Sperry Univac 1100/90 System

MANAGEMENT SUMMARY

The 1100/90 System, introduced in July 1982, is Sperry Univac's most powerful computer system to date. The 1100/90 is functionally compatible with other 1100 Series processors, particularly the 1100/60.

The 1100/90 can be configured with up to four central processors in a tightly-coupled or loosely-coupled arrangement. System components are functionally independent, and each component can have multiple access paths to and from other components. The 1100/90 can handle a number of jobs simultaneously, including jobs that involve a mixture of real-time, interactive, and batch processing. The 1100/90 will also support high-speed scientific processors and database processors.

According to Sperry Univac, the 1100/90 is aimed at the following key market areas: manufacturing, government, airlines, communications, aerospace, petrochemical, and scientific institutions.

PROCESSORS

The basic 1100/91 Processor Complex consists of a central processor with 16K words (64K bytes) of buffer storage, a Main Storage Unit (MSU) with 2 million words (8 million bytes) of main memory, an Input/Output Processor (IOP) with four block multiplexer channels and eight word channels, a System Support Processor (SSP), a master operator console with system panel, and a processor cooling unit. When configured with two, three, or four CPUs, the system becomes an 1100/92, 1100/93, or 1100/94, respectively. The 1100/90 also supports a maximum of four IOPs, four operator consoles, and two SSPs. Optional equipment includes up to four Subsystem Access Units that control the partitioning of peripheral subsystems and up to four Subsystem Power Controllers ▷

The 1100/90 represents the top of the 1100 Series product line. It features a number of enhancements, including a virtual machine facility, that are not available on previous 1100 Series models. The 1100/90 can be used for batch, interactive, and real-time processing.

MODELS: 1100/91, 1100/92, 1100/93, and 1100/94.
CONFIGURATION: From 1 to 4 CPUs, 2 to 16 million words of main memory, 1 to 4 I/O processors, and 12 to 176 I/O channels.
COMPETITION: Amdahl 5870 and 5880, IBM 308X Series, and NAS AS/9060 and AS/9080.
PRICING: A basic system can be purchased for $2,865,660.

CHARACTERISTICS

MANUFACTURER: Sperry Univac Division, Sperry Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19424. Telephone (215) 542-4011.
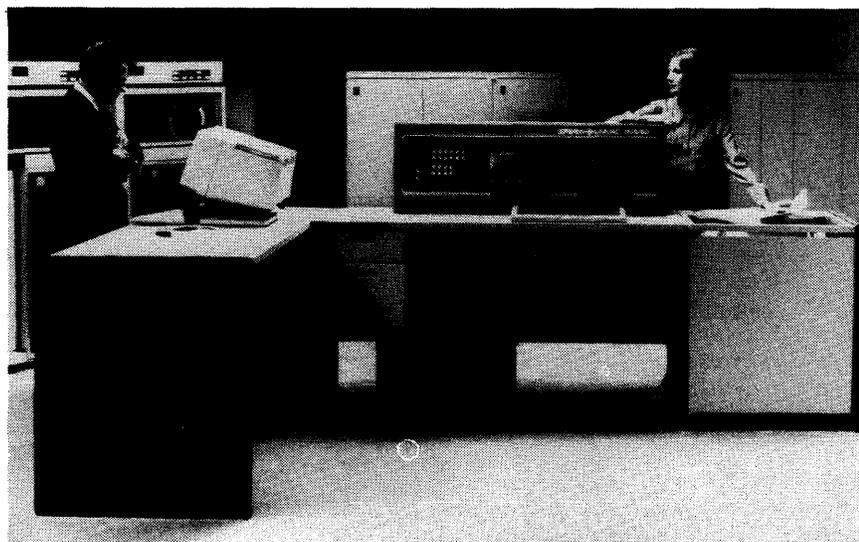
MODELS: 1100/91, 1100/92, 1100/93, and 1100/94.

DATE ANNOUNCED: July 14, 1982.

DATE OF FIRST DELIVERY: June 1983.

DATA FORMATS

BASIC UNIT: 36-bit word. In main storage, each word location includes four additional parity bits.

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 ▶

The 1100/90 System is the most powerful member of the 1100 Series family of large-scale computers. The 1100/90 offers double the main memory capacity of the 1100/60 and 1100/80, provides a new virtual machine capability, and features a number of extensions to the 1100 Series architecture.

Sperry Univac 1100/90 System

that automatically control the power to peripheral controllers connected to the IOPs.

All 1100/90 systems can have up to four MSUs, each of which can house up to four million words (16 million bytes) of memory for a total system capacity of 16 million words (64 million bytes).

The 1100/90 processors feature a number of enhancements over the previously introduced 1100/60 and 1100/80 processors. High density packaging and sub-nanosecond ECL circuits provide greater logic density and higher switching speeds. The package density of the 1100/90 is 10 times greater than that of the 1100/80. The gate switching speed is 0.37 nanosecond per gate.

The 1100/90 processor also features extended addressing, 24-bit indexing, a virtual machine capability not previously offered on 1100 Series processors, an 8K-word instruction buffer and an 8K-word operand buffer, an instruction pipelining feature that allows three instructions to be executed concurrently, and an arithmetic unit divided into a binary arithmetic section, a high-speed multiply section, and a decimal arithmetic section. The Extended Instruction Set, introduced as an option on the 1100/60, is a standard feature on the 1100/90.

Input/output operations are off-loaded from the central processor to the independent Input/Output Processor (IOP). The CPU sends a request to the IOP through a new Universal Processor Interface that consists of a send request/acknowledge pair and a receive request/acknowledge pair. The IOP accepts the request, executes the appropriate channel program, handles path selection and error control, and prepares a completion message for CPU notification and handling. Data is transferred from the IOP to main storage via a two-word-wide interface.

PERIPHERALS AND COMMUNICATIONS

Mass storage devices available for the 1100/90 system include the 8430, 8433, and 8434 removable-media disk drives and the 8450, 8470, and 8480 fixed-disk drives. The 8430, 8433, and 8434 disk drives provide capacities of 17, 34, and 67 million words (77, 154, and 243 million bytes), respectively. The 8450 provides 54 million words (243 million bytes) of storage, while the 8470 provides 89.6 million words (403 million bytes). The 8480, introduced in conjunction with the 1100/90 processor, has a storage capacity of 358 million words (1.6 billion bytes).

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 line printer models with speeds ranging from 760 to 2000 lines per minute and a laser printer with a print speed of 10,500 to 21,000 lines per minute.

Data communications capabilities are strongly emphasized. The DCP/40 Communications Processor can handle from 16 to 156 communications lines and contains

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 1100/90 can also perform decimal addition and subtraction operations on 9-bit bytes, packed 4 to a word.

FLOATING-POINT OPERANDS: One word, consisting of 27-bit-plus-sign fraction and 8-bit exponent 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. In Extended Instruction Set mode, the Address Field is 12 bits long, and a 5-bit Base Register Select Field and an 18-bit Index Register Format Selector Field are also included.

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 metal oxide semiconductor (MOS) using 64K-bit chips.

CAPACITY: From 2,097,152 words (8 million bytes) to 16,777,216 words (64 million bytes). Memory is divided into four independent 524,288-word or 1,048,596-word banks that can simultaneously service four different requests.

CYCLE TIME: 360-nanosecond double-word read/write cycle, 600-nanosecond partial-word and block (eight-word) read cycle, and 660-nanosecond block write cycle. Memory refresh takes 360 nanoseconds. Two- or four-way interleaving automatically allocates consecutive block addresses to separate storage banks when consecutive eight-word blocks are being moved. A write request queue can stack up to 16 double-word write requests in each central processor.

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. The MSU also detects single-bit address errors and out of bounds addresses.

STORAGE PROTECTION: The virtual address space is about 69 billion words long and is partitioned into variable-length banks that can contain up to 16 million words. Each bank is described by a data structure called a Bank Descriptor that contains the address of the bank in physical main storage and the upper and lower address limits. A Bank Descriptor Index (BDI) is used to locate the bank in which the data is stored. An OFFSET field locates the word being addressed within the bank selected by the BDI. When a virtual address is moved into a Base Register, a check is made to ensure that the entire bank is resident in physical main storage. If it is not, an interrupt is generated. Access control mechanisms are

Sperry Univac 1100/90 System

1100/90 System Summary

Configurations	CPUs	Cooling Units	I/O Processors	Main Memory, Words	SSPs	Operator Consoles*	Auxiliary Consoles
1100/91	1	1	1	2,097K to 16,777K	1-2	1-4	0-16
1100/92	2	2	2	2,097K to 16,777K	2	1-4	0-16
1100/93	3	3	3	2,097K to 16,777K	2	1-4	0-16
1100/94	4	4	4	2,097K to 16,777K	2	1-4	0-16

*One operator console must have a system panel.

