NAS Advanced Systems

MANAGEMENT SUMMARY

UPDATE: *Close on the heels of IBM's announcement of its new 3090 Series, National Advanced Systems introduced its line of mega-mainframes, the Alliance AS/XL Series. This series of processors currently consists of two models, the uniprocessor AS/XL Model 60, and the dyadic AS/XL Model 80. With expected delivery early in the second quarter of 1986, NAS expects its prime market to be very large corporate users who typically experience data processing growth of 60 percent or better annually. The AS/XL Model 60 is the entry-level uniprocessor machine. It operates in the 28 million instructions per second range, which makes it comparable to IBM's 3090 Model 200. The Model 60, available with a base main memory of 32 megabytes, is expandable to 256 megabytes. Also included in the entry-level system is 256K bytes of cache memory. At the high end of the Alliance Series is the dyadic CPU, Model 80, which has 64 megabytes of main memory expandable to 256 megabytes, 32 I/O channels expandable to 64, and 512K bytes of cache memory.*

In previously announced releases, NAS responded to IBM's revamping of the top-of-the-line 308X computer systems by expanding its AS/8000 series to five models and introducing its AS/91X0 series of vector processors. As plug-compatible replacements for IBM 4300, 308X, and 3090 computers, the NAS systems have been designed to provide an increase in price/performance over their IBM counterparts.

NAS has consistently demonstrated its ability to provide IBM plug-compatibility throughout its sixteen model product line. With the introduction of the Alliance AS/XL mega-mainframe, NAS has once again extended its product ▷

The NAS Advanced Systems (AS) family currently consists of 16 models that are compatible with IBM's 4300 Series processors, the 308X Series processors, and 3090 Series processors. The Advanced Systems Series of processors is functionally compatible with IBM software/firmware enhancements, and peripheral equipment.

MODELS: AS/6620, AS/6630, AS/6650, AS/6660, AS/8023, AS/8043, AS/8053, AS/8063, AS/8083, AS/9040, AS/9050, AS/9060, AS/9070, AS/9080, AS/XL 60, and AS/XL 80.

CONFIGURATION: One or 2 CPUs with from 8 to 256 megabytes of main memory, 16K to 256K bytes of buffer storage per processor, and 8 to 64 I/O channels.

COMPETITION: IBM 4341, 4381, 308X, 3090 Series; Amdahl 470 and 580 Series; and IPL 4400 Series.

PRICING: Purchase prices range from $255,000 to $8,900,000.

CHARACTERISTICS

MANUFACTURER: National Advanced Systems (NAS), 800 East Middlefield Road, Mountain View, California 94043. Telephone (415) 962-6100.

MODELS: AS/6620, AS/6630, AS/6650, AS/6660, AS/8023, AS/8043, AS/8053, AS/8063, AS/8083, AS/9040, AS/9050, AS/9060, AS/9070, AS/9080, AS/XL 60, and AS/XL 80. ▶

The recently announced top-of-the-line AS/XL Series is available in two processor models that are compatible with IBM's 3090 Series. The AS/XL Series processors have from 32 to 256 megabytes of main memory and from 16 to 64 I/O channels. The system features VLSI circuits throughout, and a one-megabyte dynamic working storage caching system between the main memory and the cache buffer.

▷ reach to encompass IBM's latest top-end offering, the 3090 Models 200 and 400.

The Alliance AS/XL Series, announced in March of 1985, uses complementary metal oxide semiconductor (CMOS) logic, and the majority of the AS/XL's high-speed functions are built with bipolar ECL gate array logic. The AS/XL Series is the only mega-mainframe to rely solely on the use of very large-scale integrated (VLSI) circuitry. The ECL devices feature 2,000 and 5,000 logic gates per chip, operating at switching speeds as fast as 200 trillionths of a second.

The AS/XL Series supports all current versions of MVS and VM operating systems in both Extended Architecture (XA) and System/370 modes. All peripherals currently supported by these operating systems on large-scale processors will attach to the AS/XL Series models.

A new feature available for the AS/XL Series is a one-megabyte dynamic working storage subsystem that serves as a caching system between the main memory and the cache buffer, thereby reducing access time for the machine's I/O and instruction processors. Another level of cache is a high-speed cache storage subsystem, using 4K-byte ECL RAM devices, with switching speed at 4.5 nanoseconds. These components implement the 256K-byte cache buffer in each instruction processor on the system, and provide fast storage for microcode control programs.

In addition to the storage subsystem, the AS/XL Series includes one or two instruction processors, depending on model, that consist of a buffer control unit, an instruction unit, a general arithmetic unit, and a floating-point unit.

The AS/XL Series also incorporates 40,000 gate complementary metal oxide silicon (CMOS) logic components in its associated I/O processors. In the data streaming mode each channel is capable of data transfer rates of three megabytes per second.

Since the heat generated by all the gates on a chip could damage the chip substrate causing problems in reliability, NAS's use of CMOS and bipolar technology greatly reduces the heat output per gate. This feature allows greater operational switching speed (less than one-quarter nanosecond) and greater density of gates without the problem of excess heat production. The practical result is that the AS/XL can be air-cooled, thereby eliminating the need for costly liquid cooling apparatus and reducing the footprint to half that of the AS/9000 Series.

The use of advanced chip and circuit technology as well as the introduction of new processor models up and down the product line has been characteristic of NAS's committment to provide its users with an attractive alternative to IBM.

NAS manifested this committment in 1983 with the introduction of a high-end AS/6660 processor model, and the overall performance enhancements to the entire AS/6000 line. NAS increased the minimum memory capacity to eight megabytes and expanded the maximum channel ca- ▷

▶ DATA FORMATS

All data formats, instruction formats, and other architectural features completely follow the IBM System/370 architecture.

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two consecutive bytes form a "halfword" of 16 bits, while four consecutive bytes form a 32-bit "word."

FIXED-POINT OPERANDS: Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; 1 halfword (16 bits) or 1 word (32 bits) in binary mode.

FLOATING-POINT OPERANDS: 1 word consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 2 words, consisting of 56-bit fraction and 7-bit hexadecimal exponent, in "long" format; or 4 words in "extended precision" format.

