Unisys A15

MANAGEMENT SUMMARY

UPDATE: *Unisys replaced the A 15 Models F, H, I, J, K, L, M, and N with the new A 15 Models FX, HX, IX, JX, KX, LX, MX, and NX. The new A 15 X Models operate exclusively with the Master Control Program/Advanced System (MCP/AS) operating system. Unisys increased the maximum main memory to 96 megabytes on the Model FX and to 192 megabytes on the Models HX, IX, amd JX. To further improve the performance of the A 15 system Unisys introduced the Disk Cache Module. This software module permits users to designate a complement of main system memory as a disk cache unit.*

The A 15 is the high-end system of the A Series of general-purpose mainframes including the A 2, A 3, A 5, A 9, A 10, and A 12 systems. The A 15 uses sub-nanosecond Emitter Coupled Logic (ECL), Very Large Scale Integration (VLSI) air-cooled gate array technology, resulting in a 35 percent reduction in power and air-conditioning and 40 percent reduction in floor space requirements. According to Unisys, the new X Models improve overall system performance an average of 20 percent over the models they replace. The improvements are achieved with the MCP/AS operating system. MCP/AS, an improved version of the MCP operating system, expands the capacity, performance, and memory addressability of the A 15 System.

To further enhance the performance of the processor, a cache system, divided into a 24K-byte code cache and a 24K-byte data cache, reduces the traffic between main memory and the processor and is transparent to software in single or multiple-processor systems. The use of cache and pipeline technology greatly improves the speed of the system, executing almost a full instruction within a 65-nanosecond clock cycle. The memory modules use 256K-bit ➢

The Unisys A 15 System is a large-scale mainframe with a distributed processing architecture designed to satisfy the demands of a heavy batch load combined with high-volume transaction processing. The A 15 provides configuration flexibility and growth potential; various central processor and I/O processor modules can be combined to address a user's particular information processing requirements. The A 15 is object code compatible with all the A Series computers and the B 5900, B 6900, and B 7900 systems.

MODELS: A 15 Models FX, HX, IX, JX, KX, LX, MX, and NX.
CONFIGURATION: The A 15 Systems have from one (Model FX) to four (Models MX and NX) central processors. The main memory capacity ranges from 24 to 192 megabytes, expandable in 12-megabyte increments.
COMPETITION: Amdahl 580; Control Data Cyber 180; IBM 3090; Honeywell DPS 90; and NAS AS/XL Series.
PRICE: Base prices range from $2,940,000 for the A 15 Model FX to $8,475,000 for the A 15 Model NX.

CHARACTERISTICS

MANUFACTURER: Unisys Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19424. Telephone (215) 542-4011. Canada: Unisys Canada, 2001 Sheppard Avenue East, North York, Ontario M2J 4Z7. Telephone (416) 495-0515. ➢

The Unisys A 15 large-scale system is available in eight models with one to four central processors and a main memory range from 24 to 192 megabytes. The system has one or two I/O subsystems supporting up to 64 Data Link Processors and up to 512 data communications lines.

Unisys A15

TABLE 1. SYSTEM COMPARISON

MODEL	A 15 Model FX	A 15 Model HX	A 15 Model IX	A 15 Model JX
SYSTEM CHARACTERISTICS				
Date announced	April 1987	April 1987	April 1987	April 1987
Date first delivered	2nd quarter 1987	2nd quarter 1987	2nd quarter 1987	2nd quarter 1987
Field upgradable to	Model HX	Model IX	Model JX, Model KX	Model LX
Relative performance	—	—	—	—
Number of processors	1	2	2	2
Cycle time, nanoseconds	65	65	65	65
Word size, bits	48	48	48	48
Operating systems	MCP/AS	MCP/AS	MCP/AS	MCP/AS
MAIN MEMORY				
Type	256K-bit DRAM	256K-bit DRAM	256K-bit DRAM	256K-bit DRAM
Minimum capacity, bytes	24M	24M	24M	24M
Maximum capacity, bytes	96M	192M	192M	192M
Increment size	12M	12M	12M	12M
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE				
Minimum capacity	—	—	—	—
Maximum capacity	48K	96K	96K	96K
Increment size	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	—	—	—	—
Block multiplexer	—	—	—	—
Word	—	—	—	—
Other	32 DLPs per HDU	32 DLPs per HDU	32 DLPs per HDU	32 DLPs per HDU

Dynamic RAM (DRAM) chips and have up to 192 megabytes of directly addressable main storage with a memory bandpass of up to 768 megabytes per second.

The A 15 is available in eight models with one to four central processors. The multiprocessor configurations are fully redundant and optional partitioning is offered on the Models JX, LX, and NX. A second memory control with 12 megabytes of memory, expandable up to 192 megabytes, is included in a partitionable environment only. Requirements for redundancy are satisfied with only one memory subsystem. Partitioning allows an A 15 System to split into two logical A 15 subsystems, each with its own operating system. The system partitions may be defined to provide for the separation of production work from development work.

Model IX through NX have two I/O cabinets with two Host Data Units, each of which provides an I/O throughput of 24 megabytes for a maximum system throughput of 48 megabytes per second. To further expand the I/O subsystem additional independent I/O expansion cabinets can be added to the system.

Data communications have been enhanced with the addition of the CP2000 Communications Processor which is available as an option on the A 15. The CP2000 provides connection to the CP LAN, a proprietary high-speed Local Area Network facility, and communicates with remote systems or workstations using various transmission methods, speeds, and protocols.

All models of the A 15 System operate under the MCP/AS operating system. The major feature of the MCP/AS is an enhanced memory management scheme implemented through a combination of software and microcode which

MODELS: A 15 Models FX, HX, IX, JX, KX, LX, MX, and NX.

DATA FORMATS

BASIC UNIT: 60-bit word consisting of 48 data bits, 4 control bits, and 8 error correcting bits.

FIXED-POINT OPERANDS: Each single-precision integer operand occupies one word and consists of a 6-bit octal exponent with sign and a 39-bit fraction with sign. Each double-precision operand occupies two words and consists of a 15-bit octal exponent with sign and a 78-bit fraction with sign. String operands may consist of a variable number of 4-, 6-, 7-, or 8-bit characters.

FLOATING-POINT OPERANDS: Integer and floating-point operands have the same format and may be freely combined in arithmetic operations.

INSTRUCTIONS: One to twelve 8-bit syllables in length. Syllables are packed six to a program word and executed sequentially left to right.

INTERNAL CODE: 8-bit EBCDIC is standard. Information coded in ASCII can also be processed. ASCII is the primary data communications code.

MAIN MEMORY

The A 15 memory system consists of a single fault-tolerant Memory Control (MC), up to two Memory Storage Units (MSUs), and the requisite power supply modules. The MC has the capability to address 192 megabytes of memory with a requestor bandpass of 192 megabytes per second. The Memory Control contains a purgeless cache mechanism that extends the memory system to the requestors' cache, allowing only one original of the data, referenced by a main memory address, to exist in the system. If the original is in main memory, the requestors may have copies in their caches. The copies cannot be modified by the requestor. The memory controller accepts jobs from, and initiates jobs to, its requestors to cause selective blocks of data to migrate back to memory from the requestors' caches. This elimi-

Unisys A15

TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	A 15 Model KX	A 15 Model LX	A 15 Model MX	A 15 Model NX
SYSTEM CHARACTERISTICS				
Date announced	April 1987	April 1987	April 1987	April 1987
Date first delivered	2nd quarter 1987	2nd quarter 1987	2nd quarter 1987	2nd quarter 1987
Field upgradable to	Model LX, Model MX	Model MX	Model NX	—
Relative performance	—	—	—	—
Number of processors	3	3	4	4
Cycle time, nanoseconds	65	65	65	65
Word size, bits	48	48	48	48
Operating systems	MCP/AS	MCP/AS	MCP/AS	MCP/AS
MAIN MEMORY				
Type	256K-bit DRAM	256K-bit DRAM	256K-bit DRAM	256K-bit DRAM
Minimum capacity, bytes	24M	24M	24M	24M
Maximum capacity, bytes	192M	192M	192M	192M
Increment size	12M	12M	12M	12M
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE				
Minimum capacity	—	—	—	—
Maximum capacity	144K	144K	144K	144K
Increment size	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	—	—	—	—
Block multiplexer	—	—	—	—
Word	—	—	—	—
Other	32 DLPs per HDU	32 DLPs per HDU	32 DLPs per HDU	

makes the entire systems memory visible to a single application. This new memory architecture reduces the overhead of managing the virtual memory of the system.

The full complement of B 7900 and earlier A Series system software can be migrated to the A 15 without modification. This includes a complete range of compilers, data management facilities, data communications facilities, and application system generators. The A 15 supports all peripherals qualified on the B 7900 system and all Data Link Processors (DLPs) currently available on that system. Most peripherals can migrate from the B 5900, B 6900, and other A Series systems to the A 15. The B 9494-12 thin-film disk drive with a capacity of 1320M bytes of unformatted storage and 868M bytes of formatted storage is available for the A 15.

COMPETITIVE POSITION

The lineup of formidable competitors in the A 15's performance range include the high-end systems of every mainframe vendor: the Amdahl 580, the Control Data Cyber, the IBM 3090, the Honeywell DPS 90, and the NAS AS/XL 180. All the systems offered by these vendors feature 256K-bit memory chips (IBM—288K bit) and VLSI circuitry. In addition, all the processors have high-speed cache (buffer) memories of varying capacities to enhance throughput.

The low-end A 15 Model FX with 24 megabytes of memory competes with the Amdahl 5860 with 16 megabytes of memory, and the Honeywell DPS 90/91 with 32 megabytes of memory. The dual processor A 15 Models HX and IX with 24 to 192 megabytes of memory compete with the IBM dyadic 3090 Model 200 with 64 megabytes of memory, the Control Data Cyber Model 870 with 16 to 128 megabytes of memory, the Honeywell DPS 90/92 with 32

nates the need to periodically purge the cache to maintain accuracy of main memory. Data will reside in a requestors' cache until it is displaced by more recently needed data or is required by another requestor. The Requestor Interface Modules (RIM) provide all the logic required to interface a requestor (Central Processor, Host Data Unit) to the memory system. The RIM contains the cache control tables and data storage for uncompleted store operations. The Storage Interface Modules (SIM) provide the interface between the memory control and the storage units. The SIMs are connected to the Requestor Interface Modules via four pairs of unidirectional buses, each pair connecting one Storage Interface Module to all the Requestor Interface Modules.

