Unisys A 12

MANAGEMENT SUMMARY

Unisys is the name of the new computer company formed by the merger of Burroughs Corporation and Sperry Corporation. The name is new, but otherwise it's business as usual in Detroit. In fact things are rather quiet. No additions or enhancements have been made to the A Series even after IBM announced its new six processor 3090 Model 600. Maybe Detroit is waiting to see the impact IBM's new large-scale mainframe will have on a sluggish economy before the long-rumored, high-end A System will become reality. But maybe it will be sooner; after all, the A 12 was announced in March 1986.

The A 12 is a single-processor, large-scale, general-purpose computer designed to provide a new entry point into the top end of the A Series. Users of the A 12 system can field upgrade to the A 15 systems and increase their processing power nearly seven times without physically replacing their system. The A 12 is compatible with the other A Series mainframes and the B 7900 system. Comparing a similarly configured B 7900 F to the A 12 shows a 30 percent performance improvement for commercial work loads, and up to a 100 percent gain in performance for scientific processing. According to the vendor, the A 12 system is designed for various work environments, a centralized processing hub, a distributed processing node, a program development system, or an information center system.

The A 12 features Emitter Coupled Logic, Very Large Scale Integration (ECL VLSI) circuitry and 256K-byte high-density Dynamic RAM (DRAM) chips, resulting in a smaller

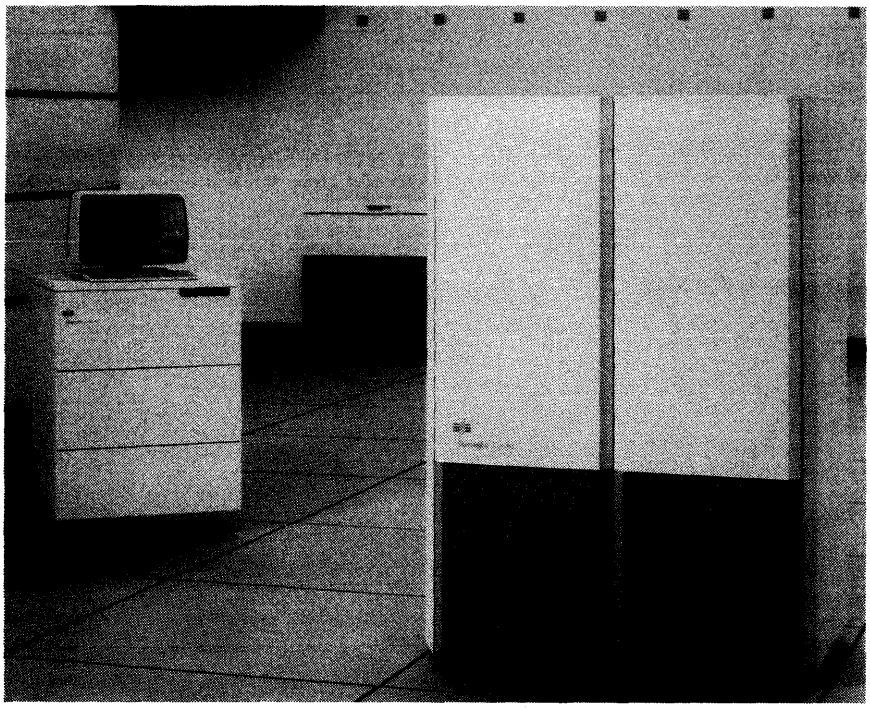
The Unisys A 12 System is positioned between the A 10 dual-processor system and the very large-scale A 15 Systems providing a mid-size entry point into Unisys' large system family. The A 12 is field-upgradable to the A 15 representing a sevenfold increase in processing performance. The A 12 features a distributed architecture and is supported by the Master Control Program/ Advanced System (MCP/AS) operating system.

MODEL: A 12.
CONFIGURATION: The A 12 is a single-processor system with 24 to 96 megabytes of main memory expandable in 24-megabyte increments. The I/O system contains 12 to 48 Data Link Processors which are responsible for information transfer.
COMPETITION: Amdahl 580, Honeywell DPS 88, IBM 308X, and NAS AS/80.
PRICE: The purchase price for a basic A 12 System is $1,400,000.

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.

MODEL: Unisys A 12.



The Burroughs A 12 is a single-processor system offering pipeline architecture for increased efficiency and greater throughput. Main memory capacity ranges from 24 megabytes to 96 megabytes, expandable in 24-megabyte increments. The A 12 is object code-compatible with all the A Series mainframes and is field-upgradable to the high-end A 15.

