UNIVAC 1100 Series

MANAGEMENT SUMMARY

The UNIVAC 1100 Series of large-scale computers may have the longest history of any computer family. Its development began in 1948, shortly after completion of the ENIAC at the University of Pennsylvania. Since then, a long line of computer systems with progressively increasing power and flexibility has borne the 1100 Series designation. The early systems were intended for use in batch-oriented scientific and engineering applications. As the trend toward business data processing increased, the succeeding 1100's were designed to support functions that increased their performance in business applications while maintaining the performance levels that scientific/engineering users had grown to expect. UNIVAC recently stated that more than 1200 of its 1100 Series systems have been installed.

Most recently, UNIVAC has concentrated its efforts upon enhancing the high-end 1100/80 systems and consolidating the overall 1100 Series product line by enhancing the 1100/10 system into the performance range of the 1100/20 computers.

The 1100/80 systems were expanded from two systems to five systems. The original 1100/81 and 1100/82 systems, with one and two CPU's, respectively, were joined by a new low-end system called the 1100/80 and by two high-end multiprocessor models with three and four CPU's. The low-end 1100/80 CPU can be upgraded to full-performance status.

The performance of the 1100/10 CPU was enhanced by 20 to 30 percent by the introduction of 875-nanosecond MOS memory. This performance increase made the 1100/10 more cost-effective than the 1100/20 systems, effectively superseding the latter systems.

The UNIVAC 1100 Series is a family of large-scale computer systems that can perform effectively in a broad range of applications. Originally, these systems were directed toward batch-oriented scientific/engineering applications, but subsequent models and software enhancements have increasingly supported interactive and business-oriented capabilities.

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, 1100/80, 1100/81, 1100/82, 1100/83, and 1100/84.

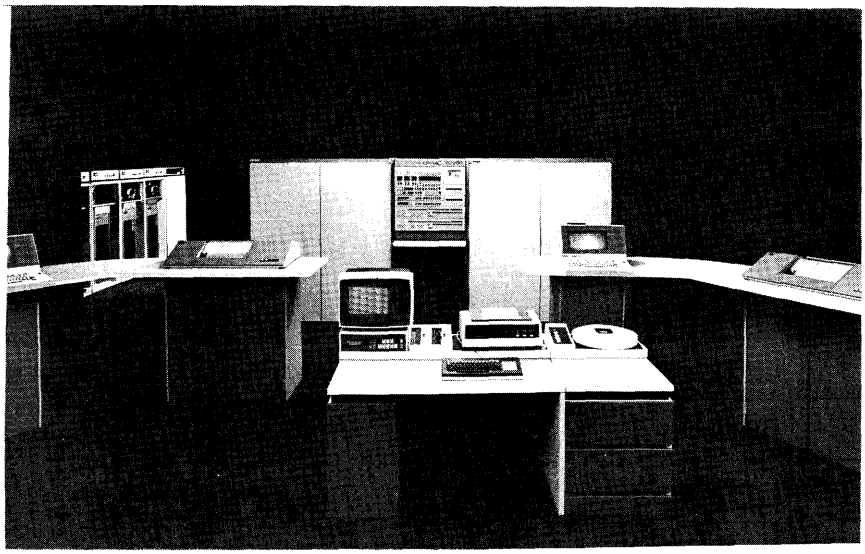
DATA FORMATS

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.

INSTRUCTIONS: One word, consisting of 6-bit Function Code, 4-bit Partial-Word or Immediate-Operand Designator,



The UNIVAC 1100/80 is the most powerful member of the 1100 Series family and is now available in five distinct models. Originally, only the single-processor 1100/81 and the dual-processor 1100/82 were offered. In October 1977, three more models were added: the low-end 1100/80 and the three- and four-CPU 1100/83 and 1100/84.

UNIVAC 1100 Series

In the following paragraphs, we will examine the principal characteristics of both past and present models of the UNIVAC 1100 family.

THE UNIVAC 1108

The 1108 was introduced in July 1964 as a single-processor system and as a multiprocessor configuration one year later. Although the venerable 1108 has been superseded by later models, its architecture served as the prototype for succeeding 1100 Series processor models. The 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 controllers that 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.
- 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 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

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: UNIVAC communications terminals and other I/O units can employ either a 6-bit Fieldata code or standard ASCII code. The 1100 processors are not code-sensitive and can manipulate data in 6-bit, 9-bit, 12-bit, or 18-bit codes.

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 or 262, 144-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 or 524,288-word banks. Two banks can be housed in one cabinet, with a maximum of four 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 all 1100 Series computer systems, a parity bit with each half-word is checked whenever storage is referenced and, in all models except the 1106, 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.

In 1100/10, 1100/20, and 1100/80 main storage, a 7-bit error correction code is generated for each word for all read and

UNIVAC 1100 Series

CHARACTERISTICS OF THE UNIVAC 1100 SERIES SYSTEMS

	1106	1106 II	1100/10 (1100/11, /12)	1100/20 (1100/21, /22)	1110	1100/40 (1100/41 to /44)	1100/80 (1100/80 to /84)
SYSTEM CHARACTERISTICS							
No. of central processors	1 or 2	1 or 2	1 or 2	1 or 2	1 to 4	1 to 4	1 to 4
No. of I/O controllers	None	None	None	None	1 to 4	1 to 4	1 to 4
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
Relative performance level (approximate)	1.0	1.3	1.3	2.0	4.8 to 16	4 to 15	6.6 to 34
Storage characteristics	1-level	1-level	1-level	1-level	Primary/ extended	Primary/ extended	Cache/main
MAIN STORAGE							
Type	Core	Core	MOS	MOS	Plated wire	Bipolar	MOS
Cycle time, nanoseconds	1500	1000	1125, 1000, or 875	875	280/480	280/380	1250 per 8 words
Interleaving	None	None	Standard	Standard	Standard	Standard	Standard
Minimum capacity, words	131,072	131,072	196,608	131,072	32,768	32,768	524,288
Maximum capacity, words	524,288	262,144	2,097,152	524,288	262,144	524,288	4,194,304
Error correcting	No	No	Yes	Yes	No	No	Yes
BUFFER STORAGE (CACHE)							
Type	None	None	None	None	None	None	ECL
Cycle time, nanoseconds	—	—	—	—	—		100
Capacity, words	—	—	—	—	—	—	4K to 32K
EXTENDED STORAGE							
Type	None	None	None	None	Core	MOS	None
Cycle time, nanoseconds	—	—	—	—	1500 or 750	1800	—
Minimum capacity, words	—	—	—	—	131,072	131,072	—
Maximum capacity, words	—	—	—	—	1,048,576	1,048,576	—
PROCESSING UNIT							
Integer add time, nanoseconds	1500	1000	1125	875	300	300	200
Scientific accelerator module	No	No	No	No	No	No	Yes
No. of instructions	144	144	146	146	199	199	219
Byte handling instructions	None	None	24	24	24	24	24
General registers	2 x 48	2 x 48	2 x 48	2 x 48	2 x 48	2 x 48	128
Instruction lookahead stack	None	None	4 inst.	4 inst.	4 inst.	4 inst.	—
Accelerated addressing	No	No	No	No	Yes	Yes	Yes
Segment descriptor registers	None	None	4	4	4	4	4
494 emulation mode	No	No	No	No	No	No	Yes
INPUT/OUTPUT CONTROL							
Number of I/O channels:							
Per central processor	4 to 16	4 to 16	4 to 16	—	—	—	—
Per I/O controller	—	—	—	8 to 24	8 to 24	8 to 24	2 to 26
Per system	4 to 32	4 to 32	4 to 32	8 to 96	8 to 96	8 to 96	2 to 104
Max. I/O data rate:							
Per I/O channel or channel module	333,000	333,000	444,000	571,000	500,000	500,000	2,000,000
Per central processor	667,000	1,000,000	888,000	1,142,000	—	—	—
Per I/O controller	—	—	—	—	4,000,000	4,000,000	—

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. Later in 1969, UNIVAC introduced an alternative 1.5-microsecond core memory system for the 1106. Called Unitized Storage, it cost only half as much as the original Multi-Modular Storage—but performance was degraded because the Unitized Storage did not permit overlapped accessing of instructions and data unless the memory capacity exceeded 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 included two independent processors (each with 4 to 16 I/O channels), 131K to 262K words of core

write operations. 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 areas and data areas 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 1100/10 and 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.

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

UNIVAC 1100 Series

storage,two CRT display consoles, and an Availability Control Unit that permitted the hardware to be partitioned into two independent systems.

In January 1972, UNIVAC introduced the 1106 II, a new model that delivered processing power intermediate between that of the original 1106 and the faster 1108. The 1106 II used 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 was 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 with Unitized Memory doubled its main memory size from 262K words to 393K or 524K words. The larger memory sizes were intended to benefit multiprocessor configurations and large data base-oriented systems. The 524K addressing capability could be installed on existing 1106 systems and did not require equipment replacement.

All models of the 1106 were program-compatible with the larger 1100 Series processors, had the same functional capabilities, and used the same software. UNIVAC delivered over 300 of the 1106 systems.

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 retained 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 were the key technical features of the 1110. Every system included 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 supported configurations were limited to one, two, three, or four CAU's, there were hardware provisions for connecting up to six CAU's.

Other significant technical innovations of the 1110 system included:

- A four-deep instruction stack in each CAU that permitted instruction look-ahead and concurrency.
- 112 high-speed control registers in each CAU.
- A powerful instruction set that included all of the UNIVAC 1108 instructions plus a new group of byte-

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: 100 nanoseconds per word.

CAPACITY: 4,096 to 32,768 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 can be expanded by the addition of 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. An additional SIU must be added to systems with three or four processors, providing a maximum of 32K words per system.

