UNIVAC 90/30

MANAGEMENT SUMMARY

On June 19, 1974, UNIVAC introduced the long-awaited small-to-medium scale member of its Series 90 byte-oriented product line. The new UNIVAC 90/30 will be to the Series 90 family what the 9200, 9300, and 9400/9480 central processors were to the older UNIVAC 9000 Series.

In addition, UNIVAC reinforced its new, more aggressive marketing posture. As in the case of the 90/60 and 90/70 systems, UNIVAC intends to attract new customers from competitive accounts. Targets for replacement by the 90/30, in addition to UNIVAC's own base of 9200 and 9300 accounts, include IBM 360/20 and 360/22 sytems, disk-oriented versions of the IBM System/3 Model 10, and the surprisingly large number of remaining IBM 1130 systems. Beyond these segments of the IBM customer base, UNIVAC is also eyeing users of the smaller members of the Honeywell Series 200, the NCR Century Series, and the Burroughs B 1700 Series as potential customers for the 90/30.

To achieve these goals, the 90/30 system is equipped with a variety of emulation and conversion aids and has potential growth capabilities that are uniquely broad for a single central processor model. As a result, 90/30 systems will span a wide price range, with rentals ranging from approximately $4,000 for a minimum configuration to over $17,000 per month for an expanded system. Deliveries are scheduled to begin early in 1975.

Third member of the UNIVAC Series 90 family, the small-to-medium-scale 90/30 offers a broad range of configurations supported by the modular OS/3 operating system. System rentals range from less than $4,000 per month for an entry-level system to over $17,000 per month for fully expanded systems.

CHARACTERISTICS

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

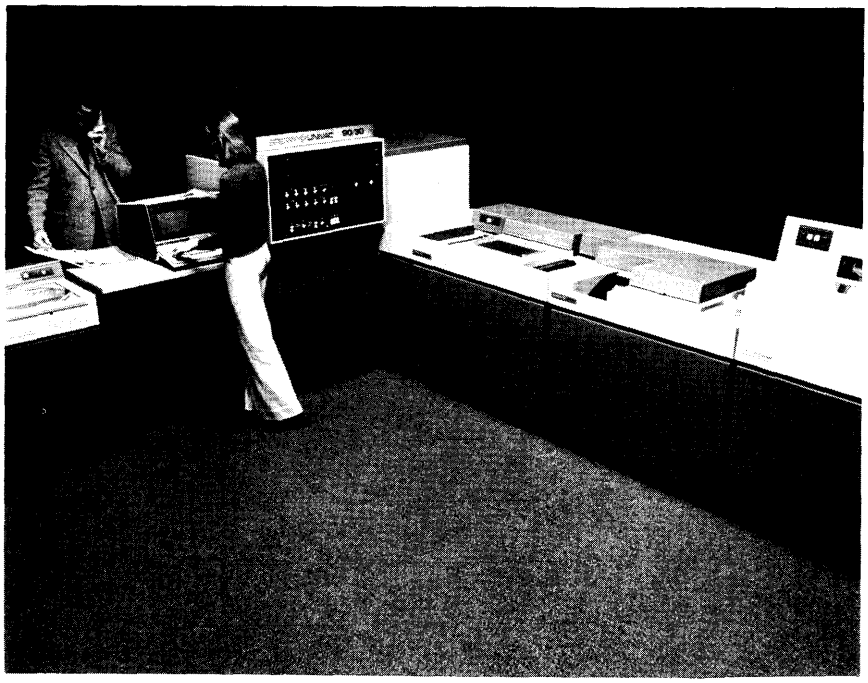
MODEL: UNIVAC 90/30.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 decimal digits, or 8 binary bits. Two consecutive bytes form a 16-bit "halfword," four consecutive bytes form a 32-bit "word," and eight consecutive bytes form a 64-bit "doubleword."

FIXED-POINT OPERANDS: Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; 1 halfword (16 bits) or 1 word (32 bits) in binary mode. Certain operations use a doubleword (63-bit integer field plus sign) in binary mode.

FLOATING-POINT OPERANDS: Optional floating-point hardware provides for addition, subtraction, multiplication, division, loading, storing, and sign control of



The basic UNIVAC 90/30 configuration includes a processor with 32K bytes of MOS storage, CRT system console, 500-cpm card reader, 500-lpm printer, and two 8416 Disk Drives with a total capacity of 57.8 million bytes. Also shown in the photo is an optional card punch.

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Like the senior members of the Series 90 product line, the 90/30 features metal oxide semiconductor (MOS) main memory. Memory sizes can range from 32,768 bytes to 262,144 bytes, with a cycle time of 600 nanoseconds per two bytes. Although the 90/30 is not totally dissimilar in design from the 90/60 and 90/70 central processors, it employs some architectural concepts that distinguish it from the larger Series 90 central processors. Among these is the use of integrated peripheral channels to interface both random-access and unit-record peripheral devices economically in small-scale 90/30 configurations. A multiplexer channel and up to two selector channels are optional, to expand the I/O device complement of larger 90/30 systems. However, like the two original members of the Series 90, the 90/30 employs a writable control storage for implementation of the basic instruction repertoire plus the optional instructions and emulation microcode, and relocation hardware for flexible main memory management.

The 90/30 instruction repertoire surpasses the UNIVAC 9400/9480 instruction set in the range of operations that can be performed. Like the UNIVAC 90/60 and 90/70, the 90/30 offers the complete set of System/360 Model 50 nonprivileged instructions. The basic instruction repertoire for the 90/30 consists of 84 instructions, including complete arithmetic facilities for variable-length decimal operands and binary arithmetic operations. Sixty-four additional instructions can be implemented as part of a micrologic expansion feature, including 44 optional floating-point instructions that are unavailable for the UNIVAC 9200, 9300, and 9400/9480 central processors.

The 90/30 thus becomes the third member of the expanding UNIVAC Series 90 product line. Series 90 central processors now compete across a broad range of price/performance, ranging from the IBM System/3 Model 10 level on the low end of the UNIVAC 90/30 to the IBM System/370 Model 145 level for the UNIVAC 90/70. More processor models can be expected to join the Series 90 line-up, including a larger system to provide a growth path for users of large Series 70 systems. Also absent from the UNIVAC product line at present is an entry-level computer system, with rentals starting in the $1,000-per-month price range, that would appeal to first-time computer users.

For UNIVAC 9200/9300 users, however, the 90/30 offers approximately five times the raw processing power of the 9300, or approximately the equivalent of the UNIVAC 9400/9480, at substantially reduced prices. A 9480 central processing unit with an operator console and printer, multiplexer channel, selector channel, and 65,536 bytes of main memory rents for $4,060 per month on a one-year rental contract including maintenance. In contrast, a 90/30 central processor with an integrated peripheral channel, console and printer,

short or long format operands. The short format provides 24-bit precision and is represented by one word, which uses bit 0 for the sign, bits 1 through 7 for the exponent, and bits 8 through 31 for the fraction. Long format is represented with a doubleword which provides 56-bit precision; the long format is similar to the short format except that the fraction is contained in bit positions 8 through 63. A guard digit is carried by the hardware for intermediate "place holding" during addition/subtraction, multiplication, comparison, and halving.

INSTRUCTIONS: 2, 4 or 6 bytes in length, specifying 0, 1, or 2 main storage addresses, respectively.

INTERNAL CODE: EBCDIC or ASCII, depending upon setting of a mode bit in the program status word by certain processor instructions. The processor is sensitive to zone fields and edit control characters.

MAIN STORAGE

STORAGE TYPE: MOS (metal oxide semiconductor).

CAPACITY: From 32,768 to 262,144 bytes in nine sizes: 32K, 49K, 65K, 98K, 131K, 163K, 196K, 229K, and 262K.

CYCLE TIME: 0.6 microsecond per 2-byte access.

CHECKING: Parity bit with each byte is generated during writing and checked during reading, with additional parity generation and checking provided on the channels and memory busses.

STORAGE PROTECTION: The optional Storage Protect feature utilizes 8 keys to provide read and/or write protection for 512-byte segments of main storage, or for 1024-byte segments in configurations with more than 131K bytes of main storage.

RESERVED STORAGE: The first 640 bytes of main storage are reserved to hold specific operating information accessed by the hardware and the supervisor.

CENTRAL PROCESSOR

REGISTERS: The programmer has access to sixteen 32-bit general registers that are used for indexing, base addressing, and as accumulators. (A second full set of 16 registers is used by the operating system.) Four double-word floating-point registers are standard.

Eight additional standard program relocation registers in low-order main storage serve as base registers for the program modules in main memory; one of these registers is reserved for the operating system. These program relocation registers act with other relocation hardware to facilitate the OS/3 rollout/rollin capability.