INSTRUCTIONS: 2, 4, or 6 bytes in length, which usually specify 0, 1, or 2 memory addresses, respectively.

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

STORAGE TYPE: See Table 1.

CAPACITY: See Table 1.

CYCLE TIME: See Table 1.

CHECKING: Error checking and correction (ECC) circuitry in main memory performs automatic correction of all single-bit errors and detection of all double-bit and most other multiple-bit memory errors.

A reconfiguration capability is standard with all AS models. In the event of an unrecoverable error, or any other problem with a memory module, the operator can "dial out" the problem module (one-half million, one million, or two million bytes) and reconfigure the remaining memory for continuous operation.

STORAGE PROTECTION: The Store and Fetch Protection features, which guard against inadvertent overwriting and/or unauthorized reading of data in specified 2048-byte blocks or 4096-byte alternative protection on AS/80X3 and AS/90X0 systems are standard in all models.

In addition, the 370-EF feature provides protection for the first 512 bytes of storage for MVS/SE and MVS/SP users. The PLPA segment protection feature protects portions of the MVS/SP Version 1 pageable length packed area, and CMS for VM/HPO users. In Extended Architecture mode, any 4K page can be protected to enhance availability.
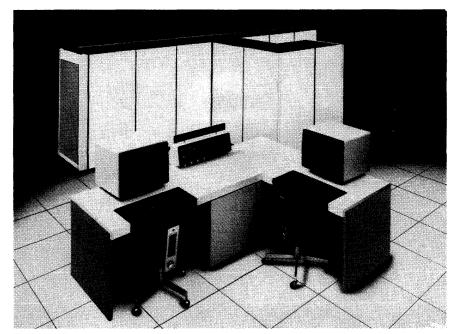
CENTRAL PROCESSORS

INDEX REGISTERS: Sixteen 32-bit general registers, used for indexing, base addressing, and as accumulators, plus four 64-bit floating-point registers per processor.

INSTRUCTION REPERTOIRE: The AS instruction set consists of the complete System/370 Universal Instruction Set, including the five S/370 instructions for Dynamic Address Translation.

INSTRUCTION TIMES: NAS states that individual instruction times are not currently available, but that average execution times for the AS systems will equal or exceed the ▶

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The top-of-the-line AS/9000 Series is available in five processor models that are compatible with IBM's 3083, 3081, and 3084 systems. The AS/9000 Series processors have from 8 to 64 megabytes of main memory and from 6 to 32 I/O channels. The system console includes a service processor, two keyboard/display units, and two floppy disk drives.

▷ pacity to twelve channels on the AS/6650 and to eight channels on the AS/6620 and AS/6630. In addition to the performance improvements, and the expansion of the mid- and high-end processor line, NAS added a High-Speed Arithmetic feature on all AS/6600 Series processors.

Three models within the AS/8000 series were also enhanced in 1983. The AS/8043, AS/8053, and AS/8063 were replacements for the AS/8040, AS/8050, and AS/8060, respectively. These models offer an eight percent improvement in the performance over the previous products. At the same time NAS introduced two new product offerings: the AS/8023 intermediate mainframe and the AS/8083 large-system computer. The entire NAS product line consists of 16 processor models: the AS/6620, AS/6630, AS/6650, and AS/6660; the AS/8023, AS/8043, AS/8053, AS/8063, and AS/8083; the AS/9040, AS/9050, AS/9060, AS/9070, and AS/9080; and the AS/XL 60 and AS/XL 80.

Aside from the system enhancements and new processor introductions, NAS has further strengthened its marketing stance by initiating the use of 256K-bit chip technology on the AS/6600, AS/80X3, and the new AS/XL Series processors. The change to the 256K-bit chip from the 64K-bit chip represents NAS's strategic move as the first mainframe manufacturer to utilize this state-of-the-art technology. According to NAS, the utilization of the 256K-bit chip is intended to reinforce the inherent reliability of the NAS processors. The incorporation of the 256K-bit chip will eventually result in parts reductions, lower memory prices, greater system flexibility, and lower maintenance costs.

The remaining members of the NAS Advanced Systems family feature from 2 to 64 megabytes of main memory, from 16K to 256K bytes of buffer storage per processor, and from 5 to 32 I/O channels. The AS/80X3 base configurations are: 8 channels and 8 megabytes on the 8023; 8 channels and 8 megabytes on the 8043, 8053, and 8063; and 16 channels and 16 megabytes on the 8083.

▷ performance of the comparable IBM processors (see Management Summary).

OPERATIONAL MODES: Like the System/370, the NAS AS computers can operate in either the Basic Control (BC) mode or Extended Control (EC) mode. The BC mode maintains general upward compatibility with the System/360 architecture and programming. In the EC mode, the Program Status Word (PSW) and the layout of the permanently assigned lower main storage area are altered to support Dynamic Address Translation and other system control functions; therefore, the virtual-storage-oriented operating systems must be used.

The selection at IPL time of Extended Architecture allows the AS/80X3, AS/90X0, AS/9100, and AS/XL Series processors to support 370-XA (Extended Architecture) mode. Extended Architecture provides 31-bit addressing, a dynamic channel subsystem, and bimodal operation (the intermix of programs with 24-bit and 31-bit addresses). In 370-XA mode, the AS/6000, AS/9000, and AS/XL Series processors support MVS/SP Version 2 and related products, as well as the VM/XA Migration Aid.

PROCESSOR FEATURES: The timing features of the System/370 architecture are included in the AS central processors. These include a CPU timer and a Clock Comparator; the latter provides a means for causing an interrupt when the standard Time-of-Day Clock reaches a program-specified value. Additional instructions are provided to set and store the Time-of-Day Clock, Clock Comparator, and CPU Timer.

The Direct Control feature provides six external interrupt lines which operate independently of the normal data channels, plus the Read Direct and Write Direct Instructions which provide for single-byte data transfers between an external device and main storage. Direct Control is optional on the AS/6600, the AS/8000, the AS/9000 Series, and the AS/XL Series.