STORAGE TYPE: 64K-bit Dynamic RAM integrated circuit (IC) boards.

CAPACITY: For memory capacities of the A 15, refer to Table 1.

CYCLE TIME: Not specified.

CHECKING: Logic in the Memory Control (MC) performs automatic correction of single-bit errors and detection of multiple-bit errors.

RESERVED STORAGE: Not available on the A 15 system.

CENTRAL PROCESSOR

The Central Processor Module (CPM) utilizes Very Large Scale Integration (VLSI), Emitter Coupled Logic (ECL) gate array technology. Microcode is used as the source of control for operator execution. The A 15 Central Processor Module is part of a distributed system and is functionally subdivided into the following five relatively independent submodules that perform concurrent functions:

- Program Control Unit (PCU)
- Reference Unit (RU)
- Execution Unit (EU)

Unisys A15

to 128 megabytes of memory, and the NAS AS/XL 180 with 64 to 256 megabytes of memory. The three-processor A 15 Models KX and LX with 24 to 192 megabytes of memory compete with the Honeywell DPS 90/93 with 64 megabytes of memory. IBM has no three-processor model in its 3090 Series. The four-processor A 15 Models MX and NX with 24 to 192 megabytes of memory compete with the Amdahl 5890-600 with 128 to 512 megabytes of memory, the Honeywell DPS 90/94 with 64 to 256 megabytes of memory, the IBM 3090 Model 400 with 128 megabytes of memory, and the NAS AS/XL 100 with 128 to 512 megabytes of memory.

The two incompatible Unisys systems, the A 15 and the 1100/90, compete with each other in the commercial data processing, transaction processing, and engineering area. The A 15 clearly has the advantage with the larger memory capacity and a MIPS (Millions of Instructions per Second) rating more than double the 5.5 to 25.0 MIPS rating of the 1100/90 Series. The performance ratings of the A 15, the IBM 3090, and the NAS AS/XL are almost the same. IBM's four 3090 models are priced lower than the A 15 models, but IBM includes fewer hardware components in its basic systems.

ADVANTAGES AND RESTRICTIONS

The A 15 is designed for companies with high-volume batch, on-line, and transaction processing and organizations with a need to expand their computing capacity. To make the A 15 even more attractive for users in the transaction processing environment, Unisys is offering the Disk Cache Module which improves the performance of the mainframe by an average of 40 percent, according to the vendor. Unisys has stepped up its marketing and is aggressively competing with IBM for a larger share of the mainframe market, but it seems that the major source of A 15 business is coming from Unisys' own customer base, mostly users of B 6900 and B 7900 systems. The full code compatibility of the A 15 with the B 6900, B 7900, and A Series computers provides the users of these systems with the incentive of a growth path without costly conversion.

The Unisys A Series represents one of the widest ranges of object code-compatible computer systems in the industry. This compatibility provides a smooth migration path from the low-end A 2 to the high-end A 15 Model NX, a 70 times increase in performance growth.

The A 15 features improved processor performance in both commercial and scientific environments. In an I/O-intensive environment, the performance of the A 15 is three to four times that of the B 7900 processor, which is rated at 5.5 MIPS. In a batch or transaction/DMS II mode, the performance is 2.65 to 3.5 times that of the B 7900, and in scientific applications, the performance is 2.0 to 2.7 times that of the B 7900.

USER REACTION

Eight Unisys A 15 users responded to Datapro's 1987 survey of general-purpose computer users. Three respon-

- Write Unit (WU)
- Memory Access Unit (MAU)

Operations are distributed through the five concurrent units, allowing execution order to be determined by resource availability rather than code sequence order.

The Program Control Unit fetches operators from its program cache and translates the operators from the external machine stack architecture into a three-address operation for processing by the Reference Unit and the Execution Unit. These addresses are pointers to locations in the Central Data Buffer which contains 64 registers. Along with these addresses, the PCU allocates a job number and passes on other pertinent information necessary to complete the operation. The job number is used to maintain overall orderly processing of an operator in the various pipelines of the Reference Unit and Execution Unit. The Central Data Buffer locations assigned by the PCU to an operator are deallocated at the end of the operation.

The Reference Unit uses the operator queues built by the Program Control Unit and calculates the absolute address for all data required to perform the operation. It also fetches data from its data cache. If the data is not present in cache, it will prompt the Memory Access Unit to provide the data from the main memory via the cache.

The Execution Unit performs all arithmetic and logic operations on data from the preallocated locations in the Central Data Buffer. The results of an Execution Unit operation may either be stored in the Central Buffer registers or sent to cache memory and the Write Unit.

The Write Unit logic provides and manages a buffer for the storing of data from the Execution Unit before sending it to the Reference Unit for storing in the data cache. This action minimizes the impact on the Execution Unit of operators that perform write operations.

The Memory Access Unit is pipelined and can handle up to eight separate active requests simultaneously, and concurrently process returns. The Memory Access Unit performs nonlocal references, memory control initiated purge, and return operations. It also handles system message traffic and system interrupts.

SPECIAL FEATURES: The System Control is housed in its own cabinet and contains the Central Power Control for the A 15, the Maintenance Exchange, and the Master System Clock. The Central Power Control function allows all mainframe components to be powered up or down from one central location. The Maintenance Exchange provides connectivity from the System Maintenance Processor to every possible mainframe unit under test. The Master System Clock provides the proper clock rate signals to each of the mainframe units that require a clock signal.

The System Maintenance Station contains the electronics and storage for the ET2000-based soft console. Two ET2000 terminals are provided, each with its own Maintenance Interface Processor, dual Winchester disk drives, disk controller, and diskette drive. Each Maintenance Interface Processor is cabled to the Maintenance Exchange in order to access all the mainframe units. The dedicated System Maintenance Processor (SMP), located in the I/O subsystem cabinet, executes diagnostic programs on the A 15, and is intended to operate at all times. The A 15 can also be remotely supported from a Remote Support Center via a data communications link to the SMP. Diagnostic programs may be initiated remotely to run on the System Maintenance Processor to test various hardware components such as the Central Processor, Host Data Unit, or the Memory Subsystem.

Unisys A15

dents purchased their systems directly from the manufacturer and five users leased their computers from a third-party vendor. Four respondents upgraded from older Burroughs systems, one user converted from another vendor, and three were first-time Unisys A 15 users. The A 15 Systems were operating in a wide variety of installations: transportation; retail and wholesale businesses; banks, public untilities, government agencies; and a disaster backup site. The principal applications were accounting and billing; payroll and personnel; order processing and inventory; purchasing; and sales and distribution.

Four respondents already had the new MCP/AS Release 3.6 operating system installed. The most popular programming language was Cobol. The Data Base Management System DMS II was used by all eight users, and was rated Good to Excellent for Overal satisfaction, Ease of installation and use by all but one user. The usual complaint was Documentation and Maintenance.

Five respondents had implemented a disaster recovery plan, while two were in the planning stage. Three users had established an information center, and one user was planning such a center during 1987. When asked about plans concerning future acquisitions, most users listed additional software from the manufacturer or other suppliers, as well as expansions to present hardware and data communications facilities as priorities for 1987.

As part of the survey, users were asked to rate their computer systems on a scale from excellent to poor. A weighted average was then calculated based on the total responses. The users were very satisfied with the MCP operating system and the reliability of the A 15. But again this year, Detroit please note, the areas of Troubleshooting, Education, and Documentation drew complaints from the users. The ratings of the A 15 systems are summarized in the following table:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	6	2	0	0	3.75
Reliability of system	6	2	0	0	3.75
Reliability of peripherals	1	7	0	0	3.13
Maintenance service:					
Responsiveness	6	2	0	0	3.75
Effectiveness	5	2	0	1	3.38
Technical support:					
Troubleshooting	1	5	2	0	2.88
Education	1	4	3	0	2.75
Documentation	1	3	3	1	2.71
Manufacturers software:					
Operating system	6	2	0	0	3.75
Compiler & assemblers	5	3	0	0	3.63
Application programs	0	5	3	0	2.63
Ease of programming	4	4	0	0	3.50
Ease of conversion	3	5	0	0	3.38
Overall satisfaction	3	5	0	0	3.38

*Weighted Average on a scale of 4.0 for Excellent.

When asked if their computer system performed as expected, all eight respondents said "Yes," and all users would recommend their system to other users. □

PHYSICAL SPECIFICATIONS: The A 15 central processing complex includes the Central Processor Module, the Input/Output Subsystem Module, the Memory Subsystem Module, the System Maintenance Station, and the System Control Cabinet. Models FX, HX, IX, and JX have a footprint ranging from 40.5 to 62.5 square feet. Power consumption ranges from 22.7 kVA for the Model FX to 45.1 kVA for the Model JX and heat dissipation is 70,300 to 139,700 Btus per hour. Floor space required by the Models KX, LX, MX, and NX ranges from 63.5 to 72.1 square feet. Power consumption ranges from 45.8 kVA for the Model KX to 60.5 kVA for the Model NX and heat dissipation is 141,700 to 187,500 Btus per hour.

CONFIGURATION RULES

The A 15 System is available in eight models with one to four processors and a memory capacity of up to 192 megabytes.

Model FX consists of one Central Processor with a 48K-byte cache, one Memory Subsystem with 24 megabytes of main memory expandable to 96 megabytes in 12 megabyte increments, and one Input/Output Subsystem supporting up to 32 Data Link Processors (DLPs), and up to 256 data communications lines; also included are a System Control Cabinet, a System Maintenance Station, Maintenance/Operator Display Terminals, and up to three Operator Display Terminals (ODTs). A maximum of two expansion cabinets for Network Support Processors (NSPs) can be configured. Model FX can be field upgraded to Model HX with the addition of a second processor.

Model HX has two Central Processors with a 48K-byte cache each, and main memory can be expanded to 192 megabytes. Model HX can be field upgraded to Model IX with the addition of a second I/O Subsystem.

Model IX also has two Central Processors and the same main memory and cache capacity as Model HX, but is configured with two I/O Subsystems supporting up to 64 DLPs and a maximum of 512 communications lines. Up to four NSP expansion cabinets may be added to the system. Model IX can be field upgraded to either a Model JX or a Model KX.