INDIRECT ADDRESSING: None.

CONTROL STORAGE: In addition to main storage, a fast writable control storage of 1K 82-bit words is available for the microprograms used to support the basic instruction set, microdiagnostics, and integrated emulation of UNIVAC 9200/9300 and IBM 360/20 systems. An additional 1K of writable control storage is optional to supply the expanded instruction set, including floating-point operations. The cycle time is 600 nanoseconds per 82-bit word. Data is loaded into the writable control storage from a regular disk storage unit during the prep routine.

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writable control storage for 9200/9300 or IBM 360/20 emulation, and 65,536 bytes of MOS main memory rents for $3,009 on a one-year lease including maintenance, and can be purchased for $121,656.

Users of UNIVAC 9200/9300 systems can upgrade to the new 90/30 system in one of two ways. For those who are willing to convert, UNIVAC is supplying a conversion utility package to translate data files to disk formats acceptable to the 90/30 operating system and a source code analysis package that will pinpoint incompatible 9200/9300 assembly language instructions for modification. Source programs written in COBOL, FORTRAN, or RPG can generally be recompiled, with some modifications, and run under the 90/30 operating system. As an alternative, UNIVAC is offering a 9200/9300 emulation feature that will accept almost all 9200/9300 input media with the exception of data recorded on 8410 disk drives. Both the 9200/9300 programs and the original 9200/9300 supervisor are executed as a job under the OS/3 operating system.

UNIVAC has ambitions for its new medium-scale system beyond that of upgrading the 9200/9300 systems, most of which are rapidly approaching obsolescence. The 90/30 also is definitely aimed at the IBM customer base, and, in particular, at those remaining System/360 Model 20 users that have not yet upgraded within the IBM product line. For these installations, the 90/30 offers an alternative to the currently somewhat limited growth path of the System/3 or the giant step to the System/370 Model 115. For System/360 Model 20 users, the UNIVAC 90/30 offers integrated emulation for 360/20 programs under the OS/3 operating system. IBM 360/20 RPG II source programs can also be recompiled to run on the 90/30. For System/3 Model 10 users, the 90/30 offers better performance and substantially greater growth capability at prices roughly equal to or somewhat below the competing IBM systems. For these accounts, the 90/30 offers an RPG II compiler with features comparable to that of its IBM System/3 counterpart, but as yet no emulation and no 96-column card capabilities. The latter features may be in the offing, however.

Conversion aids will also be available for converting Honeywell Series 200 and NCR Century Series COBOL programs to 90/30 COBOL equivalents and for translating Honeywell Series 200 Easycoder programs to 90/30 COBOL, although the latter will require more modifications in the area of I/O operations and register-to-register instructions.

In order to design a system that will appeal to such a wide variety of potential customers, UNIVAC has carefully taken into account the requirements of most users of small systems. Thus, although the resulting 90/30 blazes no new technological trails, it does incorporate capabilities that are unusual for a system of its size.

INSTRUCTION REPERTOIRE: 84 instructions in the basic instruction set, including decimal arithmetic, fixed-point binary arithmetic, code conversion, logical operations, packing, unpacking, editing, shifting, testing, and branching. An optional expanded instruction set adds 44 floating-point instructions plus 20 additional non-privileged instructions.

INSTRUCTION TIMES: All times are estimated and are given in microseconds. The times for binary instructions are for the register-to-indexed-storage (RX) formats. Operations involving the use of negative numbers require slightly longer execution times.

Binary add/subtract (32 bits):	5.4
Multiply (32 bits)	39.6
Divide (32 bits)	65.4
Load (RX)	4.8
Store (RX)	5.4
Compare (RX)	5.4
Decimal add (2-address, 5-digit fields)	43.0
Decimal multiply (5-digit fields)	39.9

EMULATION: Integrated emulation features are available for the IBM System/360 Model 20 and for the UNIVAC 9200/9300 systems. Both the IBM 360/20 and the UNIVAC 9200/9300 emulators operate as a "job" under control of the OS/3 operating system and can be executed concurrently with 90/30 native-mode programs. Preliminary performance estimates indicate that the 90/30 can execute 360/20 programs with performance at least equal to that of a native-mode 360/20.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The basic 90/30 Processor has an integrated disk adapter and an integrated peripheral channel for attachment of a CRT console, card reader, card punch, and line printer. A multiplexer channel with a maximum data transfer rate of 83K bytes per second and up to two selector channels with a maximum data transfer rate of 825K bytes per second are optional. The maximum aggregate system I/O data transfer rate is approximately 1.8 million bytes per second.

CONSOLE: The System Console consists of a keyboard with operator controls and a Uniscope 100 CRT display unit. The standard mode of operation provides for display of messages on the CRT screen. The screen images are rolled upward, with new display lines or operator input appearing on the bottom of the screen. Console management routines selectively delete messages not requiring responses from the top of the screen. The operator can optionally recall deleted messages from a message log maintained on disk storage. Although messages and operator responses are normally output via a line printer, an optional Console Printer is also available. The Console Printer operates at 30 characters per second and connects to the System Console.

The UNIVAC 90/30 "softscope" feature allows the System Console to perform some functions of an oscilloscope to exercise the system hardware and to perform diagnostic testing of the integrated peripheral units.

CONFIGURATION RULES: The basic 90/30 configuration contains integrated control units for two UNIVAC 8416 Disc Drives, a 500 card-per-minute card reader, a 75 to 160 card-per-minute card punch, a 500

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Paramount among these is its unusual capability for expansion. Main memory on the 90/30 can be expanded from the basic 32,768 bytes to a maximum of 262,144 bytes, twice the amount currently available for the IBM System/3 Model 15.

I/O capabilities of the 90/30 also span an extremely wide range. The basic system with its Integrated Peripheral Channel can accommodate a CRT console, a 500 card-per-minute card reader, 500 line-per-minute printer, and an optional 75 to 160 card-per-minute card punch. An optional Integrated Disk Adapter permits attachment of a minimum of two Model 8416 Disk Drives with a combined storage capacity of 57.8 million bytes. Up to eight Model 8416 Disk Drives can be attached to the Integrated Disk Adapter for a total of over 230 million bytes of random-access storage. Communications capabilities are provided by an Integrated Communications Adapter that can control up to 24 half-duplex lines.

Many users of small-to-medium-sized computer systems express frustration with the limited capacity for expanding their I/O capabilities without first upgrading to larger central processor models. An important element of the 90/30 design is to prolong the life of the central processor by permitting extensive growth of its I/O processing and on-line storage capacities beyond those available with the integrated peripheral interfaces. An optional multiplexer channel allows connection of 250 card-per-minute punches, 1000 card-per-minute readers, and printers with speeds of up to 2000 lines per minute. Two optional selector channels expand the system's range of peripheral devices to include magnetic tape drives with transfer rates of up to 320,000 bytes per second and the new UNIVAC 8430 Disk Subsystem. The latter, a product of UNIVAC's recently acquired Information Storage Systems division, offers up to 16 IBM 3330-type disk storage drives per controller, for a total of 1.6 billion bytes of on-line random-access storage. Also available are a paper tape subsystem and an optical document reader.

Software for the UNIVAC 90/30 centers around OS/3, a new operating system designed specifically to maximize the modularity and growth potential of the 90/30 hardware. OS/3 features concurrent execution of up to seven user programs, including programs entered from remote terminals. In addition, each job step may also have one or more tasks which can be executed concurrently. OS/3's design relies heavily on transient routines and re-entrant coding for data management routines to achieve a high level of multiprogramming with a relatively small main memory overhead. The resident supervisor size is estimated to begin at 8K bytes for the minimum 90/30 configuration and supports multiprogramming of up to seven jobs plus multitasking. I/O spooling routines and the addition of optional I/O channels and faster peripheral devices naturally will enlarge the resident supervisor size.

line-per-minute printer, and a CRT System Console. The console is required for operation of the OS/3 operating system.

Additional low-speed devices, including card readers, card punches, printers, a paper tape subsystem, an optical document reader, and the Uniservo VI-C magnetic tape subsystem, can be connected through the optional multiplexer channel, which accommodates up to eight control units and eight subchannel addresses.

High-speed peripheral devices, such as Uniservo 12, 16, or 20 Magnetic Tape Units or 8430 Disk Drives, must be connected to one of the optional selector channels. Up to eight control units can be connected to each channel.

An Integrated Communications Adapter can handle up to 6 full-duplex or 12 half-duplex lines with aggregate speeds of up to 50K bytes per second. A Communications Adapter Expansion feature expands the number of communications lines to 12 full-duplex or 24 half-duplex lines.

