Sperry Univac 1100/60 System

MANAGEMENT SUMMARY

The Sperry Univac 1100/60 System was the first mainframe to make use of multi-processor architecture. The arithmetic and logic portions of the 1100/60 employ sets of nine Motorola 10800 microprocessors (4-bit slice) combined with ECL circuitry and multilayer packaging. Sperry Univac terms these sets microexecution units, which concurrently execute parts of the same micro-instructions for improved throughput.

A fundamental consideration in the 1100/60 system design was the provision of high availability, reliability, and maintainability (ARM). Sperry Univac has implemented ARM through such techniques as duplicate micro-execution units, and duplicates of the shifter, logic function, and control store address generator. Further, an instruction retry mechanism is included that allows the system to recover from most transient faults, transparent to the operating environment.

TRACE, the Total Remote Assistance Center, is another step Sperry Univac has taken to implement ARM. TRACE provides remote hardware maintenance from Roseville, Minnesota via phone lines. Software maintenance is still being handled from local offices.

PROCESSORS

The 1100/60 processors are available in six basic models. The entry-level C models do not include buffer storage. The medium-performance E models include 2K words of buffer storage, while the high-performance H models include 8K words of buffer storage. Models C1, E1, and H1 use the standard 1100 Series instruction set. Models C2, E2, and H2 include the Extended Instruction Set ➢

The 1100/60 medium- to large-scale computer systems feature a multiple-microprocessor implementation of the 1100 Series architecture. Both uniprocessor and multiprocessor configurations are available. More than 700 1100/60 systems are currently installed.

MODELS: 1100/61 C1, C2, E1, E2, H1, and H2; 1100/62 E1MP, E2MP, H1MP, and H2MP; 1100/63 H1MP and H2MP; and 1100/64 H1MP and H2MP.
CONFIGURATION: From 1 to 4 CPUs, 512K to 8192K words of main memory, 1 to 4 IOUs, and 1 to 7 consoles.
COMPETITION: Burroughs B 5900 and B 6900, Control Data Cyber 170 Series, Digital Equipment DECsystem 10, Honeywell DPS8, and IBM 303X and 4341.
PRICE: Purchase prices for basic Processing Complexes range from $336,519 to $2,797,332.

CHARACTERISTICS

MANUFACTURER: Sperry Univac Division, Sperry Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19424. Telephone (215) 542-4011.

DATE ANNOUNCED: June 1979.

DATE OF FIRST DELIVERY: January 1980.

MODELS: 1100/61 C1, C2, E1, E2, H1, and H2; 1100/62 E1MP, E2MP, H1MP, and H2MP; 1100/63 H1MP and H2MP; and 1100/64 H1MP and H2MP. ➢

The 1100/60 System has been enhanced to support up to 4 central processors and up to 8192K words of main memory. A single processor configuration can include a maximum of four consoles; a multiprocessor configuration, a maximum of seven consoles.

Sperry Univac 1100/60 System

(EIS), which is designed to enhance the performance of high-level languages and system software. The C1, E1, and H1 can be upgraded to a C2, E2, or H2 with the addition of the EIS. The C models can also be upgraded to E models, which in turn can be upgraded to H models.

Six uniprocessor configurations and eight multiprocessor configurations are available. The 1100/61 and 1100/62 systems include one and two central processors, respectively. In November 1981, Sperry Univac announced the three-processor 1100/63 and the four-processor 1100/64, which are scheduled for delivery in the fourth quarter of 1982. An 1100/61 system can include any processor model in the 1100/60 series. An 1100/62 system can include a Model E1, E2, H1, or H2 processor. The 1100/63 and 1100/64 systems can be configured with Model H1 or H2 processors only.

The 1100/62 Model E1 or E2 comes packaged as a dual-processor system and can also be configured by adding a Multiprocessor Upgrade feature to an 1100/61 E1 or E2. Multiprocessor Upgrade features are available to upgrade a Model H1 or H2 from an 1100/61 to an 1100/62, an 1100/62 to an 1100/63, or an 1100/63 to an 1100/64.

The basic 1100/60 Processor Complex consists of the CPU, main memory, buffer storage (Models E and H only), System Support Processor (SSP), I/O Unit (IOU), and system console with printer. Multiprocessor systems also include a maintenance console. The SSP provides system management, support for diagnostics and maintenance, and console handling. Each standard IOU includes one block multiplexer channel and four word channels. An IOU can be expanded to include 3 block multiplexer and 8 word channels, 2 block multiplexer and 12 word channels, or 5 block multiplexer and 4 word channels.

Originally, main memory was housed in the 1100/60 processor cabinet. However, Sperry Univac recently expanded the memory capacity of the 1100/60 systems by adding a separate memory cabinet. Main memory capacity now ranges from 512K words (2 megabytes) to 4096K words (16 megabytes) on the C models and from 512K words to 8192K words (32 megabytes) on the E and H models. The older memory is composed of 16K-bit chips, but the new external memory uses 64K-bit chips. Current users can upgrade to the new external memory unit by ordering the appropriate memory upgrade features. New customers can order the 1100/60 systems with a minimum of 1024K words housed in the external memory cabinet.

Sperry Univac also offers the 1100/60 Attached Virtual Processor (AVP) for users upgrading from a Series 90/60 or 90/80 to an 1100/60 system. The AVP provides concurrent execution of applications written for the Series 90 operating system and applications written for the 1100 Series operating system.

DATA FORMATS

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

FIXED-POINT OPERANDS: One 36-bit single precision word. Addition and subtraction can also be performed upon 2-word (72-bit) double precision 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 1100/60 C2, E2, and H2 models can 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 for single precision; or two words, consisting of 60-bit-plus-sign fraction and 11-bit exponent for double precision. The range for single precision is from 10 to the 38th power to 10 to the minus 38th power with 8-digit precision; for double precision, the range is 10 to the 307th power to 10 to the minus 308th power with 18-digit precision. The sign is the most significant bit in single precision (bit 35) and double precision (bit 71). Negative floating point numbers are represented by the ones complement of the entire corresponding positive floating point number. Single precision negative exponents are biased by 128 while double precision negative exponents are biased by 1024.

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

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

MAIN STORAGE

STORAGE TYPE: N-channel MOS. Memory housed in the processor cabinet uses 16K-bit chips; the new external memory uses 64K-bit chips.

CAPACITY: Models C1 and C2—512K words (2 megabytes) to 4096K words (16 megabytes); Models E1, E2, H1, and H2—512K words to 8192K words (32 megabytes).

CYCLE TIME: Read/write cycle time of 580 nanoseconds; 625 nanosecond access to corrected read data; and 928 nanosecond partial write cycle. Memory refresh takes 24 nanoseconds. Single and partial word writes are available. In multiprocessor systems, storage modules may be interleaved under control of the System Support Processor (SSP) software.

CHECKING: The Main Storage Unit (MSU) contains circuitry for single-bit error detection and correction and detection of double-bit errors. Multiples of double-bit errors and some odd multiples of double-bit errors are also detected. Memory errors are detected using a 7-bit hamming code generated for all read and write operations.

A parity bit with each half-word is checked whenever storage is referenced for I/O transfers via the two IOU interfaces. The MSU also detects single-bit address errors and out of bounds addresses.

STORAGE PROTECTION: The Bank Descriptor Registers (BDRs) loaded by the 1100 Operating System define the

Sperry Univac 1100/60 System

Sperry Univac 1100/60 System Summary

	No. of CPUs	No. of IOUs	Extended Instruction Set	SIUs/Words Buffer Storage	Main Memory Capacity, Words	SSP/ Console	Additional Consoles
1100/61:							
C1	1	1	No	None	512K-4096K	1	0-3
C2	1	1	Yes	None	512K-4096K	1	0-3
E1	1	1	No	1/2K	512K-8192K	1	0-3
E2	1	1	Yes	1/2K	512K-8192K	1	0-3
H1	1	1	No	1/8K	512K-8192K	1	0-3
H2	1	1	Yes	1/8K	512K-8192K	1	0-3
1100/62:							
E1MP	2	2	No	2/4K	1024K-8192K	2	1-5
E2MP	2	2	Yes	2/4K	1024K-8192K	2	1-5
H1MP	2	2	No	2/16K	1024K-8192K	2	1-5
H2MP	2	2	Yes	2/16K	1024K-8192K	2	1-5
1100/63:							
H1MP	3	3	No	3/24K	1024K-8192K	2	1-5
H2MP	3	3	Yes	3/24K	1024K-8192K	2	1-5
1100/64:							
H1MP	4	4	No	4/32K	1024K-8192K	2	1-5
H2MP	4	4	Yes	4/32K	1024K-8192K	2	1-5

PERIPHERALS AND COMMUNICATIONS

Mass storage equipment available for the 1100/60 system includes fixed-head drums, disk pack drives, and fixed-disk drives. Storage capacities range from 256,144 to 89,600,000 words. Also available is the new Cache/Disk System, a hierarchical mass storage system that provides a level of memory between the 1100/60 CPU and 8450 or 8470 disk drives.

Sperry Univac offers a variety of magnetic tape drives in both 7- and 9-track models, with data transfer rates ranging from 34,160 to 1,250,000 bytes per second. Also available are six printer models with speeds ranging from 760 to 2000 lines per minute.

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

The DCP/40 Communications Processor, announced concurrently with the 1100/60 system, is based on the same multi-microprocessor architecture as the 1100/60. This unit can handle from 16 to 256 communications lines and contains from 256K to 2048K bytes of memory. The DCP/40 can be used as a front-end processor, nodal processor, or remote concentrator, and is supported by Telcon software. The DCP/40 will handle data rates of 45 to 1.3 million bps as well as automatic answering and dialing. The DCP/40 supports UDLC, bisync, synchronous and asynchronous transmission.

The newer DCP/20 is a smaller version of the DCP/40. It supports 256K to 512K bytes of memory, 1 or 2 I/O processors, and up to 32 communications lines.

Sperry Univac's Distributed Communication Architecture, first announced in November 1976, continues to

upper and lower boundaries of both the instruction areas and data areas that may be referenced by the currently active user program. Any attempt to reference an address beyond these limits causes a guard mode interrupt. The setting of a bit in the Designator Register determines whether the protection is against write operations; read, write, or jump operations; or whether no protection exists. In the first case, the operating system is in privileged mode. Under this mode, privileged programs such as real time programs or executive controlled subroutines may enter nonalterable (re-entrant) subroutines for reading or jumping only. In the second case, the operating system is in user mode. In the third case, the BDRs are loaded but ignored since the operating system is in OPEN mode. Registers BDR0 and BDR1 correspond to I-bank (instruction word) address ranges and Registers BDR2 and BDR3 correspond to D-bank (data word or operand) address ranges.

RESERVED STORAGE: The low end of memory is reserved for storing the processor state during interrupts. The processor state consists of the program status, addressing status, and interrupt status. Interrupt routines and the general register stack are also located in the low end of memory.

BUFFER STORAGE (E and H models only)

STORAGE TYPE: IC semiconductor.

CAPACITY: 2048 words per CPU in E models, 8192 words per CPU in H models. Buffer storage is located in the Storage Interface Unit (SIU). A read request results in a serial retrieval of a four-word block from the MSU—the requested word and three adjacent words. Subsequent read references to the same or adjacent words in the block are presented at SIU speed with no further reference to the MSU required. The words in the buffer are divided into 512 sets. Each set contains four 4-word blocks. The SIU employs a paired least recently used (PLRU) algorithm to control aging and replacement of data blocks within each set. In case of buffer malfunction, the affected blocks are automatically bypassed.

CYCLE TIME: 116 nanoseconds per word.

CENTRAL PROCESSOR

All models of the 1100/60 employ the same basic 116 nanosecond CPU, which is a multi-microprocessor implementation of the 1100 Series architecture. The 1100/60 utilizes the Motorola 10800 as an LSI building block. The

Sperry Univac 1100/60 System

be a viable technology in the vendor's overall communications philosophy. Under the DCA concept, according to Sperry Univac, continued compatibility of present and future products will be ensured by specifying interfaces and functions of all components and providing guidelines for the building of communications networks. DCA can accommodate a broad range of host processors and terminal attachments, including other manufacturers' equipment. Adaptable to both simple and complex networks, DCA is said to permit the design of networks that fulfill many specialized requirements, such as maximum-security, ultra-resilient, and low-overhead systems.

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

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

Concurrently with the DCA announcement, Sperry Univac also introduced the Telcon communications system. Telcon provides not only front-end processing for the 1100 Series, but network capability for communications with other 1100 systems, other Sperry Univac systems such as the Series 90, and other vendors' host systems or networks. The basic hardware of a Telcon system is now incorporated into the aforementioned DCP/20 and DCP/40.

In Telcon, the network control software resides in all DCPs within the network and is capable of being configured as a front-end processor, nodal processor, or remote concentrator. This software provides the necessary message control, routing, and network control to communicate between DCPs and/or host processors. Placing control of the communications network within the DCPs provides the host processor with communications independence.

SOFTWARE

The 1100 Operating System (formerly called EXEC 8) is the standard operating system for all members of the 1100 Series, and furnishes comprehensive supervisory and control facilities for three distinct modes of multiprogrammed operation: batch, demand (or time-sharing), and real-time (or communications). It provides virtually the ➢

➤ **Motorola 10800 is a 4-bit slice with a 70 microinstruction repertoire using 10K ECL technology. The 1100/60 contains two microexecution units each composed of nine 10800 components. The two microexecution units concurrently execute parts of the same macroinstruction (see below). Complete execution of every microinstruction requires four cycles. Speed is enhanced by overlapping execution of microinstructions. To further increase performance, microprocessor functions are generated using a phantom branching technique in which one of two functions is selected for execution in each microprocessor, one cycle after microaddress selection.**

The concept of availability, reliability, and maintainability (ARM) was an important consideration in the design of the 1100/60 processor, according to Sperry Univac. To implement ARM, Sperry Univac provided duplicates for the microinstruction units, executing the same function on the same data in the duplicate unit and comparing the results at the end of each cycle. Similarly, the shifter, logic function section, and control store address generator are also duplicated. The 1100/60 also includes a hardware instruction retry mechanism which allows the system to recover from most transient faults, transparent to the operating environment.

All magnetic storage in the processor includes parity and/or error correction including main storage, control storage, and buffer storage in the E and H models. An override mechanism bypasses sections of the buffer not operational. All failing components are bypassed for later maintenance provided they have backup within the system.

The 1100/60 processor has an address range of 16 million words and makes extensive use of relative addressing. Sperry Univac has not yet extended the processor to this limit, leaving this enhancement for a possible future announcement.

The hardware monitor feature enables an 1100/60 to collect system profile performance data on hardware and software. Sampling of data can be initiated by software or operator request. The signals are sampled every 475 microseconds and collected by the System Support Processor (SSP) every 30 seconds for storage in the system log for later report generation.

Among other features of the 1100/60 processor are: interprocessor interrupt interface, program relocation, arithmetic designators, split-word arithmetic, and shifting. The interprocessor interrupt interface allows operational control by the operating system to permit a CPU to interrupt another CPU or to be interrupted by another CPU in a multiprocessor environment. Program relocation is supported via relative addressing.

Nine special internal designators define arithmetic operational rules and exceptions. These rules and exceptions include floating point zero conventions, arithmetic exceptions, divide check, overflow, carry, and double precision underflow.

Addition and subtraction of fixed point numbers can be performed on half- or third-words simultaneously. This is permitted because each partial word operates as a separate independent entity with its own end-around carry.

The 1100/60 performs both 36-bit single length shifting or 72-bit double length shifting. Shifting types include right and left circular, right and left logical, right algebraic, and scale factor. Other features of the processor can be found in the Register and Instruction Repertoire sections of this report.

CONTROL STORAGE: Consists of 2000 words where each word is 36-bits wide. Control storage has an access time of 50 nanoseconds.