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footprint and lower energy consumption. The Central Processor, the Memory Storage Unit (MSU) with 24 megabytes to 96 megabytes of main memory, the Memory Control (MC) and the Host Data Unit (HDU), are housed in a single, air-cooled cabinet occupying less than ten square feet. The system also includes two independently powered input/output cabinets that contain two I/O Bases each, and 12 Data Link Processors (DLPs). The Maintenance Subsystem is housed in a separate cabinet. In total, the A 12 requires less than half the floor space of the B 7900 F.

The A 12 operates under the Master Control Program/Advanced System (MCP/AS) operating system which includes several new products and features. Among them are MicroView, a micro/mainframe link; InfoView, a multiwindow capability for microcomputers; and DataAid, an information management facility. Memory Disk and Mirror Disk are two of the major features of the MCP/AS. Memory Disk provides a cost-effective method to improve performance by using the system's large main memory as a disk unit. The increase in speed of memory access over disk access is significant. With Mirror Disk, realtime data on disk units are duplicated, increasing data integrity through multiple pack copies. Critical packs and crucial data base systems are key targets for mirroring. The A 12 also operates with the complete range of A Series software, including the InterPro software series and the Logic and Information Network Compiler (LINC II).

COMPETITIVE POSITION

The A 12 is designed as a general-purpose data processing system and offers a comprehensive library of application program products tailored for specific lines of business, plus general-purpose applications. In this area of general business data processing, the A 12 faces stiff competition from Amdahl, Honeywell, IBM, and NAS systems.

The Unisys A 12 with 24 to 96 megabytes of memory, 24 to 36 Data Link Processors, and a performance rating of approximately 8.6 MIPS (million instructions per second), competes with the Amdahl 5840 with 16 to 128 megabytes of memory, 1 to 31 I/O channels and a performance rating of 8.4 MIPS; and the Honeywell DPS 88/861 with 32 to 64 megabytes of memory, 64 to 128 I/O channels, and a 5.4 MIPS performance rating; also the IBM 3083 with 8 to 32 megabytes of memory, 8 to 24 I/O channels, and an 8.4 MIPS rating; and the NAS AS/8083 with 32 to 128 megabytes of memory, 12 to 32 I/O channels, and a 9 MIPS performance rating. The MIPS ratings are estimates and are based on information supplied by the vendors.

All these systems use different operating systems, instruction sets, and architectures; therefore, they cannot be directly compared. In addition, actual performance varies with the application, software, and peripherals.

ADVANTAGES AND RESTRICTIONS

The A Series offers one of the widest ranges of object code-compatible systems in the industry, a 1.0 to 70.0 increase in

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 Memory Subsystem consists of a Memory Storage Unit (MSU) and a Memory Control (MC). The Memory Control provides the processor interface to the memory subsystem which contains from one to four memory modules. Main memory is based on 256K-bit Dynamic RAM (DRAM) chip technology and is expandable in 24-megabyte increments, from a base of 24 megabytes to a maximum of 96 megabytes. The Memory Control contains a purgeless cache mechanism that extends the memory system to the requestors' cache, allowing only one master of the data referenced by a 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 eliminates 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 (RIMs) 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 (SIMs) provide the interface between the memory control and the storage units.

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

CAPACITY: For memory capacity of the A 12, refer to Table 1.

CYCLE TIME: Not specified.

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

RESERVED STORAGE: Not available on the A 12 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

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TABLE 1. SYSTEM CHARACTERISTICS

MODEL	A 12
SYSTEM CHARACTERISTICS	
Date announced	March 1986
Date first delivered	Third quarter 1986
Field upgradable to	A 15 F
Relative performance	10.3*
Number of processors	1
Cycle time, nanoseconds	62.5
Word size, bits	48
Operating systems	MCP/AS
MAIN MEMORY	
Type	256K-bit DRAM
Minimum capacity, bytes	24MB
Maximum capacity, bytes	96MB
Increment size	24MB
Cycle time, nanoseconds	—
BUFFER STORAGE	
Minimum capacity	Not applicable
Maximum capacity	—
Increment size, bytes	—
INPUT/OUTPUT CONTROL	
Number of channels:	
Byte multiplexer	—
Block multiplexer	—
Word	—
Other	12 to 48 DLPs

**Based on a relative performance of 1.0 for the A 3 Model D.*

relative performance growth. No program or data code conversion is necessary when moving from the A 2 through the A 15 N systems. In addition, the A Series is object code compatible with all previous models of "Burroughs" large-scale computers. The A Series is not compatible with its Unisys stablemate, the "Sperry" 1100 family of mainframes. This leads to speculation that Unisys will concentrate on developing ways to link the two incompatible product lines. The company has to protect not only its own huge investment in its product line, but also the investment of its substantial user base. Unisys will continue with its different computer architectures and operating systems, and it is not the first company to do so. IBM did it first and still does.

