bpi; 16.6/25KC	34,250	171.25	633
70/442-1	Magnetic Tape Unit; 800 bpi, 60KB	41,050	206.25	760
70/442-2	Magnetic Tape Unit; 800 bpi, 60KB	41,050	206.25	760
5412	7-Track Tape Feature	0	0	0
5464	7/9-Track Tape Feature	900	4.50	17

* Rental prices do not include equipment maintenance.

RCA Spectra 70
EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
MAGNETIC TAPE (cont)				
70/445-1	Magnetic Tape Station; 800 bpi, 120KB	35,300	178.75	657
70/445-2	Magnetic Tape Station; 800 bpi, 120KB	35,300	178.75	657
5413	7-Track Tape Feature	0	0	0
5463	Run to Beginning-of-Tape Mark Feature	450	2.25	8
70/451-1	Magnetic Tape Unit; 1600 bpi, 60KB	35,900	178.75	647
70/451-2	Magnetic Tape Unit; 1600 bpi, 60KB	36,900	182.50	
70/453-1	Magnetic Tape Unit; 1600 bpi, 120KB	50,100	247.50	902
70/453-2	Magnetic Tape Unit; 1600 bpi, 120KB	51,000	252.50	918
70/461-208	Tape Controller; 2x8; for 581 tape drives only	62,100	165.00	1,518
70/461-216	Tape Controller; 2x16; for 581 tape drives only	87,300	232.50	2,134
5420	RCA 301 Code Translation Feature	0	0	0
5421	RCA 301/501 Code Translation Feature	950	2.50	23
70/463-108	Tape Controller; 1x8; for 70/432-1, 441-1, 442-1, and 445-1 drives; 7/9 tracks	41,200	87.50	805
70/463-116	Tape Controller; 1x16; for 70/432-1, 441-1, 442-1, and 445-1 drives; 7/9 tracks	67,900	143.75	1,325
5414-1	382 Tape Mode Feature	750	1.50	14
5415-1	Pack/Unpack Feature	2,450	5.50	48
70/463-208	Tape Controller; 2x8; for 70/432-2, 441-2, 442-2, and 445-2 drives; 7/9 tracks	54,600	116.00	1,067
70/463-216	Tape Controller; 2x16; for 70/432-2, 441-2, 442-2, and 445-2 drives; 7/9 tracks	88,550	187.50	1,730
5414-2	382 Tape Mode Feature	1,450	3.25	29
5415-2	Pack/Unpack Feature	4,150	8.75	81
70/472-108	Tape Controller; 1x8; for 70/432-1, 442-1, and 445-1 drives; 9 tracks	33,950	72.00	663
70/472-116	Tape Controller; 1x16; for 70/432-1, 442-1, and 445-1 drives; 9 tracks	65,500	138.75	1,279
70/472-208	Tape Controller; 2x8; for 70/432-2, 442-2, and 445-2 drives; 9 tracks	47,350	100.75	925
70/472-216	Tape Controller; 2x16; for 70/432-2, 442-2, and 445-2 drives; 9 tracks	84,900	180.00	1,656
70/473-108	Tape Controller; 1x8; for 70/432-1, 442-1, and 445-1 drives; 7/9 tracks	36,400	77.00	709
70/473-116	Tape Controller; 1x16; for 70/432-1, 442-1, and 445-1 drives; 7/9 tracks	67,900	143.75	1,325
5402-1	Pack/Unpack Feature	2,450	5.50	48
70/473-208	Tape Controller; 2x8; for 70/432-2, 442-2, and 445-2 drives; 7/9 tracks	51,000	108.25	994
70/473-216	Tape Controller; 2x16; for 70/432-2, 442-2, and 445-2 drives; 7/9 tracks	88,550	187.50	1,730
5402-2	Pack/Unpack Feature	4,150	8.75	81
70/476-108	Tape Controller; 1x8; for 70/451-1 and 453-1 drives; 9 tracks; 1600 bpi	38,900	82.50	759
70/476-116	Tape Controller; 1x16; for 70/451-1 and 453-1 drives; 9 tracks; 1600 bpi	70,800	150.00	1,380
5431-1	9-Track NRZ (800 bpi) Feature	12,300	26.00	239
70/476-208	Tape Controller; 2x8; for 70/451-2 and 453-2 drives; 9 tracks; 1600 bpi	57,400	121.25	1,118
70/476-216	Tape Controller; 2x16; for 70/451-2 and 453-2 drives; 9 tracks; 1600 bpi	95,100	202.50	1,853
5431-2	9-Track NRZ (800 bpi) Feature	14,700	31.00	285
CARD INPUT/OUTPUT UNITS				
70/234-10	Card Punch; 100 cpm	21,850	133.50	358
70/234-11	Card Punch; 100 cpm (with column binary)	27,450	165.00	448
5213	Scored Card Feature	500	3.00	8
70/236-10	Card Punch; 300 cpm	36,400	222.50	592
70/236-11	Card Punch; 300 cpm (with column binary)	42,000	255.00	686
5215-1	Scored Card Feature	500	3.00	8
5261	Programmed Stacker Select	1,000	5.00	16
70/237-10	Card Reader; 1435 cpm	31,550	180.00	526
70/237-21	Card Mark-Reader; vertical marks	40,050	227.50	668
70/237-22	Card Mark-Reader; slanted marks	40,050	227.50	668
5202	51-Column Card Feature	500	3.00	8
5204	Column Binary Feature	1,450	8.25	25
5211-1	End of File Feature	0	0	0