Sperry Univac 1100/60 System

full gamut of desirable operating facilities, including dynamic storage allocation, reentrancy, multiprocessing, dynamic reconfiguration, automatic recovery, multi-level prioritization, system optimization, and two types of program segmentation (one of which provides, in effect, a software-controlled virtual storage capability).

The 1100 Operating System formerly required the presence of high-performance (and expensive) fixed-head drum units, but Sperry Univac now offers a Disk-Resident System that uses fixed-disk drives instead of drums for all systems functions.

Software facilities that operate under the control of the 1100 Operating System include processors for the COBOL, FORTRAN, ALGOL, BASIC, JOVIAL, PL/1, APL, RPG, and Assembly languages, plus a variety of utility routines and application packages.

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

The new Interactive Processing Facility (IPF), which effectively supersedes CTS, provides a user interface to the 1100/60 system in both batch and time-sharing environments. IPF includes data management and distributed processing capabilities, security features, and terminal session control capabilities. It can operate in conjunction with EDIT 1100, a full-screen text editor.

COMPATIBILITY

Within the 1100 Series, Sperry Univac has maintained a high degree of program and data compatibility. This has been continued with the 1100/60, both on the source and object level. There is no direct program compatibility, at the machine or assembly-language level, between the 1100 Series and any other line of Sperry Univac or competitive computers. The 1100 Series implementations of the COBOL, FORTRAN, ALGOL, BASIC, PL/1, and JOVIAL languages, however, are generally in accordance with the accepted standards for these languages. The 1100 Series systems originally used the 6-bit Fieldata code, but in an effort to resolve the resulting compatibility problems, Sperry Univac has gradually revised most of the hardware and software to make use of ASCII. Thus, for most

REGISTERS: The 1100/60 processor contains a general register stack (GRS) that consists of 36-bit integrated circuit registers with a basic cycle time of 116 nanoseconds. The GRS includes 128 program addressable control registers with some overlap of function and some areas guard mode protected (e.g., the executive system of the operating system). The GRS includes an unassigned non-indexing register; 15 index registers; 4 registers that can be used for either indexing or accumulation; 16 accumulators; and the processor state control registers consisting of 2 pointer registers, the Executive Bank Descriptor Table Pointer and the User Bank Descriptor Table Pointer. There are 11 interrupt status words, including the Immediate Storage Check Designator Register and Guard Mode Designator Register, a quantum timer, Bank Descriptor Table Indexes, and jump history stack; 16 special registers, including the Real Time Clock (guard mode protected) Repeat Count Register, Mask Register, and user registers R3 through R15; 16 special guard mode protected executive registers, such as Executive Registers R0 and R3 through R15; Repeat Count Register and Mask Register; a guard mode protected (executive) non-indexing register; 15 executive index registers; 4 executive registers for indexing or accumulation; and 16 executive accumulators.

The Real Time Clock is initially loaded by the program and decremented once every 200 microseconds. The Repeat Count Register controls repeated operations such as block transfer and search instructions. The Mask Register is used with the search command in determining which portions of words are to be compared in repeated masked search operations. The Jump History Stack holds the recent 24-bit absolute addresses of jump instructions. The Quantum Timer, once loaded with an initial value, is decremented every 116 nanoseconds of actual CPU use, provided that a bit in the Designator Register is set. The Bank Descriptor Registers are described in the section entitled Storage Protection. The Designator Register generally determines functioning characteristics of the CPU.

The Breakpoint Register is employed with the address breakpoint mechanism. It allows an interrupt to be initiated when an equality comparison is made between the absolute address in the register or an operand address. The Breakpoint Register is operational on all instruction addresses, read/write references to main memory, and I/O references to main memory.

ADDRESSING: Both indirect and direct addressing are possible in the 1100/60. Indirect addressing is possible to any desired number of levels, with full indexing capabilities at each level. Operand addresses can be modified by the contents of any of 19 index registers. If desired, the contents of the index register can be automatically incremented by any specific value each time the register is referenced.

The 1100/60 has 161 standard instructions. To a great extent, the instruction repertoire is identical with that of the other 1100 Series systems in order to maintain compatibility. To utilize the full capabilities of the 1100/60 system, additional privileged instructions are included, and an optional Extended Instruction Set (EIS) is also available.

Most instructions specify the address of one operand in main storage and one of the 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.

The instruction set is broken down as follows: 11 load instructions, 8 store instructions, 20 fixed-point arithmetic

Sperry Univac 1100/60 System

practical purposes, an 1100 Series computer can now be considered a byte-oriented ASCII machine.

COMPETITIVE POSITION

In terms of relative performance levels, Sperry Univac describes the position of the 1100/60 by individual model. If the Model C1 is assigned a relative performance level of 1.0, then the Model C2 is 1.2 times more powerful and approximately equivalent to the IBM 4341 or Burroughs B 5900. The Model E1 is 1.4 times as powerful as the Model C1, while the Model E2 is 1.7 times as powerful. The Model H1 is twice as powerful as the Model C1, and the Model H2 is 2.4 times more powerful.

With the expanded memory capacity, the 1100/60 Model E and H systems now equal the memory capacity of the IBM 3081 and offer four times the memory capacity of the IBM 4341 Model Group 2. Multiprocessor 1100/60 systems are competitive with the Burroughs B 6900, the IBM 303X series, and the Honeywell DPS8 systems.

USER REACTION

Although there are currently more than 700 1100/60 systems installed, only five Sperry Univac 1100/60 users responded to Datapro's 1981 survey of general-purpose computer users. To augment the survey, we interviewed four additional users and asked them to rate the 1100/60 system. These 9 users had installed a total of 11 central processors—2 Model C2's, 5 Model H1's, and 4 unspecified models. The 1100/60 systems had been installed for an average of 12.4 months.

The users' ratings of the 1100/60 systems were as follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	4	1	4	0	3.00
Reliability of mainframe	5	3	0	1	3.33
Reliability of peripherals	2	2	4	1	2.55
Maintenance service:					
Responsiveness	6	3	0	0	3.66
Effectiveness	5	2	2	0	3.33
Technical support:					
Trouble-shooting	3	2	2	1	2.87
Education	1	3	4	1	2.44
Documentation	0	1	5	3	1.77
Manufacturer's software:					
Operating system	5	3	1	0	3.44
Compilers & assemblers	6	3	0	0	3.66
Application programs	0	3	1	1	2.40
Ease of programming	3	3	2	0	3.12
Ease of conversion	0	5	2	1	2.50
Overall satisfaction	4	2	3	0	3.11

*Weighted Average on a scale of 4.0 for Excellent.

The four users we interviewed represented a manufacturing company, an engineering consulting firm, a service bureau, and an educational institution.

One user had installed an 1100/61 Model C2 as a replacement for a Sperry Univac 90/30 and 90/40. He reported that he had experienced no problems with the

instructions, 16 floating-point arithmetic instructions, 14 repeated search instructions, 14 test or skip instructions, 12 shift instructions, 17 executive system control instructions, 29 jump instructions, 4 logical instructions, 11 miscellaneous instructions, 5 I/O instructions, and 20 optional EIS instructions.

EIS includes bit string instructions for moving, comparing, and translating character or byte fields; decimal arithmetic and edit instructions; and instructions for converting between ASCII, decimal and binary notation. Sperry Univac states that gains realized by the use of EIS can be expected to be in the range of 25 to 35 percent for heavy COBOL/DMS batch type environments.

INSTRUCTION TIMINGS: Sperry Univac states that instruction timings for the 1100/60 will be made available only to "qualified" users or consultants.

INTERRUPTS: A program interrupt facility causes storage of the current processor state in the three groupings of program status, address status, and interrupt status from the Processor State Register's 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.

There are 24 priority level interrupts available in the 1100/60. Priority levels 0 through 10 are internal interrupts, which can neither be locked out nor deferred. The remainder are external interrupts which can be both locked out and deferred. All external interrupts are presented to each CPU in the system. Therefore, an interlocked synchronization mechanism is provided to ensure that only one CPU actually accepts the interrupt request.

PHYSICAL SPECIFICATIONS: The 1100/60 central complex cabinet is 30 inches deep, 78 inches wide, and 64 inches high. The cabinet weighs approximately 1500 pounds. Power requirements for the basic CPU complex cabinet is 7 KVA, 60 Hz. A motor alternator is not required. Cooling required by the CPU complex is less than 1500 cubic feet per minute forced air, supplied from room air or false floor. Sperry Univac quotes the heat dissipation as less than 24,000 BTU per hour. Recommended temperature for the typical system is 75 degrees F with a relative humidity of 50 percent noncondensing.

SYSTEM SUPPORT PROCESSOR (SSP): The 1100/60 SSP provides partitioning, system control, maintenance, and console management functions. The SSP is a stand-alone desk-sized unit that interfaces to the CPU complex and its component parts including the CPU, IOU, MSU, and SIU. A basic configuration for the SSP includes CRT/keyboard/printer console, 128K bytes of addressable storage, a console interface, diskette drive interface, remote maintenance interface, and central complex interface.

The partitioning function provides the ability to assign individual central-complex units of a system to either one of two independent smaller systems, or to isolate a unit from either application for off-line concurrent maintenance. Partitioning is supported via partitioning panel displays. The SSP also defines special system protection modes such as real-time and maintenance modes.

The partitioning function also indicates the operational status of each central-complex unit. These status conditions are available to system software for configuration control. The ability to control the partitioning of subsystems is also provided.

Two partitioning features are built into the IOU. One feature controls shared peripheral interface units on word channels,

Sperry Univac 1100/60 System

central processor, but had experienced "excessive downtime" with the 8450 Disk Subsystem. He further commented that the disk problems "brought the whole system down."

The second user interviewed had replaced a Control Data 3200 with an 1100/61 Model H1. He said there were no major problems during the conversion process, except that Sperry Univac's "documentation was poor." He cited the 1100/60 system's multiprogramming capability as a major advantage.

The third user represented a service bureau that had upgraded from a Sperry Univac 1108 and 1100/11 to an 1100/62 Model H2 dual-processor system. This user commented that the CPU "runs very well, the operating system is good, and the system is easy to operate once everything settles down." However, he said there were two "weak links" in the 1100/60 system—the System Support Processor and the 8470 Disk Subsystem. He reported problems with the software and diskette on the SSP and said he had experienced "multiple failures" with the 8470 disks. He commented that the 8470 disks "can't withstand power outages, and we've had several."

The fourth user interviewed was using an 1100/62 Model H1 in conjunction with an 1100/82 system. This user stated that the 1100/60 is "the best machine in its category for price/performance." He added that the CPU is "really solid" and the "system overall is excellent." However, he expressed dissatisfaction with the reliability of the 8450 Disk Subsystem and with the quality of the maintenance service. He explained that the service people responded quickly, but the customer engineers were "not familiar with the 8450 disks."

The users' ratings and comments indicate a fairly high level of satisfaction with the performance and reliability of the 1100/60 processors. Most of the negative comments centered on the 8450 and 8470 Disk Subsystems. Despite these criticisms, however, eight of the nine survey respondents said they would recommend the 1100/60 system to others.□

and the other controls the byte channel transfer switch for subsystems connected to a block multiplexer channel. The SSP provides control of system functions such as clocks and timers, stop jump control, initial load path, and auto recovery through system operator panel displays on the console. An optional System Performance Monitor (see Software) is also under SSP control.

The SSP acts as a primary maintenance tool through functions such as control storage loading, fault corrections, scan/set data comparisons, error logging, and a remote maintenance capability. One of the tools available to the SSP for maintenance is the Logic Analyzer, which provides a means of sampling and recording logic signals at discrete intervals of time. Not only does the SSP control the sampling rate, but also the starting/stopping of logic signal recording.

The SSP also acts as the communications link between the 1100/60 and the system console(s). The minimum system console consists of a Uniscope 200 Display Terminal with alphanumeric keyboard, 200-cps bidirectional printer, a control panel, and a stand. The CRT displays 16 lines of 64 characters each and uses a 7-bit ASCII character set. The System Console also includes a fault indicator, which indicates fault conditions in major system components, and an interface for the Total Remote Assistance Center (TRACE) remote diagnostic capability.

ATTACHED VIRTUAL PROCESSOR (AVP): The 1100/60 AVP is a special-purpose processor that provides a migration path from the byte-oriented Series 90/60 and 90/80 systems to the word-oriented 1100/60 system. The 1100/60 AVP can be attached to any processor model in the 1100/60 family. Performance is comparable to the 90/80-3. The AVP provides concurrent execution of applications written for the VS/9 operating system and applications written for the 1100 Series operating system.

The 1100/60 AVP incorporates system features found in both Series 90 and 1100/60 processors. On the VS/9 side, the hardware includes a CPU with a logic bus structure and microcode control similar to the Univac 90/80 family. In addition, the reliability features of the 90/80, such as parity checking, control store, and duplicate adders, have been maintained and applied to the AVP. The 1100/60 System Support Processor (SSP) is also included, and provides partitioning, system control, maintenance, and console management functions.

The system's main memory ranges from 512K (2 megabytes) to 1024K words (4 megabytes). An 8K-word (32K bytes) cache unit provides buffer storage of instructions and data between the 1100 Main Storage Unit (MSU) and the AVP CPU. The cache is designed to improve CPU performance while reducing the number of requests into the MSU.

I/O operations are handled by the 1100/60 AVP using a new software product, the Attached Processor Control Software (APCS). The 1100/60 AVP can accommodate VS/9 random access data files via direct, logical, or local attachment. The Direct Attachment feature permits disk subsystems of the Series 90 systems to attach directly to the 1100/60 block multiplexer channel. Files written for VS/9 can be run on the 1100/60 AVP without change. The Logical Attachment facility permits the VS/9 user to utilize current technology random access devices, such as the Univac 8470 disk drive, that are not included in standard VS/9 configurations. The third access mode, Local Attachment, permits devices available for VS/9 operation, but not for OS 1100, to be run on the 1100/60 AVP. The devices are attached to an optional block multiplexer channel.

Several VS/9 software products have been modified for use in the 1100 Series. These products are IMS 1100, based on the IMS/90 transaction processing system; the Interactive Processing Facility 1100; a full-screen display text editor called EDIT 1100; the Programmers Advanced Debugging System, PADS 1100; and an industry compatible RPG II compiler.

INPUT/OUTPUT CONTROL

I/O CHANNELS: All 1100/60 models contain one Input/Output Unit (IOU). The IOU consists of a central control module (CCM) and up to five or six channel modules. The CCM provides independent control paths to up to two CPUs and up to two SSPs and data paths to/from up to two MSUs and the channel modules. The CCM processes all I/O instructions, passes control information to the channel modules, controls main storage requests, updates control words and format status words, and generates all interrupt requests.

Each channel module consists of either one block multiplexer channel or four word channels. The basic IOU contains one

Sperry Univac 1100/60 System

word channel module and one block multiplexer channel. A fully configured IOU can consist of 2 block multiplexer channels and 12 word channels, 3 block multiplexer channels and 8 word channels, or, on the new Type 3062 processors only, 5 block multiplexer channels and 4 word channels.

Individual word channels operate in one of three modes: 36-bit Internally Specified Index (ISI), 18-bit Externally Specified Index (ESI), or 9-bit ESI. The ISI mode word channel has one subchannel assignment. The ESI mode word channel has up to 64 subchannels, while the block multiplexer channel has up to 128 subchannels for concurrent operation. Each IOU can support up to 1024 subchannels. One subchannel is reserved for the status table, leaving 1023 for use by the system.

The maximum block multiplexer channel data rate is 1.66 million bytes per second. The maximum word channel data rate is 0.60 million words per second in ISI mode. The aggregate output data rate for a word channel module operating in ISI mode is 0.86 million words per second. The aggregate input data rate for a word channel module is 1.4 million words per second.