SIMULTANEOUS I/O OPERATIONS: Concurrently with computing, the 90/30 Processor can control multiple I/O operations with a combined data rate of up to 50K bytes per second on the integrated peripheral channel, plus an 83KB data transfer rate on the multiplexer channel, one 625KB transfer on the Integrated Disk Adapter, plus one I/O operation on each Selector Channel (one with a transfer rate of 825KB and the second with a somewhat degraded transfer rate when two Selector Channels are operating simultaneously). The maximum aggregate I/O data transfer rate is approximately 1.8 million bytes per second.

MASS STORAGE

8416 DISK SUBSYSTEM: Removable disk pack storage that attaches to the 90/30 via the integrated disk adapter. Each disk pack contains five 14-inch disks; seven of the surfaces are used for data recording, the eighth is used to position the accessor mechanism, and the top and bottom surfaces are used for protective purposes.

Each surface contains 404 tracks plus 7 spares. Each track can hold up to forty 256-byte records, for a total of 10,240 bytes of data per track. Each track has a track error flagging capability, which permits accessing one of the assigned spare tracks if an addressed track is flagged as defective.

One read-write head serves each of the 7 recording surfaces. Up to 71,680 bytes (7 tracks) can be read or written at each position of the comb-type access mechanism.

From 2 to 8 disk pack drives, each with a data capacity of 28.9 million bytes, can be attached to the integrated disk adapter, for a total on-line storage capacity of over 230 million bytes. Average positioning time is 33 milliseconds, average rotational delay is 10.75 milliseconds, and data transfer rate is 625,000 bytes per second.

8430 DISK SUBSYSTEM: Provides large-capacity random-access storage in interchangeable 11-disk packs with storage capacities comparable to the standard-density IBM 3330 Disk Storage Subsystem. Each disk pack stores up to 100 million bytes of data. Up to 247,570 bytes (19 tracks) can be read or written at each position of the comb-type access mechanism. Average head movement time is 27 milliseconds, average rotational delay is 8.33 milliseconds, and data transfer rate is 806,000 bytes per second.

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Language processors for the 90/30 will include COBOL, FORTRAN, RPG II, and an assembler. OS/3 is scheduled for release with the first shipment of the 90/30 in January 1975.

Communications software is provided by the Integrated Communications Access Method, which supplies several levels of communications support ranging from device handlers for a wide variety of terminals to a message control program that offers message queueing, remote job entry, and an interface to IMS/90. The modular design of ICAM permits the user to tailor his communication software to his specific communications needs. Network configurations can be expanded by regenerating the Network Control Program, with no alteration of user programs required. Of particular interest to RPG users is a simplified remote I/O capability via an RPG II telecommunications interface. The 90/30 RPG II telecommunications feature will include software support for the IBM System/3, the IBM 360/20, and larger IBM System/360 computers with OS/360 or DOS BTAM binary synchronous communications support.

UNIVAC is also offering IMS/90, an on-line information storage and retrieval system previously released with the 90/60 and 90/70 systems. IMS/90 permits users at remote terminals to retrieve and update records in files ordinarily used for batch processing through the use of UNIQUE, a user inquiry language that is easy to learn and use.

The OS/3 operating system is designed to fully utilize the 90/30's relocation hardware to allocate main memory to user programs. Each program is assigned a variable-length region composed of segments of 512 bytes, or 1,024 bytes in systems with more than 131K bytes of main memory. In the event of excessive "checkerboarding" of memory, the supervisor provides automatic memory compaction services to relocate scattered memory segments into contiguous areas suitable for program scheduling. UNIVAC management restated its conviction that the dynamic memory management capabilities of the Series 90 processors lessen the need for the paging capabilities and associated CPU overhead of virtual storage operating systems. UNIVAC's efforts in virtual memory development are still focused mainly on the upper end of the Series 90 product line, where a replacement for the RCA VMOS operating system can be expected. However, a virtual storage version of OS/3 remains a distinct future possibility.

Although current users of UNIVAC 9400 and 9480 systems may be attracted to the price/performance of the new 90/30 system, the lack of compatibility between OS/3 and the OS/4 operating system released with the 9400 probably will act as a deterrent against user "downgrades" to the new system. OS/4 will ➤

From two to eight 8430 Disk Pack Drives can be attached to a 5039 Controller for a total of 800 million bytes of interchangeable disk pack storage. The Sixteen Drive Expansion Feature expands the capability of the 5039 Controller to up to 16 drives for a total of 1.6 billion bytes of on-line storage. The 8430 subsystem features a Command Retry facility and error correction coding circuitry.

INPUT/OUTPUT UNITS

UNISERVO 12 MAGNETIC TAPE UNIT: A medium-speed tape drive that reads and records data on standard 1/2-inch tape in IBM-compatible phase-encoded or NRZI format. Available in both 9-track and 7-track versions. Tape speed is 42.7 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 68,320 bytes per second; the optional Dual Density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 34,160 bytes per second—the same speed as the Uniservo VIC. The 7-track version can operate at 200, 556, or 800 bpi, with corresponding data rates of 8,540, 23,740, or 34,160 characters per second. The Data Conversion feature, for 7-track drives, converts each group of four 6-bit characters from tape into three 8-bit bytes in main storage, and vice versa.

From 1 to 16 Uniservo 12 Tape Units can be connected to a Uniservo 12 tape control, and up to 8 controls can in turn be connected to each UNIVAC 90/30 selector channel. Optional features enable the tape control to be connected to two selector channels, permitting simultaneous read/read, read/write, or write/write tape operations, with bimodal (7- or 9-track) compatibility.

With addition of the Uniservo 16 Capability option, any combination of up to sixteen Uniservo 12 and Uniservo 16 drives may be connected to the Uniservo 12 Control. A Uniservo 12/16 Control is also available which includes the Uniservo 16 Capability as a standard feature.

UNISERVO 16 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard 1/2-inch tape in IBM-compatible phase-encoded or NRZI formats. Available in both 9-track and 7-track versions. Tape speed is 120 inches per second, forward or backward. The standard 9-track version has a recording density of 1600 bpi (in phase-encoded mode) and a data rate of 192,000 bytes per second; the optional Dual Density feature permits operation at 800 bpi (in NRZI mode) at a data rate of 96,000 bytes per second. The 7-track version operation at 200, 556, or 800 bpi, with corresponding data rates of 24,000, 66,720, or 96,000 characters per second.

From 1 to 16 Uniservo 12 and Uniservo 16 Tape Units can be connected to a Uniservo 12/16 Control, or any combination of 1 to 16 Uniservo 12, 16, or 20 Tape Units can be connected to a Uniservo 20 Control, and up to 8 tape controls can in turn be connected to each selector channel. Optional features enable the tape control to be connected to two selector channels, permitting simultaneous read/read, read/write, or write/write tape operations.

UNISERVO 20 MAGNETIC TAPE UNIT: A high-speed tape drive that reads and records data on standard 1/2-inch tape in IBM-compatible formats. Available in a 9-track version only. Tape speed is 200 inches per second, forward or backward. The Uniservo 20 has a recording density of 1600 bpi (in phase-encoded mode) and a data ➤

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continue to be a supported UNIVAC software product, and 9400/9480 customers will be encouraged to upgrade to the 90/60 computer system and the OS/7 operating system, of which OS/4 is a compatible subset.

A fully expanded 90/30 system overlaps the low end of the 90/60, currently the second largest system in the UNIVAC Series 90 product line. Thus, an installation with a basic 90/30 configuration can avail itself of a vast growth potential in main memory, I/O capability, and software facilities before having to consider a move upward to a more powerful central processor and the OS/7 operating system. Since the two operating systems support identical compilers and the 90/30 assembly language is a compatible subset of the 90/60 and 90/70 assembly language, users can recompile programs to run under OS/7 with a minimum of effort, although the job control language will require modification to take advantage of the additional facilities provided by OS/7.

UNIVAC is emphasizing the availability of industry-oriented software packages for the 90/30. Among these are off-the-shelf packages for manufacturing, newspaper production, banking, wholesaling and retailing, and hospital patient accounting. In connection with announcing the availability of these programs for the 90/30 system, UNIVAC announced a "visible pricing" policy. In other words, some applications programs supplied by UNIVAC for the 90/30 will be unbundled and will be available for monthly license fees ranging from $75 to $420 per month. The operating system, language processors, and all other software support will continue to be supplied with the system at no additional charge.

Various configurations of the UNIVAC 90/30 will compete with IBM computers ranging from the System/3 Model 10 and Model 15 to the System/370 Model 115, 125, and small configurations of the Model 135. Computer users who are considering the acquisition of a small-to-medium-scale system might want to consider the following points before making a final selection:

- The UNIVAC 90/30 system can be equipped with up to 262,144 bytes of main memory, twice the amount currently available with the System/3 Model 15 and equal to the maximum main memory size available with the System/370 Model 125.