The dual-processor Model JX is a partitionable system including a second Memory Control with an additional 12 megabytes of memory. Additional partition memory can also be expanded up to 192 megabytes. Model JX can be upgraded to the partitionable Model LX by adding a third processor.

Model KX has three Central Processors, with a total cache of 144K bytes and a main memory capacity ranging from 24 to 192 megabytes. Model KX can be upgraded to the partitionable Model LX with the addition of a second 12-megabyte Memory Subsystem. An upgrade to a Model MX is accomplished by adding a fourth processor to the system.

Model LX is a partitionable system with three Central Processors and a 144K-byte cache. The second Memory Control with 12 megabytes of memory can also be expanded to 192 megabytes. Model LX is field upgradable to the high-end, partitionable Model NX by adding a fourth processor.

The four-processor Model MX has a total cache capacity of 192K bytes and a main memory ranging from 24 to 192 megabytes. To upgrade the Model MX to the partitionable Model NX requires the addition of a second Memory Subsystem.

The high-end, four-processor Model NX is a partitionable system with a maximum cache capacity of 192K bytes and a main memory capacity of 192 megabytes.

Unisys A15

TABLE 2. MASS STORAGE

MODEL	B 9484-12	B 9494-10I	B 9494-10S	B 9494-12
Cabinets per subsystem	2 to 16	2 to 8	2 to 8	1 to 8
Disk packs/HDAs per cabinet	1 removable	2 fixed	2 fixed	1 fixed
Capacity	252MB formatted	1084MB formatted	962MB formatted	868MB formatted
Tracks/segments per drive unit	—	—	—	—
Average seek time, msec.	28.5	211.7	13.7	16
Average access time, msec.	36.8	30	22	24.3
Average rotational delay, msec.	8.3	8.3	8.3	8.3
Data transfer rate	1.2MB per sec.	600KB per sec.	1.2MB per sec.	3MB per sec.
Controller model	B 9387-51C, B 9387-52C	B 9387-51C, B 9387-52C	B 9387-51C, B 9387-52C	B 9389, B 9399
Comments	Requires A 304-91 DLP-3	Requires A 304-91 DLP-3	Requires A 304-91 DLP-3	Requires A 304-91 DLP-3

The partitioning option for the Models JX, LX, and NX allows the systems to be split into two logical A 15 subsystems. Partitions can be created and controlled with console operator commands entered at a system console. The system partition can be defined to allow the separation of production work from development work.

INPUT/OUTPUT CONTROL

The Input/Output Subsystem Module (IOSM) is a modular subsystem that houses the following components:

- Host Data Unit (HDU)
- Input/Output Subsystem
- System Maintenance Processor (SMP)
- Data Communications

The Host Data Unit handles all I/O data transfers between the A 15 main memory and the I/O subsystem. The Host Data Unit contains the Memory Bus Control, the Host Dependent Port, and the Queue Manager.

The Memory Bus Control is responsible for controlling the memory operations between the Memory Subsystem Module and the internal requestors in the Host Data Unit. The Memory Bus Control can service up to four internal requestors, three Host Dependent Ports, and the Queue Manager. A bus architecture is used to transfer data, and any bus parity errors are detected by the Memory Bus Control.

The Host Dependent Port provides the physical link between the Host Data Unit and the I/O subsystem via a Message Level Interface. The Host Dependent Port controls the Message Level Interface and is responsible for the format, integrity, and transfer of all I/O data directly to and from main memory. Only one Message Level Interface per Host Dependent Port is active at a time, although two are provided. The Host Data Unit is configured with three Host Dependent Ports, and provides direct connection to 32 Data Link Processors. Additional Data Link Processors can be connected through the use of I/O expansion cabinets.

The Queue Manager maintains the I/O jobs for the Host Dependent Ports. The Queue Manager contains 12,000 bytes of local memory which, is used to store copies of Input/Output Control Blocks relating to I/O requests in progress. The Queue Manager maintains two queue pointers, one pointing to the address of the Host Data Unit's home address queue and the second pointing to the Host Data Unit's error command queue. A 256-word RAM is maintained by the Queue Manager and is used in the Halt/Load sequence. The RAM contains information concerning the Halt/Load unit and the bootstrap code to be executed by the processor.

The Input/Output Subsystem consists of a series of specialized, microprocessor-based Data Link Processors (DLPs). These units control the transfer of information to and from the peripheral subsystem, thereby relieving the Central Processor of that responsibility. The Data Link Processors are also responsible for the transfer of information to and from memory via the Message Level Interface. Each type of peripheral subsystem has its own specialized DLP. Some DLPs (such as those for disk drives) can service multiple peripheral devices of the same type. In operation, a DLP receives a request for an I/O data transfer from the central processor via the Message Level Interface. Some DLPs will accept multiple I/O message requests and queue them for processing. The DLP then initiates the peripheral-dependent functions required to perform the I/O transfer, independent of the central system. Each DLP includes local memory that is used to buffer the data transfer operations.

MASS STORAGE

For information on mass storage devices for the A 15, refer to Table 2.

INPUT/OUTPUT UNITS

For information on magnetic tape units and printers used with the A 15, refer to Table 3.

TERMINALS

For information on terminals used with the A 15, refer to Table 4.

COMMUNICATIONS

The modular Data Communications Subsystem off-loads communications responsibilities from the Central Processor and distributes them to a series of function processors, including the Network Support Processor (NSP), Line Support Processor (LSP), and Quad Line Adapters (QLAs). The A 15 communications networks are serviced with the advanced Network Support Processor (NSP IV).

The *Network Support Processor (NSP)* is a programmable front-end processor that serves as the central element of the communications subsystem; it contains 512K bytes of integrated circuit memory. Interaction between the NSP and the central system is performed at the message level, eliminating the need to interrupt the central system each time a character or word of data is to be transferred. The NSP handles subsystem control, data link control, and line discipline control functions. Subsystem control includes control of data links and stations, information transfer, and network

Unisys A15

TABLE 4. TERMINALS

MODEL	ET 1100	ET 2150	B 25
DISPLAY PARAMETERS			
Max. chars./screen	2080	2080	2240
Screen size (lines x chars.)	24 x 80	24 x 80	29 x 80
Symbol formation	7 x 9 dot matrix	7 x 9 dot matrix	9 x 12 dot matrix
Character phosphor	P39 green	P39 green	P31 green
Total colors/no. simult. displayed	—	8	—
KEYBOARD PARAMETERS			
Style	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII	128 ASCII
Detachable	Standard	Standard	Standard
Program function keys	10	10	10
OTHER FEATURES			
Buffer capacity	512K	512K	256K
Tilt/swivel	Standard	Standard	Standard
Graphics capability	No	Yes	No
TERMINAL INTERFACE	RS-232-C, TDI	RS-232-C, TDI	RS-232-C, RS-422, Centronics, parallel

reconfiguration. Data link control involves tracking logical status of communications lines; making and breaking connections on switched lines; first-level recovery and determining which line-protocol function is to be performed next, and, on multipoint lines, for which station. Station control includes keeping track of the ready/not ready and enabled/disabled conditions for input status of stations on a communications line, device control for properly formatting output display, and handling user options.

The information transfer function includes translating between logical station addresses, transmitting output messages to stations, forwarding input messages from stations to the central system, and performing application-dependent editing upon both output and input messages on a per-station basis. The network reconfiguration function allows an installation to assign, remove, or swap stations or communications lines, permitting dynamic network revisions as the environment changes.

Low-level details of data link control are off-loaded by the Network Support Processor to the *Line Support Processor (LSP)* by down-line loading the appropriate line discipline and parameters in the Line Support Processor. The LSP performs individual line protocol functions as directed by the NSP and provides translation between the character set of the line and the character set of the central system.

The LSPs are a series of specialized microprocessors that provide the connection between the Line Adapters and the NSP. Information is transferred between the LSP and the NSP at the message level, reducing NSP interruptions and allowing more information to be transferred at a time. A single Line Support Processor can support up to 16 half- or full-duplex communications lines with sub-broadband speeds of up to 19.2K bps (bits per second). A special version of the LSP is available for installations requiring 56K bps transmission speeds. This specialized LSP services a single 56K bit Line Adapter and supports transmission rates of 56K bps per second. The same configuration flexibility available with Network Support Processors is available with Line Support Processors. Multiple communications paths may be activated through the use of MCP/AS operator console commands.

A *Quad Line Adapter (QLA)* provides the electrical interface between the LSP and each communication line. The Quad Line Adapter maintains physical control of the line, accumulates characters, and transfers them to or from the LSP. Each Quad Line Adapter includes 4K bytes of local memory for storage of translation tables, message buffers, line parameters, polling sequences, and the code required to control the communications line and line discipline.

The Quad Line Adapters are packaged in sets of four. Each set accommodates the electrical interfaces for four lines, and may be specified as either character oriented or bit oriented. Most communications protocols use character oriented transmission; Burroughs Network Architecture (BNA) uses bit oriented transmission. For each line position within a Quad Line Adapter, one of three types of electrical interfaces must be specified: RS-232, for U.S. modem connection; CCITT V.24, for international modem connection; or TDI/20, for direct connection. Different electrical interfaces can be intermixed within the same Quad Line Adapter, and character- and bit-oriented Quad Line Adapters can be intermixed on the same Line Support Processor. Each LSP accommodates up to four Quad Line Adapters and up to 16 lines.

The *CP2000 Communications Processor* is also available for the A 15 System and can be used as a front-end processor. When placed in a remote location, the CP2000 can perform as a concentrator or controller. Together with the enhanced BNA Network Services software, the communications processor provides distributed processing capabilities, control of terminal networks and gateways which allow Burroughs mainframes to communicate with IBM systems through SNA networks.

SOFTWARE

The System Software Facility for the A 15 System includes the Master Control Program/Advanced System (MCP/AS) operating system, Microcode, Utilities, an Algol compiler, a DC Algol compiler, a Program Binder, the SMF II Site Management, the Work Flow Language (WFL), Menu Assisted Resource Control (MARC), and Cross Reference Symbolic.

OPERATING SYSTEM: The *Master Control Program/Advanced System (MCP/AS)* Release 3.6.4, designed to support the advanced architecture of the A Series family of computers, is the operating systems used by the A 15. The operating system software consists of a group of routines organized in three-level hierarchical fashion. The first level is a kernel routine that fields all interrupt signals and transfers control to the appropriate MCP/AS routines. The second-level routines handle the dynamic resource allocation of main memory, disk storage, I/O devices, processors, and time among the concurrently operating programs. The third-level routines handle utility functions such as job

Unisys A15

scheduling, control card interpretation, file control, library maintenance, etc.

