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UNIVAC 1100 Series

MANAGEMENT SUMMARY

Development of the Sperry Univac 1100 Series computer systems started about 1948, only a short time after the world's first electronic digital computer (ENIAC) was completed. Today these systems are being successfully employed in a wide range of scientific, business, communications, and real-time applications. UNIVAC claims that there are over 1,000 of the 1100 Series systems now installed. With an average value of $2.5 million per system, this represents a sales value of several billion dollars of equipment.

The latest additions to the 1100 Series product line are the 1100/10, the entry-level system in the new family of MOS memory-based 1100 Series computers; and the 1100/80, the largest and most sophisticated product in the 1100 Series product line. The announcement of these computers reflects UNIVAC's new, aggressive marketing posture. The 1100/10 system is clearly intended to attract users of competitive equipment into the UNIVAC fold, and the primary targets are IBM System/370 Model 135 and 145 accounts, as well as the Burroughs B 6738 and B 6748 and the Honeywell Series 60 Level 66/10 and 66/20 systems. Multiprocessor UNIVAC 1100/10 configurations are aimed at the Burroughs B 6750, the IBM 370/158-3, and the Honeywell 66/40. The 1100/80 system is a viable alternative to the IBM 370/168-3, as well as an upgrade for current 1100 users and a migration path for UNIVAC 494 customers. The uniprocessor 1100/81 system is somewhat lower in performance than the IBM 370/168-3, but also lower in price. The dual-processor 1100/82 system offers a major improvement in performance at a slightly higher price.

The 1100 Series has long been the mainstay of Sperry Univac's computer system product line, and these systems are being employed successfully in a broad range of applications. The latest member of the family is the Univac 1100/80, a large-scale system intended to compete with the IBM System/370 Model 168.

CHARACTERISTICS

MANUFACTURER: Sperry Univac Division, Sperry Rand Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19422. Telephone (215) 542-4011.

MODELS: UNIVAC 1106, 1110, 1100/11, 1100/12, 1100/21, 1100/22, 1100/41, 1100/42, 1100/43, 1100/44, 1100/81, and 1100/82.

DATA FORMATS

BASIC UNIT: 36-bit word. In main storage, each word location includes two additional parity bits, one for each half-word.

FIXED-POINT OPERANDS: One 36-bit word. Addition and subtraction can also be performed upon 2-word (72-bit) operands and upon 18-bit half-words and 12-bit third-words; the leftmost bit holds the sign in each case. Moreover, partial words of 6, 9, 12, or 18 bits can be transferred into and out of the arithmetic and control registers. The 1110, 1100/40, and 1100/80 can also perform decimal addition and subtraction operations on 9-bit bytes, packed 4 to a word.

FLOATING-POINT OPERANDS: One word, consisting of 27-bit-plus-sign fraction and 8-bit exponent; or two words, consisting of 60-bit-plus-sign fraction and 11-bit exponent.

The UNIVAC 1100/80, introduced in November 1976, is Sperry Univac's most powerful computer to date and is designed to compete directly against the IBM System/370 Model 168. The 1100/80 is the first 1100 Series computer to employ high-speed buffer storage. It can have up to 16 million bytes of main memory and is available in both uniprocessor and dual-processor configurations.

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In November 1976, concurrently with the 1100/80 announcement, UNIVAC introduced its new Distributed Communications Architecture (DCA). Under the new DCA concept, according to UNIVAC, continued compatibility of present and future products will be ensured by specifying interfaces and functions of all components and providing guidelines for the building of communications networks. DCA can accommodate a broad range of host processors and terminal attachments, including other manufacturers' equipment. Adaptable to both simple and complex networks, DCA is said to permit the design of networks that fulfill many specialized requirements, such as maximum-security, ultra-resilient, and low-overhead systems.

A DCA-compatible remote concentrator can be used to mix old and new terminals, all using their own protocols. Remote concentrators, as part of a DCA network, will provide the user with many advantages, such as structured networks or bit-oriented protocols, without impacting his current investment in terminals.

DCA allows the user to centralize control in a single node or distribute it among several nodes to minimize the possibility of failure. Networks can be designed to adapt to changing conditions, such as network failures, by moving control functions within the network. Star, hierarchical, and ring networks can all be accommodated within the DCA, with reconfiguration from one type to another. According to UNIVAC, all types of communications operations—remote batch, interactive, time-sharing, and simple message switching—can be designed within the DCA framework.

In the following paragraphs, we will examine the principal characteristics of the UNIVAC 1108 and all the current 1100 Series computer systems.

THE UNIVAC 1108

Although the venerable 1108 has been superseded by the UNIVAC 1110 and the 1100/40, its architecture served as the prototype for succeeding 1100 Series processor models. The UNIVAC 1108 was originally conceived as an improved version of the second-generation UNIVAC 1107, a system that had been well received by scientific users. Although the 1108 also had the 36-bit word length and binary arithmetic facilities of the "classical" (i.e., IBM 704-style) scientific computer, UNIVAC was farsighted enough to endow it with a number of additional capabilities that made it suitable for virtually the entire spectrum of large-scale computer applications. Among these features were:

- Large main storage capacity–131,072 to 262,144 words.
- High internal speed–the capability to execute most instructions in a single 750-nanosecond core cycle through overlapped accessing of instructions and data stored in separate memory modules.
- Modularity–an 1108 multiprocessor system could include up to three central processors and two I/O

INSTRUCTIONS: One word, consisting of 6-bit Function Code, 4-bit Partial-Word or Immediate-Operand Designator, 4-bit Control Register Designator, 4-bit Index Register Designator, 1-bit Index Modification Designator, 1-bit Indirect Address Designator, and 16-bit Address Field.

INTERNAL CODE: A 6-bit BCD code, Fieldata, is used by most of the line printers, and ASCII is used by the UNIVAC communications terminals and some of the newer I/O units; the processors are not code-sensitive and can conveniently manipulate data in any 6-bit or 9-bit code.

MAIN STORAGE/PRIMARY STORAGE

STORAGE TYPE: Magnetic core in the 1106 and 1106 II; plated wire primary storage and magnetic core extended storage in the 1110; metal oxide semiconductor (MOS) in the 1100/10, 1100/20, and 1100/80; and bipolar primary memory and MOS extended memory in the 1100/40.

CAPACITY: 1106–131,072, 196,608, or 262,144 words of Multi-Modular Storage (consisting of two 32,768-word modules per 65K bank); or 131,072, 262,144, 393,216, or 524,288 words of Unitized Storage.

1106 II–131,072, 196,608, or 262,144 words of Multi-Modular Storage II (consisting of two 32,768-word modules per 65K bank).

1110 Primary Storage–32,768 to 262,144 words, in 32,768-word storage units. Each storage unit contains four simultaneously accessible 8,192-word modules, with odd-even interleaved addressing of each pair of adjacent 8K modules. Each 65K storage cabinet can service up to eight Requestors (either CAU or IOAU) simultaneously.

1100/10—131,072 to 524,288 words, consisting of one 131,072-word module per cabinet, with a maximum of four cabinets.

1100/20–131,072, 196,608, 262,144, 327,680, 393,216, 458,752, or 524,288 words, consisting of one 65,536-word or one 131,072-word module per cabinet, with a maximum of four cabinets.

1100/40–32,768 to 524,288 words, in 32,768-word or 65,536-word storage units. Each storage unit contains four simultaneously accessible 8,192-word or 16,384-word modules, with odd-even interleaved addressing of each pair of adjacent modules. A basic 65K storage unit can service up to four Requestors (CAU or IOAU) simultaneously, while a fully expanded 131K-word storage unit can service up to eight Requestors simultaneously.

1100/80—524,288 to 4,194,304 words, in 262,144-word storage units. Two storage units can be housed in one cabinet, with a maximum of eight cabinets.

CYCLE TIME: See table. Except in the case of an 1106 with 131K words of Unitized Storage, each storage module operates independently, permitting overlapped accessing of instructions and data when they are located in different modules.

CHECKING: In 1106 and 1100/20 computer systems, a parity bit with each half-word is checked whenever storage is referenced and, in the 1100/20, on all I/O transfers. In 1110 and 1100/40 systems, parity is initially checked on all addresses presented to Multi-Module Access units, Memory Access Interfaces, Primary Storage Units, and Extended Storage Units to associate any errors with the malfunctioning component. A parity bit with each half-word is also checked at the component level for each read and write operation.

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CHARACTERISTICS OF THE 1100 SERIES CENTRAL SYSTEMS

	UNIVAC 1106	UNIVAC 1106 II	UNIVAC 1100/10	UNIVAC 1100/20	UNIVAC 1110	UNIVAC 1100/40	UNIVAC 1100/80
SYSTEM CHARACTERISTICS							
No. of central processors (CAU's)	1 or 2	1 or 2	1 or 2	1 or 2	1 to 4	1 to 4	1 or 2
No. of I/O controllers (IOAU's)	None	None	None	None	1 to 4	1 to 4	1 or 2
Date of introduction	March 1969	Jan. 1972	Oct. 1975	March 1975	Nov. 1970	March 1975	Nov. 1976
Date of first delivery	Dec. 1969	March 1972	April 1976	July 1975	June 1972	Sept. 1975	March 1977
MAIN STORAGE							
Storage type	Core	Core	MOS	MOS	Plated wire	Bipolar	MOS
Minimum capacity, 36-bit words	131,072	131,072	131,072	131,072	32,768	32,768	524,288
Maximum capacity, 36-bit words	524,288	262,144	524,288	524,288	262,144	524,288	4,194,304
Cycle time, microseconds/word	1.5	1.0	1.125	0.875	Read: 0.28 Write: 0.48	Read: 0.28 Write: 0.38	1.25 per 8 words**
Storage interleaving	Optional*	Standard	Standard	Standard	Standard	Standard	Standard
EXTENDED STORAGE							
Storage type	None	None	None	None	Core	MOS	None
Minimum capacity, 36-bit words	—	—	—	—	131,072	131,072	—
Maximum capacity, 36-bit words	—	—	—	—	1,048,576	1,048,576	—
Cycle time, microseconds/word	—	—	—	—	1.5 or 0.75	0.800	—
Storage interleaving	—	—	—	—	Optional	Optional	—
CENTRAL PROCESSORS							
Register cycle time, nanoseconds	166	166	125	125	90	90	50
No. of instructions	144	144	146	146	199	199	199
Instruction times, microseconds:							
Fixed-point add/subtract (36 bits)	1.50	1.00	1.125	0.88	0.30	0.30	0.20
Fixed-point add/subtract (72 bits)	3.17	2.17	2.375	1.88	0.60	0.60	0.45
Fixed-point multiply (36 bits)	3.67	3.17	2.75	2.50	1.50	1.50	0.90
Fixed-point divide (36 bits)	13.95	13.45	10.50	10.25	6.40	6.40	6.20
Floating-point add/subtract (1 word)	3.00	2.50	2.25	2.00	0.90	0.90	0.70
Floating-point multiply (1 word)	4.00	3.50	3.0	2.75	1.65	1.65	1.65
Floating-point divide (1 word)	11.50	11.00	8.625	8.33	5.30	5.30	4.80
Floating-point add/subtract (2 words)	4.50	3.50	3.375	2.88	0.75	0.75	0.95
Floating-point multiply (2 words)	6.67	5.67	5.0	4.50	2.40	2.40	2.45
Floating-point divide (2 words)	24.00	23.00	18.0	17.50	10.30	10.30	9.85
Load/store (36, 18, 12, 9, or 6 bits)	1.50	1.00	1.125	0.88	0.30	0.30	0.20
Load/store (72 bits)	3.00	2.00	2.25	1.75	0.60	0.60	0.40
INPUT/OUTPUT CONTROL							
Number of I/O channels:							
Per central processor (CAU)	4 to 16	4 to 16	4 to 16	4 to 16	—	—	—
Per I/O controller (IOAU)	—	—	—	—	8 to 24	8 to 24	2 to 24
Per system	4 to 32	4 to 32	4 to 32	4 to 32	8 to 96	8 to 96	2 to 48
Max. total I/O data rate, words/sec:							
Per I/O channel	333,000	333,000	444,000	571,000	500,000	500,000	2,000,000
Per central processor (CAU)	667,000	1,000,000	888,000	1,142,000	—	—	—
Per I/O controller (IOAU)	—	—	—	—	4,000,000	4,000,000	—

*Standard in configurations with more than 131K words of memory.
**The 1100/80 also has 8K to 16K words of 125-nanosecond buffer storage.

controllers and could readily be configured for "fail-soft" operation.

- Real-time capabilities—two clocks, a powerful interrupt system, storage protection facilities, and a group of registers accessible only to the operating system provided the equipment for a wide range of real-time, communications, and multiprogramming functions.

- Control registers—128 integrated-circuit registers, including 16 accumulators and 15 index registers for enhanced power and flexibility.

- Partial-word operands—although no decimal arithmetic instructions were provided, facilities to manipulate partial words of 6, 9, 12, and 18 bits were included in the system.

In 1100/10 and 1100/20 main storage, a 7-bit error correction code is generated for each word for all read and write operations. Single-bit errors are corrected automatically, and multiple-bit errors cause a data parity interrupt.

In 1100/80 main storage, an 8-bit error correction code is generated from data to be stored, and is stored with that data. Single-bit errors are corrected automatically, and multiple-bit errors cause a data parity interrupt.

STORAGE PROTECTION: The Storage Limits Register, loaded by the Operating System, defines the upper and lower boundaries of both the instruction area and data area that may be referenced by the currently active user program. Any attempt to reference an address beyond these limits causes an interrupt. The setting of a bit in the Processor State Register determines whether the protection is against write operations only or against all reads, writes, and jumps. In 1100/20 systems, the I-Bank and D-Bank Write Protection bits in the Processor State Register provide read, write, and storage protection for data in both banks.

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- Drum storage—a variety of reliable drum units, ranging from head-per-track FH-432 drums with a 4.3-millisecond average access time to moving-head Fastrand III units capable of storing up to 198 million characters.

The 1108 was introduced in July 1964 as a single-processor system and as a multiprocessor configuration one year later. Over 300 of the 1108 processors are still in use around the world.

THE UNIVAC 1106

The 1106 was announced in March 1969, nearly five years after the 1108. Customer deliveries began in December 1969. Introduced as an entry-level system for the 1100 Series, with from 40 to 75 percent of the processing power of the 1108, the 1106 was the lowest-priced of the 1100 Series processor models until the 1100/10 arrived on the scene in 1975. Initially, the 1106 was offered only as a single-processor system with a core storage cycle time of 1.5 microseconds—half as fast as the 1108.

In October 1969, UNIVAC introduced an alternative 1.5-microsecond core memory system for the 1106. Called Unitized Storage, it costs only half as much as the original Multi-Modular Storage—but performance is degraded because the Unitized Storage does not permit overlapped accessing of instructions and data unless the memory capacity exceeds 131K words.

In November 1970, concurrently with the unveiling of the 1110 system, UNIVAC announced a multiprocessor version of the 1106. Designed for applications that required continuous "fail-safe" operation, the 1106 Multiprocessor System includes two independent processors (each with 4 to 16 I/O channels), 131K to 262K words of core storage, two CRT display consoles, and an Availability Control Unit that permits the hardware to be partitioned into two independent systems.

In January 1972, UNIVAC introduced the 1106 II, a new model that delivers processing power intermediate between that of the original 1106 and the faster 1108. The 1106 II uses a standard 1106 processor and 131K to 262K words of Multi-Modular Core Storage with a cycle time of 1.0 microsecond, compared with 1.5 microseconds for the 1106 and 0.75 microsecond for the 1108. The 1106 II is available in both single-processor and multiprocessor configurations. Customer deliveries began in March 1972.

In March 1975, concurrently with the introduction of the 1100/20 and 1100/40 systems, UNIVAC also announced expanded addressing and memory capacities for the 1106. The 1106 system, which uses the Unitized Memory, may now double its main memory size from 262K words to 393K or 512K words. The larger memory sizes are intended to benefit multiprocessor configurations and large data-base-oriented systems. The 524K addressing capability can be installed on existing 1106 systems and does not require equipment replacement.

EXTENDED STORAGE (for 1110 and 1100/40 only)

STORAGE TYPE: 1110—magnetic core; 1100/40—metal oxide semiconductor (MOS).

CAPACITY: 1110—131,072 to 1,048,576 words, in 131,072-word modules, for the 1.5-microsecond storage; or 131,072 to 524,288 words, in 65,536-word modules, for the 750-nanosecond storage. One- or two-way address interleaving is optional. Extended storage is connected to the system by Multiple Access Interface (MAI) units. Each MAI, with appropriate optional features, can interface up to two modules of extended storage with up to four CAU's and four IOAU's.

1100/40—131,072 to 1,048,576 words, in 131,072-word modules. One- or two-way address interleaving is optional. Extended storage is connected to the system by Multiple Access Interface (MAI) units. Each MAI, with appropriate optional features, can interface two 131K-word modules of extended storage with up to four CAU's and four IOAU's.

1100 Series extended storage is directly addressable.

CYCLE TIME: 1110—1.5 microseconds per word. A 750-nanosecond option enables UNIVAC 1108 users to retain their main storage modules for reuse as extended storage in an 1110 system. Modules of the two speeds can be intermixed in a system.

1100/40—800 nanoseconds per word.

CHECKING: 1110—Parity bit with each half-word is checked whenever storage is referenced. 1100/40—a 7-bit error correction code is generated for each word during each read and write operation. Single-bit errors are corrected automatically, and double-bit errors cause a parity interrupt.

STORAGE PROTECTION: Same as for primary storage, above.

BUFFER STORAGE (for 1100/80 only)

STORAGE TYPE: IC semiconductor.

CAPACITY: 8,192 to 16,384 words, in 4,096-word modules. Buffer storage is located in the Storage Interface Unit (SIU). The basic SIU contains 4K words of buffer storage and a 4K-buffer expansion for a total of 8K words. In addition, a second 4K-word buffer can be added, and this can also be expanded to 8K words, giving a maximum buffer size of 16K words in the SIU. The second buffer is functionally independent of the first, and main storage units can be individually connected to either, but not both, buffers.

ACCESS TIME: 125 nanoseconds per word.

CENTRAL PROCESSORS

REGISTERS: In 1106, 1106 II, and 1100/20 systems, each central processor has 128 program-addressable control registers. Each integrated-circuit register is 36 bits long and has a cycle time of 166 nanoseconds in the 1106 and 125 nanoseconds in the 1100/20. User programs can make use of 15 index registers, 16 accumulators (4 of which also serve as index registers), 17 unassigned registers (which can be used for fast-access temporary storage), a Repeat Count Register, a Mask Register, and a Processor State Register. In 1100/20 systems a Breakpoint Register is operational on all instruction addresses and read/write and I/O references to main memory, and is available as a debugging aid. Accessible only to the Operating System are 32 I/O access control registers, duplicate sets of 15 index registers and 16

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FULLY SUPPORTED 1100/40 CONFIGURATIONS*

COMPONENTS	CONFIGURATION						
	1100/41 1 x 1	1100/42 2 x 1	1100/42 2 x 2	1100/43 3 x 2	1100/44 4 x 2	1100/44 4 x 3	1100/44 4 x 4
Command/Arithmetic Units	1	2	2	3	4	4	4
Input/Output Access Units	1	1	2	2	2	3	4
Input/Output Channels	8 to 24	8 to 24	16 to 48	16 to 48	16 to 48	24 to 72	32 to 96
Primary Storage (words)	32K to 524K	65K to 524K	65K to 524K	131K to 524K	131K to 524K	131K to 524K	131K to 524K
Extended Storage (words)	131K to 1048K	262K to 1048K	262K to 1048K	262K to 1048K	262K to 1048K	262K to 1048K	262K to 1048K
System Consoles	1 to 4	1 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
System Partitioning Unit	0 or 1	0 or 1	0 or 1	1	1	1	1

*The same range of configurations is now available for UNIVAC 1110 systems, but primary storage is limited to 262K words.

All models of the 1106 are program-compatible with the larger 1100 Series processors, have the same functional capabilities, and use the same software. UNIVAC has delivered over 300 of the 1106 systems to date.

THE UNIVAC 1110

The 1110, introduced in 1970, represented a strong UNIVAC bid to update its large-scale computer product line and strengthen its position as a technological leader. The 1110 retains virtually all of the processing facilities, peripheral equipment, and software of the widely accepted UNIVAC 1108/1106 systems, while providing greatly increased processing power.

Multiprocessing and two levels of directly addressable storage are the key technical features of the 1110. Every system includes both high-speed plated-wire and somewhat slower magnetic core storage units. Moreover, until the January 1972 introduction of the single-processing "1 x 1" configuration, every 1110 system was required to include either two or four central processors (called Command/Arithmetic Units, or CAU's). Though the present configurations are limited to one, two, three, or four CAU's, there are hardware provisions for connecting up to six CAU's.

Other significant technical innovations of the 1110 system include:

- A four-deep instruction stack in each CAU that permits a high degree of instruction look-ahead and concurrency.
- 112 integrated-circuit control registers in each CAU.
- A powerful instruction set that includes all of the UNIVAC 1108 instructions plus a new group of byte-oriented commercial instructions that facilitate

accumulators, 17 unassigned registers, a Repeat Count Register, a Mask Register, and a Real-Time Clock Register which is decremented every 200 microseconds.