▷ from 512K 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 to 3 I/O processors, and up to 48 communications lines.

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

SOFTWARE

The 1100 Operating System 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, interactive, and real-time (or communications). It provides virtually the full gamut of desirable operating facilities, including dynamic storage allocation, re-entrancy, multiprocessing, dynamic reconfiguration, automatic recovery, multi-level prioritization, and system optimization.

Software facilities that operate under the control of the 1100 Operating System include processors for the Cobol, Fortran, Algol, Basic, Pascal, PL/1, APL, RPG, and ▷

▶ incorporated to ensure that only authorized activities are permitted to access or modify a bank. The access checks are made by comparing an "access key" in the processor with an "access lock" in the Bank Descriptor. In addition, two independent sets of access permissions, general and special, are associated with each virtual storage bank. Each set of permissions consists of enable bits for read, write, and enter accesses. If the bit is set, the access is permitted; if not set, the access is forbidden. The special access permission bits are used when the access key fits the access lock in the Base Register, while the general access permission bits are used if the key does not fit the lock.

BUFFER STORAGE

CAPACITY: 8K words per buffer. Each central processor has two internal buffers: an instruction buffer and an operand buffer. Each buffer is organized into 256 sets, each of which consists of four 8-word blocks. Both buffers can fetch 8-word blocks from main storage across a 72-bit-wide interface.

CYCLE TIME: The instruction buffer reads two instructions in 60 nanoseconds. The operand buffer has a cycle time of 30 nanoseconds.

CENTRAL PROCESSOR

The 1100/90 central processor features high-density packaging and sub-nanosecond emitter-coupled logic (ECL) circuits with a gate switching speed of 0.37 nanosecond. The packaging technology, which Sperry Univac terms High-Performance Packaging (HPP), provides 10 times the density of the 1100/80 system. The HPP technology uses liquid cooling to maintain a constant conservative temperature. Cold plates placed between the circuit cards conduct the generated heat to a circulating liquid coolant. The coolant flows to an external cooling unit that serves as a heat exchanger between the coolant and the customer-supplied chilled water system. The cooling unit also monitors temperature, pressure, and leak sensors.

The central processor arithmetic unit is divided into three sections: a binary arithmetic section, a binary high-speed multiply section, and a decimal arithmetic section. Each section is optimized to reduce execution time for its specific type of calculation. The arithmetic unit performs 36-bit single-length shifting or 72-bit double-length shifting. Addition and subtraction of fixed-point numbers can be performed on half- or third-words simultaneously. In addition, there are nine special internal registers that define arithmetic operational rules and exceptions.

Other central processor features include an instruction pipelining feature that permits the concurrent execution of ▶

Sperry Univac 1100/90 System

▷ Assembly languages, plus a variety of utility routines and applications packages.

Sperry Univac, like most other mainframe manufacturers, places a strong marketing emphasis on data base and data communications software. The new Universal Data System (UDS) 1100 is a collection of programs designed to provide a single unified data management subsystem. UDS 1100 components include the UDS 1100 Control, Data Management System (DMS) 1100, Processor Common Input/Output System (PCIOS) 1100, Relational Data Management System (RDMS) 1100, Data Dictionary System (DDS) 1100, Define FileProcessor (DFP), Integrated Recovery Utility (IRU), and File Administration System (FAS).

Data communications software includes the Communications Management System (CMS) 1100, which provides the communications interface to a DCA-based DCP/Telcon network, and the Processor Common Communication System (PCCS), which enables applications programs to utilize the communications system.

The following end-user-oriented software systems are available to facilitate the development of transaction processing and management information systems: the Remote Processing System (RPS) 1100, a system that allows nonprogrammers to interactively develop and use their own file management applications from remote CRT terminals; Query Language Processor (QLP) 1100, an English-language batch or interactive interface to DMS 1100; Mapper 1100, a real-time report processing system; and ADVISE 1100, an application development tool.

The Interactive Processing Facility (IPF) consists of eight modules that provide a user interface to the 1100/90 system. IPF includes data management and distributed processing capabilities, security features, and terminal session control capabilities.

COMPATIBILITY

Within the 1100 Series, Sperry Univac has maintained a high degree of program and data compatibility. This has been continued with the 1100/90, 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 Pascal 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 practical purposes, an 1100 Series computer can now be considered a byte-oriented ASCII machine. ▷

▶ three instructions, a wraparound feature that routes intermediate results from one instruction to the appropriate registers when needed by the following instructions, a duplicate index file that accelerates operand and instruction address formation, an address range of 16 million words, 24-bit indexing, and a Universal Processor Interface that provides interprocessor communications.

Each 1100/90 system includes a system clock unit that provides synchronized clock signals for the central processors, I/O Processors, and Main Storage Units, and a motor alternator that provides the system with 400-hertz power. An optional Performance Monitor is available for analyzing system performance.

The 1100/90 system includes a number of Availability, Reliability, and Maintainability (ARM) features. These include transient-free design, extensive error detection and recovery, error logging and analysis, on-line fault analysis, diagnostic software, and a remote maintenance interface. Failure in the System Support Processor (SSP) will not cause a system failure, and if the system console fails, the SSP can function as a system console.

REGISTERS: The 1100/90 processor contains two sets of program-addressable registers: the General Register Set (GRS) and the Base Register Set. The GRS includes 128 control registers. User programs can make use of a Non-Indexing Register, 11 Index Registers, 4 Overlapped Registers that can be used as either Index Registers or Accumulators, 12 Accumulators, 4 Unassigned Registers that are available as temporary storage locations, and 32 Jump History Registers. Also available are 16 Special Registers, including a Latent Parameter Register, a Repeat Count Register, a Mask Register, and User Registers that can be used as loop counters, transient registers, or storage for intermediate values or constants. A duplicate set of Executive control registers is accessible only by the operating system.

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 and test operations. The Jump History Register holds the recent 24-bit absolute addresses of jump instructions.

The Base Register Set consists of 32 registers, each containing a virtual address. In basic instruction mode, only base registers B12 to B15 are available. In extended instruction mode, either the first 16 base registers or all 32 base registers are available, depending on the current processor privilege level. User programs can address base registers B0 to B15 only. Base registers B16 to B31 are executive base registers accessible only to the operating system. The B0 register points to the current instruction stream when in extended mode, and the B1 register points to the programming language "automatic" stack and can only be modified by very privileged executive routines. The B2 to B11 registers are available for program data, while the B12 to B15 registers point at either code or data in basic mode or at data in extended mode. The B16 register points to the interrupt vector and the bank descriptor table for Level 0 virtual addresses, and the B17 to B19 registers point to the bank descriptor tables for Levels 1 to 3 virtual addresses. The B20 register points to the table containing a copy of the virtual addressses loaded into B1 to B15, the B21 register points to the current return control stack, the B22 register points to the interrupt control stack, and the B23 to B31 registers are available to executive code. Levels 0 to 3 are assigned to the program banks to indicate the degree to which the banks are to be shared.

A processor state or condition is maintained for each program activity. The processor state consists of the internal registers of the central processor that are required for system operation, including the addressing state, the register state, ▶

Sperry Univac 1100/90 System

> COMPETITIVE POSITION

The 1100/90 system will compete with the Amdahl 580 Series, the IBM 308X Series, and the National Advanced Systems AS/9060 and AS/9080 systems.

Sperry Univac has released the following performance comparisons between the 1100/90 and the IBM 308X: the single-processor 1100/91 competes with the 3083 Model Group J, the dual-processor 1100/92 offers performance equal to or better than the 3081 Model Group K, the three-processor 1100/93 provides more than 50 percent greater power than the 3081 K, and the four-processor 1100/94, with a rating of 25 million instructions per second, offers nearly twice the performance of the 3081 K. The 1100/90 has a gate switching speed of 0.37 nanosecond per gate, compared to 1.0 nanosecond for the IBM 3081 and 0.4 nanosecond for the Amdahl 580.□

▶ the activity state, and the instrumentation state. The addressing state consists of the Base Register Set, while the register state consists of the GRS.