Jobs are submitted to the operating system through the Operator Display Terminal (ODT) and/or the system input units, which can be a card unit or a disk or tape file performing as a "pseudocard unit." As the control statements for each task are analyzed, a partial stack is created on a schedule queue containing the estimated main memory requirements, the priority, the maximum amount of processing time and I/O time, the size and location of the file parameter block, the working storage stack size, and the size and location of code segments. The program scheduling priority ordinarily is specified by the programmer, although a default option automatically assigns a priority job one-half the maximum allowable priority.

The operating system maintains a queue of jobs available for initiation. A scheduling routine evaluates resource and priority requirements of the programs in the queue and schedules their execution so as to utilize the system's resources efficiently in a multiprogramming mode. The job sequence is dynamically rescheduled whenever a high-priority job is introduced into the schedule. When the required resources are available (for example, when a job completes processing or suspends itself to await completion of an input/output operation), an available job with the highest priority is added to the processing mix. Jobs submitted from remote terminals are interpreted and entered into the schedule queue and are added to the multiprogramming mix in much the same way as batch jobs.

The operating system maintains control of tasks through the use of stacks, descriptors, and tables that summarize the history and current status of each task in process. A stack is created for each job in the system to provide storage for basic program and data references. When a task is activated, four high-speed registers are linked to the task's stack memory area. In addition, an area of high-speed local memory is available to contain additional portions of the active stack, for fast access. The contents of the top-of-stack registers are maintained automatically by the central processor hardware according to the requirements of the executing program. Central processors can handle multiple active stacks organized into a tree structure. The tree-structured organization allows program code and program data and variables to be described at different stack levels, thus permitting program code to be reentrant and shared. The tree-structured stack also enables a single task to split itself into two independent tasks by establishing a new link on the stack to make full use of a multiprocessor configuration or to multiprogram independent processes.

Both data and program segments are referenced through descriptors. Segment Descriptors, maintained in a portion of the stack base known as the Segment Dictionary, are the basis for the implementation of virtual memory. In contrast to the fixed-page concept utilized in many storage allocation schemes, programs can be divided into variable-length segments, which are brought into main memory only as they are needed. In MCP/AS, Segment Descriptors contain a length field, ASD (Actual Segment Descriptor) number field, and a touched bit. The length field specifies the length of the code segment in words. The touched bit indicates the status of the ASD number field. If the touched bit is on, the ASD number field points to an ASD table entry, and the ASD table entry points to the code segment in memory or on disk. If the touched bit is off, the code segment is on disk and has never been referenced.

A Data Descriptor is used to fetch data to the stack or to store data in a storage area outside the stack. The Data Descriptors contain a length or index field, ASD number field, touched bit, copy bit, indexed bit, and size field. The size field indicates the size of the data items in the data segment. The index bit indicates the status of the length or index field. If the index bit is on, the length or index field is an index. The touched bit indicates the status of the ASD number field. If the touched bit is on, the ASD number field points to an ASD table entry. The ASD table entry points to the data segment in memory or on disk. If the touched bit is off, the data segment has never been referenced by the program. If the copy bit is off, it specifies that the data descriptor is the original descriptor for a data segment.

The Actual Segment Descriptor (ASD) memory management provides monolithic memory management of memory sizes up to 24 gigabytes. The ASD table is an area in memory which can contain up to one million entries. Each entry in this table is a multiple-word structure. The operating system will initially allocate an ASD table of a size that is proportional to the amount of main memory. The ASD Operator Display Terminal command allows the operator to display the size of the table and the maximum number of entries used, as well as to change the size of the table. The ability to change the size of the ASD table ensures the user the table is large enough for the workload, but not so large as to waste memory. The ASD table contains an entry for each code or data segment which has been touched. A touch will occur on the first reference to the code or data segment. At that time the MCP/AS operating system will allocate an entry in the ASD table. An entry in the ASD table contains an address field and a presence bit. The presence bit indicates the status of the address field. If the presence bit is on, the data or code segment is in memory and the address field contains a 32-bit physical memory address. If the presence bit is off, the data or code segment is on disk and the address field contains the record number of the item in the overlay or code file. With ASD memory management, when an area of physical memory is overlaid all data and segment descriptors point to a common descriptor, the ASD.

True dynamic memory allocation is a feature of the operating system. The compilers automatically divide all object programs into logical, relocatable segments. Moreover, all object programs are reentrant. Because code is never modified during execution, two or more jobs can concurrently make use of a single program segment residing in main memory. Program and data segments are automatically transferred from disk storage to main memory when needed. When necessary, the operating system automatically overlays these new segments over other program or data segments that have not been accessed recently.

Memory protection is provided by a combination of hardware and software features. Two registers associated with the stack mechanism, the Base of Stack register and the Stack Limit register, define the upper and lower limits of the stack. An interrupt is generated if an attempt is made to exceed these limits. When an element in a data array is referenced, an automatic comparison of the index value of the data element and the length of the data area, as specified in the Data Descriptor, identifies any attempt by a program to reference beyond its designated data area. In addition, control bits in each word prevent a user program from altering program segments, data descriptors, segment descriptors, memory links, control words, and tables maintained by the operating system.

The MCP/AS operating system provides comprehensive input/output and file control facilities, automatically assigning peripheral devices to symbolic files whenever possible to minimize operator intervention. Three tables are maintained by the operating system which contain label equation and file attribute information such as the access type, peripheral type, physical unit being used, etc. This allows modification of file specifications at program execution time. Blocking, buffering, label checking, and other standard I/O control functions are performed in accordance with the programmer's specifications. Magnetic tape drives or disk files can

Unisys A15

TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
B 9495-82	9	1600	PE	75	120,000
B 9495-83	9	1600	PE	125	200,000
B 9495-24	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
B 9495-32	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
B 9495-33	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Printers	**Printing Speed**	**Print Positions**	**Horizontal Spacing, Chars./Inch**	**Vertical Spacing, Lines/Inch**	**Form Size, Inches**
B 9290-30	30 ppm	—	2.5-20	2.5-13.3	8.5 by 11
B 9246-12	1250 lpm	132	10	6 or 8	15
B 9246-21	2000 lpm	132	10	6 or 8	15

be freely used as backup or "pseudo" devices for card readers, punches, and printers. This makes it unnecessary to delay the processing of a job because of the nonavailability of a particular I/O unit.

Communication between the system operator and the operating system is accomplished through a combination of CRT display units, keyboards, control statements, and a comprehensive system log. The status of the system and of the jobs in progress is presented on the CRT displays. Messages and requests can be keyed by the operator, and the system responses are displayed on the CRT. Jobs are usually submitted to the system in the form of a set of control statements accompanied by a source language deck, or alternatively through control statements entered through the console keyboard if the programs have previously been compiled and stored on disk. Jobs to be compiled must be accompanied by a compile statement identifying the compiler to be used and specifying one of three types of compilations: compile and execute, compile for the library, or compile for the syntax. Optional control statements for all jobs contain an execution statement, process time statement, priority statement, and I/O statements which associate file labels with specific input/output devices.

Memory Disk is a major new feature of the MCP/AS operating system. With Memory Disk, some portion of the system's main memory may be used as a disk unit. Up to two units of Memory Disk can be specified as a family or as individual units. Each unit is declared in terms of pages, with 768K bytes per page. Up to 80 pages are possible per unit, or a total of 120 megabytes for two units. Each unit must be identified as a unique peripheral unit and will be treated as a disk. From 3 megabytes up to 120 megabytes of memory may be specified as disk, and files from any disk unit may be copied to the Memory Disk units.

The software *Disk Cache Module* is available under the current MCP/AS operating system. It permits users to designate a complement of main system memory as a disk cache unit to ensure that data is directly accessible from main memory rather than disk. The Cache Module supports all information managed on each disk unit selected. Disk caching is automatically performed at the track or half-track level, depending on the type of disk specified. Disk units selected for disk caching can be dynamically added or removed from disk cache support at any time. The Disk Cache Module requires a minimum of 48 megabytes of system memory and a minimum system memory configuration of 72 megabytes.

The *Menu Assisted Resource Control (MARC)* module has been enhanced under MCP/AS to provide a more flexible system. The MARC module offers menu assistance for all system operations. Complete on-line help and teach information is available. A direct interface allows a user to define, create, and name commands to be executed by MARC.

Work Flow Management is an MCP/AS facility that provides enhanced capabilities for the control of task initiation and resource allocation. The *Work Flow Language (WFL)* enables users to describe each job as a network of interrelated tasks. The WFL compiler accepts these control statements as input and generates machine code to control the tasks within each job as the user prescribes. Facilities provided by the Work Flow Management System include sequencing and synchronizing of related tasks via input from control statements, improved consistency in task restarts after system failures, job summary printouts, multiple job scheduling queues for different levels of service, interfaces for installation-tailored system control programs, and accounting records grouped by job.

PROGRAMMING LANGUAGES: A wide range of high-level and interpreter languages including APL, Algol, Basic, Cobol 68 and 74, Fortran 66 and 77, Pascal, PL/1, and RPG II are supported.

DATA BASE MANAGEMENT: *DMS II* is a comprehensive Data Base Management System which uses MCP/AS facilities for accessing records in the data base to achieve greater runtime efficiency. Through the operating system facilities, the DMS II data base can be accessed by applications programs operating in multiple processing environments, such as batch, remote job entry, time-sharing, and transaction processing. DMS II incorporates a Data and Structure Definition Language (DASDL) that provides for the logical description of data in sets or subsets and for mapping the logical data into physical structures. A variety of retrieval methods are supported, including indexed sequential, indexed random, and bit vectors. The latter method creates indices that require small amounts of disk storage and permit very fast searches.

DMS II permits multiple indices to be established for accessing a file, and each file can be accessed by any of the available access methods to provide retrieval of information by different applications programs. User-language interfaces to the data management system are provided for the Cobol, Algol, RPG, and PL/1 languages. When multiple programs are accessing the data base, DMS II provides

Unisys A15

lockout protection at the record level to prevent simultaneous updating of a record. DMS II recovery capabilities include the ability to audit transactions as they are referenced or added to the data base and a checkpoint/restart capability. A recovery utility is automatically initiated by the operating system in the event of system failure to effect recovery of the data base and the restart of applications programs. In addition, DMS II permits the data base to be dumped concurrently with updates to the files, so that dumps correspond to the current audit trail.

