UNIVAC 1100 Series

MANAGEMENT SUMMARY

The UNIVAC 1100 Series currently consists of three large-scale computer systems: the 1106, 1108, and 1110. The three systems are upward-compatible and share the same peripheral equipment and software. They are being successfully employed in a broad range of scientific, business, communications, and real-time applications, ranging from conventional batch processing to airline reservation systems. Although the venerable 1108 has now been left behind in the cost/performance derby, the newer 1106 and 1110 systems are among the most cost-effective large-scale computers on the market.

THE UNIVAC 1108

The 1108 was introduced in July 1964 as a single-processor system. Initial customer deliveries were made in July 1965. Simultaneously, UNIVAC announced the availability of multiprocessor configurations of the 1108, which were initially delivered late in 1967. Approximately 260 of the 1108 processors are now in use around the world.

Although the 1108 has the 36-bit word length and binary arithmetic facilities of the "classical" (i.e., IBM 704-style) scientific computer, UNIVAC was foresighted enough to endow it with a number of additional capabilities that make it suitable for virtually the entire spectrum of large-scale computer applications. Among these features are:

- Large main storage capacity—65,536 to 262,144 words.

UNIVAC's large-scale 1106, 1108, and 1110 systems combine powerful hardware facilities with advanced software to achieve impressive performance levels. The top-of-the-line 1110 system features multiple processors, two levels of directly addressable storage, and independent I/O controllers and communications processors.

CHARACTERISTICS

MANUFACTURER: UNIVAC Division, Sperry Rand Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19422.

MODELS: UNIVAC 1106, 1106 II, 1108, and 1110.

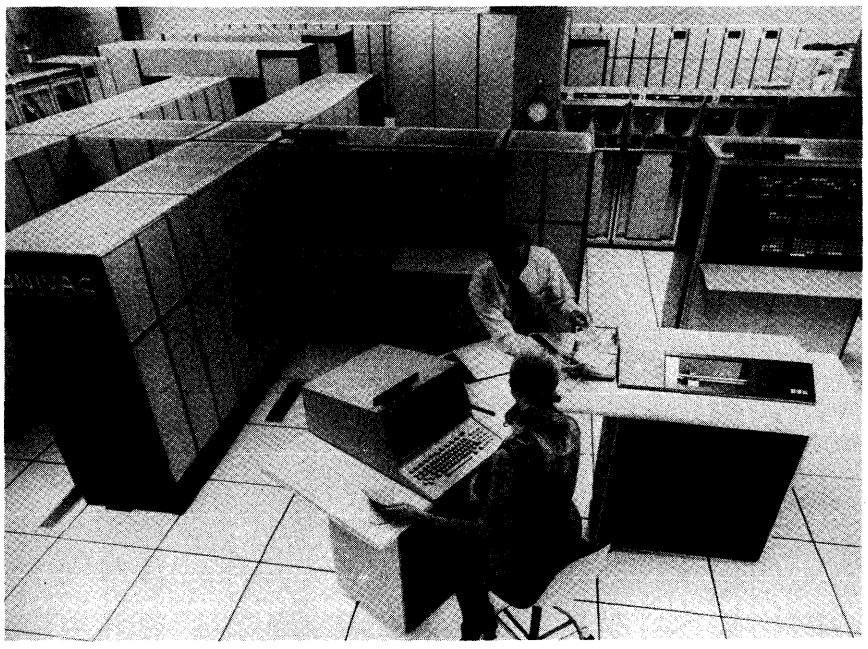
DATA FORMATS

BASIC UNIT: 36-bit word. In core 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 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,



Dual-processor UNIVAC 1110 systems such as the one shown here are comparable with the IBM 370/168 in performance and pricing. The new, single-processor 1110 1 x 1 system is a strong contender in the 370/158 class.

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- High internal speed—most 1108 instructions can be executed in a single 750-nanosecond core cycle through overlapped accessing of instructions and data stored in separate core modules.

- Modularity—an 1108 multiprocessor system can include up to three central processors and two I/O controllers, and the system can readily be reconfigured 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 equip the 1108 for a wide range of real-time, communications, and multiprogramming functions.

- Control registers—128 integrated-circuit registers, including 16 accumulators and 15 index registers, enhance the power and flexibility of the 1108 Processor.

- Partial-word operands—although no decimal arithmetic facilities are provided, partial words of 6, 9, 12, or 18 bits can be conveniently manipulated.

- Drum storage—UNIVAC offers 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.

In January 1970, UNIVAC unveiled the 1108 Shared Processing System. The 1108 SP is a comparatively low-priced dual-processor configuration in which one processor handles all I/O functions while the other is dedicated to computing. The two processors, sharing a common core memory of 131K to 262K words, provide roughly two-thirds more computational capacity than a single-processor 1108 system.

The UNIVAC 1108 was originally conceived as an improved version of the second-generation UNIVAC 1107 system. The 1107, initially delivered in 1962, had been well received by scientific computer users. In addition to its effective hardware design, a major factor in the 1107's success was its drum-based software, which resulted in compilation speeds and overall operational efficiency substantially higher than those of most of the competitive systems of the early 1960's.

The 1108 is largely program-compatible with the 1107 and offers more than five times the internal speed, as well as larger storage capacities and useful new facilities such as storage protection and double-precision arithmetic. Thus, the 1108 quickly superseded the 1107. More significantly, the similarity between the two machines provided UNIVAC with a virtually ready-made complement of software for the 1108. The EXEC II Operating System

4-bit Control Register Designator, 4-bit Index Register Designator, 1-bit Index Modification Designator, 1-bit Indirect Address Designator, and 16-bit Address Field.

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

MAIN STORAGE

STORAGE TYPE: Magnetic core in 1106, 1106 II, and 1108; plated wire in 1110.

CAPACITY: 1106—65,536, 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 or 262,144 words of Unitized Storage (which is only half as costly but precludes overlapped accessing of instructions and data).

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).

1108 – 65,536, 131,072, 196,608, or 262,144 words, with each 65K bank composed of two 32,768-word modules. (A minimum of 131K words is required for a multiprocessor system and for the use of the 1100 Operating System in any 1106 or 1108 system.)

1110 – 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 32K storage unit can service up to 4 I/O channels simultaneously.

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

CHECKING: Parity bit with each half-word is checked whenever storage is referenced.

STORAGE PROTECTION: The Storage Limits Register, loaded by the Operating System, defines the upper and lower boundaries of both the instruction area and data area that may be referenced by the currently active user program. Any attempt to reference an address beyond these limits causes an interrupt. The setting of a bit in the Processor State Register determines whether the protection is against write operations only or against all reads, writes, and jumps.

EXTENDED STORAGE (FOR 1110 ONLY)

STORAGE TYPE: Magnetic core.

CAPACITY: 131,072 to 1,048,576 words, in 131,072-word modules, for the 1.5-microsecond storage; or 131,072 to 524,288 words, in 65,536-word modules, for the 750-nanosecond storage. One-, two-, or four-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 2 modules of extended storage with up 4 CAU's and 4 IOAU's.

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CHARACTERISTICS OF THE 1100 SERIES CENTRAL SYSTEMS

	UNIVAC 1106	UNIVAC 1106 II	UNIVAC 1108	UNIVAC 1110
SYSTEM CHARACTERISTICS				
No. of central processors (CAU's)	1 or 2	1 or 2	1 to 3	1 to 4
No. of I/O controllers (IOAU's)	None	None	0 to 2	1 to 4
Date of introduction	March 1969	Jan. 1972	July 1964	Nov. 1970
Date of first delivery	Dec. 1969	March 1972	July 1965	June 1972
MAIN STORAGE				
Storage type	Core	Core	Core	Plated wire
Minimum capacity, 36-bit words	65,536	131,072	65,536	32,768
Maximum capacity, 36-bit words	262,144	262,144	262,144	262,144
Cycle time, microseconds/word	1.5	1.0	0.75	Read: 0.32 Write: 0.52
Storage interleaving	Optional	Standard	Standard	Standard
EXTENDED STORAGE				
Storage type	None	None	None	Core
Minimum capacity, 36-bit words	–	–	–	131,072
Maximum capacity, 36-bit words	–	–	–	1,048,576
Cycle time, microseconds/word	–	–	–	1.5 or 0.75
Storage interleaving	–	–	–	Optional
CENTRAL PROCESSORS				
Register cycle time, nanoseconds	166	166	125	75
No. of instructions	144	144	144	199
Instruction times, microseconds:				
Fixed-point add/subtract (36 bits)	1.50	1.00	0.75	0.30
Fixed-point add/subtract (72 bits)	3.17	2.17	1.63	0.60
Fixed-point multiply (36 bits)	3.67	3.17	2.38	1.50
Fixed-point divide (36 bits)	13.95	13.45	10.13	6.40
Floating-point add/subtract (1 word)	3.00	2.50	1.88	0.90
Floating-point multiply (1 word)	4.00	3.50	2.63	1.65
Floating-point divide (1 word)	11.50	11.00	8.25	5.30
Floating-point add/subtract (2 words)	4.50	3.50	2.63	0.75
Floating-point multiply (2 words)	6.67	5.67	4.25	2.40
Floating-point divide (2 words)	24.00	23.00	17.25	10.30
Load/store (36, 18, 12, 9, or 6 bits)	1.50	1.00	0.75	0.30
Load/store (72 bits)	3.00	2.00	1.50	0.60
INPUT/OUTPUT CONTROL				
Number of I/O channels:				
Per central processor (CAU)	4 to 16	4 to 16	8 to 16	–
Per I/O controller (IOAU)	–	–	4 to 16	8 to 24
Per system	4 to 32	4 to 32	8 to 78	8 to 96
Max. total I/O data rate, words/sec:				
Per I/O channel	333,000	333,000	333,000	500,000
Per central processor (CAU)	667,000	1,000,000	1,333,000	–
Per I/O controller (IOAU)	–	–	1,333,000	4,000,000

and its associated assembler and compilers, which had been developed for the 1107, were revised slightly and made available to initial users of the 1108.