CENTRAL PROCESSORS

REGISTERS: In 1106, 1106 II, 1100/10, 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 1100/10 and 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

UNIVAC 1100 Series

INSTRUCTION EXECUTION TIMES FOR THE 1100 SERIES PROCESSORS

	1106	1106 II	1100/10 and 1100/20*	1110	1100/40	1100/80**
Load/store (36, 18, 12, 9, or 6 bits)	1.50	1.00	1.13/ 1.00/ 0.88	0.30	0.30	0.20/0.20
Load/store (72 bits)	3.00	2.00	2.25/ 2.00/ 1.75	0.60	0.60	0.40/0.40
Fixed-point add/subtract (36 bits)	1.50	1.00	1.13/ 1.00/ 0.88	0.30	0.30	0.20/0.20
Fixed-point add/subtract (72 bits)	3.17	2.17	2.38/ 2.13/ 1.88	0.60	0.60	0.45/0.45
Fixed-point multiply (36 bits)	3.67	3.17	2.75/ 2.63/ 2.50	1.50	1.50	1.40/0.60
Fixed-point divide (36 bits)	13.95	13.45	10.50/10.38/10.25	6.40	6.40	5.55/2.30
Floating-point add/subtract (single)	3.00	2.50	2.25/ 2.13/ 2.00	0.90	0.90	0.70/0.40
Floating-point multiply (single)	4.00	3.50	3.00/ 2.88/ 2.75	1.65	1.65	1.70/0.70
Floating-point divide (single)	11.50	11.00	8.63/ 8.50/ 8.33	5.30	5.30	4.85/2.10
Floating-point add/subtract (double)	4.50	3.50	3.38/ 3.13/ 2.88	0.75	0.75	0.95/0.70
Floating-point multiply (double)	6.67	5.67	5.00/ 4.75/ 4.50	2.40	2.40	2.35/1.40
Floating-point divide (double)	24.00	23.00	18.00/17.75/17.50	10.30	10.30	9.85/3.90

* Dependent on memory speed employed.
**Without/with scientific accelerator feature.

oriented commercial instructions that facilitated data manipulation, decimal arithmetic, code translation, radix conversion, and editing.

- An extended, 24-bit addressing capability that provided for direct addressing (through base registers) of up to 16 million words of storage.
- Input/Output Access Units (IOAU's) which controlled all I/O operations independently of the Command/Arithmetic Units. An 1110 system could include one, two, three, or four IOAU's, and each IOAU could 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 permitted 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 C/SP reduced the CAU load by 20 to 25 percent. The C/SP can also be used in the other 1100 Series computers.

The instruction stack within each CAU, together with the capability to simultaneously access multiple storage modules, permitted 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.) was one 300-nanosecond CAU cycle. Each CAU in an 1110 system provided approximately 1.8 times the raw computing power of the 1108 central processor.

State Register. In the 1100/10 and 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 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 1100/10 and 1100/20 have 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

UNIVAC 1100 Series

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

The second level of directly addressable storage for the 1110 was provided by conventional magnetic core storage in a choice of 1.5-microsecond or 750-nanosecond cycle times. The minimum configuration required at least 131K words of this extended storage; a maximum of 1048K words could be used. Two-way or four-way interleaving was offered as an option.

In January 1972, UNIVAC 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 were installed.

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 a new family of MOS memory-based 1100 Series computers. The 1100/10 replaced the UNIVAC 1106 system as the lower-priced 1100 Series computer. The central processor architecture and peripheral handling capabilities of the 1100/10 bore a remarkable resemblance to those of the larger 1100/20 system. Main memory sizes ranged from 131K to 524K words, identical with those of the 1100/20, although the initial 1100/10 cycle time of 1125 nanoseconds was slower than the 1100/20 cycle time of 875 nanoseconds. Both the 1100/10 and 1100/20 processors had comparable instruction repertoires, CPU design, and internal clock speed, although UNIVAC rated the 1100/10 somewhat 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. Later, UNIVAC introduced two additional memories for the 1100/10, a 1.0-microsecond version and, more significantly, a 0.875-microsecond version that brought the 1100/10 up to the performance level of the 1100/20.

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 introduction of the 0.875-microsecond memory, in February 1978, increased the performance level of the 1100/10 by 20 to 30 percent. An upgrade kit was also offered for installed 1100/10 systems that improved their

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 in microseconds and 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.

Instruction timings given for 1100/80 family processors are measured without the optional scientific accelerator module. Significantly faster execution times for fixed-point multiply and divide as well as floating point arithmetic instructions are obtainable through the accelerator module.

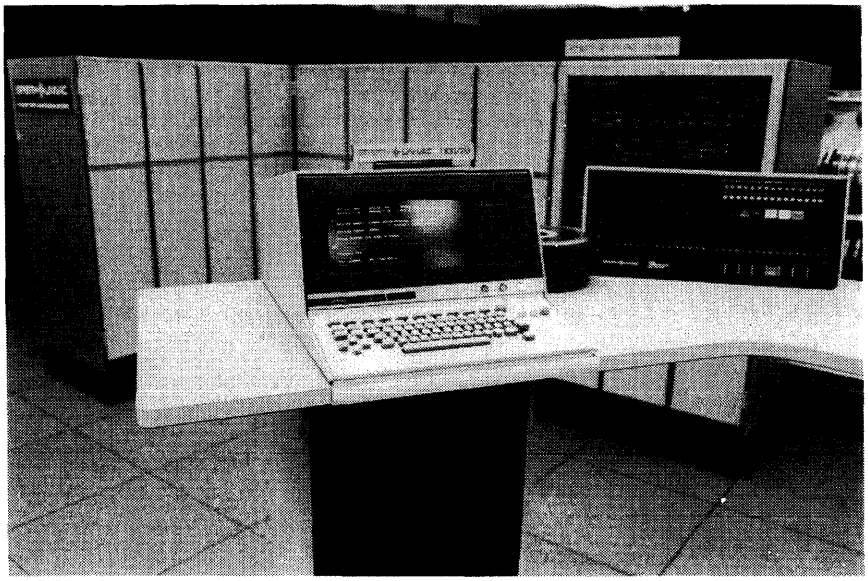
PROCESSOR MODES: When a processor is operating in Guard Mode, as denoted by the setting of a bit in the Processor State Register, no accesses to the Executive control registers are permitted, and the Storage Limits Register defines the main storage areas that can be accessed. When the Guard Mode bit 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 4013 System Console, used in the 1110, 1100/10, 1100/20, 1100/40, and 1100/80 systems, consists of a Uniscope 100 or Uniscope 200 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,

UNIVAC 1100 Series



The UNIVAC 1100/20 was the direct successor to the 1108. It has the same instruction set as the earlier model but features a modified addressing structure that permits improved multiprogramming. Early in 1978, UNIVAC introduced enhancements to the lower-priced 1100/10 system that boosted its performance level by 20 to 30 percent, making the 1100/10 a more cost-effective system than the 1100/20.

performance by between 10 and 20 percent. This enhancement made the 1100/10 equal in power to the 1100/20, and, therefore, the 1100/10 effectively superseded the higher model.

The 1100/10 can use the full complement of 1100 Series peripherals, including the 8405 Fixed-Head Disk, the 8430, 8433, 8434, and 8450 disk drives, and the Uniservo Series magnetic tape drives. The system can also 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, employed the 1106 architecture as its foundation, but also included several significant hardware enhancements that contributed to its improved performance and reliability characteristics. The most significant of these included 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 with a fault indicator panel for identifying malfunctions in major system components and an interface for UNIVAC's Total Remote Assistance Center (TRACE) facility, which permitted an 1100/20 to be connected directly to a TRACE center in UNIVAC's Roseville, Minnesota facility for on-line maintenance and diagnostics.

and an interface for the Total Remote Assistance Center (TRACE) remote diagnostic capability. An 1100/10 or 1100/20 processor has one System Console and can have one auxiliary console per processor. An 1100/80 processor can have any number required.

AVAILABILITY CONTROL UNIT (ACU): A component of 1106, 1100/10, 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 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 multiaccess peripheral subsystems.

SYSTEM TRANSITION UNIT (STU): 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 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

UNIVAC 1100 Series

- An Availability Control Unit for multiprocessor configurations that permitted manual separation of an 1100/20 system into two independent systems and provided 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 were available, the single-processor 1100/21 and the multiprocessor 1100/22. The latter model included two central processors with 4 to 16 input/output channels per system.

Although the 1100/20 systems are still offered, UNIVAC is quick to point out that the enhanced 1100/10 systems are more cost-effective choices.

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 introduction of the 1100/80. Both single-processor and multi-processor 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.

The 1100/40 systems, like the 1100/20, reflected UNIVAC's switch from plated-wire to semiconductor storage technology. Primary memory was 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 were achieved through the faster 380-nanosecond write cycle speed of the memory.

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

A 1 x 1 1100/41 system offered an estimated 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 outperformed a 4 x 4 1110 by approximately 15 percent for an additional 5 percent in price. Typical 1100/40 system rentals ranged from $45,000 to $250,000 per month, while purchase prices ranged from about $2 million to $12 million.

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 the Subsystem Availability Unit (SAU) and the Byte Channel Transfer Switch (BCTS) or by controls located on the individual subsystems.

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 a Uniscope 200 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; three are standard—a byte multiplexer channel, a block multiplexer channel, and a word channel module (four word channels)—and one more is 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 32 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 word channel module, so an IOU may have as many as 24 word channels. Two of the four word channels in each module may be externally specified index (ESI) channels. An ESI word channel can handle up to 32 full-duplex lines, making possible a total of 46 full-duplex lines on the two optional ESI 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 subsystems, and one of two types of core storage: 262K, 393K, or 524K words of 1.5-microsecond Unitized Storage or 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.

UNIVAC 1100 Series

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.

THE UNIVAC 1100/80

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

In the 1100/80 systems, 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. Either four or eight words at a time are fetched from the backing store into the buffer. All programs and data are loaded into the buffer for execution. Buffer storage ranges from 4K to 32K words in 4K-word increments. The buffer storage interface unit initially had a 125-nanosecond access time, which was later reduced to 100 nanoseconds.

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.

When first announced, the 1100/80 systems were offered in uniprocessor (1100/81) or dual-processor (1100/82) configurations, and main memory was subdivided into two banks, each having up to two million words. In October 1977, UNIVAC announced three additions to the 1100/80 family, a low-end model designated the 1100/80 and two multiprocessor configurations designated the 1100/83 (3 CPU's) and 1100/84 (4 CPU's). The four-CPU model is claimed to be significantly more powerful than the IBM 3033 processor and slightly more powerful than Amdahl's 470/V7.

The most important aspect of the October 1977 announcement was a new storage system that serves as a base for all of the current 1100/80 systems. All subsequent 1100/81

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 1125, 1000, or 875-nanosecond MOS main memory.

An 1100/12 or 1100/22 Multi-Processor System consists of two processors (each with System Console), 4 to 16 I/O channels, and associated peripheral subsystems. The system can have 262K to 524K words of main memory. A Shared Peripheral Interface (SPI) is required for each peripheral subsystem to be accessed by two processors, and a Multi-Module Access is required for each 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.

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.

An 1100/80 System is a limited-configurability version of the 1100/81 (below) that includes 4K words of buffer storage and one of two main memory configurations: 524K or 1048K words. The 1100/80 is fully compatible with the 1100/81 and can be upgraded to 1100/81 status.