The activity state includes the registers required for operational control of an activity. The activity state consists of the following: the Program Address Register, which contains the virtual address of the current instruction; the Designator Register, which controls the basic operational modes and conditions of the processor; the Indicator/Key Register, which contains mid-execution control indicators, the current access key value, and pending interrupt indicators; two Quantum Timers, one of which counts both real and virtual processing and one of which counts only virtual processing; and four Interrupt Status words.

The instrumentation state includes the Breakpoint Register, the Jump History Register, and software monitoring controls.

INSTRUCTION REPERTOIRE: To a great extent, the 1100/90 instruction set is identical with that of other 1100 Series systems in order to maintain compatibility. To utilize the full capabilities of the 1100/90, additional privileged instructions and an extended mode of operation with several new instructions have been included.

The 1100/90 has 271 instructions. Of these, 26 are available in basic mode only and 30 are available in extended mode only. The instruction set includes: 16 load instructions, 20 store instructions, 30 fixed-point arithmetic instructions, 15 floating-point instructions, 16 search and masked search instructions, 7 data type conversion instructions, 37 test instructions, 12 shift instructions, 28 conditional and unconditional jump instructions, 6 inter-bank jump instructions, 4 logical instructions, 24 miscellaneous instructions, 11 character manipulation instructions, 2 stack instructions, 12 address space management instructions, 12 activity control instructions, 8 dayclock instructions, 4 universal processor interface instructions, 5 recovery and partitioning control instructions, and 2 virtual machine instructions.

INTERRUPTS: An interrupt suspends the current instruction sequence and initiates an instruction sequence starting at an address found at a fixed location relative to the B16 base register. The address of this location replaces the value in the Program Address Register. Except for instructions that are explicitly named as interruptible, the central processor honors an interrupt only after the current instruction is completed and only if the interrupt is allowed.

All external interrupt requests, such as those generated by an I/O processor, are presented to each central processor in the system. Therefore, an interlocked synchronization mechanism is provided to ensure that only one CPU actually accepts the request. There are 64 interrupt priority levels.

VIRTUAL MACHINE FACILITY: The Enter Virtual Machine (EVM) instruction activates the virtual machine facility. The operand of this instruction is a control structure known as a virtual processor control block, which contains a pointer to a set of tables used to translate addresses generated while the virtual machine is active into relative addresses within the space of the program that executed the EVM instruction. This translation is performed through the use of a set-associative look-up paging mechanism. A history of translated addresses is maintained.

When the EVM activates the virtual machine, the current state of the central processor, such as register contents or designator registers, is saved in the central processor. The contents of the virtual processor control block is transferred into the central processor, overlaying the previous processor state, and the processor is then switched from real mode to virtual mode. The Designator Register is duplicated so that the central processor can respond to interrupt conditions.

The virtual machine facility operates in either program mode or system mode. Program mode provides performance assists for software debugging. This is especially useful when a debugging operation requires actual execution of the object program instructions. Supporting software can control the length of time the virtual machine is active, either by specifying a fixed number of instructions to be executed or by specifying one or more addresses that cause a virtual machine exit when referenced. System mode provides for the controlled testing of operating systems. In system mode, interrupt conditions are processed inside the active virtual machine, while in program mode interrupt conditions are reported to the supporting software.

SYSTEM SUPPORT PROCESSOR (SSP): The 1100/90 SSP is a free-standing system that includes 256K bytes of memory, fixed-disk storage, a magnetic tape unit, and a CRT workstation with printer. The SSP interfaces to the CPU, IOP, and MSU. It performs power control, unit initialization, system partitioning, initial program load, and system maintenance. The SSP monitors each central complex unit, taking recovery and isolation action when errors are discovered. Errors are logged for later analysis. For maintenance, the SSP performs on-line diagnostic testing, full prognosis, and off-line analysis for pinpointing faults.

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.

CONSOLE: The 1100/90 master operator console is a UTS 20 terminal equipped with a clock calendar and a system panel used to control initial program load, assign SSPs to application partitions, and sound a system alarm. The master console also includes a printer. A second display unit and up to four auxiliary consoles can be added. The UTS 20 has a 12-inch screen and a typewriter-style keyboard with function keys and numeric keypad. ▶

Sperry Univac 1100/90 System

SUBSYSTEM ACCESS UNIT (SAU): The SAU is an optional unit that controls the partitioning of peripheral subsystems via commands from the SSP. The SAU allows a peripheral subsystem to be accessible or inaccessible to any application. Peripheral subsystems can be dedicated to a particular application or shared among applications.

SUBSYSTEM POWER CONTROLLER (SPC): The SPC is an optional unit that automatically controls dc power to the peripheral subsystems connected to an I/O processor. The SPC can control up to 64 peripheral control units. It can be operated manually, but usually operates under the control of the SSP.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The 1100/90 Processor Complex contains one Input/Output Processor (IOP). The IOP consists of a central control module (CCM) and up to six channel modules. The CCM provides independent control paths to up to four CPUs and up to two SSPs and data paths to/from up to four 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 four block multiplexer channels or eight word channels. Channels can be intermixed in the IOP, but the first channel module must be a block multiplexer channel module. The basic IOP includes a CCM with one block multiplexer channel module and one word channel module. The IOP can be expanded by adding two additional channel modules of either type to the basic cabinet. An IOP expansion cabinet is available to provide space for two more channel modules. Thus, each IOP can include a maximum of 24 block multiplexer channels or 40 word channels in two cabinets. A fully configured 1100/90 system with four IOPs can have up to 96 block multiplexer channels or 160 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 256 subchannels for concurrent operation. Each IOP can support up to 4096 subchannels.

The maximum block multiplexer channel data rate is 4.3 million bytes per second on input and 3.7 million bytes per second on output. The maximum word channel data rate is 3.7 million bytes per second in ISI mode. Maximum aggregate transfer rates are 17.2 million bytes per second per block multiplexer channel module and 18 million bytes per second per word channel module.

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

CONFIGURATION RULES

The basic 1100/91 Processor Complex consists of a central processor with 16K words (64K bytes) of buffer storage, a Main Storage Unit (MSU) with 2 million words (8 million bytes) of main memory, an Input/Output Processor (IOP) with four block multiplexer channels and eight word

channels, a System Support Processor (SSP), a master operator console with system panel, and a processor cooling unit. The system can be expanded to include a second SSP, three additional operator consoles, and four auxiliary consoles per operator console. The 1100/91 also supports one Subsystem Power Controller (SPC) and up to four Subsystem Access Units (SAUs).

The 1100/92 includes the basic Processor Complex plus an additional CPU and cooling unit, an additional IOP, and an additional SSP. The 1100/92 supports up to four operator consoles and 16 auxiliary consoles, two SPCs, and up to four SAUs.

The 1100/93 includes the basic Processor Complex plus two additional CPUs and cooling units, two additional IOPs, and one additional SSP. The 1100/93 supports up to four operator consoles and 16 auxiliary consoles, up to three SPCs, and up to four SAUs.

The 1100/94 consists of the basic Processor Complex plus three additional CPUs and cooling units, three additional IOPs and one additional SSP. The 1100/94 supports up to four operator consoles and 16 auxiliary consoles, up to four SPCs, and up to four SAUs.

All 1100/90 systems can have up to four MSUs, each of which can house up to four million words (16 million bytes) of memory for a total system capacity of 16 million words (64 million bytes).

Minimum peripheral equipment to complete an 1100/90 system includes an 0776 printer subsystem, a disk subsystem with one control unit and one 8470 disk unit, 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 one 0770 printer subsystem, a disk subsystem with one control unit and one 8480, 8450, 8434, 8433, or 8430 disk unit, and a magnetic tape subsystem with one control unit and two Uniservo 30, 32, 34, or 36 magnetic tape units.