As a result, UNIVAC found itself in the enviable position of being able to offer a powerful large-scale computer, supported by field-proven software, during a period in the mid-1960's when IBM, GE, and several other firms were encountering severe difficulties in developing the software to go with their third-generation computers. This combination of circumstances led to rapid worldwide acceptance of the 1108, which in turn has been one of the principal factors in UNIVAC's resurgence to an important–and highly profitable–position in the computer industry.

CYCLE TIME: Choice of 1.5 microseconds or 750 nanoseconds per word. (Most new installations choose the 1.5-microsecond extended storage; the 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.)

CHECKING: Parity bit with each half-word is checked whenever storage is referenced.

STORAGE PROTECTION: Same as for main storage, above.

CENTRAL PROCESSORS

REGISTERS: In 1106, 1106 II, and 1108 systems, each central processor has 128 program-addressable control reg-

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But the EXEC II software, which ranked among the best of the second-generation operating systems, leaves much to be desired when measured by current standards. Oriented toward batch-mode processing, it provides no facilities for true multiprogramming, multiprocessing, data communications, time-sharing, or real-time functions (although a number of sophisticated users, such as Computer Sciences Corporation, have modified EXEC II to provide some of these facilities).

To enable 1108 users to take full advantage of the system's outstanding hardware capabilities, UNIVAC set out to develop a comprehensive new operating system called EXEC 8. Not surprisingly, UNIVAC's software designers then ran into most of the same monumental development problems as their competitors. As a result, EXEC 8's arrival was long delayed, and the early releases of the system exhibited lower-than-promised operational efficiencies together with higher-than-planned main storage requirements. But UNIVAC perservered, and EXEC 8 (rechristened the 1100 Operating System) now ranks as one of the most powerful and effective computer operating systems.

THE UNIVAC 1106

The 1106 was introduced in March 1969, nearly five years after the 1108. Customer deliveries began in December 1969. Initially, the 1106 was offered only as a single-processor system with a core storage cycle time of 1.5 microseconds – half as fast as the 1108.

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

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

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

isters. Each integrated-circuit register is 36 bits long and has a cycle time of 166 nanoseconds in the 1106 and 125 nanoseconds in the 1108. Users' programs can make use of 15 index registers, 16 accumulators (4 of which also serve as index registers), 8 unassigned registers (which can be used for fast-access temporary storage), a Repeat Count Register, a Mask Register, and a Processor State Register. Accessible only to the Operating System are 32 I/O access control registers, duplicate sets of 15 index registers and 16 accumulators, and a real-time clock register which is decremented every 200 microseconds.

In 1110 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 75 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.

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, 1106 II, and 1108 have 144 instructions, all one word in length. Most instructions specify the address of one operand in core 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 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 CAU has 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.

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

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

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FULLY SUPPORTED UNIVAC 1110 SYSTEM CONFIGURATIONS

COMPONENTS	CONFIGURATION				
	1 x 1	2 x 1	2 x 2	4 x 2	4 x 4
Command/Arithmetic Units	1	2	2	4	4
Input/Output Access Units	1	1	2	2	4
Input/Output Channels	8 to 24	8 to 24	16 to 48	16 to 48	32 to 96
Main Storage (words)	32K to 262K	65K to 262K	98K to 262K	131K to 262K	131K to 262K
Extended Storage (words)	131K to 1048K	262K to 1048K	262K to 1048K	262K to 1048K	262K to 1048K
System Consoles	1	1 or 2	1 or 2	2	2 to 4
System Partitioning Unit	0 or 1	0 or 1	0 or 1	1	1

All models of the 1106 are completely program-compatible with the 1108, have the same functional capabilities, and use the same peripheral equipment and software. The various versions of the 1106 provide about 40 to 75 percent of the computational power of the 1108 at savings of thousands of dollars per month in mainframe rental cost. Therefore, users who are attracted by the proven capabilities of the 1108 but do not require all of its processing power have found the 1106 to be a very attractive alternative. UNIVAC has delivered approximately 100 of the 1106 systems to date.

THE UNIVAC 1110

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

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

Other significant technical innovations of the 1110 system include:

- A four-deep instruction stack in each CAU that permits a high degree of instruction look-ahead and concurrency.

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 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, 1106 II, and 1108 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 Page-writer Printer capable of printing 80-character lines at 25 characters per second, and a day clock that displays the time of day and furnishes timing information to the central processor.

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

SYSTEM PARTITIONING UNIT (SPU): Permits manual separation of an 1110 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 is required in every 4-processor 1110 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, 1048K words of extended storage, and 48 multi-access peripheral subsystems.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The basic 1106 Processor has 4 I/O channels, expandable in 4-channel increments to a maximum of 16 channels.

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- 112 integrated-circuit control registers in each CAU.
- A powerful instruction set that includes all of the UNIVAC 1108 instructions plus a new group of byte-oriented commercial instructions that facilitate data manipulation, decimal arithmetic, code translation, radix conversion, and editing.
- An extended, 24-bit addressing capability that provides for direct addressing (through base registers) of up to 16 million words of storage.
- Input/Output Access Units (IOAU's) which control all I/O operations independently of the Command/Arithmetic Units. An 1110 system can include one, two, or four IOAU's, and each IOAU can accommodate up to 24 I/O channels and an aggregate data rate of up to 24 million characters per second.
- Provisions for complete hardware redundancy through the use of up to four CAU's, four IOAU's, four System Consoles, multiple modules of main and extended storage, and dual-channel peripheral subsystems.
- A System Partitioning Unit (SPU) that permits an 1110 system to be manually separated into two or three logically independent smaller systems.
- An independently programmed Communications/Symbiont Processor (C/SP) designed to relieve the CAU's of most of the processing functions associated with the control of data communications and low-speed I/O operations. Based on the UNIVAC 9400 processor architecture, the C/SP provides 32K to 131K bytes of 630-nanosecond plated-wire storage and has a full complement of supporting software. In typical transaction-oriented environments, the use of a C/SP should reduce the CAU load by 20 to 25 percent. Introduced with the 1110, the C/SP can also be used in UNIVAC 1106 and 1108 systems.

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

The plated-wire memory that UNIVAC has been using in its smaller 9000 Series computers since 1966 finally reached the "big time" as the main storage for the 1110. The nondestructive readout capability of the plated-wire memory yields a cycle time of 320 nanoseconds per word for reading and 520 nanoseconds for writing, and four simultaneous accesses can be made to each 32K storage

The basic 1108 II Processor has 8 I/O channels, expandable in 4-channel increments to a maximum of 16. Each 1108 I/O Controller has 4 channels, expandable in 4-channel increments to a maximum of 16.

The 1108 Shared Processing System includes 8 channels in the I/O Processor, expandable in 4-channel increments to a maximum of 16.

The basic 1110 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 Command/Arithmetic Units.)

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 three types of core storage: 131K or 262K words of 1.5-microsecond Unitized (non-overlapped) Storage, 65K to 262K words of 1.5-microsecond Multi-Modular Storage I, 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 three types of core storage: 262K words of 1.5-microsecond Unitized Storage, 131K to 262K words of 1.5-microsecond Multi-Modular Storage I, or 131K to 262K words of 1.0-microsecond Multi-Modular Storage II. In addition, a Shared Peripheral Interface (SPI) is required for each peripheral subsystem to be accessed by two 1106 Processors, and either a Multi-Module Access (MMA) or a Shared Memory Interface (SMI) is required for each core storage module.

An 1108 Unit Processor System consists of one 1108 II Processor with 8 to 16 I/O channels, Display Console, 65K to 262K words of main storage, and associated peripheral subsystems.

An 1108 Multiprocessor System consists of one to three 1108 II Processors (each with Display Console and 8 to 16 I/O channels), one or two I/O Controllers, 131K to 262K words of main storage, and associated peripheral subsystems. In addition, a Multi-Module Access (MMA) is required for each 65K storage module, a Shared Peripheral Interface (SPI) is required for each peripheral subsystem to be accessed by two Processors or I/O Controllers, and an Availability Control Unit (ACU) is required to control the system configuration in systems that include more than one Processor.

An 1108 Shared Processing System consists of an I/O Processor with 8 to 16 I/O channels, a Support Processor dedicated to computational activities, a Display Console, 131K to 262K words of main storage, an MMA for each 65K storage module, and associated peripheral subsystems.

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

Each peripheral subsystem fully occupies one or two I/O channels, depending upon the type of control unit em-

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unit. A system can include from 32K to 262K words of plated-wire main storage.

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

In January 1972, UNIVAC greatly enlarged the potential market for the 1110 by announcing the 1110 1 x 1 system, a single-processor configuration that can be rented for as little as $36,300 per month. Previously, the monthly rental for a minimum 2 x 1 (dual-processor) system was about $60,000.

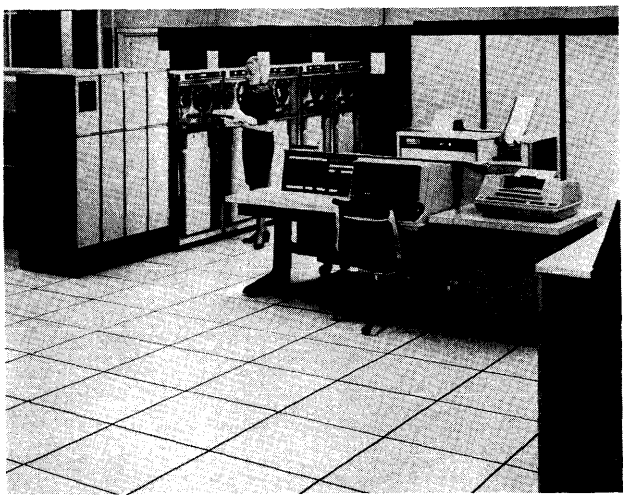
The advent of the 1110 1 x 1 system is highly significant for two reasons. First, it makes the 1110 directly competitive, in both performance and pricing, with systems such as the IBM System/370 Models 155 and 158. Second, it impacts the UNIVAC 1108 system so strongly that the 1108 can no longer be considered a good buy at a price anywhere near its list purchase or rental price. (This "devaluation" of the 1108 does not represent a serious problem for UNIVAC because the great majority of the installed 1108 systems have been purchased outright, either by their users or by leasing firms.)