SIMULTANEOUS OPERATIONS: One input or output operation on each I/O channel can occur simultaneously with computation in each processor (or CPU). Moreover, the Externally Specified Index (ESI) mode permits multiple remote communications devices to transmit data to and from main storage in multiplexed fashion over a single I/O channel. All installed processors and IOUs can operate simultaneously and independently, with interference occurring only when two or more of these units simultaneously attempt to access the same storage module.

The microinstruction execution units utilize overlap execution techniques, with one new microinstruction starting each cycle.

CONFIGURATION RULES

The 1100/61 Model C1 consists of the 1100/60 CPU with 512K or 1024K words (2 or 4 megabytes) of main memory expandable to 4096K words (16 megabytes), one IOU with a second optional, one SSP, and one system console. Up to three additional consoles are optional. The additional consoles may be system consoles with printers or auxiliary consoles without printers. The 1100/61 Model C2 is the same as the C1 with the addition of the Extended Instruction Set (EIS).

The 1100/61 Model E1 consists of the 1100/60 CPU with 512K or 1024K words of main memory expandable to 8192K words (32 megabytes), one IOU with a second optional, one 2K-word (8K-byte) SIU, and one SSP. The console configuration is the same as for the 1100/61 Model C1. The 1100/61 Model E2 is the same as the E1 with the addition of the EIS.

The 1100/62 Model E1 consists of two 1100/61 Model E1 systems in a tightly coupled multiprocessor configuration. Similarly, the 1100/62 Model E2 consists of two 1100/61 Model E2 systems. The maximum main memory capacity of these systems is 8192K words—4096K words per processor. A maximum of five additional consoles is permitted in an 1100/62 Model E1 or E2 configuration. One auxiliary console, interfaced to both SSPs, is required as a maintenance console. The other additional consoles can be system consoles or auxiliary consoles.

The 1100/61 Model H1 consists of the 1100/60 CPU with 512K or 1024K words of main memory expandable to 8192K words, one IOU with a second optional, one 8K-word (32K-byte) SIU, and an SSP. The console configuration is the same as for the 1100/61 Model C1. The 1100/61 Model H2 is the same as the H1 with the addition of the EIS.

The 1100/62 Model H1 is configured by adding an H1 Multiprocessor Upgrade to an 1100/61 Model H1 system. The upgrade includes a second H1 processing complex without main memory. Main memory can be expanded to 8192K words. The 1100/62 Model H2 is the same as the H1 with the addition of the EIS. The console configuration for the 1100/62 Model H1 or H2 is the same as for the 1100/62 Model E1 or E2.

The 1100/63 and 1100/64 Model H1 configurations consist of an 1100/62 Model H1 system plus two or three additional CPUs and SIUs. The 1100/63 and 1100/64 multiprocessor upgrades do not include main memory, an SSP, or a system console. Main memory can be expanded to a maximum of 8192K words, regardless of the number of CPUs. The 1100/63 or 1100/64 Model H2 configuration is the same as the H1 with the addition of the EIS. The console configuration for the 1100/63 and 1100/64 Model H1 or H2 is the same as for the 1100/62 Model E1 or E2.

In the original 1100/60 systems, main memory was housed in the processor cabinet and was expandable in 256K-word increments. In November 1981, Sperry Univac introduced a new external memory storage cabinet with a capacity of 1024K to 4096K words, with expansion in 1024K-word increments. Two memory cabinets are required to house the maximum of 8192K words permitted on a Model E or H system. Various memory expansion features are available to expand the memory capacity of existing 1100/60 systems with less than 1024K words of memory. New customers can order an 1100/60 system with a minimum of 1024K words of memory housed in the external cabinet.

Minimum peripheral equipment required to complete a 1100/60 processing system includes an 0716 Card Reader Subsystem, an 0776 Printer Subsystem, an 8450 Disk Subsystem with one control unit and two 8450 Disk Drives, and a magnetic tape subsystem with one control unit and two Uniservo 22 or 24 Magnetic Tape Units.

As an alternative, a minimum peripheral system would include a communications subsystem with at least one input terminal, an 0770 Printer Subsystem, an 8430/8433/8434/8470 Disk Subsystem with one control unit and two 8430, 8433, 8434, or 8470 Disk Drives, and a magnetic tape subsystem with one control unit and two Uniservo 30, 32, 34, or 36 Magnetic Tape Units.

No maximum peripheral restrictions are placed on the 1100/60 configurations other than channel considerations (see Input/Output Control). However, some peripheral subsystems used on earlier Sperry Univac 1100 Series Systems can only be configured with present software support. Sperry Univac will not enhance any of the existing 1100 Series software for these subsystems. For additional configuration details, see the Mass Storage and Input/Output Units sections of this report.

MASS STORAGE

FH-432 MAGNETIC DRUM: Provides fast random access to fairly small quantities of data. Stores 262,144 words (1,179,648 bytes) in 384 data tracks, each served by a fixed read/write head. Data is read and written on 3 tracks in parallel, and each 3-track group holds 2,048 words. Average access time is 4.3 milliseconds. Drum speed is quoted as 7,200 rpm. The data transfer rate is 240,000; 120,000; 60,000; 30,000; or 15,000 words (1,080,000; 540,000; 270,000; 135,000; 67,500 bytes) per second, depending upon the degree of interlacing employed. An FH-432 subsystem consists of a control unit and one to eight drums. Total subsystem capacity is 2,097,152 words (9,437,184 bytes). 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.

Sperry Univac 1100/60 System

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 (9,437,184 bytes) in 1536 data tracks, each served by a fixed read/write head. Average access time is 17 milliseconds. Drum speed is quoted as 1800 rpm. The data transfer rate is the same as shown for the FH-432, depending upon the degree of interlacing employed. An FH-1782 subsystem consists of a control unit and one to eight drums. Total subsystem capacity is 8,388,608 words (75,497,472 bytes). FH-432 and FH-1782 drums can be intermixed in the same subsystem, and dual-channel access to a subsystem is possible through the use of two control units and appropriate special features.

8405 FIXED-HEAD DISK SUBSYSTEM: Provides rapid access to up to 11 million 36-bit words per subsystem stored in nonremovable head-per-track disks. The drive revolves at 3600 rpm with average rotational delay of 8.34 milliseconds. The 8405 drives are available in two versions: the 8405-04 Fixed-Head Disk provides six recording surfaces and up to 688,128 36-bit words (3,096,576 bytes) per disk drive, and the 8405-00 provides 12 recording surfaces and up to 1,376,256 36-bit words (6,193,152 bytes) per disk drive. Each recording surface contains 64 tracks plus 8 spares, each of which can contain up to 16 records, with each record containing 112 36-bit words. The data transfer rate is 138,222 36-bit words (622,000 bytes) per second.

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

8430 DISK SUBSYSTEM: Provides large-capacity random-access storage in interchangeable 11-disk packs with storage capacities comparable to the standard density (100-million-byte) IBM 3330 Disk Storage Subsystem. Each disk pack stores up to 17,194,240 36-bit words (77,374,084 bytes) of data. Data is recorded on 404 tracks per surface (plus 7 spares) in 20 records of 112 words each per track. There are 19 read/write heads (one for each recording surface) in each comb-type access mechanism. Minimum and maximum head movement times are 7 and 50 milliseconds, respectively. Average head movement time is 27 milliseconds, average rotational delay is 8.3 milliseconds with a drive rotational speed of 3600 rpm. The data transfer rate is 179,111 36-bit words (806,000 bytes) per second.

From two to eight 8430 Disk Pack Drives can be attached to a 5039 Control Unit in combination with up to eight 8405 Fixed-Head Disk Drives. The 8430 Disk Drives can also be intermixed with 8433 Disk Drives on the 5039 Control Unit. The F2047-00 Sixteen-Drive Expansion Feature expands the capability of the 5039 Control Unit to up to sixteen 8430 and/or 8433 Disk Storage Drives. A dual-access feature and a second 5039 Control Unit permit simultaneous read and write operations on any two 8430 Disk Drives. The 8430 features a command retry facility and error correction coding circuitry.

8433 DISK SUBSYSTEM: Provides random access to very large quantities of data stored on removable "double-density 3330-type" disk packs. Each industry-standard disk pack contains 200 million bytes in Free Format recording mode. When the data is stored in records of 112 words each, it has a capacity of 34,388,340 36-bit words (154,748,160 bytes). There are 20 records of 112 words each per track and 808 tracks (plus 7 spares) on each of the 19 recording surfaces. Minimum, average, and maximum head positioning times are 10, 30, and 55 milliseconds, respectively. Drive rotation is 3600 rpm with an average rotational delay of 8.3 milliseconds. Data transfer rate is 179,111 36-bit words (806,000 bytes) per second.

From two to eight 8433 Disk Pack Drives can be connected to a 5039 Control Unit for a total of 275 million words per subsystem. (See the 8430 section above for expansion capabilities.) The 8433 also includes the command retry facility and error correction coding circuitry. For additional configuration information, see the 8470 Disk Subsystem.

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

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

The 8434 disk drive contains a fixed disk stack consisting of 10 platters with 19 recording surfaces. The twentieth surface is used for servo positioning information. When necessary, the disk stack can be removed for servicing, and in the event of drive failure, the pack can be moved to another drive to facilitate data recovery. Data is recorded on 878 tracks per surface in 29 records of 112 words each per track.

Each 8434 Disk Drive stores up to 54,183,136 words (243,824,110 bytes). Minimum, average, and maximum head movement times are 10, 30, and 55 milliseconds, respectively. The drive has a rotational speed of 3600 rpm and a rotational delay of 8.3 milliseconds. The data transfer rate is 279,333 words (1,257,000 bytes) per second.

8450 DISK SUBSYSTEM: The 8450 Disk Drive provides up to 54,079,200 words (243,356,400 bytes) of storage. The head disk assembly (HDA) provides eight platters with 15 surfaces used for data and one surface for servo control. The bottom surface of the lowest platter provides data storage under control of an optional 60-head fixed-head assembly. Data is recorded on 56 of these tracks with 6 spares. Movable head assemblies with two heads per surface provide the means for recording on the other 14 surfaces. These heads each cover 555 tracks (plus 5 spares). Each 8450 has the optional capability of 181,888 words of fixed-head storage. Data is recorded on 1110 moving-head and 56 fixed-head tracks per surface in 29 records of 112 words per track.

Minimum, average and maximum head movement times are 4, 23, and 46 milliseconds, respectively. The drive has a rotational speed of 3600 rpm and a rotational delay of 8.3 milliseconds. Transfer rate for the drive is 280,000 words (1,260,000 bytes) per second.

The 8450 Disk Drive connects to a word channel through the 5046 Storage Control Unit, which permits the drives to be intermixed with 8430 and 8433 disk drives. The 5046 SCU can control up to 16 drives, and can be expanded to provide control for up to 16 additional drives through the F2837-00 Power Control Expansion. Disk drives are attached to the 5046 SCU in groups of four. Each group can consist of either 8430/8433 drives or 8450 drives. The 8450 disk drives can also be adapted for dual access by addition of the F2718-99 Dual Access Feature, which permits simultaneous Read/Write, Read/Read, Write/Read, and Write/Write access on any two drives. Additional features of the 5046/8450 subsystem include rotational position sensing, error correction facilities, and enhanced command retry. The 8450 may also be attached to the 8470 Subsystem; see the next entry.

8470 DISK SUBSYSTEM: Consists of the 5056-83 controller and the 8470 Disk Drive. This drive, an enhanced version of

Sperry Univac 1100/60 System

the 8450, provides up to 89,600,000 words (403,200,000 bytes) of storage. The HDA consists of nine platters with 16 surfaces used for data and one surface of the remaining platter used for servo control.

The bottom surface of the lowest platter provides data storage under control of an optional 60-head fixed-head assembly. Data is recorded on 56 of these tracks with 6 spares. Movable head assemblies with two heads per surface provide the means for recording on the other 14 surfaces. These heads each cover 625 tracks plus 5 spares. Each 8470 has the optional capability of 241,920 words of fixed-head storage. Data is recorded on 1250 moving-head and 56 fixed-head tracks per surface in 40 records of 112 words per track.

Minimum, average, and maximum head movement times are 4, 23, and 46 milliseconds, respectively. Head positioning time for the fixed-head option is 8.3 milliseconds (rotational delay factor). The drive has a rotational speed of 3600 rpm and a rotational delay of 8.3 milliseconds. Transfer rate for the drive is 466,666 words (2,097,000 bytes) per second.

The 5056-83 controller can attach up to eight 8470 Disk Drives with or without fixed-head option. The F3192-02 feature allows for the attachment of eight additional 8470 drives to the 5056-83. Up to three F3192-02 features are allowed per controller, thus providing for a maximum of 32 8470 drives per 5056-83. The F3192-00 and F3192-01 features allow for the attachment of up to eight 8430/8433 and 8450 Disk Drives, respectively. Dual access may be added to the 8470 with feature F2718-00.

CACHE/DISK SYSTEM: A hierarchical mass storage system that provides a level of memory between the 1100/60 processor and 8450 or 8470 disk drives. The Cache/Disk System consists of one or two 5057 Cache/Disk Processors, up to four 7053 Storage Units, and up to sixteen 8450 or 8470 disk drives.

The 5057 Cache/Disk Processor controls all data access functions including indexing, searching, buffering, storage management, staging and destaging of data to and from disk, and error recovery. The 7053 Storage Unit contains 917,504 words (4 megabytes) of semiconductor memory. It can be configured as cache memory, as a solid-state disk, or both.

In Cache/Disk mode, data is automatically transferred from the 8450 or 8470 disk to the 7053 Storage Unit. The host computer accesses data as if it were stored on the disks. A separate indexing feature, the Segment Descriptor Table (SDT), is required in one of the 7053 units. The SDT contains a list of disk addresses that point to cache storage areas containing duplicates of data in recently referenced disk space. When an index find occurs, data transmission between the cache and the host CPU begins in about one millisecond. If an index miss occurs, the 5057 processor issues a seek to disk and disconnects for other activity.

In Solid-State Disk mode, the 7053 is directly addressed by the host processor. The access time in this mode is approximately 0.2 millisecond. In both Cache/Disk and Solid-State Disk modes, the response time is improved by eliminating the seek and latency time required by the disk drives.

In addition, the Cache/Disk System permits the use of larger disk record sizes, thus maximizing the capacity of disk storage. In Cache/Disk mode, data is transferred from the 8450 disk unit in segments of 448 words and from the 8470 disk unit in segments of 1792 words. Using the 448-word format, each 8450 stores up to 67 million words. Each 8470 stores up to 143 million words using the 1792-word format.

INPUT/OUTPUT UNITS

UNISERVO 14 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard ½-inch tape in IBM-compatible phase-encoded or NRZI formats. Available in both 9-track and 7-track versions. Tape speed is 60 inches per second, forward or backward. The 9-track versions have a recording density of 1600/800 bpi PE/NRZI and a data rate of 96,000/48,000 bytes per second. The 7-track NRZI version operates at 200, 556 or 800 bpi, with data rates of 12,000, 33,400, or 48,000 bytes per second.

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

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. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 192,000 bytes per second; the optional Dual Density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 96,000 bytes per second. The 7-track operates at 200, 556, or 800 bpi, with corresponding data rates of 24,000, 66,720, or 96,000 bytes per second. A Uniservo 16 subsystem consists of up to 16 tape units connected to a single- or dual-channel control unit.

UNISERVO 22/24 MAGNETIC TAPE UNITS: High-performance tape drives that match the performance of the IBM 3420 Model 7. Both models are 9-track, 800/1600-bpi tape drives designed for NRZI and PE recording. The Uniservo 22 has a transfer rate of 120,000 bytes per second at 1600 bpi and 60,000 bytes per second at 800 bpi. The Uniservo 24 transfers data at 200,000 bytes per second at 1600 bpi and 100,000 bytes per second at 800 bpi. Tape speed is 75 ips on the Uniservo 22 and 125 ips on the Uniservo 24. Operational conveniences include a power window, automatic tape threading, and wraparound tape cartridge loading. The Uniservo 22 subsystem consists of 1 to 8 Uniservo 22 or 24 drives with at least one Uniservo 22 drive. The Uniservo 24 subsystem consists of 1 to 8 Uniservo 22 or 24 drives with at least one Uniservo 24 drive. A dual-access subsystem can be configured by adding a second control unit and installing the Dual-Access feature in each tape unit.