In 1110 and 1100/40 systems, each Command/Arithmetic Unit (CAU) has a General Register Stack consisting of 112 integrated-circuit control registers, each 36 bits long and program-addressable. Register cycle time is 90 nanoseconds. Users' programs can make use of 15 index registers, 16 accumulators (4 of which also serve as index registers), a Repeat Register, a Mask Register, a Real-Time Clock, and a number of unassigned registers that can be used for fast-access temporary storage. Accessible only to the Operating System are duplicate sets of index registers and accumulators, plus a variety of special-purpose registers.

In the 1100/80 system, the General Register Stack (GRS) includes 128 program-addressable control registers, which are 36-bit integrated-circuit registers with a basic cycle time of 50 nanoseconds. Effective use of multiple accumulators and index registers for the development and use of constants, index values, and operands substantially improves CPU performance. Four of the accumulators (A registers) overlap four of the index registers (X registers); this means they can be used as either A or X registers, providing additional versatility in their use. User programs can make use of 15 index registers, 16 accumulators, 16 special registers, and 4 unassigned registers that are available as temporary storage locations.

INDEXING: Operand addresses can be modified by the contents of any of the 15 index registers. If desired, the contents of the index register can be automatically incremented by any specified value each time the register is referenced.

INDIRECT ADDRESSING: Possible to any desired number of levels, with full indexing capabilities at each level.

INSTRUCTION REPERTOIRE: The 1106 and 1106 II have 144 instructions and the 1100/20 has 146 instructions, all one word in length. Most instructions specify the address of one operand in main storage and one of the 16 accumulators. Complete binary arithmetic facilities are provided for single-precision fixed-point and both single and double-precision floating-point operands. Addition and subtraction can also be performed on double-precision fixed-point operands and on 18-bit

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data manipulation, decimal arithmetic, code translation, radix conversion, and editing.

- An extended, 24-bit addressing capability that provides for direct addressing (through base registers) of up to 16 million words of storage.

- Input/Output Access Units (IOAU's) which control all I/O operations independently of the Command/Arithmetic Units. An 1110 system can include one, two, three, or four IOAU's, and each IOAU can accommodate up to 24 I/O channels and an aggregate data rate of up to 24 million characters per second.

- Provisions for complete hardware redundancy through the use of up to four CAU's, four IOAU's, four System Consoles, multiple modules of main and extended storage, and dual-channel peripheral subsystems.

- A System Partitioning Unit (SPU) that permits an 1110 system to be manually separated into two or three logically independent smaller systems.

- An independently programmed Communications/Symbiont Processor (C/SP) designed to relieve the CAU's of most of the processing functions associated with the control of data communications and low-speed I/O operations. Based on the UNIVAC 9400 processor architecture, the C/SP provides 32K to 131K bytes of 630-nanosecond semiconductor storage and has a full complement of supporting software. In typical transaction-oriented environments, the use of a C/SP should reduce the CAU load by 20 to 25 percent. Introduced with the 1110, the C/SP can also be used in the other 1100 Series.

The instruction stack within each CAU, together with the capability to simultaneously access multiple storage modules, permits overlapping of the five basic stages of instruction execution: instruction acquisition, address generation, operand acquisition, computation, and storage of results. As a result, the total execution time for most 1110 instructions (load, store, fixed-point add, etc.) is a single 300-nanosecond CAU cycle. Each CAU in an 1110 system provides approximately 1.8 times the raw computing power of the 1108 central processor.

The plated-wire memory that UNIVAC had been using in its smaller 9000 Series computers since 1966 finally reached the "big time" as the main storage for the 1110. The nondestructive readout capability of the plated-wire memory yields a cycle time of 280 nanoseconds per word for reading and 480 nanoseconds for writing, and four simultaneous accesses can be made to each 32K storage unit. A system can include from 32K to 262K words of plated-wire primary storage.

The second level of directly addressable storage for the 1110 is provided by conventional magnetic core storage in a choice of 1.5-microsecond or 750-nanosecond cycle times. The minimum configuration requires the presence

half-words and 12-bit third-words. Also included are extensive facilities for testing, shifting, searching, and logical operations. Not available, however, are instructions for decimal arithmetic, radix conversion, code translation, or editing.

The 1110 and 1100/40 CAU's have 199 instructions, including all of the facilities of the smaller systems plus a group of character-oriented instructions that permit the following operations upon byte strings: move, move with translate, compare, edit, decimal add, decimal subtract, pack, unpack, radix conversion, and format conversions.

The 1100/80 has 219 instructions. To a great extent, the instruction repertoire is identical with that of the other 1100 Series systems in order to maintain compatibility. To utilize the full capabilities of the 1100/80 system, character manipulation instructions and additional privileged instructions are included.

INSTRUCTION TIMES: See Table. All times are for instructions and data located in different modules of main storage, with no storage conflicts due to I/O activity. For same-bank accessing (as in the 1106 with Unitized Storage), execution time for each instruction is increased by one main storage cycle.

PROCESSOR MODES: When a processor is operating in Guard Mode, as denoted by the setting of a bit in the Processor State Register, no accesses to the Executive control registers are permitted, and the Storage Limits Register defines the main storage areas that can be accessed. When the Guard Mode bit is turned off, all registers and storage locations can be freely accessed. The Guard Mode is normally enabled for user programs and disabled for Executive functions.

INTERRUPTS: A program interrupt facility causes storage of the Processor State Register's current contents and a transfer of control to the Operating System whenever one of the following conditions occurs: completion of an I/O operation, abnormal condition in an I/O subsystem, processor or storage fault, program error, or program-requested interrupt. In 1110 and 1100/40 systems, each IOAU contains a 2-bit pointer register that determines which CAU receives I/O interrupt signals. If desired, each I/O interrupt can be directed to the CAU that initiated the I/O operation on the channel involved.

CONSOLE: The Display Console used in UNIVAC 1106 and 1106 II systems is a free-standing I/O subsystem used to monitor and direct each system's operation. It consists of an operator's control and indicator panel, a CRT capable of displaying 16 lines of 64 characters each, a typewriter-style keyboard for data entry, a UNIVAC Pagewriter Printer capable of printing 80-character lines at 25 characters per second, and a day clock that displays the time of day and furnishes timing information to the central processor.

The UNIVAC 1110 System Console is a free-standing I/O subsystem used to monitor and direct an 1110 system's functions. It consists of a Uniscope 100 CRT display, a typewriter-style keyboard and control panel, and a Pagewriter printer for hard-copy output. The CRT displays 16 lines of 64 characters each, and the printer can print 80-character lines at 25 characters per second. The System Console also includes a fault indicator, which indicates fault conditions in major system components, and a real-time maintenance communication system (RTMCS), which permits diagnostic maintenance operations to be performed from a remote location via a telephone line.

The UNIVAC 4013 System Console, used in the 1100/20, 1100/40, and 1100/80 systems, consists of a Uniscope 100

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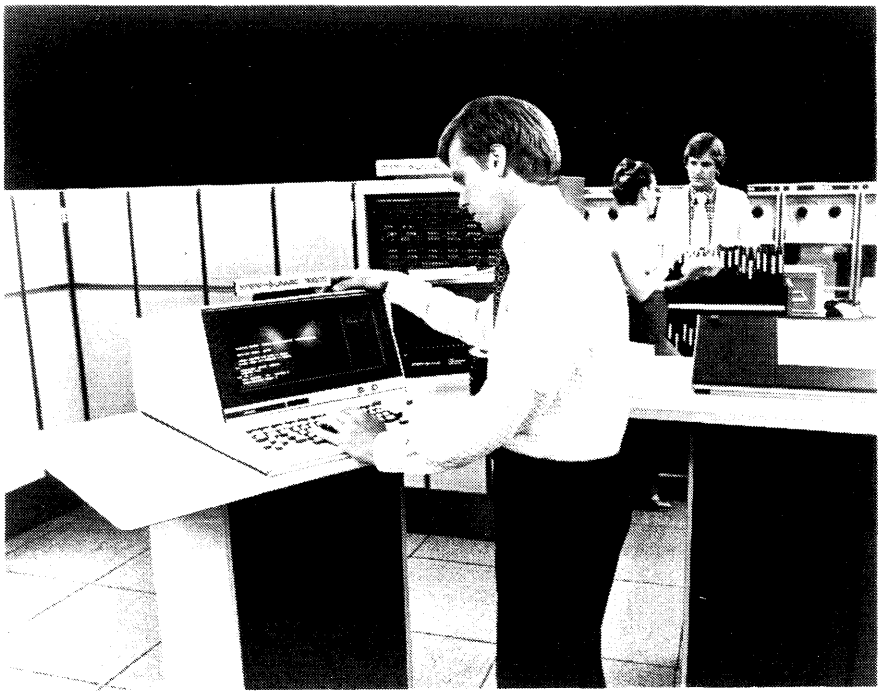

UNIVAC 1100/20 configurations feature up to 524K words of semiconductor main memory, a CRT system console, and an optional Communications/Symbiont Processor with expanded communications capabilities. Rental for 1100/20 systems ranges from about $25,000 to as much as $80,000 for a large system.

of at least 131K words of this extended storage, and a maximum of 1048K words can be used. Two-way or four-way interleaving is offered as an option.

In January 1972, UNIVAC greatly expanded the potential market for the 1110 and ended the active marketing life of the earlier 1108 system by announcing the 1110 1 x 1 system, a single-processor configuration with rentals as low as $36,300 per month. Previously the monthly rental for a minimum 2 x 1 (multiprocessor) 1110 system was about $60,000. Deliveries of the 1110 began in June 1972, and approximately 150 systems have been installed to date.

THE UNIVAC 1100/10

Introduced in October 1975, the 1100/10 joined the previously announced UNIVAC 1100/20 and 1100/40 as the entry-level system in the new family of MOS memory-based 1100 Series computers. The 1100/10 replaces the UNIVAC 1106 system as the lowest-priced currently marketed 1100 Series computer, although 1106 users will continue to receive new software releases and support for new peripherals.

The central processor architecture and peripheral handling capabilities of the 1100/10 bear a remarkable resemblance to those of the larger 1100/20 system, but the 1100/10 is not a configuration-constrained or slowed-down version of any of the larger 1100 Series processors. Main memory sizes range from 128K to 512K words, identical with those of the 1100/20, although the 1100/10 cycle time of 1125 nanoseconds is somewhat slower than the 1100/20 cycle time of 875 nanoseconds. Both the 1100/10 and 1100/20 processors have comparable instruction repertoires, CPU design, and internal clock speed, although UNIVAC rates the 1100/10 somewhat

CRT display, a typewriter-style keyboard and control panel, and a 30-cps incremental printer for hard-copy output. Up to five additional printers can be connected to a console. The CRT displays 16 lines of 64 characters each and uses a 7-bit ASCII character set. The System Console also includes a fault indicator, which indicates fault conditions in major system components, and an interface for the Total Remote Assistance Center (TRACE) remote diagnostic capability. An 1100/20 processor has one System Console and can have one auxiliary console. An 1100/80 processor can have any number required.

AVAILABILITY CONTROL UNIT (ACU): A component of 1106 multiprocessor and 1100/20 multiprocessor configurations that permits the system to be configured into two independent systems, permits individual units to be taken off-line for preventive maintenance, monitors the status of system components, and initiates automatic recovery procedures when failures occur.

SYSTEM PARTITIONING UNIT (SPU): Permits manual separation of an 1110 or 1100/40 system into two or three logically independent smaller systems, permits individual units to be taken off-line for maintenance, and initiates automatic recovery procedures when failures occur. The 1100/40 SPU also monitors the status of system components and performs the initial system load. The SPU is required in every 3-processor or larger system and is optional in smaller systems. When all optional features are included, the SPU can interface with 4 CAU's, 4 IOAU's, 262K words of main storage in 1110 systems or 524K words of main storage in 1100/40 systems, 1048K words of extended storage, and 48 multi-access peripheral subsystems.

SYSTEM TRANSITION UNIT: Contains the controls and indicators required for control and assignment of the system units in an 1100/80 system. Power sequencing, manual control of the CPU's and IOU's, initial load, automatic recovery, and partitioning are controlled by the STU.

The initial load function provides the ability to set module select register (MSR) values, select initial load paths, and initiate the initial load operation for either one of two applications. The MSR selects the section of main storage in

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slower in instruction speed, at 0.68 million instructions per second compared to the 1100/20's 0.86 million instructions per second, as a result of the 1100/10's slower memory speed. Each 1100/10 central processor is equipped with 4 integrated input/output channels, and the total number of channels can be expanded to 16 in 4-channel increments. Both single-processor and dual-processor 1100/10 configurations are available.

The 1100/10 can use the full complement of 1100 Series peripherals, including the 8405 Fixed-Head Disc, the 8430, 8433, and 8434 disk drives, and the Uniservo Series magnetic tape drives. Complete software compatibility with other 1100 Series systems is an important feature of the 1100/10. The system can utilize all the available 1100 Series software, including the 1100 Operating System, DMS-1100 (UNIVAC's popular data base management system), and the full range of 1100 Series programming languages and applications packages.

THE UNIVAC 1100/20

The 1100/20, unveiled in March 1975, uses the 1106 architecture as its foundation, but also includes several significant hardware enhancements that contribute to its improved performance and reliability characteristics. The most significant of these include the following:

- Metal oxide semiconductor (MOS) memory in capacities ranging from 131,072 to 524,288 words with a cycle time of 875 nanoseconds.
- Improved reliability features, including automatic single-bit error correction and double-bit error detection in main memory and extensive parity checking on both main memory accesses and I/O peripheral transfers.
- A new system console that includes a fault indicator panel for identifying malfunctions in major system components and an interface for UNIVAC's Total Remote Assistance Center (TRACE) facility, which permits an 1100/20 to be connected directly to a TRACE center in UNIVAC's Roseville facility for on-line maintenance and diagnostics.
- An Availability Control Unit for multiprocessor configurations that permits manual separation of an 1100/20 system into two independent systems and provides dynamic reconfiguration and automatic recovery capabilities.
- A slightly faster Center Processor Unit, with an internal clock speed of 125 nanoseconds as compared to 167 nanoseconds for the 1106.

Two models of the 1100/20 are available, the single-processor 1100/21 and the multiprocessor 1100/22. The latter model includes two central processors with 4 to 16 input/output channels per system. Monthly rentals for the 1100/20 systems range from about $25,000 to $80,000 per month.

which the fixed interrupt addresses are located, and the location in main storage where the instruction execution sequence is initiated on an initial load.

The partitioning function provides the ability to assign individual central-complex units of a system to either one of two independent smaller systems, or to isolate a unit from either application for off-line concurrent maintenance. Included in this function is the control for the automatic expansion or compression of main storage address range for both applications. This operation provides main storage ranges for either or both applications for any combination of main storage unit assignments. The partitioning function also indicates the operational status of each central-complex unit. These status conditions are available to system software for configuration control. The ability to partition peripheral subsystems is provided by controls on the individual subsystems and, optionally for some subsystems, by software command.

SYSTEM MAINTENANCE UNIT (SMU): In an 1100/80 system, the SMU provides for diagnostic checkout and fault isolation of the CPU and IOU by the automatic comparison of internal logic status against known correct data. The SMU includes a maintenance processor, card tester, communications capability, and CRT workstation.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The basic 1106, 1100/10, and 1100/20 Processors have 4 I/O channels, expandable in 4-channel increments to a maximum of 16 channels.

The basic 1110 and 1100/40 Input/Output Access Unit (IOAU) contains 8 channels, expandable in 8-channel increments to a maximum of 24. (There are no I/O channels in the 1110 and 1100/40 Command/Arithmetic Units.) Since up to 4 IOAU's can be configured in a system, the maximum total number of I/O channels is 96.

The basic 1100/80 Input/Output Unit includes space for four channel modules; two are standard—a byte multiplexer channel and a block multiplexer channel—and two more are optional. Up to 8 channel modules including byte multiplexer, block multiplexer, and/or word channel modules, can be accommodated per input/output unit for a total of 16 per 1100/80 system. Each byte or block multiplexer channel has eight shared subchannels and is capable of controlling up to eight subsystems. Four word channels share one byte channel interface, so an IOU may have as many as 24 word channels. Two of the four word channels on an interface may be externally specified index (ESI) channels. An ESI word channel can handle up to 32 full-duplex lines, making possible a total of 64 full-duplex lines on the two optional word channels in the word channel module.

All channels on an 1100/80 system can run simultaneously, and they are independent, not interfering with each other or the CPU. Each channel interfaces with main storage through the IOU control section, which resolves storage request and interrupt conflicts, by priority, and synchronizes channel operations with storage access timing.

CONFIGURATION RULES: An 1106 Unit Processor System consists of an 1106 Processor with 4 to 16 I/O Channels, Display Console, associated peripheral subsystems, and one of two types of core storage: 131K, 262K, 393K, or 524K words of 1.5-microsecond Unitized (non-overlapped) Storage or 131K to 262K words of 1.0-microsecond Multi-Modular Storage II.

An 1106 Multi-Processor System consists of two 1106 Processors (each with Display Console, 4 to 16 I/O channels, and the Multiprocessor Capability feature), one Availability Control Unit (ACU), associated peripheral

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THE UNIVAC 1100/40

The UNIVAC 1100/40 systems, introduced in March 1975, are enhanced versions of the UNIVAC 1110 and replaced the 1110 systems as the most powerful computers in UNIVAC's product line until the recent introduction of the 1100/80. Both single-processor and multiprocessor systems are available in a larger range of configurations than was previously offered with the 1110. As a result, 1100/40 users can configure systems with one, two, three, or four Command/Arithmetic Units and from one to four Input/Output Access Units. At the same time, UNIVAC made the same range of configurations available for 1110 systems as well. The accompanying table shows the seven standard system configurations that are fully supported by UNIVAC software (page 70C-877-11e).

The 1100/40 systems, like the 1100/20, reflect UNIVAC's switch from plated-wire to semiconductor storage technology. Primary memory is available in capacities of from 32K words to 524K words of bipolar storage, twice the amount previously available for the 1110. The 1100/40's performance improvements are achieved through the faster 380-nanosecond write cycle speed of the new memory.

Extended storage for 1100/40 systems uses the same semiconductor storage modules that provide main memory for the 1100/20. The capacity of from 131,072 to 1,048,576 words is equal to that offered for the 1110, but the 800-nanosecond cycle time is nearly twice as fast as that of the magnetic core extended storage used in 1110 systems. Extended storage for 1100/40 systems features single-bit error correction and double-bit error detection capabilities.

UNIVAC estimates that a 1 x 1 1100/41 system offers a performance improvement of 25 percent over a comparable 1110 system for a 4 percent price increase. At the very large end, a 4 x 4 1100/44 system can outperform a 4 x 4 1110 by approximately 15 percent for an additional 5 percent in price. Typical 1100/40 system rentals range from $45,000 to $250,000 per month, while purchase prices range from about $2 million to $12 million.

THE UNIVAC 1100/80

Introduced in November 1976, the 1100/80 is the largest and most powerful computer offered by Sperry Univac to date, having twice the power of the 1100/40 system. Featuring multi-layer printed circuit boards, emitter-coupled logic (ECL), and a new buffered memory concept, the 1100/80 can have up to 16 million bytes of real memory and is available in either uniprocessor or multiprocessor configurations.

In the 1100/80, a large backing store of moderate speed has been combined with a high-speed buffer to support the processing components. In this way, more real memory is available to the user. Eight words at a time are fetched from the backing store into the buffer. All pro-

subsystems, and one of two types of core storage: 262K, 393K, or 524K words of 1.5-microsecond Unitized Storage or 131K to 262K words of 1.0-microsecond Multi-Modular Storage II. In addition, a Shared Peripheral Interface (SPI) is required for each peripheral subsystem to be accessed by two 1106 Processors, and either a Multi-Module Access (MMA) or a Shared Memory Interface (SMI) is required for each core storage module.

An 1100/11 or 1100/21 Unit Processor System consists of an 1100/10 or 1100/20 Processor with 4 to 16 I/O Channels, System Console, associated peripheral subsystems, and from 131K to 524K words of 875-nanosecond MOS main memory.

An 1100/22 Multi-Processor System consists of two 1100/20 Processors (each with System Console), 4 to 16 I/O channels, one Multi-Module Access (MMA), and associated peripheral subsystems. The system can have 131K to 524K words of main memory. A Shared Peripheral Interface (SPI) is required for each peripheral subsystem to be accessed by two 1100/20 Processors, and an MMA is required for each additional 65K- or 131K-word main storage unit.

An 1110 System consists of 1, 2, 3, or 4 Command/Arithmetic Units, 1 to 4 Input/Output Access Units (each with 8 to 24 channels), 1 to 4 System Consoles, 0 or 1 System Partitioning Unit, 32K to 262K words of Main Storage, 131K to 1048K words of Extended Storage, and associated peripheral subsystems. See table for the seven 1110 (and 1100/40) system configurations that are fully supported by UNIVAC software.

An 1100/40 System consists of 1, 2, 3, or 4 Command/Arithmetic Units, 1 to 4 Input/Output Access Units (each with 8 to 24 channels), but not exceeding the number of CAU's, 1 to 4 System Consoles, 0 or 1 System Partitioning Unit, 32K to 524K words of Primary Storage, 131K to 1048K words of Extended Storage, and associated peripheral subsystems. See table for the seven 1100/40 system configurations that are fully supported by UNIVAC software.