For current users of the UNIVAC 1106 and 1108, the 1110 shapes up as highly suitable upgrade system. It offers greatly increased processing power with minimal conversion difficulty. Moreover, companies that have purchased 1108 systems can salvage much of their investment by reusing the 1108 peripheral equipment and using the 750-nanosecond 1108 core storage modules as extended storage for the 1110.

Deliveries of the 1110 were originally scheduled to begin in November 1971, but a series of development and production delays caused the date to slip to June 1972. The 1110 is now in full-scale production, and both the equipment and the supporting software are performing well. To date, approximately 12 systems have been delivered, and about 40 more are believed to be on order.

PERIPHERAL EQUIPMENT

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



The UNIVAC 1106 offers most of the same features as the faster 1108 in a considerably less costly package. Three different types of core storage give the 1106 buyer a choice of performance levels.

ployed. (See the descriptions of specific Mass Storage and Input/Output Units below.)

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

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

FH-432 MAGNETIC DRUM: Provides fast random access to fairly small quantities of data. Stores 262,144 words (1,572,864 characters) in 384 data tracks, each served by a fixed read/write head. Data is read and written in 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.

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product line now includes the 8414 and 8440 Disc Drives, which are comparable in performance to the IBM 2314 and 3330, respectively, as well as the recently announced 8424 (a "double-density" version of the 8414) and the 8460 (a fixed-disc drive of extremely large capacity).

UNIVAC also offers a variety of magnetic tape drives, in both 7-track and 9-track models, with data transfer rates ranging from 34,160 to 320,000 bytes per second. In addition, the whole range of UNIVAC 9000 Series peripheral devices can be connected to an 1100 Series system via either the C/SP or an on-line UNIVAC 9200 or 9300 Processor. In fact, card reading, punching, and printing operations are usually performed by devices connected to an on-line 9200, 9300, or C/SP rather than directly to the 1100 Series mainframe.

Data communications is an important function of most 1100 Series systems, and UNIVAC offers an effective complement of communications control and remote terminal equipment to handle it. Although most new installations will choose the C/SP to lighten the communications processing load on the central processor, the older Communications Subsystem, or CTMC, may prove to be more suitable for some applications.

SOFTWARE

The 1100 Operating System (formerly called EXEC 8) is now the standard operating system for all members of the 1100 Series, although some 1106 and 1108 installations are still using the far less powerful EXEC II system. The 1100 Operating System furnishes comprehensive supervisory and control facilities for three distinct modes of multiprogrammed operation: batch, demand (or time-sharing), and real-time (or communications). It provides virtually the full gamut of desirable operating system facilities, including dynamic storage allocation, reentrancy, multiprocessing, dynamic reconfiguration, automatic recovery, multi-level prioritization, system optimization, and two types of program segmentation (one of which provides, in effect, a software-controlled virtual storage capability).

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

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

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.

FASTRAND MASS STORAGE: Provides moderately fast access to large quantities of data stored on magnetic drums. Each Fastrand unit is served by 64 read/write heads. The heads are mounted on a common positioning unit that moves laterally, allowing each head to serve 192 tracks. Average head positioning time is 57 milliseconds, and average rotational delay is 35 milliseconds. Data is stored in 28-word sectors. An off-line search capability enables the Fastrand unit to search for a specific data record and notify the central processor when it is found.

Two models of Fastrand Mass Storage are currently being marketed. Fastrand II stores 22,020,096 words (132 million characters) in each drum unit, while Fastrand III, which has a 50 percent higher recording density, stores 33,030,144 words (198 million characters) in each unit. Data transfer rate is 153,600 characters per second for Fastrand II and 230,400 characters per second for Fastrand III.

An optional feature called Fastband adds 24 fixed read/write heads, each serving one track, with an average access time of 35 milliseconds. The Fastband option increases the storage capacity by 43,008 words per Fastrand II unit or 64,512 words per Fastrand III unit.

A Fastrand II or III subsystem consists of a single- or dual-channel control unit and from one to eight drums. The dual-channel control unit permits simultaneous operations on any two drums in the subsystem. The Fastrand units are no longer in production and have been largely superseded by the disc drives described below.

8414 DISC DRIVE: Provides large-capacity random-access storage in interchangeable 11-disc packs which are physically compatible with the IBM 2316 Disk Packs used in the IBM 2314 Direct Access Storage Facility. Each pack stores up to 29.17 million bytes of data. Up to 145,880 bytes (20 tracks) can be read or written at each position of the comb-type access mechanism. Average head movement time is 60 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 312,00 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 8414 in a simulated Fastrand format, each track holds 12 sectors of 112 words each. In this format, each 8414 pack stores 5.4 million 36-bit words, and the data transfer rate is 69,444 words/second.

An 8414 subsystem consists of a control unit and two, four, six, or eight disc drives; a Multi-Subsystem Adapter (MSA) equipped with the Function Buffer Expansion and Search Identifier Register features is a prerequisite. A dual-access subsystem can be configured by installing a Dual Access feature for each pair of disc drives and adding a second control unit and the MSA Expansion feature.

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UNIVAC, like most other mainframe manufacturers, is now placing a strong marketing emphasis upon data management software. Three data management systems – DMS, IMS-8, and ISFMS – are now available for the 1100 Series computers. The most powerful, DMS, is one of the four components of UNIVAC's impressive Total Information Management System, which also includes a Communications Management System (CMS), a Transaction Interface Package (TIP), and a Conversational Time-Sharing System (CTS). The Total Information Management System should greatly facilitate the development of integrated, on-line data processing systems for many organizations.

COMPATIBILITY

Within the 1100 Series, UNIVAC has maintained a high degree of program and data compatibility. The 1106 and 1108 use exactly the same instruction repertoire, which is a compatible subset of the expanded 1110 instruction repertoire. Thus, object programs can be freely interchanged between an 1106 and an 1108, and programs written for an 1106 or 1108 can be executed without alteration on an 1110.

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/I, 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 the IBM System/360 and other competitive equipment. Moreover, since UNIVAC is still a fully "bundled" manufacturer, it 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 $24,000 to over $150,000 per month. Thus, the 1100 Series competes against such impressive performers as the IBM System/370 Models 145, 158, and 168, the Honeywell Series 6000, the Burroughs B 6700, and the Control Data Cyber 70 Models 72, 73, and 74.

8424 DISC STORAGE: Provides large-capacity random-access storage in 11-disc packs which are physically compatible with the IBM 2316 Disk Packs. Introduced in January 1973, the 8424 records data at the same bit density (2200 bpi) as the 8414 but records 406 tracks on each disc surface, compared with 203 for the 8414. Thus, the 8424 can store twice as much data–or up to 58.34 million bytes–in each pack. A servo-controlled electromagnetic actuator yields an improved average head movement time of 30 milliseconds. Average rotational delay is 12.5 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 8424 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 69,444 words/second.

An 8424 subsystem consists of a control unit and one to four 8424 Disc Storage units, each containing two independent disc drives. A Multi-Subsystem Adapter (MSA) equipped with the Function Buffer Expansion and Search Identifier Register features is a prerequisite. A dual-access subsystem can be configured by installing the Dual Access feature in each 8424 Disc Storage unit and adding a second control unit and the MSA Expansion feature.

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

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

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

The 8440 Disc Subsystem was announced with the UNIVAC 1110 system in November 1970. After encountering serious delays in developing the subsystem, UNIVAC turned to an outside supplier. A set of revised and improved specifications for the 8440 subsystem was issued in January 1973, and customer shipments of the improved equipment (as described above) began later the same month.

8460 DISC FILE: Provides fairly rapid random access to extremely large quantities of data stored on noninterchangeable discs. Each 8460 Disc File contains two

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As previously mentioned, the UNIVAC 1108 can no longer be considered a cost-effective system; it has been displaced by UNIVAC's own 1110, which now offers substantially more power for less money at all configuration levels. Moreover, the 1110 is available at a relatively small price premium over the much slower 1106 system, which means that the 1106 will normally be chosen over the 1110 only in situations where the user is more interested in minimizing his equipment costs than in getting maximum performance per dollar.

In model-to-model comparisons with the IBM System/370, the UNIVAC 1106 and the 1110 1 x 1 system are generally comparable in price/performance to Models 145 and 158, respectively. Similarly, a dual-processor 1110 is comparable to the System/370 Model 168, and a four-processor 1110 should equal or surpass the performance of IBM's new dual-processor Model 168 MP system. In business data processing and real-time applications, where the System/370 buffer storage is not particularly effective and the 1110's substantially higher I/O capacity can be used advantageously, the 1110 will often exhibit a significant price/performance edge. UNIVAC's fully bundled support policy will result in additional savings for 1100 Series users, and the powerful 1100 Operating System offers some noteworthy advantages over IBM's ponderous OS/VS2. □

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

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

Introduced in June 1972, the 8460 is based upon the Data Products System/7114 Large Disc Store, which UNIVAC acquired from Data Products Corporation in January 1972. Earlier, UNIVAC had collaborated with Data Products in developing this equipment to satisfy a large military procurement.

INPUT/OUTPUT UNITS

UNISERVO VI C MAGNETIC TAPE UNIT: A low-cost 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 9-track version has a recording density of 800 bpi, while the 7-track version can operate at 200, 556, or 800 bpi. The 9-track model transfers 45,547 six-bit characters (or 34,160 bytes) per second, while the 7-track model transfers a maximum of 34,160 characters per second (at 800 bpi). A Uniservo VI C subsystem consists of up to 16 tape units (4 "master" units and 12 "slave" units) connected to a single- or dual-channel control unit.

UNISERVO VIII C MAGNETIC TAPE UNIT: 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, and backward reading is a standard feature. The 9-track version has a recording density of 800 bpi, while the 7-track version can operate at 200, 556, or 800 bpi. The 9-track model transfers 128,000 six-bit characters (or 96,000 bytes) per second, while the 7-track model transfers a maximum of 96,000 characters per second (at 800 bpi). A Uniservo VIII C subsystem consists of up to 16 tape units connected to a single- or dual-channel control unit.