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

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

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

Uniservo 32—a 9-track unit designed for GCR and PE recording. The transfer rate is 120,000 bytes/second at 1600

Sperry Univac 1100/60 System

bpi or 470,000 bytes/second at 6250 bpi. Tape speed is 75 inches/second.

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

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

0770 PRINTERS: These printers employ a horizontally moving print band and combine various convenience, maintenance, and availability features. The three models differ only in their speeds, offering 48-character printing rates of 800, 1400, or 2000 lines per minute and 24-character printing rates of 1435, 2320, and 3000 lpm. The printers, each of which contains an integral control unit, can be connected to an 1100/60 system via a word channel.

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

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

0776 PRINTER SUBSYSTEM: An impact printer subsystem that offers a choice of three line speeds: the Model 0776-00 prints a 48-character set at 760 lines per minute, the Model 0776-02 at 900 lines per minute, and the Model 0776-04 at 1200 lines per minute. Skipping speed for all models is 22 inches per second. Vertical spacing is operator-selectable at either 6 or 8 lines per inch. All models can have character sets ranging from 24 to 384 characters in size, and have 136 print positions as standard equipment. Printing takes place at 10 characters per inch. The 0776 printers have a single-space print time of 14.2 milliseconds and a single line space time of 16 milliseconds. Forms ranging from 4 to 18.75 inches wide and up to 24 inches long can be accommodated.

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

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

0716-89 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, validity checks, stacker feature permitting the alternate filling of stackers one and two when in the "stop on errors" mode, and dual translate. Connects to an 1100/60 system via a word channel.

0604-99 CARD PUNCH: Punches 80-column cards in row-by-row fashion at 250 cards per minute. Has a 1000-card input hopper and two 1000-card output stackers. Punched cards are directed to one of the two stackers under program control. Punching is in card-image mode or compressed code translation. Contains an integrated controller and connects to an 1100/60 system via a word channel.

TERMINALS: Sperry Univac offers a wide variety of terminal equipment including the UTS 400 Display Terminal (see Report 70D1-877-06 for details), the UTS 400 Text Editor, UTS 4000 Series (see Report 70D1-877-02), DCT 500 Series, Sperry Univac V77 minicomputer, and the Sperry Univac 90/30 system (see report 70C-877-04).

COMMUNICATIONS CONTROL

TELCON: Telcon is an intelligent communications system that provides basic hardware, software, and peripherals for users with large communications networks. The system can operate as a front-end processor for 1100/60 and other 1100 Series host processors, as a network nodal processor, or as a remote concentrator. As such, it provides networks that support real-time, time-sharing, remote job entry, and message switching applications. The major components of Telcon are the Distributed Communications Processor (DCP) and the Telcon network software. Multiple DCPs can be combined to form a node of high throughput and processing capability.

The original DCP and the newer DCP/40 are independently operating communications processors designed to perform as front ends, remote concentrators/terminal controllers, stand-alone network nodes, or in a combination of these roles at the same time. The recently introduced DCP/20, a smaller version of the DCP/40, can serve as a front-end processor or as a remote concentrator.

The DCP/20 system consists of a processor with 256K to 512K bytes of memory, one or two I/O processors, and communications line modules. The main processor performs both generalized communications processing and input/output processing; the I/O processors perform input/output processing only.

The DCP/20 processor and each I/O processor provide programmed control for up to 16 data paths, which can be a combination of serial lines to remote equipment, channels to peripheral devices, or channels to on-site host Series 1100 or Series 90 processors. Each operational port on the I/O processors requires one line module, which provides an interface to a line and performs various communications functions such as control character recognition and line timing. DCP/20 accommodates asynchronous, synchronous, and wideband transmission at up to 64K bits per second. It supports Universal Data Link Control as well as character-oriented communications protocols.

Sperry Univac 1100/60 System

The DCP/40 represents a significant increase in the performance and throughput over the original DCP, primarily through the introduction of multiple microprocessors and microcoded message handlers.

Main memory ranges from a minimum of 256K to 2048K bytes, expandable in 128K-byte increments. A maximum DCP/40 may include up to 16 I/O processors, each of which provides program control for up to 16 communications channels. Each can handle a mixture of remote lines, parallel interfaces and host channel connections. Each I/O processor is programmed separately using a set of over 60 macroinstructions and each handles, in addition to data transmission and receipt, remote terminal polling, error checking and recovery, dynamic buffer allocation, reporting of line status, and recording of error and traffic statistics.

The increased memory permits larger and more complex user applications to be included in a single DCP. In addition, the DCP/40 may front end either 1100 Series or 90 Series mainframes, and supports up to 256 half- or full-duplex communications lines.

For user migration, there are several different microprogrammed packages available to run on the DCP/40. One is designed for the user of a Series 90 CPU, and permits the DCP/40 to emulate an MCC to the host. Another package offers the DCP/40 emulation of an original DCP; the last drives the DCP/40 in its own "native mode." The major advantage of the emulation packages is that the user need not change his existing communications software, which may be resident in either his host or in an original DCP. Programs and user code running an original DCP cannot be run on a DCP/40 operating in "native mode;" new user code and operating software needs to be assembled and generated.

The DCP/20 and DCP/40 are modular hardware systems that can be tailored to meet the needs of a broad range of users. The network software, Telcon, like the hardware, is also modularly structured and readily tailored by the user. A repertoire of over 285 instructions is available to the user for the generation, assembly and loading of message handling routines.

The Telcon-controlled system performs all message control operations. As users access the system (network), predetermined routing paths are followed, or alternate routes are selected using predefined table search routines should established paths become unavailable. Specialized I/O controllers (frequently microcoded modules) handle specific functions including terminal interfaces, line, trunk or channel control.

Terminal handlers in the DCPs, software and firmware, are available for most standard Sperry Univac terminal devices, as well as several non-Univac terminals including Teletype and IBM 2780/3780 batch. Other software modules handle particular line protocols such as the UDLC trunk lines, or access links to/from X.25 packet switching services.

DCP message switching can be achieved through user-coded applications which use the message routing facilities inherent in the Telcon software. Message routing between terminals, host systems, and network-resident applications is achieved either through user definition in the network generation process, or by a dynamic selection through network management services.

If multiple DCPs are configured in the network, each is assigned both specific and network-common responsibilities. For example, all messages remain the responsibility of the originating DCP until accepted by another DCP or end user. Under normal conditions, main memory is used to maintain message queues and buffers, with disk storage used for overflow. Terminal and line handlers are placed as close to the terminals or gateway links as possible, usually in the nearest DCP. This philosophy permits as much of the network as possible to consist of high-speed trunk lines, and the low-speed lines running a variety of different terminal protocols, character codes, transmission speeds and modes, to be minimized.

In addition to off-loading the host, the DCP lends a degree of network reliability and resiliency to the user. The stand-alone capability of a single network DCP may permit continued message acceptance and storage of data during periods of temporary inaccessibility to a given host or terminal. Similarly, multiple DCPs may be redundantly configured to maximize network uptime or increase network throughput. The user is free to mix and match all of the communications processors and subsystems thus far discussed into an efficient communications network. Cost may be a limiting factor in providing increased sophistication.

The Telcon operating system supports local disk and magnetic tape storage for their respective DCPs. This support permits functions including store and forward message switching, logging, journalization, file management and monitoring.

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

A Sperry Univac cartridge disk subsystem provides mass storage on the DCP for network data base storage and other storage associated with distributed communications and distributed processing applications. The subsystem has a 10-million-byte capacity, 5 million bytes on a fixed disk and 5 million bytes on a removable disk. Recording is on four surfaces in each unit, two on each disk. The disk rotates at 2400 rpm and has an average rotational delay time of 12.5 milliseconds. The average head movement time is 50 milliseconds and the data transfer rate is 312,000 bytes per second.

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

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

Sperry Univac 1100/60 System

to 50,000 bits per second. In addition to the bit-serial interfaces, an automatic dial interface is available.

SOFTWARE

OPERATING SYSTEM: All UNIVAC 1100 Series systems utilize the 1100 Operating System, which was originally released as EXEC 8 for the third-generation UNIVAC 1108 system and has been extended to support all 1100 Series systems including the 1100/60 system.

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

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

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

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

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

The minimum equipment configuration for the full 1100 Operating System is an 1100/60 system with 128K words of main memory, approximately 786K words of direct-access storage, two magnetic tape units, a card reader, and printer. Once the operating system has been loaded from tape, it is fully drum- or disk-oriented, and the tape units are available for other functions. Drum or disk storage is used for permanent storage of the operating system and its system library, for segments of all active programs (to facilitate "swapping"), for user programs in both absolute and relocatable form, for users' data files, and for buffering of remote terminals and on-line card readers, punches, and printers. Operating system functions typically occupy about 40K to 60K words of storage.

A single set of symbolic programs comprises the 1100 Operating System. A Symbolic Stream Generator (SSG) tailors the system to the specific 1100/60 system, its configuration, and the requirements of each user. A complete system generation typically takes from three to six hours of computer time and produces an initial load tape for the Operating System.

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

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

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

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

The Quota System has been added to the 1100 Operating System to enable 1100 Series installations to control the use of system resources by both batch and demand users. Quota includes a Quota Input Processor (QUIP), which can be used by each installation to establish account and individual limits through user identification codes for use of system resources. With the Quota System, installations can prevent users from requesting the use of system resources beyond an account budget or a preassigned limit, control the number of concurrent demand and batch runs executing in the system, and define limits to be applied to resources available to demand and/or batch jobs at specified times.

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

Sperry Univac 1100/60 System

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 Sperry Univac calls the "program bank" concept, effectively provides 1100 Series programmers with a software-controlled virtual storage mechanism. The system currently supports a virtual storage space of up to 250 program banks (available to the programmer for his individual program) and 4095 library banks (used for common routines which are sharable by all programs). Each program or library bank can be up to 64K 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. Bank referencing instructions effectively replace one of the accessible banks with a new bank; these instructions are direct hardware functions.

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

Dynamic reconfiguration and auto recovery facilities of the 1100 EXEC help to minimize the impact of hardware failures upon user operations. Recoverable Error Edit (EDTERR/RECERR) programs produce reports on all recoverable errors logged by the operating system, identified by system unit, peripheral subsystem, and the time of occurrence. On-line diagnostic programs execute under control of the operating system for exercising peripheral devices and system components. Dynamic reconfiguration capabilities permit system components to be taken off-line through an operator console key-in, while allowing uninterrupted operation of the remainder of the system in most cases. The auto recovery sequence is initiated automatically when a critical component fails. The EXEC is reloaded from random-access storage, the catalogued file directory is verified and corrected, and executive system files are reestablished. Sperry Univac states that the system will normally be back on the air within 15 to 60 seconds after recognition of a failure.

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

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

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

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

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

TOTAL INFORMATION MANAGEMENT SYSTEM: This comprehensive software system, designed to integrate and satisfy all the management information needs of a company, consists of six functional modules: the Communications Management System (CMS), Transaction Interface Package (TIP), Conversational Time-Sharing (CTS), High Volume Time Sharing (HVTS), Data Management System (DMS), Query Language Processor (QLP), and Remote Processing System (RPS). These modules are described in the paragraphs that follow. All operate under control of the 1100 Operating System.

COMMUNICATIONS MANAGEMENT SYSTEM: CMS 1100 is the communication network interface for the 1100/60 system to a DCA-based DDP Telcon network. It has been separated from the 1100 system generation process, thus allowing the entire terminal network configuration to be generated, checked, and corrected without generating a full system. CMS has cognizance of all terminals in an 1100 Series computer network. It acts as the communications "front end" to the Transaction Interface Package (TIP), and handles polling, parity checking, data blocking, data packing and unpacking, message envelope formatting, message acknowledgement, message queuing, and other message control procedures. The message queue can be maintained in main 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.

Sperry Univac 1100/60 System

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

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

CONVERSATIONAL TIME-SHARING: CTS is a modular software system that provides users at remote terminals with an efficient human-machine interface. The system consists of the CTS Control module, interactive syntax analyzers for BASIC, FORTRAN, and COBOL; and access to the compilers for BASIC, FORTRAN, COBOL, ALGOL, and APL. CTS provides the user with a simplified command language editor.

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.

CTS has effectively been superseded by the newer Interactive Processing Facility, which is described later in this report.

HIGH VOLUME TIME SHARING (HVTS): An alternative to CTS, HVTS looks to the end user like a subset of CTS. It has the ability to handle 50 to 2000 active terminals concurrently. Each terminal can be active in one of six modes: APL, BASIC and FORTRAN language modes; a data mode; master mode; and monitor mode. A quota set regulates each terminal user, restricting use by time of day, maximum CPU usage, maximum program size, maximum data size, maximum program execution time, and language mode selection.

DATA MANAGEMENT SYSTEM: DMS 1100 is a comprehensive data base management system developed under the guiding principles of the CODASYL Data Base Task Group. It is designed to satisfy the need for standardized data management techniques that provide: (1) separation of the data definition and data manipulation functions, (2) an acceptable degree of data independence, (3) data base protection and integrity, and (4) alternate data access methods. DMS has four principal components: a Data Description Language, a Data Manipulation Language, a Data Management Routine, and a Data Recognition Utility.

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

The concept of "areas" in DDL provides the means for associating the data base with the physical mass storage devices in which it resides. A "set" is simply a named collection of records. The records in a set can be ordered in first-in, first-out fashion or on the basis of one or more keys. The ordering can be done through a chain, an index, or a calc (randomizing) procedure. A given record can be both an "owner record" of one or more sets and a "member record" of one or more sets, and a different ordering procedure can be used in each set. DMS 1100 also permits records in a set to be arranged in an indexed-sequential fashion and retrieved through the index using the key value or accessed directly using the data base key. It also allows pointer arrays to be defined in which an owner record references an array of pointers that point to the member records for that owner, which normally share some common characteristics with the owner.

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

The Data Manipulation Language (DML) consists of commands embedded in COBOL, FORTRAN, and PL/1 to allow these host languages to manipulate the data base via DMS 1100. The DML is the procedural language used by individual programmers to access the data base. It is used in connection with a host language—COBOL, FORTRAN, or PL/1—which describes the procedures for processing the data once it has been accessed. The functions of DML can be generally described by listing its commands: OPEN, CLOSE, FIND, GET, MODIFY, STORE, DELETE, INSERT, REMOVE, IF, ON-ERROR, PRIVACY, LOG, and DEPART. The programmer inserts the appropriate DML commands into the syntax of the COBOL source program. A DML Preprocessor then converts the DML commands into a COBOL-compatible format and adds the necessary record descriptions and communication areas. The altered syntax is passed on to the COBOL compiler, which produces an executable program called a "run unit."

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

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

With the announcement of the 1100/60, Sperry Univac added a Data Dictionary to DMS 1100. The Data Dictionary is designed to aid in the administration and management of data bases and contains definitions, descriptions, and established data relationships.

Sperry Univac 1100/60 System

QUERY LANGUAGE PROCESSOR: QLP 1100 is an English-language inquiry system that allows inquiries to be made to data bases generated under DMS 1100. On the 1100/60 systems, QLP 1100 has the ability to access standard data files and incorporates extended reporting capabilities. It uses a command language designed around a simplified English syntax and requires a minimum knowledge of the DMS 1100 data base structure. QLP can operate either in demand or batch mode, although the primary mode is interactive. Its two major component modules, the Scan Parser, which analyzes incoming commands, and the Task Translator, which accesses the data base, are both re-entrant. Through the use of the QLP command languages, users can inquire into the data base, update records, add new records, or delete records. QLP 1100 uses a Subschema Data Definition Language (QLPSDDL) that is similar to the DMS 1100 DDL. Access to the data base via QLP is regulated by the Data Base Administrator through use of SDDL. QLP also provides a report writer and procedural facilities.