DMS Inquiry is an optional extension of DMS II and provides an easy-to-use language that enables non-EDP personnel to access the data base via remote terminals. Users can "browse" through information stored in the data base and retrieve it either serially or randomly, without the delays normally associated with programming and debugging an inquiry program. Users with appropriate security clearances can also update information in the data base and add new records or delete existing records. The DMS II audit trail captures a record of all data base maintenance functions to facilitate automatic recovery.

DMS II DB Analyzer gives detailed statistical and descriptive attributes of both the physical and logical data base implementation. The information is presented by means of a series of predefined report programs, aiding the user in determining the efficiency of the current implementation, changing the structure for increased efficiency, and deciding when reorganization is needed.

DMS II DB Monitor provides realtime monitoring and control of the status of a DMS II data base. DB Monitor provides dynamic monitoring of current data base performance statistics such as memory usage, audit trail attributes, sync point/control point frequency, buffers allocated for each structure, and user counts of the number of programs accessing the data base and one or more structures within it.

DM Interpreter is a DMS II facility which expands the capabilities and control characteristics of DMS II. It provides an interpretive interface to a DMS II data base, permitting non-DMS II languages access to DMS II-managed information. This allows for extended flexibility in a DMS II environment. It uncouples the application from the data base and allows data base changes without a corresponding recompilation of the application program, in most cases.

The *Advanced Data Dictionary System (ADDS)* is a DMS extension providing for the centralized definition, storage and retrieval of data descriptions. Information about DMS II data base definitions, Cobol 74 file structures, and SDF screen formats are all stored in the ADDS data base. Line and page scrolling allow easy browsing of data base structures and their entities. A security mechanism restricts access to the dictionary contents by assigning an authorized user code when ADDS is first brought on-line. Tracking of Cobol 74 programs is optionally enforced by the Dictionary Administrator. If enforced, all Cobol 74 programs must have a valid ADDS program name identified in the dictionary. A set of report programs provide on-line support and store the specifications of printed reports for future viewing and modification.

Extended Retrieval with Graphic Output (Ergo): The enhanced inquiry and reporting system is used to access DMS II data bases and conventional files defined in the Advanced Data Dictionary System. Ergo offers a graphic representation of information and defines the relationships between data sets and powerful selection expressions to filter the data used in reports. Ergo features a prompt mode and Help commands to guide the user. Multiple presentation formats allow the user to select the most appropriate graphic output representation.

Data-Aid is an interactive, menu-driven system complemented by on-line help and teach. If a new data base is to be described, Data-Aid transfers the user to ADDS. Data-Aid monitors the generation of the data base software modules and the data base initialization, then transfers the user to ERGO to load the data base through the ERGO update capabilities, and report against it. On request, Data-Aid will initiate and track the Dump, Copy, and Recovery functions of the data base.

DATA MANAGEMENT: Included in DMS II described above.

DATA COMMUNICATIONS: The special-purpose programming tool *Network Definition Language II (NDL II)* enables users to define and generate customized NSP control programs for data communications applications. These programs equip the NSP to handle line disciplines, buffer management, message queuing, auditing, and supervision of the flow of messages between user-coded programs and remote terminals. This enables the user's application programs to deal with remote terminals in the same manner as with conventional on-site peripheral devices. IBM data communications algorithms allow Burroughs networks to interface to non-Burroughs terminals utilizing 3270 and 2780/3780 protocols. The IBM 3270 protocol supports both terminals and printers compatible with the IBM 3270 bisynchronous protocol for DLP-based systems. A point-to-point bisynchronous algorithm enables DLP-based A Series systems to support communications to IBM 2780/3780 RJE terminal devices.

The *Interactive Datacomm Configurator (IDC)* is an extensive tool to aid in the on-line development, implementation, and maintenance of data communications. It provides a menu-driven interface to configure the data communications subsystem from a workstation or the operator display terminal. The terminal network configuration can be changed dynamically without interruption to the network. A new enhancement enables the IDC to convert NDL to NDL II.

The *Generalized Message Control System (Gemcos)* generates an installation-defined Message Control System (MCS) that manages a transaction-oriented communications network, provides security, handles transaction routing, controls message formatting, and provides a transaction processing interface for application programs. All transaction terminals in the network are controlled by the Gemcos-created MCS and interfaced to the applications programs and the data base. Gemcos enables users to develop transaction processing applications programs independently of the network environment. The input to Gemcos is coded in the Transaction Control Language, a descriptive, free-form language that uses keywords to describe both the network environment and the requirements for message routing, message formats, access control, and recovery.

The *Communication Management System (Coms)* is an advanced communication monitor facility. Coms provides most of the features offered by Gemcos and enables users to develop transaction programs independently of the network environment. Coms supports direct windows providing multiple views of the system and allows Cobol 74 programs to communicate with it. Verification of messages received by a terminal are confirmed back to the direct window. Programs communicate dynamically over a modem with a station. This dial-out capability is flexible and easy to use within an application program.

The *Command and Edit (Cande)* program enables multiple users at remote terminals to create programs or data files,

Unisys A15

compile and execute programs, edit and alter programs or files, search files, send messages to other terminals, and perform a variety of other functions. Files created through Cande can be saved and used later by the same user or by other users to whom access is granted. Cande provides the capability for interactive program development and testing concurrently with the execution of applications programs. It also provides effective control of the access, security, and charging functions in a computer time-sharing network.

Remote Job Entry (RJE) enables users at remote batch terminals to enter jobs into the computer system in the same manner as if they were on-site in the computer room. RJE allows files to be transferred between remote systems, and enables terminals attached to remote systems to be controlled by the host system.

Burroughs Network Architecture (BNA) software is designed to enhance the interaction of terminals with host CPUs in a network environment. BNA is also designed to facilitate distributed data processing. Through the BNA architecture, processors and terminals can be granted access to data bases throughout a network. Job tasks and information files can be transferred from one point to another, and data processing resources available in a network can be shared among participants regardless of location. BNA works with existing terminal networks and with the Global Memory multiprocessing facility available on large-scale processors. BNA depends on logical links rather than physical links, relying on network tables maintained in the host processor for routing. All routing is through host mainframes. Services provided by BNA include those designated host, and those designated network. Host services include coordination of communication between tasks being executed at various hosts; control of the creation, updating, and transfer of data from host to host; and handling of communication with logical points within the network. Network services perform message routing, linking hosts using the *Burroughs Data Link Control (BDLC)* bit oriented protocol. Network services also permit connection of the vendors processors to packet-switching services using X.25 procedures. Links can also be established to machines of other manufacturers using software such as NDL II.

PROGRAM DEVELOPMENT: The *Logic and Information Network Compiler II (Linc II)* is a fourth-generation programming language which generates complete on-line, realtime systems, including programs, data base descriptions, screen formats, transaction management, and network management. Where possible, the Linc II Interactive System utilizes menu and checklist formats to provide user guidance in the development process. The central menu is referred to as the Activities Menu and provides access to all areas within the Interactive System. All documentation for Linc II will be available on-line in the Linc II Interactive System.

The Linc II Data Dictionary facility provides for the user a new level of project control when developing Linc II applications, and allows the user to specify common data items and their characteristics to ensure consistency whenever those data items are used in Linc II developed applications. There are two levels within the Data Dictionary facility. The Global level is for data items to be used across multiple Linc II applications, and the Local level is for single Linc II applications.

Using Linc II, all screen and report formats are built through an interactive painting process. This process permits a screen or report format to be developed and displayed without requiring a generation, but a generation is still required to put the form into production. The Linc II enhanced generation process, using the interactive syntax checking and screen and report painting features, will significantly reduce the previous Linc generation times, as well as the number of generations necessary to create the production version. The Linc II Logic Editor is used to enter the specifications for global logic, global setup data items, keywords, profiles, teach/help text for a screen format, and all types of on-line and report logic. Linc II command syntax convention is still required by the Linc II Editor. As a page of logic is entered and the screen is transmitted, the Editor will verify all information for syntax errors and return the page with any errors highlighted. Temporary memory areas may be defined within the Editor to allow the user to store commonly used logic. Up to nine temporary memory areas can be used, with each area allowing 23 lines of stored logic.

The *Query Mode* facility allows a user to perform generalized interrogations about a Linc II application specification. Essentially, Query provides a higher level "where used" capability, which aids the user in remembering particular naming conventions devised for a Linc II application.

Release 13.0 of Linc II features the ability to download select application functionality and data to BTOS- and MS-DOS-based workstations from a host system. If the mainframe is inaccessible, data is entered in an off-line mode and saved locally on the BTOS or MS-DOS systems, then uploaded to the mainframe when it is available. Release 13.0 provides additional support for display devices, including IBM 3270 or compatible terminals and cluster terminals configured under BTOS.

The *Test and Debug System (TADS)* is an interactive, source-level debugging tool supporting Cobol 74, Fortran 77, and Algol. The debugging code is generated at compilation time and is evoked when the application program is executed with the TADS option set. Program execution will terminate at the initiation of a conditional or unconditional breakpoint specified by the programmer via TADS. Data is then displayed and modified as appropriate, and the execution of the program can continue.

UTILITIES: The Master Control Program includes a variety of utility routines that perform functions such as system resource management, data transcription, library maintenance, and system log analysis. Also included are a multilingual system and an intelligent printer support facility. The System Log program accumulates statistics relating to the execution of programs, the number of file openings and closings, and data on system operations such as halt/load information, time/date changes, the amount of system overhead, and operator input messages. Errors detected during system operation are stored in a Maintenance Log that includes descriptor errors, invalid memory address errors, I/O errors, violations of memory protection, parity errors, and write lockout errors.

OTHER SOFTWARE: The *Intelligent Distributed Editor (IDE)* supports the Fortran 77, Cobol 74, and Algol languages and offers source file editing and text editing extensions. IDE is available in two versions. In the first version, functions are performed on the host system and interaction is achieved via a standard display terminal. The second version runs under Infoview II on an intelligent workstation, off-loading much of the mainframe overhead associated with editing into the workstation, thus balancing resource utilization between these processing units.