An 1100/81 System consists of one Central Processor Unit, one or two Input/Output Units, one to any number of System Consoles, 524K to 4194K words of main storage, one Storage Interface Unit with from 8K to 16K words of buffer storage, one System Transition Unit, one System Maintenance Unit, one motor/alternator, and associated peripheral subsystems.

An 1100/82 System consists of two Central Processor Units, one or two Input/Output Units, one to any number of System Consoles, 1048K to 4194K words of main storage in a minimum of two Main Storage Units, one Storage Interface Unit with 16K words of buffer storage, one System Transition Unit, one System Maintenance Unit, one motor/alternator and associated peripheral subsystems.

Any 1100/80 system can operate in a degraded mode with one 4K-word Storage Interface Unit and one Main Storage Unit with 262K words of memory.

Each peripheral subsystem fully occupies one I/O channel. Additional channels may be connected. (See the descriptions of specific Mass Storage and Input/Output Units below.)

SIMULTANEOUS OPERATIONS: One input or output operation on each I/O channel can occur simultaneously with computation in each processor (or CAU). Moreover, the Externally Specified Index (ESI) mode permits multiple remote communications devices to transmit data to and from main storage in multiplexed fashion over a single I/O channel. All installed processors (or CAU's) and IOAU's can

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grams and data are loaded into the buffer for execution. Buffer storage ranges from 8K to 16K words in 4K-word increments. The buffer storage interface unit has a 125-nanosecond access time.

The 1100/80's central processor has a 50-nanosecond cycle time, the full 1100 Series floating-point and byte instruction sets, and an optional emulation set for the UNIVAC 494 computer system, and is timed to run instruction overlap with the buffer memory.

The 1100/80 has twice the power of the 1100/40 system, which was previously the largest processor offered by UNIVAC. Monthly rental prices for the 1100/80 system range from $50,000 to $100,000 (including maintenance) on a one-year contract. Comparable purchase prices range from $2 million to $6 million. First customer deliveries of the 1100/80 are planned for the first quarter of 1977.

PERIPHERAL AND COMMUNICATIONS EQUIPMENT

UNIVAC has offered an unusually broad array of mass storage equipment for the 1100 Series computers, including fixed-head drums, moving-head drums (Fastrand), and disc pack drives. The company's early emphasis on drums has largely shifted to interchangeable disc pack drives, although the high-performance FH-432 drum units are still used for operating system residence and program swapping in many 1100 Series systems.

In March 1975, UNIVAC unveiled a new complement of mass storage devices, available both for new and currently installed 1100 Series systems. All are manufactured by the company's ISS subsidiary, and all three, the 8405 fixed-head disc drive and the 8430 and 8433 removable disc drives, can be intermixed on a single 5039 microprogrammed control unit. The two versions of the 8405 Fixed-Head Disc provide either 3 million or 6 million bytes of fixed-head storage per unit, or 24 or 48 million bytes per subsystem, with a very fast average access time of 8.3 milliseconds. The 8430 Disc Drive has a capacity of 17 million 36-bit words (or 100 million bytes) per unit, while the "double density" 8433 Disc Drive contains 34 million 34-bit words (or 200 million bytes) of storage per drive. All three mass storage units support state-of-the-art features such as Command Retry, Rotational Position Sensing, and error detection and correction. The new 5039 Control Unit can handle combinations of up to sixteen 8430 and/or 8433 disc units, or a combination of up to eight 8405 fixed-head drives and eight 8430 and/or 8433 removable disc drives.

In November 1976, concurrently with the announcement of the 1100/80, the company introduced the 8434 Disk Storage Subsystem for both the UNIVAC 90/80 and the 1100 Series systems. The 8434 increases the on-line disc storage capacity for the 1100 systems to 1.7 billion words in fixed record formats. The 8434 subsystem consists of a UNIVAC 5046 Storage Control Unit and from 2 to 16 8434, 8430, or 8433 disc drives in any combination. Up to

operate simultaneously and independently, with interference occurring only when two or more of these units simultaneously attempt to access the same storage module.

MAXIMUM I/O DATA RATES: See table.

MASS STORAGE

UNITIZED CHANNEL STORAGE (UCS): Provides very rapid random access to up to 1,048,576 words (6,291,456 characters) of data in magnetic core storage. Data transfer rate is 2.6 million characters per second, with no loss of time due to rotational delays. Uses the same peripheral interface and software as the UNIVAC drum subsystems. Each UCS subsystem consists of a control unit and one to four 262,144-word storage modules. The subsystem can be shared between processors in a multiprocessor system. UCS is available for use in 1106, 1108, and 1110 systems, but is not commonly used with the 1110.

FH-432 MAGNETIC DRUM: Provides fast random access to fairly small quantities of data. Stores 262,144 words (1,572,864 characters) in 384 data tracks, each served by a fixed read/write head. Data is read and written on 3 tracks in parallel, and each 3-track group holds 2,048 words. Average access time is 4.3 milliseconds. Data transfer rate ranges from 1,440,000 down to 90,000 characters per second, depending upon the degree of interlacing employed. An FH-432 subsystem consists of a control unit and one to eight drums. FH-432 and FH-1782 drums can be intermixed in the same subsystem, and dual-channel access to a subsystem is possible through the use of two control units and appropriate special features.

FH-1782 MAGNETIC DRUM: Provides eight times the storage capacity of the FH-432 Drum with an access time four times as long. Stores 2,097,152 words (12,582,912 characters) in 1536 data tracks, each served by a fixed read/write head. Average access time is 17 milliseconds. Data transfer rate (as in the FH-432) ranges from 1,440,000 down to 90,000 characters per second, depending upon the degree of interlacing employed. An FH-1782 subsystem consists of a control unit and one to eight drums. FH-432 and FH-1782 drums can be intermixed in the same subsystem, and dual-channel access to a subsystem is possible through the use of two control units and appropriate special features.

8405 FIXED-HEAD DISC SUBSYSTEM: Provides rapid access to up to 11 million 36-bit words per subsystem stored in nonremovable head-per-track discs. The average latency time is 8.34 milliseconds. The 8405 drives are available for all 1100 Series systems in two versions. The 8405-04 Fixed-Head Disc provides six recording surfaces and up to 688,128 36-bit words (3.1 million bytes) per disc drive, and the 8405-00 provides 12 recording surfaces and up to 1,376,256 36-bit words (6.2 million bytes) per disc drive. Each recording surface contains 64 tracks plus 8 spares, each of which can contain up to 16 records of 112 36-bit words each. The data transfer rate is 138,222 36-bit words (622K bytes) per second.

An 8405 Disc Subsystem consists of a 5039 Control Unit with an F2076 8405 Fixed-Head Disc attachment and from one to eight 8405 Disc Drives. From two to eight 8433 and/or 8430 Disc Storage Drives also can be intermixed on the 5039 Control Unit. A Dual Access feature on each 8405 Disc Drive provides dual access when two 5039 Control Units are present.

8425 DISC STORAGE: Provides medium-capacity random-access storage in 11-disc packs which are physically compatible with the IBM 2316 Disk Packs. Introduced in January 1973, the 8425 records data at the same bit density (2220 bpi) as the 8414 but records 406 tracks on each disc surface, compared with 203 for the 8414. Thus,

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16 additional drives can be added. In addition to the 8430, 8433, and 8434 disc drives, 8405 Fixed-Head Discs can also be used.

UNIVAC also offers a variety of magnetic tape drives, in both 7-track and 9-track models, with data transfer rates ranging from 34,160 to 320,000 bytes per second. In addition, the whole range of UNIVAC 9000 Series peripheral devices can be connected to an 1100 Series system via either the C/SP, an on-line UNIVAC 9200 or 9300 Processor, or a Multi-Subsystem Adapter (MSA).

Data base/data communications capabilities are strongly emphasized for all 1100 Series processors. The General Communications Subsystem supports communications networks of up to 32 half- or full-duplex lines. The GCS has a total throughput capacity of 250,000 bits per second.

UNIVAC has also added significant new capabilities to its programmable front-end communications processor. The new Communications/Symbiont Processor (C/SP) uses MOS memory in place of the earlier plated-wire storage, and can now be equipped with up to eight Model 8425 Disc Drives and eight Uniservo 16 Magnetic Tape Units, for use in message staging, audit trail preparation, and store-and-forward message switching applications. Important new reliability features added to the C/SP include the capability for stand-alone operation in the event of a host processor malfunction, the ability to share a C/SP between two host processors or to configure a fully redundant dual-host-processor/dual-C/SP configuration, and the ability to dynamically reconfigure the communications network through a DCT 500-based CS/P console. New full-duplex transmission capabilities are designed to improve remote batch processing capabilities using either a UNIVAC DCT 1000 or a 9200/9300 computer system as a remote batch terminal. Binary synchronous transmission capabilities also have been added to allow transfer of data between UNIVAC 1100 Series systems and IBM System/360 and System/370 computers as well as binary synchronous batch terminals.

Concurrently with the 1100/80 announcement in November 1976, UNIVAC also introduced TELCON, a new communications system. TELCON provides not only front-end processing for the 1100 Series, but network capability for communications with other 1100 systems, other UNIVAC systems such as the Series 90, and other vendors' host systems or networks. The basic hardware of a TELCON system is made up of a distributed communications processor, which can have discs, diskettes, or tapes attached, as well as two types of communications scanners: Scanner I for up to 32 full- or half-duplex lines, or Scanner II for up to 128 full-duplex or 256 half-duplex lines.

In TELCON, the network control software resides in all DCP's within the network and is capable of being configured as a front-end processor, nodal processor, or remote concentrator. This software provides the necessary message control, routing, and network control to com-

the 8425 can store twice as much data—or up to 58.34 million bytes—in each pack. A servo-controlled electromagnetic actuator yields an improved average head movement time of 29 milliseconds, and data transfer rate is 312,000 bytes/second. Record lengths are variable, with each track capable of holding up to 7,294 eight-bit bytes. The File Scan and Recover Overflow features are standard.

When data is stored on an 8425 in a simulated Fastrand format, each track holds 12 sectors of 112 words each. In this format, each pack stores 10.9 million 36-bit words, and the data transfer rate is 69,333 words/second.

An 8425 subsystem consists of a control unit and two to eight 8425 Disc Storage units. A Multi-Subsystem Adapter (MSA) equipped with the Function Buffer Expansion and Search Identifier Register features is a prerequisite. A dual-access subsystem can be configured by installing the Dual Access feature in each 8425 Disc Storage unit and adding second control unit and the MSA Expansion feature.

An 8425 subsystem consists of a control unit and two to eight 8425 Disc Storage units. A Multi-Subsystem Adapter (MSA) equipped with the Function Buffer Expansion and Search Identifier Register features is a prerequisite. A dual-access subsystem can be configured by installing the Dual Access feature in each 8425 Disc Storage unit and adding a second control unit and the MSA Expansion feauture.

8430 DISC SUBSYSTEM: Provides large-capacity random-access storage in interchangeable 11-disc packs with storage capacities comparable to the standard-density (100-million-byte) IBM 3330 Disc Storage Subsystem. Each disc pack stores up to 17,194,240 36-bit words (77 million bytes) of data. Data is recorded on 404 tracks per surface (plus 7 spares) in 20 records of 112 words each per track. There are 19 read/write heads (one for each recording surface) in each comb-type access mechanism. Average head movement time is 27 milliseconds, average rotational delay is 8.3 milliseconds, and the data transfer rate is 179,111 36-bit words (806K bytes) per second.

From two to eight 8430 Disk Pack Drives can be attached to a 5039 Control Unit in combination with up to eight 8405 Fixed-Head Disc Drives. The 8430 Disc Pack Drives can also be intermixed with 8433 Disc Storage Drives on the 5039 Control Unit. A Sixteen-Drive Expansion Feature expands the capability of the 5039 Control Unit to up to sixteen 8430 and/or 8433 Disc Storage Drives. A dual-access feature and a second 5039 Control Unit permit simultaneous read and write operations on any two 8430 Disc Drives. The 8430 features a command retry facility and error correction coding circuitry.

8433 DISC SUBSYSTEM: Provides random access to very large quantities of data stored on removable "double-density 3330-type" disc packs. Each industry-standard disc pack contains 200 million bytes in Free Format recording mode. When the data is stored in records of 112 words each, it has a capacity of 34,388,340 36-bit words. There are 20 records per track and 808 tracks (plus 7 spares) on each of the 19 recording surfaces. The average head positioning time is 30 milliseconds, and the average rotational delay is 8.3 milliseconds. Data transfer rate is 179,111 36-bit words (806,000 bytes) per second.

From two to eight 8433 Disc Pack Drives can be connected to a 5039 Control Unit for a total of 275 million words per subsystem. A Sixteen-Drive Expansion Feature expands the capability of the 5039 Control Unit to up to 16 drives, or 550 million 36-bit words. The 8433 and 8430 Disc Pack Drives can be intermixed on one 5039 Control Unit up to the maximum of 8 or 16 drives. In addition, 8433 and 8430 Disc Pack Drives can be intermixed with 8405 Fixed-Head

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The UNIVAC 1100/40, introduced in 1975 as the successor to the 1110, features semiconductor primary and extended storage, twice the primary storage capacity of the 1110, and up to one million words of directly addressable extended storage.

municate between DCP's and/or host processors. Placing control of the communications network within the DCP's provides the host processor with communications independence.

SOFTWARE

The 1100 Operating System (formerly called EXEC 8) is the standard operating system for all members of the 1100 Series, and furnishes comprehensive supervisory and control facilities for three distinct modes of multiprogrammed operation: batch, demand (or time-sharing), and real-time (or communications). It provides virtually the full gamut of desirable operating system facilities, including dynamic storage allocation, reentrancy, multiprocessing, dynamic reconfiguration, automatic recovery, multi-level prioritization, system optimization, and two types of program segmentation (one of which provides, in effect, a software-controlled virtual storage capability).

The 1100 Operating System formerly required the presence of high-performance (and expensive) fixed-head drum units, but UNIVAC now offers a Disc-Resident System that uses disc pack drives instead of drums for all systems functions. The Disc-Resident version provides all the facilities of the full 1100 Operating System, at some sacrifice in performance because of the slower disc access times.

Disc Drives. A second 5039 Control Unit and the dual access feature permit simultaneous read/write operations to be performed on any two drives. The 8433 includes a command retry facility and error correction coding circuitry.

8434 DISC SUBSYSTEM: Consists of a 5046 Storage Control Unit and from 2 to 16 (in any combination) 8430, 8433, or 8434 disc drives. Up to 16 additional disc drives can be added to the 5046. Optionally, the controller can also handle the 8405 Fixed-Head Disc in addition to the 8430, 8433, and 8434 drives. When 8405's are used, the maximum configuration is from 1 to 8 8405 FHD's and from 2 to 16 8430, 8433, and/or 8434 drives.

The 5046 is a word-oriented, microprogrammable control unit that offers on-line diagnostic capability for more effective trouble-shooting. The microprogram is loaded from a diskette.

The 8434 disc drive contains a fixed disk stack consisting of 10 platters with 19 recording surfaces. The twentieth surface is used for servo positioning information. When necessary, the disc stack can be removed for servicing, and in the event of drive failure, the pack can be moved to another drive to facilitate data recovery.

Each 8434 disk drive stores up to 307 million bytes or 54 million words in software-supported formats. Average head positioning time is 30 milliseconds, and average rotational delay is 8.3 milliseconds. Data transfer rate is 1,260,000 bytes per second.

8440 DISC SUBSYSTEM: Provides fairly rapid random access to very large quantities of data stored in interchangeable 11-disc packs. Each pack stores up to 119.3 million bytes. Data is recorded in 406 tracks on each of the 20 recording surfaces. Average head movement time is 30 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 624,000 eight-bit bytes/second or 138,700 words/second. Record lengths are variable, with each track capable of holding up to 14,910 eight-bit bytes. Standard features include Angular Position Sensing, which increases channel availability by reducing delays during record search times; Programmed Servo Offset, which permits the heads to be moved slightly away from their normal positions in attempts to recover data during search and read operations; and Error Correction Code, which permits automatic correction of many recording errors.

When data is stored on an 8440 in a simulated Fastrand format, each track holds 22 sectors of 112 words each. In this format, each pack stores 20 million 36-bit words, and an 8-drive subsystem stores 160 million words or 960 million 6-bit characters.

An 8440 subsystem consists of a control unit and from one to four 8440 Disc Storage units, each containing two independent disc drives. Up to four control units, each controlling up to eight drives, can share a single I/O channel interface. A dual-access subsystem can be configured by adding a second control unit and installing a Dual Access feature in each 8440 Disc Storage unit.

The 8440 Disc Subsystem was announced with the UNIVAC 1100 system in November 1970. After encountering serious delays in developing the subsystem, UNIVAC turned to an outside supplier. A set of revised and improved specifications for the 8440 subsystem was issued in January 1973, and customer shipments of the improved equipment (as described above) began later the same month. The 844(is not available with the 1100/20 and 1100/40 systems, and is available only for expansion of currently installed systems.

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UNIVAC software facilities that operate under the control of the 1100 Operating System include processors for the COBOL, FORTRAN, ALGOL, BASIC, JOVIAL, PL/I, and Assembly languages, plus a variety of utility routines and application packages.

UNIVAC, like most other mainframe manufacturers, is now placing a strong marketing emphasis on data base/data communications software. DMS 1100, a powerful data base management system, is one of the major components of UNIVAC's impressive Total Information Management System (TIMS), which also includes a Communications Management System (CMS), a Transaction Interface Package (TIP), and a Conversational Time-Sharing System (CTS). Two new end-user-oriented software systems, which are aimed at facilitating the development of transaction processing and management information systems, are the Remote Processing System (RPS 1100), which allows nonprogrammers to interactively develop and use their own file management applications from remote Uniscope 100 or 200 CRT terminals, and Query Language Processor (QLP 1100), an English-language batch or interactive interface to DMS 1100.

Additional security measures have been added to the 1100 Series software product line in the form of the Terminal Security System (TSS), which allows installation managers to create and maintain their own security environment, and the QUOTA System, which enables each installation to define the limits of resource usage available to each batch and demand user. New ASCII-oriented compilers for the COBOL and FORTRAN languages are other recent additions to the 1100 Operating Systems software line-up, as is a UNIVAC Series 70-compatible RPG.

COMPATIBILITY

Within the 1100 Series, UNIVAC has maintained a high degree of program and data compatibility. The 1106, 1100/10, and 1100/20 models use essentially the same instruction repertoire, which is a compatible subset of the expanded 1110, 1100/40, and 1100/80 repertoire. Thus, object programs can be freely interchanged between an 1106 and an 1100/20 or 1100/10, and programs written for an 1106, an 1100/10, or an 1100/20 can be executed without alteration on an 1110, 1100/40, or 1100/80.

There is no direct program compatibility, at the machine or assembly-language level, between the 1100 Series and any other line of UNIVAC or competitive computers. The 1100 Series implementations of the COBOL, FORTRAN, ALGOL, BASIC, PL/1, and JOVIAL languages, however, are generally in accordance with the accepted standards for these languages. The 1100 Series systems originally used the 6-bit Fieldata code, but in an effort to resolve the resulting compatibility problems, UNIVAC has gradually revised most of the hardware and software to make use of ASCII. Thus, for most practical purposes, an 1100 Series computer can now be considered a byte-oriented ASCII machine.

8460 DISC FILE: Provides fairly rapid random access to extremely large quantities of data stored on noninterchangeable discs. Each 8460 Disc File contains two independent positioner modules. Each module can access 46.56 million 36-bit words for a total of 93.12 million words per unit. Each positioner module services 11 discs mounted on a horizontal shaft. Read/write heads are mounted on a comb-like access mechanism driven by a voice-coil positioner, with 2 heads serving each of the 20 data recording surfaces. There are 812 tracks on each surface, and each head serves 406 tracks. Average head movement time is 55 milliseconds, and average rotational delay is 25 milliseconds. Data transfer rate is 75,000 words/second for the inner zone and 95,000 words/second for the outer zone.

An 8460 subsystem consists of a control unit and from one to four 8460 Disc Files, each containing two positioner modules. Thus, a subsystem can store up to 372 million 36-bit words of 2.235 billion 6-bit characters of data. A dual-access subsystem can be configured by adding a second control unit and installing the Dual Access feature in each 8460 Disc File.

Introduced in June 1972, the 8460 is based upon the Data Products System/7114 Large Disc Store, which UNIVAC acquired from Data Products Corporation in January 1972. Earlier, UNIVAC had collaborated with Data Products in developing this equipment to satisfy a large military procurement. The 8460 is not available with UNIVAC 1100/20 and 1100/40 systems, and is available only for expansion of currently installed systems.

INPUT/OUTPUT UNITS

UNISERVO 12 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible formats. Available in both 9-track and 7-track versions. Tape speed is 42.7 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 68,320 bytes (or 91,000 six-bit characters) per second; the optional Dual Density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 34,160 bytes per second. The 7-track version can operate at 200, 556, or 800 bpi, with corresponding data rates of 8,540, 23,740, or 34,160 characters per second. A Uniservo 12 subsystem consists of up to 16 tape units (4 "master" units and 12 "slave" units) connected to a single- or dual-channel control unit; the Multi-Subsystem Adapter is a prerequisite. Uniservo 12 and Uniservo 16 tape units can be intermixed in the same subsystem, provided they are not dual-access units.

UNISERVO 14 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible phase-encoded or NRZI formats. Available in both 9-track and 7-track versions. Tape speed is 60 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 96,000 bytes per second. The optional Dual Density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 48,000 bytes per second, while the 7-track NRZI version operates at 200,556, or 800 cpi, with data rates of 12,000, 33,400, or 48,000 characters per second.