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 or two Storage Interface Units with 16K to 32K words of buffer storage, one System Transition Unit, one System Maintenance Unit, one or more motor/alternator, and associated peripheral subsystems.

UNIVAC 1100 Series

FULLY SUPPORTED 1100/80 CONFIGURATIONS*

COMPONENTS	CONFIGURATION				
	1100/80	1100/81	1100/82	1100/83	1100/84
1100/80 CPU	1	—	—	—	—
1100/81 CPU	—	1	1	1	1
Expansion CPU's	—	—	1	2	3
Input/Output Channel Modules	3	3 to 16	3 to 32	6 to 32	6 to 32
Buffer Storage (words)	4K	8K to 16K	8K to 32K	24K to 32K	32K
Main Storage (words)	524K to 1024K	524K to 4194K	1048K to 4194K	1572K to 4194K	2096K to 4194K
System Consoles	1	1 or 2	1 or 2	1 to 3	1 to 4

*Does not apply to systems with earlier 1100/80 CPU's

and 1100/82 systems use this new storage architecture as well as the new 1100/83 and 1100/84 systems. The system architecture has been upgraded to support three- and four-CPU multiprocessor systems and features a new main storage system, increased buffer memory (SIU), and an improved Subsystem Availability Unit. An optional Scientific Accelerator Module (SAM) increases the execution speeds of floating-point and extended fixed-point arithmetic functions. This new module is claimed to provide overall performance increases of up to 15 percent in applications that are heavily scientific in nature.

Customers with installed 1100/81 or 1100/82 systems who wish to upgrade these systems to 1100/83 or 1100/84 systems must exchange the Main Storage Unit, the Storage Interface Unit, and the System Transition Unit.

The new main memory employs 16K-bit MOS chips and can now be divided into four banks instead of the two-bank architecture that was previously possible. However, each bank must be equal in size.

The basic 1100/83 system includes three processors with 24K words of buffer storage, 1536K words of backing store, two byte multiplexer channels, two block multiplexer channels, eight word channels, system console, system maintenance unit, system transition unit, and two motor/alternators. Purchase price is $3,677,228, and monthly rental is $105,285 on a 1-year lease. The 1100/83 will provide about three times the performance of a basic 1100/81. Compared to IBM systems, UNIVAC says the 1100/83 offers about 1.25 times the performance of the IBM 3033 for about the same price.

The 1100/84 is a four-processor system that is said to provide a 60-percent performance advantage over the IBM 3033 while priced only 10 percent higher. A basic 1100/84 system includes 32K words of buffer storage, 2048K words of backing store, two byte multiplexer channels, two block multiplexers, eight word channels, two system maintenance units, two system consoles, and two motor/alternators. The system purchase price is $4,639,783, and the monthly rental is $133,620 on a 1-year lease.

An 1100/83 System consists of three Central Processor Units, two to four Input/Output Units, two or more System Consoles, three to four MSU's capable of controlling 1572K to 4194K words of main memory, 24K to 32K words of buffer storage, one System Transition Unit, two System Maintenance Units, two or more motor/alternator units, and associated peripheral subsystems.

An 1100/84 System consists of four Central Processor Units, two or four Input/Output Units, two or more System Consoles, four MSU's capable of controlling 2096K to 4194K words of main memory, 32K words of buffer storage, one System Transition Unit, two System Maintenance Units, two or more motor/alternator units, 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 CPU). 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 and IOU's can 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

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.

UNIVAC 1100 Series

The entry-level 1100/80 processor is a limited-expandability version of the 1100/81 CPU with only 4K 36-bit words of buffer storage, instead of the 8K words incorporated in the larger version. The smaller system provides only 524K to 1024K words of backing store (main memory), whereas the 1100/81 can support up to 4096K words. The 1100/80 can, however, be upgraded to 1100/81 status by the addition of a Performance Enhancement option.

The UNIVAC 1100/80 entry-level system includes one processor, 4K words of buffer storage, 512K words of backing store, one byte multiplexer channel, one block multiplexer channel, four word channels, maintenance unit, system console, and motor/alternator. Purchase price is $1,447,670, and monthly rental is $34,185 on a 1-year lease. This smallest 1100/80 system is said to provide about 30 percent greater internal performance than IBM's Model 3031 at a price that is about 7 percent lower.

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 disk pack drives. The company's early emphasis on drums has shifted to interchangeable disk pack drives, although the high-performance FH-432 drum units are still used for operating system residence and program swapping in some 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 disk drive and the 8430 and 8433 removable disk drives, can be intermixed on a single 5039 microprogrammed control unit. The two versions of the 8405 Fixed-Head Disk 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 Disk Drive has a capacity of 17 million 36-bit words (or 100 million bytes) per unit, while the "double density" 8433 Disk 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 disk units, or a combination of up to eight 8405 fixed-head drives and eight 8430 and/or 8433 removable disk 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 disk 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 disk drives in any combination. Up to

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 DISK SUBSYSTEM: Provides rapid access to up to 11 million 36-bit words per subsystem stored in nonremovable head-per-track disks. 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 Disk provides six recording surfaces and up to 688,128 36-bit words (3.1 million bytes) per disk drive, and the 8405-00 provides 12 recording surfaces and up to 1,376,256 36-bit words (6.2 million bytes) per disk 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 Disk Subsystem consists of a 5039 Control Unit with an F2076 8405 Fixed-Head Disk attachment and from one to eight 8405 Disk Drives. From two to eight 8433 and/or 8430 Disk Storage Drives also can be intermixed on the 5039 Control Unit. A Dual Access feature on each 8405 Disk Drive provides dual access when two 5039 Control Units are present.

8425 DISK STORAGE: Provides medium-capacity random-access storage in 11-disk packs which are physically compatible with the IBM 2316 Disk Packs. The 8425 records data at 2220 bpi and records 406 tracks on each disk surface. Thus, the 8425 can store up to 58.34 million bytes in each pack. A servo-controlled electromagnetic actuator yields an 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 Record 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 Disk Storage units. A Multi-Subsystem Adapter (MSA) equipped with the Function Buffer Expansion and Search Identifier Register features is a prerequisites. A dual-access subsystem can be configured by installing the Dual Access feature in each 8425 Disk Storage unit and adding second control unit and the MSA Expansion feature.

8430 DISK SUBSYSTEM: Provides large-capacity random-access storage in interchangeable 11-disk packs with storage capacities comparable to the standard-density (100-million-byte) IBM 3330 Disk Storage Subsystem. Each disk 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

UNIVAC 1100 Series

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

In October 1977, the 8450 Disk Storage Subsystem was announced. The 8450 disk drive includes both moving-head and optional fixed-head access and provides up to 67 million words of storage. The optional fixed-head capability provides an additional 241,920 words of fast-access storage per non-removable disk pack. The 8450 disk drives attach to the 1100/80 systems through the 5046, which can control up to 16 drives. An additional 16 drives can also be controlled through an optional expansion feature. An 8450 subsystem can also include the earlier 8430 and 8433 disk drives and can be adapted for dual-access operation.

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 the C/SP, an on-line UNIVAC 9200 or 9300 Processor, a Multi-Subsystem Adapter (MSA), or direct connection to an 1100/80 multiplexer channel.

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 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 Disk Drives and eight Uniservo 16 Magnetic Tape Units, for use in message staging, audit trail preparation, and store-and-forward message switching applications. Important 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 C/SP console. New full-duplex transmission capabilities are designed to improve remote batch processing capabilities using either a UNIVAC DCT 1000 or UTS 700 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.

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

Fixed-Head Disk Drives. The 8430 Disk Pack Drives can also be intermixed with 8433 Disk 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 Disk Storage Drives. A dual-access feature and a second 5039 Control Unit permit simultaneous read and write operations on any two 8430 Disk Drives. The 8430 features a command retry facility and error correction coding circuitry.

8433 DISK SUBSYSTEM: Provides random access to very large quantities of data stored on removable "double-density 3330-type" disk packs. Each industry-standard disk 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 Disk 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 Disk Pack Drives can be intermixed on one 5039 Control Unit up to the maximum of 8 or 16 drives. In addition, 8433 and 8430 Disk Pack Drives can be intermixed with 8405 Fixed-Head Disk 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 DISK SUBSYSTEM: Consists of a 5046 Storage Control Unit and from 2 to 16 (in any combination) 8430, 8433, or 8434 disk drives. Up to 16 additional disk drives can be added to the 5046. Optionally, the controller can also handle the 8405 Fixed-Head Disk 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, microprogrammed control unit that offers on-line diagnostic capability for more effective trouble-shooting. The microprogram is loaded from a diskette.

The 8434 disk 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 disk 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 67 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.

8450 DISK SUBSYSTEM: The 8450 disk drive, introduced in October 1977, provides up to 67 million words of storage. The non-removable disks provide 15 recording surfaces, each having 555 tracks (plus 5 spares) and serviced by 2 read-write heads. Up to 242K words of fixed-head storage can be added to each unit. The average head-positioning time is 23 milliseconds, and the average rotational delay is 8.3 milliseconds (3600 rpm). Data transfer rate is 280,000 words per second.

The 8450 disk drives connect to a word channel through the 5046 Storage Control Unit (SCU), which permits the drives

UNIVAC 1100 Series

The UNIVAC 1100/10 was introduced as a lower-cost alternative to the 1100/20. It is now available with a choice of three main memory speeds (875, 1000, or 1125 nanoseconds), and the fastest of these raises the 1100/10's processing power to the level of the 1100/20.

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 posibility 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.

Concurrently with the DCA announcement, 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 DCU, which can have disks, diskettes, or tapes attached, as well as a communications scanner 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 con-

to be intermixed with 8430 and 8433 disk drives. The 5046 SCU can control up to 16 drives, and can be expanded to provide control for up to 16 additional drives through the F2837-00 Power Control Expansion. Disk drives are attached to the 5046 SCU in groups of four. Each group can consist of either 8430/8433 drives or 8450 drives. The 8450 disk drives can also be adapted for dual access by addition of the F2718-99 Dual Access Feature, which permits simultaneous Read/Write, Read/Read, Write/Read, and Write/Write access on any two drives. Additional features of the 5046/8450 subsystem include rotational position sensing, error correction facilities, and enhanced command retry.