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 same speed as the Uniservo VI C. The 7-track version can operate at 200, 556, or 800 bpi, with corresponding data rates of 8,540, 23,740, or 34,160 characters per second. A Uniservo 12 subsystem consists of up to 16 tape units (4 "master" units and 12 "slave" units) connected to a single- or dual-channel control unit; the Multi-Subsystem Adapter is a prerequisite. Uniservo 12 and Uniservo 16 tape units can be intermixed in the same subsystem, provided they are not dual-access units.

UNISERVO 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 version operates at 200, 556, or 800 bpi, with corresponding data rates of 24,000, 66,720, or 96,000 characters per second. A Uniservo 16 subsystem consists of up to 16 tape units connected to a single- or dual-channel control unit; the Multi-Subsystem Adapter is a prerequisite. Uniservo 16 and Uniservo 12 tape units can be intermixed in the same subsystem, provided they are not dual-access units.

UNISERVO 20 MAGNETIC TAPE UNIT: A high-performance tape drive that uses standard ½-inch tape and matches the performance of the IBM 2420 Model 7. Data is recorded in the 9-track mode at 1600 bpi. Tape speed is 200 inches per second, forward or backward, yielding a data transfer rate of 320,000 bytes (or 426,667 six-bit characters) per second. Operational conveniences include a power window, automatic tape threading, and wrap-around tape cartridge loading. A Uniservo 20 subsystem consists of 1 to 16 tape units connected to either one or two control

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units. Uniservo 12 and 16 tape units can also be connected to the Uniservo 20 control unit. The Multi-Subsystem Adapter (MSA), which is a prerequisite for the Uniservo 12 and 16 Subsystems, is furnished as an integral part of the Uniservo 20 control unit. A dual-access subsystem can be configured by adding a second control unit and installing the Dual Access feature in each tape unit.

TYPE 0706-97 CARD READER: Reads 80-column cards serially by column at 900 cpm, using photodiodes with redundant read checking. Input hopper holds 3000 cards and main stacker holds 2100 cards. Error cards are routed into a 100-card reject stacker. Reads data punched in Fieldata code, row binary, or column binary. Connects to a Card Control, which uses one 1106 or 1108 I/O channel and also accommodates a 300-cpm Card Punch.

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 or Communications/Symbiont Processor (CSP), described below.

TYPE 0600-00 CARD PUNCH: Punches 80-column cards on a row-by-row basis at 300 cpm, with read-after-punch checking. Has a 1000-card input hopper and two 850-card stackers. Can punch data in Fieldata code, row binary, or column binary. Connects to a Card Control, which uses one 1106 or 1108 I/O channel and also accommodates a 900-cpm Card Reader.

TYPE 0758-00 PRINTER: Prints at 1200 lpm when the full 63-character set is used and at 1600 lpm when using any 43 contiguous characters. Uses a conventional rotating-drum printing mechanism. Has 132 print positions. Skipping speed is 33 inches per second when printing at 6 lines per inch; an alternate line spacing of 8 lines per inch can be manually selected. Handles continuous forms from 4 to 22 inches in width. Connects to a Printer Control, which occupies one 1106 or 1108 I/O channel and can be expanded to control a second printer.

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 or Communications/Symbiont Processor, described below.

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.

UNIVAC 1107 SUBSYSTEMS: In addition to the standard peripheral devices described above, a number of 1107 subsystems can also be used with the UNIVAC 1106 and 1108 systems. Among these subsystems, which are no longer in production, are the Uniservo II A, III A, III C, and IV C Magnetic Tape Subsystems and the 1004 Card Processor.

COMMUNICATIONS EQUIPMENT

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 communications 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 plated-wire 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 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 and one or two General-Purpose Communications Channels.

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 300,000 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 of the currently available UNIVAC 9000 Series peripheral devices, as described in Reports 70C-877-01 and 70C-877-02.

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.

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 I/O channel, and up to 16 Communications Terminal Modules (CTM's).

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Each serial CTM accommodates two full-duplex or two half-duplex lines. 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 a single-line automatic dialing module.

WORD TERMINAL SYNCHRONOUS (WTS): Links a single synchronous communications line to an 1100 Series I/O channel. Handles 6-bit character codes at speeds of 2000, 2400, or 40,800 bits per second. Communicates with main storage on a word-at-a-time basis (six 6-bit characters per word). Adds character and message parity to outgoing data and checks the parity of incoming data. Automatic dialing and unattended answering are optional features. The WTS is not supported by UNIVAC software.

COMMUNICATION TERMINAL SYNCHRONOUS (CTS): Links a single synchronous communications line to an 1100 Series I/O channel. Handles 5, 6, 7, or 8-bit character codes at speeds of 2000, 2400, or 40,800 bits per second. Communicates with main storage on a character-at-a-time basis. Can generate and check parity in accordance with plugboard wiring. Automatic dialing and unattended answering are optional features.

TERMINALS: The following UNIVAC devices, described elsewhere in DATAPRO 70, are supported for use as remote terminals with the 1100 Series systems: DCT 500 (Report 70D-877-02), DCT 1000 (Report 70D-877-03), DCT 2000 (Report 70D-877-01), Uniscope 100 (Report 70D-877-05), and UNIVAC 9000 Series computers (Report 70C-877-01).

SOFTWARE

OPERATING SYSTEMS: All UNIVAC 1110 systems utilize the 1100 Operating System, which was formerly known as EXEC 8. UNIVAC 1106 and 1108 users, however, can choose to run under the control of either EXEC II or the 1100 Operating System.

EXEC II was originally developed for the second-generation UNIVAC 1107 system. It is fully supported for the 1106 and 1108 and is still in fairly widespread use, mainly because it became available long before the 1100 Operating System and because it facilitated conversion for 1107 users. Also, EXEC II requires only 65K words of main storage, versus 131K for the 1100 Operating System. EXEC II, however, provides no facilities for true multiprogramming, although multiple data transcription functions can be overlapped with the execution of one main program at a time.

The 1100 Operating System (EXEC 8) was developed specifically for the third-generation UNIVAC 1108 system and has been extended to support the 1106 and 1110 systems as well. It supports multiprogrammed batch, real-time, and time-sharing operations on systems with single or multiple central processors. Since most new users will elect to use this newer, more powerful operating system, the capabilities of the 1100 Operating System and its related language processors and utility routines are emphasized in this report.

EXEC II OPERATING SYSTEM: A drum-oriented operating system designed to supervise and control the sequential compilation and/or execution of user programs. The drum is used as a buffer store for I/O data and for storage of program segments, systems programs, and library programs.

The most distinctive feature of EXEC II is its emphasis upon "symbionts." A symbiont is a routine that transfers data between a peripheral device and an intermediate storage device (usually the drum). Two or more symbionts can operate simultaneously with a single user-written main program. The use of symbionts and drum buffers for I/O operations permits effective utilization of the available card readers, punches, and printers and helps to ensure that the central processor will be kept productively occupied even through only one main program at a time is being processed.

The minimum configuration for EXEC II is a UNIVAC 1106 or 1108 system with 65K words of main storage, one FH-1782 Drum or equivalent (2 million words), two magnetic tape units, and either a card reader, punch, and printer or an on-line UNIVAC 9200 or 9300 system.

EXEC II is the principal component of "Software Package B" for the UNIVAC 1107, developed for UNIVAC by Computer Sciences Corporation in the early 1960's. UNIVAC offers 1106 and 1108 users a slightly revamped version of this package, which also includes an assembler, effective drum-oriented COBOL and FORTRAN V compilers, a generalized sort/merge routine, and a variety of utility routines and application programs. An 1106 or 1108 operating under EXEC II can directly execute most programs written for an 1107, though others will require minor modifications. Also, many of the 1100 Operating System programs described below can be run under EXEC II control. EXEC II is not supported for the UNIVAC 1110.

1100 OPERATING SYSTEM: This comprehensive software system, formerly known as EXEC 8, is the principal operating system for the UNIVAC 1106, 1108, and 1110 computers. It supervises and controls multiprogrammed operation in three basic processing modes: batch, demand (or conversational), and real-time.

Batch processing jobs can be submitted either locally or remotely. The 1100 Operating System, like EXEC II, uses symbiont routines and drum or disc buffering for effective overlapping of multiple I/O functions with computing. 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.)

Real-time and communications programs, which are subject to specific time constraints, receive top-priority handling by the 1100 Operating System. The Operating System provides suitable facilities for interrupt handling, priority scheduling, inter-program protection, program switching, and I/O device handling. Communications control facilities are provided by the associated Communications Management System and Transaction Interface Package, described later in this report.

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The minimum configuration for the full 1100 Operating System is a UNIVAC 1106 or 1108 system with 131K words of main storage (or an 1110 with 32K words of main storage and 131K words of extended storage), three FH-432 drums or equivalent (786K words), one Fastrand Mass Storage Unit or equivalent disc storage, two magnetic tape units, and either a card reader, punch, and printer or an on-line 9000 Series computer system. Once the Operating System has been loaded from tape, it is fully drum-oriented, and the tape units are available for other functions. Drum 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 main storage in an 1106 or 1108 system; in an 1110, the typical residence requirements are 20K to 30K words of main storage and a similar amount of extended storage.

For users of comparatively small 1106 systems and for the 1 x 1 configuration of the 1110, UNIVAC offers a specialized version of the 1100 Operating System called the Disc Resident System. This version stores the non-resident Executive functions in disc storage instead of in the usual high-speed drums. Thus, it reduces the cost of the minimum equipment configuration required for the 1100 Operating System, at some sacrifice in performance because of the slower disc access times. The Disc Resident System provides all the facilities of the 1100 Operating System and requires the following minimum configuration: either an 1106 Processor with 131K words of Unitized Storage or an 1110 Processor with 32K words of Main Storage and 131K words of Extended Storage, a two-drive 8414 Disc Subsystem, a UNIVAC 9300 Subsystem, and four magnetic tape units.

A single set of symbolic programs comprises the 1100 Operating System for 1106, 1108, and 1110 systems of all sizes. A Symbolic Stream Generator (SSG) tailors the system to the specific configuration and requirements of each user. A complete system generation takes from three to six hours of computer time and produces an initial load tape for the Operating System.