- A maximum of 92 million bytes of on-line random-access storage can currently be attached to a System/3 Model 15, compared to 230 million bytes of disk storage available to a UNIVAC 90/30 system via the Integrated Disk Adapter.

- A UNIVAC 90/30 system equipped with an optional selector channel can accommodate up to 16 Model 8430 Disk Drives for a total of 1.6 billion bytes of rate of 320,000 bytes per second. Standard features include a power window, automatic tape threading, and a wrap-around cartridge.

  From 1 to 16 nine-track, 800 or 1600 bpi Uniservo 12, 16, and/or 20 Tape Units can be connected in any combination to the Uniservo 20 Control Unit, and up to 8 tape controls can in turn be connected to each selector channel. With the 7-Track Capability and 9-Track Addition feature, Uniservo 12 and 16 Tape Units in the Uniservo 20 subsystem may be 7- or 9-track. Two or more control units may be used in the Uniservo 20 Subsystem to provide simultaneous dual access for read/write, read/read, and write/write operations on any appropriately equipped Uniservo 16 or 20 Tape Units connected to the control units. Each control unit in a simultaneous dual access system has its own power supply and independent access path to provide increased reliability. Individual tapes cannot be switched off-line without removing all the tapes connected to that controller from service.

  0716 CARD READER: A free-standing unit that reads 80-column cards serially by column at 100 cards per minute. Reads in either card-image or translate mode; ASCII, EBCDIC, or compressed codes can be read in either mode. Includes a 2400-card input hopper and two 2000-card stackers. Multi-read error checking and validity checking are standard features. Includes an integrated control unit and attaches to a position on the optional multiplexer channel on a 90/30 Processor.

  0717 INTEGRATED CARD READER: Attaches to a position on the integrated peripheral channel. Reads 80-column cards serially by column at a rate of 500 cards per minute. Can be equipped to read 51- or 66-column cards. Reads in either EBCDIC or card-image mode. Has a 2400-card feed hopper and a 2000-card stacker. Multi-read error checking and validity checking are standard features.

  0604 CARD PUNCH: A free-standing card punch that punches 80-column cards in row-by-row fashion at 250 cards per minute. Has a 1000-card input hopper and two 500-card output stackers. Punched cards are directed to one of the two stackers under program control. Punching is in card-image mode or compressed code translation. Contains an integrated controller and attaches to a position on the multiplexer channel.

  0605 CARD PUNCH: An integrated card punch that attaches to a position on the integrated peripheral channel. Punches 80-column cards in column-by-column fashion at speeds of 75 to 160 cards per minute depending upon the number of columns punched per card. Contains a 700-card input hopper and a 700-card output stacker. Punches in EBCDIC or card-image mode. Can be equipped with a pre-punched read station, giving the unit read/punch capabilities.

  0920 PAPER TAPE SUBSYSTEM: A free-standing unit that reads and punches 5-, 6-, 7-, or 8-level tape at speeds of 300 and 110 characters per second, respectively. Spoolers are optional for both the reader and punch take-up. Attaches to a position on the multiplexer channel. (The 0921 Paper Tape Subsystem, which reads 5-, 6-, 7-, or 8-level tape at 2000 characters per second, is marketed for 90/30 systems outside the U.S.)

  0770 PRINTERS: 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

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random-access storage per disk subsystem, nearly four times that available with the System/370 Model 125.

- An integrated emulation capability for the IBM System 360/20 is available for the UNIVAC 90/30 and the IBM System/370 Models 115, 125, and 135, but is not available for the IBM System/3. The UNIVAC 90/30, however, does not yet support the processing of 96-column cards.

- Average instruction execution times for the 90/30 are estimated to be more than 2.5 times as fast as those for the IBM System/3, and the 90/30 offers more I/O channels and nearly three times the aggregate I/O data transfer rate of the System/3.

- The 90/30 OS/3 operating system supports the concurrent execution of up to seven user jobs, in comparison with two user jobs for the IBM System/3 and up to five user programs for DOS/VS. However, although OS/3 supports dynamic memory management, it does not now have a virtual storage operating system capability.

- UNIVAC prices for the 90/30 are still largely "bundled," with systems software, language processors, education, and a reasonable amount of technical support supplied at no extra charge. In addition, UNIVAC offers unlimited use of all equipment and attractive discounts on rental prices for customers who select long-term lease contracts of five-year duration.

In the 90/30, UNIVAC has designed a computer system that is geared to meet the requirements of a large number of small-system users for additional processing capability, communications-oriented applications, extensive direct-access storage capacity, and growth potential, at prices that make it an extremely attractive competitor in the small-to-medium-scale computer marketplace. □

for Model 0770-04. The respective skipping speeds for these three models are 50, 75, and 100 inches per second. All can have character sets from 24 to 384 characters in size, and all have 132 print positions as standard. An optional feature for all models can increase the number of print positions to 160 without affecting the printing speed. All have a single-space print time of 8.75 milliseconds, line spacings that are operator-selectable at 6 or 8 lines per inch, and forms dimensions from 3 to 22 inches wide and up to 24 inches long. The printers use a new horizontal print band technique. Their control units have a standard Series 90 interface.

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.

0773 INTEGRATED PRINTER: Prints 120 columns of data at speeds of 500 lines per minute with a 48-character set and 400 lines per minute with a 64-character set. An optional feature provides 132 or 144 print positions. The type medium consists of a flexible, horizontally moving metallic band containing etched characters. Character sets range from a 48-character business set to a special 256-character set, the latter having a nominal print speed of 114 lines per minute. Single-space print time is 8.75 milliseconds, line spacings are operator-selectable at 6 or 8 lines per inch, and forms dimensions range from 3 to 18.75 inches wide and 1 to 24 inches long. The 0773 Printer attaches to a position on the integrated peripheral channel.

2703 OPTICAL DOCUMENT READER: Reads printed numeric data from individual documents ranging from 2.75 to 4.25 inches in height and 2.00 to 8.75 inches in length. Basic speed of 300 six-inch documents per minute can be increased to 600 dpm by an optional feature. Other options permit reading of vertical pencil marks and of standard 80-column punched cards. The Modulus-10 Check Digit option compares a computed modulus-10 check digit with a check digit printed on the document. Character set consists of the digits 0-9 and four special symbols, in either UNIVAC H-14, OCR-A, or OCR-B (ECMA) font. Has a 2000-document feed hopper and three 1000-document stackers. Connected via the multiplexer channel.

90/30 CHANNEL ADAPTER: Permits UNIVAC 9200/9200 II and 9300/9300 II systems to be directly connected to 90/30 systems via their respective multiplexer channels. Each attachable processor can function as an I/O subsystem providing peripheral capabilities.

COMMUNICATIONS CONTROLS

INTEGRATED COMMUNICATIONS ADAPTER: Controls message discipline for either 6 full-duplex or 12 half-duplex lines or, with an expansion feature, for either 12 full-duplex or 24 half-duplex lines. Contains the communications adapter interface, a communications multiplexer module, and line adapters can accommodate synchronous, asynchronous, wideband, auto-dial, asynchronous relay, TWX, and Telex communications lines. The Integrated Communications Adapter is mounted in the console stand, and attaches to a special port on the integrated peripheral channel.

SOFTWARE

OPERATING SYSTEM: OS/3 is a disk-oriented operating system specifically designed for the 90/30 hardware. The operating system has been designed in a modular fashion in order to provide support for the wide span of configurations available with the 90/30 system. Processing capabilities of the system at its highest level of implementation include concurrent execution of up to 7 jobs, each of which in turn is capable of initiating up to 255 subtasks. Communications processing capabilties include inquiry/response, transaction processing, and remote job entry. The minimum OS/3 Supervisor requires 8,192 bytes of storage and supports seven levels of multiprogramming, multitasking, and the minimum complement of integrated peripherals.

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The OS/3 Supervisor resides in main memory and consists of the system modules that perform storage management, task management, I/O control timer service, program management, system recovery, spooling control, record and file protection, program error handling, and diagnostic and debugging aids. Basic resources controlled by the supervisor include main storage for job residence, processing time for program execution, and the queuing and initiation of I/O commands and processing of I/O completion interrupts. Four types of spooling routines are available under OS/3: input readers, a supervisor printer/punch spooling cooperative (SPOOLIN), card-to-disk readers (SPOOLOUT), and output printer/punch writers. Input readers and output writers can interface with remote subsystems, accepting data files and providing output services identical with those supported for locally submitted programs. The Task Switcher component of the Supervisor is implemented in microcode and determines the order in which the various tasks are allocated central processing time. Every job step submitted to OS/3 is established as a primary task. Each job step, in turn, has the capability of initiating a theoretical maximum of 255 tasks. Dispatching priority among tasks is specified by the user in a system switch list. Diagnostic debugging aids provided by the Supervisor include a system Monitor Mode that accumulates information on branch and interrupt activities, main storage snapshots and dumps, system error messages, and program checkpoint/restarts.