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 units. On all systems except the 1100/80, 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

UNIVAC 1100 Series

figured as a front-end processor, nodal processor, or remote concentrator. This software provides the necessary message control, routing, and network control to communicate 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 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 disk pack drives instead of drums for all systems functions. The Disk-Resident version provides all the facilities of the full 1100 Operating System, at some sacrifice in performance because of the slower disk access times.

UNIVAC software facilities that operate under the control of the 1100 Operating System include processors for the COBOL, FORTRAN, ALGOL, BASIC, JOVIAL, PL/1, APL, RPG, 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 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

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.

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. On all systems except the 1100/80, 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. On all systems except the 1100/80, the Multi-Subsystem Adapter (MSA) 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

UNIVAC 1100 Series

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.

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 "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

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.

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), the Multi-Subsystem Adapter (MSA), or directly to the byte multiplexer channel of an 1100/80 CPU.

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), the Multi-Subsystem Adapter (MSA), or directly to the byte multiplexer channel of an 1100/80 CPU.

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, the Multi-Subsystem Adapter (MSA), or directly to the byte multiplexer channel of an 1100/80 CPU.

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), or directly to the byte multiplexer channel of an 1100/80 CPU.

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,

UNIVAC 1100 Series

$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 and the 303X Series processors, the Honeywell Series 60 Level 66 systems, the Burroughs B 6700 and B 6800 systems, 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 1100/11 system provides approximately twice the internal performance of an IBM System/370 Model 145 at slightly less cost, while a multiprocessor 1100/12 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 303X Series processors.

USER REACTION

Twenty respondents with a total of 23 UNIVAC 1100 Series systems responded to the 1977 Datapro survey of general-purpose computer users. This sample consisted of six 1106 systems, eleven 1108 systems, three 1110 systems, one 1100/10 system, and two 1100/40 systems. Approximately half of the users were federal or city government agencies, and the others represented manufacturers, schools, insurance companies, and financial institutions.

The users cited various system applications, but those most frequently mentioned were business data processing and program development. Over half indicated scientific/engineering applications, and nearly as many reported data communications and data base management uses. The installed life of the systems varied from 2 to 84 months, and the average was 42 months.

A typical system in the survey had 256K words of memory, and the range was from 64K to 512K words. The average amount of disk storage was 1355 megabytes, with a low of 160 megabytes and a high of 6664 megabytes; however, only four systems exceeded the average figure. All of the respondents were using magnetic tape, and the average number of tape drives was seven per system.

Twelve of the 20 users were utilizing remote batch terminals; the greatest number, 200, was claimed by a federal government agency with an 1108 processor. The same user reported using 200 interactive terminals. An average system, however, was found to include 14 remote batch terminals and 38 interactive terminals.

Summarized in the following table are the users' ratings of the Univac 1100 Series equipment, software, and support.

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 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 II communication controller, and the remote control module.

UNIVAC 1100 Series

	Excellent	Good	Fair	Poor	WA*
Ease of operation	7	11	2	0	3.3
Reliability of mainframe	5	12	2	1	3.1
Reliability of peripherals	4	8	8	0	2.8
Responsiveness of maintenance service	9	7	4	0	3.3
Effectiveness of maintenance service	5	10	5	0	3.0
Technical support	3	7	7	1	2.7
Operating system	6	14	0	0	3.3
Compilers and assemblers	4	15	1	0	3.2
Applications programs	2	7	7	0	2.7
Ease of programming	6	12	2	0	3.2
Ease of conversion	1	8	7	0	2.6
Overall satisfaction	3	14	3	0	3.0

*Weighted Average on a scale of 4.0 for Excellent.

Surprisingly, the 1100 systems' ratings for overall user satisfaction dropped from 3.5 in Datapro's 1976 survey to 3.0 in 1977, which was slightly below the average rating in that category for all systems in the 1977 survey. In previous years, the Univac systems' overall satisfaction ratings had steadily increased.

Two categories—reliability of mainframe and responsiveness of maintenance service—have shown consistent drops through the years, although both are still rated above the "good" (3.0) level. The users' ratings of technical support and the 1100 Series Operating System were also lower in 1977, as were ease of programming and ease of conversion.

Improved ratings were seen only for technical support and applications programs—which is another surprise, since this is contrary to the general trend of user ratings given to other vendors' systems.

It should be noted that nearly 70 percent of the survey population reported having the older UNIVAC 1106 and 1108 systems, and that the majority of negative comments were received from this group. At the same time, this group of users was most specific in noting their satisfaction with the operating system.□

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.

Additional details on the Distributed Communications Processor can be found in Report 70D-877-41 (Volume 2).

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 disk 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 disk and 5 million bytes on a removable disk. Recording is on four surfaces in each unit, two on each disk. The disk 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 disk 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 disk can store up to 256,000 bytes of data. The disk 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 II is a communications multiplexer that provides communications line termination and multiplexing for the Distributed Communications Processor (DCP). The DCP with the Scanner II expansion provides up to 128 half-duplex or 64 full-duplex lines. The Scanner II is located in its own cabinet with its own power supply. Up to two Scanner II's can be attached to the DCP, supporting up to 256 half-duplex or 128 full-duplex communications 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 operands; 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 Report 70C-877-01.

UNIVAC subsequently enhanced the C/SP through the substitution of MOS memory for plated-wire storage, the capability to attach one tape controller with up to sixteen

UNIVAC 1100 Series

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 Disk 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 disk 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: 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.

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 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.

UNIVAC 1100 Series

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 or 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 modules 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.

The Quota System has been added to the 1100 Operating System 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 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 program or library 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, 1100/40, and 1100/80 systems and

UNIVAC 1100 Series

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, 1100/40, and 1100/80 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 saved 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. Moreover, 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. Recoverable Error Edit (EDTERR/RECERR) programs produce reports 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 STU, 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 STU, 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 and Performance Analysis Reports (SIP/PAR) consist of a set of data collection routines that execute under the 1100 EXEC and a set of user-level data reduction programs. SIP/PAR 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 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.

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

UNIVAC 1100 Series

The UNIVAC 1100/40 has an architecture similar to that of the earlier UNIVAC 1110 and employs the same two-level main storage/extended storage scheme. It differs from the earlier system in the use of faster bipolar memory for main storage instead of the 1110's plated-wire technology and in the use of 800-nanosecond error-correcting MOS memory for extended storage instead or core. The use of denser semiconductor memory permitted the 1100/40 to have twice the memory capacity of the 1110.

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, and COBOL; and access to the compilers for BASIC, FORTRAN, COBOL, ALGOL, and APL. CTS provides the user with a simplified command language editor. For the support of a greater number of simultaneous users, an option called High-Volume Time-Sharing (HVTS) is provided. HVTS features an even more simplified command language (a subset of CTS).

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 1100 is a comprehensive data base management system developed under the guiding principles 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 four principal components: a Data Description Language, a Data Manipulation Language, a Data Management Routine, and a Data Recognition Utility.

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. DMS 1100 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. It 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.

UNIVAC 1100 Series

In addition to the DDL for the schema, there is a Subschema Data Definition Language (SDDL) which provides for specification of subsets of the areas, records, and sets of the schema.

The Data Manipulation Language (DML) consists of commands embedded in COBOL, FORTRAN, and PL/1 to allow these host languages to manipulate the data base via DMS 1100. The DML is the procedural language used by individual programmers to access the data base. It is used in connection with a host language—COBOL, FORTRAN, or PL/1—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."

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.

The Data Reorganization Utility (DRU) provides for optimization of the physical placement of records within an existing data base without the need for tailored unload and reload programs. The DRU consists of two modules: a Reorganization Syntax Analysis (RSA) Module, which accepts reorganization specifications and the data base scheme as input; and a Reorganization Module (REORG), which accomplishes the reorganization directly against the data base in an optimized manner.

QUERY LANGUAGE PROCESSOR: QLP 1100 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. QLP also provides a report writer and procedural facilities.

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.

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, DCT 1000, and UTS 400 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.

The most recent enhancements 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 disk or tape, and to initiate automatic recovery procedures for the C/SP using the audit files.

UNIVAC 1100 Series

NINE THOUSAND REMOTE (NTR) 9000 INTERFACE: Enables a UNIVAC 9200/9300, 90/30, or 90/40 computer system equipped with a Data Communications Subsystem (DCS) or Communications Adapter 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 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: The newest and most powerful COBOL compiler offered by UNIVAC is 1100 Series ASCII COBOL. This compiler implements the modules of the 1974 American National Standard COBOL. 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. Some of the 1974 American National Standard COBOL facilities 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 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 COBOL and an earlier Fieldata COBOL compiler. 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.

ASCII FORTRAN: 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 implements the new FORTRAN 77 Standard. It contains features specified by the standard as well as many language extensions, including 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, re-entrant, common-banked compiler that provides for extensive optimization, generates re-entrant programs, and contains facilities designed to fully utilize 1100 Series hardware features and the operating system. Some of these features are I/O data format compatibility, interlanguage communication with COBOL and PL/1, sort/merge capability, and an interface with DMS 1100. 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 re-entrant ASCII FORTRAN Syntax Analyzer (BTFN), which is used in conjunction with the Conversational Time-Sharing software. BFTN aids the time-sharing user in constructing, editing, and debugging the syntax of ASCII FORTRAN programs from a demand terminal.

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 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

UNIVAC 1100 Series

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 1100 Series Meta-Assembler (MASM) is capable of generating code for any binary machine, but is tailored to be especially efficient for the 1100 Series instruction set. MASM provides all the conventional features of an assembler: code and data generation, symbol definition, space definition, and external communication with separately constructed elements. As an assembler, MASM is highly compatible with (and a replacement for) the 1100 Series Assembler (ASM).

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)
ASET (Author System for Education and Training)
FMPS (Functional Mathematical Programming System)
GPSS 1100 (General Purpose System Simulator)
OPTIMA (Project Management System)
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.

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 Disk 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 Disk Drives, two 8405 Fixed-Head Disk Drives, eight 9-track Uniservo 16 (192KB) Tape Units, Communications/Symbiont Processor with 98K bytes of memory, 1000-cpm Card Reader, 250-cpm 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 Disk 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 Disk 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.

SMALL 1100/40 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 Disk 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 Disk 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 4 x 2 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 Disk 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.

UNIVAC 1100 Series

SMALL 1100/80 SYSTEM: Consists of one 1100/80 Processor with I/O unit, 4K words of buffer storage, 524K words of backing store, system console, one word channel module with ESI/ISI capability, eight 8434 Disk 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 $53,400 and $2,256,900, 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, 1024K words of backing store, twelve 8434 Disk Drives, two 8433 Disk Drives, two 8405 Disk 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. Monthly rental and purchase prices are approximately $117,500 and $5,050,800, respectively.