The 1100 Operating System 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. The Dynamic Allocator allots core space according to the needs of each individual task within a run; storage swaps between core and drum are performed when necessary to provide prompt responses to demand-processing terminals. The CPU Dispatcher controls switching of the processor from one currently active task to another; periodic time-slices can be allotted to demand-mode routines.

Dynamic storage allocation is a key feature of the 1100 Operating System. The system continually strives to optimize the usage of main storage. Allocation is done in 512-word granules and is based on the current space requirements of all tasks; programs can expand and contract dynamically. When tasks are to be swapped out to make room for higher-priority tasks, the swapping decisions are based upon criteria such as best fit, relative priorities, number and sizes of tasks to be swapped out, distance from the "edges" of storage, etc. The system monitors resource usage by individual tasks and classes of tasks and adjusts task priorities accordingly. In 1110 systems, programs can be executed in either main or extended storage and can even be split between the two types of storage. The Operating System monitors the execution characteristics of all programs and attempts to place computational code in main (high-speed) storage and I/O-oriented or low-frequency code in extended storage.

The 1100 Operating System supports two types of program segmentation. The first is the conventional overlay method, in which one part of a program physically replaces another in main storage. The second type, which UNIVAC calls the "program bank" concept, effectively provides 1100 Series programmers with a software-controlled virtual storage mechanism. The system currently supports a virtual storage space of up to 250 program banks (available to the programmer for his individual program) and 4095 library banks (used for common routines which are sharable by all programs). Each bank can be up to 65K words in size, and data banks can be even larger if desired. Moreover, each bank can be specified as either static (resident in memory whenever the program is active) or dynamic (loaded upon request). The number of banks that can be directly accessed at any one time is four in the 1110 system and two in 1106 and 1108 systems. Bank referencing instructions effectively replace one of the accessible banks with a new bank; these instructions are direct hardware functions in the 1110 and are simulated by software in the 1106 and 1108.

Re-entrant processing is another featured capability of the 1100 Operating System. Processors such as the Assembler, Conversational FORTRAN, and Text Editor are re-entrant and can be shared by any number of concurrent jobs. The COBOL and FORTRAN compilers produce re-entrant code, and the COBOL, FORTRAN, and ALGOL libraries consist of re-entrant modules. 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 Operating System help to minimize the impact of hardware failures upon user operations. Console type-ins can be used to add or subtract specific components from the on-line configuration, while allowing uninterrupted operation in most cases. The auto recovery sequence is initiated when a critical component fails, and UNIVAC states that the system will normally be back on the air within 15 to 60 seconds after recognizing the failure.

Multiprocessing is handled as a logical extension of the 1100 Operating System'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 Operating System component that handles the creation and maintenance of program and data files, and maintains a master directory of all cataloged 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.

The Software Instrumentation Package (SIP) consists of a set of data collection routines within the 1100 Operating System and a set of user-level data reduction programs. SIP collects statistics on central processor, storage, and I/O channel utilization, file placement and accesses, and other

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The Communications/Symbiont Processor (C/SP) is an independently programmed computer designed to control data communications and card and printer I/O operations. It can be used with any of the 1100 Series systems.

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.

TOTAL INFORMATION MANAGEMENT SYSTEM: This comprehensive software system, designed to integrate and satisfy all the management information needs of a company, consists of four functional modules: the Communications Management System (CMS), Transaction Interface Package (TIP), Conversational Time-Sharing (CTS), and Data Management System (DMS). These modules are described in the paragraphs that follow. All operate under control of the 1100 Operating System, and they can be used individually or in any combination. Most of the facilities of the Total Information Management System are currently in use, and all of the announced facilities are due for delivery by early 1974.

COMMUNICATIONS MANAGEMENT SYSTEM: CMS is a data communications monitor that has cognizance of all terminals in an 1100 Series computer network. It 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 terminls 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 "middle man" between the 1100 Operating System and the user's application programs in a transaction-oriented on-line data processing system. TIP's functions are stimulated by the incoming transaction messages stored in the common data pool maintained by CMS. The TIP transaction scanner, TRANSCAN, analyzes each message, determines which application program is required to process it, and arranges for the Executive to load and execute that program. One application program can also call another application program via TIP, through program action based on data parameters. The application programs can be written in COBOL, FORTRAN, or Assembly Language 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.

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 configured for the 1100 Operating System. (A standard transaction is defined as having 50 characters of input, 100 characters of output, 6 mass storage file accesses, a 4000-word transaction program, and 10,000 instruction executions.) TIP typically requires about 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 and FORTRAN, and compilers for BASIC, FORTRAN (RFOR), COBOL, ALGOL, etc. A straight-forward control language enables remote users to perform all their activities from within the CTS environment; no knowledge of the 1100 Series job control language is required.

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

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

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

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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.

The Data Manipulation Language (DML) is the procedural language used by individual programmers to access the data base. It is used in connection with a host language–usually COBOL–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.

IMS-8: This is a self-contained information management system that consists of three re-entrant modules: FMS-8, Interactive Processor, and Report Writer. FMS-8 is a procedural file management system that permits sequential and/or random accessing of files stored in the indexed sequential format. The Interactive Processor analyzes and coordinates the activities of demand-mode users accessing the files. The Report Writer produces user-specified reports based upon data extracted from the files; its capabilities include sorting, totaling, and calculation of new fields.

ISFMS: The "Indexed Sequential File Management System" handles the creation, accessing, and maintenance of indexed sequential files, which can be processed in either random or sequential fashion. ISFMS is neither re-entrant nor data base oriented; it is a comparatively simple, procedurally oriented system designed to interface with programs coded in either COBOL or Assembler language.

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 Display Terminal; DCT 500, DCT 1000, and DCT 2000 Data Communications Terminals; UNIVAC 1004 and 9000 Series Computers; and Binary Synchronous Communication (BSC) devices.

C/SP programs that run on the host 1100 Series system include an Assembler, Element Collector, Simulator, and Symbionts. 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.

COBOL: UNIVAC offers three COBOL compilers for use under the 1100 Operating System. The newest and most powerful is UNIVAC 1100 Series ASCII/ANSI COBOL. This compiler implements all modules of the American National Standard COBOL language at the highest levels and includes numerous extensions. ASCII is recognized as the standard data code at both source and object time, with Fieldata code-handling facilities available as an option. Principal language extensions based on CODASYL development efforts include: data base management (via DMS), teleprocessing (via CMS), interprogram communication, asynchronous processing, character manipulation features, and an extended EXAMINE capability through the INSPECT verb. Additional, non-standard extensions include: debugging features (including MONITOR and EXHIBIT), a TRANSFORM verb to develop one character string from another, multiple data formats, expanded forms control facilities, and the capability to produce re-entrant object code.

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

UNIVAC 1100 Series COBOL, the earliest of the three current compilers, is a reasonably comprehensive implementation of D.O.D. COBOL-65. It includes the Mass Storage, Sort, and Segmentation facilities, the COMPUTE, COPY, and ENTER verbs, and several useful extensions. The MONITOR verb, for example, facilitates testing and debugging by providing dynamic printouts of the values of specified data items. This compiler can be used under EXEC II as well as under the 1100 Operating System.

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

1. A variable may have up to seven subscripts, and complex subscript expressions are permitted.

2. Mixed-mode arithmetic is permitted, with only a few exceptions.

3. Backward DO loops (with decreasing index variables) are permitted.

4. The FLD function permits extraction and insertion of bit fields.

5. The DEFINE, DELETE, ENTRY, IMPLICIT, INCLUDE, and NAMELIST statements provide useful additional facilities.

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

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

LIFT is a source-language translator that converts programs written in the FORTRAN II language into FORTRAN V, so that they can be compiled by the 1100 Series FORTRAN V compiler. LIFT itself is written in FORTRAN V and runs under 1100 Operating System control.

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/I: UNIVAC recently announced an 1100 Series compiler for PL/I, the multi-purpose programming language developed by IBM and the SHARE user group. Although no firm timetable has been announced, UNIVAC expects to deliver a subset PL/I compiler in the fourth quarter of 1973 and to add such advanced facilities as multi-tasking, teleprocessing, and recursive procedures by the first quarter of 1975.

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

UTILITY ROUTINES: The Sort/Merge Package is a generalized routine that uses the 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 EXEC II and 1100 Operating Systems include ample complements of utility routines to perform common functions such as I/O control, data transcription, file maintenance, editing, snapshots, and dumps.

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

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

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

APT (Automatically Programmed Tools)
FMPS (Functional Mathematical Programming System)
GPSS 1100 (General Purpose System Simulator)
Linear Programming System
PERT/Time and PERT/Cost
SIMULA (Simulation 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 six systems 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. A quick comparison of these system prices makes it clear that the 1108 is no longer a cost-effective choice.

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UNIVAC 1106 SYSTEM: Consists of one 1106 Processor with 131K words (786K characters) of Unitized Storage and 8 I/O channels, Display Console, three FH-432 Drums (4.7 million characters), one 4-drive 8414 Disc Subsystem (130 million characters), four 9-track Uniservo 12 Magnetic Tape Units (68KB), 900-cpm Card Reader, 300-cpm Card Punch, and 1200/1600-lpm Printer. Monthly rental and purchase prices are approximately $30,000 and $1,107,000, respectively. (If the three FH-432 Drums were omitted, monthly rental and purchase prices would be approximately $24,400 and $897,000 respectively.)

UNIVAC 1106 II SYSTEM: Consists of one 1106 Processor with 131K words (786K characters) of Multi-Modular Storage II and 8 I/O channels, plus same peripheral equipment as the UNIVAC 1106 system above. Monthly rental and purchase prices are approximately $36,700 and $1,375,000, respectively.

UNIVAC 1108 SYSTEM: Consists of one 1108 II Processor with 131K words (786K characters) of Main Storage and 8 I/O Channels, plus same peripheral equipment as the UNIVAC 1106 system above. Monthly rental and purchase prices are approximately $56,100 and $2,140,000, respectively.