* Rental prices do not include equipment maintenance.

RCA Spectra 70

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
PRINTERS				
70/242-30	Printer; 625 lpm, 132 positions	46,100	237.50	530
70/242-40	Printer; 625 lpm, 160 positions	60,650	311.25	781
70/243-30	Printer; 1250 lpm, 132 positions, 64 characters	50,950	258.75	873
70/243-40	Printer; 1250 lpm, 160 positions, 64 characters	65,500	332.50	1,124
70/243-51	Printer; 833 lpm, 132 positions, 96 characters	60,650	308.75	1,043
70/243-61	Printer; 833 lpm, 160 positions, 96 characters	75,200	381.25	1,290
70/246	Train Printer; 1100 lpm	77,600	632.00	1,153
70/248-11	Bill Feed Printer; 600 lpm	84,750	493.75	1,330
5216	Interchangeable Chain Cartridge Adapter	3,125	-	75
70/249-11	Bill Feed Printer Control	50,250	106.75	980
MISCELLANEOUS INPUT/OUTPUT UNITS				
70/216	Input/Output Typewriter (for 70/15 Processor only)	8,800	51.00	144
5276-1	Paper Tape Reader (for 70/216)	1,200	7.00	20
5277-1	Paper Tape Punch (for 70/216)	4,050	23.25	67
5277-2	Printing Paper Tape Punch (for 70/216)	4,300	24.75	70
70/221-10	Paper Tape Reader/Punch; 200/100 cps	24,250	138.25	405
70/221-11	Paper Tape Reader/Punch; 200/100 cps	25,500	145.00	424
70/221-20	Paper Tape Reader/Punch; 200/100 cps	26,950	153.50	447
70/221-21	Paper Tape Reader/Punch; 200/100 cps	28,250	159.75	467
5219	Advanced Sprocket 6-Level Read	2,250	12.25	36
5256	Long Block Indicator	950	4.50	17
5292	4N Terminate	1,900	10.00	32
5296	Read Kleinschmidt Format	1,900	10.00	32
5297	End of Tape	475	2.50	8
5298	Gapless Mode	475	2.50	8
5299	Punch Kleinschmidt Format	1,650	8.75	28
70/224-10	Paper Tape Reader; 1000 cps	26,700	152.00	444
70/224-11	Paper Tape Reader; 1000 cps	27,950	158.25	464
5264	Long Block Indicator	950	4.50	17
5273	Supply Reel Reverse	950	4.50	17
5293	4N Terminate	1,900	10.00	32
70/272	MICR Sorter-Reader Controller	29,100	62.00	571
COMMUNICATIONS EQUIPMENT				
70/510-11	Voice Response Unit; 10 lines; 31 words/phrases	24,250	64.50	464
5514-11	Voice Line Expansion; 10 lines	7,550	20.00	144
70/510-21	Voice Response Unit; 10 lines; 63 words/phrases	29,100	77.50	558
5514-21	Voice Line Expansion; 10 lines	9,700	25.75	186
70/510-26	Voice Response Unit; 10 lines; 189 words	38,800	103.25	743
5514-26	Voice Line Expansion; 10 lines	12,900	34.00	246
70/627-10	Data Exchange Control	21,900	46.75	428
70/653	Communication Control	14,550	31.00	285
70/656	Communication Controller—Single Channel	20,700	57.50	394
5628	Auto-Call Feature	1,175	3.25	23
70/668-11	Communication Controller—Multichannel; 16 buffers	33,950	108.25	634
70/668-21	Communication Controller—Multichannel; 32 buffers	43,650	138.75	814
70/668-31	Communication Controller—Multichannel; 48 buffers	53,350	170.00	999
5617-1	Telex Operation	2,350	6.25	45
5618	USASCII Block Check Character	940	2.50	18
5620	Timer Restart/Interval Selector	700	2.00	14
5622	Message Separation	470	1.25	9
5623	OW-Unshift	470	1.25	9
5624	Timer Reset	700	2.00	14
5635	Synchronous Full-Duplex Operation	940	2.50	18
Communication Buffers:				
70/710	Telegraph Buffer	1,300	3.50	24
70/712	Telegraph Low-Level Buffer	1,850	4.75	34
70/715	Parallel Buffer	1,850	4.75	34
70/717	Parallel Data Set Buffer	4,700	13.25	90
5717	Auto-Call Feature	950	2.50	18
70/720	ADS Buffer	2,050	5.50	39
5705	Auto-Call Feature	950	2.50	18
70/721	SDS Buffer	2,050	5.50	39
5705	Auto-Call Feature	950	2.50	18
5714	Full-Duplex Operation	475	1.25	9
70/725	DGS Buffer	5,175	13.75	99
70/780	Time Generator/Buffer	5,350	14.25	102