SOFTWARE AND SUPPORT: UNIVAC is still largely "bundled," and the equipment prices listed above include most of the UNIVAC software described in this report and all normal educational courses and professional assistance. However, UNIVAC has released separate monthly rental prices for the UNIS (UNIVAC Industrial System), OPTIMA, and ASET application programs for all 1100 Series systems. Monthly charges for the UNIS modules are as follows: UNIS Master Data Processor—$150; UNIS Production Planning and Scheduling—$300; and UNIS Inventory Management—$300. Monthly charges for OPTIMA and ASET are $300 and $375, respectively.

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 between the hours of 7 a.m. and 6 p.m., Monday through Friday. Extended periods of maintenance are available at premium rates. The premiums for additional coverage are a percentage of the base maintenance rate and are as follows:

	Hours of Coverage								
	4	8	9	10	12	16	18	20	24
Monday through Friday	—	—	0	10	20	25	35	40	45
Saturday	5	8	9	—	11	12	—	14	15
Sunday and Holidays	7	10	12	—	14	16	—	18	20

Maintenance service performed outside the contracted maintenance period is subject to the following rates:

	Monday through Saturday	Sunday and Holidays
Min. charge per call	$108	$128
Each add'l. hour	54	64
Max. charge per call	270	320

For users who elect not to contract for maintenance with Univac, the following per-call rates apply:

	Monday through Friday	Overtime and Saturday	Sunday and Holidays
Min. charge	$100	$112	$132
Each add'l. hour	50	56	66

On-call maintenance is also subject to travel time and expense charges.

UNIVAC offers reduced maintenance rates for multiple-processor installations. The percent premiums listed below apply to installations containing two or more processors or systems of the same type and located at the same address.

	Two-Processor Installation Hours of Coverage		
	9	16	24
Monday through Friday	0	15	27.5
Saturday	6	8	10
Sunday and Holidays	7.5	10	12.5

	Three or More Processors Hours of Coverage		
	9	16	24
Monday through Friday	0	12	22
Saturday	5	6.5	8
Sunday and Holidays	6	8	10

LONG-TERM LEASES: In addition to the basic 1-year agreement, UNIVAC offers an extended-term 5-year lease at significantly lower monthly rates. Under the 5-year "level-payment" agreement, the monthly equipment charge is approximately 75 percent of the 1-year rental rate shown in the accompanying price list.

UNIVAC also offers a 7-year lease to state and local governments and to educational institutions. Educational institutions are eligible for an additional 10 percent discount. The discount does not apply to maintenance service charges.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1106 PROCESSORS AND MAIN STORAGE				
3011-20	1106 Processor with 128-word control memory, double-precision floating point, four I/O channels (12 through 15), and power distribution center; requires 4009-99 display console and card reader	$ 348,816	$1,822	$ 7,267
F0680-99	I/O Channel Expansion; four additional channels, maximum three expansions per 1106 processor	25,200	84	525
F1053-98	Multiprocessor Capability for 1106 processor; one required per processor	10,368	NA	216
Unitized Storage; 1.5-microsecond cycle time:				
7013-04	Unitized Storage; 131,072 words, 1.5-microsecond cycle time, expandable to 524,288 words	220,512	789	5,290
7013-79	Unitized Storage Expansion; expands main storage from 131,072 to 262,144 words	220,512	789	5,290
7013-78	Unitized Storage Expansion; expands main storage from 262,144 to 393,216 words; requires F2252-00 addressing expansion feature	96,000	789	2,300
7013-77	Unitized Storage Expansion; expands main storage from 393,216 to 524,288 words	96,000	789	2,300
F2252-00	Addressing Expansion Feature; required on 1106 processors with more than 262K words of Unitized Storage	9,600	12	200

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1106 PROCESSORS AND MAIN STORAGE (Continued)				
Storage II (Multi-Modular); 1.0-microsecond cycle time:				
7005-42	131,072 words; two 64K modules	534,144	1,255	11,128
7005-41	196,608 words; three 64K modules	803,376	1,815	16,737
7005-40	262,144 words; four 64K modules	1,072,896	2,369	22,352
4009-99	Display Console; includes control console, entry keyboard, CRT display, and page printer; one required with each 1106 processor	42,240	428	880
F0774-00	Auxiliary Console; required when CTMC's are used	8,784	17	183
1106 MULTIPROCESSOR SYSTEM COMPONENTS				
Minimum multiprocessor configuration with unitized storage consists of two 1106 processors, two F1053-98 capability features, two display consoles, two 128K modules of unitized storage, two unitized MMA's, and one availability control unit. Minimum multiprocessor configuration with Storage II consists of two 1106 processors, two F1053-98 capability features, two display consoles, 128K words of 7005 Storage II, two Storage II MMA's, and one availability control unit.				
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	135	1,315
F0874-00	ACU Expansion for up to six additional SPI's	3,552	13	74
0955-04	Shared Peripheral Interface; permits two processors to share a peripheral subsystem	24,528	31	511
0955-05	Shared Peripheral Interface; same functional characteristics and shares a cabinet with 0995-04 SPI	21,840	24	460
F1384-98	Unitized MMA; allows two processors to access a 128K module of unitized storage	45,312	97	944
0954-99	Storage II MMA; allows two processors to access a 64K module of 1.0-microsecond Multi-Modular Storage	67,488	64	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 (RTMCW) interface, and 128K words of main storage; requires card reader	256,752	1,668	5,349
3011-75	1100/10 Processor; same as 3011-81 processor, but includes 196K words of main storage, 5046-99 disk control, and 8434 disk drive	463,500	2,897	9,349
3011-69	1100/10 Processor; same as 3011-75 processor, but includes 262K words of main storage	527,520	3,093	14,239
3011-73	1100/10 Processor; same as 3011-69 processor, but includes two main storage units with 262K words of main storage	547,600	3,221	14,778
3011-67	1100/10 Processor; same as 3011-73 processor, but includes two main storage units with 524K words of main storage	810,000	4,118	22,768
F2882-00	Processor Performance Enhancement; provides 10 to 20 percent greater performance for 1100/10 processor	27,380	160	740
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 128K storage expansion (7036-99); also requires two F1053-98 multiprocessor capability features plus two F2249-00 MMA's	256,752	1,668	5,349
3011-75	1100/10 Processor; same as 3011-81 processor, but includes 196K words of main storage, 5046-99 disk control, and 8434 disk drive	463,500	2,897	9,349
3011-69	1100/10 Processor; same as 3011-75 processor, but includes 262K words of main storage	527,520	3,093	14,239
3011-73	1100/10 Processor; same as 3011-69 processor, but includes two main storage units with 262K words of main storage	347,600	3,221	14,778
3011-67	1100/10 Processor; same as 3011-73 processor, but includes two main storage units with 524K words of main storage	810,000	4,118	22,768
F2882-00	Processor Performance Enhancement; provides 10 to 20 percent greater performance for 1100/10 processor	27,380	160	740
F0680-99	I/O Channel Expansion; four additional I/O channels; maximum of three expansions per 1100/10 processor	25,200	84	525
F1053-98	Multiprocessor Capability for 1100/10 processor; one required per processor	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	55	350
7036-99	Storage Expansion, 128K; provides cabinet with 131,072 words of storage and space for one additional 128K expansion module via feature F2248-99; maximum of three type 7036-99 storage units per system	170,000	520	4,615
F2248-99	Storage Expansion, 128K; 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	134,000	392	3,460
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	77	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	196	6,081
F2248-97	1100/10 Expanded Processor Upgrade; upgrades an 1100/10 expansion processor (3011-79) to an 1100/20 processor (3011-83)	195,888	83	4,081
F2248-96	7036 Storage Upgrade; upgrades a 7036-99 storage expansion 128K to a 7033-97 storage 64K with an F2079-99 storage expansion	79,600	113	1,385
7033-95	F2248-99 Storage Upgrade; upgrades an F2248-99 storage expansion 128K to a 7033-97 storage 64K with an F2079 storage expansion	115,600	241	2,540