The Extended Addressing feature is standard on the AS/8000, AS/9000, and AS/XL Series processors. Extended Addressing allows the addressing of real storage beyond 16 megabytes as supported by MVS/SP Release 3 and subsequent releases as well as VM/HPO from Release 3. The Extended Channel Adapter is a prerequisite. ▸

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TABLE 1. SYSTEM COMPARISON

MODEL	AS/6620, AS/6630	AS/6650, AS/6660	AS/8023	AS/8043, AS/8053	AS/8063
SYSTEM CHARACTERISTICS					
Date announced	Jan. 1983 (6620), Oct. 1982 (6630)	Oct. 1982 (6650), Sept. 1984 (6660)	April 1984	April 1984	April 1984
Date first delivered	July 1983 (6620), Oct. 1982 (6630)	Nov. 1982 (6650), Dec. 1984 (6660)	July 1984	May 1983 (8043), June 1983 (8053)	Dec. 1983
Field upgradable to	AS/6630, AS/6650	AS/6660, not applicable	AS/8043	AS/8063, AS/8083	Not applicable
Relative performance	—	—	—	—	—
Number of processors	1	1	1	1	1
Cycle time, nanoseconds	60	50 (6650), 43 (6660)	40	40 (8043), 37 (8053)	35
Word size, bits	32	32	32	32	32
Operating systems	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS
MAIN MEMORY					
Type	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256k-bit NMOS
Minimum capacity, bytes	8M	8M	8M	8M	8M
Maximum capacity, bytes	16M	16M	32M	32M	32M
Increment size	4M	4M	8M	8M	8M
Cycle time, nanoseconds	420	420	360	360	315
BUFFER STORAGE					
Minimum capacity	—	—	—	—	—
Maximum capacity	64K	64K	32K	64K	64K
Increment size	—	—	—	—	—
INPUT/OUTPUT CONTROL					
Number of channels:	5 to 8	5 to 12	8 to 24	8 to 24	8 to 24
Byte multiplexer	1 or 2	1 or 2	1 to 6	1 to 6	1 to 6
Block multiplexer	4 or 6	4, 6, 8, or 10	7 to 23	7 to 23	7 to 23
Word	—	—	—	—	—
Other	—	—	—	—	—

TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	AS/8083	AS/9040, AS/9050	AS/9060	AS/9070	AS/9080	AS/XL 60, AS/XL 80
SYSTEM CHARACTERISTICS						
Date announced	April 1984	Sept. 1982	May 1982	Jan 1982	May 1982	Mar. 1985
Date first delivered	Mar. 1985	Nov. 1982, Sept. 1982	Aug. 1982	Sept. 1982	Dec. 1982	—
Field upgradable to	—	AS/9050, AS/9060	AS/9080	AS/9080	—	AS/XL 60 to AS/XL 80
Relative performance	—	—	—	—	—	—
Number of processors	2	1	1	2	2	1 or 2
Cycle time, nanoseconds	35	38	30	38	30	—
Word size, bits	32	32	32	32	32	32
Operating systems	MVS, MVS/XA, VM/SP	MVS, MVS/XA, VM/SP	MVS, MSV/XA, VM/SP	MVS, MVS/XA, VM/SP	MVS, MVS/XA, VM/SP	MVS/XA
MAIN MEMORY						
Type	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256K-bit CMOS
Minimum capacity, bytes	16M	8M	16M	16M	16M	32M, 64M
Maximum capacity, bytes	32M	48M	64M	64M	64M	128M, 256M
Increment size	16M	8M	8M	16M	16M	8M
Cycle time, nanoseconds	315	342	270	342	270	—
BUFFER STORAGE						
Minimum capacity	—	—	—	—	—	—
Maximum capacity	64K/CPU	64K	256K	64K/CPU	256K/CPU	256K/CPU
Increment size	—	—	—	—	—	—
INPUT/OUTPUT CONTROL						
Number of channels:	16 to 32	8 to 24	16 to 24	16 to 32	16 to 32	16 or 32 to 64
Byte multiplexer	2 to 8	1 to 6	1 to 6	2 to 8	2 to 8	—
Block multiplexer	12 to 30	6 to 23	12 to 23	12 to 30	12 to 30	—
Word	—	—	—	—	—	—
Other	—	—	—	—	—	—

▷ The Advanced Systems processors are compatible with IBM's System/360, System/370, 4300, 303X, 308X, and 3090 Series software. Operating systems supported by the AS systems vary according to the model, but the principle operating systems for the AS processors include IBM's DOS/VS, DOS/VSE, VM/370, OS/VS1, SVS, MVS, and MVS/XA. The AS processors also include firmware enhancements comparable to IBM's. The firmware enhancements implement several frequently used operating system functions in microcode for increased operational efficiency. Firmware assist features supported by the AS processors ▷

► The optional Preferred Machine Assist feature is a hardware/microcode assist which is used in conjunction with VM/HPO to provide a high performance "preferred" capability for one MVS/SP quest machine achieving near native performance.

The Virtual Machine Assist feature is a microcode enhancement that is designed to improve the performance of operating systems running under the control of VM/370. VMA handles system interrupts caused by privileged instruction execution and supervisor calls. ►

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⊳ include System/370 Extended Facility, Virtual Machine Assist, VM Extended Control Program Support, OS/VS1 Extended Control Program Support, MVS/SP Assists and Preferred Machine Assists. The System/370 Extended Facility enables NAS users to execute the MVS/SE or MVS/SP enhancement program product that permits the MVS operating system to utilize the firmware enhancements.

COMPETITIVE POSITION

With the introduction of the AS/XL Series, NAS has again protected its current and prospective user's software investment by maintaining IBM compatibility up and down its product line. In addition, NAS is hoping that its current commercial customers who need to expand their present performance capability over the AS/9080, and also potential IBM customers who are looking for upward migration from the 308X Series will find the new AS/XL mega-mainframe an attractive alternative. NAS plans to deliver the AS/XL Model 80 a full year ahead of the IBM 3090, and this fact alone may influence some buyers.