USER REACTION

The first customer shipments of the A 12 did not take place until the third quarter of 1986, therefore no user ratings are available. Prospective buyers of the A 12 System may consult the Report "User Ratings of Mainframes" on Page 70C-000EB-101 for user experiences with earlier A Series mainframes. Unisys computers have consistently earned high marks for their operating system, hardware reliability, and conversion ease. □

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)**
- **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 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 Maintenance Subsystem is housed in its own cabinet and consists of integrated error detection and fault isolation units, dedicated Host Maintenance Controllers (HMCs) for error logging and mainframe data access, the System Maintenance Station (SMS II), and the ET2160 intelligent workstation as the System Control/Maintenance Diagnostic Processor (SC/MDP). The System Maintenance Station executes hardware diagnostics and test routines, monitors all A 12 cabinets, and is responsible for system configuration and initialization. It allows remote access to all maintenance functions and remote hardware or system software support through an RS-232 remote support link.The Maintenance Subsystem includes two 85M-byte disk drives, a quarter-inch streaming tape drive, and a 5¼-inch diskette drive.

PHYSICAL SPECIFICATIONS: The A 12 System consists of three cabinets occupying less than ten square feet of floor space. The central processor/memory cabinet is 43.7 inches long and 31.7 inches deep, the system maintenance cabinet and the I/O cabinet each measure 29 inches in length and 29 inches in depth.

CONFIGURATION RULES

The A 12 system consists of one central processor, a memory storage unit containing 24 megabytes of memory expand-

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able to 96 megabytes in 24-megabyte increments, and two independent I/O cabinets with a total of four I/O base modules supporting 12 Data Link Processors (DLPs); also included are a System Maintenance Station, one SC/MDP maintenance terminal, 2 Line Expansion Modules (LEMs), one free-standing operator display terminal, one operator console DLP-3, and one ODT adapter for additional ET1100 operator display terminals. The optional Data Communications Subsystem can be configured with a Network Support Processor (NSP), Line Support Processors (LSPs), and Quad Line Adapters (QLAs), each of which controls four data communications lines.

INPUT/OUTPUT CONTROL

The Host Data Unit (HDU) located in the processor/memory cabinet provides the interface between main memory and the independent I/O cabinets through two Message Level Interfaces (MLIs). Each Message Level Interface connects to an I/O base module in the I/O cabinet. The I/O base modules contain 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 information transfer 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 12, refer to Table 2.

INPUT/OUTPUT UNITS

For information on magnetic tape units and printers used with the A 12, refer to Table 3.

TERMINALS

For information on terminals used with the A 12, 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 12 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 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 downline 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 communicationslines 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 Line Adapter and supports transmission rates of 56K bps. 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 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 12 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 Unisys mainframes to communicate with IBM systems through SNA networks.

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SOFTWARE

The System Software Facility for the A 12 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 Work Flow Language (WFL), Menu Assisted Resource Control (MARC), and Cross Reference Symbolic.

OPERATING SYSTEM: The *Master Control Program/Advanced System (MCP/AS)* designed to support the advanced architecture of the A Series family of computers, is the operating systems used by the A 12. 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 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 "pseudo card 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 work load, 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; a bit maintained in the ASD entry specifies whether or not the segment has been altered. The segment will only be written to disk if it has been altered.

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.

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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

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 provides comprehensive input/output and file control facilities. Whenever possible, peripheral devices are automatically assignd to symbolic files to minimize operator intervention. Three tables are maintained by the operating system, containing 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 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 *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. Products and features such as PrintS and ReprintS are supported 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. WFL has been enhanced with the Print statement providing a batch interface to the PrintS and ReprintS system.