UNIVAC 1108 MULTIPROCESSOR SYSTEM: Consists of three 1108 II Processors, 262K words (1.572 million characters) of Main Storage, two I/O Controllers with 8 channels each, three Display Consoles, one Availability Control Unit, four Multi-Module Access Units, ten Shared Peripheral Interfaces, eight FH-432 Drums with dual-channel Control Units (12.5 million characters), four Fastrand III Mass Storage Units with Dual Control (792 million characters), twelve 9-track Uniservo 16 Magnetic Tape Units (192KB) with dual-channel Control Units, two 900-cpm Card Readers, two 300-cpm Card Punches, and two 1200/1600-lpm Printers. Monthly rental and purchase prices (exclusive of the extensive data communications and remote terminal equipment normally used in a system of this type) are approximately $176,000 and $6,778,000, respectively.

UNIVAC 1110 1 x 1 SYSTEM: Consists of one Command/Arithmetic Unit, one Input/Output Access Unit with 8 channels, 32K words of Main Storage, 131K words of Extended Storage, System Console, Communications/Symbiont Processor (with 49K bytes of storage, 1000-cpm card reader, and 1000-lpm printer), 4-drive 8414 Disc Subsystem (130 million characters), and four 9-track Uniservo 12 Magnetic Tape Units (68KB). Monthly rental and purchase prices are approximately $36,300 and $1,315,000, respectively.

UNIVAC 1110 2 x 2 SYSTEM: Consists of two CAU's, two IOAU's with 16 channels each, 131K words of Main Storage, 393K words of Extended Storage, System Console, Communications/Symbiont Processor (with 65K bytes of storage, 1000-cpm card reader, and two 1000-lpm printers), six FH-432 Drums (9.4 million characters) with dual-channel controls, four 8440 Disc Drives (480 million characters), and eight Uniservo 20 Magnetic Tape Units (320KB). Monthly rental and purchase prices (exclusive of the extensive data communications and remote terminal equipment usually used in a system of this type) are approximately $95,600 and $3,603,000, respectively.

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

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

LONG-TERM LEASES: In addition to the basic 1-year agreement, UNIVAC offers extended-term leases for the 1100 Series systems at significantly lower rates. UNIVAC 1106 systems are available on a 5-year lease at a monthly equipment charge of 75% of the 1-year rental rate shown in the accompanying price list. UNIVAC 1108 systems are available on a 3-year, 4-year, or 5-year lease at 90%, 82.5%, or 75% of the 1-year rental rates, respectively. UNIVAC 1110 systems are available on a 5-year lease at 80% of the 1-year rental rate. In additional to these "level-payment" leases, UNIVAC also offers "reducing-payment" leases. For example, under a 5-year reducing-payment agreement, the monthly charge for an 1110 system is 90% of the 1-year rental rate during the first year, 85% the second year, 80% the third year, 75% the fourth year, and 70% the fifth year. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1106 PROCESSORS AND MAIN STORAGE				
3011-20	1106 Processor (with 4 I/O channels)	283,230	1,246	6,195
F0680-99	I/O Channel Expansion (4 channels)	21,000	64	485
F1053-98	Multiprocessor Capability (required on each 3011-20 Processor in a multiprocessor system)	8,700	0	200
Unitized Storage; 1.5 microsecond cycle time:				
7013-04	131,072 words	205,875	615	4,504
7013-99	262,144 words	411,750	1,230	9,009
Storage I (Multi-Modular); 1.5 microsecond cycle time:				
7005-60	65,536 words	205,875	401	4,504
7005-58	131,072 words	411,750	797	9,009
7005-57	196,608 words	617,625	1,198	13,508
7005-56	262,144 words	823,500	1,594	18,012
Storage II (Multi-Modular); 1.0 microsecond cycle time:				
7005-42	131,072 words	474,540	897	10,909
7005-41	196,608 words	713,748	1,298	16,408
7005-40	262,144 words	953,215	1,694	21,913
4009-99	Display Console (includes control console, entry keyboard, CRT display, and Page-printer; one required with each 1106 Processor)	32,625	267	750
F0774-00	Auxiliary Console (required when CTMC's are used; houses 4 CTMC's)	6,600	10	155
1106 MULTIPROCESSOR SYSTEM COMPONENTS				
2506-00	Availability Control Unit (for up to 2 Processors, 4 MMA's, and 6 SPI's; expandable to a maximum of 24 SPI's)	52,200	123	1,200
F0874-00	ACU Expansion (for up to 6 more SPI's)	2,830	10	68
0955-04	Shared Peripheral Interface (permits 2 Processors to share a peripheral subsystem)	19,575	26	472
0955-05	Shared Peripheral Interface (has same functional characteristics, and shares a cabinet with, Type 0955-04 SPI)	17,400	21	420
F1384-98	Unitized MMA (allows 3 Processors to access a 131K module of Unitized Storage)	40,237	75	925
0962-99	Shared Memory Interface (allows 2 Processors to access a 65K module of 1.5-microsecond Multi-Modular Storage)	28,160	50	645
0954-99	Storage II MMA (allows 2 Processors to access a 65K module of 1.0-microsecond Multi-Modular Storage)	56,550	53	1,300
1108 PROCESSORS AND MAIN STORAGE				
3011-91	1108 II Processor (with 8 I/O Channels and 65,536 words of Core Storage)	1,086,900	3,284	24,845
F1053-99	Multiprocessor Capability (required on each 3011-91 in a multiprocessor system)	8,700	—	200
F0680-01	I/O Channel Expansion (4 additional channels; for 3011-91 or 3011-87)	21,000	64	485
3011-87	1108 Shared Processor (consists of an I/O Processor with 8 I/O Channels, a Main Processor dedicated to computing, 65,536 words of Core Storage and 2 MMA's)	1,500,630	4,638	32,195
7005-48	65K Storage Expansion; add to Processor for 131,072 words total	457,500	642	10,440
7005-47	131K Storage Expansion; add to Processor for 196,608 words total	640,500	1,305	14,620
7005-46	196K Storage Expansion; add to Processor for 262,144 words total	960,750	1,867	21,930
4009-99	Display Console (includes control console, entry keyboard, CRT display, and Page-printer; one required with each 1108 Processor)	32,625	267	750
F0774-00	Auxiliary Console (required when CTMC's are used; houses 4 CTMC's)	6,600	10	155
1108 MULTIPROCESSOR SYSTEM COMPONENTS				
5013-00	I/O Controller (with 4 I/O channels, 256-word index storage, and 131K addressing)	174,000	128	4,000
F0778-00	I/O Channel Expansion (4 channels)	22,620	64	520
F0790-00	Index Storage Expansion (256 words)	32,450	—	705
F0832-00	Processor Interface (for second Processor)	5,220	—	120
F0832-01	Processor Interface (for third Processor)	5,220	—	120
F0833-00	MMA Interface (for addressing 196K words)	2,610	—	60
F0833-01	MMA Interface (for addressing 262K words; F0833-00 is a prerequisite)	2,610	—	60
2506-00	Availability Control Unit (for up to 3 Processors, 2 I/O Controllers, 4 MMA's and 6 SPI's; expandable to up to 24 SPI's)	52,200	123	1,200
F0874-00	ACU Expansion (for up to 6 more SPI's)	2,830	10	68
0954-99	Multi-Module Access (permits up to 2 Processors and 1 I/O Controller to access a 65K storage module)	56,550	53	1,300
F0879-00	MMA Expansion (enables an MMA to accommodate up to 3 Processors and 2 I/O Controllers)	2,610	—	60

* Rental prices do not include equipment maintenance.