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

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

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

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

INTERACTIVE PROCESSING FACILITY (IPF) 1100: IPF 1100 supports both batch and time-sharing operations. It provides a user interface to the 1100/60 system through a procedural command language and an English-language response language. IPF 1100 is designed for ease of use by users with little or no data processing background as well as by computer professionals. Functional capabilities can be expanded by adding user-developed program modules or by modifying or adding commands. IPF 1100 includes data management capabilities, security features, and session control capabilities. It can be used in conjunction with EDIT 1100 if editing functions are required.

EDIT 1100: A full-screen text editor that can be used as a stand-alone program or as a callable routine under IPF 1100. When used in conjunction with IPF 1100, EDIT 1100 provides procedural capabilities, prescanning of program source lines, user assistance capabilities, and concurrent file editing. It can be used with Sperry Univac Uniscope and UTS display terminals and also with non-display terminals. Both full-screen and general editing capabilities are provided.

INFORMATION MANAGEMENT SYSTEM: IMS 1100 is an interactive transaction processing system compatible with the IMS 90 used on the Sperry Univac 90 Series computers. It provides defined record management and access to both data base and conventional files.

MAPPER 1100: A real-time report processing system for multiple Uniscope 100/200 or UTS 400/4000 terminal systems. Data is collected and updated via the CRT display units in free-form or prescribed report formats. Functions such as record and page display, update, search, sort, and report generation can be developed into saved programs for on-line applications development. A forms generation capability allows implementation of data bases and related report processing and generating services without applications programming.

DISPLAY PROCESSING SYSTEM: DPS 1100 provides for screen handling and the management of display-oriented transactions in an on-line environment. The system operates in conjunction with the Transaction Interface Package or the Conversational Timesharing System. DPS 1100 includes an interactive screen generator and a screen handler. Additional functions are provided for data editing and validation, applying passwords to screens or separate fields of screens, and controlling access to multi-page screens.

SPERRY UNIVAC DISTRIBUTED COMMUNICATIONS ARCHITECTURE: Describes the currently-available communications hardware and software components through which networking of Univac processors and terminal devices is achieved.

Whether network control is host-dependent or host-independent, there are still certain hardware components and subsystems required to implement a DCA network. Inherently, a DCA node or host must contain several software components which provide it with the network interface. These components are detailed in this report.

The capability of completely separating communications management from applications processing is a key characteristic of DCA. The off-loading of communications processing permits the host, or hosts, to concentrate their energies on applications processing, their primary function.

In fact, in a DCA network, the host may (from a communications point of view) be required only to compile user programs for network management. Support programs would reside in the host for this purpose, and after compilation, object code would be loaded directly into channel-attached front ends, or written to storage media for later loading into remote communications nodes. The host would then be free of communications and network control activities.

It is noteworthy that Sperry Univac offers an extensive library of modular network management applications. User programming for tailored communications functions (such as message switching) is also fully supported.

A feature which serves to distinguish DCA from the architectural offerings of other major vendors is the facile acceptance into the DCA environment of non-Univac terminals, processors and networks, and the flexible modularity of the existing Sperry Univac communications hardware and software.

A minimal DCA network requires a DCA host with a communications subsystem. The host may be either an 1100

Sperry Univac 1100/60 System

mainframe running under the 1100/OS operating system, or a 90 Series CPU, model 60 or 80, running the VS/9 operating system.

A DCA terminal is generally one for which a standard terminal handling module is available from Sperry Univac. In DCA, each terminal might be operating with different character codes (ASCII, EBCDIC), transmission modes (start/stop asynchronous, character synchronous), or terminal protocols (U100, IBM 2780). It is the responsibility of the DCP closest to the terminal to translate its data format into a common trunk language—typically UDLC.

UDLC: A bit-oriented, synchronous protocol designed for full-duplex operation. Devices connected by UDLC trunks can utilize either switched or non-switched, voice-grade or digital lines. UDLC, like its SDLC, HDLC and ADCCP predecessors, uses bit sequences for control codes rather than whole characters. (Hence the nomenclature "bit-oriented.") This characteristic permits much more control information to be contained in the same or smaller amount of message space.

A UDLC trunk requires that a device at one end assume the role of a primary station, and exert control over the other, or secondary station (or stations, if on a multidropped line). Control between the devices will be in one of three modes determined by the degree of communications capability in the secondary station. Each mode varies in its treatment of the secondary station, and each is designed for a specific environment, such as polling of multidropped terminals, communications between two DCPs, or whatever.

A UDLC message is called a frame, which is the user's data surrounded by control bits. The length of the user data field is variable, but will generally be maximized depending on several parameters such as buffer space limitation, or the quality of the transmission facility.

Errors are corrected through retransmission, and numerous other methods are utilized to handle transmission problems. For example, timeouts and threshold counters are used to reduce overhead in polling, and prevent an unrecoverable error from resulting in indefinite retransmission. If a certain number of retries is reached, a subroutine for rerouting may be automatically invoked.

COBOL: The newest and most powerful COBOL compiler offered by Univac is 1100 Series ASCII COBOL. This compiler implements the modules of the 1974 American National Standard COBOL. Numerous extensions are also included. The ASCII COBOL compiler is re-entrant and produces re-entrant code.

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

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

ASCII FORTRAN: ASCII FORTRAN is a re-entrant FORTRAN compiler that handles ASCII data codes and contains useful extensions for the manipulation of both numeric and non-numeric data. The ASCII FORTRAN language is an extension of the previous Sperry Univac FORTRAN V language and implements the FORTRAN 77 Standard. It contains features specified by the standard as well as many language extensions, including the following ASCII extensions. A CHARACTER type statement allows handling of character variables, character scalars, and character arrays. A set of character operations is provided, including concatenation of strings, relational comparisons of strings, character-valued functions, and a string function that permits character variables to be extracted from or assigned to substrings of character variables. ASCII FORTRAN provides the double-precision complex data type, in which complex numbers are represented internally as a pair of double-precision floating-point numbers. This data type supports a precision of approximately 17 significant decimal digits and an exponent range of 10^{-308} to 10^{308} for both real and imaginary components of a complex number. ASCII FORTRAN also expands the use of expressions by permitting expressions to be used in positions that previously (in FORTRAN V only) allowed simple variables or array elements.

ASCII FORTRAN is a four-pass, re-entrant, common-banked compiler that provides for extensive optimization, generates re-entrant programs, and contains facilities designed to fully utilize 1100 Series hardware features and the operating system. Some of these features are I/O data format compatibility, interlanguage communication with COBOL and PL/1, sort/merge capability, and an interface with DMS 1100. In addition, the ASCII FORTRAN compiler contains a checkout option that provides for direct execution of FORTRAN programs and subroutines, with interactive debugging also provided.

Sperry Univac also offers a re-entrant ASCII FORTRAN Syntax Analyzer (BFTN), which is used in conjunction with the Conversational Time-Sharing software. BFTN aids the time-sharing user in constructing, editing, and debugging the syntax of ASCII FORTRAN programs from a demand terminal.

ALGOL: Sperry 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.

UBASIC: Sperry 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.

Sperry Univac 1100/60 System

JOVIAL: Sperry Univac offers an 1100 Series compiler for JOVIAL, a general-purpose procedure-oriented language that is used mainly in military command and control applications. JOVIAL describes functions to be performed by algebraic and logical notations.

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

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

RPG II: The RPG II Group is a new software package that inlcudes an RPG II compiler, auto report feature, and RPG II editor. The compiler is compatible with the Sperry Univac VS/9 and OS/3 operating systems used on the Series 90 computers.

MACRO: A general-purpose processor for extending host languages through its ability to process character strings. MACRO performs text generation, editing, and validation.

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

PROCESSOR COMMON INPUT/OUTPUT SYSTEM: PCIOS is designed to assure compatible data file formats. It supports sequential, indexed sequential, and multi-keyed sequential access methods for PL/1, ASCII COBOL, ASCII FORTRAN, RPG, and Sort.

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

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

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

Sperry 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 Sperry Univac Series 70, IBM System/360 and 370, and several other computer families.

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

APT (Automatically Programmed Tools)
ASET (Author System for Education and Training)
FMPS (Functional Mathematical Programming System)
GIFTS (Graphics-Oriented Interactive Finite-Element Time-Sharing System)
OPTIMA 1100 (Project Management System)
SIMULA (Simulation Language)
SIMSCRIPT 1.5 (Simulation Programming Language)
UNIFACS 1100 (Univac Financial Systems)
UNIS 1100 (Univac Industrial Systems); includes Bill of Materials Processor, Inventory Control, and Planning and Scheduling.

PRICING

EQUIPMENT: The following systems illustrate some of the configurations that are possible within the Sperry Univac 1100/60 Systems. All can use the 1100 Operating System. All necessary control units and adapters are included in the indicated prices. Quoted lease prices do not include equipment maintenance charges.

SMALL 1100/61 MODEL C1 SYSTEM: Includes CPU, external Memory Storage Unit with 1024K words of main memory, System Support Processor, System Console, Maintenance Console, I/O Unit with one block multiplexer channel and one word channel module, two 8450 Fixed-Disk Drives with controller, two Uniservo 22 Magnetic Tape Drives with controller, a 1200-lpm 0776 Printer, and an 0176-89 Card Reader. Purchase price is $777,773 and the monthly charge on a one-year lease is $19,913.

1100/62 E2 MULTIPROCESSOR SYSTEM: Includes two CPUs and two 2K-word buffers, one external Memory Storage Unit with 2048K words of main memory, two System Support Processors, two System Consoles, one Maintenance Console, two I/O Units with one block multiplexer channel and one word channel module each, four 8450 Fixed-Disk Drives with controller, six Uniservo 32 Magnetic Tape Drives with controller, two 1200-lpm 0776 Printers, one 0176-89 Card Reader, and a DCP/20 Data Communications System with eight communications lines. Purchase price is $1,809,981 and the monthly charge on a one-year lease is $46,387.

1100/64 H2 MULTIPROCESSOR SYSTEM: Includes four CPUs and four 8K-word buffers, two external Memory Storage Units with a total of 8192K words of main memory, two System Support Processors, two System Consoles, one Maintenance Console, four I/O Units with one multiplexer channel and one word channel module each, eight 8470 Fixed-Disk Drives with two controllers, eight Uniservo 36 Magnetic Tape Drives with controller, two 2000-lpm 0770 Printers, and a DCP/40 Data Communications System with 16 communications lines. Purchase price is $4,330,694 and the monthly charge on a one-year lease is $109,287.

TERMS, SOFTWARE, AND SUPPORT: The 1100/60 is available for purchase or on a one-year or five-year lease. All software except the operating system is unbundled. On-site service for operating system support can be obtained for a flat monthly fee of $500 or by an hourly rate. Support for unbundled software is included in the license fee. Sperry Univac also offers a 7-year lease to state and local governments and to educational institutions. Educational institutions are eligible for an additional 10 percent discount. The discount does not apply to maintenance service charges.

Sperry Univac 1100/60 System

CONTRACT TERMS: The standard Sperry Univac use and service agreements allow unlimited use of the equipment (exclusive of the time required for remedial and preventive maintenance). There are no extra-use charges. The basic maintenance charge covers maintenance of the equipment for nine consecutive hours a day between the hours of 7 a.m. and 6 p.m., Monday through Friday. Extended periods of maintenance are available at premium rates. The premiums for additional coverage are a percentage of the base maintenance rate and are as follows:

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

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

	Monday through Saturday	Sunday and Holidays
Min. charge per call	$112	$132
Each add'l. hour	56	66
Max. charge per call	280	330

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

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

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

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

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

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

TRACE: Sperry Univac has initiated a remote hardware maintenance concept through its facility in Roseville, Minnesota. The Total Remote Assistance Center (TRACE) is available to the 1100/60 system customers via a dedicated WATS number 24 hours per day and seven days per week. Via TRACE, a user's 1100/60 system may be monitored and controlled using on-site and remote library testing programs. TRACE also provides support for a wide range of Sperry Univac terminals connected to dial up lines. Various data files in Roseville contain information on approved hardware changes, references to solutions for problems encountered with diagnostic test software in field use, and operating system enhancements and problems. Other files contain a history of how the system should operate properly, and can be utilized for comparison purposes during diagnostic testing.

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	Monthly Lease Charges 5-Year*
PROCESSOR COMPLEX					
3042-99	1100/61 Model C1 Standard Processing Complex; includes CPU with standard instruction set and 512K words of main memory, an IOU with one block multiplexer and one 4-word word channel module, a System Support Processor (SSP), and a system console with printer	$ 336,519	$1,342	$ 8,007	$6,346
3042-96	1100/61 Model C2 Standard Processing Complex; same as 3042-99 but with Extended Instruction Set	375,100	1,458	8,925	7,074
3062-99	1100/61 Model C1 Standard Processing Complex; same as 3042-99 but with 1024K words of main memory housed in a separate cabinet	473,469	1,542	11,268	8,931
3062-96	1100/61 Model C2 Standard Processing Complex; same as 3062-99 but with Extended Instruction Set	512,050	1,658	12,186	9,659
3042-75	1100/61 Model E1 Medium Performance Processing Complex; includes CPU with standard instruction set, 512K words of main memory, 2K-word high-speed buffer, and integrated multiprocessor capability; an IOU with one block multiplexer and one 4-channel word channel module; an SSP; a system console with printer; and a maintenance console	547,519	1,692	13,035	10,328
3042-72	1100/61 Model E2 Medium Performance Processing Complex; same as 3042-75 but with Extended Instruction Set	586,100	1,808	13,951	11,056
3062-75	1100/61 Model E1 Medium Performance Processing Complex; same as 3042-75 but with 1024K words of main memory housed in a separate cabinet	684,469	1,892	16,296	12,913
3062-72	1100/61 Model E2 Medium Performance Processing Complex; same as 3062-75 but with Extended Instruction Set	723,050	2,008	17,212	13,641

*Lease charges do not include maintenance.

Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
PROCESSOR COMPLEX (Continued)					
3042-93	1100/61 Model H1 High Performance Processing Complex; includes CPU with standard instruction set, 512K words of main memory, 8K-word high-speed buffer, and integrated multiprocessor capability; an IOU with one block multiplexer and one 4-word word channel module; an SSP; a system console with printer; and a maintenance console	693,177	2,042	16,505	13,077
3042-90	1100/61 Model H2 High Performance Processing Complex; same as 3042-93 but with Extended Instruction Set	731,759	2,158	17,423	13,805
3062-93	1100/61 Model H1 High Performance Processing Complex; same as 3042-93 but with 1024K words of main memory housed in a separate cabinet	830,127	2,242	19,766	15,662
3062-90	1100/61 Model H2 High Performance Processing Complex; same as 3062-93 but with Extended Instruction Set	868,709	2,358	20,648	16,390
3042-81	1100/62 Model E1 Multiprocessor Complex; includes two CPUs with standard instruction set, 1024K words of main memory, and a 2K-word buffer in each CPU; two IOUs with one block multiplexer and one 4-word word channel module each; two SSPs; two system consoles with printers; and one maintenance console	938,254	3,499	22,340	17,703
3042-78	1100/62 Model E2 Multiprocessor Complex; same as 3042-81 but with Extended Instruction Set	1,015,416	3,732	24,175	19,159
3062-81	1100/62 Model E1 Multiprocessor Complex; same as 3042-81 but with main memory housed in a separate cabinet	999,654	3,499	23,802	18,863
3062-78	1100/62 Model E2 Multiprocessor Complex; same as 3062-81 but with Extended Instruction Set	1,076,816	3,732	25,637	20,319
3064-99	1100/60 Attached Virtual Processor; includes CPU with 512K to 1024K words of main memory and 32K-byte buffer; main storage interface unit; interprocessor interface; one byte multiplexer channel; one externally specified index attachment; VS/9 facility; AVP console; and Attached Processor Control Software	132,040	455	2,669	2,357
PROCESSOR COMPLEX OPTIONS					
F2917-00	Model Upgrade; makes 1100/61 Model C1, E1, or H1 into equivalent of C2, E2, or H2 through the addition of the Extended Instruction Set	96,453	117	2,295	1,820
1952-99	Model Upgrade; makes 1100/61 Model C1 into H1 or C2 into H2	356,659	700	8,498	6,731
1952-96	Model Upgrade; makes 1100/61 Model C1 into E1 or C2 into E2	211,000	350	5,027	3,983
1952-95	Model Upgrade; makes 1100/61 Model E1 into H1 or E2 into H2; two required to upgrade a multiprocessor system	224,050	350	5,333	4,225
3042-69	Model E1 Multiprocessing Upgrade; adds a second E1 processing complex to 3042-75 together with transfer switches to allow either System Support Processor (SSP) to attach to the maintenance console and the remote maintenance modem	469,127	1,808	11,172	8,851
3042-66	Model E2 Multiprocessing Upgrade; same as 3042-69 but adds E2 to E2	507,708	1,925	12,090	9,579
3062-69	Model E1 Multiprocessing Upgrade; adds a second E1 processing complex to 3062-75 together with transfer switches to allow either SSP to attach to the maintenance console and the remote maintenance modem	393,577	1,608	9,373	7,426
3062-66	Model E2 Multiprocessing Upgrade; same as 3062-69 but adds E2 to E2	432,158	1,725	10,291	8,154
3042-87	Model H1 Multiprocessing Upgrade; adds a second H1 processing complex to 3042-93 together with transfer switches to allow either SSP to attach to the maintenance console and the remote maintenance modem	693,177	2,158	16,504	13,077
3042-84	Model H2 Multiprocessing Upgrade; same as 3042-87 but adds H2 to H2	731,759	2,275	17,423	13,805
3062-87	Model H1 Multiprocessing Upgrade; adds second H1 processing complex to 3062-93 together with transfer switches to allow either SSP to attach to the maintenance console and the remote maintenance modem	617,627	1,958	14,705	11,652
3062-84	Model H2 Multiprocessing Upgrade; same as 3062-87 but adds H2 to H2	656,209	2,075	15,624	12,380
3062-63	Model H1 Multiprocessing Upgrade; adds a third or fourth H1 processing complex to 3062-87 (or upgraded 3042 equivalent) to form an 1100/63 or 1100/64 system; does not include main memory, SSP, or system console	597,625	1,800	14,229	11,276
3062-62	Model H2 Multiprocessing Upgrade; same as 3062-63 but adds H2 to H2	636,207	1,916	15,148	12,004

*Lease charges do not include maintenance.

Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
PROCESSOR COMPLEX OPTIONS (Continued)					
F2869-00	Performance Monitor; provides scannable buffered counters within a processing complex to allow the system support processor to collect selected performance parameters; one required per complex	32,151	23	765	607
F2688-00	IOU Expansion for 3042 systems; provides space for up to two word channel modules and one block multiplexer channel; one per processor complex; mutually exclusive with F2916-00	10,903	23	258	206
F2688-01	IOU Expansion; same as F2688-00 but for 3062 systems; mutually exclusive with F2916-01 and F3751-00	10,903	23	258	206
F2916-00	IOU Expansion for 3042 systems; provides space for up to two block multiplexer channels and one word channel; one per processor complex; mutually exclusive with F2688-00	10,903	23	258	206
F2916-01	IOU Expansion; same as F2916-00 but for 3062 systems; mutually exclusive with F2688-01 and F3751-01	10,903	23	258	206
F3751-00	IOU Expansion for 3062 systems only; provides space for four additional block multiplexer channels; one per processor complex; mutually exclusive with F2688-01 and F2916-01	16,500	75	450	350
F2684-00	Word Channel Module for 3042 systems; provides four additional independent word channel interfaces; for use with F2688-00 and F2916-00	20,573	105	491	390
F2684-01	Word Channel Module; same as F2684-00 but for 3062 systems; for use in F2688-01 or F2916-01	20,573	105	491	390
F2690-00	Block Multiplexer Channel for 3042 systems; provides interface for up to eight byte-oriented control units; for use with F2688-00 or F2916-00	17,334	70	412	327
F2690-01	Block Multiplexer Channel; same as F2690-00 but for 3062 systems; for use in F2688-01, F2916-01, or F3751-00	17,334	70	412	327
F2867-00	Shared Peripheral Interface (SPI) Control; provides capability to control up to six word control units, each with up to four SPI interfaces	16,105	23	385	306
F2904-00	Byte Channel Transfer Switch Control; provides capability to control one fully configured 4 by 8 byte channel transfer switch; maximum of 2 F2867-00 or F2904-00 per processing complex	16,105	23	385	306
2521-00	Channel Transfer Switch for block multiplexer channels; free-standing cabinet contains operator controls for manual switching of 4 subsystem strings, a primary module with a 2x1 switch, and power and space for 4x8 switching	19,781	74	466	348
2521-02	Channel Transfer Switch for remote operation	19,781	74	466	348
F2600-00	Primary Module Expansion; adds a switch for one subsystem string; maximum of 3 per 2521-00 or F2601-00; maximum of one per F2601-01	586	—	14	11
F2601-00	Additional Primary Module; adds a second 2x1 primary module and operator control for switching up to 4 subsystem strings	10,476	40	260	185
F2601-02	Additional Primary Module for remote operation	10,476	40	260	185
F2601-01	Secondary Module; for applications requiring 2-by switching capability when up to 4 switchable strings can be configured among independent 2-by switches; may be expanded by one F2600-00	10,476	40	260	185
F2601-03	Secondary Module; same as F2601-01 but for remote operation	10,476	40	260	185
F2602-00	Secondary Module; expands primary module from 2x1 to 4x1; two maximum	7,127	31	176	127
F2602-01	Secondary Module; same as F2602-00 but for remote operation	7,127	31	176	127
F2603-00	Secondary Module; allows expansion of 4-by switching by one subsystem string; maximum of 3 with each F2602-00; requires F2600-00	586	—	14	11
F2604-00	DC Power Redundancy; adds back-up DC supplies for hot-standby dynamic power redundancy	2,680	12	66	47
3542-97	Additional System Console; attaches to SSP; includes CRT console with keyboard, 200-cps bidirectional printer, and console table; maximum of two per SSP	28,627	129	680	538
3542-94	Auxiliary Console; same as 3542-97 but without the printer; maximum of two per processing complex	11,574	70	274	216
0786-02	Console Printer; up to 3 per console allowed; requires F1247-01 and F2656-01 for attachment to 3542-94	6,594	64	177	148
F2656-01	Terminal Interface; required to interface console printer to any 1100/60 console	422	—	11	9
F1247-01	Auxiliary Interface; required to interface console printer to 3542-94 console	327	—	11	8
2522-00	Transfer Switch; allows console to be switched between two SSPs	1,108	—	27	21
MEMORY					
K2687-00	Memory Storage Unit Expansion for 3042 systems; provides additional 256K words of storage; maximum of two per processing complex (maximum of 1024K words for a uniprocessor or 2048K words for a multiprocessor)	32,151	59	765	607

*Lease charges do not include maintenance.

Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
► **MEMORY (Continued)**					
7049-98	Memory Upgrade; upgrades a 3042 system to an equivalent 3062; expands a uniprocessor (UP) system from 512K words of main memory to 1024K words in a separate storage cabinet; may be further expanded to 4096K words by adding up to 3 F3368-99 storage expansions. Multiprocessor (MP) systems require two 7049-98's, which expand the system to 2048K words. Model E and H UP or MP systems can also have 7049-99 MSUs plus expansions for a total capacity of 8192K words	172,500	200	4,398	3,483
7049-97	Memory Upgrade; similar to 7049-98, but expansion is from 768K to 2048K words; two F3368-99 expansions can be added. MP systems require two 7049-97's. Model E and H UP or MP systems can also have a 7049-99 MSU plus expansions	244,650	241	6,233	4,938
7049-96	Memory Upgrade; similar to 7049-98, but expansion is from 1024K to 2048K words; two F3368-99 expansions can be added. MP systems require two 7049-96's. Model E and H UP or MP systems can also have a 7049-99 MSU plus expansions	212,500	182	5,414	4,291
7049-99	Main Storage Unit Expansion; adds a second MSU with 1024K words of memory to a 3062 (or equivalent) Model E or H processor; may be expanded to 4096K words by adding up to 3 F3368-99 expansions	212,500	400	5,414	4,291
F3368-99	Storage Expansion; adds 1024K words of memory to 3062 processors or 7049 MSUs	80,000	100	2,038	1,616
MASS STORAGE					
5012-99	FH-432/FH-1782 Drum Control; controls one to eight 6016-00 or 6015-00 drums in any combination	102,720	509	2,247	1,605
F0929-00	Write Lockout Feature for 5012-99 drum control	1,392	5	32	22
F0930-00	Shared Peripheral Interface for 5012-99 drum control; multiprocessor application only	22,608	48	495	355
6016-00	FH-432 Drum; 256K words	52,848	210	1,271	825
6015-00	FH-1782 Drum; 2048K words	146,064	585	3,512	2,280
F0786-01	Dual Channel Feature for 6016-00 drum	3,024	28	72	47
F0767-00	Dual Channel Feature for 6015-00 drum	3,024	32	69	47
5039-91	8433/8430 Control for up to eight 8430 or 8433 disk drives; includes one I/O interface and 1024K words of buffer storage; minimum two disk drives per subsystem	54,000	374	1,825	1,187
F2047-00	Drive Expansion Feature for the 5039-91; provides for up to 16 8433/8430 drives to be attached to the 5039-91	5,760	51	195	127
8430-99	8430 Disk Drive; removable disk media; minimum of two drives per system	18,720	162	633	411
F2076-00	8405 Capability; adds capability for 5039-91 to control up to eight 8405-00/04 fixed head disk drives; mutually exclusive with F2047-00	2,160	5	55	36
F1230-00	Disk Pack for the 8430-99; 17 million words	1,440	—	49	32
8433-00	8433 Disk Drive; removable disk media; minimum of two drives per system	27,360	237	923	601
F1223-00	Disk Pack for the 8433-00; 34 million words	1,820	—	61	40
F2342-00	Disk Drive Upgrade; converts 8430-99 to 8433-00	8,640	75	290	190
F2021-00	8433/8430 Dual Access Feature; provides dual access and simultaneous read/read, read/write, write/read, or write/write on any two 8433-00 or 8430-99	1,630	5	55	36
8405-00	8405 Disk Drive; fixed head, 1.3 million words	38,400	555	976	633
8405-04	0.68 million words	23,040	332	586	380
F1664-00	8405 Dual Access Feature; provides dual access and simultaneous read/read, read/write, write/read, or write/write on any two 8405 drives	2,160	5	55	36
5046-99	8430/8433/8434 Control; controls up to sixteen 8430, 8433 or 8434 disk drives; maximum 866M words of storage; requires minimum of two disk drives	102,000	509	2,922	1,899
5046-97	8430/8433/8434 Dual Control; for dual-access subsystem operation; requires two channels	176,448	889	5,291	3,439
8434-99	8434 Disk Storage; provides two single-spindle disk drives with non-removable pack; 54.18M words per drive	66,600	288	2,258	1,466
F2561-00	32-Device Capability; allows up to 32 8430, 8433, or 8434 disk drives to be intermixed on one 5046-99 control; two required for 5046-97 dual control	7,680	51	195	127
F2558-00	8405 Fixed-Head Disk Capability; allows up to eight 8405 fixed-head disk drives to be attached to the 5046-99 control, two required for 5046-97 control (precludes use of F2561-00 32-device capability)	2,160	5	55	36

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Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
MASS STORAGE (Continued)					
F2021-99	8434 Dual Access; provides simultaneous read/write, read/read, write/read, and write/write on any two 8434 disk drives; requires 5046-97 dual control	2,688	17	59	44
F2555-00	Shared Peripheral Interface; provides an additional I/O interface for the 5046-99/97 controls	6,600	37	146	108
5046-95	8430/8433/8450 Control; provides control for up to 16 8450 disk drives and power for up to four sets of four drives of any type (i.e., 8430/8433 or 8450); requires minimum of two disk drives of the same type	102,000	509	2,849	1,899
5046-93	8430/8433/8450 Dual Control; two control units; each with the same characteristics and restrictions as the 5046-95 control; requires two F2838-00 8450 capability expansions or two F2720-00 8430/8433 capability expansions	176,448	889	5,291	3,439
F2838-00	8450 Capability Expansion; allows 5046-95 control to handle up to 32 8450 disk drives; requires 2837-00 power control expansion (excludes use of F2720-00 8430/8433 capability)	6,000	57	158	106
F2720-00	8430/8433 Capability Expansion; allows 5046-95 control to handle up to 16 8430 or 8433 disk drives (excludes use of F2838-00 8450 capability)	2,400	12	63	44
F2837-00	Power Control Expansion; required when total number of disk drives exceeds 16; two required for 5046-93 dual control	7,680	51	195	127
F2555-00	Shared Peripheral Interface; multiprocessor, allows 5046-95 to connect to two separate 1100 Series processors, two required for 5046-93 control	6,600	37	146	108
8450-99	8450 Disk Storage; provides two 8450 disk drives using non-interchangeable data module included as part of each drive; 54M words of storage	66,600	288	2,258	1,466
8450-97	8450 Disk Storage; provides two 8450 disk drives using non-interchangeable data modules with fixed and movable heads	74,600	318	2,521	1,677
F2717-99	8450 Fixed-Head Conversion; converts 8450-99 disk storage unit to an 8450-97 disk storage unit	13,600	31	264	211
F2718-99	8450 Dual Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write on any two 8450 disk drives; requires two 5046 controls	2,688	17	59	44
5056-99	8470 Disk Subsystem; includes controller for up to eight 8470 drives and one 8470 drive without fixed heads	87,200	327	2,473	1,843
5056-97	With fixed heads for up to 338,688 words additional capacity	94,000	349	2,615	1,937
5056-95	8470 Disk Subsystem; includes two controllers each having capacity for up to eight 8470 drives; each drive has dual access feature but not fixed head feature	162,000	610	4,594	3,402
5056-93	With fixed-head feature in each drive	175,600	654	4,877	3,612
5056-91	8470 Disk Subsystem; same as 5056-95 but with four drives	224,000	844	6,353	4,704
5056-89	With fixed-head feature in each drive	251,200	931	6,920	5,124
5056-87	8470 Disk Subsystem; same as 5056-95 but with eight drives	328,600	1,310	9,314	6,899
5056-85	With fixed-head feature in each drive	383,000	1,485	10,448	7,739
5056-83	8470 Disk Control; provides second control for dual accessing	102,000	467	2,835	1,890
F2994-00	Four Channel Capability for 5056-83	8,090	34	179	131
F3192-00	8430/8433 Attachment; allows up to eight 8430/8433 drives on 5056 control unit; up to three are allowed	9,840	53	290	215
F3192-01	8450 Attachment; allows up to eight 8450 drives on 5056 control unit; up to three are allowed	11,680	53	290	215
F3192-02	8470 Attachment; allows up to eight additional 8470 drives on single control unit; up to three are allowed	4,000	19	100	74
F3193-00	Controller Enhancement for up to 32 drives; required when over 16 drives are configured	1,600	4	36	26
F2837-00	Power Control Expansion; required on control unit when over 16 drives are configured	7,680	51	195	127
8470-99	8470 Disk Drive without fixed heads; 90M words of storage	33,600	109	992	735
8470-97	With fixed heads	38,400	131	1,134	840
F2717-03	8470 Conversion Package; converts 8470-99 to 8470-97	6,800	24	150	111
F2718-00	8470 Dual Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write	2,688	16	56	44
5057-99	Cache/Disk Processor; manages up to four 7053 cache storage units plus up to eight 8450 and eight 8470 disk units (16 drives maximum)	104,700	355	2,795	2,105
7053-97	First Cache Storage Unit; 917,504 words of RAM; requires Segment Descriptor Table to operate in Cache/Disk mode; can be expanded to 3 million words via K3351-00	137,534	430	3,475	2,836
7053-96	Cache Storage Expansion Unit; 917,504 words; can be expanded to 3 million words via K3351-00	137,534	430	3,475	2,836
K3351-00	Cache Storage Expansion; provides additional 917,504 words of storage to 7053-96 or 7053-97; maximum of 3 per 7053	89,000	170	2,200	1,854