In comparison with their IBM opponents, the NAS processor family reportedly maintains superior performance ratings. Specifically, the performance of the low-end AS/6620 is equal to or better than the IBM 4341 Model Group 12. The performance of the 6630 is equal to or better than the IBM 4381-1; the AS/6650 has a performance rating equal to that of the 4381-2; and the AS/6660 has a performance rating equal to or better than the IBM 4381-2. The AS/8043 is designed to provide up to 10 percent greater performance than the IBM 3083EX, and has equivalent processing power to the IBM 4381-3. According to the vendor, the AS/8053 offers the equivalent performance of the IBM 3083BX and the AS/8063 parallels the performance of the IBM 3083JX. While the AS/8023 compares with IBM's 4381-2, and the AS/8083 compares with the IBM 3081KX.

NAS also aims the AS/9040 at the IBM 3083 Model Group B market, and the AS/9050 is aimed at the IBM 3083 Model Group J. The performance of the AS/9060 is comparable to the IBM 3081 Model Group G. Finally, the AS/9070 and AS/9080 are dual-processor versions of the AS/9050 and AS/9060, respectively. The AS/9070 competes with IBM's 3081 Model Group K, the AS/9080 is aimed at the IBM 3084 market, and at the high-end, the new AS/XL Series matches the performance of IBM's 3090 Series.

Aside from the IBM system targets, NAS retains a highly competitive position among other vendors in the plug-compatible market. NAS rivals in this arena include Amdahl Corporation and IPL Systems. The IPL 4400 Series processors compete directly with the NAS AS/6600 Series as replacements for IBM's 4331 and 4341 systems. Amdahl's timely expansion of its 580 Series with the addition of two new processors, the 5867 dual processor and the 5868 multiprocessor, plus a number of enhancements to existing 580 Series models have strengthened its market standing. Among the 580 Series enhancements, the increase of main memory to 128 megabytes and the avail- ▷

▶ The Floating-Point Arithmetic feature provides instructions to perform floating-point arithmetic operations on both short (1-word) and long (2-word) operands.

The Extended Precision Floating-Point feature provides seven instructions for performing floating-point arithmetic on 4-word (16-byte) operands that provide a precision of up to 28 hexadecimal or 34 decimal digits.

The High-Speed Arithmetic feature provides faster execution of fixed and floating-point arithmetic instructions as well as certain packed decimal instructions on AS/6600, and AS/XL Series systems. Designed to improve system performance by up to 50 percent, this option is suited for engineering and scientific applications.

The Channel-to-Channel Adapter permits direct communication between an AS processor and a System/370 via a standard I/O channel. It can be attached to either a selector channel or a block multiplexer channel and uses one control unit position on either channel. Either system can be equipped with the optional Channel-to-Channel Adapter, and it is required on only one of the interconnected channels.

Dynamic Address Translation is standard on all AS processor models. Instruction retry, command retry, and channel retry are also standard on all models. The AS/8000 Series, AS/9000 Series, and AS/XL Series also feature enhanced I/O logout and a stage tracer for fault logging. On the AS/9000 and AS/XL Series, a Log-Out Analyzer speeds fault diagnosis and verification. In addition to the error-logging facility supported by the operating system, up to 9K bytes of status information is logged to the console diskette whenever there is a CPU or channel malfunction. The status information can be recalled and analyzed by a field engineer without affecting normal system operation. The AS/6600, AS/8000, AS/9000, and AS/XL Series also have a remote support capability that allows information from a failing CPU to be accessed by a remote support site through a telecommunications link. This capability enables the remote support site to receive logout information from, and assume control of, the service processor of the failing CPU. The remote facility can then process the information to diagnose the problem.

SYSTEM CONSOLES: The operator communicates with an AS system via the system console, which also serves as a diagnostic console for maintenance purposes. The AS/80X3, AS/90X0, AS/91X0, and AS/XL systems include two 7-color display units, the service processor console includes two 20-inch four-color display units, two independent processors, and two diskette drives. A remote diagnostic capability is provided. The AS/9070 and AS/9080 include four service processor consoles.

MULTIPROCESSING CONFIGURATIONS: The AS/8083, AS/9070, AS/9080, and AS/XL 80 each consist of two independent processors that share a common main memory. They are capable of running at a single-system image or partitioned into two independent systems. If one processor fails, the system can be reconfigured to a uniprocessor system through the operator console or the operating system. A Channel Cross-Call feature allows control of input/output operations to be switched to the available processor.

VECTOR PROCESSORS: The AS/91X0 Series enhances the AS/9000 processor by adding the ability to perform array processing. Field upgradable from existing AS/9000 Series models, the AS/91X0 Series is designed to accelerate vector processing at a rate that is eight times faster than other large-scale mainframes. With the architectural expansion of the AS/9100 Series, a vector instruction with 46 order codes processes data and stores the results in the central processor. A parallel processing execution element is ▶

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TABLE 2. MASS STORAGE

MODEL	7350-A2, B2, C2	7360-A4, B4	7380-A4, B4	7380-AE, BE
Cabinets per subsystem	4 to 16	2	1 to 8	1 to 4
Disk packs/HDAs per cabinet	2	2	2	4
Capacity	317.5MB	635MB	2.54GB	5.04GB
Tracks/segments per drive unit	16,830	16,650	13,275	26,550
Average seek time, msec.	21	20	16	9.3
Average access time, msec.	29.3	28.3	20.3	17
Average rotational delay, msec.	8.3	8.3	8.3	8.3
Data transfer rate	1.198MB/sec	1.198MB/sec	1.5MB/sec	3.0MB/sec
Controller model	7830-22	7860 Model 2	7880-3	7880-3, 7880-3C
Comments	Four channel interfaces standard, 7350-A2 and C2 contain two independent disk drive spindles and a controller, 7350-B2 must attach to a 7350-A2 or C2	7360-A4 is the head of string drive/controller, one 7350-B4 drive units may be attached to each 7350-A4	7380-A4 is the head of string drive/controller, up to three 7350-B4 drive units may be attached to each 7380-A4	7380-AE is the head of string drive/controller, up to three 7380-BE drive units may be attached to each 7380-AE

▶ ability of 48 input/output channels on all 580 multiprocessor models gives Amdahl the competitive edge. Both the Amdahl and NAS feature full software and peripheral compatibility across the entire product line, and can be field-upgraded to the next higher model within a series. This is a distinct advantage over the older IBM 308X models which cannot be field-upgraded to the newer models. IBM has tried to appease current 308X users by offering an optional performance-improvement feature that enables the older models to perform closer to the level of the new models.