MASS STORAGE

8407 DISKETTE SUBSYSTEM: A free-standing cabinet with a control unit and one or two autoloader diskette drives. The drives can use either single- or double-density diskettes. Each single-density diskette has a storage capacity of 250,000 bytes, and each double-density diskette has a capacity of 1,000,000 bytes. The track-to-track seek time is 3 milliseconds, the head settling time is 15 milliseconds, and the head loading time is 35 milliseconds. The average latency time is 83.3 milliseconds. The nominal data transfer rate is 31,000 bytes per second for single-density diskettes and 62,000 bytes per second for double-density diskettes.

Each 8407 diskette drive has an autoloader feed mechanism that can sequentially feed up to 20 diskettes without operator intervention.

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, and the rotational speed is 3600 rpm. The data transfer rate is 179,111 36-bit words (806,000 bytes) per second.

Sperry Univac 1100/90 System

From two to eight 8430 Disk Pack Drives can be attached to a 5039 Control Unit. 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. 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 fixed 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. Additonal 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 or 8480 Subsystem; see the next entries.

A special version of the 8450 Disk Subsystem that conforms to Federal Information Processing (FIPS) Standard 63, Class B, is also available.

8470 DISK SUBSYSTEM: Consists of the 5056-83 controller and the 8470 Disk Drive. This drive, an enhanced version of 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 466,000 words (2,097,000 bytes) per second.

The 5056-83 controller can attach up to eight 8470 Disk Drives with or without the fixed-head option. The F3192-02 feature allows for the attachment of eight additional 8470 drives or two 8480 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.

8480 DISK SUBSYSTEM: Introduced in conjunction with the 1100/90, the 8480 Disk Drive includes four HDAs that provide a total storage capacity of 358,400,000 words (1,612,800,000 bytes) of storage. Each HDA consists of 8 platters with 16 recording surfaces. Data is recorded on 1260 tracks per surface in 40 records of 112 words per track. Minimum, average, and maximum access times are 4, 23, and 46 milliseconds, respectivley. The drive has a rotational speed of 3600 rpm. The data transfer rate is 466,000 words (2,097,000 bytes) per second.

The 8480 Disk Subsystem includes two dual-access controllers and two 8480 disk units. The controllers support up to eight 8480 drive units. The F3192-99 and F3192-98 Attachment Features allow the attachment of up to eight 8430/8433 or eight 8450 disk drives, respectively. The F3192- ▶

Sperry Univac 1100/90 System

97 Attachment feature permits the attachment of up to eight 8470 or two additional 8480 drives. Up to three attachment features can be added. All disk drives in the subsystem must have a dual-access capability.

CACHE/DISK SYSTEM: A hierarchical mass storage system that provides a level of memory between the 1100/90 processor and 8450, 8470, or 8480 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, 8470, or 8480 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 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 and 8480 disk units 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 (645 million bytes) using the 1792-word format. Using the same 1792-word format, the 8480 stores up to 573 million words (2580 million bytes).

INPUT/OUTOUT UNITS

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 a control unit and two Uniservo 22 tape units in a single cabinet. The Uniservo 24 subsystem includes a control unit and two Uniservo 24 tape units in a single cabinet. Both subsystems support up to eight Uniservo 22 and/or Uniservo 24 magnetic tape units.

UNISERVO 30 SERIES TAPE UNITS: High-performance units that record data on 1/2-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 seocnd control unit, also with appropriate features, permit communication with up to 16 tapes in a dual-access mode. The five models in the Uniservo 30 series and their characteristics are as follows:

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

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

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

● Uniservo 34—a 9-track unit designed for GCR and PE recording. The transfer rate is 780,000 bytes/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 1100/90 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 ▶

Sperry Univac 1100/90 System

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.

0777 PRINTER SUBSYSTEM: The 0777 printer is a high-speed non-impact printer that uses laser technology. The printer operates at a print rate of 159 eleven-inch pages per minute, ranging from 10,500 to 21,000 lines per minute. Line spacing of 6, 8, and 12 lines per inch and character spacing of 10, 12, and 15 characters per inch are available. A variety of character sets are available and are stored on the system diskette. For further details on the 0777 laser printer, please refer to Report 70D7-877-01 in Volume 2.

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 1100/90 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 1100/90 system via a word channel.

COMMUNICATIONS CONTROL

DCP/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 1100/90 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 newer 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 to three 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.

The DCP/40 represents a significant increase in 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 512K to 2048K bytes, expandable in 512K-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 micropro-grammed 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 ►

Sperry Univac 1100/90 System

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 3270 and 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 standalone 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.

The DCPs require an operator console, which can be either a UTS 20 terminal or a UTS 400 terminal attached to a communications line.

TERMINALS: Sperry Univac offers a wide variety of terminal equipment for use with the 1100/90, including the UTS 4000 Series (see Report 70D1-877-02), the UTS 400 Display Terminal, the Uniscope 200 Display Terminal, and the DCT 500 Series. The Univac BC/7, V77, 90/30, and System 80 computers can also serve as remote communications terminals.

SOFTWARE

OPERATING SYSTEM: All 1100 Series systems utilize the 1100 Operating System, which supports batch, transaction, real-time, and interactive processing in multiprogramming, multiprocessing, and distributed processing environments. The heart of the 1100 Operating System is the Executive, which supports user program processing.

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 Interactive Processing Facility, Conversational Time-Sharing, and High-Volume Time-Sharing systems, described later in this report.)

Real-time and communications programs, which are subject to specific time constraints, receive top-priority handling by the 1100 Operating System. 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 Executive 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.

Multiprocessing is handled as a logical extension of the 1100 Executive'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.

A number of *system management tools* are available for Executive system management, upgrading, and testing. These include the Customer On-site Maintenance and Installation System (COMUS), the Quota system, and Fault Location by Interpretive Testing (FLIT).

Sperry Univac 1100/90 System

▶ The Customer On-Site Maintenance and Installation Subsystem (COMUS) facilitates the installation and maintenance of the Executive software and program products. COMUS provides a high-level interface that directs an automatic system generation process. Augmenting COMUS is the Symbolic Stream generator (SSG). Directions and models for building the desired stream images are conveyed to SSG through a skeleton program. The resulting symbolic output streams can be placed in a user-specified file, printed, and dynamically added for execution after SSG terminates. SSG also helps to maintain symbolic input files that may be printed, corrected, and updated for later use.

The Quota System enables 1100 Series installations to control the use of system resources by both batch and demand users. The Quota Input Processor (QUIP) 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.

Fault Location by Interpretive Testing (FLIT) provides the capability to execute and diagnose the Executive while running as a normal user program under Executive control. Thus, a new version of the Executive or a planned new configuration can be studied and tested in a "virtual" environment prior to its use as the production Executive system.

In addition, the 1100 Executive can dynamically monitor its own activity. The Software Instrumentation Package (SIP) provides a tool for system throughput and response optimization.

A number of *system processors* are also available, including The Terminal Security System (TSS), Sentry, Checkpoint/ Restart, Memory Allocation Processor, Post-Mortem Dump Processor (PMD), Element Processor (ELT), Procedure Definition Processor (PDP), File and Program Utility Processor (FURPUR), and Data Processor.

The 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.

Sentry is a security control processor that is used to create and maintain a user security profile database, which is then used to control user access to files and certain privileged functions. Checkpoint/Restart snapshots a run or program and creates a checkpoint that may be used for restarting at a later time if desired. The Memory Allocation Processor provides for the collection and interconnection of relocatable elements produced by the compilers to produce an executable program. The Postmortem Dump Processor is a user debugging aid that produces edited dumps of the contents of main storage if the program terminates abnormally. Optionally, a dump can be produced when a program terminates normally.

The Element Processor is used to insert symbolic, relocatable, absolute, or omnibus elements into a program file from images in the runstream. The Procedure Definition Processor processes symbolic elements that may contain Assembler, Fortran, or Cobol procedures and produces entries in the

table of contents of a program file. The File and Program Utility Processor consists of a set of file maintenance routines that provide for the management and manipulation of cataloged or temporary files containing data or programs. Finally, the Data Processor provides data handling capabilities at the file level.

COMMUNICATIONS PROCESSING: The 1100 Operating System supports two communications processing packages: the Communications Management System (CMS 1100) and the Processor Common Communication System (PCCS 1100), as well as the Distributed Communications Architecture (DCA).

The *Communications Management System* is the communications network interface for the 1100/90 system to a DCA-based DCP/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.

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.