Reporter III is a report writer designed to simplify the retrieval, analysis, and reporting of information maintained in computer files. Reporter III accepts report specifications coded in a free-form report description language and generates a Cobol program tailored to produce the required report. The system can retrieve input data from multiple files and/or DMS II data bases, select data based on a wide range of criteria, perform arithmetic and statistical functions, sort data in ascending or descending order according to multiple keys, control access through a password system,

Unisys A15

produce automatically formatted reports, and create one or more files of extracted data for subsequent processing or reporting.

In addition to the basic version, Reporter III is available in an Advanced version, an Audit version, and an On-Line version. Reporter III (Advanced) adds the capabilities for generation of multiple reports in one pass through the input data, creation of summary-only (matrix) reports, and controlled formatting for special reports or preprinted forms. Audit Reporter extends the Reporter III system by providing auditors with effective software tools for testing and evaluating the records produced by an EDP system. The On-Line Reporter is an optional module that can be added to any of the three preceding systems to provide an on-line mode of operation that enables users at remote terminals to enter, generate, compile, and execute report programs.

The *Screen Design Facility (SDF)* features both screen painting facilities and data entry functions such as field verification, status checking, required field, and many more. An extended inquiry capability displays all form libraries defined in the SDF indexed file or the ADDS dictionary.

The *Transaction Processing System (TPS)* provides the framework and methodology for implementing an application system for high-volume, on-line transaction processing. TPS has the ability to synchronize data base and input message recovery and to centralize, formalize, and simplify message interfaces and user programming. It also provides an interface to access remote data bases using the BNA network.

Infoview II manages the interconnection of intelligent workstations, including the B 25 and ET2000, with the A Series host mainframe. Up to five windows may be assigned using Burroughs MT terminal emulation. One of these windows may be used to run an application program under the workstation-native mode. Native mode for Infoview II will function under MS-DOS on an ET2000 or BTOS on a B 25. Infoview II supports manipulation of the window environment with the keyboard arrow keys or a mouse device. To further control the local workstation environment, the commands View, Edit, Repeat, and Write, as well as a scrolling capability, have been added. Copy and paste functions support the transfer of text between windows, allowing for more effective editing when working with multiple source files.

The *InfoGuard* software security module extends the security facilities already available on the A 15 systems, which prevents unauthorized access and tampering with information. InfoGuard contains extensive password management facilities, such as password aging and password generation. InfoGuard has a disk scrub mechanism that writes over an existing area of disk when a new file is opened. This prevents a new program or user from gaining unauthorized access to previously stored information. The magnetic tape volume protection mechanism that extends security protection to individual tapes completes the access control available on the A 15 Systems. Additionally, InfoGuard offers extensive system auditing and security reporting. The auditor can tailor the auditing of events to meet specific installation requirements, including the ability to selectively view the audit file by individual users. The auditor also can perform a dynamic "spot check" on a specific task or individual when needed. All existing application programs and data bases are supported without the need to reprogram or recompile.

PRICING AND SUPPORT

POLICY: The A 15 System is available for purchase or lease under a 1-year, 3-year, or 5-year lease agreement. The standard lease agreement entitles the customer to unlimited use of the equipment and includes full-time equipment maintenance coverage (24 hours a day, 7 days a week). The standard maintenance agreement for purchased systems covers maintenance of the equipment for eight consecutive hours per day Monday through Friday only; extended maintenance is available at higher rates.

All maintenance charges listed in this report are for monthly maintenance Metro 1 (city) Plan A.

All lease plans may include purchase options that allow 50 percent of the rental paid during the first 36 months to be applied toward the purchase price at any time during the lease period.

SUPPORT: Users can purchase Unisys' Program Product Service Agreement which provides various Support Service packages. The availability of a particular service package (PSA) is product dependent. Generally, PSAs provide for ongoing program product service and/or field service. Program product service deals with corrections by the program product design facility. Field service provides program product problem identification assistance via telephone and/or on-site. Five service packages (PSAs) are defined: Software Product Support (PSA 1), for computers and customers who will not require on-site program product problem assistance; Extended Software Product Support (PSA 2), for computers and customers who will require on-site program product problem assistance; Centralized Software Product Support (PSA 3), for selected program products where only telephone service is needed; Software Product Assistance (PSA 4), for micro and PC products only; and Basic Software Product Support (PSA 5), for certain products for which telephone and on-call services are not generally available.

Mainframe computer systems will be supported from a hardware and operating system (MCP/AS) standpoint for at least seven years from date of last manufacture. Reworked, refurbished, and remarketed models are guaranteed support from a hardware and operating system (MCP/AS) standpoint for a period of five years from date of delivery. Notification of termination of either hardware or operating system support, or both, will be provided at least 24 months in advance of such termination. Unisys will support the current and immediately preceding version of each major release of the operating system and utilities.

All software is unbundled. Program products for the A 15 System are offered under a plan which provides for the use of the products on a designated system on a month-to-month or extended basis.

EDUCATION: Users can obtain the necessary training by paying for individual courses. The currently available courses range from 1 to 10 days in length, and fall into the following broad categories: Systems Management and Operations, Control Systems, Network Systems, Data Base Systems, Programming Systems, and Applications.

TYPICAL CONFIGURATION: The following configurations illustrate three typical A 15 Systems: the low-end Model FX, the medium-level Model JX, and the high-end Model NX. The quoted prices include all necessary hardware, but no software.

Unisys A15

A 15 Model FX:

One single processor with 24MB of memory, 1 I/O Subsystem Module with a System Maintenance Processor, 1 system Maintenance Station, 1 System Control Cabinet, 1 console table, 2 maintenance/ operator displays, 1 operator display terminal, 1 Model F installation kit	$2,940,000
3 B9494-10S disk drives (1084MB)	180,000
3 B9495-83 tape drives (125 ips)	67,341
1 B9387-51C disk cotroller (1x8)	15,750
1 B9387-52C disk controller (2x8)	21,000
1 B9499-22 tape controller (2x8)	85,288
2 B9246-12 line printers (1250 lpm)	89,250
1 AX246-92 line printer DLP-2	4,620
1 AX395-91 tape DLP-2	7,717
1 AX304-91 disk DLP-3	7,581
3 AX372-5 Network Support Processors	126,000
12 AX378-1 Line Support Processors	50,400
48 AX378-3/4 Quad Line Adapters	151,200
20 ET1100 terminals	33,180
TOTAL PURCHASE PRICE:	$3,779,327

A 15 Model JX:

One dual processor with 36MB of main memory, 2 Memory Subsystems, 1 I/O Subsystem with a System Maintenance Processor, 1 extra I/O Subsystem, 1 System Control Cabinet, 2 console tables, 2 Maintenance/ Operator Displays, 3 Operator Display Terminals, 1 Model J installation kit, 1 partitioning option	$5,185,000
1 B9494 disk drive (868MB)	34,450
1 B9399 dual string controller	26,100
1 B9380 dual storage controller	53,600
1 B9389-DH dual host option	5,450
2 B9494-10S disk drives (1084)	120,000
1 B9387-52C disk controller (2x8)	21,000
8 B9495-24 tape drives (200 ips)	289,800
2 B9499-22 tape controllers (2x8)	170,576
4 B9246-21 line printers (2000 lpm)	160,000
3 AX304-91 disk DLP-3	22,743
2 AX395-92 tape DLP-3	15,434
2 AX246-92 line printer DLP-2	9,240
4 AX372-5 Network Support Processors	168,000
16 AX378-1 Line Support Processors	67,200
64 AX378-3/4 Quad Line Adapters	201,600
60 ET1100 terminals	99,540
TOTAL PURCHASE PRICE:	$6,649,733

A 15 Model NX:

Two dual processors with 36MB of main memory, 2 Memory Subsystems, 1 I/O Subsystem with a System Maintenance Processor, 1 extra I/O Subsystem, 1 System Maintenance Station, 1 System Control Cabinet, 2 console tables, 2 Maintenance/ Operator Displays, 3 Operator Display Terminals, 1 Model N installation kit, 1 partitioning option	$ 8,475,000
12 12-megabyte memory modules	1,728,000
1 memory cabinet with 12MB memory	250,000
1 B9494 disk drive (868MB)	34,450
1 B9399 dual string controller	26,100
1 B9380 dual storage controller	53,600
1 B9389-DH dual host option	5,450
4 B9494-10S disk drives (1084)	240,000
2 B9387-52C disk controllers (2x8)	42,000
12 B9495-24 tape drives (200 ips)	434,700
3 B9499-22 tape controllers (2x8)	255,864
5 B9246-21 line printers (2000 lpm)	200,000
1 B9290-30 laser printer (30 ppm)	65,000
1 AX293-30 nonimpact printer DLP-3	4,500
3 AX246-92 line printer DLP-2	13,860
5 AX304-91 disk DLP-3	37,905
3 AX395-92 tape DLP-3	23,151
1 X112-ICP Integrated Communications Processor DLP	14,200
4 AX372-5 Network Support Processors	168,000
16 AX378-1 Line Support Processors	67,200
64 AX378-3/4 Quad Line Adapters	201,600
1 CP2000-P Communications Processor	13,500
100 ET1100 terminals	165,900
TOTAL PURCHASE PRICE:	$12,256,980

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
PROCESSORS AND MEMORY					
A 15 Model FX	Basic System; includes one single processor, one memory subsystem module, 24MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one system maintenance station, one system control cabinet, one console table, two maintenance/operator displays, one freestanding operator display terminal, one FX System installation kit	2,940,000	3,616.00	159,168	120,693
A 15 Model HX	Basic System; includes one dual processor, one memory subsystem module, 24MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one system maintenance station, one system control cabinet, one console table, two maintenance/operator displays, one freestanding operator display terminal, one HX System installation kit	4,235,000	5,859.00	229,944	193,040