The NAS design policy of field upgradability has been reinforced with the addition of the AS/91X0 Series of vector processors. Targeted at users requiring array processing capabilities, NAS is marketing the new processors as alternatives to the full-fledged supercomputers from Cray Research or Control Data Corporation. The performance level of the AS/91X0 Series has been comparable to IBM's Model 3838 array processor. The fact that IBM's 3838 is no longer available will undoubtedly open up new market opportunities for NAS.

NAS has indicated that an AS/9100 type vector processor will soon be available for the new Alliance AS/XL Series. This fact, coupled with integration of the NAS vector processors into the already firmly established Advanced Systems product family provides NAS with additional ammunition in the price/performance battle with IBM.

ADVANTAGES AND RESTRICTIONS

NAS's consistent policy of protecting the customer's investment by providing growth paths across an entire product line remains a distinct advantage. The decision to incorporate a vector processor into the product line further protects the customer's investment. The AS/91X0 Series will attract new customers in the scientific and engineering fields. Users who need vector processing capabilities but cannot afford high-end supercomputers or don't choose to opt for time-shared systems will find that the NAS 91X0 Series provides a viable alternative. This upgrade commitment is also demonstrated by recent upgrade plans and new ▶

▶ added to the execution unit of each instruction processor to implement vector processing functions. Vector Address Generation elements, Vector Data elements, and a microcoded engine perform parallel arithmetic operations which provide the performance increase. The AS/9140, AS/9150, AS/9160, AS/9170, and AS/9180 processors utilize a Fortran preprocessor called VAST (Vector and Array Syntax Translator) which enable the systems to execute vectorized Fortran programs yet remain compatible with IBM architecture. All existing 370 business-oriented software can be run without modification and the entire series support both MVS and VM operating systems.

INPUT/OUTPUT CONTROL

The AS/6600 Series processors include six integrated I/O channels: one byte multiplexer channel and five block multiplexer channels. The AS/8000 Series and AS/9000 Series uniprocessor models include one microprogram-controlled I/O Processor, while the dual-processor models include two I/O Processors. The AS/8000 Series and AS/9000 Series systems support from 8 to 32 channels. The AS/XL Series supports from 32 to 64 channels. (See Table 1 for the exact number of channels available for each processor model.)

Expansion of channels on the AS/8040 and AS/9000 Series is accomplished via the extended channel group, which provides an additional I/O Processor with channels. The AS/6000 System can be expanded to 12 channels. Datastreaming support is standard on all Advanced System models.

Each I/O channel implements the standard IBM interface and is provided with 256 Unit Control Words. All block multiplexer channels can operate at up to 3.0 megabytes per second. The data transfer rate for byte multiplexer channels is 100K bytes per second for all processor models.

The AS/XL Series has a dynamic channel subsystem (DCS) on each of the input/output processors (IOPs) that can manage up to 32 channel paths per IOP. All the channels can transfer data at a rate of 3 megabytes per second in datastreaming mode. To support full, simultaneous data transfer on all 64 channels, the DCS has a maximum data transfer capability of 192 megabytes per second.

PERIPHERAL EQUIPMENT

The NAS systems can utilize all IBM System/360, System/370, 4300, 303X, or 308X Series input/output and mass storage devices, as well as their plug-compatible counterparts from independent vendors. ▶

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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.
7420-44	9	1600,	PE	80	128K
		6250	GCR	80	500K
7420-66	9	1600	PE	125	200K
		6250	GCR	125	780K
7420-77	9	800	NRZI	200	160K
		1600	PE	200	320K
7420-88	9	1600	PE	200	320K
		6250	GCR	200	1250K

▷ lease options which allow customers leasing a low-end AS/6600 system to apply a portion of their accrued lease payments towards the purchase of a high-end AS/80X3 mainframe.

In accordance with NAS's traditional policy of providing consistent growth paths across its entire product line, existing AS/8000 users can upgrade on-site. This commitment towards protecting customer investments was further reinforced by the introduction of the AS/91X0 Series. The AS/91X0 Series marked NAS's entrance into the realm of vector processing. Although the AS/91X0 is not a stand-alone computer system, it fits in the same enclosure as AS/9000 Series of processors, and accesses and integrates with the same system resources. According to NAS, the AS/91X0 Series represents an "entry-level supercomputer" that can process vector data up to eight times faster than NAS's 90X0 Series. Intended to provide high-speed computing for applications such as medical, scientific, aerospace, and defense research, automotive manufacturing, and semiconductor design, the incorporation of the new vector processors into the existing NAS product line will generate new market opportunites for NAS.

While providing an upgrade path for the existing AS/90X0 Series, the AS/9140, AS/9150, AS/9160, AS/9170, and AS/9180 computers are designed to perform at 28 megaflops (million floating-point operations per second), compared to the supercomputer standard of 100 MFLOPS and the conventional standard of less than 4 MFLOPS. The AS/91X0 Series features a Fortran preprocessor developed by Pacific-Sierra Research called VAST (Vector and Array Syntax Translator) that locates operations it can vectorize and inserts the appropriate code which activates the vector processing hardware. With VAST, existing programs need not be recoded in order to utilize the system's vector processing capabilities. This feature enables users upgrading to these processors to retain their present base of IBM 370 software. All of the 91X0 processors support both the MVS and VM operating systems. IBM's Extended Architecture (XA) feature provides users with a dynamic channel subsystem, real and virtual 31-bit addresses, bimodal operation, page protection, and interpretive execution.

In comparing NAS with its counterparts, there are decided advantages on the side of NAS. The Advanced Systems processors have fewer components, thus reducing power consumption, heat dissipation, and floor space require- ▷

▶ NAS currently markets the 7880/7380, and 7860/7360, Disk Storage Subsystems. The 7380 is a plug-compatible replacement for the IBM 3380 Disk Storage Facility. The 7360 is plug-compatible with and has twice the capacity of the IBM 3350 Direct Access Facility. The recently announced double-capacity version of the 7380 Disk Storage Subsystem offers nearly twice the capacity of the single-capacity device (20.16 gigabytes), and the 7880-3C cache controller, available in versions from 8 to 64 megabytes, will allow users the ability to manage data storage at high speeds. The NAS 7803/7420 Magnetic Tape Subsystem is plug-compatible with IBM's 3803/3420 Magnetic Tape Subsystem. (See Reports 70D6-638XM-101 and 70D6-638XM-201 in Volume 2 for detailed descriptions of these systems.)