The *Processor Common Communication System* provides a means by which application programs developed in high-level languages such as Cobol and PL/1 can utilize the Series 1100 communications system. Programs using PCCS 1100 can communicate with other communication programs, terminal users, remote batch systems, and certain host computers.

The Distributed Communications Architecture (DCA) 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. ▶

Sperry Univac 1100/90 System

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 mainframe running under the 1100 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 is a bit-oriented, syncrhonous 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.

DATA MANAGEMENT: The *Universal Data System* (UDS 1100) is a collection of programs designed to provide 1100 Series users with a single unified data subsystem that furnishes the data management services for all components of the 1100 Operating System. UDS 1100 components include the UDS 1100 Control, Data Management System (DMS 1100), Processor Common Input/Output System (PCIOS), Relational Data Management System (RDMS 1100), Data Dictionary System (DDS 1100), Define File Processor (DFP), Integrated Recovery Utility (IRU), and File Administration System (FAS).

The *UDS 1100 Control* is the on-line data manager of the UDS system, which provides a complete range of data structures, utility programs, and support programs. UDS 1100 Control integrates these different programs and manages the movement of data between data models. The control module allows file sharing through a locking mechanism and allows the same program to access several data models. It also centralizes functions such as audit trails and administration.

DMS 1100 is a comprehensive database 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) database 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 is a standalone language whose record descriptions are compatible with those of Cobol. The Data Manipulation Language consists of commands embedded in Cobol, Fortran, and PL/1 to allow these host languages to manipulate the database via DMS 1100. The Data Management Routine, the key operational component of DMS 1100, maintains the database and preserves its integrity. The Data Reorganization Utility provides for optimization of the physical placement of records within an existing database without the need for tailored unload and reload programs. (For further information on DMS 1100, please refer to Report 70E-877-02 in Volume 3.)

PCIOS is designed to assure compatible data file formats. It supports sequential, indexed sequential, and multi-keyed sequential access methods for APL, PL/1, ASCII Cobol, ASCII Fortran, RPG, Sort, and QLP.

RDMS 1100 provides definition and access for both host language programming and end-user interface software. Relational databases are defined by the data manipulation language used for retrieval and updating of data. The Relational Transformation Language provides relational views of other databases, such as DMS 1100.

DDS 1100 provides a means for the centralized description, location, and control of the various elements within a user database environment. DDS 1100 consists of a database of information, called the meta-database, about the entities in the user database environment, as well as a set of processors that access the meta-database for the purpose of creating, updating, and reporting information.

The Define File Processor provides a data file description external to the program processing the file. Using DFP, programs written in Fortran, Cobol, PL/1, APL, and RPG are file-format-independent and can share common files.

The *Integrated Recovery Utility* provides the user with English-language commands to initiate a variety of integrity features and capabilities. IRU can be used to control user access to selected TIP or TIP/DMS files or to provide partial file access. It can also be used to compare complete or partial records between files.

The *File Acquisition System* is a functional successor to Sperry Univac's file administration processor, SECURE. FAS provides extensive file handling and control within an Interactive Processing Facility system environment. FAS includes capabilities for mass storage file backup, archiving, and reporting. It also provides for the administration of hierarchical files and directories.

TRANSACTION PROCESSING: The following programs provide transaction processing capabilities for 1100 Series systems: The Transaction Interface Package (TIP), Information Management System (IMS 1100), and Display Processing System (DPS 1100).

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 lcad 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.

IMS 1100 is an interactive transaction processing system compatible with the IMS 90 used on the Sperry Univac 90 ►

Sperry Univac 1100/90 System

Series computers. It provides defined record management and access to both data and conventional files.

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 Time-Sharing 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.

END-USER SYSTEMS: The following software products are specifically designed for end users: Mapper 1100, Advanced Information Service (ADVISE 1100), Query Language Processor (QLP 1100), and Remote Processing System (RPS 1100).

Mapper 1100 is 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 application development. A forms generation capability allows implementation of databases and related report processing and generating services without applications programming.

ADVISE 1100 provides a set of easy-to-use tools for data definition, data interaction, and application development. ADVISE 1100 furnishes the query, update, and application development interface to RDMS 1100, so that users can design and access relational databases.

QLP 1100 is an English-language inquiry system that allows inquiries to be made to databases generated under DMS 1100. 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 database 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 database, are both re-entrant. Through the use of the QLP command languages, users can inquire into the database, 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 database via QLP is regulated by the Data Base Administrator through use of SDDL. QLP also provides a report writer and procedural facilities.

The *Remote Processing System* is an interactive data management and file processing system that provides access to system resources by a nonprogramming-oriented user interface through a Uniscope 100 or Uniscope 200 CRT display terminal. RPS 1100 database 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.

INTERACTIVE PROCESSING: Several software programs are available for interactive processing, including the Conversational Time-Sharing System (CTS 1100), High-Volume Time-Sharing (HVTS), and Interactive Processing Facility (IPF).

CTS 1100 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, 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 below.

HVTS is an alternative to CTS that 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.

The *Interactive Processing Facility* supports both batch and time-sharing operations. It provides a user interface to the 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.

IPF consists of eight separately priced modules. The IPF Command Language is the primary interface for using IPF. It is based on CODASYL specifications. The development of command language subroutines and macros is accomplished through the use of the IPF Procedures module. The Distributed Data Processing module supports file transfers and job submissions from 1100 Series to 1100 Series systems. The Edit 1100 module is an input and update editor that provides access to a variety of file formats, works in an easy-to-use full-screen mode, and can be used from a terminal or called from a program. The User Assistance module manages both responses to the terminal user and HELP and explanation processing.

LANGUAGE PROCESSORS: The 1100 Series computers support a number of programming languages, which are described in the following paragraphs.

The *ASCII Cobol* 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 ▶

Sperry Univac 1100/90 System

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: database 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 full 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 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   to 10   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 the 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.

APL 1100 is a re-entrant, interpretive processor that uses 9-bit ASCII code and functions as part of the Conversational Time-Sharing System. APL 1100 provides a superset of the ad hoc industry-standard APL language. It provides all the

language features of the Iverson notation and offers extended capabilities in the areas of I/O operations and operating system related functions.

Pascal 1100 is based on the specifications of the American National Standard X3J9. Pascal 1100 facilitates the use of structured programming techniques for general programming problems through the use of the following control constructs: IF-THEN-ELSE, WHILE-DO, REPEAT-UNTIL, FOR-DO, and CASE. Pascal 1100 also includes data structuring facilities such as arrays, record structures, and file structures.

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.

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.

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.

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).

The *RPG II Group* is a software package that includes 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 is a general-purpose processor for extending host languages through its ability to process character strings. MACRO performs text generation, editing, and validation.

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.

In addition to the language processors described above, Sperry Univac also offers the *Programmers Advanced Debugging System* (PADS 1100), a language-independent ▶

Sperry Univac 1100/90 System

debugging tool. PADS was designed primarily for debugging programs written in high-level languages such as Cobol, Fortran, and PL/1, but it may also be used for programs written in Assembler.

UTILITIES: The 1100 Operating System supports a number of utility packages, including CULL, Sort/Merge, Log Analyzer, Performance Analysis Routines, and the On-Line System Activity Monitor.

CULL produces an alphabetically sorted, cross-referenced listing of all symbols in a specified set of symbolic elements. Each symbol processed by CULL can contain up to 12 alphanumeric characters plus the dollar sign. An interactive version, IACULL, is also available.

The *Sort/Merge* package provides three sort options and a standard merge option. The sort options are record sort, selection sort, and tag sort. Up to 26 files can be merged, and up to 40 keys can be specified.

The *Log Analyzer* (LA) is designed to assist the user in monitoring the resource utilization of an 1100 Series system. The *Performance Analysis Routines* (PAR) package is a reporting system for data collected by the Software Instrumentation Package embedded in the operating system. The *On-Line System Activity Monitor* (OSAM) provides an on-line, real-time display of system activity. OSAM can be used in conjunction with LA and PAR.

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)
ICES (Integrated Civil Engineering System)
OPTIMA 1100 (Project Management System)
SUFICS 1100 (Sperry Univac Financial Integrated Control System)
UNIDAS 1100 (Information Storage and Retrieval)
UNIFACS 1100 (Univac Financial Systems)
UNIS 1100 (Univac Industrial Systems); includes Bill of Materials Processor, Inventory Control, and Planning and Scheduling

PRICING

The 1100/90 is available for purchase 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. Support for unbundled software is separately priced. 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.