The OS/3 Job Control routines control the scheduling and initiation of job steps according to the availability of system resources. Other functions include the suspension and cancellation of jobs, restarting of jobs, and termination of jobs. Jobs submitted to the system are queued for initiation by a scheduling priority designated by the user. Scheduling priority can be specified as normal priority, high priority, or preemptive priority (used for urgent jobs that require immediate scheduling and execution). The main storage requirements for a job can be calculated automatically by OS/3 if all job steps associated with the job reside in a load library. The user also can specify a minimum memory requirement for execution of all job steps within a job and a maximum memory allocation that will enable a job to be processed more efficiently. Main memory is allocated in contiguous "regions" to each job step in increments of 512 bytes, or 1024 bytes in systems with more than 131K bytes of main memory. Peripheral devices are allocated for each job and are released under control of a job control statement at the termination of a job step. Automatic volume recognition is supported.

Jobs are initiated on a first-in, first-initiated basis until available resources are insufficient to satisfy the requirements of an encountered job. Succeeding priority levels are then searched for a job that can be accommodated within the available resources. Jobs that require more resources than are currently available remain in the job queues of their respective priority levels until sufficient resources become available.

The Job Control routines utilize a simulated day clock for providing job accounting entries. Job Control sequences that are frequently used can be added to the system catalog in the form of procedures. These procedures can be called from the catalog for inclusion in a control stream. The system file catalog permits files to be identified by file name and is automatically updated to reflect the current stature of generations of files. Passwords are used to protect files from unauthorized use.

Data Management provides a convenient interface between user programs and hardware-oriented I/O controls performed by the supervisor. Four access methods are available: the sequential access method (SAM), the direct access method (DAM), the indexed sequential access method (ISAM), and the system access technique (SAT). SAT is used only by the OS/3 system routines to support library and work files and to access all direct-access files. Re-entrant logical I/O control modules provide for record blocking and unblocking, I/O buffering, data validation, and label processing. The OS/3 Data Management routines are designed to provide a high degree of compatibility with UNIVAC 9200/9300, IBM 360/20, and IBM DOS systems. Names and functions of macroinstructions are the same those of the other byte-oriented systems, and the spellings of keyword parameters used in these systems are accepted to provide compatibility.

The Integrated Communications Access Method (ICAM) is a modular component of OS/3 that provides three levels of communications support. The highest level of support provides a Message Control Program (MCP) that enables the user to communicate with the network by means of GET and PUT macroinstructions. A single Message Control Program can provide concurrent support for multiple user message processing programs that use a variety of terminals and line types. It provides the facilities for initiation and control of message flow, line control, buffering, code translation, data compression and decompression, and error detection. In addition to the assembly language macroinstruction interface, the MCP provides a communications interface for programs written in OS/3 RPG II, and for IMS/90. A remote job entry capability permits jobs to be submitted from a variety of remote terminal devices. Optional facilities available with the MCP include message queuing, multiple destination routing, an activity scheduling routine with an optional priority suspension and scheduling capability, checkpoint/restart, creation of journal files, and operational statistics accumulation.

The Remote Device Handler (RDH) Interface provides a communications capability for small systems with a limited degree of device independence. At this level, the user program communicates directly with the remote device handlers. Message queueing on disk and network buffering are not supported.

The Channel Control Routine (CCR) Interface permits user programs to interface with a communications facility at the physical input/output level. The primary purpose of this level is to permit users to write specialized Message Control Programs without having to modify the OS/3 interfaces.

Remote Device Handlers are available to interface with the Uniscope 100, the DCT 500, 1000, and 2000 Data Communications Terminals, the UNIVAC 1004 Card Processing System, the UNIVAC 9200/9300 systems, and Teletype Model 28, 33, 35, 37, and 38 terminals. Binary synchronous communications procedures are also supported to simulate the IBM 2780.

Main memory requirements for ICAM depend on the level of communications support implemented. Mini ICAM requires a minimum of 5,700 bytes of storage, plus an average of 4,000 bytes per device handler. Midi ICAM requires a minimum of 8,400 bytes, plus memory for handlers and message queueing in memory. Maxi ICAM requires a minimum of 11,000 bytes of main storage, plus

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memory for handlers and buffers to support disk and main memory message queuing.

COBOL: UNIVAC offers two COBOL compilers for use under OS/3. Basic COBOL requires a system with 32K bytes of main storage and includes the minimum American National Standard COBOL language facilities (i.e., Level 1 of the Nucleus, Sequential Access, Segmentation, Random Access, and Library modules and Level 2 of the Table Handling module. Extended COBOL requires a system with at least 65K bytes of main storage and includes the following facilities of ANS COBOL: Level 2 of the Nucleus, Sequential Access, Random Access, Sort, Segmentation, and Library modules, and Level 3 of the Table Handling module.

FORTRAN: The OS/3 FORTRAN compiler implements a subset of American National Standard FORTRAN 3.9-1966. It is also a compatible superset of IBM DOS/360 FORTRAN F. In addition, there are more than 20 useful language extensions, such as direct-access I/O statements and the ability to handle arrays of up to 7 dimensions. The compiler occupies 54,000 bytes of main memory.

A subset of FORTRAN IV is also provided to offer compatibility with the FORTRAN available with the IBM 1130 and System/3 computers. It includes the logical IF statement and a large mathematical library, but not such features as COMPLEX arithmetic and LOGICAL data types, and requires 18,000 bytes of main storage.

ASSEMBLER: The OS/3 Assembler is a logical extension of the assemblers used with the UNIVAC 9200/9300 Series systems and supports the capabilities of the IBM 360/20 Assembler. Consequently, programs written for the 9200/9300 and the 360/20 can be assembled and executed under OS/3 with no modification.

The Assembler requires a minimum of 15,000 bytes of main memory. If more than the minimum amount of main memory is available, the Assembler will expand to occupy the additional storage by extending its table areas and creating larger input and output buffers to lessen assembly times.

The OS/3 Assembler features a conditional assembly facility that allows one source program to produce several object program versions by excluding or including specified lines of code and altering the values used to determine the source of assembly.

REPORT PROGRAM GENERATOR: OS/3 RPG II is an extended version of the UNIVAC 9200/9300 RPG. Enhancements include a communications interface, access to the system console through programmed operations, a DEBUG operation code to aid the user in source-level debugging, and more than 10 other new features and modifications. UNIVAC 9200/9300 RPG programs written for card, tape, or disk systems and RPG source code programs for the IBM 360/20 can be recompiled under OS/3 for execution on the 90/30. OS/3 RPG II offers the same features as the RPG compilers available for the IBM System/3 and IBM System/360 DOS.

OS/3 RPG II, interfacing with the Message Control Program of OS/3 ICAM, can access the following terminals: Uniscope 100, 1004 Card Processor System, DCT 500, DCT 1000, DCT 2000, UNIVAC 9300, IBM System/3, IBM 360/20, IBM System/360 operating under OS or DOS BTAM Binary Synchronous Communications support, and various teletypewriter models. Minimum main storage requirement is 16,000 bytes.

INFORMATION MANAGEMENT SYSTEM (IMS/90): Provides OS/3 users with an on-line information storage and retrieval capability utilizing the Message Control program and the Data Management handlers for standard file access methods. After initiating a dialog with IMS/90, passwords are used to control access to restricted information. A free-form query/update language, supported by either CRT or hardcopy terminal devices, permits users to retrieve and display information from files, generate and display lists of qualified data, and add, delete, or change files. The defined record management capabilities permit a new record to be created from selected portions of multiple files. IMS/90 also facilitates applications programming by providing communications interfacing, application program scheduling, data management, system security, and recovery of files and messages. Main memory requirement for IMS/90 is about 40K bytes, which includes the user-terminal language processor called UNIQUE.

UTILITY ROUTINES: The OS/3 Sort/Merge program is a subroutine or a stand-alone program capable of using disk and/or tape files. It can sort fixed or variable-length records in ascending or descending sequence, with the capability to include user-code. Sort keys can use characters, signed or unsigned binary, decimal, floating-point, EBCDIC characters in ASCII sequence, and ASCII numeric key field formats. Up to 255 noncontiguous key fields can be specified, using shared input devices. The COBOL SORT verb generates a linkage to the Sort/Merge utility program, and the stand-alone Sort routine provides exits to COBOL.