SOFTWARE

The Advanced Systems offer complete functional compatibility with IBM System/360, System/370, 4300 Series, 303X, and 308X Series software. NAS supports users of current IBM system software by supplying software support services for its customers.

The AS systems include firmware that supports the following IBM operating system enhancements: System/370 Extended Facility (370 EF), which allows the use of the MVS/System Extensions (MVS/SE) and MVS/System Product (MVS/SP); OS/VS1 Extended Control Program Support (VS1:ECPS); Virtual Machine Assist (VMA); Virtual Machine Extended Control Program Support (VM:ECPS); and MVS/SP Assists, which consist of the Cross Memory Services Assist, Auxiliary Storage Management Assist, Real Storage Management Assist, and I/O Assist features. All of these enhancements improve system throughput by implementing a number of frequently used system routines in microcode. (See Table 1 for the microcode assist features available on the individual AS processors.)

The Advanced Systems in 370-XA model fully support MVS/SP Version 2 and its associated products collectively known as MVS/XA. They provide every feature of the comparable IBM processors in 370-XA mode.

Program products marketed by NAS include the Advanced Conversational Editing and Programming System (ACEP), Performance Monitor, Extend/SP, DP Technician, and a series of three performance monitors including QCM, Discern VS/1, and Discern VM.

ACEP is an on-line programming system that permits programmers to create, modify, and maintain programs and systems. ACEP can be used with IBM or IBM plug-compatible processors running under OS/VS1 or MVS. An optional System Productivity Facility (SPF) enables users to work with easy-to-understand screens and menus to arrive at programming decisions. The ACEP/SPF system includes capabilities for entering, editing, compiling, and saving source programs. ▶

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▷ ments. Additionally, all Advanced Systems computers are air-cooled. Also, as the first mainframe manufacturer to utilize the 256K-bit chip, NAS achieves a technological edge over its competition. In addition, with the introduction of the AS/XL Series, NAS has eliminated its previous disadvantage in memory capacity.

Advanced Systems processors also have the ability, in a dual-processor system, to reconfigure to a uniprocessor system through the operator console or the operating system. Control of the input/output operations can be switched to the available processor. Perhaps the most significant advantage of all plug-compatible products, however, is the fact that a machine with equal or better performance can be attained at a substantially lower price.

The NAS AS/6600 Series, which is aimed at the IBM 4300 Series market, does not support MVS/XA. IBM has included support for MVS/XA on the 4300 Series with the recent 4381 announcement. NAS argues that system resources are drained so significantly by the use of MVS/XA in a production environment, that the most efficient use of MVS/XA would appear on the larger systems. Therefore, NAS has no future plans for MVS/XA support on the AS/6600 Series.

USER REACTION

In the 1985 User Ratings of Computer Systems Survey, we received five responses from the users of installed NAS computer systems. The respondent's systems represented a range of NAS models, included were two AS/6650's, an AS/7000, AS/8023, and AS/8043. Two leased their equipment from the manufacturer and three leased from a third party. The five respondents were involved in a variety of industries including banking/finance/securities, education, public utilities, and software development. The most common applications included accounting/billing, payroll/personnel, order processing/inventory, purchasing, and statistics.

The majority of the respondents reported that more than 60 local and remote terminals or workstations were installed, and three used database management systems. All five of the respondents stated that they had converted to NAS from another vendor's system. Three converted from an IBM 4341, one from an IBM 370/158, and one from a Magnuson M80/43. Main memory ranged from one megabyte to four megabytes, and total disk storage went from ten megabytes to ten gigabytes. When asked about future acquisitions, four of the five NAS users indicated that they intend to expand present hardware and data communications capabilities along with adding additional proprietary software from other suppliers, and two stated a need to incorporate power conditioning equipment.

As part of the survey, the users were asked to rate their NAS equipment from excellent to poor. A weighted average was then calculated based on the total number of responses. A summary of these ratings is included in the following table. ▷

▶ SP simulates the System/370 Extended Facility, substituting standard System/370 instruction set sequences for the machine instructions in the Extended Facility. SP is designed to enable System/370 users to take advantage of MVS/SP3 without making hardware modifications. According to NAS, EXTEND/SP, when used in conjunction with IBM's MVS/SE or MVS/SP operating systems, offers a 12 to 20 percent improvement in performance.

The DP Technician is a DASD management utility. Capabilities include volume configuration/dump/restore, catalog management, file management, file record retrieval, and DASD management. DP Technician can be used with all OS and OS/VS operating systems and supports IBM 3330, 3344, 3350, 3375, and 3380 disk subsystems. The IBM 3420 magnetic tape units are also supported.

The NAS Performance Monitors are a family of products designed to measure and report on the performance and use of NAS and IBM plug-compatible processors running MVS, MVS/XA, OS/VS1, and VM/370 operating systems.

PRICING AND SUPPORT

The NAS Advanced Systems are available for purchase or for lease under 12-month, 18-month, 24-month, or 48-month operating lease terms. A new upgrade plan allows low-end AS/6600 Series users on a 48-month lease to upgrade at any time after the 24th month to a high-end AS/8000 or AS/9000 Series computer. An additional upgrade option enables users signing up to lease an AS/6600 computer to apply a percentage of the accrued AS/6600 lease payments toward the purchase of an AS/8000 mainframe at the end of the leasing term.

NAS offers two levels of software support. The Central Program Support Center function in Mountain View and San Diego, California, provides a Central Program Support Service, which includes telephone assistance 24 hours a day, 7 days a week, customer guidance in IPAR (Incident Program Analysis Report) preparation, problem diagnosis advice, temporary fix or bypass service, and PTF selection and application assistance. The Local Program Support Service at the customer site includes problem diagnosis, IPAR preparation and submission assistance, local fix or bypass development and assistance, and PTF/PUT application problem assistance. The Local Program Support Service is available as an option. Customers can elect to pay a monthly program support charge or to pay hourly rates.