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	—	—	100	105	110	115	120	125	130
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 Friday	Saturday, Sunday and Holidays
Min. charge per call	$174	$198
Each addl. hour	87	99

Users who elect not to contract for maintenance with Sperry Univac pay the same rates on a per call basis.

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 1100/90 system customers via a dedicated WATS number 24 hours per day and seven days per week. Via TRACE, a user's 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 encounted 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: The following systems illustrate two 1100/90 configurations. All necessary control units and features are included in the indicated prices, but software is not included. Quoted lease prices do not include maintenance charges.

1100/91 SYSTEM: Includes Processor Complex (CPU, cooling unit, MSU with 2 million words of main memory, IOP with 4 block multiplexer channels and 8 word channels, SSP, motor alternator, and master operator console), plus one 8470 Disk Subsystem with controller and 4 disk drives (1.6 gigabytes), a Uniservo 24 Magnetic Tape Subsystem with a controller and 6 tape units (1600/800 bpi), and one 1200-lpm 0776 Line Printer and control. Purchase price is $3,266,440 and the monthly charge on a five-year lease is $95,989.

1100/94 MULTIPROCESSOR SYSTEM: Includes Processor Complex (as above) plus 3 additional CPUs, 3 additional MSUs, and 8 one-megaword memory increments for a total of 16 million words, 3 additional IOPs, 7 additional block multiplexer channel modules, 4 additional word channel modules, one additional SSP, 3 operator consoles, an 8480 Disk Subsystem with 2 controllers and 4 disk drive units (6.4 gigabytes), a Uniservo 36 Magnetic Tape Subsystem with controller and 16 tape units (6250/1600 bpi), and two 2000-lpm 0770 Line Printers and controls. Purchase price is $12,916,147 and the monthly charge on a five-year lease is $313,094.

Sperry Univac 1100/90 System

EQUIPMENT PRICES

	Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	5-Year Lease
PROCESSOR COMPLEX				
3054-99	1100/91 Processor Complex; includes Instruction Processor (CPU) with cooling unit and power system, Main Storage Unit (MSU) with 2 million words of memory, I/O Processor with one 4-channel block multiplexer channel module and one 8-channel word channel module, a System Support Processor (SSP), a motor alternator, and a master operator console with CRT display, printer, system clock, and system panel — $2,865,660	$5,551	$115,625	$86,740
3054-95	Instruction Processor Expansion; provides an addditional CPU, cooling unit, and motor alternator; maximum of 3 per 1100/90 system; requires a minimum of two MSUs — 1,829.293	3,168	44,611	33,467
F3378-00	Instruction Processor Performance Monitor; if used, one is required for each CPU in the system — 5,000	11	202	151
3067-00	I/O Processor (IOP); includes one block multiplexer channel module and space for 3 additional block multiplexer or word channel modules; maximum of 3 per system — 228,000	486	9,199	6,901
1964-00	IOP Expansion Cabinet; provides housing for 2 block multiplexer or word channel modules; one channel must be ordered — 30,000	64	1,210	908
F3938-00	IOP Performance Monitor; if used, one is required for each IOP in the system — 5,000	11	202	151
K3675-00	Word Channel Module; 8 channels — 60,000	128	2,421	1,816
K3676-00	Block Multiplexer Channel Module; 4 channels — 60,000	128	2,421	1,816
F3953-00	FIPS I/O Compatibility; provides compliance with Federal Information Processing Standard 60-1 for block multiplexer channels — 3,000	6	121	91
7052-99	Main Storage Unit Additional; includes cabinet, interfaces, and 2 million words of memory; maximum of 3 per system — 270,000	575	10,894	8,173
K3125-00	MSU Storage Expansion; one million words; maximum of 2 per MSU — 80,000	170	3,228	2,422
4019-99	Operator Console; includes CRT display, keyboard, clock calendar, and printer; provides 37-inch cabinet with work surface and storage; maximum of 3 per system — 75,000	160	3,026	2,270
3660-99	Console CRT Expansion; adds secondary display to master console or 4019-99 — 2,500	5	101	76
3660-97	Auxiliary Console; attaches to operator console; maximum of 3 — 6,500	14	262	197
0798-65	Auxiliary Console Printer; 200 cps — 8,000	17	323	242
F3697-00	Transition Cabinet; 28 inches high; attaches to master console, 4019-99, or F3699-01 — 2,556	—	103	77
F3697-01	Transition Cabinet; 37 inches high; attaches to master console, 4019-99, F3699-03, or printer cabinet — 2,556	—	103	77
F3699-00	Work Surface; 28 inches high, 36 inches wide — 1,218	—	49	37
F3699-01	Work Surface; 28 inches high, 60 inches wide; attaches to console or F3697-00 — 1,518	—	61	46
F3699-02	Work Surface; 37 inches high, 36 inches wide — 1,218	—	49	37
F3699-03	Work Surface; 37 inches high, 60 inches wide; attaches to console, F3697-01, or printer cabinet — 1,518	—	61	46
3058-92	System Support Processor (SSP), Additional; maximum of one per 1100/90 system — 90,000	192	3,631	2,724
0985-00	Subsystem Access Unit (SAU); performs subsystem partitioning from SSPs; includes 2 SSP interfaces, 4 master console interfaces, and 32 Shared Peripheral Interfaces (SPIs); maximum of 4 SAUs per 1100/90 system — 80,000	170	3,228	2,422
F3832-00	SAU SPI Interface; provides an additional 32 SPIs; maximum of 3 F3832-00s per SAU — 11,850	25	478	359
F3833-00	SAU Byte Channel Transfer Switch Interfaces; maximum of 2 per SAU — 10,000	21	403	303
F3834-00	SAU SSP Interface; provides 2 additional SSP interfaces; maximum of one per SAU — 10,000	21	403	303
1980-99	Subsystem Power Control (SPC); provides remote power control for up to 4 peripheral control units; also includes 2 IOP interfaces and an SSP interface — 26,457	56	1,068	801
K3728-00	SPC Expansion; provides 4 additional control unit interfaces; maximum of one per SCP — 16,000	34	646	484
F3729-00	SPC Interface Expansion; expands the number of control unit interfaces by 6; requires 1980-99 or K3738-00; maximum of 10 per SCP — 600	1	24	18
F3947-00	SPC SSP Interface; maximum of one per SCP — 900	2	36	27
8513-00	Motor Alternator, Additional; requires 2914-00 — 58,000	124	2,340	1,756
2914-00	Motor Alternator Paralleling Unit; provides the capability to parallel up to 3 Motor Alternators — 60,000	128	2,421	1,816
MASS STORAGE				
8407-00	8407 Diskette Subsystem; includes control unit and auto-load diskette drive; stores up to 20 one-megabyte diskettes — 22,000	150	514	412
8407-02	8407 Diskette Drive; requires 8407-00 — 6,000	40	172	132
F3470-00	Translate Table; performs character translation; 512 bytes — 3,640	17	104	78

*Lease charges do not include maintenance.