*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				
3011-83	1100/20 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; requires 128K words of main storage and card reader	452,640	1,751	9,430
F0680-99	I/O Channel Expansion; provides four additional I/O channels; maximum three expansions per 1100/20 processor	25,200	84	525
F1053-98	Multiprocessor Capability for each 3011-83 processor in a multiprocessor system	10,368	NC	216
0769-10	Incremental Printer; provides a 132-column, 30-cps, free-standing printer for use as an additional hard-copy device on the 1100/20 processor console; up to five printers permitted per processor	16,800	55	350
7033-97	Storage, 65,536 words; includes a cabinet with space for an additional 64K words via F2079-00 expansion; maximum four 7033-97 storage units per processor	162,240	412	3,900
F2079-99	Storage Expansion, 65,536 words	87,360	221	2,100
F2080-97	Multi-Module Access (MMA) for multiprocessor application only; allows a maximum of two 1100/20 processors to access a 7033 storage unit	45,312	77	944
1100/20 MULTIPROCESSOR SYSTEM COMPONENTS				
2506-04	Availability Control Unit (ACU); required for multiprocessor applications	62,256	135	1,315
F0874-00	ACU Expansion; expands the SPI Access capability of the ACU by six SPI's; maximum of three expansions may be added	3,552	13	74
0961-99	Multi-Subsystem Adapter (MSA); includes cabinet, I/O interface, one MSA module to adapt from one to eight byte-oriented subsystems, and space for one F1321-02 MSA module	26,976	66	562
MSA Features:				
F1321-99	MSA Expansion; provides second MSA module with power supply to expand 0961-99 MSA; includes one I/O interface	21,504	50	448
F1324-02	Shared Peripheral Interface (API); provides one I/O interface for 0961-99 MSA or F1321 MSA expansion	6,600	32	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	10	46
F1325-00	ASCII Translator; translates Fieldata code to and from a 64-character subset of ASCII; maximum two per MSA module	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	Search Identifier Register (SIR); provides storage for up 12 bytes of parameter (search) data required for disk operations	2,208	10	46
0955-99	SPI; provides control of a peripheral subsystem as a multi-access subsystem	24,528	31	511
0955-98	SPI; although functionally independent, shares cabinet with and has the same characteristics as 0955-99 SPI	21,840	24	460
F1095-99	1100/9000 Inter-Computer Control Unit (ICCU); permits a 9300 Series system to communicate on-site in 36-bit word format	11,184	56	233
1110 PROCESSORS AND I/O CONTROL				
3023-95	1110 Processor (CAU); includes eight I/O channels and interfaces for up to 262,144 words of main storage and 1,048,576 words of extended storage; requires 32K words main storage, 128K words of extended storage, card reader, and system console; maximum three CAU expansions and three IOAU expansions	617,856	2,870	14,850
3023-00	CAU Expansion; provides one additional CAU; requires 64K words of main storage, 256K words of extended storage, and system console (use of a second CAU expansion requires 96K words main storage, 256K words of extended storage, system partitioning unit, IOAU expansion, and two system consoles; use of a third CAU expansion has same prerequisites, except requires 128K words of main storage with 12 MMA interfaces)	355,968	795	8,550
3025-00	I/O Access Unit Expansion; provides control and 8 I/O channels, interface for up to 256K words of main storage, interface for up to 1,048K words of extended storage, and 2 control channels to interface to 2 CAU's; expandable to 24 I/O channels (the number of IOAU expansions cannot exceed the number of CAU expansions)	191,520	882	4,600
F1387-00	I/O Channel Expansion; Channels 8-15	20,160	49	485
F1387-01	I/O Channel Expansion; Channels 16-23; requires F1387-00 channel expansion	20,160	49	485
4013-99	System Console; includes CRT display with entry keyboard, hard-copy printer; and real-time maintenance communication (RTMCS) interface; requires one I/O channel; up to five additional 0769-10 printers may be added	79,824	332	1,663
0769-10	Console Printer; 132 columns, 30-cps; maximum five per 4013-99 console	16,800	55	350
2516-00	System Partitioning Unit; includes interfaces for two CAU's, two IOAU's, two MSU's, four MAI's, and six MAS's; required when two or more CAU expansions are present	60,720	154	1,460
F1448-00	CAU Interface Expansion for third and fourth CAU's	6,240	11	150
F1449-00/01	IOAU Interface Expansion for third and fourth IOAU's	6,240	11	150
F1450-00/01	MSU Interface Expansion for third and fourth main storage unit	4,080	11	98
F1451-00/03	MAI Interface Expansion for fifth through eighth MAI, respectively	3,552	11	85
F1441-00/06	MAS Interface Expansion; each accommodates six additional Multi-Access Subsystems, for up to 48 total	3,024	5	72
0955-99	Shared Peripheral Interface (SPI); permits two IOAU's to share a peripheral subsystem	24,528	31	511
0955-98	SPI; shares a cabinet with 0955-99 SPI	21,840	24	460
0789-99	SPI Expansion; adds third interface	4,176	5	87
0789-98	SPI Expansion; adds fourth interface	2,880	5	60
F1095-99	1100/9000 Inter-Computer Control Unit for on-line connection of a Univac 9000 Series computer	11,184	56	233

*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)				
7015-00	Primary Storage Subsystem; includes basic MMA, eight interfaces, and cabinet	338,592	463	7,054
F1331-00	64K Storage Expansion Module (expands total main storage from 32,768 to 65,536 words)	288,624	316	6,013
7015-99	Storage Expansion Subsystem; 32,768 words (expands total main storage from 65,536 to 98,304 words)	338,592	463	7,054
F1331-99	128K Storage Expansion Module (expands total main storage from 98,304 to 131,072 words)	288,624	316	6,013
7015-93	Storage Expansion Subsystem; 65,536 words (expands total main storage from 131,072 to 196,608 words)	125,000	779	4,500
7015-92	Storage Expansion Subsystem; 65,536 words (expands total main storage from 196,608 to 262,144 words)	125,000	779	4,000
F1330-00/03	MMA Expansion; adds four interfaces to 32K storage module; all storage expansion modules require equal MMA expansions	8,592	10	179
F1330-99/98	MMA Expansion; adds four interfaces to 65K storage module; all storage expansion modules require equal MMA expansions	8,592	10	179
1110 EXTENDED STORAGE (CORE)				
7013-81	Unitized Storage; 131,072 words, 1.5-microsecond cycle time (requires one MAI or one MAI expansion)	220,512	789	5,290
7013-73	Unitized Storage; 131,072 words for between 524K and 1048K words; requires one MAI or one MAI expansion	96,000	789	2,300
7033-99	131,072 words of storage; requires one 0963-00 MAI or one F1394-00 MAI expansion	249,600	634	6,000
0963-00	Multiple Access Interface; provides four interfaces and control for one 7013-81 (can be used with 1108 Storage, Type 7005, if F1397-00 is also used)	52,416	148	1,260
F1394-00	MAI Expansion; adds a second MAI to an 0963-00	23,808	93	570
F1393-00	MAI Interface Expansion; adds three more interfaces to an 0963-00	14,064	24	340
F1393-01	MAI Interface Expansion; adds second set of three additional interfaces to an 0963-00	14,064	24	340
F1397-00	1108 Storage Interface; permits use of one 65K module of 1108 Storage, Type 7005, as Extended Storage	10,608	18	255
F1384-99	MMA Expansion; provides two additional interfaces for 7013-81 storage unit	3,936	11	95
F2080-99	MMA Expansion; provides one additional interface for 7033-99 storage unit	3,936	11	95
1100/40 PROCESSORS AND I/O CONTROL				
3023-89	1100/40 Processor (1x1); includes one CAU and one IOAU with eight channels; requires 192K words of main storage, card reader, and console	617,856	2,870	14,850
3023-91	Command/Arithmetic Unit Expansion for 3023-89 processor; maximum three per system	355,968	795	8,550
3025-99	IOAU Expansion for 3023-89; includes control, 8 I/O channels, and 2 control channels to interface to 2 CAU's; expandable to 24 channels (number of IOAU expansions may not exceed the number of CAU expansions)	191,520	882	4,600
F1387-00	I/O Channel Expansion; Channels 8-15	20,160	49	485
F1387-01	I/O Channel Expansion; Channels 16-23	20,160	49	485
4013-99	System Console; includes CRT display with entry keyboard, hard-copy printer, and real-time maintenance communication (RTMCS) interface; requires one I/O channel; up to five additional free-standing hard-copy printers may be added	79,824	332	1,663
0769-10	Console Printer for use as an additional hard-copy device on the 1100/40 processor console; 132 columns, 30-cps; up to five printers permitted per console	16,800	55	350
1100/40 MAIN STORAGE				
7030-93	192K Words Main Storage for 3023-89 processor; includes basic MMA with eight interfaces; expandable to 524K words	984,000	2,337	31,635
2407-98	Storage Expansion for 7030-93 storage; 64K words	328,000	779	10,545
7030-98	Storage Expansion; 64K words; requires 2407-98 expansion	282,000	632	9,000
2407-97	Storage Expansion; 64K words; requires 7030-98 expansion	282,000	632	9,000
7030-97	Storage Expansion; 64K words; requires 2407-97 expansion	282,000	632	9,000
2407-96	Storage Expansion; 64K words; requires 7030-97 expansion	282,000	632	9,000
F1953-00	MMA Expansion for 7030 storage units from 8 to 12 interfaces	8,592	10	210
F1953-01	MMA Expansion for 2407 storage units from 8 to 12 interfaces	8,592	10	210
F1953-02	MMA Expansion for 7030 storage units from 12 to 16 interfaces	8,592	10	210
F1953-99	MMA Expansion for 2407 storage units from 12 to 16 interfaces	8,592	10	210
1100/40 EXTENDED STORAGE				
7033-99	Extended Storage, 131,072 words; requires one 0963-00 MAI or one F1394-00 MAI expansion and 524K words of 7030 storage	249,600	634	6,000
0963-00	Multiple Access Interface; provides four access interfaces and control module for 128K words of 7033-99 extended storage	52,416	148	1,260
F1394-00	MAI Expansion; adds a second MAI control module to 0963-00 MAI to provide access to a 7033-99 extended storage	23,808	93	570
F1393-00	MAI Interface Expansion; provides three access interfaces to 0963-00 MAI	14,064	24	340
F1393-01	MAI Interface Expansion; provides second set of three access interfaces to 0963-00 MAI; requires F1393-00 expansion	14,064	24	340
F1397-00	1108 Storage Interface; required for use of 7005-08, 64K words, as extended storage	10,608	18	255
F2080-99	MMA Expansion; provides one additional interface for 7033-99 extended storage	3,936	11	95
1100/80 PROCESSORS AND I/O CONTROL				
3032-87	1100/80 Processor; includes full 1100 floating-point and byte instruction set, one I/O processing unit (IOU) with one byte and one block multiplexer channel, 4K words of buffer storage in one buffer module, 524K words of backing store in one cabinet, system maintenance unit, transition unit, system console, and motor/alternator; expandable to 1048K words of backing store; any further expansion requires addition of F2335-99 performance enhancement, or must be expanded as a standard 1100/81 processor; requires card reader	1,447,670	2,420	34,185