PrintS is integrated with the MCP/AS and provides routing and scheduling of files for printing and controls when and where to print. Printer backup file control descriptors maintain the number of copies to be printed by destination and handle the file after printing. Several descriptors control the presentation of printed files in terms of forms, banners, and transformation of data. *ReprintS* extends these PrintS facilities to remote printers.

Mirror Disk is the parallel functioning of two to four disks where all the units are exact copies of each other. This feature is an extension of the MCP/AS operating system. Critical operations, key object program packs, and data base systems should be mirrored. Each pack may be copied up to three times, with each pack family and each of its copies constituting a mirrored set. On-line creation of mirrors is allowed while still providing access to the master pack. An audit trail is maintained to identify which areas have already been copied, are to be copied, and are in the process of being copied. At the completion of the mirror creation, a recopy of updated areas will take place to ensure the mirrored copy is brought up to the level of the master. Members of a mirrored set residing off-line are audited and updated to match the master and then placed on-line.

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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

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 or 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 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) is an enhanced inquiry and reporting system 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

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Help commands to guide the user. Multiple presentation formats allow the user to select the most appropriate graphic output representation.

Data-Aid is a new, 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 applications 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, 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 to develop and test programs remotely in an on-line environment 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 a move into 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 Unisys terminal networks and with the Global Memory multiprocessing facility available on the vendors 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 Unisys processors to packet-switching services using X.25 procedures. Links can also be established to non-Unisys machines 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 signif-

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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

icantly 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.

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 operation 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, 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. Advanced Reporter III 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

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Unisys 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.

PRICING AND SUPPORT

POLICY: The A 12 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 12 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 configuration illustrates a typical A 12 system. The quoted prices include all necessary hardware, but no software.

A 12:

One single processor with 24MB of memory, 1 Independent I/O cabinet with 2 DLP bases, 1 additional Independent I/O Cabinet with 2 DLP bases, 2 Line Expansion Modules, 1 System Maintenance Station, 1 operator console DLP-3, 1 ODT adapter for ET1100 terminal, 1 ET2160 maintenance terminal, 1 free-standing operator display terminal, 1 system installation kit	$1,400,000
3 B9494-10S disk drives (1084MB)	180,000
3 B9495-83 tape drives (125 ips)	67,341
1 B9387-51C disk controller (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 Processor	110,250
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:	$2,215,996

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
PROCESSORS AND MEMORY					
A 12	Basic System; includes one single processor, 24MB main memory, one independent I/O cabinet with 2 DLP bases, one additional independent I/O cabinet with two DLP bases, two line expansion modules, one system maintenance station, one operator console DLP-3, one ODT adapter for ET1100 terminal, one ET2160 maintenance terminal, one free-standing operator display terminal, and one system installation kit	1,400,000	3,088.50	179,472	161,172
A 12-UT5	Upgrade Kit; A 12 to A 15 F	1,824,000	—	98,586	74,744
A 12-MEM	Additional Memory; 24 megabytes	288,000	108.00	15,486	11,721