The Uniservo 14 Magnetic Tape Units use the 5045 Control Unit, which includes the controller and housing for two magnetic tape units. A maximum of eight tape units can be attached to each 5045 Control Unit. Features available with the Uniservo 14 include automatic tape loading, dustproof wraparound tape cartridges, single-capstan drive, and a dual-channel option that permits non-simultaneous operation on two channels on a single processor or shared operation between two central processors.

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UNIVAC has developed an imposing collection of software aids to simplify the conversion process for current users of UNIVAC (ex-RCA) Series 70 equipment and IBM System/360 and System/370 computers. These include an 1100 COBOL Source Translator to convert System/360 and System/370, UNIVAC Series 70, or UNIVAC 494 COBOL programs to UNIVAC ASCII COBOL; a FORTRAN Source Translator for System 360/370, Series 70, or UNIVAC 494 FORTRAN programs; and an 1100 Data File Converter to convert IBM, Series 70, or UNIVAC COBOL files to ASCII COBOL format. Conversion aids specifically for Series 70 users, in addition to the COBOL and FORTRAN Translators, include an assembly language translator (BALT), a generalized data translator for converting Series 70 EBCDIC data to UNIVAC Fieldata and ASCII format, an upward-compatible RPG compiler, and a new stand-alone Sort/Merge program that accepts Series 70 parameter cards as input. Job control language manuals are also available that illustrate comparable 1100 Series job streams for conversion from the Series 70 TDOS and DOS operating systems. In addition, UNIVAC is still a fully "bundled" manufacturer and can often afford to commit sizeable quantities of manpower to aid users in converting their programs and data files.

COMPETITIVE POSITION

System rentals for practical UNIVAC 1100 Series configurations span a broad range, from approximately $15,000 to over $150,000 per month. Thus, the 1100 Series competes with such impressive performers as the IBM System/370 Models 135 through 168, the Honeywell Series 60 Level 66 systems, the Burroughs B 6700, and the Control Data Cyber 170 Series.

The entry-level 1100/10 system is directly competitive with the IBM System/370 Models 135 through 148 and makes the sophistication of the 1100 Operating System available to users at a minimal equipment cost. According to UNIVAC estimates, a single-processor 1100/21 system provides approximately twice the internal performance of an IBM System/370 Model 145 at slightly less cost, while a multiprocessor 1100/22 offers over three times the performance of a 370/145 for less than twice the cost. UNIVAC aimed the 1100/41 directly at the IBM System/370 Model 158, while the 1100/43 and 1100/44, which UNIVAC estimates can provide significantly higher performance at a slightly higher price than the single-processor 370/168, also offer the advantages of multiprocessing and hardware redundancy. As mentioned previously, the 1100/80 is directly competitive with the IBM 370/168-3.

USER REACTION

Datapro received a total of 20 responses from users of UNIVAC 1100 Series systems in its 1976 survey of users of general-purpose computer systems. These 20 replies represented ten 1106 systems, three 1108 systems, seven 1110 systems, and two 1100/10 systems. Although

UNISERVO 16 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard ½-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 (or 256,000 six-bit characters) 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. The 7-track operates at 200, 556, or 800 bpi, with corresponding data rates of 24,000, 66,720, or 96,000 characters per second. A Uniservo 16 subsystem consists of up to 16 tape units connected to a single- or dual-channel control unit; the Multi-Subsystem Adapter is a prerequisite. Uniservo 16 and Uniservo 12 tape units can be intermixed in the same subsystem, provided they are not dual-access units.

UNISERVO 20 MAGNETIC TAPE UNIT: A high-performance tape drive that uses standard ½-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 (or 426,667 six-bit characters) per second. Operational conveniences include a power window, automatic tape threading, and wrap-around tape cartridge loading. A Uniservo 20 subsystem consists of 1 to 16 tape units connected to either one or two control units. Uniservo 12 and 16 tape units can also be connected to the Uniservo 20 control unit. The Multi-Subsystem Adapter (MSA), which is a prerequisite for the Uniservo 12 and 16 Subsystems, is furnished as an integral part of the Uniservo 20 control unit. A dual-access subsystem can be configured by adding a second control unit and installing the Dual Access features in each tape unit.

UNISERVO 30 SERIES TAPE UNITS: High-performance units that record data on ½-inch tape in IBM-compatible formats. There are five models in the series, three of which use Group Coded Recording (GCR) at a density of 6250 bits per inch. All five models use the Uniservo 5042 Control Unit, and Uniservo 30 series tape units can be intermixed in any combination on the same subsystem, provided the proper control unit is included to accommodate the various tape unit types. The basic control unit can handle one to eight Uniservo 30 series tape units. Optional features in the control unit and the addition of a second control unit, also with appropriate features, permit communication with up to 16 tapes in a dual-access mode. The five models in the Uniservo 30 series and their characteristics are as follows:

Uniservo 30 (7-track)—a conventional NRZI unit with a transfer rate of 160,000 bytes/second at 800 bpi, 111,200 bytes/second at 556 bpi, or 40,000 bytes/second at 200 bpi. Tape speed is 200 inches/second.

Uniservo 30 (9-track)—a unit designed for NRZI and PE (phase encoded) recording. The transfer rate is 320,000 bytes/second at 1600 bpi or 160,000 bytes/second at 800 bpi. Tape speed is 200 inches/second.

Uniservo 32—a 9-track unit designed for GCR and PE recording. The transfer rate is 470,000 bytes/second at 6250 bpi or 120,000 bytes/second at 1600 bpi. Tape speed is 75 inches/second.

Uniservo 34—a 9-track unit designed for GCR and PE recording. The transfer rate is 780,000 bytes per second at 6250 bpi or 200,000 bytes per second at 1600 bpi. Tape speed is 125 inches/second.

Uniservo 36—a 9-track unit designed for GCR and PE recording. The transfer rate is 1,250,000 bytes/second at 6250 bpi or 320,000 bytes/second at 1600 bpi. Tape speed is 200 inches/second.

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several of the recently announced systems which are currently receiving principal marketing emphasis from UNIVAC were not represented in this survey, Datapro believes the survey results will be generally indicative of the performance that can be expected from the newer 1100 Series systems.

These 1100 Series systems were employed in a wide variety of data processing activities. Fifteen of the systems were being used in business applications and 12 in scientific applications. Every one of the 1100 Series configurations represented in this sample included a data communications network. The maximum number of remote batch terminals reported was 10 for an 1106, 8 each for an 1108 and an 1110 system, and 2 for an 1100/10 system. One 1106 system was reported to be handling 112 interactive terminals, one 1100/10 system was handling 75 interactive terminals, and one 1110 system was handling 120 interactive terminals in addition to 8 remote batch terminals.

These users supplied the following ratings for their systems in Datapro's 12 performance categories.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	11	7	0	0	3.6
Reliability of mainframe	10	7	2	0	3.4
Reliability of peripherals	1	14	4	0	2.8
Maintenance:					
Responsiveness	8	8	2	0	3.3
Effectiveness	6	9	3	0	3.2
Technical support	6	7	5	0	3.0
Operating system	14	4	1	0	3.7
Compilers and assemblers	5	13	1	0	3.2
Application programs	2	11	2	1	2.9
Ease of programming	9	10	0	0	3.5
Ease of conversion	3	11	2	1	2.9
Overall satisfaction	9	10	0	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

In commenting on their systems, several of these users cited the operating system, ease of operation, and ease of programming as principal strengths of the 1100 systems. One user praised the job control language, another the system's stability, and still another said that the system's "interactive processing is excellent."

Two 1100 Series users were not happy with their tape drives, and one said that the applications software was weak. Several users would like more IBM compatibility, and one mentioned as a weakness the "failure to support advanced RJE methods."

For the most part, these 1100 Series users were well pleased with their systems, as evidenced by their combined 3.5 rating for overall satisfaction. It's clear that the 1100 Series systems deserve serious consideration by all computer users with large-scale, multiprocessing, and/or multifunction data processing requirements.□

TYPE 0716-02 CARD READER AND CONTROL: Reads 80-column cards serially by column at 1000 cpm. Has a 2400-card input hopper and two 2000-card stackers. Can read data in EBCDIC, ASCII, Compressed Code, or card image mode. Optional features permit reading of 51- or 66-column cards. Connects to an 1100 Series system via the Multiplexer Channel of an on-site UNIVAC 9300 or 9300 II Computer System, Communications/Symbiont Processor (CSP), or the Multi-Subsystem Adapter (MSA).

TYPE 0604-99 CARD PUNCH: Punches 80-column cards in row-by-row fashion at 250 cards per minute. Has a 1000-card input hopper and two 500-card output stackers. Punched cards are directed to one of the two stackers under program control. Punching is in card-image mode or compressed code translation. Contains an integrated controller and connects to an 1100 Series system via the Multiplexer Channel of an on-site UNIVAC 9300 or 9300 II, Communications/Symbiont Processor (C/SP), or the Multi-Subsystem Adapter (MSA).

TYPE 0768-02 PRINTER AND CONTROL: Provides both upper and lower case printing in a choice of three 94-character ASCII subsets. Uses a conventional rotating-drum printing mechanism. Rated printing speeds are 840 lpm when the full 94-character set is used, 1000 lpm for any contiguous 87-character subset, and 2000 lpm for a 14-character numeric subset. Has 132 print positions and a skipping speed of 33 inches per second. A "Load Code" command enables the 0768-02 to use ASCII, EBCDIC, or any desired 7- or 8-bit code. An optional feature expands the print code to handle a 108-character print drum. Connects to an 1100 Series system via the Multiplexer Channel of an on-site UNIVAC 9300 or 9300 II Computer System, Communications/Symbiont Processor, or the Multi-Subsystem Adapter (MSA).

0770 PRINTERS: Announced in April 1973, these printers employ a horizontally moving print band and combine various convenience, maintenance, and availability features. The three models differ only in their speeds, offering 48-character printing rates of 800, 1400, or 2000 lines per minute. They can be connected to 1100 Series systems via the multiplexer channel of a 9200/9300 subsystem or Communications/Symbiont Processor (C/SP). The printers, each of which contains an integral control unit, can also be connected to an 1100 system via a Multi-Subsystem Adapter (MSA).

The three 0770 printers have the following features in common: all use interchangeable print band cartridges; all can identify the cartridge type under program interrogation to ensure that the operator has placed the proper band in the printer for that run; all use a program-loaded vertical format buffer in place of a paper tape format loop; and all have swing-out print carriages, easy ribbon replacement without rewinding, simplified line finding, lighted print areas, automatic print gap (forms thickness) adjustment, powered, program-controlled top covers, automatic power forms stackers, and enhanced acoustical covers to reduce operating noise.

Printing speeds for 48-character sets are 800 lines per minute for Model 0770-00, 1400 lines per minute for Model 0770-02, and 2000 lines per minute for Model 0770-04. The respective skipping speeds for the three models are 50, 75, and 100 inches per second. All can have character sets from 24 to 384 characters in size, and all have 132 print positions as standard. An optional feature for all models can increase the number of print positions to 160 without affecting the print speed. All have a single-space print time of 8.75 milliseconds, line spacings that are operator-selectable at 6 or 8 lines per inch, and forms dimensions from 3.5 to 22 inches wide and up to 24 inches long.

0776 PRINTER SUBSYSTEM: An impact printer subsystem that offers a choice of two line speeds: the Model 0776-00 prints a 48-character set at 760 lines per minute, and the

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Model 0776-02 at 940 lines per minute. Skipping speed for both models is 22 inches per second. Vertical spacing is operator-selectable at either 6 or 8 lines per inch. Both models can have character sets ranging from 24 to 384 characters in size, and both have 136 print positions as standard equipment. The 0776 printers have a single-space print time of 14.2 milliseconds and accommodate forms ranging from 4 to 18.75 inches wide and up to 24 inches long.

Printing is accomplished by the use of etched characters on a continuous metal band that travels horizontally across the paper. Each metal band contains 384 characters, which are usually grouped in repeating arrays. For example, a 48-character set array is repeated eight times on the band. The expanded character set control feature allows the use of character sets that contain more than 64 characters. This feature makes it possible to print upper/lower case text or to improve throughput in certain applications by designing character set arrays in which heavy-usage characters appear more frequently. The cartridge type can be identified under program interrogation to ensure that the operator has placed the proper band in the printer.

The 0776 Printer Subsystems also feature a program-loaded vertical format buffer in place of a paper tape format loop, swing-out print carriages, easy ribbon replacement without rewinding, simplified line finding, lighted print areas, automatic print gap (forms thickness) adjustment, powered, program-controlled top covers, automatic power forms stackers, and enhanced acoustical covers to reduce operating noise.

UNIVAC 9000 SERIES SUBSYSTEMS: A UNIVAC 9200, 9200 II, 9300, or 9300 II Computer System can be connected directly to an 1100 Series system by means of an Inter-Computer Control Unit (ICCU). The ICCU permits direct communication in the 36-bit word format. The 9000 Series system must include at least 8K bytes of storage, a multiplexer I/O channel, integrated printer, and card reader. Other 9000 Series peripheral units and features can also be used, but software support via the ICCU is limited to card reading, punching, and printing. See Report 70C-877-01 for details about the 9000 Series Computer Systems.

COMMUNICATIONS EQUIPMENT

TELCON: Introduced in November 1976, TELCON is an intelligent communications system that provides basic hardware, software, and peripherals for users with large communications networks. The system can operate as a front-end processor for 1100 host processors, as a network nodal processor, or as a remote concentrator. As such, it provides networks that support real-time, time-sharing, remote job entry, and message switching applications. The major components of TELCON are the Distributed Communications Processor (DCP) and the TELCON network software. Multiple DCP's can be combined to form a node of high throughput and processing capability.

The DCP can consist of a processor, remote I/O controller (RIOC), diskette, cartridge disk, magnetic tape, Scanner I and II communication controllers, and the remote control module.

The processor is a 16-bit computer with 8-bit addressability. It includes a storage interface, 32 general and 6 special registers, a read-only memory, an arithmetic section, and function control sections. Internal data transfers are communicated by means of a single parallel bus which connects all logical units and the general registers. The RIOC provides 16 parallel I/O channels that can be operated in 8-bit or 16-bit mode; 32-bit parallel operation is provided via strap selection. The RIOC interfaces an 1100 Series Internally Specified Index (ISI) I/O channel, peripheral subsystems, or transfers information between Dual Communications Controllers. The RIOC is physically installed in the DCP and obtains its operating power from the DCP.

The Remote Control Module (RCM) is a hardware component of the TELCON system that provides a means for sequencing and configuring various elements of the DCP and associated peripherals. The RCM can be controlled remotely by a computer, a DCT 500, or an ASCII teletypewriter to power up or down single or dual DCP's, perform the "stop" or "run" functions for single or dual DCP's, master-clear single or dual DCP's, or set or reset the manual jump enable latch functions for single or dual DCP's.

The Uniservo 10 Magnetic Tape Subsystem provides magnetic tape I/O for the DCP. The subsystem configuration consists of two tape drives housed in a single cabinet, along with the basic control logic. Data is recorded in the 9-track mode at 1600 bpi PE or 800 bpi NRZI. Tape speed is 25 ips, forward or backward, yielding a data transfer rate of 40,000 bytes per second PE and 20,000 bytes per second NRZI.

A UNIVAC cartridge disc subsystem provides mass storage on the DCP for network data base storage and other storage associated with distributed communications and distributed processing applications. The subsystem has a 10-million-byte capacity, 5 million bytes on a fixed disc and 5 million bytes on a removable disc. Recording is on four surfaces in each unit, two on each disc. The disc rotates at 2400 rpm and has an average rotational delay time of 12.5 milliseconds. The average head movement time is 50 milliseconds and the data transfer rate is 267,000 bytes per second.

A UNIVAC diskette subsystem is provided on the DCP for loading the operating system and diagnostic programs, for statistics logging of network operations, for error logging, and as a recording medium for receiving various down-line load functions. In cases where a cartridge disc is not available on the DCP, the diskette will retain various network control tables. The basic diskette subsystem contains one diskette drive, expandable to two drives in the same housing. Each disc can store up to 256,000 bytes of data. The disc rotates at 360 rpm and has an average rotational delay time of 83 milliseconds. Head load and seek time can overlap. Track-to-track seek time is 10 milliseconds, and head load time is 50 milliseconds. Data transfer rate is 31,250 bytes per second.

The Scanner I is a communications multiplexer that provides communication line termination and multiplexing for the DCP. The DCP with the Scanner I expansion provides up to 32 communication line termination ports, either full-duplex or half-duplex, and is physically located within the same cabinet as the processor. When the RIOC is installed within the DCP, the Scanner I has a maximum communication line termination capability of 16 line ports, either full- or half-duplex. When line termination requirements exceed 16 or 32 (depending on the use of the RIOC), the Scanner II is used.

The Scanner II provides up to 128 half-duplex or 64 full-duplex communication line termination ports and is physically located in its own cabinet with its own power supply. Up to 2 Scanner II's can be attached to the DCP, supporting up to 256 half-duplex or 128 full-duplex communication lines for each DCP.

COMMUNICATIONS/SYMBIONT PROCESSOR (C/SP): An independently programmed computer designed to relieve the 1100 Series central processors of the processing functions associated with the control of data communication and card and printer I/O operations. The C/SP's internal architecture is quite similar to that of the UNIVAC 9400 Processor. It offers 32K, 49K, 65K, 98K, or 131K bytes of MOS storage with a cycle time of 630 nanoseconds per 2-byte access. A set of 52 two-byte and four-byte instructions includes binary arithmetic on 16-bit and 32-bit oper-

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ands; no decimal arithmetic facilities are provided. There are eight or sixteen 32-bit general registers.

A minimum C/SP configuration includes a processor with 32K to 131K bytes of storage, 1100 Series Channel Adapter, Maintenance Panel, Interval Timer, Power Failure Interrupt Feature, Storage Protection Feature, Special Device Channel, and an 80-cpm card reader. Optional features include a Multiplexer Channel, Selector Channel, one or two General-Purpose Communications Channels, and one additional 1100 Series Channel Adapter.

The 1100 Series Channel Adapter provides an interface for direct connection of the C/SP to an I/O channel of an 1100 Series computer; data can be transferred at rates in excess of 100,000 36-bit words per second. The Special Device Channel is used mainly for local program loading and maintenance of the C/SP by means of an 80-cpm serial card reader. The optional Multiplexer Channel permits attachment of all the currently available UNIVAC 9000 Series peripheral devices, as described in Reports 70C-877-01 and 70C-877-02.

In March 1975 UNIVAC announced several important enhancements to the C/SP, including the substitution of MOS memory for plated-wire storage, the capability to attach one tape controller with up to sixteen UNISERVO 16 7-track and/or 9-track magnetic tape units to the Multiplexer Channel, and the capability to connect one disc controller with up to eight 8425 Disc Storage Units to the Selector Channel. In addition, an operator console, consisting of a DCT500 Data Communication Terminal with keyboard send/receive, can be attached to the Special Device Channel. Dual ICA channels are also now available to permit a C/SP to be shared by two host central processors or two channels of the same host processor. When the C/SP is being shared by two hosts, the communications and symbiont facilities of the C/SP can be dynamically partitioned by user directives between the two hosts.

Each of the two optional General-Purpose Communications Channels (GPCC's) permits connection of up to 32 full-duplex or 64 half-duplex communications lines to the C/SP. The GPCC multiplexes the data to and from the various lines, recognizes special characters and character sequences, checks character parity, and performs other essential coordination functions. A Communications Line Terminal (CLT) forms the interface between the GPCC and each line. Various CLT's are available to handle a wide range of communications facilities and transmission speeds.

The number and types of CLT's must be selected so that the total data rate on each GPCC will not exceed 50,000 bytes per second. Software considerations will further restrict the total communications data rate of each C/SP to approximately 20,000 bytes per second.

GENERAL COMMUNICATION SUBSYSTEM (GCS): Announced in March 1975, the GCS replaces the earlier CTMC for all 1100 Series configurations. The GCS can accommodate up to 32 half- and/or full-duplex communications lines at speeds of up to 50,000 bits per second, under direct program control of the central processor. The GCS consists of a Communications Terminal Controller that connects to a processor ESI I/O channel and acts as a multiplexer to from 1 to 32 Communications Terminals and Communications Interfaces. Each Communications Terminal/Communications Interface combination can accommodate one half-duplex or one full-duplex line. Transmission is in asynchronous or synchronous bit-serial mode, using codes of 5, 6, 7, or 8 levels. The asynchronous interfaces can handle speeds ranging from 45.45 to 2400 bits per second, while the synchronous interfaces can handle line speeds of up to 50,000 bits per second. In addition to the bit-serial interfaces, an automatic dial interface is available.

COMMUNICATIONS SUBSYSTEM (CTMC): Enables an 1100 Series system to transmit and receive data over up to 32 communications lines, at speeds of up to 50,000 bits per second, under direct program control of the central processor. The subsystem consists of a Communications Terminal Module Control (CTMC) which connects to any processor ESI I/O channel and up to 16 Communications Terminal Modules (CTM's).