A Linkage Editor combines object modules produced by the COBOL, FORTRAN, RPG, or Assembly language translators into "load modules" which are suitable for loading and execution under operating system control.

Other available utility programs include data transcription routines, comprehensive data utilities to copy data from any input device to any output device, a gang punch/reproduce program, a snapshot dump, a terminal (postmortem) dump, and tape and disk listing routines.

OS/3 also supports a set of diagnostic routines that can be executed concurrently with user jobs. These programs provide testing of both the central processor and peripheral subsystems. The central complex diagnostic programs are free-standing programs that run independently of the OS/3 supervisor. For integrated peripherals, a "softscope" feature permits the system console to be used as an oscilloscope for exercising integrated peripheral subsystems. Peripheral subsystem test programs can be run under OS/3 and accept parameters from the operating system to select the tests to be run and the environment under which the tests are to function.

CONVERSION AIDS: A COBOL-to-COBOL converter translates Honeywell Series 200 D Level COBOL or NCR Century Series COBOL source programs into equivalent OS/3 COBOL source statements. A conversion utility package translates UNIVAC 9200/9300 and IBM System/360 Model 20 tape and disk files to 90/30 tape and disk formats and provides source code analysis of 9200/9300 and 360/20 assembly-language programs to aid in conversion.

EMULATORS: The IBM 360/20 emulator uses microprogramming in combination with OS/3 software to execute programs written for 360/20 systems. The 360/20 emulator functions as a job under the OS/3 operating system. All 360/20 instructions are executed by microprogrammed routines with the exception of I/O

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instructions and supervisor-related functions, which are executed by software routines. The table below lists the 36/20 systems by peripheral orientation and memory size and the equivalent 90/30 systems required for emulation.

IBM 360/20 System to be Emulated	UNIVAC 90/30 System Required for Emulation Minimum	Maximum
4K, 8K, 12K, 16K or 24K–Card	32K	49K
32K–Card	49K	65K
12K or 16K–Disk	32K	65K
24K–Disk	49K	65K
32K–Disk	49K or 65K	65K
8K, 12K, 16K, 24K or 32K–Tape	32K	65K

The UNIVAC 9200/9300 emulator operates as a job under control of OS/3 and executes both the 9200/9300 program and the supervisor with which it was originally run. The 9200/9300 system sizes and the required memory sizes for emulation on a 90/30 system are listed below:

UNIVAC 9200/9300 System to be Emulated	UNIVAC 90/30 System Required for Emulation Minimum	Maximum
8K	32K	32K
12K–24K	32K	49K
32K	49K	65K

In all cases, the 90/30 system must include appropriate counterparts of the peripheral devices in the system being emulated.

APPLICATION PROGRAMS: UNIVAC application software available for the 90/30 includes an advanced Pert Management Control System, Linear Programming, UNIS (bill of materials, inventory control, planning and scheduling), APT (automatically programmed tools), PROFITS (on-line bank teller transaction processing), NEWSCOMP (on-line newspaper text editing and typesetting), LINCO III (typesetting and line justification), WIMS (Wholesale Inventory Management System), and UPACS (UNIVAC Patient Accounting System).

PRICING

EQUIPMENT: All necessary control units and adapters are included in the indicated prices for the following configurations, and the quoted one-year rental prices include equipment maintenance.

UNIVAC 90/30 BASIC SYSTEM: Consists of a 32K Processor with the basic instruction set, 2 interval timers, integrated peripheral channel, CRT console, and writable control storage for UNIVAC 9200/9300 or IBM 360/20 compatibility mode; an integrated card reader (500 cpm), integrated printer (500 lpm), integrated disk adapter and two 8416 Disk Pack Drives (57.8 million bytes). Monthly rental for a one-year lease is $4,030, and purchase price is $153,600. For a purchased system, monthly maintenance is $830.

UNIVAC 90/30 DISK SYSTEM: Consists of a 65K Processor with 2 interval timers, integrated peripheral channel, CRT/console, writable control storage for UNIVAC 9200/9300 or IBM 360/20 compatibility mode, and storage protection; integrated card reader (500 cpm), integrated printer (500 lpm), integrated card punch (75-160 cpm), integrated disk adapter and five 8416 Disk Pack Drives (145 million bytes). Monthly rental for a one-year lease is $5,310, including maintenance. Purchase price is $202,320, and monthly maintenance is $1,095.

UNIVAC 90/30 EXPANDED TAPE/DISK SYSTEM: Consists of a 131K Processor with expanded instruction set, 2 interval timers, CRT console with console printer, writable control storage for UNIVAC 9200/9300 or IBM 360/20 compatibility mode, storage protection, multiplexer channel and two selector channels; 250-cpm card punch and controller, 1000-cpm card reader and controller, 1100-lpm printer and controller, four Uniservo 12 magnetic tape units (68KB) and controller, and eight 8416 Disk Pack Drives and integrated disk adapter (230 million bytes). Monthly rental for a one-year lease is $10,521, and purchase price is $386,534. Monthly maintenance for a purchased system is $2,144.

SOFTWARE AND SUPPORT: With the exception of several industry-oriented applications packages, UNIVAC equipment prices include all of the UNIVAC software described in this report and all normal educational courses and professional assistance.

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

LONG-TERM LEASES: In addition to the basic 1-year agreement, UNIVAC offers an extended-term 5-year lease for 90/30 systems at significantly lower monthly rates. Under the 5-year "level-payment" agreement, the monthly equipment charge is 80% of the 1-year rental rate shown in the accompanying price list. Under a 5-year "reducing-payment" agreement, the monthly charge is 90% of the 1-year rental rate during the first year, 85% the second year, 80% the third year. 75% the fourth year, and 70% the fifth year. Maintenance is not discounted under these plans.■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
90/30 PROCESSOR AND MAIN STORAGE				
3029-00	90/30 Processor (includes Integrated Peripheral Channel, 2 Interval Timers, CRT/Keyboard Operator Station, UNIVAC 9200/9300 Compatibility Mode, IBM 360/20 Compatibility Mode, and 32,768-byte Memory	78,480	320	1,635
3029-99	90/30 Processor; 49,152 bytes	85,200	340	1,775
3029-98	90/30 Processor; 65,536 bytes	91,920	360	1,915
3029-97	90/30 Processor; 98,304 bytes	105,360	400	2,195
3029-96	90/30 Processor; 131,072 bytes	118,800	440	2,475
3029-95	90/30 Processor; 163,840 bytes	132,240	480	2,755
3029-94	90/30 Processor; 196,608 bytes	145,680	520	3,035
3029-93	90/30 Processor; 229,376 bytes	159,120	560	3,315
3029-92	90/30 Processor; 262,144 bytes	172,560	600	3,595
STORAGE EXPANSION				
F1775-00	Storage; 16,384 bytes (expands a 90/30 Processor from 32,768 to 49,152 bytes or from 49,152 bytes to 65,536 bytes of main storage)	6,720	20	140
F1907-01	Storage; 32,768 bytes (expands main storage from 65,536 to 98,304 bytes)	13,440	40	280
F1775-95	Storage; 32,768 bytes (expands main storage from 98,304 to 131,072 bytes)	13,440	40	280
7024-99	Storage; 32,768 bytes (expands main storage from 131,072 to 163,840 bytes)	13,440	40	280
F1775-95	Storage; 32,768 bytes (expands main storage from 163,840 to 196,608 bytes)	13,440	40	280
F1908-99	Storage; 32,768 bytes (expands main storage from 196,608 to 229,376 bytes)	13,440	40	280
F1775-95	Storage; 32,768 bytes (expands main storage from 229,376 to 262,144 bytes)	13,440	40	280
PROCESSOR FEATURES				
8541-84	Console Printer; 30 cps	2,856	22	72
F1622-00	Storage Protect; provides read/write protection for 512-byte blocks for processors with up to 131,072 bytes of main memory and 1,024-byte blocks in processors with more than 131,072 bytes	720	NC	15
F1623-00	Micrologic Expansion; adds 64 instructions, including 44 floating-point instructions and 20 non-privileged instructions	4,560	15	95
1921-00	Channel Cabinet; provides interface for housing a multiplexer channel and two selector channels	9,360	30	195
F1618-00	Selector Channel; requires 1921-00	8,160	30	170
F1620-00	Multiplexer Channel; requires 1921-00	6,000	30	125
INTEGRATED PERIPHERAL SUBSYSTEMS				
0717-00	Integrated Card Reader; 500 cpm	9,120	60	190
F1627-00	51-Column Feature; for 0717 Card Reader	1,680	10	35
F1627-01	66-Column Feature; for 0717 Card Reader	1,680	10	35
0605-00	Integrated Card Punch; 75-160 cpm	9,840	75	205
F1617-00	Punch Read Station; permits reading of 80-column cards on 0605 Card Punch	720	5	15
0773-99	Integrated Printer; 120 print positions, 500 lpm	22,080	175	460
F1648-00	132 Print Positions; expands print positions from 120 to 132	1,920	10	40
F1648-01	144 Print Positions; expands print positions from 132 to 144	1,920	5	40
F1648-02	144 Print Positions; expands print positions from 120 to 144	3,840	15	40
F1649-00	Expanded Character Set; permits use of print cartridges with more than 64 characters	2,160	8	45
F1647-00	48-Character Alpha-Numeric Business Set	1,440	NC	30
F1647-01	48-Character Alpha-Numeric Scientific Set	1,440	NC	30
F1647-02	63-Character Set; compatible with 9200/9300 integral printer	1,440	NC	30
F1647-03	48-Character Business Set; compatible with 0770 printer	1,440	NC	30
F1647-10	Alpha-Numeric Character Set; contains 48 letters and a repeated 16 numeric characters for fast numeric printing	1,440	NC	30
F1647-11	Print Cartridge; contains a 63-character set with 13 H-14 characters used with the 2703 Optical Document Reader	1,440	NC	30
F1647-12	Print Cartridge; contains a 63-character set with 13 OCR-B ISO numerics; all other characters are font style OCR-B, ECMA 11	1,440	NC	30
F1647-13	Print Cartridge; contains a 63-character set with 13 OCR-B, ECMA 11 numerics for use with the 2703 Optical Document Reader; all other characters are font style OCR-B, ECMA 11	1,440	NC	30
F1647-14	Print Cartridge; contains a 62-character set with a 13-character OCR-A numeric set for use with the 2703 Optical Document Reader; all other characters are font style OCR-B, ECMA 11	1,440	NC	30
F1650-01	Print Cartridge; contains an 85-character ASCII subset	1,440	NC	30
F1650-02	Print Cartridge; contains a 94-character ASCII graphic character set	1,440	NC	30