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Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
MASS STORAGE (Continued)					
F3117-00	Segment Descriptor Table; 16K words of storage; required when 7053 is used in Cache/Disk mode	7,584	25	237	229
F3117-01	Segment Descriptor Table Expansion; provides additional 48K words; required when cache memory exceeds 917,504 words; F3117-00 is prerequisite	12,816	45	400	356
F3117-02	Segment Descriptor Table; 64K words of storage; used when 7053 is used in Cache/Disk mode and has more than 917,504 words of storage; mutually exclusive with F3117-00 and -01	20,400	70	637	585
F3118-00	Dual Access Feature for 7053-97; requires two 5057 processors	4,416	15	138	123
F3118-01	Dual Access Feature for 7053-96; requires two 5057 processors	4,416	15	138	123
F3567-00	8450 Capability Expansion; permits sixteen 8450 disk units on cache/disk system; precludes use of 8470 disks	11,680	50	276	205
F3568-00	8470 Capability Expansion; permits sixteen 8470 disk units on cache/disk system; precludes use of 8450 disks	11,680	50	276	205
F2994-00	Four-Channel Capability; expands channel interface capability to a total of four word channels	8,090	34	179	131
MAGNETIC TAPE UNITS					
5045-93	Uniservo 14 Control; consists of a control and cabinet with space for two Uniservo 14 tape units. Controls up to eight 9-track phase-encoded tape units. Additional Uniservo 14 tape units are housed in the 5045-02 auxiliary cabinet. Up to three auxiliary units may be attached to the 5054-93 allowing the total of eight tape units	28,320	183	654	496
5045-02	Uniservo Auxiliary Cabinet; consists of a Uniservo control cabinet with power distribution and space to mount one or two Uniservo 14 Tape Units	1,296	5	30	24
F0825-00	Dual Channel Capability; provides non-simultaneous operation on two block multiplexer channels	4,416	31	102	82
F0823-95	7-track NRZI Capability for the 5045-93; includes ASCII to BCD translator and data conversion	5,760	26	133	106
F0823-94	Same as F0823-95 but translation is fieldata to BCD	5,760	26	133	106
F0823-93	Same as F0823-95 but translation is ASCII to fieldata	5,760	26	133	106
F1028-18	Adds 9-track NRZI Capability to F0823-95/94	4,175	14	96	74
F0826-01	Adds 9-track NRZI Capability to 5045-93	5,760	31	133	111
F1028-90	Adds 7-track NRZI with ASCII/BCD translator and data conversion to F0826-01	4,175	14	96	74
F1028-89	Translator is fieldata/BCD	4,175	14	96	74
F1028-88	Translator is ASCII/fieldata	4,175	14	96	74
F2627-00	Translation Feature for 9-track Uniservo 14 drives on 5045 controls; translation is in both directions involving ASCII/EBCDIC, fieldata/EBCDIC, and fieldata/ASCII	2,064	14	52	36
F2627-01	Second 9-track translator; requires F2627-00	2,064	14	52	36
0870-03	Uniservo 14 Tape Unit; 9-track, PE, 1600 bpi, 60 ips	14,880	110	344	264
0870-04	Uniservo 14 Tape Unit; 9-track, PE/NRZI, 1600/800 bpi, 60 ips	16,080	120	371	285
0870-05	Uniservo 14 Tape Unit; 7-track, NRZI, 800/556/200 bpi, 60 ips	14,880	110	344	264
F2194-00	Adds 9-track NRZI to the 0870-03; requires F0826-01	1,200	7	27	21
F2194-02	Converts 0870-05 into 0870-03	NC	NC	NC	NC
F2194-03	Converts 0870-05 into 0870-04; requires F0826-01	1,200	7	27	21
5017-00	Uniservo 12/16 Magnetic Tape Control; up to sixteen 9-track PE, 1600-bpi non-simultaneous Uniservo 12 and/or Uniservo 16 Tape Units	28,560	205	726	502
F0899-99	Simultaneous Operation for 5017-00 control; permits simultaneous read/read, read/write, write/read, and write/write on any two Uniservo 16 drives with dual access feature	21,312	131	543	396
F1131-99	Conversion Feature; converts older 5017-99 to 5017-00; if F0899-00 is present F1131-98 is required	2,112	15	49	39
F1131-98	Conversion Feature; converts older F0899-00 to F0899-99 (adds dual access and Uniservo 16 capability); requires F1131-99	2,064	15	47	39
F0825-00	Dual Channel Capability; permits non-simultaneous operation on two block multiplexer channels; if F0899-00 is present, two F0825-00 features are required	4,416	31	102	82
F0823-99	7-track NRZI, 800 bpi capability for 5017-00; includes data conversion	5,760	31	133	106
F0823-96	Includes BCD/EBCDIC (FORTRAN H set translator)	5,760	31	133	106
F0826-00	9-track NRZI Capability for 5017-00	5,760	31	133	106
F1028-96	Adds 9-track NRZI to F0823-99 or F0823-96	4,176	19	96	74
F1028-95	Adds 7-track NRZI and Data Conversion to F0826-00	4,176	19	96	74
F1028-93	Adds 7-track NRZI, BCD/EBCDIC (FORTRAN H set) Translator and Data Conversion to F0826-00	4,176	19	96	74
0862-04	Uniservo 16 Tape Unit; 9-track, PE, 1600 bpi, 120 ips	22,032	213	559	390
0862-06	Uniservo 16 Tape Unit; 7-track, NRZI, 200/556/800 bpi, 120 ips	22,032	213	559	390
F0937-01	Dual Density Feature for the 0862-04; adds 9-track, 800 bpi	2,448	—	54	40

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Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
MAGNETIC TAPE UNITS (Continued)					
F1319-00	Dual Access Feature for the Uniservo 16; also provides simultaneous read/read, read/write, write/read, and write/write on two or more Uniservo 16	2,448	16	54	40
F1040-02	Converts 0862-06 to 0862-04	NC	NC	NC	NC
0876-99	Uniservo 22 Subsystem; includes control for up to eight Uniservo 22 or Uniservo 24 drives and a Uniservo 22 Magnetic Tape Drive	44,710	222	1,192	893
0876-97	Uniservo 22 Magnetic Tape Drive; dual density PE/NRZI, 1600/800 bpi, 9-track, 75 ips	19,190	110	525	389
0876-95	Uniservo 24 Subsystem; includes control for up to eight Uniservo 24 or Uniservo 22 drives and a Uniservo 24 Magnetic Tape Drive	46,735	233	1,244	1,008
0876-93	Uniservo 24 Magnetic Tape Drive; dual density, PE/NRZI, 1600/800 bpi, 9-track, 125 ips	21,215	121	694	532
F2800-99	Adds PE/NRZI Control Unit to Uniservo 22 or 24 for dual access operation	25,520	111	667	504
F3116-01	Dual Access Feature for the Uniservo 22 and 24; also provides simultaneous read/read, read/write, write/read, and write/write when added to two or more Uniservo 22 or 24 drives	2,450	15	53	42
F3136-04	Translation Feature for Uniservo 22 or 24 controls; provides ASCII (processor) to EBCDIC (tape) and fieldata (processor) to EBCDIC (tape); maximum of one per control	2,065	11	47	32
F3136-05	Provides ASCII (processor) to EBCDIC (tape) and fieldata (processor) to ASCII (tape) translators	2,065	11	47	32
F3136-06	Provides fieldata (processor) to EBCDIC (tape) and fieldata (processor) to ASCII (tape) translators	2,065	11	47	32
5042-00	Uniservo 30 Control for up to eight 9-track, dual density (GCR/PE) Uniservo 30, 32, 34, or 36 drives	48,143	366	1,290	953
F2131-00	Adds 9-track NRZI to 5042-00; prerequisite for Uniservo 30 drives and all 7-track NRZI features	3,171	24	84	63
F2585-00	Translation Feature for 9-track drives on 5042 control; translation is in both directions involving ASCII/EBCDIC, fieldata/EBCDIC, and fieldata/ASCII	1,785	14	47	36
F2585-01	Second 9-track Translator; F2585-00 required	1,785	14	47	36
F2584-99	Adds 7-track NRZI to 5042-00; includes ASCII to BCD translator and data conversion	1,617	12	42	32
F2584-98	Translator is ASCII to fieldata	1,617	12	42	32
F2584-97	Translator is fieldata to BCD	1,617	12	42	32
F2135-00	Dual Channel Feature for the 5042-00; provides non-simultaneous access to the control from two block multiplexer channels; not software supported	5,229	40	138	104
F2137-00	Drive Expansion Feature for the 5042-00; provides for up to 16 Uniservo 30, 32, 34, or 36 drives to be attached to the 5042-00	835	5	22	15
0872-00	Uniservo 30 Magnetic Tape Drive; 9-track, dual density, PE/NRZI, 1600/800 bpi, 200 ips	30,335	230	860	601
0872-02	Uniservo 30 Magnetic Tape Drive; 7-track, NRZI, 800/556/200 bpi, 200 ips	30,335	230	860	601
F2123-00	Conversion Feature; converts 0872-02 to 0872-00	3,287	—	87	65
0873-00	Uniservo 32 Magnetic Tape Drive; 9-track, dual density, GCR/PE, 6250/1600 bpi, 75 ips	27,552	208	799	546
0873-02	Uniservo 34 Magnetic Tape Drive; 9-track, dual density, GCR/PE, 6250/1600 bpi, 125 ips	31,448	239	916	623
F2125-00	Conversion Feature; converts 0873-00 to 0873-02	4,011	31	106	80
0874-00	Uniservo 36 Magnetic Tape Drive; 9-track, dual density, GCR/PE, 6250/1600 bpi, 200 ips	33,674	256	982	667
PRINTERS					
0770-00	Line Printer and Control; 800 lpm with 48 character set	56,304	341	1,300	1,041
0770-02	1400 lpm	64,896	447	1,498	1,196
0770-04	2000 lpm	86,686	681	2,951	1,920
F1533-00	160 Print Positions for 0770 Series Printers	4,416	24	102	82
F1534-00	Expanded Character Set Control; required for other than 48-character print cartridges	2,880	5	66	53
F2230-00	Printer Upgrade; 0770-00 to 0770-02	8,592	106	198	155
F2230-01	Printer Upgrade; 0770-00 to 0770-04	30,382	228	1,159	559
F2230-02	Printer Upgrade; 0770-02 to 0770-04	21,790	122	961	404
F2822-00	Dynamic Advance Control; reduces slew rate by 50 percent to optimize stacking of light forms	300	—	8	7
	Print Cartridges for 0770 Series Printers				
F1536-00	48-character Alphanumeric Business/Commercial	462	—	24	19
F1536-01	48-character Alphanumeric Scientific	462	—	24	19
F1536-03	48-character Alphanumeric for United Kingdom	462	—	24	19

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EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
PRINTERS (Continued)					
F1536-04	48-character Alphanumeric for Denmark and Norway	462	—	24	19
F1536-05	46-character Alphanumeric for Finland and Sweden	462	—	24	19
F1536-06	48-character ANSI standard OCR-A	462	—	24	19
F1537-00	94-character ASCII Graphic (ANSI X3.4-1968)	462	—	24	19
F1537-01	63-character Alphanumeric for Denmark and Norway	462	—	24	19
F1537-02	63-character Alphanumeric for Finland and Sweden	462	—	24	19
F1537-03	68-character ISO Universal OCR-B	462	—	24	19
F1537-04	68-character OCR H-14 Universal	462	—	24	19
F1537-05	58-character COBOL/FORTRAN/Business	462	—	24	19
F1537-06	177-character International	462	—	24	19
F1537-07	95-character Alphanumeric for Finland and Sweden	462	—	24	19
F1537-08	128-character Alphanumeric/Katakama for Japan	462	—	24	19
F1537-09	24-character Numeric	462	—	24	19
F1537-10	114-character Alphanumeric/Katakama for Japan	462	—	24	19
F1537-11	68-character Universal OCR-A	462	—	24	19
F1537-12	68-character Universal ECMA-11 OCR-B	462	—	24	19
F1537-13	68-character Universal Univac 77L OCR-B	462	—	24	19
F1537-14	63-character Modified FORTRAN	462	—	24	19
F1537-15	63-character Modified ASCII	462	—	24	19
F1537-19	384-character American Library Association	462	—	24	19
F1537-20	192-character Farsi/English	462	—	24	19
F1537-21	128-character OCR-A	462	—	24	19
F1537-23	94-character Optimized ASCII	462	—	24	19
F1537-24	68-character Optimized ISO Universal OCR-B	462	—	24	19
0776-00	Line Printer and Control; 760 lpm with 48 character set	36,570	261	958	765
0776-02	900 lpm	41,340	312	1,080	864
0776-04	1200 lpm	52,150	356	1,363	1,090
F2217-00	Printer Upgrade; 0776-00 to 0776-02	4,770	51	122	100
F2245-00	Expanded Character Set Control; required for character sets with more than 64 characters	1,910	5	50	40
	Print Cartridges for 0776 Series Printers				
F2216-00	48-character Alphanumeric Business/Commercial	1,270	—	34	26
F2216-01	48-character Alphanumeric Scientific	1,270	—	34	26
F2216-07	24-character Numeric	1,270	—	34	26
F2216-08	63-character Modified FORTRAN	1,270	—	34	26
F2216-09	63-character Modified ASCII	1,270	—	34	26
F2216-10	48-character OCR-A	1,270	—	34	26
F2215-00	94-character ASCII	1,270	—	34	26
F2215-03	68-character ISO Universal OCR-B	1,270	—	34	26
F2215-04	68-character OCR H-14 Universal	1,270	—	34	26
F2215-05	58-character COBOL/FORTRAN/Business	1,270	—	34	26
F2215-06	177-character International	1,270	—	34	26
F2215-11	68-character Universal OCR-A	1,270	—	34	26
F2215-12	68-character Universal ECMA-11 OCR-B	1,270	—	34	26
F2215-13	68-character Universal Univac 77L OCR-B	1,270	—	34	26
F2215-20	94-character Optimized ASCII	1,270	—	34	26
F2215-21	68-character Optimized ISO Universal OCR-B	1,270	—	34	26
F2215-23	128-character OCR-A	1,270	—	34	26
PUNCHED CARD EQUIPMENT					
0604-99	Card Punch and Control; 250 cpm	26,640	230	615	496
0716-89	Card Reader and Control; 1000 cpm; comes with code translator EBCDIC, ASCII, compressed code, or fieldata code	18,384	164	424	307
F1487-00	51-Column Card Read Feature	1,968	16	45	32
F1487-01	66-column Card Read Feature	1,968	16	45	32
F1488-00	Validity Check	816	—	18	14
F1498-00	Stacker Feature; permits the alternate filling of stackers one and two when in the stop-on-errors mode	528	—	12	8
F1486-00	Translate Mode Conversion; from EBCDIC to ASCII	105	—	—	—
F1486-01	Compressed Code to ASCII	105	—	—	—
F1486-02	ASCII to EBCDIC	105	—	—	—
F1486-03	Compressed Code to EBCDIC	105	—	—	—
F1486-04	ASCII to Compressed Code	105	—	—	—
F1486-05	EBCDIC to Compressed Code	105	—	—	—
F1486-06	To Fieldata Code	100	—	—	—
F1530-00	Adds a second translator to translate mode under program control	1,104	5	25	18