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		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
SYSTEM OPTIONS					
A 12-IIO	Independent I/O Cabinet; two DLP bases	45,000	138.00	2,630	2,023
A 12-IO2	Additional Independent I/O Cabinet; two DLP bases	45,000	138.00	2,630	2,023
A 12-CON	Console Table	15,000	—	803	608
A 930-2	I/O Base Exchange for two processor system (required for each base to be exchanged)	4,725	15.50	217	168
A 930-3	I/O Base Exchange for three processor system (required for each base to be exchanged)	6,825	23.00	314	233
A 930-4	I/O Exchange for four processor system (required for each base to be exchanged)	8,925	30.00	410	297
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	19.00	149	121
A 995-94	Line Expansion Module; upgrade kit (1x4 to 1x7)	2,100	20.00	141	115
DATA LINK PROCESSORS					
A 341-90	Operator Console DLP-3	8,400	29.00	447	351
A 341-93	Adapter for additional operator display terminal (ET 1100 only)	3,536	15.50	214	160
X110-90	BCL Card Reader DLP	3,700	46.00	231	193
X112-90	BCL Card Punch DLP	3,700	46.00	231	193
X246-95	Printer Tape DLP (B9246-6/12 and B9498)	5,250	34.00	319	252
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
X304-95	SMD DLP II	9,345	49.00	555	435
X304-97	XSMD DLP	14,500	49.00	816	631
X304-99	SMD Expander	1,890	19.00	115	88
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	145.00	1,569	1,180
B 9494-10I	Fixed Disk Drive; 1048MB, dual spindle interlaced	50,400	227.00	3,158	2,370
B 9494-10S	Fixed Disk Drive; 1084MB, dual spindle sequential	60,000	227.00	3,685	2,773
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	106.00	992	744
B 9387-24	Disk Pack Exchange; 4x16	21,000	70.00	979	736
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
MAGNETIC TAPE UNITS					
B 9495-82	Magnetic Tape Unit; PE, 75 ips, 120KB	16,000	181.50	819	648
B 9495-83	Magnetic Tape Unit; PE, 125 ips, 200KB	22,447	206.50	1,029	811
B 9499-14H	Controller 125 ips, 1x4, with cabinet for B 9495-82/83	11,465	154.50	811	636
B 9495-24	Magnetic Tape Drive; 200 ips, 1250/320KB, PE/GCR	36,225	312.00	1,446	1,172
B 9495-32	Magnetic Tape Drive; 75 ips, 470/120KB, PE/GCR	17,750	209.00	1,011	732
B 9495-33	Magnetic Tape Drive; 124 ips, 780/200KB, PE/GCR	19,000	220.50	1,146	826
B 9499-22	Magnetic Tape Controller; 2x8, PE/GCR, with two signal and one communications cable	85,288	567.50	3,237	2,591
B 9499-42	PE/GCR Tape Exchange; 2x16, for B 9499-22, with one communications cable	7,571	32.00	309	242
PUNCH CARD EQUIPMENT					
B 9116	Card Reader; 600 cpm, 80 column	11,372	127.00	528	417
B 9213	Card Punch; 300 cpm	31,085	630.00	1,434	1,120
PRINTERS					
B 9246-21	Train Printer; 2000 lpm, with HSSI interface	40,000	826.00	3,571	2,923
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

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

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		Purchase Price ($)	Monthly Maint.* ($)	1-Year Lease** ($)	5-Year Lease** ($)
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, RS-232/TDI data-communications	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)	36,750	215.00	2,216	1,756
AX378-1	Line Support Processor (LSP3)	4,200	16.50	163	140
AX378-7	Line Support Processor (LSP2); includes interface	10,290	41.50	452	376
AX378-3	Quad Line Adapter II; character	3,150	26.00	—	125
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; character/bit oriented interface	NC	—	—	—
AX369-11	CCITT V.24 Electrical Interface; character/bit oriented interface	NC	—	—	—
AX369-12	TDI Electrical Interface; character/bit oriented interface	NC	—	—	—
AX369-41	Autocall Feature	NC	—	—	—
X113-ICP	Integrated Communications Processor; for A 12 System	14,200	95.00	1,178	919
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/B974 (for A15IIC/II2)	12,459	70.00	741	554
A 320-5	HUB 16; includes 2 port capabilities	9,040	60.50	363	297
A 320-6	HUB Expansion; provides additional 1 port capability	771	6.00	39	31
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	142.50	865	711
Peripheral Reconfiguration					
A 890-PRC	Peripheral Reconfiguration Cabinet	5,512	37.50	238	197
A 890-3	PRC Disk Pack Control Kit; (B9387-4X/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
Peripheral Power Control					
A 304-PPC	Peripheral Power Control; power for B9387-41/42, B9387-51/52, and B9389 controllers (one 304-PPC per subsystem)	1,155	—	83	68
B9387-RPC	Remote Power Control	236	—	20	17
B9389-RPC	Remote Power Control	210	—	11	8
CB 865	Cable for B9387-RPC; 50-ft.	850	—	59	48
CB 866	Cable for B9389-RPC; 100-ft.	619	—	32	23
CB 867	Cable for B9389-RPC; 200-ft.	1,018	—	52	38

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

SOFTWARE PRICES

		Limited Time-Plan	Annual Product Service Agreements	
Product Description		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
A 12-ASF	System Software for the A 12 includes Master Control Program/Advanced System (MCP/AS), Algol Compiler, DC Algol Compiler, Program Binder, Microcode, Utilities, Workflow Language, Cross Reference Symbolic, Menu Assisted Resource Control	3,300	18,816	10,896