*Rental prices do not include equipment maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
INTEGRATED PERIPHERAL SUBSYSTEMS (Continued)				
F1621-00	Integrated Disc Adapter; provides the interface and control for up to four type 8416 Disc Drives	9,600	50	200
F1621-99	IDA Expansion; expands capability of IDA (F16221-00) to control up to eight 8416 Disc Drives	8,160	30	170
8416-02	Integrated Disc Storage; provides direct access to up to 28.9 million bytes of data using removable disc pack F1216-01; average access time is 33MS; transfer rate is 626 kilobytes per second	11,520	75	240
F1216-01	Disc Pack; provides up to 28.9 million bytes of removable storage for the 8416 Disc Drive	450	—	20
F1625-99	Communications Adapter; controls and coordinates the transfer of data from up to 6 full-duplex or 12 half-duplex communication lines; expandable to 12 full-duplex or 24 half-duplex lines; each line requires a line adapter	9,360	35	195
F1625-98	Communications Adapter Expansion; expands the capability of C/A (F1625-99) to control up to 12 full-duplex or 24 half-duplex lines	9,360	35	195
F1826-00	Synchronous Line Adapter; provides a full-duplex or half-duplex interface to synchronous data sets conforming to RS 232 and CCITT; compatible with MIL 188C low-level interface electrical characteristics	864	7	18
F1826-01	Synchronous Line Adapter; same as F1826-00 and provides reverse channel of up to 150 baud asynchronous; requires two ports	1,296	8	27
F1827-00	Synchronous Line Adapter; same as F1826-00 except permits exact compliance with the MIL 188C low-level interface; control line polarity is RS-232	864	7	18
F1828-00	Asynchronous Line Adapter; provides a full-duplex or half-duplex interface to asynchronous data sets conforming to RS-232 and CCITT; compatible with MIL 188C low level interface electrical characteristics	672	6	14
F1828-01	Asynchronous Line Adapter; same as F1828-00 and provides reverse channel of up to 5 baud	864	7	18
F1828-02	Asynchronous Line Adapter; same as F1828-00 and provides reverse channel of up to 150 baud asynchronous; requires 2 ports	1,056	8	22
F1829-00	Asynchronous Line Adapter; same as F1828-00 except permits exact compliance with the MIL 188C low-level interface; control line polarity is RS-232	672	6	14
F1830-00	Wideband Line Adapter; provides a synchronous full-duplex interface to an AT&T 300 Series data set operating at 40.8K bits per second with 56K bps top speed	1,056	8	22
F1830-01	Wideband Line Adapter; provides a synchronous full-duplex interface to an AT&T 300 Series data set at 50K bps; includes auto-answering capability	1,056	8	22
F1831-00	Dial Adapter; provides the interface to both rotary and Touch-Tone auto dialing units; requires a line adapter location for each dialing unit	672	6	14
F1832-00	Asynchronous Relay Line Adapter; provides an asynchronous full-duplex interface optionally compatible with either 20-75 MA neutral or 10-40 MA polar telegraph lines	672	6	14
F1834-00	Wideband Line Adapter; same as F1839-01 except conforms to CCITT-V35	1,056	8	22
F1835-00	TWX Line Adapter; provides an interface to the USA TWX network	672	6	14
F1836-00	Telex Line Adapter; provides an interface to the USA WU Telex network	672	6	14
F1870-00	Active Line Indicator; provides a display panel to display line activity on up to 12 communication lines; two permitted if F1625-98 is present	336	2	7
MASS STORAGE				
5024-02**	8414 Control; controls up to eight type 8414 Disc Drives to a maximum capacity of 233,408,000 bytes of removable storage; includes File Scan and Record Overflow (not software-supported)	27,720	95	561
F1343-02**	8411 Capability; permits 8411 Disc Drives to be connected to a 5024-02 Control; a maximum of eight drives (any combination of 8411 and/or 8414 drives) may be connected	2,016	10	41
8414-92**	Disc Storage; consists of two 8414 Disc Drives; each drive provides direct access storage using a removable disc pack, feature F1214-00	34,650	136	836
8414-94**	Disc Storage; same as 8414-92 except consists of four disc drives	69,300	274	1,571
8414-96**	Disc Storage; same as 8414-92 except consists of six disc drives	103,950	410	2,204
8414-98**	Disc Storage; same as 8414-92 except consists of eight disc drives	138,600	546	2,734
8414-85**	Disc Drive; provides single disc drive for configuration expansion	17,325	68	418
F1214-00**	Disc Pack; provides up to 29.17 million bytes of removable storage for 8414 Disc Drive	347	—	21
8411-00**	Disc Drive; provides direct access to a maximum storage of 7.25 million bytes using removable disc pack F1211-00	20,916	84	424
F1211-00**	Disc Pack; provides 7.25 million bytes of removable storage for 8411-00	315	—	16