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		Purchase Price	Monthly Maint.	Rental (1-year lease)*
1108 MULTIPROCESSOR SYSTEM COMPONENTS (cont'd)				
0955-04	Shared Peripheral Interface (permits 2 Processors or I/O Controllers to share a peripheral subsystem)	19,575	26	472
0955-05	Shared Peripheral Interface (has same functional characteristics, and shares a cabinet with, Type 9855-04 SPI)	17,400	21	420
F0789-00	SPI Expansion (adds a third interface)	3,480	5	80
F0789-01	SPI Expansion (adds a fourth interface; F0789-00 is a prerequisite)	2,375	5	55
1110 PROCESSORS AND I/O CONTROL				
3023-95	1110 Processor (1 x 1); includes 1 CAU and 1 IOAU with 8 channels	455,380	2,330	10,973
3023-99	1110 Processor (2 x 1); includes 2 CAU's and 1 IOAU with 8 channels	692,520	2,840	16,716
3023-98	CAU Expansion; provides 2 additional Command/Arithmetic Units	547,885	1,423	13,224
3025-00	Input/Output Unit (8 channels)	125,715	716	3,034
F1387-00	I/O Channel Expansion (Channels 9-16)	16,095	42	388
F1387-01	I/O Channel Expansion (Channels 17-24)	16,095	42	388
4013-99	System Console; includes display and printer	63,730	288	1,538
2516-00	System Partitioning Unit; includes interfaces for 2 CAU's, 2 IOAU's, 2 MSU's, 4 MAI's and 6 Multi-Access Subsystems (MAS)	48,505	133	1,170
F1448-00	CAU Interface Expansion (for 3rd & 4th CAU's)	5,005	10	120
F1449-00/01	IOAU Interface Expansion (for 3rd or 4th IOAU)	5,005	10	120
F1450-00/01	MSU Interface Expansion (for 3rd or 4th Main Storage Unit)	3,265	10	78
F1451-00/03	MAI Interface Expansion (for 5th-8th MAI, respectively)	2,830	10	68
F1441-00/06	MAS Interface Expansion (each accommodates 6 additional Multi-Access Subsystems, for up to 48 total)	2,395	5	57
0955-99	Shared Peripheral Interface (permits 2 IOAU's to share a peripheral subsystem)	19,575	26	472
0955-98	Shared Peripheral Interface (shares a cabinet with Type 0955-99 SPI)	17,400	21	420
F0789-99	SPI Expansion (adds a 3rd interface)	3,480	5	80
F0789-98	SPI Expansion (adds a 4th interface)	2,395	5	55
F1095-99	1110/9000 Inter-Computer Control Unit (for on-line connection of a UNIVAC 9000 Series computer)	8,920	48	215
1110 MAIN STORAGE (PLATED-WIRE)				
7015-00	Main Storage Unit; 32,768 words (includes basic MMA with 8 interfaces)	300,805	425	6,915
F1331-00	Storage Expansion; 32,768 words (expands a 7015-00 to 65,536 words)	256,435	290	5,895
7015-02	Main Storage Unit; 32,768 words (includes basic MMA with 8 interfaces; not usable in 4-processor systems)	270,725	425	6,915
7015-04	Storage Expansion; 32,768 words (expands a 7015-02 to 65,536 words)	230,790	290	5,895
F1330-00/03	MMA Expansion; adds 4 additional interfaces to a 32K storage module	7,615	10	175
1110 EXTENDED STORAGE (CORE)				
7013-81	Unitized Storage; 131,072 words, 1.5 microsecond cycle time (requires 1 MAI or 1 MAI Expansion)	135,120	337	2,955
0963-00	Multiple Access Interface; provides 4 interfaces and control for one 7013-81 (can be used with 1108 Storage, Type 7005, if F1397-00 is also used)	43,065	128	1,039
F1394-00	MAI Expansion; adds a second MAI to an 0963-00	19,575	80	472
F1393-00	MAI Interface Expansion; adds 3 more interfaces to an 0963-00	11,530	21	278
F1393-01	MAI Interface Expansion; adds second set of 3 additional interfaces to an 0963-00	11,530	21	278
F1397-00	1108 Storage Interface; permits use of one 65K module of 1108 Storage, Type 7005, as Extended Storage	8,920	16	215
F1384-99	MMA Expansion; provides 2 additional interfaces for 7013-81	3,265	10	78
MASS STORAGE				
5031-00	Control Unit for Unitized Channel Storage	40,800	160	892
7013-97	Unitized Channel Storage; 262K words	270,240	674	5,911
7013-95	Unitized Channel Storage; 524K words	540,480	1,348	11,822
7013-93	Unitized Channel Storage; 786K words	810,720	2,022	17,733
7013-91	Unitized Channel Storage; 1048K words	1,080,960	2,696	23,644
5012-00	FH-432/FH-1782 Drum Control	82,515	278	1,979
F0929-00	Write Lockout Feature (for 5012-00)	1,040	5	26
F0930-00	Shared Peripheral Interface (for 5012-00)	17,905	26	435
F0930-01	SPI Expansion (adds third interface to F0930-00)	2,675	5	68
F0930-02	SPI Expansion (adds fourth interface to F0930-00)	2,060	5	52
6016-00	FH-432 Drum; 262K words	42,435	107	1,018
6015-00	FH-1782 Drum; 2097K words	117,210	278	2,814
F0786-01	Dual Channel Feature (for FH-432)	2,255	16	57
F0767-01	Dual Channel Feature (for FH-1782)	2,255	16	57

* Rental prices do not include equipment maintenance.

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Univac 1100 Series
EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
MASS STORAGE (cont'd)				
5009-24	Fastrand II Control (single channel)	33,190	123	1,165
5009-77	Fastrand II Dual Control (two channels; includes Dual Access Adapter for Drum 1)	78,320	246	2,770
F0959-99	Dual Access Adapter (required for each additional drum connected to 5009-77)	1,830	10	40
6010=00	Fastrand II Storage Unit; 132 million characters	107,015	321	3,750
F0686-01	Fastbands Feature (for 6010-00)	8,235	26	190
F0688-01	Write Lockout Feature (for 6010-00)	1,040	5	25
5009-89	Fastrand III Control (single channel)	62,220	144	1,430
5009-85	Fastrand III Dual Control (two channels; includes Dual Access Adapter for Drum 1)	147,010	288	3,380
F0959-97	Dual Access Adapter (required for each additional drum connected to 5009-85)	1,830	10	40
6010-10	Fastrand III Storage Unit; 198 million characters	200,800	374	4,615
F0686-01	Fastbands Feature (for 6010-10)	8,235	26	190
F0688-01	Write Lockout Feature (for 6010-10)	1,040	5	25
5024-02	8414 Disc Control (requires 0961-02 or F1321-02 MSA)	26,400	90	550
F1043-00	Dual Channel Feature (provides access to 5024-02 from 2 I/O channels)	3,700	15	85
F1371-00	Dual Access (permits simultaneous 2-channel access when used with two 5024-02 Controls)	2,160	5	45
8414-92	Two 8414 Disc Drives; 58 million bytes	33,000	130	820
8414-94	Four 8414 Disc Drives; 116 million bytes	66,000	260	1,540
8414-96	Six 8414 Disc Drives; 174 million bytes	99,000	390	2,160
8414-98	Eight 8414 Disc Drives; 232 million bytes	132,000	520	2,680
F1214-00	Disc Pack (for 8414 Drives)	440	NA	20
0961-02	Multi-Subsystem Adapter; adapts from 1 to 8 byte-oriented subsystems for use in 1100 Series systems	23,760	58	519
F1321-02	MSA Expansion; adds a second MSA module to an 0961-02	18,960	48	414
F1323-00	Function Buffer Expansion; required on MSA for disc operations	1,920	10	42
F1322-00	Search Identifying Register; required on MSA for disc operations	1,920	10	42
F1324-02	Shared Peripheral Interface; for MSA	6,000	25	125
5024-99	8424 Disc Control (requires 0961-02 or F1321-02 MSA)	48,345	310	1,165
F1043-00	Dual Channel Feature (provides access to 5024-99 from 2 I/O channels)	3,700	15	85
F1771-01	Dual Access (permits simultaneous 2-channel access when used with two 5024-99 Controls)	4,320	10	90
8424-00	8424 Disc Storage; 2 drives, 116 million bytes total	29,880	170	720
F1214-01	Disc Pack (for 8424 drives)	375	NA	20
5033-97	8440 Disc Control; for up to four 8440 Disc Storage units (8 drives)	74,700	450	1,800
5033-95	8440 Disc Control; connects to system via Type 5033-97 and controls up to 8 additional drives; maximum of three per 5033-97	65,362	410	1,575
F1324-02	Shared Peripheral Interface (for 5033-97)	6,000	25	125
F1325-00	ASCII Translator (for 5033-97)	1,920	10	40
F1325-01	EBCDIC Translator (for 5033-97)	1,920	10	40
F1482-02	Dual Access (permits simultaneous 2-channel access when used with two 5033-97 Controls)	4,320	10	90
8440-02	8440 Disc Storage; 2 drives; 238 million bytes total	50,547	290	1,218
F1221-00	Disc Pack (for 8440 drives)	850	NA	NA
5036-97	8460 Disc Control; for up to four 8460 Disc Files	37,350	150	900
8460-02	8460 Disc File	147,325	400	3,550
F1757-00	Dual Access (for 8460-02; permits simultaneous 2-channel access when used with two 5036-97 Controls)	6,850	20	165
INPUT/OUTPUT UNITS				
5008-00	Uniservo VI C Control (single channel)	31,070	37	745
5008-98	Uniservo VI C Control (dual channel)	62,140	74	1,490
F0627-04	Translator (BCD/Fieldata code; for 5008-00)	4,410	5	110
F0627-99	Translator (BCD/Fieldata code; for 5008-98)	8,820	10	220
F0706-00	9-Track Capability (for 5008-00 or 5008-98; two required for simultaneous operation)	1,960	5	47
0858-00	Uniservo VI C Master Tape Unit; 7-track	17,350	123	420
0858-08	Uniservo VI C Master Tape Unit; 7-track (with simultaneous R/R, R/W capability)	19,800	123	477
0858-01	Uniservo VI C Slave Tape Unit; 7-track (up to 3 slaves can be used with each Master Unit)	10,470	74	252
0858-10	Uniservo VI C Master Tape Unit; 9-track	17,350	123	420
0858-12	Uniservo VI C Master Tape Unit; 9-track (with simultaneous R/R, R/W capability)	19,800	123	477
0858-14	Uniservo VI C Slave Tape Unit; 9-track (up to 3 slaves can be used with each Master Unit)	10,470	74	252

* Rental prices do not include equipment maintenance.