* Rental prices do not include equipment maintenance.

RCA Spectra 70
EQUIPMENT PRICES

	<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>	
COMMUNICATIONS EQUIPMENT (cont)				
70/630 Data Gathering System:				
70/6311	Data Transmitter	1,200	7.25	22
70/6312	Data Transmitter	1,900	9.50	36
70/6321	Badge Reader	500	3.00	9
70/6331	Card Reader	1,000	5.00	18
70/6341	Variable Data Reader	1,000	5.00	18
70/6381	Line Concentrator	3,850	10.75	74
70/6382	Line Concentrator	5,650	15.75	108
70/6385	Signal Converter	11,350	30.00	216
70/674-11	DGS Control Unit	62,500	190.00	1,098
70/674-12	DGS Control Unit	75,000	227.50	1,318
70/674-21	DGS Control Unit	75,000	227.50	1,318
70/674-22	DGS Control Unit	80,000	242.50	1,406
5637	Line Adapter	2,500	7.00	45
5638	Data Set Adapter	1,250	3.50	22
70/740-11	Data Terminal; 80 print positions	37,125	162.50	695
70/740-21	Data Terminal; 132 print positions	40,500	175.00	760
5753	Card Reader Adapter	1,125	5.00	21
70/741	Card Reader (for 70/740 Data Terminal)	9,000	38.75	169
70/750 Modular Video Data System:				
70/751	Video Data Terminal	3,525	16.25	62
70/756-11	Video Data Generator; for 8 terminals	12,925	59.50	228
70/756-21	Video Data Generator; for 4 terminals	10,575	48.75	186
70/756-31	Video Data Generator; for 2 terminals	9,400	43.25	166
5716	Data Format Feature	470	2.25	8
5721	Variable Start of Transmission	470	2.25	8
70/759-11	Video Data Controller; Local	28,200	130.00	496
70/759-21	Video Data Controller; Communications	18,800	86.25	331
5715	Station Selector	1,175	5.75	21
70/752	Video Data Terminal (stand-alone)	8,325	32.25	164
5707	Station Selection	850	3.50	17
5710	Data Format	850	3.50	17
5711	Printer Adapter	1,700	7.00	35
70/755	Video Data Switch	5,900	17.25	111
6740-11	Teletypewriter; ASR, friction feed	5,650	34.75	112
6740-21	Teletypewriter; ASR, sprocket feed	5,850	35.75	117
6741-11	Teletypewriter; KSR, friction feed	3,650	22.50	72
6741-21	Teletypewriter; KSR, sprocket feed	3,850	23.50	76
6742-11	Teletypewriter; RO, friction feed	3,250	21.25	63
6742-21	Teletypewriter; RO, sprocket feed	3,450	22.25	67

* Rental prices do not include equipment maintenance.

PRICING NOTES

On March 18, 1970, RCA announced the industry's first "optional unbundling" plan. Users of Spectra 70/46, 70/60, and 70/61 systems now have a choice of leasing or purchasing their equipment either with RCA systems engineering support, at the prices listed here, or without systems engineering support, at a 3% discount from these prices. In either case, RCA will continue to provide, at no extra cost, the basic operating software, standard application programs, and normal customer education services. The smaller Spectra systems remain fully "bundled."

RCA also offers users of Spectra 70/46, 70/60, and 70/61 systems a 6-year lease. Monthly payments average approximately 15% below the regular rental prices, and the user acquires ownership of the equipment at the end of the 6-year lease period.

The Purchase Option Allowance for most Spectra 70 equipment is 65% of the total rental paid prior to June 30, 1969, and 75% of the rental paid since July 1, 1969. The total purchase option allowance, however, cannot exceed 75% of the purchase price.