*Rental prices do not include equipment maintenance.
**Subject to availability.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
MASS STORAGE (Continued)				
5039-00	8430 Control; controls up to eight type 8430 Disc Storage Drives with direct access to 800 million 8-bit bytes, via selector channel	57,600	300	1,200
8430-00	Disc Storage; provides a single disc drive using removable disc pack, feature F1230-00	24,960	130	520
F2047-00	16 Drive Expansion; provides the capability to attach up to sixteen 8430 Disc Drives to the 5039 Control	7,680	40	160
F1230-00	Disc Pack; provides up to 100 million bytes of removable storage for type 8430 Disc Drive	750	—	40
INPUT/OUTPUT UNITS				
5017-99	Uniservo 12 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, non-simultaneous Uniservo 12 tape units	22,224	95	520
5017-00	Universo 12/16 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, non-simultaneous Uniservo 12 and/or 16 tape units	23,967	105	561
F0825-00	Dual Channel; permits non-simultaneous operation on two selector channels for one processor or one selector channel on each of two 90/30 Processors	3,885	16	87
F1131-99	Uniservo 16 Capability; permits the use of Uniservo 16 tape units on type 5017-99 Control	1,743	10	41
F1029-99	Simultaneous Operation; provides a second control module for R/R, R/W, W/R, W/W simultaneous operation; simultaneous W/W operation on two Uniservo 12's is available through separate masters; appropriate features must also be added to the Uniservo 12 masters; used only with 5017-99	14,162	63	332
F1029-00	Simultaneous Operation; provides a second control module forsimultaneous operation; appropriate features must also be added to the Uniservo 12 masters and Uniservo 16 tape units; used only with 5017-00	15,905	74	373
F0823-99	7-Track NRZI; provides the capability of adding 7-track tape units to type 5017-00 or -99 Control	5,025	16	113
F0826-00	9-Track NRZI; enables read or write operation in 9-track NRZI mode at a density of 800 bpi, in addition to the 9-track phase encoded 1600 bpi; appropriate features must also be added to the Uniservo 12 masters and Uniservo 16 tape units	5,028	16	113
F1028-96	9-Track Addition; adds 9-track NRZI to F0823-99	3,654	10	82
F1028-95	7-Track Addition; adds 7-track NRZI plus data conversion to F0826-00	3,654	10	82
0861-00	Uniservo 12 Master; 9-track phase encoded master tape unit and logic to handle up to three slave tape units (0861-01); transfer rate is 68,320 bytes per second at a recording density of 1600 bpi; reads forward and backward; for non-simultaneous operation	15,383	113	360
0861-01	Uniservo 12 Slave; 9-track phase-encoded, same characteristics as 0861-00	12,333	78	289
0861-04	Uniservo 12 Master; 7-track NRZI master tape unit and logic to handle up to three slave tape units (0861-05); transfer rate 8,540, 23,741, and 34,160 characters per second at recording densities of 200, 556, and 800 bpi; reads forward and backward; for non-simultaneous operation	13,334	113	313
0861-05	Uniservo 12 Slave; 7-track NRZI tape unit; same characteristics as 0861-04	10,963	78	257
F0934-99	Simultaneous Feature; for 9-track phase encoded simultaneous operation; required in each master (0861-00)	3,429	17	80
F0934-01	Simultaneous Feature; required in each master (0861-00) in addition to F0934-99 and F0935-00 to achieve phase encoded and 7 and 9-track NRZI simultaneous operation	3,885	17	91
F0934-98	Simultaneous Operation; required in each master (0861-04) to achieve 7-track NRZI simultaneous operation	3,429	17	80
F0935-00	Dual Density; required in each master (0861-00) to provide the ability to read or write 7/9-track NRZI tapes in addition to phase encoded tapes at 1600 bpi	2,284	10	53
0862-00	Uniservo 16; 9-track phase encoded tape unit; transfer rate 192,000 bytes per second at a recording density of 1600 bpi; reads forward and backward	19,609	116	459
0862-02	Uniservo 16; 7-track NRZI tape unit; transfer rate 24,000, 66,700, and 96,000 characters per second at recording densities of 200, 556, and 800 bpi; reads forward and backward	19,609	116	459
F0936-99	Simultaneous Feature; provides for simultaneous operation when added to 0862-00 or -02; a second control unit or equivalent is required	914	NC	21
F0937-00	Dual Density; provides 0862-00 with the ability to read or write 9-track NRZI tape at 800 bpi in addition to phase encoded at 1600 bpi	2,284	NC	51
5034-00	Uniservo 20 Control; controls up to sixteen 9-track, phase encoded, 1600-bpi, nonsimultaneous Uniservo 20's or a mixture of up to 16 Uniservo 20's, Uniservo 16's, and Uniservo 12's, provided at least one Uniservo 20 is present	32,681	95	765
F0823-98	9-Track Capability; provides the capability of adding 7-track NRZI Uniservo 16 and Uniservo 12 tape units to type 5034 Control; includes data conversion; F0826-99 may not be present	5,544	16	113

*Rental prices do not include equipment maintenance.

UNIVAC 90/30

EQUIPMENT PRICES

		Purchase Price	Monthly Maintenance	Rental (1-year lease)*
INPUT/OUTPUT UNITS (Continued)				
F0826-99	9-Track NRZI; enables read or write operations in 9-track NRZI mode at a density of 800 bpi, in addition to the 9-track, phase encoded, 1600 bpi on Uniservo 16 and Uniservo 12 tape units with appropriate added features; F0823-98 may not be present	6,552	21	133
F1028-98	9-Track Addition; adds 9-track NRZI capability to F0823-99	5,544	16	113
F1028-97	7-Track Addition; adds 7-track capability and data conversion to F0826-99	4,536	10	92
0864-00	Uniservo 20; 9-track phase encoded tape unit; transfer rate 320,000 bytes per second at a recording density of 1600 bpi; reads forward and backward	24,620	132	577
F1510-00	Dual Access; provides for dual access and simultaneous R/R, R/W, W/R, W/W operation when added to two or more Uniservo 20's; requires two 5034-00 Control Units	2,284	10	51
0604-99	Card Punch and Control; 80-column, 250 cpm row punch	16,443	101	386
F0875-00	Read/Punch; permits prepunch reading of 80-column cards	5,129	53	124
0716-99	Card Reader and Control; 80-column, 1000 cpm reader	14,364	95	305
F1487-00	Short Card, 51-Column; for 0716	1,497	10	39
F1487-01	Short Card, 66-Column; for 0716	1,497	10	39
F1488-00	Validity Check	756	NC	16
F1498-00	Alternate Stacker Fill	504	NC	10
F1530-99	Dual Translate; adds ASCII translator to translate mode	1,008	5	22
0768-00	Printer and Control; prints 49 contiguous characters at 1100 lpm and 63 characters at 900 lpm; 132 print positions	42,709	354	1,001
0768-99	Printer and Control; prints 43 contiguous characters at 1600 lpm and 63 characters at 1200 lpm; 132 print positions	52,989	438	1,242
F1071-00	1600/1200 LPM Rate; converts type 0768-00 to a type 0768-99	10,280	84	241
F1820-00	Stacking/Acoustical Aid; provides additional sound suppression to type 0768-00/-99 Printers; also provides power-driven assistance to form stacking	436	NC	10
0768-02	Printer and Control; prints 87 contiguous characters at 1000 lpm, 94 characters at 840, lpm and 2000 lpm for a duplicated 14-character set (10 numerics plus 4 specials)	48,873	398	1,146
F1522-00	Print Code Expansion; provides for conersion of the 0768-02 to provide for a 103-character set	252	NC	5
0770-00	Printer and Control; prints 48-characters at 800 lpm; 132 print positions, 50 ips	45,539	221	1,066
0770-02	Printer and Control; same as 0770-00 except 1400 lpm and 75 ips	54,469	289	1,275
0770-04	Printer and Control; same as 0770-00 except 2000 lpm and 100 ips	77,128	368	1,806
F1533-00	160 Print Position; expands 132 print positions to 160	3,707	16	87
F1534-00	Expanded Character Set Control; provides control for print cartridges with other than 48-character sets	2,400	5	57
F1536-00	Print Cartridge; 43-character alphanumeric business set	420	NC	21
F1536-01	Print Cartridge; 48-character alphanumeric scientific set	420	NC	21
F1537-00	Print Cartridge; 94-character ASCII set; requires F1534-00	420	NC	21
F1537-03	Print Cartridge; 68-character OCR-B; requires F1534-00	420	NC	21
F1537-04	Print Cartridge; OCR H-14 universal; requires F1534-00	420	NC	21
F1537-05	Print Cartridge; 58-character set for COBOL, FORTRAN, and business; requires F1534-00	420	NC	21
F1537-06	Print Cartridge; 177-character international set; requires F1534-00	420	NC	21
F1537-09	Print Cartridge; 24-character numeric and special symbols for high-speed numeric printer; requires F1534-00	420	NC	21
F1537-11	Print Cartridge; universal OCR-A character set; requires F1534-00	420	NC	21
F1537-12	Print Cartridge; universal OCR-B (ECMA 11); requires F1534-00	420	NC	21
F1537-13	Print Cartridge; universal 77L	420	NC	21
2703-00	Optical Document Reader	44,100	197	937
F1108-00	600-dpm Speed Upgrade, for 6-inch documents	11,088	34	236
F1163-00	Modulus 10 Check Digit	1,008	5	22
F1106-00	Mark Read—EBCDIC	8,316	39	177
F1106-01	Mark Read—ASCII	8,316	39	177
F1149-00	Punch Card Read; requires F1106-00 or -01	2,772	10	59
F1154-00	Validity Check; requires F1106-00 or -01	504	NC	59
0920-02	Paper Tape Control	7,917	29	185
F1033-02	Paper Tape Reader	1,680	17	39
F1032-02	Paper Tape Punch	5,754	24	135
F1034-00	Reader Spooler	1,680	5	39
F1035-00	Punch Take-Up Spooler	688	5	16

*Rental prices do not include equipment maintenance.

APPLICATION PACKAGES

	Monthly License Fee
UNIS:	
Master Data Processing	75
Inventory Management Module	75
Planning—Infinite	75
Planning—Finite	100
Work Order Processing	25
NEWSCOMP:	
LINCO	100
Editor	100
Classified Ads	100
PROFITS:	
Time Deposits	420
Loans	165