Each serial CTM accommodates two full-duplex or two half-duplex lines. (A CTM VII can have one full-duplex or one half-duplex line.) Transmission is in asynchronous or synchronous bit-serial mode, using codes of 5, 6, 7, or 8 levels. The low-speed, medium-speed, and high-speed CTM's can handle speeds of up to 300, 1600, and 50,000 bits per second, respectively. Speeds of over 4800 bps also require a High-Speed Interface Module, which is not supported by UNIVAC software. In addition to the bit-serial CTM's there are parallel input and output modules, which handle up to 75 eight-bit characters per second on a single line, and single-line automatic dialing modules.

REMOTE UNIVAC 9000 SERIES SUBSYSTEMS: A UNIVAC 9200, 9200 II, 9300, or 9300 II computer system can be used as a remote terminal to an 1100 Series system for remote batch applications in either half-duplex or full-duplex transmission modes. A basic UNIVAC 9200/9300 remote subsystem consists of a central processor, 8K bytes of main storage, card reader, and an integrated printer. In addition, each 9200/9300 system requires a Data Communications Subsystem (DCS) that connects to the Multiplexer Channel and handles up to eight full-duplex lines with speeds of up to 50,000 bits per second. Transmission is synchronous, using codes of 5, 6, 7, or 8 levels. The DCS adds character and message parity to outgoing data and checks the parity of incoming data. Longitudinal redundancy can also be checked. Automatic dialing, unattended answering, and variable message lengths are standard features. In addition to card punches, card readers, and printer, other 9000 Series tape and disc peripherals can be used, but only card reading, punching, and printing are supported by the UNIVAC 1100 Series Executive.

TERMINALS: The following UNIVAC devices, most of which are described elsewhere in DATAPRO 70, are supported for use as remote terminals with the 1100 Series systems: DCT 475 and DCT 500 (Report 70D-877-02), DCT 524, DCT 1000 (Report 70D-877-03), DCT 2000 (Report 70D-877-01), Uniscope 100 (Report 70D-877-05), Uniscope 200, the Series 600 Tape Cassette System (for the Uniscope 100 or Uniscope 200), UTS 400 (Report 70D-877-06), UTS 700 (Report 70D-877-07), UNIVAC 9000 Series computers (Report 70C-877-01), and the UNIVAC 1900 Computer Aided Data Entry System (Report 70D-877-31). Support for IBM's binary synchronous communications protocol also permits transfer of data between IBM System/360 and System/370 and UNIVAC 1100 Series systems and the use of some IBM-compatible remote batch terminals.

SOFTWARE

OPERATING SYSTEM: All UNIVAC 1100 Series systems utilize the 1100 Operating System, which was originally released as EXEC 8 for the third-generation UNIVAC 1108 system and has been extended to support the 1106, 1110, 1100/10, 1100/20, 1100/40, and 1100/80 systems as well. EXEC II, an even earlier operating system originally developed for the second-generation UNIVAC

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1107 system, was also made available for 1106 and 1108 systems, primarily to facilitate conversions for 1107 users. EXEC II has by now been upgraded to the 1100 Operating System in most installations and is no longer being supported or enhanced by UNIVAC.

The 1100 Operating System supports multiprogrammed batch, real-time, and time-sharing operations on systems with single or multiple central processors.

Batch processing jobs can be submitted either locally or remotely. A scheduling routine selects the runs to be initiated in accordance with user-assigned priorities and deadlines.

The demand processing facilities of the 1100 Operating System permit interactive use of the system by multiple users at remote terminals. By means of the Executive Control Language, demand-mode users can compile and execute programs, use library facilities, and communicate with the computer center and with other terminals. (More comprehensive facilities for interactive operations are provided by the Conversational Time-Sharing system, described later in this report.)

A new Terminal Security System (TSS) permits each installation to establish a file of valid remote system users through the use of user identification codes, passwords, and other pertinent information. The system allows installation passwords to be changed dynamically, and enables users to be selected as masters or submasters to allow delegation of authority in creating and updating identifications and passwords in the TSS file. Each installation can define the action to be taken in the event of an attempted security violation.

Real-time and communications programs, which are subject to specific time constraints, receive top-priority handling by the 1100 Operating System. Real-time programs receive privileged access to system resources such as central processors, memory, and input/output channels, and have a priority higher than any other processing except for EXEC interrupt processing. Interrupt processing routines can be defined for each real-time communications line; they execute at a higher priority than all other processing. Communications control facilities for transaction processing are provided by the Communications Management System and the Transaction Interface Package, described later in this report.

The minimum equipment configuration for the full 1100 Operating System is a UNIVAC 1106, 1108, 1100/10, 1100/20, or 1100/80 system with 131K words of main storage (or an 1110 or 1100/40 with 32K words of primary storage and 131K words of extended storage), approximately 786K words of direct-access storage, two magnetic tape units, a card reader, and printer. Once the operating system has been loaded from tape, it is fully drum- or disc-oriented, and the tape units are available for other functions. Drum or disc storage is used for permanent storage of the operating system and its system library, for segments of all active programs (to facilitate "swapping"), for user programs in both absolute and relocatable form, for users' data files, and for buffering of remote terminals and on-line card readers, punches, and printers.

Operating system functions typically occupy about 40K to 60K words of storage in 1106, 1100/10, 1100/20, or 1100/80 systems; in an 1110 1100/40, the typical residence requirements are 20K to 30K words of primary storage and a similar amount of extended storage.

A single set of symbolic programs comprises the 1100 Operating System for 1100 Series systems of all sizes. A Symbolic Stream Generator (SSG) tailors the system to the specific 1100 system, its configuration, and the requirements of each user. A complete system generation typically takes from three to six hours of computer time and produces an initial load tape for the Operating System.

The 1100 EXEC Supervisor controls the sequencing, setup, and initiation of all runs. It performs three levels of scheduling: Coarse Scheduling, Dynamic Allocation, and CPU Dispatching.

The Coarse Scheduler analyzes control-card information about priorities and equipment requirements to determine the basic job schedule. Scheduling is based on the type of job, programmer-assigned priority, time of submission, and resource requirements. A deadline scheduling facility permits jobs to be given special scheduling in order to achieve completion by a specified time. Demand jobs are initiated immediately, while batch jobs are queued in the backlog queue for initiation according to priority and the availability of resources. Jobs are held in a facilities hold queue until all required resources are available; after a job has been passed over an installation-specified number of times, a message is displayed on the system console for operator action.

The Dynamic Allocator allots main memory according to the needs of each individual task within a run. Dynamic storage allocation is a key feature of the 1100 Operating System. Allocation is done in 512-word granules and is based on the current space requirements of all tasks; programs can expand and contract dynamically. Allocation of memory is based both on the type of task and the response times and priorities within each task type, and is performed for both primary storage and extended storage in 1110 and 1100/40 systems. In allocating main storage, the Dynamic Allocator attempts to locate I-banks and D-banks in different main memory banks in order to reduce main storage reference conflicts, and to load programs at the extreme ends of available main memory to reduce memory fragmentation.

Storage swaps between main memory and random-access storage are performed when necessary in order to allocate memory to higher-priority tasks, except that real-time tasks are not subject to swapping. Demand (conversational) programs are given priority for storage allocation over batch programs, and batch programs can be swapped to allow the system to accommodate other batch jobs approaching a scheduled deadline. Tasks become eligible for swapping upon reaching a voluntary wait state or when their first memory quantum has been exceeded. When tasks are to be swapped out to make room for higher-priority tasks, the swapping decisions are based upon criteria such as the best fit, relative priorities, number and sizes of tasks to be swapped out, and distance from the "edges" of storage. The system monitors resource usage by individual tasks and classes of tasks, and adjusts task priorities in order to optimize both batch and demand throughput.

In 1110 and 1100/40 systems, programs can be executed in either primary or extended storage and can even be split between the two types of storage. The EXEC Supervisor monitors the execution characteristics of all programs and attempts to place computational code in primary (high-speed) storage and I/O-oriented or low-frequency code in extended storage.

A Quota System was added to the 1100 Operating System in March 1975 to enable 1100 Series installations to control the use of system resources by both batch and demand users. Quota includes a Quota Input Processor (QUIP), which can be used by each installation to establish account and

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individual limits through user identification codes for use of system resources. With the Quota System, installations can prevent users from requesting the use of system resources beyond an account budget or a preassigned limit, control the number of concurrent demand and batch runs executing in the system, and define limits to be applied to resources available to demand and/or batch jobs at specified times.

The CPU Dispatcher controls switching of the processor from one currently active task to another. The 1100 EXEC uses a "pure preemptive" algorithm for controlling CPU usage; that is, low-priority tasks surrender CPU utilization to those of higher priority. Real-time and EXEC activities are given unlimited quantums of CPU time, while demand and batch jobs are switched according to an algorithm that allots high priorities for short periods to activites requesting I/O services and lower priorities for longer periods to compute-oriented activities. Periodic time-slices can be alloted to demand-mode routines.

The 1100 Operating System supports two types of program segmentation. The first is the conventional overlay method, in which one part of a program physically replaces another in main storage. The second type, which UNIVAC calls the "program bank" concept, effectively provides 1100 Series programmers with a software-controlled virtual storage mechanism. The system currently supports a virtual storage space of up to 250 program banks (available to the programmer for his individual program) and 4095 library banks (used for common routines which are sharable by all programs.) Each bank can be up to 65K words in size, and data banks can be even larger if desired. Moreover, each bank can be specified as either static (resident in memory whenever the program is active) or dynamic (loaded upon request).

The number of banks that can be directly accessed at any one time is four in 1110 and 1100/40 systems and two in the 1106, 1108, 1100/10, and 1100/20 systems. Bank referencing instructions effectively replace one of the accessible banks with a new bank; these instructions are direct hardware functions in the 1110 and 1100/40 and are simulated by software in the 1106, 1108, 1100/10, and 1100/20.

Re-entrant processing is another featured capability of the 1100 Operating System. Processors such as the Assembler, Conversational FORTRAN, and Text Editor are re-entrant and can be shared by any number of concurrent jobs. The COBOL and FORTRAN compilers produce re-entrant code, and the COBOL, FORTRAN, and ALGOL libraries consist of re-entrant modules. Moreoever, programs and data areas which are not re-entrant can be safely shared through a combination of hardware (the Test and Set instruction) and software (automatic conflict resolution).

Dynamic reconfiguration and auto recovery facilities of the 1100 EXEC help to minimize the impact of hardware failures upon user operations. A Recoverable Error Edit (RECERR) program produces a report on all recoverable errors logged by the operating system, identified by system unit, peripheral subsystem, and the time of occurrence. On-line diagnostic programs execute under control of the operating system for exercising peripheral devices and system components. Dynamic reconfiguration capabilities permit system components to be taken off-line through an operator console key-in, while allowing uninterrupted operation of the remainder of the system in most cases. The auto recovery sequence is initiated automatically in 1100 systems which include an SPU or ACU when a critical component fails. The EXEC is reloaded from random-access storage, the catalogued file directory is verified and corrected, and executive system files are reestablished. UNIVAC states that the system will normally be back on the air within 15 to 60 seconds after recognition of a failure. Systems that are not equipped with an SPU or ACU require the recovery sequence to be initiated manually.

Multiprocessing is handled as a logical extension of the 1100 EXEC's multiprogramming capabilities. The system maintains a list of processor activities currently waiting to be performed. Each processor inspects this list, selects a task, and executes it. One processor can interlock the others while referencing critical areas of common data, and various other techniques are employed to guard against inter-processor interference.

The File Control System is an 1100 EXEC component that handles the creation and maintenance of program and data files and maintains a master directory of all catalogued files and all available mass storage areas. Data handling routines permit device-independent processing of files at either the item or block level. Mass storage files can be accessed either sequentially or randomly and can be allocated across multiple direct-access storage devices of varying types. Sequential files can be processed from magnetic tape units or direct-access storage without program modification. Catalogued files can be rolled out to magnetic tape storage when additional mass storage space is required.

A File Administration Processor (SECURE) produces periodic tape backup for catalogued files on mass storage, with the exception of transient files, system files, or highly classified files. The set of file backup tapes, along with a tape checkpoint of the master file directory, are used to restore files that have been inadvertently destroyed or purposely removed to tape storage backup. SECURE allows inactive files to be stored on magnetic tape as archives and removed from the Master File Directory, but retains sufficient data to restore the files if required. For magnetic tape handling, the EXEC incudes a new tape labeling facility that handles user-written ANS-standard tape labels and automatically creates first file header labels for unlabeled tapes.

The Software Instrumentation Package (SIP) consists of a set of data collection routines that execute under the 1100 EXEC and a set of user-level data reduction programs. SIP collects statistics on central processor, storage, and I/O channel utilization, file placement and accesses, and other operational parameters. This information, after processing by the data reduction programs, can aid the user in making hardware, software, or scheduling modifications to improve the system's throughput. An 1100 Series Communications Simulator (CS-1100) permits some or all of the communications lines in an 1100 communications network to be placed in a simulation mode to evaluate performance without requiring that the actual communications terminal be placed on-line. A Transaction Control Language is also provided to enable users to test a variety of applications programs under the Remote Terminal Simulator.

Accounting statistics are provided by the Quota System, a replacement for an earlier accounting system, which now also has facilities to limit each user's access to system resources. Totals for each run are accumulated on CPU and peripheral utilization. Total resource utilization can be computed in the form of Standard Units of Processing (SUP's) which, in turn, can be equated to a dollars-and-cents figure for each account. Individual users may obtain data concerning their own system utilization and quota sets, but a new security arrangement prevents them from inquiring into the summary account file containing data on other accounts associated with the system.

TOTAL INFORMATION MANAGEMENT SYSTEM: This comprehensive software system, designed to integrate and

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satisfy all the management information needs of a company, consists of six functional modules: the Communications Management System (CMS), Transaction Interface Package (TIP), Conversational Time-Sharing (CTS), Data Management System (DMS), Query Language Processor (QLP), and Remote Processing System (RPS). These modules are described in the paragraphs that follow. All operate under control of the 1100 Operating System, and they can be used individually or in any combination. Most of the facilities of the Total Information Management System are currently in use.

COMMUNICATIONS MANAGEMENT SYSTEM: CMS is a data communications monitor that has cognizance of all terminals in an 1100 Series computer network. It acts as the communications "front end" to the Transaction Interface Package (TIP), and handles polling, parity checking, data blocking, data packing and unpacking, message envelope formatting, message acknowledgement, message queuing, and other message control procedures. The message queue can be maintained in main, extended, and/or auxiliary storage; this common data pool is then accessed by the Transaction Interface Package. A Protocol function determines what the current activity on each circuit should be in terms of overall system loading, availability of facilities, user-specified priorities, type of circuit or device, and activity response level from the terminal.

CMS handles the standard UNIVAC terminals as well as "alien" terminal devices. For alien devices the user must supply a skeletal communications control routine which interfaces into the device-control master service routine of CMS. Typical main storage residence requirements for CMS are 10K to 12K words.

TRANSACTION INTERFACE PACKAGE: TIP serves as the "middleman" between the 1100 Operating System and the user's application programs in a transaction-oriented on-line data processing system. TIP's functions are stimulated by the incoming transaction messages stored in the common data pool maintained by CMS. The TIP transaction scanner, TRANSCAN, analyzes each message, determines which application program is required to process it, and arranges for the Executive to load and execute that program. One application program can also call another application program via TIP, through program action based on data parameters. The application programs can be written in COBOL, FORTRAN, Assembly Language, or PL/1 (planned for future release) and can be re-entrant. TIP's features include on-line debugging aids, a batch-mode checkout capability, interprogram protection facilities, and comprehensive system recovery provisions. User-written routines can be accommodated by TIP to perform installation-specified functions such as prioritizing messages and other special message manipulation.

UNIVAC states that a typical throughput level for TIP would be 5 "standard transactions" per second (or 18,000 per hour) on a single-processor 1106 or 50 "standard transactions" per second (or 180,000 per hour) on a 2 x 2 1110 system. (A standard transaction is defined as having 50 characters of input, 100 characters of output, 6 mass storage file accesses, a 4,000-word transaction program, and 10,000 user instruction executions.) TIP typically requires 4K to 6K words of main storage.

CONVERSATIONAL TIME-SHARING: CTS is a modular software system that provides users at remote terminals with an efficient man-machine interface. The system consists of the CTS control module, interactive syntax analyzers for BASIC, FORTRAN (BFOR), and COBOL (BCOB), and compilers for BASIC, FORTRAN, COBOL, ALGOL, and APL. A straightforward control language enables remote users to perform all their activities within the CTS environment; no knowledge of the 1100 Series job control language is required.

The design of CTS is particularly oriented toward facilitating the development and debugging of programs. CTS facilities enable users to: (1) enter and debug source programs in line-by-line fashion; (2) compile programs; (3) edit source programs and data; (4) collect and execute programs; (5) save programs and data; (6) retrieve saved programs and data; (7) create files; (8) access the DMS data base; (9) format the output of data; (10) scan files and produce selective printouts; (11) write interactive procedures in CTS control language; and (12) perform calculations in desk calculator mode.

DATA MANAGEMENT SYSTEM: DMS is a comprehensive data base management system developed under the guiding principles of the 1971 Report of the CODASYL Data Base Task Group. It is designed to satisfy the need for standardized data management techniques that provide: (1) separation of the data definition and data manipulation functions, (2) an acceptable degree of data independence, (3) data base protection and integrity, and (4) alternate data access methods. DMS has three principal components: a Data Description Language, a Data Manipulation Language, and a Data Management Routine.

The Data Description Language (DDL) is a stand-alone language whose record descriptions are compatible with those of COBOL. The DDL input provided by the data manager completely defines the data base. The data base description, or "schema," is composed of areas, records, and sets. A DDL Translator converts the DDL syntax into a series of tables which are maintained in a catalogued file in mass storage for later interpretation by the Data Management Routine.

The concept of "areas" in DDL provides the means for associating the data base with the physical mass storage devices in which it resides. A "set" is simply a named collection of records. The records in a set can be ordered in first-in, first-out fashion or on the basis of one or more keys. The ordering can be done through a chain, an index, or a calc (randomizing) procedure. A given record can be both an "owner record" of one or more sets and a "member record" of one or more sets, and a different ordering procedure can be used in each set. Level 5 of DMS 1110 also permits records in a set to be arranged in an indexed-sequential fashion and retrieved through the index using the key value or accessed directly using the data base key. Level 5 also allows pointer arrays to be defined in which an owner record references an array of pointers that point to the member records for that owner, which normally share some common characteristics with the owner.

The Data Manipulation Language (DML) is the procedural language used by individual programmers to access the data base. It is used in connection with a host language–usually COBOL (although FORTRAN and PL/1 interfaces are planned for future release)–which describes the procedures for processing the data once it has been accessed. The functions of DML can be generally described by listing its commands: OPEN, CLOSE, FIND, GET, MODIFY, STORE, DELETE, INSERT, REMOVE, IF, ON-ERROR, PRIVACY, LOG, and DEPART. The programmer inserts the appropriate DML commands into the syntax of his COBOL source program. A DML Preprocessor then converts the DML commands into a COBOL-compatible format and adds the necessary record descriptions and communication areas. The altered syntax is passed on to the COBOL compiler, which produces an executable program called a "run unit."

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The Data Management Routine (DMR), the key operational component of DMS, maintains the data base and preserves its integrity. No run unit is allowed direct access to the data base; instead, all DML commands are funneled through the Data Management Routine. DMR itself is re-entrant and allows up to 64 active run units to access the data base concurrently. These run units can represent any combination of batch, demand, and real-time activities. In addition to its storage and retrieval functions, DMR includes save data, rollback, and recovery routines that prevent loss of data through hardware failures, software bugs, or erroneous input.

QUERY LANGUAGE PROCESSOR: QLP-1110 is an English-language inquiry system that allows inquiries to be made to data bases generated under DMS-1100. It uses a command language designed around a simplified English syntax and requires a minimum knowledge of the DMS-1100 data base structure. QLP can operate either in demand or batch mode, although the primary mode is interactive. Its two major component modules, the Scan Parser, which analyzes incoming commands, and the Task Translator, which accesses the data base, are both re-entrant. Through the use of the QLP command language, users can inquire into the data base, update records, add new records, or delete records. QLP-1100 uses a Subschema Data Definition Language (QLPSDDL) that is similar to the DMS-1100 DDL. Access to the data base via QLP is regulated by the Data Base Administrator through use of SDDL. Privacy functions will be provided in subsequent releases.

REMOTE PROCESSING SYSTEM: RPS-1100 is an interactive data management and file processing system. It is one element of UNIVAC's Total Information Management System (TIMS) and provides access to system resources by a nonprogramming-oriented user interface through a Uniscope 100 or Uniscope 200 CRT display terminal. RPS-1100 data base files are created and maintained under DMS-1100, and the system interfaces with TIP for transaction interfacing and control. RPS-1100 provides a set of generalized system functions which can be invoked by the user via the terminal. These include commands to ENTER, BUILD, DESTROY, or FORM a file; to process a file through SEARCH, MATCH, or SORT; to build an INDEX structure to line item data and data fields for faster access; to perform computations on specified fields; and to request printing of reports in user-specified formats. RPS-1100 provides tutorial assistance to end users by displaying a choice of functions for user selection and utilizing "fill in the blanks" techniques to permit users to enter commands.

A Tutorial Processor can also be invoked to guide the user through a user-defined sequence of functions that represents a processing procedure, such as inventory updating. No familiarity with job control language or DMS-1100 file structures is required of the end user.

Both private and shared files can be defined. Shared files may be assigned to multiple groups of users, and each user within a group can be restricted to access only certain files and to perform limited functions.