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		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Compilers				
A 12-APB	APL B	340	2,100	1,200
A 12-ATD	Test and Debug (Algol)	200	1,140	660
A 12-BSC	Basic Compiler	250	1,320	720
A 12-COB	Cobol Compiler (ANSI 68)	250	1,440	840
A 12-C74	Cobol Compiler (ANSI 74)	250	960	540
A 12-CTD	Cobol 74 Test and Debug System	200	1,140	660
A 12-FOR	Fortran Compiler (Level H)	250	1,440	840
A 12-F77	Fortran Compiler (ANSI 77)	250	1,200	660
A 12-FTD	Fortran 77 Test and Debug System	200	1,140	660
A 12-PAS	Pascal Compiler	375	2,280	1,320
A 12-PL1	PL/1 Compiler	325	1,920	1,080
A 12-RPG	RPG II Compiler	250	1,320	720
A 12-SRT	Sort Utility	250	840	480
Productivity Aids				
A 12-LN2	Logic and Information Network Compiler (LINC II)	7,840	39,900	18,600
A 12-L2R	LINC II Run Time System	480	—	840
Support Utilities				
A 12-BAR	Activity Reporting	125	720	420
A 12-SMR	SMF II System Resource Management	400	2,280	1,320
A 12-LOG	Logger	75	420	240
A 12-BSL	Billing Support Library	75	420	240
A 12-SSL	Security Support Library	75	420	240
A 12-IPF	Intelligent Printer Support Facility	160	900	540
A 12-MLS	Multilingual System	250	1,440	840
Data Communications				
A 12-DCS	Data Communications Software Package includes Network Definition Language II (A 12-NDL), Interactive Data Communications Configurator (A 12-IDC), and NSP/LSP Firmware (A 12-NSF)	250	1,440	840
A 12-NCS	Network Communications Subsystem includes Network Administration Utility (A 12-NAU) and Network Services II (A 12-NSS)	250	1,440	840
A 12-BNS	BNA Network Service	1,200	6,840	3,960
A 12-CDE	CANDE; Command and Edit	325	1,200	720
A 12-COE	Communications Management System; Entry	800	3,000	1,740
A 12-COT	Communications Management System	1,500	5,700	3,300
A 12-DIA	Diagnostic MCS	75	420	240
A 12-EDI	The Editor	200	1,140	660
A 12-ESN	SNA 3270 Emulator	115	660	385
A 12-FSL	Format Support Library	110	600	360
A 12-HSV	Host Services	1,200	6,840	3,960
A 12-L62	SNA LU 6.2 Service Manager	200	1,140	660
A 12-MCB	GEMCOS (Basic)	750	4,560	2,640
A 12-MCA	GEMCOS (Advanced)	1,100	5,700	3,300
A 12-MCT	GEMCOS (Total)	1,300	7,440	4,320
A 12-MCF	GEMCOS; Format Generator (requires MCA or MCT)	250	1,440	840
A 12-NDA	NDL II Analyzer	75	420	240
A 12-RJE	Remote Job Entry	100	540	300
A 12-RMP	Remote Print System	300	1,740	1,020
A 12-SDF	Screen Design Facility	250	1,440	840
A 12-SJE	SNA/RJE	75	428	248
A 12-X25	X.25 MCS	400	2,280	1,320
Data Management				
A 12-DM2	DMS II Data Management System II	1,750	6,660	3,840
A 12-ERG	Extended Retrieval with Graphic Output (requires DMT)	500	2,760	1,500
A 12-D12	DMS II Inquiry	300	1,740	1,020
A 12-IDD	Advanced Data Dictionary System	850	4,860	2,820
A 12-DBA	DMS II Data Base Analyzer	200	1,140	660
A 12-DDM	DMS II Data Base Monitor	200	1,140	660
A 12-DMT	DMS II DM Interpreter	175	960	540
A 12-DMC	DMS II DB Certification	200	1,140	660
A 12-DME	Data-Aid	200	1,140	660
A 12-TPS	DMS II Transaction Processing System	225	1,260	720

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		Limited Time-Plan	Annual Product Service Agreements	
		Monthly License Fee ($)	PSA 2 ($)	PSA 1 ($)
Reporting				
A 12-RP3	Reporter III	650	3,600	1,920
A 12-OR3	Online Reporter III (requires RP3)	75	420	240
Workstation Integration (Host)				
A 12-DES	Data Entry System	375	2,100	1,200
A 12-DE2	ODESY On-line Data Entry System	400	1,920	1,140
A 12-DTS	Data Transfer System	200	1,140	660
A 12-HLS	Host-Link Server	500	2,700	1,500
A 12-FDE	Intelligent Distributed Editor	300	1,714	990
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	15,000[1]	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. ■