**For 5-day, 8-hour service.*
***Includes 7-day, 24-hour maintenance coverage.*
NC—No charge.

Unisys A15

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
PROCESSORS AND MEMORY (Continued)					
A 15 Model IX	Basic System; includes one dual processor, one memory subsystem module, 24MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one I/O subsystem module, one system maintenance station, one system control cabinet, one console table, two maintenance/operator displays, one freestanding operator display terminal, one IX System installation kit	4,570,000	6,736.00	247,419	188,019
A 15 Model JX	Basic System; includes one dual processor, two memory subsystem modules, 36MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one I/O subsystem module, one system maintenance station, one system control cabinet, two console tables, two maintenance/operator displays, three freestanding operator display terminals, one JX System installation kit, one partitioning option	5,185,000	7,276.00	280,607	213,107
A 15 Model KX	Basic System; includes one dual processor, one single processor, one memory subsystem module,24MB main memory, one I/O subsystem module with a system maintenance processor, one I/O subsystem module, one system maintenance station, one system control cabinet, one console table, two maintenance/ operator displays, one freestanding operator display terminal, one KX System installation kit	6,120,000	9,136.00	331,915	252,265
A 15 Model LX	Basic System; includes one dual processor, one single processor, two memory subsystem modules, 36MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one I/O subsystem module, one system maintenance station, one system control cabinet, two console tables, two maintenance/ operator displays, three freestanding operator display terminals, one LX System installation kit, one partitioning option	6,830,000	9,676.00	370.503	281,403
A 15 Model MX	Basic System; includes two dual processors, one memory subsystem module, 24MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one I/O subsystem module, one system maintenance station, one system control cabinet, one console table, two maintenance/operator displays, one freestanding operator display terminal, one MX System installation kit	7,665,000	11,536.00	416,416	316,516
A 15 Model NX	Basic System; includes two dual processors, two memory subsystem modules, 36MB main memory, one I/O subsystem module with a system maintenance processor (SMP), one I/O subsystem module, one system maintenance station, one system control cabinet, two console tables, two maintenance/operator displays, three freestanding operator display terminals, one NX System installation kit, one partitioning option	8,475,000	12,076.00	460,401	349,701
A 15-FTH	Model FX to Model HX upgrade includes one single central processor module V kit, one FX to HX installation kit	1,420,000	2,243.50	77,519	58,959
A 15-HTI	Model HX to Model IX upgrade includes one I/O subsystem module, one HX to IX installation kit	370,000	800.00	19,111	14,656
A 15-ITJ	Model IX to Model JX upgrade includes one memory subsystem module, one console table, one 12MB memory module, one partitioning option, two freestanding operator display terminals, one IX to JX installation kit	670,000	500.00	36,433	27,523
A 15-ITK	Model IX to Model KX upgrade includes one single central processor module V, one IX to KX installation kit	1,695,00	2,400.00	92,596	70,326
A 15-JTL	Model JX to Model LX upgrade includes one single central processor module V, one JX to LX installation kit	1,805,000	2,400.00	98,536	74,776
A 15-KTL	Model KX to Model LX upgrade includes one memory subsystem module, one console table, one 12MB memory module, one partitioning option, two freestanding operator display terminals, one KX to LX installation kit	780,000	2,400.00	42,106	31,711
A 15-KTM	Model KX to Model MX upgrade includes one single central processor module V, one KX to MX installation kit	1,695,000	2,400.00	92,596	70,326
A 15-LTN	Model LX to Model NX upgrade includes, one single central processor module V, one LX to NX installation kit	1,805,000	2,400.00	98,536	74,776
A 15-MTN	Model MX to Model NX upgrade includes one memory subsystem module, one console table, one 12MB memory module, one partitioning option, two freestanding operator display terminals, one MX to NX installation kit	890,000	500.00	48,313	36,433
A 1510-MEM	Memory Module; 12 megabytes	144,000	45.00	7,845	5,901
A 1511-MEM	Memory Cabinet with 12MB memory module (required for 96 to 108MB upgrade only)	250,000	200.00	13,795	10,447

**For 5-day, 8-hour service.*
***Includes 7-day, 24-hour maintenance coverage.*
NC—No charge.

Unisys A15

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
SYSTEM OPTIONS					
A 15-IIC	Independent I/O Cabinet	45,000	138.00	2,650	2,043
A 15-II2	Additional Independent I/O Cabinet	45,000	138.00	2,650	2,043
AX 95-92	Distribution Module	1,654	6.50	59	54
AX 95-93	Logic Expansion Module	3,880	19.00	149	121
A 15-1AS	ASD Kit for one I/O subsystem module (for A 15 System installed before July 1986 only)	20,000	—	995	750
A 15-2AS	ASD Kit for two I/O subsystem modules (for A 15 System installed before July 1986 only)	40,000	—	1,990	1,500
A 930-2	I/O Base Exchange for two processor system (required for each base to be exchanged)	4,725	15.00	216	167
A 930-3	I/O Base Exchange for three processor system (required for each base to be exchanged)	6,825	22.00	312	231
A 930-4	I/O Exchange for four processor system (required for each base to be exchanged)	8,925	29.00	408	295
A 995-92	Distribution Module (one required for each base to be exchanged when upgrading from two to three, or three to four processors)	2,625	8.00	119	92
A 995-93	Line Expansion Module (LEM 1x4)	3,859	18.50	148	120
A 995-94	Line Expansion Module; upgrade kit (1x4 to 1x7)	2,100	20.00	141	115
DATA LINK PROCESSORS					
for A1582/A1583 I/O Subsystem)					
B 7341-90	Operator Display Terminal DLP-3	8,106	78.00	255	220
AX110-90	Card Reader DLP-2	3,739	37.50	128	111
AX112-90	Card Punch DLP-2	3,676	36.50	126	109
AX246-92	Line Printer DLP-2; 2000 lpm	4,620	36.50	159	137
AX247-94	Train Printer DLP-2	4,620	36.50	159	137
AX293-30	Non-Impact Printer DLP-3	4,500	28.00	235	187
AX393-90	NRZ Magnetic Tape DLP-3	7,560	46.00	379	301
AX395-91	PE Magnetic Tape DLP-2	7,717	55.50	250	215
AX395-92	GCR/PE Magnetic Tape DLP-3	7,717	55.50	250	215
AX304-90	Disk Pack DLP-2; interlaced	7,581	55.50	257	222
AX304-91	Disk Pack DLP-3; sequential/interlaced	7,581	39.00	400	285
X112-ICP	Integrated Communications Processor DLP; (for B 7900 and A 15)	14,200	95.00	1,164	905
AX394-93	Hyperchannel DLP; includes two 50 ft. I/O cables, bus and tag terminators or two 100 ft. I/O cables, bus and tag terminators	21,000	150.00	1,345	1,075
for A15-IIC/A15-II2 I/O Subsystem Cabinet					
A 341-90	Operator Console DLP-3	8,400	28.00	445	349
A 341-93	Adapter for additional operator display terminal (ET 1100 only)	3,536	15.00	213	159
X110-90	BCL Card Reader DLP	3,700	46.00	231	193
X112-90	BCL Card Punch DLP	3,700	46.00	231	193
X246-92	Printer DLP (B9246-21)	4,725	46.00	268	220
X246-91	Printer DLP (B9246-10/12)	4,725	46.00	268	220
X293-30	Non-Impact Printer DLP	4,725	46.00	268	220
X393-90	NRZ Magnetic Tape DLP	7,560	46.00	379	301
X395-91	PE Magnetic Tape DLP	7,560	46.00	379	301
X395-92	GCR Magnetic Tape DLP	7,560	46.00	379	301
X304-90	Host Transfer Interlaced DLP	7,560	46.00	379	301
X304-91	Host Transfer Sequential/Interlaced DLP	7,560	46.00	379	301
X113-ICP	Integrated Communications Processor DLP; (for A 12)	14,200	95.00	1,178	919
X394-93	FIPS Hyperchannel DLP-2; (for A 3, A 9, A 10, A 12), includes two 50 ft. I/O cables, bus and tag terminals, or two 100 ft. I/O cables, bus and tag terminals	21,000	150.00	1,345	1,075
MASS STORAGE					
B 9484-12	Disk Pack Drive; 252MB, single spindle, 3 phase power	33,000	137.00	1,550	1,298
B 9494-10I	Fixed Disk Drive; 1048MB, dual spindle interlaced	50,400	220.00	3,131	2,345
B 9494-10S	Fixed Disk Drive; 1084MB, dual spindle sequential	60,000	210.00	3,658	2,746
B 9387-51C	Controller; 1x8 spindle, one interface, cable, and I/O databus kit	15,750	71.00	747	563
B 9387-52C	Controller; 2x8 spindle, two interfaces, cables, and I/O databus kits	21,000	105.00	990	742
B 9387-24	Disk Pack Exchange; 4x16	21,000	66.00	973	730
B 9494-12	Fixed Disk Drive; 868MB, single spindle, thin-film head	34,450	120.00	—	1,495
B 9389	Dual Storage Controller	53,600	176.00	—	2,448
B 9389-DH	Dual Host Option for B 9389	5,450	19.00	—	251
B 9399	Dual String Controller	26,100	85.00	—	1,192