File security is provided by passwords that can be specified as part of the File-ID or as a reply to a password request from the system in the case of a file update. A facility interlock feature permits shared files to be updated concurrently by multiple users. RPS-1100 operates in conjunction with TIP and DMS-1100.

IMS-8. This is a self-contained information management system that consists of three re-entrant modules: FMS-8, Interactive Processor, and Report Writer. FMS-8 is a procedural file management system that permits sequential and/or random accessing of files stored in the indexed sequential format. The Interactive Processor analyzes and coordinates the activities of demand-mode users accessing the files. The Report Writer produces user-specified reports based upon data extracted from the files; its capabilities include sorting, totaling, and calculation of new fields. IMS-8 is no longer being enhanced by UNIVAC.

ISFMS: The "Indexed Sequential File Management System" handles the creation, accessing, and maintenance of indexed sequential files, which can be processed in either random or sequential fashion. ISFMS is neither re-entrant nor data base oriented; it is a comparatively simple, procedurally oriented system designed to interface with programs coded in either COBOL or Assembler language, but not the new ASCII COBOL.

C/SP SOFTWARE: Software support for the independently programmed Communications/Symbiont Processor consists of a group of resident programs, which run on the C/SP itself, and a second group of programs that run on the host 1100 Series system under control of the 1100 Operating System.

The C/SP-resident programs include an operating system, diagnostic routines, and an intercomputer adapter handler. The C/SP Operating System, in turn, consists of a Terminal Management Supervisor, Message Control Program, Terminal Management Control Routines, and Symbiont Control Program. These routines control program switching, I/O queuing, interrupt handling, call initiation, message routing, message translation and editing, initiation of polling, dynamic buffering, and a variety of other standard communications control functions.

UNIVAC will supply standard Communication Control Routines for the following remote devices: Uniscope 100 and Uniscope 200 Display Terminals: DCT 475, DCT 500, DCT 524, and DCT 1000 Data Communications Terminals: UNIVAC 9000 Series Computers; and Binary Synchronous Communications (BSC) devices.

C/SP programs that run on the host 1100 Series system include an Assembler, Element Collector, and Simulator. The C/SP Assembler is a two-pass assembler that translates C/SP programs from symbolic assembly language into relative binary elements. The C/SP Element Collector combines a group of these elements into a relocatable object program that can be executed by the C/SP. The C/SP Simulator accepts C/SP object code, simulates its execution, and provides diagnostic printouts to aid in program debugging. The C/SP Symbionts accommodate the specific capabilities of the C/SP and handle communications between the C/SP and the 1100 Operating System.

In March 1975, UNIVAC announced MCP enhancements that enable the C/SP to operate in a stand-alone mode in the event of a central processor failure, to perform store-and-forward message switching, to dynamically reconfigure line and terminal assignments in the communications network, to create audit trails on disc or tape, and to initiate automatic recovery procedures for the C/SP using the audit files.

NINE THOUSAND REMOTE (NTR) 9000 INTERFACE: Enables a UNIVAC 9200/9300 computer system equipped with a Data Communications Subsystem (DCS) to operate as a remote batch terminal to an 1100 Series host processor through full-duplex communications lines. Fieldata, ASCII, and EBCDIC codes can be handled. NTR supports 9000 Series systems configured with the 0711 and 0716 card readers, 0603 and 0604 card punches, the bar printer and the 0768-00, 0768-02, 0768-99, and 0770 printers, a CalComp plotter, and paper tape reader/punches. Provisions are available for off-line operation of the 9000 Series

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computer and for diagnostic services for the 9000 Series peripherals. The software supports console-to-console communications between the 1100 Series host processor and the remote 9000 Series system and handles message compression to enhance communications line efficiency. Message integrity and recovery are achieved by assigning a unique number to each message transmitted in both directions. NTR was announced in 1974 and can be tailored to each installation through a relatively straightforward Symbolic Stream Generator.

COBOL: UNIVAC offers two COBOL compilers for use under the 1100 Operating System. The newest and most powerful is UNIVAC 1100 Series ASCII COBOL. This compiler implements the modules of the 1968 American National Standard COBOL and has some of the 1974 American National Standard COBOL features. Numerous extensions are also included. The ASCII COBOL compiler is re-entrant and produces re-entrant code.

ASCII COBOL recognizes ASCII characters as the standard data code at both source and object time, with 6-bit Fieldata character code handling facilities available as an option. In addition to the character modes, binary and floating-point data forms are supported. Portions of the 1974 American National Standard COBOL currently implemented include: Debugging, Report Writer, Communications (via TIP or Message Control System), and the INSPECT, STRING, and UNSTRING verbs. Principal language extensions based on CODASYL development efforts include: data base management (via DMS), interprogram communication, and asynchronous processing. Additional nonstandard extensions include: debugging features (including MONITOR and EXHIBIT), a TRANSFORM verb to develop one character string from another, expanded forms control facilities including 160-character print line and variable print density control, indexed sequential file handling including generic START and conditional START facilities, and numerous compatibility features for upgrading from earlier 1100 COBOLs or other vendors' COBOLs.

UNIVAC 1100 Series Fieldata COBOL is a somewhat less powerful compiler whose standard mode of data representation is the 6-bit Fieldata code. This compiler implements the following modules of the ANS COBOL language: Nucleus (Level 2), Table Handling (Level 3), Sequential Access (Level 2), Random Access (Level 2), Sort (Level 2), Segmentation (Level 2), and Library (Level 2). Extensions include an indexed-sequential file handling capability (via ISFMS), expanded forms control facilities, subprogramming facilities, debugging verbs, and multiple receiving fields for the ADD and SUBTRACT verbs.

UNIVAC also offers a conversational COBOL Processor (BCOB) that permits time-sharing users to construct, edit, and debug COBOL programs from demand terminals. BCOB executes as a fully re-entrant submodule of the conversational Time-Sharing System (CTS) and supports the full CRT command set. Its syntax analysis facilities are compatible with both ASCII and Fieldata COBOL. Syntax analysis is performed either statement-by-statement as the program is entered from the terminal or in blocks as the program is called from the file system.

FORTRAN V: The UNIVAC 1100 Series FORTRAN V language is a powerful algebraic programming system that includes, as subsets, all the facilities of American National Standard FORTRAN, UNIVAC 1107 FORTRAN, and IBM 7090/7094 FORTRAN IV. Among the unusual language features of the 1100 Series FORTRAN V are the following:

1. A variable may have up to seven subscripts, and computed subscript expressions are permitted.
2. Mixed-mode arithmetic is permitted, with only a few exceptions.
3. Backward DO loops (with decreasing index variables) are permitted.
4. The FLD function permits extraction and insertion of bit fields.
5. The DEFINE, DELETE, ENTRY, IMPLICIT, INCLUDE, and NAMELIST statements provide useful additional facilities.
6. Parameters and options provide for the generation of re-entrant object code if desired.

The six-phase FORTRAN V compiler runs under 1100 Operating System control. Primary design emphasis is on the generation of efficient object programs, with respect to both execution time and storage requirements. Several types of optimization procedures are performed on each source program.

ASCII FORTAN: ASCII FORTRAN is a new, re-entrant UNIVAC FORTRAN compiler that handles ASCII data codes and contains useful extensions for the manipulation of both numeric and non-numeric data. The ASCII FORTRAN language is an extension of the previous UNIVAC FORTRAN V language and includes the following ASCII extensions. A CHARACTER type statement allows handling of character variables, character scalars, and character arrays. A set of character operations is provided, including concatenation of strings, relational comparisons of strings, character-valued functions, and a string function that permits character variables to be extracted from or assigned to substrings of character variables. ASCII FORTRAN provides the double-precision complex data type, in which complex numbers are represented internally as a pair of double-precision floating-point numbers. This data type supports a precision of approximately 17 significant decimal digits and an exponent range of 10^{-308} to 10^{308} for both real and imaginary components of a complex number. ASCII FORTRAN also expands the use of expressions by permitting expressions to be used in positions that previously (in FORTRAN V only) allowed simple variables or array elements.

ASCII FORTRAN is a four-pass compiler that provides for extensive optimization, generates re-entrant programs, and contains facilities designed to fully utilize 1100 Series hardware features. In addition, the ASCII FORTRAN compiler contains a checkout option that provides for direct execution of FORTRAN programs and subroutines, with interactive debugging also provided.

UNIVAC also offers a Conversational FORTRAN Processor (CFOR) that permits statement-by-statement compilation and checking of FORTRAN programs by demand-mode users at remote terminals. Here the emphasis is on effective interaction between man and machine rather than on the generation of efficient object programs. The Conversational FORTRAN language is a proper subset of 1100 Series FORTRAN V, so programs written and debugged in the conversational mode can be recompiled by the FORTRAN V compiler for efficient execution. The Conversational FORTRAN user can construct, store, alter, and execute individual statements or complete routines, change the values of variables, rename variables, take checkpoints, and request information selectively.

A re-entrant FORTRAN compiler (RFOR) is provided for processing environments that are heavily demand-oriented or in which extensive compilations are performed. Each additional user requires only a D-Bank initialization, a minimum of optimization is performed, and fast compila-

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tion speed is emphasized. BFOR is a re-entrant FORTRAN syntax analyzer that operates under the Conversational Time-Sharing software and stresses economical use of main memory (an 8K re-entrant 1Bank and one 4K d Bank per user).

ALGOL: UNIVAC's NU ALGOL language is based upon ALGOL 60, extended through the provision of input/output logic, facilities for complex and double-precision arithmetic, and the ability to name strings. Procedures written in FORTRAN V or Assembler language can be included. The ALGOL compiler runs under 1100 Operating System control.

BASIC: UNIVAC's BASIC compiler is an interactive processor that accepts source-language statements from remote users, checks their syntax, and issues diagnostics immediately whenever it detects an error. After the whole program has been checked, a RUN command causes it to be compiled and executed. A file controller package permits manipulation of saved program files, and re-entrant capability enables multiple time-sharing terminals to use the compiler simultaneously. The system need not be dedicated exclusively to BASIC operations.

JOVIAL: UNIVAC offers an 1100 Series compiler for JOVIAL, a general-purpose procedure-oriented language that is used mainly in military command and control applications.

PL/1: The 1100 Series PL/1 compiler is UNIVAC's implementation of the multipurpose programming language which has been proposed for standardization by ANSI and the European Computer Manufacturers Association (ECMA). Compilations can be performed with or without optimization. An extensive library of re-entrant run-time support routines complements the re-entrant code generated by the compiler with arithmetic computations, service subroutines such as input/output functions, dynamic program and storage management, and error and interrupt processing. Advanced facilities such as multitasking and teleprocessing are scheduled for future release.

RPG: The 1100-Series RPG is upward-compatible with UNIVAC Series 70 RPG. It supports sequential, indexed sequential, and table files and provides common report-writing features such as input data selection, editing, calculation, multiple report files, summarizing, control breaks, and file updating. During program generation, storage areas are automatically assigned, constant factors are included, and linkages are produced to routines for input/output operations and calculations. Indexed sequential files are processed through an interface with the Index Sequential File Management System (ISFMS).

ASSEMBLER: The UNIVAC 1100 Series Assembler translates programs from symbolic assembly language into relocatable machine-language object programs. The Assembler language permits direct programmer control of all the 1100 Series processing facilities. Assembler directives enable programmers to control the assembly process and generate data values or instructions based upon specific conditions at assembly time. Multiple location counters facilitate program segmentation. Interprogram communication facilities permit separately assembled programs or subprograms to be linked together at load time.

UTILITY ROUTINES: Both a Sort/Merge Processor and a user subroutine are available. The processor is a completely self-contained parameter-driven program which is capable of ordering and/or merging data sets having a wide variety of keys and characteristics. The subroutine, which is an integral part of the processor, uses a replacement selection technique for internal sorting, writes strings on either magnetic tape or drum, and permits insertion of the user's own coding. Either fixed or variable-length items can be handled. Multiple sort keys and user-defined collating sequences can be used.

The 1100 Operating System includes an ample complement of utility routines to perform common functions such as I/O control, data transcription, file maintenance, editing, snapshots, and dumps.

MATH-PACK and STAT-PACK are large collections of FORTRAN-coded subroutines that can be integrated into users' FORTRAN V programs to handle a broad range of mathematical and statistical functions.

UNIVAC also offers a variety of conversion routines designed to facilitate the conversion to 1100 Series formats of programs and data files written for the UNIVAC Series 70, IBM System/360 and 370, and several other computer families.

APPLICATION PROGRAMS: The 1100 Series application packages currently available from UNIVAC include:

APT (Automatically Programmed Tools)
FMPS (Functional Mathematical Programming System)
GPSS 1100 (General Purpose System Simulator)
PERT/Time and PERT/Cost
SIMULA (Simulation Language)
SIMSCRIPT I.5 (Simulation Programming Language)
UNIS (UNIVAC Industrial Systems); includes Bill of Materials Processor, Inventory Control, and Planning and Scheduling.

PRICING

EQUIPMENT: The following systems illustrate the wide range of configurations that are possible within the UNIVAC 1100 Series. All can use the 1100 Operating System. All necessary control units and adapters are included in the indicated prices, and the quoted rental prices include equipment maintenance.

UNIVAC 1106 SYSTEM: Consists of one 1106 Processor with 131K words of Unitized Store and 8 I/O channels, Display Console, three FH-432 Drums (4.7 million characters), one 4-drive 8414 Disc Subsystem (130 million characters), four 9-track Uniservo 12 Magnetic Tape Units (68KB), 900-cpm Card Reader, 300-cpm Card Punch, and 1200/1600-lpm Printer. Monthly rental and purchase prices are approximately $33,000 and $1,322,736, respectively. (If the three FH-432 Drums were omitted, monthly rental and purchase prices would be approximately $27,000 and $1,061,500, respectively.)

UNIVAC 1106 II SYSTEM: Consists of one 1106 Processor with 131K words of Multi-Modular Storage II and 8 I/O channels, plus same peripheral equipment as the UNIVAC 1106 system above. Monthly rental and purchase prices are approximately $39,900 and $1,636,400, respectively.

SMALL 1100/10 SYSTEM: Consists of one 1100/10 Processor with 131K words of MOS main memory and four I/O channels, system console, real-time maintenance communications interface, two multi-subsystem adapters, two 8425 Disc Drives, four 9-track Uniservo 14 Magnetic Tape Units (96KB), one 1000-cpm Card Reader, and one 760-lpm Printer. Monthly rental and purchase prices are approximately $15,900 and $763,600, respectively.

LARGE 1100/10 SYSTEM: Consists of two 1100/10 Processors with 262K words of MOS main memory and 16 I/O channels, two system consoles, four 8434 Disc Drives, two 8405 Fixed-Head Disc Drives, eight 9-track Uniservo 16 (192KB) Tape Units, Communications/Symbiont Processor with 98K bytes of memory, 1000-cpm Card Reader, 250-cpm

UNIVAC 1100 Series

Card Punch, 1400-lpm Printer, and eight communications lines. Monthly rental and purchase prices are approximately $48,300 and $2,245,800, respectively.

SMALL UNIVAC 1100/20 SYSTEM: Consists of one 1100/20 Processor with 131K words of MOS main memory and four I/O channels, Display Console, two 8430 Disc Drives and unbuffered 5039 Controller (200 million bytes), four 7-track Uniservo 12 Magnetic Tape Units (34KC), 1000-cpm Card Reader, 250-cpm Card Punch, and 900-lpm Printer. Monthly rental and purchase prices are approximately $27,000 and $1,173,000, respectively.

LARGE 1100/20 SYSTEM: Consists of one 1100/20 Processor with 262K words of MOS main memory and eight I/O channels, Display Console, three FH-432 Drums (4.7 million characters), three 8433 Disc Drives and buffered 5039 Controller (600 million bytes), six 7-track Uniservo 16 Magnetic Tape Units (96KB), and Communications/Symbiont Processor (with 98K bytes of storage, 1000-cpm Card Reader, 800-lpm Printer, 250-cpm Card Punch, General Purpose Communication Channel, and four synchronous and four asynchronous communications lines). Monthly rental and purchase prices are approximately $46,900 and $1,925,400, respectively.

UNIVAC 110 1 x 1 SYSTEM: Consists of one Command/Arithmetic Unit, one Input/Output Access Unit and 8 channels, 32K words of Main Storage, 131K words of Extended Storage, System Console, Communications/Symbiont Processor (with 49K bytes of storage, 1000-cpm card reader, and 1000-lpm printer), 4-drive 8414 Disc Subsystem (130 million characters), and four 9-track Uniservo 12 Magnetic Tape Units (68KB). Monthly rental and purchase prices are approximately $41,900 and $1,660,500, respectively.

UNIVAC 1110 2 x2 SYSTEM: Consists of two CAU's, two IOAU's with 16 channels each, 131K words of Main Storage, 393K words of Extended Storage, System Console, Communications/Symbiont Processor (with 65K bytes of storage, 1000-cpm card reader, and two 1000-lpm printers), six FH-432 Drums (9.4 million characters) with dual-channel controls, four 8440 Disc Drives (480 million characters), and eight Uniservo 20 Magnetic Tape Units (320KB). Monthly rental and purchase prices (exclusive of the extensive data communications and remote terminal equipment usually used in a system of this type) are approximately $97,700 and $4,314,600, respectively.

SMALL 110/40 1 x 1 SYSTEM: Consists of one CAU, one IOAU and eight channels, 32K words of Primary Storage, 131K words of Extended Storage, System Console, three 8433 Disc Drives (600 million bytes) and buffered 5039 Controller, six 9-track Uniservo 16 Magnetic Tape Units (192KB), and Communications/Symbiont Processor (with 98K bytes of storage, 1000-cpm Card Reader, 800-lpm Printer, 250-cpm Card Punch, General Purpose Communications Channel, and four asynchronous and four synchronous communications lines). Monthly rental and purchase prices are approximately $49,150 and $2,020,000, respectively.

MEDIUM 1100/40 2 x 1 SYSTEM: Consists of two CAU's, one IOAU and eight channels, 131K words of Primary Storage, 524K words of Extended Storage, System Console, one FH-432/1782 Drum Subsystem (2.4 million words), three 8433 Disc Drives (600 million bytes) and buffered control, six 9-track Uniservo 16 Magnetic Tape Drives (192KB), and Communications/Symbiont Processor (with 98K bytes of storage, 1000-cpm Card Reader, 250-cpm Card Punch, 800-lpm Printer, General-Purpose Communication channel, and four synchronous and four asynchronous communication lines). Monthly rental and purchase prices are approximately $93,920 and $1,001,000, respectively.

LARGE 1100/40 4x2 SYSTEM: Consists of four CAU's and two IOAU's with eight channels each, 131K words of Main Storage and 1,048K words of Extended Storage, three System Consoles, System Partitioning Unit, two FH-432/1782 Drum Subsystems and dual-channel controllers, six 8433 Disc Drives (1.2 billion bytes) and buffered control, twelve 9-track Uniservo 16 (192KB) Magnetic Tape Units and dual-access control, and two Communications/Symbiont Processors (each with 98K bytes of storage, 1000-cpm Card Reader, 250-cpm Card Punch, 800-lpm Printer, General Purpose Communication Channel, and four synchronous and four asynchronous communication lines). Monthly rental and purchase prices are approximately $160,400 and $6,786,300, respectively.

SMALL 1100/80 SYSTEM: Consists of one 1100/80 Processor with I/O unit, 8K words of buffer storage, 524K words of backing store, system console, one word channel module with ESI/ISI capability, eight 8434 Disc Drives, two 9-track Uniservo 30 Tape Units, four Uniservo 32 Tape Units, 1000-cpm Card Reader, 250-cpm Card Punch, 1400-lpm printer, and four dial-up asynchronous communications lines. Monthly rental and purchase prices are approximately $57,400 and $2,430,900, respectively.

LARGE 1100/80 SYSTEM: Consists of two 1100/80 Processors, two IOU's, two word channel modules, two system consoles, 16K words of buffer storage, 1024 words of backing store, twelve 8434 Disc Drives, two 8433 Disc Drives, two 8405 Disc Drives, four 9-track Uniservo 30 Tape Units, four Uniservo 34 Tape Units, four Uniservo 36 Tape Units, 2000-lpm printer, one Communications/Symbiont Processor with 98K bytes of memory, 1000-cpm Card Reader, 250-cpm Card Punch, 1400-lpm Printer, and eight communications lines. Montly rental and purchase prices are approximately $117,500 and $5,050,800, respectively.

SOFTWARE AND SUPPORT: UNIVAC has not "unbundled" to date, so the equipment prices listed above include all of the UNIVAC software described in this report and all normal educational courses and professional assistance. (A Basic Equipment Plan, offered only to certain self-sufficient users, provides the equipment and standard software, without UNIVAC support services, at a discount of approximately 13% from the list prices shown here.)