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1100/80 PROCESSORS AND I/O CONTROL (Continued)				
3032-91	1100/81 Processor; includes same equipment as 3032-87 except provides space for an additional channel module and 8K words of buffer storage in one module; expandable to four processors, four IOU's, 32K words of buffer storage, and 4,194K words of backing store	1,621,690	2,575	38,290
3032-89	Expansion Cluster for 3032-91 processor; includes one CPU, 8K words of buffer storage, one system maintenance unit (SMU), and one motor/alternator	806,710	1,280	19,015
3032-00	Expansion Processor; provides an additional CPU for either a 3032-91 processor or 3032-89 expansion cluster, maximum three per system	610,720	970	14,420
F2335-99	Upgrades 3032-91 processor; includes 4K words of buffer storage	174,020	155	4,105
3033-98	IOU Expansion; provides an additional IOU for either a 3032-91 processor or 3032-89 expansion cluster	350,825	685	8,080
1100/80 MEMORY				
F2336-00	Storage Interface Unit (SIU) Expansion; provides 4K words of buffer storage to expand SIU's from 8K to 12K words	208,150	330	5,660
F2335-00	SIU Expansion; provides 4K words of buffer storage to expand SIU's from 12K to 16K words	98,055	155	2,670
7037-99	Main Storage Unit; includes storage cabinet with 524K words in two banks and power supplies	315,000	500	8,575
F2350-99	Backing Storage Expansion; expands 7037-99 main storage unit to 1048K words or 3032-87 processor to 1048K words of backing storage; maximum four per system	200,000	300	5,440
MASS STORAGE				
5031-00	Unitized Channel Storage Control for up to 1,048,576 words of UCS storage (1106 processor only)	43,680	205	910
7013-97	Unitized Channel Storage; 256K words	289,392	865	6,029
7013-95	Unitized Channel Storage; 512K words	578,784	1,729	12,058
7013-93	Unitized Channel Storage; 768K words	868,176	2,593	18,087
7013-91	Unitized Channel Storage; 1024K words	1,157,616	3,457	24,117
F1375-00	Shared Peripheral Interface; provides one additional I/O interface for 5031-00 control; maximum one per control	23,136	35	482
5012-00/99	FH-432/FH-1782 Drum Control; controls one to eight 6016-00 or 6015-00 drums in any combination	102,720	379	2,140
F0929-00	Write Lockout Feature for 5012-00/99 drum control	1,392	5	30
F0930-00	Shared Peripheral Interface for 5012-00/99 drum control; multiprocessor application only	22,608	37	471
6016-00	FH-432 Drum; 262K words	52,848	155	1,210
6015-00	FH-1782 Drum; 2048K words	146,064	436	3,345
F0786-01	Dual Channel Feature for 6016-00 drum	3,024	22	69
F0767-00	Dual Channel Feature for 6015-00 drum	3,024	25	69
0961-02	Multi-Subsystem Adapter; includes cabinet, I/O interface, MSA module for one to eight byte-oriented subsystems and space for one F1321-02 MSA expansion; requires one I/O channel	26,976	66	562
F1321-02	MSA Expansion; adds a second MSA module to 0961-02 MSA; requires one additional I/O channel	21,504	63	448
F1323-00	Function Buffer Expansion; required on MSA for disk operations	2,208	10	46
F1322-00	Search Identifying Register; required on MSA for disk operations	2,208	10	46
F1324-02	Shared Peripheral Interface for MSA; requires one additional I/O channel	6,600	32	136
5024-99	8424/8425 Disk Control; requires 0961 MSA or F1321 MSA expansion (8424 and 8425 disks may not be intermixed on the same control)	57,072	438	1,189
F1043-00	Dual Channel Feature; provides non-simultaneous access to 5024-99 disk control from two MSA modules	4,416	22	92
F2001-00	Dual Access and simultaneous read/write, write/read, read/read, or write/write operations on two 8425 disk drives; required for each 8425 disk drive	2,304	5	48
8425-00	8425 Disk Storage; 312K bps	21,216	121	442
F1214-01	Disk Pack for 8425 disk drive	433	NA	21
5033-99/97/93	8440 Disk Control for up to four 8440 disk storage units; includes one I/O interface	126,890	636	2,940
5033-95	8440 Disk Control for up to four additional 8440 disk storage units; requires 5033-99/97/93 disk control, maximum three per 5033-99/97/93 disk control	111,050	579	2,570
F1324-02	Shared Peripheral Interface for 5033-99/97/93 disk control; maximum of three SPI's can be installed per control for a maximum of four I/O channel access paths	6,600	32	136
F1325-00	ASCII Translator for 5033-99/97/93 disk control; maximum two per control	2,064	11	43
F1325-01	EBCDIC Translator for 5033-99/97/93 disk control	2,064	11	43
F1482-02	Dual Access and simultaneous read/write, write/read, read/read, and write/write operations on two 8440 disk drives; required for each 8440 disk drive; requires two 5033-99/97/93 disk controls, and each must have the same number of 5033-95 controls if they are present	4,536	12	120
8440-02	8440 Disk Storage; two drives, 624K bytes per second	78,800	410	1,825
F1221-00	Disk Pack for 8440 disk drives	893	NA	61
5039-99	8433/8430 Control for up to eight 8430 and/or 8430 disk drives; includes one I/O interface and 1024 words of buffer storage; minimum two disk drives per subsystem	101,760	520	2,445
5039-91	8433/8430 Control; same as 5039-99 control (1100/80 only)	72,000	294	1,730
F2047-00	16-Drive Expansion; provides the capability to attach up to 16 8433 and/or 8430 disk drives to a 5039-99/91 control; excludes use of F2076-00 expansion	7,680	40	185
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 (5039-99 control only)	2,064	10	43

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
MASS STORAGE (Continued)				
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 (5039-99 control only)	2,064	10	43
5039-95	8433/8430 Control; same characteristics as 5039-99 except without I/O channel interface; requires 5039-99 control; maximum one per control	57,600	294	1,385
F2076-00	8405 Capability; adds the capability for control of up to eight 8405 disk drives to the control; excludes use of F2047-00 16-drive expansion	2,160	5	52
8430-99	8430 Disk Storage; provides a single 8430 disk drive; minimum two required	24,960	128	600
F2342-00	Disk Drive Upgrade; converts an 8430-99 to an 8433-00	11,520	59	275
8433-00	Disk Storage; provides a single 8433 disk drive; minimum two required	36,480	186	875
F2021-00	8433/8430 Dual Access; provides simultaneous read/read, read/write, write/read, write/write operation on any two 8433-00 or 8430-99 disk drives; required in each 8433-00 and 8430-99 disk drive in the subsystem; requires two 5039 controls	2,160	5	52
F1230-00	Disk Pack; provides up to 100 million bytes or 17 million 36-bit words of removable storage	750	—	46
F1223-00	Disk Pack; provides up to 200 million bytes or 34 million 36-bit words of removable storage	1,150	—	58
8405-00	8405 Fixed-Head Disk; provides a single 8405 disk with a storage capacity of 6,193,152 bytes or 1,376,256 36-bit words; requires F2076-00 capability	76,800	436	1,845
8405-04	8405 Fixed-Head Disk; provides a single 8405 disk with a storage capacity of 3,096,576 bytes or 688,128 36-bit words; requires F2076-00 capability	46,080	262	1,110
F1664-00	8405 Dual Access; provides simultaneous read/read, read/write, write/read, and write/write operation on any two 8405 fixed-head disk drives; prerequisite for each 8405 fixed-head disk in subsystem; requires two 5039 controls	2,160	5	52
F2076-00	8405 Capability; provides capability to attach up to eight 8405-00/04 fixed-head disk drives to the control; excludes use of F2047-00 16-drive expansion	2,160	5	52
5046-99	8430/8433/8434 Control; controls up to sixteen 8430, 8433, and/or 8434 disk drives; maximum 866 megawords of storage; requires minimum of two disk drives	102,000	400	2,770
5046-97	8430/8433/8434 Dual Control; for dual-access subsystem operation; requires two channels	176,448	700	5,015
8434-99	8434 Disk Storage; provides two single-spindle disk drives with non-removable pack	66,600	226	2,140
F2561-00	32-Device Capability; allows up to 32 8430, 8433, or 8434 disk drives to be intermixed on one 5046-99 control; two required for 5046-97 dual control	7,680	40	185
F2558-00	8405 Fixed-Head Disk Capability; allows up to eight 8405 fixed-head disk drives to be attached to the 5046-99 control, two required for 5046-97 control (precludes use of F2561-00 32-device capability)	2,160	5	52
F2021-99	8434 Dual Access; provides simultaneous read/write, read/read, write/read, and write/write on any two 8434 disk drives; requires 5046-97 dual control or two 5046-99 controls	2,688	14	56
F2021-98	8434 Dual Access; two required for 8434-99 disk storage on 1100/10 systems only	1,344	7	28
F2555-00	Shared Peripheral Interface; provides an additional I/O interface for the 5046-99/97 controls	6,600	29	138
5046-95/94	8430/8433/8450 Control; controls up to 16 8450 disk drives and power for up to four sets of four drives of any type (i.e., 8430/8433 or 8450); requires minimum of two 8450 disk drives	102,000	400	2,700
5046-93/92	8430/8433/8450 Dual Control; two control units, each with the same characteristics and restrictions as the 5046-95/94 control; requires two F2838-00 8450 capability expansions or two F2720-00 8430/8433 capability expansions	176,448	700	5,015
F2838-00	8450 Capability Expansion, allows 5046-95/94 control to handle up to 32 8450 disk drives, requires 2837-00 power control expansion (excludes use of F2720-00 8430/8433 capability)	6,000	45	150
F2720-00	8430/8433 Capability Expansion; allows 5046-95/94 control to handle up to 16 8430 and/or 8433 disk drives (excludes use of F2838-00 8450 capability)	2,400	10	60
F2837-00	Power Control Expansion; required when total number of disk drives exceeds 16; two required for 5046-93/92 dual control	7,680	40	185
F2555-00	Shared Peripheral Interface, multiprocessor; allows 5046-95/94 to connect to two separate 1100 Series processors; two required for 5046-93/92 control	6,600	29	138
8450-99/98	8450 Disk Storage; provides two 8450 disk drives using non-interchangeable data module included as part of each drive	66,600	226	2,140
8450-97/96	8450 Disk Storage; provides two 8450 disk drives using non-interchangeable data modules with fixed and movable heads	74,600	250	2,390
F2717-99	8450 Fixed-Head Conversion; converts 8450-99/98 disk storage unit to an 8450-97/96 disk storage unit	13,600	24	250
F2718-99	8450 Dual Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write on any two 8450 disk drives; requires two 5046 controls	2,688	14	56
INPUT/OUTPUT UNITS				
0961-02/99	Multi-System Adapter (MSA); includes cabinet, I/O interface, MSA module to adapt from one to eight byte-oriented subsystems; requires one I/O channel	26,976	66	562
F1321-02	MSA Expansion; provides second MSA module for 0961-02 multi-system adapter; includes power supply and one I/O interface; requires an additional I/O channel	21,504	63	448
F1321-99	MSA Expansion; provides second MSA module for 0961-99 multi-system adapter; includes power supply and one I/O interface; requires an additional I/O channel	21,504	50	448
5017-99	Uniservo 12 Magnetic Tape Control; up to sixteen 9-track, 1600-bpi, nonsimultaneous Uniservo 12 Tape Units	26,448	139	605
5017-00	Uniservo 12/16 Magnetic Tape Control; up to sixteen 9-track, 1600-bpi nonsimultaneous Uniservo 12 and/or Uniservo 16 Tape Units	28,560	152	655
F1131-99	Uniservo 16 Capability for 5017-99 control	2,112	12	44
F1131-98	Dual Access Capability and Uniservo 16 Capability for 0899-00 simultaneous operation feature; requires F1131-99 Uniservo 16 capability	2,064	12	43
F0899-00	Simultaneous Operation for 5017-99 control	19,248	90	440