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Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
GENERAL COMMUNICATIONS SUBSYSTEM					
8583-00	General Communications Subsystem (GCS); includes Communications Terminal Controller (CTC); houses maximum of 32 communications terminals with interface or communication terminal dialers	14,640	74	511	386
F1971-00	Expansion Power Supply; required when 24 or more terminals are included in the GCS configuration	1,630	5	57	43
F1972-00	Spare CTC for controlling up to 32 lines in ESI mode on an I/O channel	7,200	44	248	190
F1973-00	Communication Terminal Asynchronous; up to 2400 bps; asynchronous bit serial transmission	1,250	10	43	33
F1973-01	Communication Terminal Asynchronous; same as F1973-00, but with external interrupt capability	2,880	17	101	76
F1973-02	Communication Terminal Asynchronous VII; provides for block parity generation and checking	2,590	17	91	69
F1974-00	Communications Terminal Synchronous—Standard; up to 50,000 bps; synchronous bit serial transmission	1,820	14	63	49
F1974-01	Communications Terminal Synchronous; same as F1974-00, but with external interrupt capability	3,410	22	120	90
F1974-02	Communications Terminal Synchronous VII; provides for block parity and checking	3,070	22	108	81
F1975-00	Communications Terminal Synchronous; up to 56,000 bps, bit serial transmission	2,880	21	114	76
F1976-00	High-Level Communications Terminal; provides capability to handle bit-oriented Data Link Control, up to 56,000 bps	3,600	23	127	95
F1977-99	Communication Terminal Dialer	530	3	18	14
F1978-00	Communication Interface—Telegraph	190	1	6	4
F1979-00	Communication Interface—Modem	335	2	12	8
F1979-01	Identical to CI—modem (1979-00) except permits use of a modem not having a receive clock	530	3	18	14
F1980-00	Communication Interface—High-Speed (allows connection of a CTS—Std. or CTS—VII to the CCITT V.35 interface)	670	4	23	18
F1980-01	Communication Interface (allows connection of a CTS—Std. or CTS—VII to the ATT 303 modem or equivalent)	670	4	23	18
F1983-00	Spare Basic Clock	190	1	6	4
F1984-00	Expansion Clock (provides asynchronous timing rates not included in the basic clock)	190	1	6	4
F2072-00	Allows connections to a CTS—Std. to a MIL 188C synchronous interface	530	3	18	14
F2074-00	Communications Interface—automatic inbound bit rate detection	1,100	3	38	30
DISTRIBUTED COMMUNICATIONS PROCESSORS					
8597-99	Distributed Communications Processor/20 (DCP/20); free-standing unit including processor with 256K bytes of memory, operator panel, and maintenance panel; requires integrated flexible disk and controller plus free-standing cartridge disk; also requires a Uniscope 200, UTS 400, or UTS 4000 attached to a serial communications line module for use as a DCP/20 console	43,880	202	1,145	920
8597-01	DCP/20 Free-standing Expansion Cabinet; contains processor capable of performing I/O functions only; requires F1936-00 in basic cabinet; maximum of two per DCP/20 system	24,000	109	625	500
F3539-00	128K-byte Memory Increment; maximum of two per 8597-99	4,500	22	115	95
F2894-00	Line Module Expansion; provides for an additional 8 line modules in 8597-01	12,000	55	460	250
F2895-00	Active Line Indicator; provides a visual display of line activity on up to 16 half/full duplex communications lines	890	4	25	20
8596-99	Distributed Communications Processor/40 (DCP/40); free-standing unit including processor with 256K bytes of memory, I/O controller module, IOP, and control storage; requires integrated flexible disk plus free-standing flexible or cartridge disk and communication line modules; also requires a DCP/40 console or a Uniscope 100 or 200	63,105	316	1,645	1,315
F1930-00	128K-byte Memory Increment; two may be added to 8596-99; additional memory uses 1945-00	5,570	29	145	115
1945-00	DCP/40 Free-standing Expansion Cabinet; contains power supply and power controller; accommodates IOP and/or memory; up to three per system allowed, one containing up to three storage banks of up to 512K bytes each	27,060	134	705	565
F2942-00	Storage Controller; supplied with 128K bytes of memory; mounts in 1945-00; up to two F1929-99 and nine 128K-byte memory modules may be added	26,880	133	700	560
F1929-99	Storage Controller Expansion; includes 128K bytes of memory; provides control for 512K bytes of memory, required for storage banks three and four; mounts in F2942-00	13,950	71	365	290

*Lease charges do not include maintenance.

Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
DISTRIBUTED COMMUNICATIONS PROCESSORS (Continued)					
F1933-00	IOP Controller Module; mounts in 1945-00; includes IOP and space for three additional IOPs and storage port expander	14,680	72	380	305
F2941-99	Second IOP Expansion; provides Second IOP for 8596-99 or 1945-00; includes power for two more IOP expansions	14,920	74	390	310
F1932-99	Third IOP; mounts in 1945-00 or 8596-99; includes storage port expander	14,185	70	370	295
F1932-98	Fourth IOP; mounts in 1945-00 or 8596-99	10,635	52	280	220
F1928-00	Operator Station; work surface for local console and free-standing flexible disk unit; 8596-99	1,200	—	30	25
F1825-05	Active Line Indicator; provides a visual display of line activity on up to 16 communication line modules on an IOP; mounts on top of cabinet containing IOP	960	4	25	20
F1949-00	8-bit Interface for 8406 flexible disk	1,045	4	30	25
8406-00	Diskette Drive; 256K bytes	3,360	21	98	74
8406-02	Diskette Drive; 256K bytes, 50 Hz	3,360	21	98	74
F2338-00	Second Diskette Drive; installs with 8406-00	1,040	11	31	23
F2338-02	Second Diskette Drive; 50 Hz	1,040	11	31	23
3542-93	DCP/40 Console; includes logic cabinet, 15 inch CRT and power supply; requires F1948-00	6,690	65	170	125
0786-56	Console Printer; 200 cps unidirectional; interfaces to 3542-93	5,250	36	140	117
0786-54	Console Printer; 200 cps bidirectional; interfaces to 3542-93	6,960	60	180	155
0774-90	Console Printer; 300 cps; interfaces to 3542-93	2,630	24	71	50
	Features for DCP/20 and DCP/40:				
F1939-00	Integrated Flexible Disk Subsystem; includes 256K-byte flexible disk and controller; mounts in 8596-99 or 8597-99; one required	1,920	11	50	40
F1936-00	Storage Port Expander; provides a multiplexed interface to a single local storage access port for up to four requestors	3,550	17	95	75
F2943-00	Interface Expander; accommodates up to four F1948-00, or two F1946-01 or two F1948-00 and one F1946-01; up to four F2943-00 allowed per DCP cabinet	1,170	5	30	25
F1946-01	1100 Series ISI Interface; provides a full duplex ISI interface to a 1100 Series Host Processor Word Channel; 32 data bits plus two odd strapable parity bits; maximum of two per DCP cabinet; requires F2943-00	4,000	21	105	85
F1947-00	Series 90 Byte Interface; provides interface to Series 90 Host Byte or Block Multiplexer Channel; maximum of two; mutually exclusive with F2943-00	4,000	21	105	85
F1948-00	16-bit Peripheral Interface; provides interface to a peripheral subsystem; allows operation in 8- or 16-bit mode; odd strapable parity bit provided; requires F2943-00	3,000	15	80	65
F1941-00	Full Duplex Interface to Asynchronous Data Sets; conforms to EIA RS-232-C and CCITT V.24 and V.28	740	3	20	15
F1942-00	Full Duplex Interface to Synchronous Data Sets; conforms to EIA RS-232-C and CCITT V.24 and V.28; data set rates up to 9600 bps	740	3	20	15
F3163-00	Full Duplex Interface to Synchronous or Asynchronous Modems; conforms to EIA RS-232-C and CCITT V.24 and V.28; operates with Bell DDS up to 9600 bps	1,275	7	35	30
F3164-01	Full Duplex Interface to carrier facilities conforming to CCITT V.35; operates with UDLC protocol data formats, V.35 facilities (48K bps), Bell DDS and DSDS facilities (56K bps)	3,745	19	100	80
F1945-00	Auto Dialing Line Module; interface to Bell 801 Automatic Calling Units or those conforming to CCITT V.24 and V.25	1,005	4	25	20
8408-02	Cartridge Disk Control for up to two F2380 drives	5,564	29	139	104
F2380-04	Fixed/Removable Cartridge Disk Drive; five megabytes fixed, five megabytes removable	17,750	114	439	314
F2380-06	220-240 Volt version	17,750	114	439	314
F2187-00	Second I/O Interface for dual F2380 configuration	1,568	8	39	29
0871-01	Uniservo 10 Magnetic Tape Unit; 9-track, PE/NRZI, 1600/800 bpi, 25 ips	13,425	85	294	221
F2721-00	Uniservo 10 Controller; for up to two 0871-01 drives	10,320	51	284	215
F2879-00	AC Power Switch; for remote control of second 0871-01 power from DCP/20 or DCP/40	1,200	5	32	25
TERMINALS**					
3536-89	Uniscope 100 Display Terminal; 960 or 1024 characters; 64 character set	3,175	65	81	57
F1241-04	Expands Uniscope 100 character set to 96 characters	680	—	17	12
3542-99	Uniscope 200 Display Terminal; 1536 or 1920 characters; 64 character set	4,252	65	112	78
F2044-01	Expands Uniscope 200 character set to 96 characters	701	—	17	12
3542-98	Uniscope 200 with international 64 character set	4,252	65	112	78
F2044-03	Expands Uniscope 200 international character set to 96 characters	701	—	17	12

*Lease charges do not include maintenance.
**For pricing on the UTS 400, see Report 70D1-877-01.

Sperry Univac 1100/60 System

EQUIPMENT PRICES

		Purchase	Monthly Maint.	Monthly Lease Charges 1-Year*	5-Year*
TERMINALS (Continued)					
	For Uniscope 100 and 200:				
F1844-00	Numeric Keyboard	270	2	7	5
F1844-01	Upper Case Alpha Keyboard	300	2	13	8
F1844-02	Upper/Lower Case Alpha Keyboard	300	2	13	8
F1844-03	Upper Case Alpha Typewriter and Numeric Keyboard	490	2	20	14
F1844-04	Upper/Lower Case Alpha Typewriter and Numeric Keyboard	490	2	20	14
F1844-05	Same as F1844-01 but with protected format keys	300	2	13	8
F1844-06	Same as F1844-02 but with protected format keys	300	2	13	8
F1844-07	Same as F1844-03 but with protected format keys	490	2	20	14
F1844-08	Same as F1844-04 but with protected format keys	490	2	20	14
F1466-00	Special Function keyset for automatic disconnect	108	1	3	2
F1245-00	Direct Interface; 2400, 4800, or 9600 bps	470	5	12	8
F1245-01	Synchronous Interface to a modem or terminal multiplexer	470	5	12	8
F1245-02	Asynchronous Interface to a modem or terminal multiplexer; 300, 600, 1200, 1600, 1800, or 2400 bps	470	5	12	8
F1247-01	Auxiliary Peripheral Interface	327	—	11	8
8538-99	Terminal Multiplexer; for up to eight terminals	1,781	7	53	40
F1264-00	Multiplexer Expansion; expands number of terminals to 16	356	—	13	9
0786-00	Unidirectional Matrix Printer; 200 cps	4,540	38	133	108
0786-02	Bidirectional Matrix Printer; 200 cps	6,594	64	177	148
F2656-01	Printer Interface to Uniscope	422	—	11	9

*Lease charges do not include maintenance.

SOFTWARE PRICES

		Monthly Lease Charge
6107-11	Optima 1100 Project Management System	$660
6503-00	Aset-1100 Author System for Education and Training	375
6510-00	Unis-1100 ASCII Master Data Processor (MDP)	600
6510-01	Unis-1100 ASCII Inventory Management (IM)	600
6510-02	Unis-1100 ASCII Planning and Schedule/Work Order Management (PSWOM)	300
6510-97	Unis-1100 MDP/IM Combination	1,200
6510-98	Unis-1100 IM/PSWOM Combination	900
6510-99	Unis-1100 MDP/IM/PSWOM Combination	1,500
6523-00	Unidas Information Storage and Retrieval System	660
6547-00	Sperry Univac Financial Integrated Control System (SUFICS) 1100	900
6547-01	SUFICS 1100 Risk Analysis	220
6547-02	SUFICS 1100 Hierarchical Consolidate	220
6547-03	SUFICS 1100 Symbolic Editor and Renumbering Routine	220
6575-00	UNIFACS 1100 Accounts Payable	300
6575-01	UNIFACS 1100 Accounts Receivable	300
6575-02	UNIFACS 1100 Payroll/Personnel	500
6575-03	UNIFACS 1100 General Ledger/Budgeting	500
6548-00	Graphics Oriented Interactive Finite-Element Time-Sharing System (GIFTS)	385
6240-00	Spelling Checker	100
6207-00	Communications Simulator 1100	150
6162-00	Checkpoint/Restart	126
6133-00	Data Processor	63
6175-00	Integrated Recovery Utility	383
6161-00	Performance Analysis Routines	252
6158-00	Quota Input Processor (QUIP)	189
6167-00	Sentry Security Control Processor	635
6135-00	Sort/Merge	126
6163-00	Terminal Security System	189
6246-00	Log Analyzer	120
6148-00	Communications Management System (CMS)	446
6169-01	CMS 1100 General Communications System	446
6169-00	CMS 1100 DCP	635
6170-01	Conversational Time-Sharing System	275
6177-00	Define File Processor	63
6155-00	Data Management System (DMS) 1100	956
6176-00	Data Dictionary	383
6168-00	M/S (MATH-PAK/STAT-PAK)	252
6174-00	Functional Mathematical Programming System (FMPS)	635
6174-01	FMPS—Gamma	252
6147-00	High Volume Time-Sharing	635

Sperry Univac 1100/60 System

SOFTWARE PRICES

		Monthly Lease Charge
6159-00	Processor Common Communications System	126
6152-00	Processor Common Input/Output System	63
6157-00	Query Language Processor (QLP) 1100	383
6157-01	QLP 1100 with PCIOS Interface	446
6156-00	Remote Processing System	252
6179-00	Universal Terminal System 400	126
6201-02	UTS 400 Edit Processor	63
6202-00	UTS Host Utilities	20
6184-01	UTS 4000 Loadable Character Set Generator	40
6143-00	Univac Automatic Document System	509
6143-01	IICOMP-80 Device Handler (Information International Comp 80 Micro-File Recording System)	63
6143-02	APS 4 Device Handler (Autologic, Inc. APS 4 CRT Phototype Setting System)	63
6146-00	Mapper 1100	978
6237-00	Display Processing System (DPS) 1100	289
6241-00	Interactive Processing Facility (IPF) 1100	945
6244-00	Information Management System (IMS) 1100	195
6239-00	Programmers Advanced Debugging System (PADS) 1100	210
6245-00	Edit 1100	315
6172-00	APL 1100	509
6134-00	APT 1100	352
6134-01	APT 1100 with lathe capabilities	446
6171-00	UBASIC	126
6178-00	Syntax Analyzer for UBASIC	63
6153-00	COBOL, ASCII character recognition	252
6149-00	Syntax Analyzer for ASCII, COBOL and DMS 1100	126
6130-02	COBOL, UTS 400	121
6154-00	FORTRAN/ASCII character recognition	383
6150-00	Syntax Analyzer for ASCII, FORTRAN	126
6165-00	General Syntax Analyzer	110
6160-00	MACRO	126
6151-00	PL/1	252
6164-00	RPG 1100	126
6243-99	RPG II Group	130
6144-00	DCP/40 MCC Emulate Operating System	95
6136-00	DCP/40 DCP Emulate Operating System	114
6136-01	DCP/20-DCP/40 Operating System	146■