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 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 1100 Series system at significantly lower rates. UNIVAC 1106, 1108, and 1100/20 systems are available on a 5-year lease at a monthly equipment charge of 75% of the 1-year rental rate, and UNIVAC 1110 and 1100/40 systems are available on a 5-year lease at a monthly equipment charge of 85% of the 1-year rental rate shown in the accompanying price list. In addition to these "level-payment" leases, UNIVAC also offers "reducing-payment" leases. For example, under a 5-year reducing-payment agreement, the monthly charge for an 1106, 1108, or 1100/20 system 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. For an 1100 or 1100/40 system under a 5-year reducing payment agreement, the monthly charge is 95% of the 1-year rental rate for the first year, 90% the second year, 85% the third year, 80% the fourth year, and 75% the fifth year.■

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1106 PROCESSORS AND MAIN STORAGE				
3011-20	1106 Processor (with 4 I/O channels)	348,816	1,479	7,267
F0680-99	I/O Channel Expansion (4 channels)	25,200	68	525
F1053-98	Multiprocessor Capability (required on each 3011-20 Processor in a multiprocessor system)	10,368	0	216
Unitized Storage; 1.5-microsecond cycle time:				
7013-04	131,072 words	220,512	646	4,594
7013-79	262,144 words	441,024	1,292	9,128
7013-78	393,216 words	633,024	1,938	13,188
7013-77	524,288 words	825,024	2,584	17,188
F2252-00	Addressing Expansion Feature (required on 1106 Processors with more than 262K words of Unitized Storage)	9,600	10	200
Storage II (Multi-Modular); 1.0-microsecond cycle time:				
7005-42	131,072 words	534,144	942	11,128
7005-41	196,608 words	803,376	1,363	16,737
7005-40	262,144 words	1,072,896	1,779	22,352
4009-99	Display Console (includes control console, entry keyboard, CRT display, and Page-printer; one required with each 1106 Processor)	42,240	318	880
F0774-00	Auxiliary Console (required when CTMC's are used; houses 4 CTMC's)	8,784	13	183
1106 MULTIPROCESSOR SYSTEM COMPONENTS				
2506-00	Availability Control Unit (for up to 2 Processors, 4 MMA's, and 6 SPI's; expandable to a maximum of 24 SPI's)	62,256	138	1,297
F0874-00	ACU Expansion (for up to 6 more SPI's)	3,552	11	74
0995-04	Shared Peripheral Interface (permits 2 Processors to share a peripheral subsystem)	24,523	28	511
0955-05	Shared Peripheral Interface (has same functional characteristics, and shares a cabinet with, Type 0955-04 SPI)	21,840	22	455
F1384-98	Unitized MMA (allows 3 Processors to access a 131K module of Unitized Storage)	45,312	79	944
0962-99	Shared Memory Interface (allows 2 Processors to access a 65K module of 1.5-microsecond Multi-Modular Storage)	33,456	53	697
0954-99	Storage II MMA (allows 2 Processors to access a 65K module of 1.0-microsecond Multi-Modular Storage)	67,488	59	1,406
1100/10 PROCESSORS AND MAIN STORAGE				
3011-81	1100/10 Processor; with 128K-word control memory, double-precision floating point, four I/O channels, power distribution center, control console with CRT display and entry keyboard, hard-copy printer, real-time maintenance communication (RTMCS) interface, and 131K words of main storage	448,752	2,230	9,349
3011-79	Processor Expansion; provides a processor and system console for expansion of an 1100/10 system to a multiprocessor. Prerequisite is an 1100/10 processor with 131K storage expansion (7036-99). Also requires two multiprocessor capability features (F 1053-98) plus two MMA's (F2249-00)	256,752	1,700	5,349
F0680-99	I/O Channel Expansion; four additional I/O channels; maximum of three expansions per 1100/10 processor	25,200	68	525
F1053-98	Multiprocessor Capability	10,368	—	216
0769-10	Console Printer; 132-column, 30-cps free-standing printer for use as an additional hard-copy device on the 1100/10 processor console; up to five printers permitted per 1100/10 processor	16,800	56	350
7036-99	Storage Expansion, 131K; provides cabinet with 131,072 words of storage and space for one additional 131K expansion module via feature F2248-99; maximum of three type 7036-99 storage units per system	192,000	530	4,000
F2248-99	Storage Expansion, 131K; provides 131,072 words of additional storage for 1100/10 processor (3011-81) or 7036-99 storage unit; maximum of two F2248-99 storage expansions is allowed	144,000	400	3,000
F2249-00	Multi-Module Access (MMA); for multiprocessor applications only; allows a maximum of two 1100/10 processors to access a 7036 storage unit	45,312	79	944
1100/10 TO 1100/20 UPGRADE				
F2248-98	1100/10 Processor Upgrade; upgrades an 1100/10 processor (3011-81) to an 1100/20 processor (3011-83) with 131,072 words of storage (7033-97 plus F2079-99)	253,488	200	5,281
F2248-97	1100/10 Expanded Processor Upgrade; upgrades an 1100/10 expansion processor (3011-79) to an 1100/20 processor (3011-83)	195,888	84	4,081
F2248-96	7036 Storage Upgrade; upgrades a 7036-99 storage expansion 131K to a 7033-97 storage 65K with an F2079-99 storage expansion	57,600	116	1,200
7035-95	F2248-99 Storage Upgrade; upgrades an F2248-99 storage expansion 131K to a 7033-97 storage 65K with an F2079 storage expansion	105,600	246	2,200
1100/20 PROCESSORS AND MAIN STORAGE				
3011-83	11/20 Processor (includes 4 I/O channels and console with CRT display and keyboard)	452,640	1,784	9,430

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1100/20 PROCESSORS AND MAIN STORAGE (Continued)				
F0680-99	I/O Channel Expansion (4 channels)	25,200	68	525
F1053-98	Multiprocessor Capability (required on each 3011-83 Processor in a multi-processor system)	10,368	NC	216
0769-10	Incremental Printer (provides a 132-column, 30-cps freestanding printer for use as an additional hard-copy device on the 1100/20 Processor console; up to five printers permitted per 1100/20 Processor)	16,800	56	350
7033-00	Storage—65K (provides cabinet with 65,536 words of storage and space for an additional 65K via feature F2079-00; maximum of four Type 7033 storage units per 1100/20 system)	162,240	420	3,380
F2079-00	Storage Expansion—65K (provides 65,536 words of additional storage to a 7033-00 storage unit)	87,360	226	1,820
F2080-00	Multi-Module Access (MMA) (for multiprocessor application only; allows a maximum of two 1100/20 processors to access a 7033 storage unit)	45,312	79	944
1100/20 MULTIPROCESSOR SYSTEM COMPONENTS				
2506-00	Availability Control (ACU) (mandatory for multiprocessor applications using more than one 1100/20 Processor)	62,256	138	1,297
F0874-00	ACU Expansion (expands the SPI access capability of the ACU by six SPI's; maximum of three expansions may be added to the ACU)	3,552	11	74
0961-99	Multi-Subsystem Adapter (includes cabinet, I/O interface, one MSA module to adapt from one to eight byte-oriented subsystems, and space for one MSA module, F1321-02)	26,976	61	562
MSA Features:				
F1321-99	MSA Expansion (provides second MSA module with power supply to expand Type 0961 MSA; includes one I/O interface)	21,504	51	448
F1324-02	SPI (Shared Peripheral Interface; provides one I/O Interface for MSA Type 0961 or MSA Expansion F1321)	6,600	29	136
F1323-00	Function Buffer Expansion (adds six function registers to an MSA Function Buffer for expanding command chaining capability; required for disk operation)	2,208	11	46
F1325-00	ASCII Translator (translates Fieldata code to and from a 64-character subset of ASCII)	2,064	11	43
F1325-01	EBCDIC Translator (same as F1325-00 except translates Fieldata to and from a 64-character subset of EBCDIC)	2,064	11	43
F1322-00	SIR (Search Identifier Register; provides storage for up to twelve bytes of parameter (search) data required for disc operations)	2,208	11	46
0955-99	SPI (Shared Peripheral Interface; provides control of a peripheral subsystem as a multi-access subsystem)	24,528	28	511
0955-98	SPI (Shared Peripheral Interface; although functionally independent, shares cabinet with and has the same characteristics as Type 0955-99)	21,840	22	455
F1095-99	1100/9000 ICCU (Inter-Computer Control Unit; permits a 9300 Series system to communicate on-site in 36-bit word format)	11,184	51	233
1110 PROCESSORS AND I/O CONTROL				
3023-95	1110 Processor (1 x 1); includes 1 CAU and 1 IOAU with 8 channels	617,856	2,633	12,872
3023-99	1110 Processor (2 x 1); includes 2 CAU's and 1 IOAU with 8 channels	941,232	3,209	19,600
3023-98	CAU Expansion; provides 2 additional Command/Arithmetic Units	744,576	1,608	15,512
3025-00	Input/Output Unit (8 channels)	191,520	809	3,990
F1387-00	I/O Channel Expansion (Channels 9-16)	20,160	45	420
F1387-00	I/O Channel Expansion (Channels 17-24)	20,160	45	420
4013-99	System Console; Includes display and printer	79,824	305	1,663
2516-00	System Partitioning Unit; includes interfaces for 2 CAU's, 2 IOAU's, 2 MSU's, 4 MAI's and 6 Multi-Access Subsystems (MAS)	60,720	141	1,265
F1448-00	CAU Interface Expansion (for 3rd & 4th CAU's)	6,240	11	130
F1449-00/01	IOAU Interface Expansion (for 3rd or 4th IOAU)	6,240	11	130
F1450-00/01	MSU Interface Expansion (for 3rd or 4th Main Storage Unit)	4,080	11	85
F1451-00/03	MAI Interface Expansion (for 5th-8th MAI, respectively)	3,552	5	74
F1441-00/06	MAS Interface Expansion (each accommodates 6 additional Multi-Access Subsystems, for up to 48 total)	3,024	5	63
0955-99	Shared Peripheral Interface (permits 2 IOAU's to share a peripheral subsystem)	24,528	28	511
0955-98	Shared Peripheral Interface (shares a cabinet with Type 0955-99 SPI)	21,840	22	455
F0789-99	SPI Expansion (adds a 3rd interface)	4,176	5	87
F0789-98	SPI Expansion (adds a 4th interface)	2,880	5	60
F1095-99	1110/9000 Inter-Computer Control Unit (for on-line connection of a UNIVAC 9000 Series computer)	11,184	51	233
1110 MAIN STORAGE (PLATED-WIRE)				
7015-00	Main Storage Unit; 32,768 words (includes basic MMA with 8 interfaces)	338,592	425	7,054
F1331-00	Storage Expansion; 32,768 words (expands a 7015-00 to 65,536 words)	288,624	290	6,013

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1110 MAIN STORAGE (PLATED-WIRE) (Continued)				
7015-99	Storage Expansion; 32,768 words (expands main storage from 65,536 to 98,304 words)	338,592	425	7,054
F1331-99	Storage Expansion; 32,768 words (expands main storage from 98,304 to 131,072 words)	288,624	290	6,013
7015-98	Storage Expansion; 32,768 words (expands main storage from 131,072 to 163,840 words)	264,000	425	5,500
F1331-98	Storage Expansion; 32,768 words (expands main storage from 163,840 to 196,608 words)	216,000	290	4,500
7015-97	Storage Expansion; 32,768 words (expands main storage from 196,608 to 229,376 words)	240,000	425	5,000
F1331-97	Storage Expansion; 32,768 words (expands main storage from 229,376 to 262,144 words)	192,000	290	4,000
F1330-00/03	MMA Expansion; adds 4 additional interfaces to a 32K storage module	8,592	10	179
1110 EXTENDED STORAGE (CORE)				
7013-81	Unitized Storage; 131,072 words, 1.5-microsecond cycle time (requires 1MAI or 1 MAI Expansion)	220,512	646	4,594
0963-00	Multiple Access Interface; provides 4 interfaces and control for one 7013-81 (can be used with 1108 Storage, Type 7005, if F1397-00 is also used)	52,416	136	1,092
F1394-00	MAI Expansion; adds a second MAI to an 0963-00	23,808	85	496
F1393-00	MAI Interface Expansion; adds 3 more interfaces to an 0963-00	14,064	22	293
F1393-01	MAI Interface Expansion; adds second set of 3 additional interfaces to an 0963-00	14,064	22	293
F1397-00	1108 Storage Interface; permits use of one 65K module of 1108 Storage, Type 7005, as Extended Storage	10,608	17	221
F1384-99	MMA Expansion; provides 2 additional interfaces for 7013-81	3,936	11	82
1100/40 PROCESSORS AND I/O CONTROL				
3023-93	1100/40 Processor (1 x 1); includes 1 CAU and 1 IOAU with 8 channels	617,856	2,633	12,872
3023-91	CAU Expansion (permits 1 additional CAU; maximum of 3 per system)	355,968	729	7,416
3025-99	IOAU Expansion (provides control 8 I/O channels, and 2 control channels to interface to 2 CAU's; maximum of 3 per system)	191,520	809	3,990
F1387-00	I/O Channel Expansion (Channels 8-15)	20,160	45	420
F1387-01	I/O Channel Expansion	20,160	45	420
4013-99	System Console (Includes CRT display with entry keyboard, hard-copy printer, and real-time maintenance communication (RTMCS) interface; requires 1 I/O channel; up to 5 additional freestanding hard-copy printers (0769-10) may be added)	79,824	305	1,663
0769-10	Incremental Printer (provides a 132-column, 30-cps freestanding printer for use as an additional hard-copy device on the 1100/40 system console; up to 5 printers permitted per console)	16,800	56	350
1100/40 MAIN STORAGE				
7030-00	Storage (includes cabinet, 32,768 words of main storage, basic MMA with eight interfaces, and space for up to 131,072 words; expandable to 65,536 words by addition of F1952-99; may then be expanded from 65,536 to 131,072 words by addition of 2407-99)	338,592	425	7,054
F1952-99	Storage expansion (expands main storage from 32,768 words to 65,536 words)	288,624	290	6,013
2407-99	Storage expansion (expands main storage from 65,536 words to 131,072 words; F1952-99 is prerequisite)	627,216	715	13,067
7030-99	Storage expansion (expands main storage from 131,072 words to 196,608 words; 2407-99 is prerequisite)	480,000	715	10,000
2407-98	Storage expansion (expands main storage from 196,608 words to 262,144 words; 7030-99 is prerequisite)	432,000	715	9,000
7030-98	Storage expansion (expands main storage from 262,144 words to 327,680 words; 2407-98 is prerequisite)	336,000	580	7,000
2407-97	Storage expansion (expands main storage from 327,680 words to 393,216 words; 7030-98 is prerequisite)	336,000	580	7,000
7030-97	Storage expansion (expands main storage from 393,216 words to 458,752 words; 2407-97 is prerequisite)	336,000	580	7,000
2407-96	Storage expansion (expands main storage from 458,752 words to 524,288 words; 7039-97 is prerequisite)	336,000	580	7,000
F1953-00	MMA Expansion (expands Type 7030 storage unit from an 8-interface storage to a 12-interface storage)	8,592	10	179
F1953-01	MMA Expansion (expands Type 2407 storage expansion from an 8-interface storage to a 12-interface storage)	8,592	10	179
F1953-02	MMA Expansion (same as F1953-00 except expands 7030 from 12 to 16 interfaces)	8,592	10	179
F1953-99	MMA Expansion (same as F1953-01 except expands 2407 from 12 to 16 interfaces)	8,592	10	179

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1100/40 EXTENDED STORAGE				
7033-99	Extended Storage (131,072 words of extended storage; requires one 0963 MAI or one F1394-00 MAI Expansion)	249,600	646	5,200
0963-00	Multiple Access Interface (provides four access interfaces and control module for 131K of extended storage, 7033-00)	52,416	136	1,092
F1394-00	MAI Expansion (adds a second MAI control module to 0963-00 to provide access to a 7033-99)	23,608	85	496
F1393-00	MAI Interface Expansion (provides three access interfaces to 0963-00)	14,064	22	293
F1393-01	MAI Interface Expansion (provides second set of three access interfaces to 0963-00)	14,064	22	293
F1397-00	1108 Storage Interface (prerequisite to using 1108 storage type 7005-08 (65K) as Extended Storage)	10,608	17	221
F2080-99	MMA Expansion (provides one additional interface for 7033-99 Extended Storage	3,936	11	82
1100/80 PROCESSORS AND I/O CONTROL				
3032-99	1100/80 Processor; includes 1 IOU with 1 byte and 1 block multiplexer channel, 8K words of buffer storage in 1 buffer module, 524K words of backing store in 1 cabinet, a maintenance processing system, 1 transition unit, 1 system console, and 1 motor/alternator	1,621,690	2,575	38,290
3032-97	1100/80 Processor; includes same as 3032-99 except buffer storage is in 2 modules, and backing store is housed in two cabinets	1,794,785	2,850	42,375
F1653-00	494 Emulation mode; adds 494 user instruction set to 1100/80 processor expansion	178,500	280	4,215
3032-00	Processor expansion; provides a second processing unit with 1100 instruction set and byte instruction set	610,720	970	14,420
3033-99	IOU expansion; provides a second I/O processing unit, including 1 byte and 1 block multiplexer channel	241,920	384	5,710
1923-00	I/O channel expansion; includes housing for an additional 4 channel modules	10,540	15	250
F1656-00	Byte multiplexer channel module	46,725	75	1,110
F1657-00	494 Block multiplexer channel module	46,725	75	1,110
F1658-00	494 Word channel module	54,075	85	1,275
5309-99	1100 to 494 intercomputer coupler unit; requires F1653-00 and F1658-01	30,240	83	630
F1658-01	1100 Word Channel module; provides 4 independent word channels with 36-bit, 1100 mode word-type data in ISI mode	54,075	85	1,275
F1654-00	1100 Word Channel definition; provides the capability to accept 36-bit ESI communications through an 1100 word channel module F1658-01	1,050	5	25
F2141-00	1100 Block multiplexer channel module	54,075	85	1,275
4013-97	System console; required when a processor expansion and an IOU expansion are both present in the configuration; includes CRT display, entry keyboard, and hard-copy printer	79,824	332	1,663
0769-10	Console printer; provides a 132-column, 30-cps free-standing printer for use as an additional hard-copy device on the system console; up to 5 printers permitted per console	16,800	61	350
1100/80 MEMORY GROUP				
F1660-00	Buffer storage; provides expansion of 4096 words to a total of 12K words in the 1100/80 processor 3032-99	208,150	330	4,915
F1659-00	Buffer storage; provides expansion of 4096 words in an 1100/80 processor—from 12K to 16K words in a 3032-99, or from 8K to 12K or 12K to 16K words in a 3032-97	98,055	155	2,315
7034-00	Backing storage expansion of 262K words; may be expanded by 1 F2168-00 to a maximum of 524K words	189,000	300	4,460
F2168-00	Backing storage expansion of 262K words; housed in 7034-00 cabinet	126,000	200	2,975
5012-99	FH-432/FH-1782 control; interfaces to 1 word I/O channel to provide control of 1 to 8 FH-432 or FH-1782 Drums	102,720	338	2,140
MASS STORAGE				
5031-00	Control Units for Unitized Channel Storage	43,680	168	910
7013-97	Unitized Channel Storage; 262K words	289,342	708	6,029
7013-95	Unitized Channel Storage; 524K words	578,784	1,416	12,058
7013-93	Unitized Channel Storage; 786K words	868,176	1,124	18,087
7013-91	Unitized Channel Storage; 1048K words	1,157,616	2,831	24,117
5012-00	FH-432/FH-1782 Drum Control	102,720	310	2,140
F0929-00	Write Lockout Feature (for 5012-00)	1,392	5	29
F0930-00	Shared Peripheral Interface (for 5012-00)	22,608	30	471
F0930-1	SPI Expansion (adds third interface to F0930-00)	2,809	5	70
F0930-02	SPI Expansion (adds fourth interface to F0930-00)	2,163	5	53