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
INPUT/OUTPUT UNITS (Continued)				
F0899-99	Simultaneous Operation for 5017-00 control	21,312	103	490
F0823-99	7-Track NRZI Capability for 5017-00 or 5017-99 control	5,760	24	120
F0826-00	9-Track NRZI Capability for 5017-00 or 5017-99 control	5,760	24	120
0861-00	Uniservo 12 Master Tape Unit; 9-track, 1600 bpi; includes logic for up to 3 Slave Units	18,336	165	382
0861-01	Uniservo 12 Slave Tape Unit; 9-track, 1600 bpi	14,688	113	306
0861-04	Uniservo 12 Master Tape Unit; 7-track, 200/556/800 bpi; includes logic for up to 3 Slave Units	15,936	165	332
0861-05	Uniservo 12 Slave Tape Unit; 7-track, 200/556/800 bpi	13,056	113	272
F0934-99	Simultaneous Feature for 0861-00	4,080	21	85
F0934-98	Simultaneous Feature for 0861-04	4,080	21	85
F0935-00	Dual Density Feature for 0861-00	2,688	15	56
F1041-00	7-to-9-Track Conversion; converts 0861-04 to 0861-00	2,448	NA	51
F1041-01	7-to-9-Track Conversion; converts 0861-05 to 0861-01	2,448	NA	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	120	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	22	113
F0826-00	9-Track NRZI	5,760	24	120
F1028-96	9-Track Addition; adds 9-track NRZI to F0823-97 tape unit	4,176	15	87
F1028-95	7-Track Addition; adds 7-track NRZI plus data conversion to F0826-00 tape unit	4,176	15	87
0870-03	Uniservo 14; 9-track phase-encoded tape unit; 96 KB per second at 1600 bpi	14,880	87	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	94	335
0870-05	Uniservo 14; 7-track NRZI tape unit; 48/33 4/12 KB per second at 800/556/200 bpi	14,880	87	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	159	505
0862-06	Uniservo 16 Tape Unit; 7-track, 200/556/800 bpi	22,032	159	505
F0937-01	Dual Density Feature for 0862-04 tape unit	2,448	—	51
F1319-00	Dual Access Feature	2,448	13	51
5034-99	Uniservo 20 Control Unit	52,416	153	1,200
F0823-98	7-Track Capability; permits addition of 7-track Uniservo 12 and/or 16 tape units	5,554	22	113
F0826-99	9-Track NRZI; permits addition of 9-track Uniservo 12 and/or 16 tape units at 800 bpi	6,552	30	133
F1028-98	9-Track Addition; adds 9-Track NRZI capability to F0823-98 7-track capability	5,544	22	113
F1324-02	Shared Peripheral Interface; provides an additional I/O interface for the 5034-99 Control	6,600	32	136
F1325-00	ASCII Translator for 5034-99 control unit	2,064	11	43
F1325-01	EBCDIC Translator for 5034-99 control unit	2,064	11	43
0864-00	Uniservo 20 Tape Unit; 9-track; 1600 bpi	27,696	186	635
F1510-00	Dual Access Feature for 0864-00 tape unit; permits simultaneous 2-channel access when used with two 5034-99 Controls	2,448	13	51
5034-02	Uniservo 20 Control Unit	45,888	155	1,050
F2627-00	9-track Translation	2,064	11	47
5042-00	Uniservo 30 Control	55,392	288	1,170
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	780
0872-02	Uniservo 30 7-Track Tape Unit	34,800	181	780
F2123-00	Uniservo 30 7- to 9-Track Conversion	3,774	—	79
0873-00	Uniservo 32 GCR/PE Tape Unit	31,584	164	725
0873-02	Uniservo 34 GCR/PE Tape Unit	36,192	188	830
0874-00	Uniservo 36 GCR/PE Tape Unit	38,880	202	890
0770-00	Printer, 800 lines per minute	56,304	268	1,173
0770-02	Printer, 1400 lines per minute	64,896	351	1,352
0770-04	Printer, 2000 lines per minute	86,686	447	2,220
0776-00	Printer, 760 lines per minute	41,400	205	865
0776-02	Printer and Control; 900 lines per minute	46,680	245	975
F1533-00	160 Print Positions for 0770 series printers	4,416	19	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

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
INPUT/OUTPUT UNITS (Continued)				
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	46	260
F1095-10	1106/9000 Inter-Computer Control Unit for on-line connection of a UNIVAC 9200/9300 system	11,184	63	233
0716-02	Card Reader and Control; 1000 cpm (connects to C/SP or on-line 9000 Series computer or MSA)	15,504	121	323
0768-02	Printer and Control; 900/1100 lpm (connects to C/SP or on-line 9000 Series computer or MSA)	50,928	528	1,061
0604-99	Card Punch and Control; 250 cpm (connects to C/SP, on-line 9000 Series Computer, or MSA)	26,640	170	555
COMMUNICATIONS/SYMBIONT SUBSYSTEM				
3021-99	Communications/Symbiont Processor; includes arithmetic/control unit, 16 general-purpose registers, and interval timer; requires card reader, F1276 channel adapter, 8542-00 general-purpose communications channel, and 32K words of storage	22,176	73	449
F1276-99/02	1100 Channel Adapter	5,544	24	113
F1418-00	Special Device Channel for addition of 0708-27 card reader	1,512	5	31
F1273-00	Selector Channel; requires F1577-00 I/O expansion and console; maximum 1 per 3021-99 processor	6,500	24	133
F1274-00	Multiplexer Channel; requires 49K words storage and F1577-00 I/O expansion	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; required with use of F1273-00 selector channel	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
0708-27	80-Column Card Reader with control; requires F1418-00 special device channel	2,268	21	46
8542-00	General-Purpose Communications Channel (GPCC); includes data transfer control, processor interface logic, multiplexer with 8 positions (4 communications line terminals), and one asynchronous timing source; accommodates 64 positions or 32 communications line terminals; maximum two GPCC's per Communications/Symbiont Processor	11,592	37	235
F1367-00	Multiplexer Expansion; adds 8 positions to 8542-00 GPCC; maximum 7 per GPCC	1,008	5	21
F1286-00	CLT Expansion Module	3,528	18	72
F1287-00	Active Line Indicators for lines 1 to 16 (32 indicators and 16 lines)	504	—	10
F1287-01	Line Indicator Expansion for lines 1 to 32 (64 indicators and 32 lines)	504	—	10
F1287-08	Active Line Indicators for lines 1 to 32 (64 indicators and 32 lines)	1,008	—	21
F1287-09	Active Line Indicators for lines 1 to 48 (96 indicators and 48 lines)	1,512	—	31
F1287-10	Active Line Indicators for lines 1 to 64 (128 indicators and 64 lines)	2,016	—	41
F1287-11	Active Line Indicators for lines 1 to 80 (160 indicators and 80 lines)	2,520	—	51
F1287-12	Active Line Indicators for lines 1 to 96 (192 indicators and 96 lines)	3,024	—	62
F1287-13	Active Line Indicators for lines 1 to 112 (224 indicators and 112 lines)	3,528	—	72
F1287-14	Active Line Indicators for lines 1 to 128 (256 indicators and 128 lines)	4,032	—	82
F1365-99	Asynchronous Timing Assembly (ATA); provides up to 3 timing sources for asynchronous communications line terminals; maximum two per GPCC	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); houses maximum of 32 communications terminals with interfaces and/or communication terminal dialers	19,344	58	403
F1971-00	Expansion Power Supply; required when 24 or more terminals are included in the GCS configuration	2,160	5	45
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

*Rental prices do not include equipment maintenance.

UNIVAC 1100 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
DATA COMMUNICATIONS (Continued)				
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
F1975-00	Communications Terminal Synchronous; up to 56,000 bps, bit serial transmission	4,320	16	90
F1976-00	High-Level Communications Terminal; provides capability to handle 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 connections to 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	Distributed Communications Processor (DCP); free-standing unit including processor, real-time clock, power-protect, storage parity, breakpoint, unary shift, power supplies, control, and 32K bytes of storage; requires either an F2223-00 single port or an F2223-01 multi-port feature, an 8406 flexible diskette or an 8408 cartridge disk subsystem, and an F1811-99 Type I Scanner or a 1928-03 Type II Scanner	40,668	187	1,017
F2224-00	I/C Storage Expansion for DCP; provides 16K bytes of additional storage to expand capacity from 32K to 48K bytes, 64K to 80K bytes, and 96K to 112K bytes	3,600	23	90
F2224-01	I/C Storage Expansion for DCP; 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 I scanner	3,200	14	80
F1795-01	Parallel I/O Channel; supports four channels; requires F2268-00 I/O controller	2,400	10	60
F2691-00	Remote I/O Controller; provides a programmable controller with 16 parallel I/O channels; requires F2223-01 multi-port storage	18,000	75	450
F1791-99	Host Channel Interface, Single; provides connection of a DCP to an 1100/80 byte multiplexer channel	3,136	13	78
F1800-99	Host Channel Interface, Dual; provides connection to switch between two byte/multiplexer channels of a single 1100/80 or two separate 1100/80's	4,832	20	120
F2223-00	Single-Port Storage; provides a single-access port to I/C storage; required when only a Type I scanner is used	3,460	14	86
F2223-01	Multi-Port Storage; provides four access ports to I/C storage; required whenever an F2262-01 Type I scanner, a 1928-03 Type II scanner, or an F2691-00 remote I/O controller is used	4,040	25	101
8406-99	Diskette Drive; 256K bytes	5,000	20	125
F2338-00	Drive Expansion; provides for an additional disk drive for DCP; 256K bytes	1,440	9	40
8408-02	Cartridge Disk Control; provides cabinet, control, and housing for up to two F2380-04/05 disk drives; requires either an F1795-01 parallel I/O channel or an F2691-00 remote I/O controller	5,564	23	139
F2380-04	Disk Drive, 10 million bytes; requires 8408-02 control	17,750	90	418
F2187-00	Cartridge Disk, Dual; provides a second I/O interface for dual DCP configurations; requires 8408-02 control	1,568	7	39
5045-95	Uniservo 10 Control; includes cabinet, control, and housing for up to two dual-density U-10's; requires either an F2691-00 remote I/O controller or an F1795-01 parallel I/O channel	15,280	64	382
0870-27	Uniservo 10 9-track, dual-density tape unit; requires 5045-95 cabinet	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	20	61
F1811-99	Type I Scanner; requires F2268-00 I/O controller	636	4	16
F2262-01	Scanner Expansion—Type I; requires F1811-99 type I scanner and F2223-01 multi-port storage; excludes use of F2691-00 remote I/O controller	9,456	33	197
8591-00	Type I 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 I UDLC Line Adapter	1,672	7	42

*Rental prices do not include equipment maintenance.