**For 5-day, 8-hour service.*
***Includes 7-day, 24-hour maintenance coverage.*
NC—No charge.

Unisys A15

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
MAGNETIC TAPE UNITS					
B 9495-82	Magnetic Tape Unit; PE, 75 ips, 120KB	16,000	168.00	797	626
B 9495-83	Magnetic Tape Unit; PE, 125 ips, 200KB	22,447	173.00	926	724
B 9499-14H	Controller 125 ips, 1x4, with cabinet for B 9495-82/83	11,465	143.00	803	618
B 9495-24	Magnetic Tape Drive; 200 ips, 1250/320KB, PE/GCR	36,225	294.00	1,417	1,143
B 9495-32	Magnetic Tape Drive; 75 ips, 470/120KB, PE/GCR	17,750	197.00	992	713
B 9495-33	Magnetic Tape Drive; 124 ips, 780/200KB, PE/GCR	19,000	208.00	1,126	806
B 9499-22	Magnetic Tape Controller; 2x8, PE/GCR, with two signal and one communications cable	85,288	535.00	3,185	2,539
B 9499-42	PE/GCR Tape Exchange; 2x16, for B 9499-22, with one communications cable	7,571	30.00	306	239
PUNCH CARD EQUIPMENT					
B 9116	Card Reader; 600 cpm, 80 column	11,372	118.00	511	400
B 9213	Card Punch; 300 cpm	31,085	583.00	1,351	1,097
PRINTERS					
B 9246-21	Train Printer; 2000 lpm, with HSSI interface	40,000	779.00	3,488	2,840
B 9246-12	Band Printer; 1250 lpm, with HSSI interface	44,625	440.00	1,745	1,448
B 9290-30	Intelligent Laser Printing System; 30 ppm	65,000	698.00	4,235	3,358
TERMINALS					
ET 1100-ODT	Operator Display Terminal; 14-inch, with keyboard, RS-232-C/TDI data communications	1,659	21.50	113	85
ET 2150-ODT	Maintenance Display Terminal; 14-inch, monochrome, with keyboard, bit-mapped graphics capabilities, 512K-bit RAM	2,095	27.00	237	191
B 25	Basic Workstation; 80186 processor, 256KB memory, 12 in. monochrome display, standard keyboard	3,060	30.00	—	—
COMMUNICATIONS EQUIPMENT					
AX372-5	Network Support Processor (NSP4); 512KB memory and line expansion module	42,000	215.00	—	1,466
AX378-1	Line Support Processor (LSP3)	4,200	29.00	—	156
AX378-7	Line Support Processor (LSP2); 56KB	10,290	42.00	—	339
AX378-3	Quad Line Adapter II; character	3,150	26.00	—	120
AX378-4	Quad Line Adapter II; bit	3,150	26.00	—	125
1-QD	Fore Plane Jumper Cables; for 1, 2, 3, or 4 Quad Line Adapters	NC	—	—	—
AX369-10	RS-232 Electrical Interface	NC	—	—	—
AX369-11	CCITT V.24 Electrical Interface	NC	—	—	—
AX369-12	TDI/20 Electrical Interface	NC	—	—	—
AX369-41	Autocall Feature; character/bit	NC	—	—	—
AX369-61	CCITT V.35 Electrical Interface	NC	—	—	—
X112-ICP	Integrated Communications Processor; for A 15 and B 7900	14,200	95.00	1,164	905
CP 2000-P	Communications Processor; cabinet, processor, and memory	13,500	47.00	1,040	797
CP 2000-K01	Memory Expansion Kit	4,000	18.00	312	237
CP 2011-80	Line Module; 8-TDI	5,250	19.00	405	313
CP 2011-221	Line Module; 2-RS-232, 2-TDI	4,570	19.00	358	275
CP 2011-401	Line Module; 4-RS-232, 1-RS-366	3,560	19.00	286	221
CP 2012-V35	Line Module; 2-V.35	4,500	19.00	351	270
CP 2012-X21	Line Module; 2-X.21, 1-TDI	4,500	26.00	362	281
CP 2013-1	Line Module; CP LAN	7,925	19.00	599	454
CP 2014-1	Blank I/O Connector	NC	—	—	—
Inter-System Control					
AX321-2	Inter-System Host Control DLP-3; (for A1582/1581 I/O subsystem module)	12,459	71.50	469	386
A 320-5	HUB 16; includes 2 port capabilities	8,610	58.00	338	277
A 320-6	HUB Expansion; provides additional 1 port capability	735	6.00	37	30
CB 736	Inter-System Control Cable; 50 ft. (FCC)	NC	—	—	—
CB 737	Inter-System Control Cable; 100 ft. (FCC)	NC	—	—	—
A 320-IHC	Independently Powered HUB Cabinet	22,270	137.00	855	701
Peripheral Reconfiguration					
A 890-PRC	Peripheral Reconfiguration Cabinet	5,512	37.50	230	197
A 890-3	PRC Disk Pack Control Kit; (B9387-5X/5X, B9389)	1,765	15.00	72	61
A 890-34	PRC Disk Pack Control Kit; (B9387-4X with B9387-3X exchange)	1,765	15.00	72	61
A 890-4	PRC PE/NRZ Magnetic Tape Control Kit	3,859	22.50	163	127
A 890-8	PRC GCR Magnetic Tape Control Kit	2,095	15.00	89	71

**For 5-day, 8-hour service.*
***Includes 7-day, 24-hour maintenance coverage.*
NC—No charge.

Unisys A15

SOFTWARE PRICES

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Product Description				
A 15-ASF	System Software for Model FX includes MCP/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, Program Binder, Microcode, SMF II Site Management, Utilities, Workflow Language, Cross Reference Symbolic, Menu Assisted Resource Control	3,750	21,372	12,372
A 15-ASH	System Software for Models HX, IX, and JX includes MCP/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, Program Binder, Microcode, SMF II Site Management, Utilities, Workflow Language, Cross Reference Symbolic, Menu Assisted Resource Control	4,375	24,936	14,436
A 15-ASK	System Software for Models KX and LX includes MCP/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, Program Binder, Microcode, SMF II Site Management, Utilities, Workflow Language, Cross Reference Symbolic, Menu Assisted Resource Control	5,000	28,500	16,500
A 15-ASM	System Software for Models MX and NX includes MCP/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, Program Binder, Microcode, SMF II Site Management, Utilities, Workflow Language, Cross Reference Symbolic, Menu Assisted Resource Control	5,625	32,064	18,564
	Disk Cache Module	6,360		7,620
Compilers				
A 15-APB	APL B	340	2,100	1,200
A 15-APL	APL/700	340	2,100	1,200
A 15-ATD	Test and Debug (Algol)	200	1,140	660
A 15-BSC	Basic Compiler	263	1,452	792
A 15-COB	Cobol Compiler (ANSI 68)	263	1,512	888
A 15-C74	Cobol Compiler (ANSI 74)	263	1,008	564
A 15-CTD	Cobol 74 Test and Debug System	200	1,140	660
A 15-FOR	Fortran Compiler (Level H)	263	1,512	888
A 15-F77	Fortran Compiler (ANSI 77)	265	1,320	732
A 15-FTD	Fortran 77 Test and Debug System	200	1,140	660
A 15-PAS	Pascal Compiler	375	2,280	1,320
A 15-PL1	PL/1 Compiler	358	2,016	1,140
A 15-RPG	RPG II Compiler	275	1,452	792
A 15-SRT	Sort Utility	248	924	528
Productivity Aids				
A 15-LN2	Logic and Information Network Compiler (LINC II)	7,000	39,900	18,600
A 15-L2R	LINC II Run Time System	480	—	840
Support Utilities				
A 15-BAR	Activity Reporting	131	756	444
A 15-SMR	SMF II System Resource Management	420	2,400	1,392
A 15-LOG	Logger	79	444	252
A 15-BSL	Billing Support Library	83	468	264
A 15-SSL	Security Support Library	83	468	264
A 15-IPF	Intelligent Printer Support Facility	168	948	564
A 15-MLS	Multilingual System	250	1,440	840
Data Communications				
A 15-DCS	Data Communications Software Package includes Network Definition Language II (A 15-NDL), Interactive Data Communications Configurator (A 15-IDC), and NSP/LSP Firmware (A 15-NSF)	263	1,008	564
A 15-NCS	Network Communications Subsystem includes Network Administration Utility (A 15-NAU) and Network Services II (A 15-NSS)	250	1,440	840
A 15-BNS	BNA Network Service	1,200	6,840	3,960
A 15-CDE	CANDE; Command and Edit	341	1,320	756
A 15-COE	Communications Management System; Entry	840	3,156	1,824
A 15-COT	Communications Management System	1,575	5,988	3,468
A 15-DIA	Diagnostic MCS	79	444	252
A 15-EDI	The Editor	210	1,200	696

[1]one-time charge.
[2]extended license fee.

Unisys A15

SOFTWARE PRICES

		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Data Communications (Continued)				
A 15-ESN	SNA 3270 Emulator	115	660	385
A 15-FSL	Format Support Library	110	660	360
A 15-HSV	Host Services	1,200	6,840	3,960
A 15-L62	SNA LU 6.2 Service Manager	200	1,140	660
A 15-MCB	GEMCOS (Basic)	788	4,788	2,772
A 15-MCA	GEMCOS (Advanced)	1,050	5,988	3,468
A 15-MCT	GEMCOS (Total)	1,365	7,812	4,536
A 15-MCF	GEMCOS; Format Generator (requires MCA or MCT)	250	1,512	888
A 15-NDA	NDL II Analyzer	79	444	252
A 15 RJE	Remote Job Entry	105	564	312
A 15-RMP	Remote Print System	300	1,716	996
A 15-SDF	Screen Design Facility	250	1,440	840
A 15-SJE	SNA/RJE	75	428	248
A 15-X25	X.25 MCS	420	2,400	1,392
Data Management				
A 15-DM2	DMS II Data Management System II	1,835	7,020	4,040
A 15-ERG	Extended Retrieval with Graphic Output (requires DMT)	530	3,000	1,620
A 15-D12	DMS II Inquiry	315	1,848	1,080
A 15-IDD	Advanced Data Dictionary System	890	5,280	3,060
A 15-DBA	DMS II Data Base Analyzer	210	1,200	696
A 15-DDM	DMS II Data Base Monitor	210	1,200	696
A 15-DMT	DMS II DM Interpreter	185	1,008	564
A 15-DMC	DMS II DB Certification	210	1,200	696
A 15-DME	Data-Aid	200	1,140	660
A 15-TPS	DMS II Transaction Processing System	235	1,416	792
Reporting				
A 15-RP3	Reporter III	680	3,780	2,040
A 15-OR3	Online Reporter III (requires RP3)	75	420	240
Workstation Integration (Host)				
A 15-DES	Data Entry System	394	2,208	1,260
A 15-DE2	ODESY On-line Data Entry System	400	1,140	1,896
A 15-DTS	Data Transfer System	200	1,140	660
A 15-HLS	Host-Link Server	550	2,976	1,656
A 15-FDE	Intelligent Distributed Editor	300	1,716	996
A 15-RGF	Remote Graphics Facility (CP2000 host application for A 15)	6,300[1]	1,140	660
Networking System Software				
A 99-NCF	Network Control Facility includes Network Control Manager (A 99-NCM), Distributed Control Agent (A 99-DCA), and Graphics Display Module (A 99-GDM)	375	2,160	1,260
A 99-CPG	Custom Protocol Generator	19,500[2]	2,880	1,680
A 99-CPC	CP2000 Configurator	120	720	420
CP2000 Software and Protocols				
CP 2000-COS	CP2000 Operating System Software	80	480	300
C 99-TTY	TTY Station Group	40	240	180
C 99-BSC	Bisynchronous Station Group	50	300	180
C 99-X25	X.25 Protocol	210	1,200	720
C 99-X21	X.21 Protocol	90	540	300
C 99-ST2	SNA PU T2 Adapter	80	480	300
C 99-SDL	SDLC Station Group	50	300	180

[1]one-time charge.
[2]extended license fee. ■