NAS has a Support Agency service for selected IBM Licensed Programs. Under the terms of an agreement between NAS and IBM, licensed users can select NAS as their support agent. The agreement permits NAS to use the IBM support centers on behalf of the users. NAS is offering a combined Central and Local Program Support Service for the designated IBM programs. A remote, first-level interface is provided via a toll-free telephone number, and local support is provided via local NAS Systems Support Representatives. The Support Agency service provides support for the following licensed programs: MVS/SP Version 1, VM/SP Release 1, DOS/VSE Advanced Functions Release 3, Data Facility/ Device Support, Data Facility/Extended Function, Data Facility/Data Set Services, RMF, SAM-E, ACF/VTAM, ACF/NCP, SPF, Information System, VSE/VSAM, VSE/POWER, VSE/OCCF, VSE/IPCS, VSE/IPF, VSE/ICCF, VSE/Fast Copy, VSE/DITTO, BTAM-ES, VM/IPCS, RSCS, SPF/CMS, and IPF. ▶

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	Excellent	Good	Fair	Poor	WA*
Ease of operation	3	2	0	0	3.60
Reliability of mainframe	4	1	0	0	3.80
Reliability of peripherals	3	2	0	0	3.60
Maintenance service:					
Responsiveness	3	2	0	0	3.60
Effectiveness	3	1	1	0	3.40
Technical support:					
Troubleshooting	3	1	0	1	3.20
Education	2	2	0	0	3.50
Documentation	0	2	1	1	2.25
Overall satisfaction	1	1	0	0	3.50

*Weighted Average on a scale of 4.0 for Excellent.

Datapro talked with three NAS users to find out how well their systems performed. We spoke with a securities house in Washington state, a college in eastern Virginia, and a public utility company in southern Florida. Across the board the respondents stated that "once the machine was cabled in, all we had to do was hit the button and go." All of the respondents indicated that the service was excellent, and NAS system engineers went out of their way to accommodate the user.

The vice-president of the securities house stated that his firm had converted to NAS AS/6630 from an IBM 4331-II because at the time his company was looking, IBM had no offerings in mid-range mainframes. They also wanted to protect their software investment. They investigated other PCM vendors, but on a price/performance basis NAS was the best investment. The system has been installed for 22 months and has yet to be down except for scheduled maintenance.

The director of computing for the college converted to a NAS AS/6650 from an IBM 370/158 14 months ago. Stating that "there was nothing to it," the spokesman indicated that the conversion went exceptionally smooth. As soon as the college had cabled the new NAS equipment in, and pushed the start button the system was up and running. He told us that although the AS/6650 has not yet had any performance problems, his opinion of the NAS service representatives was very favorable. He said that he anticipated no drawbacks if a problem should occur.

The director of information systems for the public utility converted to a NAS AS/8043 from an IBM 4341. The system has been installed for about 16 months, and they have experienced no problems. His responses to our questions mirrored those of the other two respondents. His strongest statement was that "NAS service engineers go out of their way to satisfy the user." In the 16 months that the system has been up and running he has experienced no problems. □

EQUIPMENT PRICES

		Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
PROCESSOR COMPLEXES					
AS/6000 Series:					
AS/6620	Processor with 8 megabytes of main memory, 64K bytes of buffer storage, 5 I/O channels, and a standalone operator console with color CRT	255,000	752	8,950	7,845
AS/6630	Processor with 8 megabytes of main memory, 64K bytes of buffer storage, 5 I/O channels, and a standalone operator console with color CRT	341,500	833	11,095	9,715
AS/6650	Processor with 8 megabytes of main memory, 64K bytes of buffer storage, 5 I/O channels, and a standalone operator console with color CRT	417,500	983	13,815	12,090
AS/6660	Processor with 8 megabytes of main memory, 64K bytes of buffer storage, 12 I/O channels, and a standalone operator console with color CRT	475,000	1,135	15,720	13,760
AS/8000 Series:					
AS/8023	Compact processor with 8 megabytes of main memory, 64K bytes of buffer storage, 8 I/O channels, a single power distribution unit, and color CRT	699,000	3,250	21,310	18,885
AS/8043	Compact processor with 8 megabytes of main memory, 64K bytes of buffer storage, 8 I/O channels, a single power distribution unit, and color CRT	1,067,000	4,637	32,875	29,090
AS/8053	Compact processor with 8 megabytes of main memory, 64K bytes of buffer storage, 8 I/O channels, a single power distribution unit, and color CRT	1,492,000	4,821	48,725	42,850
AS/8063	Compact processor with 8 megabytes of main memory, 64K bytes of buffer storage, 8 I/O channels, a single power distribution unit, and color CRT	1,905,000	5,724	63,795	56,025
AS/8083	Compact processor with 16 megabytes of main memory, 64K bytes of buffer storage, 16 I/O channels, a single power distribution unit, and color CRT	3,074,000	7,413	103,525	90,675

NC—No charge.
Complete service for 24 hours/day, 7 days/week.

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		Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)

PROCESSOR COMPLEXES (Continued)

AS/9000 Series:

		Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
AS/9040	Processor with 8 megabytes of main memory, 64K bytes of buffer storage, I/O processor, 8 I/O channels, and service processor console with dual 4-color CRTs, keyboards, and 2 floppy disk drives	1,492,000	4,821	55,440	48,695
AS/9050	Processor with 8 megabytes of main memory, 64K bytes of buffer storage, I/O processor, 8 I/O channels, and service processor console with dual 4-color CRTs, keyboards, and 2 floppy disk drives	1,909,000	5,724	66,990	58,820
AS/9060	Processor with 16 megabytes of main memory, 256K bytes of buffer storage, I/O processor, 16 I/O channels, and service processor console with dual 4-color CRTs, keyboards, and 2 floppy disk drives	2,308,000	6,662	81,430	71,460
AS/9070	Dual processors with 16 megabytes of main memory, 64K bytes of buffer storage per processor, 2 I/O processors, 16 I/O channels and 2 service processor consoles with dual 4-color CRTs, keyboards, and 2 floppy disk drives	3,249,000	8,790	118,545	103,910
AS/9080	Dual processors with 16 megabytes of main memory, 256K bytes of buffer storage per processor, 2 I/O processors, 16 I/O channels, and 2 service processor consoles with dual 4-color CRTs, keyboards, and 2 floppy disk drives	4,140,000	10,437	130,855	114,800