OCTOBER 1982

Sperry Univac 1100/90 System

EQUIPMENT PRICES (Continued)

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	5-Year Lease

MASS STORAGE (Continued)

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
5039-91	8433/8430 Control for up to eight 8430 or 8433 disk drives; minimum two disk drives per subsystem	54,000	374	1,971	1,282
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	211	137
8430-99	8430 Disk Drive; removable disk media; minimum of two drives per system	18,720	162	684	444
F1230-00	Disk Pack for the 8430-99; 17 million words	1,440	—	53	35
8433-00	8433 Disk Drive; removable disk media; minimum of two drives per system	27,360	237	997	649
F1223-00	Disk Pack for the 8433-00; 34 million words	1,820	—	66	43
F2342-00	Disk Drive Upgrade; converts 8430-99 to 8433-00	8,640	75	313	205
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	59	39
5046-99	8430/8433/8434 Control; controls up to 16 8430, 8433 or 8434 disk drives; maximum 866M words of storage; requires minimum of two disk drives	102,000	509	3,156	2,051
5046-97	8430/8433/8434 Dual Control; for dual-access subsystem operation; requires two channels	176,448	889	5,714	3,714
8434-99	8434 Disk Storage; provides two single-spindle disk drives with non-removable pack; 54.18M words per drive	66,600	288	2,439	1,583
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	211	137
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	64	48
F2555-00	Shared Peripheral Interface; provides an additional I/O interface for the 5046-99/97 controls	6,600	37	158	117
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	3,077	2,051
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	5,417	3,714
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	171	114
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	68	48
F2837-00	Power Control Expansion; required when total number of disk drives exceeds 16; two required for 5046-93 dual control	7,680	51	211	137
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	158	117
8450-99	8450 Disk Storage; provides two disk drives using non-interchangeable data module; 54M words of storage per drive	66,600	288	2,439	1,583
8450-97	8450 Disk Storage; same as 8450-99, but also includes 194K words of fixed-head storage	74,600	318	2,723	1,811
F2717-99	8450 Fixed-Head Conversion; converts 8450-99 disk storage unit to an 8450-97 disk storage unit	13,600	31	285	228
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	64	48
5040-91	8430/8433/8450 FIPS Control; connects via 1100 FIPS block multiplexer channel; controls up to 16 8450 disk drives with F2719-02 installed, eight 8450 and eight 8430/8433 drives with F2719-03 installed, or 16 8430/8433 drives with F2836-02 installed	102,000	509	2,700	1,800
5040-89	Dual Disk Control; same as 5040-91, but with two controls	176,448	889	5,015	3,260
F2719-02	8450 Capability/Conversion; provides 5040-91 or -89 with capability to control 16 8450 drives	0	0	0	0
F2719-03	8430/8433/8450 Capability/Conversion; provides 5040-91 or -89 with the capability to control up to eight 8430/8433 drives and eight 8450 drives	0	0	0	0
F2836-02	8430/8433 Capability/Conversion; provides 5040-91 or -89 with the capability to control up to 16 8430/8433 drives	0	0	0	0
8450-95	8450 Disk Storage; includes two drive units, each with 54M words of storage; conforms to FIPS 63, Class B	66,600	288	2,258	1,466
8450-93	8450 Disk Storage; same as 8450-95 but also includes 194K words of fixed-head storage	74,600	318	2,521	1,677
F2717-98	Fixed-Head Conversion; converts 8450-95 to 8450-93	13,600	31	264	211
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 and two 8470 drives; each drive has dual access feature but not fixed head feature	162,000	610	4,594	3,402

*Lease charges do not include maintenance.

Sperry Univac 1100/90 System

EQUIPMENT PRICES (Continued)

		Purchase	Monthly Maint.	Monthly Charges*	
				1-Year Lease	5-Year Lease

MASS STORAGE (Continued)

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
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	8470/8480 Attachment; allows up to eight additional 8470 or two 8480 drives on single control unit; up to three are allowed	4,000	19	100	74
F2837-00	Power Control Expansion; required on control unit when over 16 drives are configured	7,680	51	211	137
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
5056-73	8480 Disk Subsystem; includes two dual-access control units and two 8480 disk units; supports up to eight 8480 units; a maximum of three attachment features may be added; all drives must have dual access	310,890	1,310	7,773	6,615
F2994-99	Four-Channel Capability; provides two additional channel interfaces; maximim of one per subsystem	16,180	68	358	262
F3192-99	8430/8433 Attachment; allows up to eight 8430/8433 drives on 5056-73 control	19,680	106	580	430
F3192-98	8450 Attachment; allows up to eight 8450 drives on 5056-73 control	23,360	106	580	430
F3192-97	8470/8480 Attachment; allows up to eight 8470 or two additional 8480 drives on 5056-73 control	8,000	38	200	148
F2837-99	Control Power Expansion; required when total number of drives in a subsystem exceeds 16	15,360	102	390	254
8480-99	8480 Disk Storage Unit; contains 4 spindles with a total capacity of 360M words; includes dual-access feature	92,240	456	2,212	1,847
8480-97	8480 Disk Storage Unit; same as 8480-99, but without dual access	84,240	436	2,040	1,700
F2718-02	8480 Dual-Access Feature; provides dual access and simultaneous read/write, read/read, write/read, and write/write	8,000	20	172	147
5057-99	Cache/Disk Processor; manages up to four 7053 cache storage units plus up to eight 8450 and eight 8470 or 8480 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; maximim of 3 per 7053	89,000	170	2,200	1,854
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	8470/8480 Capability Expansion; permits sixteen 8470 or four 8480 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

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
5058-00	Uniservo 22 Subsystem; includes two Uniservo 22 tape drives and control for up to eight Uniservo 22 or Uniservo 24 drives	75,840	377	2,129	1,580
5058-02	Uniservo 22 Magnetic Tape Drives; includes two dual-density PE/NRZI drives; 1600/800 bpi, 9-track, 75 ips	47,040	245	1,320	980
5058-06	Uniservo 24 Subsystem; includes two Uniservo 24 tape drives and control for up to eight Uniservo 24 or Uniservo 22 drives	83,520	417	2,349	1,740
5058-08	Uniservo 24 Magnetic Tape Drives; includes two dual-density PE/NRZI drives; 1600/800 bpi, 9-track, 125 ips	54,720	285	1,540	1,140
F0825-00	Dual Channel Feature; provides non-simultaneous operation on two channels of one processor or one channel on each of two processors	4,593	31	110	89

*Lease charges do not include maintenance.

OCTOBER 1982

Sperry Univac 1100/90 System

EQUIPMENT PRICES (Continued)

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	5-Year Lease

MAGNETIC TAPE UNITS (Continued)

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
F2627-00	Translation Feature; translation is ASCII/EBCDIC, fieldata/ EBCDIC, or filedata/ASCII	2,064	14	52	36
F2627-01	Second Translation Feature	2,064	14	52	36
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

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
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	3,187	2,074
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
F1536-06	48-character ANSI standard OCR-A	462	—	24	19
F1537-00	94-character ASCII Graphic (ANSI X3.4-1968)	462	—	24	19
F1537-03	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
F1537-09	24-character Numeric	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
F1537-21	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 (Cartridges are also available for languages other than English)	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

*Lease charges do not include maintenance.

Sperry Univac 1100/90 System

EQUIPMENT PRICES (Continued)

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	5-Year Lease

PRINTERS (Continued)

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
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
F2215-11	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
0777-97	On-Line Laser Printer; up to 21,000 lpm; one diskette with 15 character sets included	360,000	850	—	7,670
F3380-00/-01	Additional Character Sets	30	—	—	—
F2874-00	Character Font Expansion; up to 255 characters	3,640	16	104	78
F2876-00	Forms Overlay Capability	11,700	31	335	249
F3426-00	Overlay Transparencies	35	—	—	—
1963-00	Burster/Trimmer/Stacker	40,196	166	1,217	857
F3595-00	Forms Counter for 1963-00	1,580	5	38	32
F3598-00	Center Slitter for 1963-00; provides lengthwise separation of forms	900	10	21	18
F3601-00	One-Wide Roll Imprinter; for special printing on forms before bursting; requires 1963-00	1,060	25	25	21
F3601-01	Two-Wide Roll Imprinters; same as F3601-00, but provides two-wide printing	1,520	25	45	38

PUNCHED CARD EQUIPMENT

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
0604-99	Card Punch and Control; 250 cpm	31,968	230	664	536
0716-89	Card Reader and Control; 1000 cpm; comes with code translator; EBCDIC, ASCII, compressed code, or fieldata code	15,504	154	358	253
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-error 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

DISTRIBUTED COMMUNICATIONS PROCESSORS

		Purchase	Monthly Maint.	1-Year Lease	5-Year Lease
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 flexible or cartridge disk; also requires a UTS 20 console or a UTS 400 attached to a communications line module	29,040	133	756	605
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 DCP/20	4,500	22	131	105
F3539-99	256K-byte Memory Increment; maximum of one per DCP/20	8,650	44	225	180
F2894-00	Line Module Expansion; provides for an additional 8 line modules in 8957-01	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
8406-04	Free-standing Diskette Drive; one megabyte of storage	3,600	22	103	79
F3145-00	Diskette Expansion; provides additional drive	2,160	11	61	47
8596-96	Distributed Communications Processor/40 (DCP/40); free-standing unit including processor with 512K bytes of memory, I/O controller module, IOP, and control storage; requires integrated flexible disk plus free-standing cartridge disk and communications line module; also requires a UTS 20 console or a UTS 400 attached to a communications line module	84,245	415	2,195	1,755
K1930-01	512K-byte Memory Increment; three may be added to 8596-96; additional memory uses 1945-00	15,600	116	410	325
1945-00	DCP/40 Free-standing Expansion Cabinet; contains power supply and power controller; accommodates up to four IOPs or three storage banks of up to 512K bytes each; maximum of three per system, only one of which may contain storage	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

*Lease charges do not include maintenance.