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UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
MASS STORAGE (Continued)				
6016-00	FH-432 Drum; 262K words	52,848	120	1,101
6015-00	FH-1782 Drum; 2097K words	146,064	310	3,043
F0786-01	Dual Channel Feature (for FH-432)	3,024	18	63
F0767-00	Dual Channel Feature (for FH-1782)	3,024	18	63
0961-02	Multi-Subsystem Adapter; adapters from 1 to 8 byte-oriented subsystems for use in 1100 Series systems	26,976	61	562
F1321-02	MSA Expansion; adds a second MSA module to an 0961-02	21,504	51	448
F1323-00	Function Buffer Expansion; required on MSA for disc operations	2,208	11	46
F1322-00	Search Identifying Register; required on MSA for disc operations	2,208	11	46
F1324-02	Shared Peripheral Interface; for MSA	6,600	29	136
5024-99	8424/8425 Disc Control (required 0961-02 or F1321-02 MSA)	57,072	355	1,189
F1043-00	Dual Channel Feature (provides access to 5024-99 from 2 I/O channels)	4,416	17	92
F1771-01	Dual Access (permits simultaneous 2-channel access when used with two 5024-99 Controls)	4,536	10	92
8425-00	8425-00 Disk Storage	21,216	98	442
F1214-01	Disk Pack (for 8425 drives)	433	NA	21
5033-97	8440 Disc Control; for up to four 8440 Disc Storage units (8 drives)	88,126	473	1,836
5033-95	8440 Disc Control; connects to system via Type 5033-97 and controls up to 8 additional drives; maximum of three per 5033-97	77,136	470	1,607
F1324-02	Shared Peripheral Interface (for 5033-97)	6,600	29	136
F1325-00	ASCII Translator (for 5033-97)	2,064	11	43
F1325-01	EBCDIC Translator (for 5033-97)	2,064	11	43
F1482-02	Dual Access (permits simultaneous 2-channel access when used with two 5033-97 Controls)	4,536	10	92
8440-02	8440 Disk Storage; 2 drives; 238 million bytes total	59,664	305	1,243
F1221-00	Disk Pack (for 8440 drives)	983	NA	46
5036-97	8460 Disc Control; for up to four 8460 Disc Files	44,064	158	918
8460-02	8460 Disc File	173,808	420	3,621
F1757-00	Dual Access (for 8460-02; permits simultaneous 2-channel access when used with two 5036-97 Controls)	8,112	21	169
5039-91	8433/8430 Control (buffered) (controls up to eight 8433 and/or 8430 Disk Storage Drives with direct access up to 275 million 36-bit words (8433) or 137 million 36-bit words (8430); includes one I/O interface and 1024 words of buffer storage; minimum of two 8433 or two 8430 Disc Storage Drives required per subsystem; may be expanded to control up to 16 8433 and/or 8430 Disc Drives via F2047-00, or to control up to 8 8405-00 Fixed-Head Disc Drives via F2076-00)	72,000	327	1,500
F2047-00	16-Drive Expansion (provides the capability to attach up to 16 8433 and/or 8430 Disc Storage Drives to a 5039-99/98 control; adds the capability for control of up to eight 8405-00/04 disc drives to the control; excludes use of F2076-00)	7,680	44	160
F2041-00	Shared Peripheral Interface (provides an additional I/O interface for the 5039-99 control)	6,600	29	136
F2042-02	EBCDIC Translator (translates Fieldata code to and from a 64-character subset of EBCDIC; may be connected to up to four I/O interfaces; available in 5039-99 controls only)	2,064	11	43
F2042-01	ASCII Translator (translates Fieldata code to and from a 64-character subset of ASCII; may be connected to up to four I/O interfaces; available in 5039-99 controls only)	2,064	11	43
5039-93	8433/8430 Control (unbuffered) (controls up to eight 8433 and/or 8430 Disc Storage Drives with direct access to up to 275 million 36-bit words (8433) or 137 million 36-bit words (8430); may be expanded to control up to 16 8433 and/or 8430 Disc Drives via F2047-00 or to control up to 8 8405-00/04 Fixed-Head Disc drives via F2076-00)	92,160	480	1,920
0974-99	Control Conversion (converts an unbuffered 8433/8430 control to a buffered control)	9,600	50	200
F2047-00	16-Drive Expansion (provides the capability to attach up to 16 8433 and/or 8430 Disc Storage Drives to a 5039-93 Control)	7,680	40	160
F1324-02	Shared Peripheral Interface (provides an additional I/O interface for the 5039-93 control; up to three features may be added to provide a maximum of four shared access paths per control)	6,600	29	136
F2233-01	EBCDIC Translator (translates Fieldata code to and from a 64-character subset of EBCDIC; for 5039-93 only)	2,064	11	43
F2233-00	ASCII Translator (translates Fieldata code to and from a 64-character subset of ASCII; for 5039-93 only)	2,064	11	43
5039-95	8433/8430 Control (same characteristics as 5039-99 except no I/O channel interface interface; connects to system via 5039-99)	57,600	300	1,200
F2076-00	8405 Capability (adds the capability for control of up to eight 8405 Disc Drives to the control)	2,160	5	45

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UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
MASS STORAGE (Continued)				
8430-99	8430 Disc Storage (provides a single 8430 Disc Drive)	24,960	142	520
F2020-00	Dual Access, 8430 (provides dual access and simultaneous read/write operation on any two 8430 Disc Drives; required in each 8430 disc unit in the subsystem; also requires two 5039 Control units)			
F1230-00	Disc Pack (provides up to 100 million bytes or 17 million 36-bit words of removable storage when used on the 8430)	740	–	40
8433-00	Disc Storage (provides a single 8433 Disc Drive)	36,480	190	760
F2021-00	Dual Access, 8433 (provides dual access and simultaneous read/write operation on any two 8433 Disc Drives; required in each 8433 disc unit in the subsystem; also requires two 5039 Control Units)	2,160	5	45
F1223-00	Disc Pack (provides up to 200 million bytes or 34 million 36-bit words of removable storage)	1,150	–	50
8405-00	8405 Fixed-Head Disc (provides a single 8405 disc with a storage capacity of 6,193,152 bytes of 1,376,256 36-bit words; F2076-00 is prerequisite)	76,800	436	1,600
8405-04	8405 Fixed-Head Disc (provides a single 8405 disc with a storage capacity 3,096,576 bytes of 688,128 36-bit words; F2076-00 is prerequisite)	46,080	262	960
F1664-00	Dual Access, 8405 (provides dual access and simultaneous read/write operation on any two 8405 disc drives; required in each 8405 disc in the subsystem; also requires two 5039 control units)	2,160	5	45
5046-99	8430/8433/8434 Control; controls up to 16 8430, 8433, and/or 8434 disc drives	102,000	400	2,400
5046-97	8430/8433/8434 Dual Control; for dual access 8434 disc storage subsystem operation—connects via 2 word channels	176,448	700	4,346
8434-99	8434 Disc Storage; provides 2 single spindle disc drives with nonremovable packs	66,600	226	1,850
F2561-00	32-Device Capability; allows up to 32 8430, 8433, or 8434 disc drives to be intermixed on one 5046-99 controller	7,680	40	160
F2558-00	8405 FHD Capability; allows the attachment of up to 8 8405 Fixed-Head Disc drives to the 5046-99	2,160	5	45
F2021-99	Dual Access for 8434 (permits simultaneous 2-channel access when used with two 5046-97 Controls)	4,416	18	92
F2555-00	SPI; provides an additional I/O interface for the 5046-99/97 controls	6,600	29	136
INPUT/OUTPUT UNITS				
0961-02	Multi-System Adapter (prerequisite for Uniservo 12 & 16 Subsystem)	26,976	61	562
F1321-02	MSA Expansion (required for dual-channel operation)	21,504	51	448
5017-99	Uniservo 12 Magnetic Tape Control (for up to sixteen 9-track, 1600-bpi, nonsimultaneous Uniservo 12 Tape Units)	26,448	110	551
5017-00	Uniservo 12/12 Magnetic Tape Control (for up to sixteen 9-track, 1600-bpi nonsimultaneous Uniservo 12 and/or Uniservo 16 Tape Units)	28,560	121	595
F0825	Dual Channel Feature (for 5017-00 or 5017-99; permits simultaneous operation on either of two Selector Channels)	4,416	17	92
F1131-99	Uniservo 16 Capability (for 5017-99)	2,112	11	44
F0899-00	Simultaneous Operation (for 5017-99)	19,248	80	401
F0899-00	Simultaneous Operation (for 5017-00)	21,312	92	444
F0823-99	7-Track NRZI Capability (for 5017-00 or 5017-99)	5,760	18	120
F0826-00	9-Track NRZI Capability (for 5017-00 or 5017-99)	5,760	18	120
0861-00	Uniservo 12 Master Tape Unit; 9-track, 1600 bpi (includes logic for up to 3 Slave Units)	18,336	131	382
0861-01	Uniservo 12 Slave Tape Unit; 9-track, 1600 bpi	14,688	90	306
0861-04	Uniservo 12 Master Tape Unit; 7-track, 200/556/800 bpi (includes logic for up to 3 Slave Units)	15,936	131	332
0861-05	Uniservo 12 Slave Tape Unit; 7-track, 200/556/800 bpi	13,056	90	272
F0934-99	Simultaneous Feature (for 0861-00)	4,080	19	85
F0934-98	Simultaneous Feature (for 0861-04)	4,080	19	85
F0935-00	Dual Density Feature (for 0861-00)	2,688	11	56
F1041-00	7-to-9-Track Conversion (converts 0861-04 to 0861-00)	2,448	126	51
F1041-01	7-to-9-Track Conversion (converts 0861-05 to 0861-01)	2,448	126	51
5045-99	Uniservo 14 Control; consists of a control and cabinet with space for two Uniservo 14 tape units. Controls up to eight 9-track phase-encoded tape units. Additional Uniservo 14 tape units are housed in the 5045-02 auxiliary cabinet. Up to three auxiliary units may be attached to the 5045-99 allowing the total of eight tape units. Must be connected via one Multi-Subsystem Adapter module 0961-99 or F1321-99	21,168	110	441
5045-02	Uniservo Auxiliary Cabinet; consists of a Uniservo control cabinet with power distribution and space to mount one or two Uniservo 14 Tape Units	1,296	5	27
F0823-97	7-Track NRZI	5,544	16	113
F0826-00	9-Track NRZI	5,760	17	120

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UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
INPUT/OUTPUT UNITS (Continued)				
F1028-96	9-Track Addition; adds 9-track NRZI to F0823-97	4,176	11	87
F1028-95	7-Track Addition; adds 7-track NRZI plus data conversion to F0826-00	4,176	11	87
0870-03	Uniservo 14; 9-track phase-encoded tape unit; 96 KB per second at 1600 bpi	14,880	80	310
0870-04	Uniservo 14; 9-track phase-encoded and NRZI tape unit; 96 KB per second at 1600 bpi and 48 KB at 800 bpi	16,080	86	335
0870-05	Uniservo 14; 7-track NRZI tape unit; 48/33 4/12 KB per second at 800/556/200 bpi	14,880	80	310
F2194-00	U14 Dual Density; adds 9-track NRZI to a Uniservo 14 phase-encoded tape unit Type 0870-03	1,200	6	25
F2194-02	U14 7 to 9 Conversion; converts a Type 0870-05 Uniservo 14 7-track NRZI tape unit into a 9-track phase-encoded unit	—	—	—
F2194-03	U14 7 to 9 Dual Density; converts a Type 0870-05 Uniservo 14 7-track NRZI tape unit into a 9-track phase-encoded and NRZI unit; requires F0826-00 or equivalent in the control	1,200	6	25
0862-04	Uniservo 16 Tape Unit; 9-track, 1600 bpi	22,032	126	459
0862-06	Uniservo 16 Tape Unit; 7-track, 200/556/800 bpi	22,032	126	459
F0937-01	Dual Density Feature (for 0862-04)	2,448	—	51
F1319-00	Dual Access Feature	2,448	10	51
5034-99	Uniservo 20 Control Unit	52,416	126	1,092
F0823-98	7-Track Capability (permits addition of 7-track Uniservo 12 and/or 16 tape units)	5,544	16	113
F0826-99	9-Track NRZI (permits addition of 9-track Uniservo 12 and/or 16 tape units at 800 bpi)	6,552	21	133
F1028-98	9-Track Addition (adds 9-Track NRZI capability to F0823-98)	5,544	16	113
F1324-02	Shared Peripheral Interface (provides an additional I/O interface for the 5034-99 Control)	6,600	29	136
F1325-00	ASCII Translator (for 5034-99)	2,064	11	43
F1325-01	EBCDIC Translator (for 5034-99)	2,064	11	43
0864-00	Uniservo 20 Tape Unit; 9-track, 1600 bpi	27,696	132	577
F1510-00	Dual Access Feature (for 0864-00; permits simultaneous 2-channel access when used with two 5034-99 Controls)	2,448	10	51
5034-02	Uniservo 20 Control Unit	45,888	138	956
F2627-00	9-track Translation	2,064	11	43
5042-00	Uniservo 30 Control	55,392	288	1,154
F2131-00	Uniservo 30 9-track NRZI feature	3,648	19	76
F2585-00	Uniservo 30 9-track translation feature	2,064	11	43
F2584-99	Uniservo 30 7-track NRZI code translation feature	1,824	10	38
0872-00	Uniservo 30 9-Track Tape Unit	34,800	181	725
0872-02	Uniservo 30 7-Track Tape Unit	34,800	181	725
F2123-00	Uniservo 30 7- to 9-Track Conversion	3,774	—	79
0873-00	Uniservo 32 GCR/PE Tape Unit	31,584	164	658
0873-02	Uniservo 34 GCR/PE Tape Unit	36,192	188	754
0874-00	Uniservo 36 GCR/PE Tape Unit	38,880	202	810
0770-00	Printer, 800 lines per minute	56,304	255	1,173
0770-02	Printer, 1400 lines per minute	64,896	334	1,352
0770-04	Printer, 2000 lines per minute	86,686	425	1,806
0776-00	Printer, 760 lines per minute	40,800	200	850
F1533-00	160 Print Positions (for 0770 series printer)	4,416	18	92
F1534-00	Expanded Character Set Control (required for other than 1536-00 or -01 Print Cartridges)	2,880	5	60
	Print Cartridges for 0770 series printers:			
F1536-00	48-character alphanumeric Business	462	—	22
F1536-01	48-character alphanumeric Scientific	462	—	22
F1537-00	94-character ASCII	462	—	22
F1537-03	64-character universal ISO OCR-B	462	—	22
F1537-04	64-character universal OCR H-14	462	—	22
F1537-05	58-character COBOL-FORTRAN-Business	462	—	22
F1537-06	177-character International	462	—	22
F1537-09	24-character Numeric	462	—	22
F1537-11	68-character universal OCR-A	462	—	22
F1537-12	68-character universal OCR-B	462	—	22
F1537-13	68-character universal 77L	462	—	22
F0597-97	1004 Control (for on-line connection of a UNIVAC 1004 Card Processor)	12,480	34	260
F1095-02	1108/9000 Inter-Computer Control Unit (for on-line connection of a UNIVAC 9000 Series Computer)	8,920	51	215

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UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
INPUT/OUTPUT UNITS (Continued)				
0716-02	Card Reader and Control; 1000 cpm (connects to C/SP or on-line 9000 Series computer or MSA)	15,504	110	323
0768-02	Printer and Control; 840/1000 lpm (connects to C/SP or on-line 9000 Series computer or MSA)	58,320	422	1,215
0604-99	Card Punch and Control; 250 cpm (connects to C/SP, on-line 9000 Series Computer, or MSA)	22,234	117	463
COMMUNICATIONS SYMBIONT SUBSYSTEM				
3021-99	Communications/Symbiont Processor	22,176	73	449
F1276-99	1100 Channel Adapter	5,544	24	113
F1418-00	Special Device Channel	1,512	5	31
F1273-00	Selector Channel	6,500	24	133
F1274-00	Multiplexer Channel	6,300	24	128
F1577-00	I/O Expansion (provides two additional I/O features)	1,764	—	36
8541-88	C/SP Console (provides keyboard input and printer output console capability for the C/SP)	5,440	28	136
Storage for C/SP:				
7026-99	Storage; 32,768 bytes	42,840	153	867
7026-98	Storage; 49,152 bytes	64,260	231	1,301
7026-97	Storage; 65,536 bytes	85,680	298	1,735
7026-96	Storage; 98,304 bytes	128,520	420	2,602
7026-95	Storage; 131,072 bytes	171,360	541	3,469
F1775-94	Storage Expansion; 16,384 bytes; expands 32K storage to 49K	21,420	78	434
F1775-93	Storage Expansion; 16,384 bytes; expands 49K storage to 65K	21,420	66	434
F1784-98	Storage Expansion; 32,768 bytes; expands 65K storage to 98K	42,840	122	867
F1775-92	Storage Expansion; 32,768 bytes; expands 98K storage to 131K	42,840	121	867
0709-27	80-Column Card Reader	2,268	18	46
8542-00	General-Purpose Communications Channel	11,592	37	235
F1367-00	Multiplexer Expansion (adds 8 positions)	1,008	5	21
F1286-00	CLT Expansion Module	3,528	18	72
F1287-00	Active Line Indicators (for 16 lines)	504	—	10
F1287-01	Line Indicator Expansion (per 16-line increment)	504	—	10
F1287-08	Active Line Indicators (64 indicators and 32 lines)	1,008	—	21
F1287-09	Active Line Indicators (96 indicators and 48 lines)	1,512	—	31
F1287-10	Active Line Indicators (128 indicators and 64 lines)	2,016	—	41
F1287-11	Active Line Indicators (160 indicators and 80 lines)	2,520	—	51
F1287-12	Active Line Indicators (192 indicators and 96 lines)	3,024	—	62
F1287-13	Active Line Indicators (224 indicators and 112 lines)	3,528	—	72
F1287-14	Active Line Indicators (256 indicators 128 lines)	4,032	—	82
F1365-99	ATA (Asynchronous Timing Assembly)	768	5	16
F1290-00	Asynchronous CLT; EIA RS-232B	352	5	7
F1290-01	Asynchronous CLT; Mil. Std. 188B	352	5	7
F1290-02	Asynchronous CLT; CCITT	352	5	7
F1290-03	Asynchronous CLT; Telegraph I	352	5	7
F1290-04	Asynchronous CLT; Telegraph II	352	5	7
F1291-00	Synchronous CLT; EIA RS-232B	1,764	11	36
F1291-01	Synchronous CLT; Mil. Std. 188B	1,764	11	36
F1291-02	Synchronous CLT; CCITT	1,764	11	36
F1291-04	Synchronous CLT; Telpak	2,268	11	46
F1292-00	Dialing Adapter, Single	768	5	16
F1292-01	Dialing Adapter, Double	1,512	5	31
DATA COMMUNICATIONS				
8583-00	General Communications Subsystem (GCS)	19,344	58	403
F1971-00	Expansion Power Supply (required when more than 15 terminals are included in the GCS configuration)	2,160	35	196
F1972-00	Spare CTC (for controlling up to 32 lines in ESI mode on an I/O channel)	9,408	35	196
F1973-00	Communication Terminal Asynchronous (up to 2400 bps, asynchronous bit serial transmission)	1,632	8	34
F1973-01	Communication Terminal Asynchronous (same as F1973-02, but with external interrupt capability)	3,840	14	80
F1973-02	Communication Terminal Asynchronous—VII (provides for block parity generation and checking)	3,456	14	72
F1974-00	Communication Terminal Synchronous—Standard (up to 50,000 bps, synchronous bit serial transmission)	2,400	11	50
F1974-01	Communications Terminal Synchronous (same as F1974-02, but with external interrupt capability)	4,560	17	95
F1974-02	Communication Terminal Synchronous VII (provides for block parity and checking)	4,080	17	85

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UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
DATA COMMUNICATIONS (Continued)				
F1975-00	Communications Terminal Synchronous (up to 56,000 bps, bit serial transmission)	4,320	16	90
F1976-00	High-Level Communications Terminal (bit-oriented Data Link Control, up to 56,000 bps)	4,800	18	100
F1977-99	Communication Terminal Dialer	672	3	14
F1978-00	Communication Interface—Telegraph	240	1	5
F1979-00	Communication Interface—Modem	432	2	9
F1979-01	Identical to CI—modem (1979-00) except permits use of a modem not having a receive clock	672	3	14
F1980-00	Communication Interface—High-Speed (allows connection of a CTS—Std. or CTS—VII to the CCITT V. 35 interface)	864	4	18
F1980-01	Communication Interface (allows connection of a CTS—Std. or CTS—VII to the ATT 303 modem or equivalent)	864	4	18
F1983-00	Spare Basic Clock	240	1	5
F1984-00	Expansion Clock (provides asynchronous timing rates not included in the basic clock)	240	1	5
F2072-00	Allows connection of a CTS—Std. to a MIL 188C synchronous interface	672	3	14
F2074-00	Communications Interface—automatic inbound bit rate detection	1,440	3	30
DISTRIBUTED COMMUNICATIONS PROCESSOR				
8579-83	DCP; contains processor, clock, power supplies, control, 32K bytes of storage	40,668	187	1,017
F2224-00	I/C storage expansion; provides 16K bytes of additional storage to expand capacity from 32K to 48K, 64K to 80K, and 96K to 112K bytes	3,600	23	50
F2224-01	I/C storage expansion; provides 16K bytes of additional storage to expand capacity from 48K to 64K, 80K to 96K, and 112K to 128K bytes	1,800	23	45
F2268-00	I/O Controller; provides a programmable interface between DCP and parallel I/O channel and type 1 Scanner	3,200	14	80
F1795-01	Parallel I/O channel; 4 channels	2,400	10	60
F2691-00	Remote I/O controller; 16 channels	18,000	75	450
F1791-99	Host channel interface; provides connection to an 1100/80 byte multiplexer channel	3,136	13	78
F1800-99	Host channel interface; provides connection to switch between 2 byte multiplexer channels of a single 1100/80 or 2 separate 1100/80's	4,832	20	120
F2223-00	Single-port storage; provides a single access port to I/C storage	3,460	14	86
F2223-01	Multi-port storage; provides 4 access ports to I/C storage	4,040	25	101
8406-99	Diskette drive; 256K bytes	5,000	20	125
F2338-00	Drive expansion; provides for addition of second diskette drive	1,440	9	36
8408-02	Cartridge disk control; cabinet, control, and housing for up to 2 cartridge disk drives	5,564	23	139
F2380-04	Disk drive; 10 million bytes	20,296	90	472
F2187-00	Cartridge disk, dual; provides a second I/O interface for dual DCP configurations	1,568	7	39
5045-95	Uniservo 10 control	15,280	64	382
0870-27	Uniservo 10 9-track tape unit	12,576	67	262
8590-99	Remote control module	6,148	38	154
3536-86	DCP console	7,000	41	175
8541-76	DCP output printer; 30 cps	2,596	25	67
0774-97	Terminal printer; 300 cps	2,320	18	61
F1811-99	Scanner—Type 1	636	4	16
F2262-01	Scanner—Type 1 expansion	9,456	33	197
8591-00	Type 1 line adapter expansion cabinet	4,524	18	113
F2645-99	Universal Data Link Control module	2,580	10	65
F2643-01	UDLC module expansion	184	1	5
F2372-99	Type 1 UDLC line adapter	1,672	7	42

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