Alliance AS/XL Series:

		Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
AS/XL Model 60	Single processor with 64 megabytes of main memory, 256K bytes of buffer storage, one I/O processor, 32 I/O channels.	4,840,000	10,846	—	—
AS/XL Model 80	Dual processor with 64 megabytes of main memory, 256K bytes of buffer storage per processor, two I/O processors, 32 I/O channels.	8,470,000	18,674	—	—

PROCESSOR OPTIONS

AS/6600 Series:

Item	Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
Additional Memory Increment, 4 megabytes	38,000	56	1,190	1,040
Additional Memory Increment, 8 megabytes	64,000	115	1,920	1,680
Additional Block Channels Increment, 2 channels	20,000	40	800	700
Additional Byte Channels, each	8,000	20	325	285
Channel to Channel Adapter	20,000	25	790	690
Direct Control	5,000	NC	195	170
High-speed Arithmetic	80,000	250	3,355	2,885
Hard Copy Printer	3,700	139	225	215
AS/6620 to AS/6630 Upgrade	95,000	81	—	—
AS/6630 to AS/6650 Upgrade	115,000	150	—	—
AS/6630 to AS/6660 Upgrade	172,000	202	—	—
AS/6650 to AS/6660 Upgrade	57,500	152	—	—

AS/8000 Series:

Item	Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
Additional Memory Increment, 8 megabytes	123,000	452	4,370	3,845
Additional Channel Group, 8 channels	123,000	132	4,115	3,580
Channel to Channel Adapter	14,000	56	575	510
Additional Console	29,000	300	1,300	1,165
Console Printer	6,000	139	315	290
High-speed Arithmetic	200,000	300	5,975	5,220
Preferred Machine Assist	50,000	NC	1,925	1,160
Extended Architecture (AS/8023 only)	150,000	NC	5,770	5,000
AS/8023 to AS/8043 Upgrade	390,000	387	—	—
AS/8043 to AS/8053 Upgrade	425,000	164	—	—
AS/8053 to AS/8063 Upgrade	413,000	903	—	—
AS/8063 to AS/8083 Upgrade	923,000	1,689	—	—

AS/9000 Series:

Item	Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
Additional Memory Increment for AS/9040, AS/9050 and AS/9060; 8 megabytes	123,000	452	4,285	3,770
Additional Memory Increment for AS/9070 and AS/9080; 16 megabytes	246,000	904	8,965	7,890
Additional Channel Group, 8 channels	123,000	132	4,165	3,630
Channel to Channel Adapter	14,000	56	575	510
Console Printer	6,000	139	315	290
Additional Console	29,000	300	1,300	1,165
Direct Control	1,500	21	75	65
Preferred Machine Assist	50,000	—	—	—
9140 Vector Processors	1,792,000	6,329	67,930	59,720
9150 Vector Processors	2,209,000	7,232	79,480	69,845
9160 Vector Processors	2,608,000	8,170	93,920	82,480
9170 Vector Processors	3,849,000	11,790	143,410	125,860
9180 Vector Processors	4,740,000	13,453	155,730	136,760
AS/9040 to AS/9050 Upgrade	417,000	903	—	—
AS/9050 to AS/9060 Upgrade	153,000	938	—	—
AS/9050 to AS/9070 Upgrade	1,094,000	3,066	—	—
AS/9060 to AS/9080 Upgrade	1,832,000	3,775	—	—

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		Purchase ($)	Monthly Maint.* ($)	1-Year Lease ($)	2-Year Lease ($)
PROCESSOR OPTIONS (Continued)					
	AS/9070 to AS/9080 Upgrade	891,000	1,647	—	—
	AS/9040 to AS/9140 Upgrade	300,000	903	—	—
	AS/9050 to AS/9150 Upgrade	300,000	938	—	—
	AS/9060 to AS/9160 Upgrade	300,000	3,066	—	—
	AS/9070 to AS/9170 Upgrade	600,000	3,775	—	—
	AS/9080 to AS/9180 Upgrade	600,000	1,647	—	—
	AS/9080 to AS/9180 Upgrade	600,000	1,647	—	—
AS/XL Series:	Additional memory increments for the AS/XL Models 60 and 80, 64 megabytes	394,000	626	—	—
	Additional channel group for the AS/XL Models 60 and 80, 16 channels	247,000	403	—	—
	AS/XL Model 60 to AS/XL Model 80 upgrade	3,630,000			

NC—No charge.
*Complete service for 24 hours/day, 7 days/week.

SOFTWARE PRICES

	One-Time License Fee ($)
ACEP (Advanced Conversational Editing and Programming System)	28,000
SPF (System Productivity Facility)	4,000
NAS Performance Monitor:	
SPI (System Performance Interrogator)	14,000
SPM (System Performance Module)	6,000
SPI and SPM	6,000
Performance Data Base for SAS Users:	
IMS Data Option	1,000
CICS Data Option	1,000
VM Data Option	1,000
JAB (Job Analysis and Billing):	6,000
IMS Option	7,000
CICS Option	2,000
VM Option	2,000
EXTEND/SP System/370 Extended Facility Simulator	5,000 to 15,000
DISCERN VS1 Performance Analyzer	6,500
DP Technician	12,000

LOCAL PROGRAM SUPPORT

	Category A ($)	Category B ($)
AS/6620	515	740
AS/6630	515	740
AS/6650	515	740
AS/8023	640	960
AS/8043	725	1,025
AS/8053	800	1,140
AS/8063	910	1,300
AS/8083	1,085	1,550
AS/9040	800	1,140
AS/9050	910	1,300
AS/9060	1,085	1,550
AS/9070	1,325	1,890
AS/9080	1,875	2,675 ■