Univac 1100 Series
EQUIPMENT PRICES

	INPUT/OUTPUT UNITS (cont'd)	Purchase Price	Monthly Maint.	Rental (1-year lease)*
5008-12	Uniservo VIII C Control (single channel)	40,580	128	1,501
5008-89	Uniservo VIII C Control (dual channel)	81,160	256	3,002
F0704-00	VI C Capability (for 5008-12 or 5008-89; two required for simultaneous operation)	2,200	5	84
F0706-00	9-Track Capability (for 5008-12 or 5008-89; two required for simultaneous operation)	1,960	5	47
F0627-98	Translator (BCD/Fieldata code; for 5008-89)	8,820	10	220
F0627-04	Translator (BCD/Fieldata code; for 5008-12)	4,410	5	110
0859-00	Uniservo VIII C Magnetic Tape Unit; 7-track	21,275	117	787
0859-08	Uniservo VIII C Magnetic Tape Unit; 7-track (for dual-channel simultaneous operation)	22,130	117	819
0859-04	Uniservo VIII C Magnetic Tape Unit; 9-track	21,700	117	802
0859-10	Uniservo VIII C Magnetic Tape Unit; 9-track (for dual-channel simultaneous operation)	22,555	117	834
0961-02	Multi-System Adapter (prerequisite for Uniservo 12/16 Subsystem)	23,760	58	519
F1321-02	MSA Expansion (required for dual-channel operation)	18,960	48	414
5017-99	Uniservo 12 Magnetic Tape Control (for up to sixteen 9-track, 1600-bpi, nonsimultaneous Uniservo 12 Tape Units)	21,165	90	510
5017-00	Uniservo 12/16 Magnetic Tape Control (for up to sixteen 9-track, 1600-bpi, nonsimultaneous Uniservo 12 and/or Uniservo 16 Tape Units)	22,825	100	550
F0825-00	Dual Channel Feature (for 5017-00 or 5017-99; permits simultaneous operation on either of two Selector Channels)	3,700	15	85
F1131-99	Uniservo 16 Capability (for 5017-99)	1,660	10	40
F0899-00	Simultaneous Operation (for 5017-99)	15,355	65	370
F0899-99	Simultaneous Operation (for 5017-00)	17,015	75	410
F0823-99	7-Track NRZI Capability (for 5017-00 or 5017-99)	4,785	15	110
F0826-00	9-Track NRZI Capability (for 5017-00 or 5017-99)	4,785	15	110
0861-00	Uniservo 12 Master Tape Unit; 9-track, 1600 bpi (includes logic for up to 3 Slave Units)	14,650	107	353
0861-01	Uniservo 12 Slave Tape Unit; 9-track, 1600 bpi	11,745	74	283
0861-04	Uniservo 12 Master Tape Unit; 7-track, 200/556/800 bpi (includes logic for up to 3 Slave Units)	12,699	107	306
0861-05	Uniservo 12 Slave Tape Unit; 7-track, 200/556/800 bpi	10,440	74	252
F0934-99	Simultaneous Feature (for 0861-00)	3,265	16	78
F0934-98	Simultaneous Feature (for 0861-04)	3,265	16	78
F0935-00	Dual Density Feature (for 0861-00)	2,175	10	52
F1041-00	7-to-9-Track Conversion (converts 0861-04 to 0861-00)	1,951	–	47
F1042-00	7-to-9-Track Conversion (converts 0861-05 to 0861-01)	1,305	–	31
0862-04	Uniservo 16 Tape Unit; 9-track, 1600 bpi	18,675	110	450
0862-06	Uniservo 16 Tape Unit; 7-track, 200/556/800 bpi	18,675	110	450
F0937-01	Dual Density Feature (for 0862-04)	2,175	–	50
F1319-00	Dual Access Feature	2,175	10	50
5034-99	Uniservo 20 Control Unit	44,405	120	1,070
F0823-98	7-Track Capability (permits addition of 7-track Uniservo 12 and/or 16 tape units)	5,280	15	110
F0826-99	9-Track NRZI (permits addition of 9-track Uniservo 12 and/or 16 tape units at 800 bpi)	6,240	20	130
F1028-98	9-Track Addition (adds 9-Track NRZI capability to F0823-98)	5,280	15	110
F1324-02	Shared Peripheral Interface (provides an additional I/O interface for the 5034-99 Control)	6,000	25	125
F1325-00	ASCII Translator (for 5034-99)	1,920	10	40
F1325-01	EBCDIC Translator (for 5034-99)	1,920	10	40
0864-00	Uniservo 20 Tape Unit; 9-track, 1600 bpi	23,447	125	565
F1510-00	Dual Access Feature (for 0864-00; permits simultaneous 2-channel access when used with two 5034-99 Controls)	2,175	10	50
5010-00	Card Control (for 1 reader and 1 punch)	28,620	283	687
0706-97	Card Reader; 900 cpm	15,385	133	372
0600-00	Card Punch; 300 cpm	21,560	246	485
5011-00	Printer Control	30,015	213	718
F0751-00	Printer Control Expansion (for second printer)	23,055	107	556
0758-00	Printer; 1200/1600 lpm	43,500	326	992
F0597-97	1004 Control (for on-line connection of a UNIVAC 1004 Card Processor)	10,230	32	240
F1095-02	1108/9000 Inter-Computer Control Unit (for on-line connection of a UNIVAC 9000 Series Computer)	8,920	48	215
0716-02	Card Reader and Control; 1000 cpm (connects to C/SP or on-line 9000 Series computer)	13,680	90	299
0768-02	Printer and Control; 840/1000 lpm (connects to C/SP or on-line 9000 Series computer)	46,545	379	1,123

* Rental prices do not include equipment maintenance.

Univac 1100 Series
EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
COMMUNICATION/SYMBIONT SUBSYSTEM				
3021-99	Communication/Symbiont Processor (C/SP)	21,120	60	440
F1276-99	1100 Channel Adapter	5,280	20	110
F1418-00	Special Device Channel	1,440	5	30
F1274-00	Multiplexer Channel	6,000	20	125
0708-27	Card Reader; 80 cpm	2,160	15	45
7010-87	C/SP Storage; 32,768 bytes	40,800	125	850
7010-86	C/SP Storage; 49,152 bytes	61,200	190	1,275
7010-85	C/SP Storage; 65,536 bytes	81,600	245	1,700
7010-84	C/SP Storage; 98,304 bytes	122,400	345	2,550
7010-83	C/SP Storage; 131,072 bytes	163,200	445	3,400
8542-00	General-Purpose Communications Channel (for C/SP)	11,040	30	230
F1367-00	Multiplexer Expansion (adds 8 positions)	960	5	20
F1286-00	CLT Expansion Module	3,360	15	70
F1287-00	Active Line Indicators (for 16 lines)	480	—	10
F1287-01	Line Indicator Expansion (per 16-line increment)	480	—	10
F1365-99	ATA (Asynchronous Timing Assembly)	720	5	15
F1290-00	Asynchronous CLT; EIA RS232B	335	5	7
F1290-01	Asynchronous CLT; Mil. Std. 188B	335	5	7
F1290-02	Asynchronous CLT; CCITT	335	5	7
F1290-03	Asynchronous CLT; Telegraph I	335	5	7
F1290-04	Asynchronous CLT; Telegraph II	335	5	7
F1291-00	Synchronous CLT; EIA RS232B	1,680	10	35
F1291-01	Synchronous CLT; Mil. Std. 188B	1,680	10	35
F1291-02	Synchronous CLT; CCITT	1,680	10	35
F1291-04	Synchronous CLT; Telpak	2,160	10	45
F1292-00	Dialing Adapter, Single	720	5	15
F1292-01	Dialing Adapter, Double	1,440	5	30
DATA COMMUNICATIONS				
F0900-06	Communication Terminal Module Controller (accommodates up to 16 CTM's)	24,700	144	598
F0906-06	Spare CTMC (mounts in, and provides back up capability for, original CTMC)	9,020	53	220
F0901-04	CTM—Low Speed; up to 300 bps	2,255	16	52
F0902-02	CTM—Medium Speed; up to 1600 bps	2,895	16	73
F0903-02	CTM—High Speed; up to 50,000 bps	3,630	16	89
F0905-00	Automatic Dialing Module	635	5	15
F0904-00	Parallel Output Module; up to 75 char/sec	1,315	10	31
F0904-01	Parallel Input Module; up to 75 char/sec	1,315	10	31
F1019-01	High-Speed Interface Module; 8 duplex lines (for speeds above 4800 bps on F0903-02)	3,050	10	73
F1019-03	High-Speed Interface Module; 4 duplex lines	1,525	5	36
F0771-02	Word Terminal Synchronous (WTS) Module	14,210	171	341
8552-01	WTS Basic Cabinet (holds 2 WTS Modules)	8,380	85	199
F0614-00	Power Supply (for first WTS Module)	3,335	32	84
F0614-01	Power Supply (for second WTS Module)	3,335	32	84
F0772-00	Voice-Band Interface (connects WTS to Bell System 201 Data Set or equivalent)	225	—	5
F0772-01	Unattended Answering (F0772-00 is prerequisite)	225	—	
F0772-02	Automatic Dialing (F0772-01 is prerequisite)	1,670	—	5
F0772-03	Broad-Band Interface (connects WTS to Bell System 301 Data Set or equivalent)	225	16	42
F0615-00	Communication Terminal Synchronous (CTS) Module	8,380	85	199
8552-00	CTS Basic Cabinet (holds 6 CTS Modules	8,380	85	199
F0614-00	Power Supply (for first 3 CTS Modules)	3,335	32	84
F0614-01	Power Supply (for second 3 CTS Modules)	3,335	32	84
F0616-00	Broad-Band Interface (connects CTS to Bell System 301 Data Set or equivalent)	3,335	32	84
F0617-00	Unattended Answering (cannot be used with F0616-00)	225	—	5
F0618-00	Automatic Dialing (F0617-00 is prerequisite)	1,670	16	43

* Rental prices do not include equipment maintenance.

UNIVAC 1100 Series
NEW PRODUCT ANNOUNCEMENT

UNIVAC announced a new family of high-speed line printers, the UNIVAC 0770 Printers, on April 4, 1973. The new printers utilize 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, and 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), Type 0961, or to a UNIVAC 9700 system directly via its multiplexer channel.

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

Printing speeds for 48-character sets are 800 lines per minute for Model 0770-00, 1400 lines per minute for Model 0770-02, and 2000 lines per minute for Model 0770-04. The respective skipping speeds for these 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 printing 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 to 22 inches wide and up to 24 inches long. Cabinets are universally 72 inches wide, 54 inches high, and 54 inches deep, and all weigh approximately 1700 pounds. Power required is 3-phase, 208 to 240 volts, 50 or 60 Hertz.

First customer deliveries of the new printers will be made in September 1973 for 1100 systems and sometime during the remainder of 1973 for 9700 systems. The control units of the printers have a standard 9000 Series interface.

	Purchase Price	Monthly Maint.	Rental (1-year lease)*
0770 PRINTERS			
0770-00 Printer, 800 lines per minute	$43,370	$210	$1,045
0770-02 Printer, 1400 lines per minute	51,875	275	1,250
0770-04 Printer, 2000 lines per minute	73,455	350	1,770
0770 PRINTER FEATURES			
F1533-00 160 Print Positions	3,530	15	85
F1534-00 Expanded Character Set Control (required for other than 1536-00 or -01 Print Cartridges)**	2,285	5	55
PRINT CARTRIDGES			
F1536-00 48-character alphanumeric Business	400	–	20
F1536-01 48-character alphanumeric Scientific	400	–	20
F1537-00 94-character ASCII	400	–	20
F1537-03 64-character universal ISO OCR-B	400	–	20
F1537-04 64-character universal OCR H-14	400	–	20
F1537-05 58-character COBOL-FORTRAN-Business	400	–	20
F1537-06 177-character International	400	–	20
F1537-09 24-character Numeric	400	–	20
F1537-11 68-character universal OCR-A	400	–	20
F1537-12 68-character universal OCR-B	400	–	20
F1537-13 68-character universal 77L	400	–	20

* Rental prices do not include maintenance.
** Can be field-installed at a charge of $25.00.