OCTOBER 1982

Sperry Univac 1100/90 System

EQUIPMENT PRICES (Continued)

		Purchase	Monthly Maint.	Monthly Charges* 1-Year Lease	5-Year Lease
DISTRIBUTED COMMUNICATIONS PROCESSORS (Continued)					
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
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 8596-96 or 1945-00; includes power for two more IOP expansions	14,920	74	390	310
F1932-99	Third IOP; mounts in 1945-00 or 8596-96; includes storage port expander	14,185	70	370	295
F1932-98	Fourth IOP; mounts in 1945-00 or 8596-96	10,635	52	280	220
F1928-00	Operator Station; work surface for local console and free-standing flexible disk unit	1,200	—	30	25
F1825-05	Active Line Indicator; provides a visual display of line activity on up to 16 communications 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
F1800-02	Series 90 Byte Interface Switch; provides the capability to manually switch F1947-00 between selector/multiplexer channels of a single host CPU or two separate host CPUs	4,305	17	83	62
	Features for the DCP/20 and DCP/40:				
F1939-00	Integrated Flexible Disk Subsystem; includes 256K-byte flexible disk and controller; mounts in 8596-96 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
F1946-02	1100 Series ISI Interface; provides a full-duplex ISI interface to a word channel; maximum of two per DCP/20 cabinet or four per DCP/40 cabinet	4,000	21	105	85
F1947-00	Series 90 Byte Interface; provides interface to Series 90 byte or block multiplexer channel; maximum of one per DCP/20 cabinet or two per DCP/40 cabinet	4,000	21	105	85
F1948-01	16-bit Peripheral Interface; provides interface to a peripheral subsystem; allows operation in 8- or 16-bit mode	3,000	15	80	65
F1941-00	Full-Duplex Interface to Asynchronous Data Sets; conforms to EIS RS-232-C and CCITT V.24 and V.28; data set rates up to 2400 bps	960	3	25	20
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	960	3	25	20
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 or at data set rates up to 19,200 bps	1,275	7	35	30
F3163-01	Full-Duplex Interface to Public Data Networks; conforms to CCITT X.21 and X.25; operates at rates up to 19,200 bps	2,500	13	63	50
F3164-01	Full-Duplex Interface to Carrier Facilities; conforms to CCITT V.35; operates with UDLC protocol data formats (64K bps), V.35 facilities (48K bps), and Bell DDS and DSDS facilities (56K bps)	3,745	19	100	80
F3835-00	Remote Partitioning Capability; maximum of one on DCP/20 or four on DCP/40	960	5	25	20
F1945-00	Auto Dialing Line Module; interfaces 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; controls 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
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 bps, 25 ips	13,962	85	318	239
F2721-00	Uniservo 10 Controller; controls up to two drives	10,320	51	284	215
F2879-00	AC Power Switch; provides remote control of second Uniservo 10	1,200	5	32	25
3560-93	UTS 20 DCP Console; includes 12-inch CRT, keyboard, and communications interface	3,225	30	128	97
0797-99	Printer; 80 cps; connects to DCP/20 or DCP/40	1,900	27	84	63
0798-99	Printer; 200 cps, bidirectional; connects to UTS 20	6,650	64	188	156

*Lease charges do not include maintenance.

SOFTWARE PRICES

		Monthly Lease Charge	Monthly Extended Support Charge
System Processors			
6163-98	Terminal Security System	$ 189	$ 38
6167-98	Sentry Security Control Processor	635	127
6158-98	Quota Input Processor (QUIP)	189	38
6162-98	Checkpoint/Restart	126	25
6133-98	Data Processor	63	3

Sperry Univac 1100/90 System

SOFTWARE PRICES (Continued)

		Monthly Lease Charge	Monthly Extended Support Charge
Utility Processors			
6271-98	CULL Processor	25	3
F3859-98	Interactive CULL (IACULL)	25	3
6203-98	Fault Location of Interpretive Testing (FLIT)	116	23
6135-98	Sort/Merge	126	13
6246-98	Log Analyzer	120	12
6161-98	Performance Analysis Routines	252	25
6274-98	On-Line System Activity Monitor (OSAM)	250	25
Communications Processing			
6162-89	Communications Management System (CMS) 1100 DCP/20	500	120
6162-90	CMS 1100 DCP/40	600	120
6159-98	Processor Common Communications System (PCCS)	126	25
6136-95	DCP/20 Operating System	100	—
6136-01	DCP/40 Operating System	165	—
6136-00	DCP/40 DCP Emulate Operating System	114	—
6144-00	DCP/40 MCC Emulate Operating System	95	—
6276-00	BSC 3270 Terminal Handler	150	—
Data Base/Transaction Processing			
6292-98	Universal Data System (UDS) 1100 Control	250	50
6700-98	UDS Data Management System (DMS) 1100	1,200	240
6296-98	UDS Processor Common Input/Output System (PCIOS)	100	20
6293-98	UDS Relational Data Management System (RDMS) 1100	1,500	300
6299-98	UDS Data Dictionary System	750	150
6177-98	Define File Processor	63	6
6175-96	Integrated Recovery Utility (IRU)	383	77
6175-95	IRU Version II	400	80
6175-94	IRU Version III	600	120
6291-98	File Acquisition System (FAS)	300	60
6155-98	Data Management System (DMS) 1100	956	191
6176-98	Data Dictionary	383	77
6152-98	Processor Common Input/Output System (PCIOS)	63	13
6283-00	Transaction Interface Package (TIP)	1,500	300
6244-98	Information Management System (IMS) 1100	195	39
6237-98	Display Processing System (DPS) 1100	289	43
End User Products			
6146-97	Mapper 1100	978	196
6146-96	Mapper (ASCII)	978	196
6290-98	Advanced Information Service (Advise) 1100	300	60
6157-96	Query Language Processor (QLP) 1100	383	77
6156-98	Remote Processing System	252	50
Interactive Processing			
6170-98	Conversational Time-Sharing System (CTS) 1100	275	41
6147-98	High-Volume Time-Sharing (HVTS)	635	127
6263-98	Interactive Processing Facility (IPF) Command Language	275	41
6261-98	IPF Control	200	30
6269-98	IPF Procedures	350	53
6245-98	Edit 1100	290	44
6264-98	User Assistance	75	11
6262-98	Distributed Data Processing (DDP) 1100	100	15
Language Processors			
6165-98	General Syntax Analyzer	110	17
6172-98	APL 1100	509	76
6171-98	UBasic	126	19
6178-98	UBasic Syntax Analyzer	63	19
6153-98	ASCII Cobol	252	38
6149-98	Cobol Syntax Analyzer (BCOB)	126	19
6154-98	ASCII Fortran	383	57
6150-98	Fortran Syntax Analyzer (BFTN)	126	19
6151-98	PL/1	252	38
6164-98	RPG 1100	126	19
6251-97	RPG II Group	130	20
6160-98	MACRO	126	19
6294-00	Meta-Assembler (MASM)	1,000	200
6239-98	Programmers Advanced Debugging System (PADS) 1100	210	32
6251-98	Requirements and Development Processor (RDP)	1,000	150
Miscellaneous Products			
F3791-98	Univac Printer Interface Software (UPRINTS); provides interface to 0777 Printer	200	40
F3793-98	Cache Disk Interface Software (CADIS)	400	80
F3790-00	Compatible Channel Interface Software (COMPCIS)	400	80
6704-99	1100/91 Programming Aids/Extended Support Services (ESS)	—	925
6704-98	1100/92 Programming Aids/ESS	—	1,300
6704-97	1100/93 Programming Aids/ESS	—	1,500
6704-96	1100/94 Programming Aids/ESS	—	1,600■

OCTOBER 1982