NAS Advanced Systems

MANAGEMENT SUMMARY

In direct response to IBM's recent revamping of the top-of-the-line 308X computer systems, NAS has expanded its AS/8000 series with the addition of five new models and introduced its AS/91X0 series of vector processors. As plug-compatible replacements for IBM 4341, 4381, 303X, and 308X computers, the NAS systems have been designed to provide price/performance improvements over their IBM counterparts.

Three of the new models within the revised AS/8000 series, the AS/8043, AS/8053, and AS/8063, are replacements for the AS/8040, AS/8050, and AS/8060, respectively. These new models offer an eight percent improvement in the performance of the previous products. In addition, 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 14 processor models: the AS/6620, AS/6630, AS/6650, and AS/6660; the AS/8023, AS/8043, AS/8053, AS/8063, and AS/8083; and the AS/9040, AS/9050, AS/9060, AS/9070, and AS/9080.

Activity has also occurred across the mid-range AS/6600 product family with overall performance enhancements and the introduction of a high-end AS/6660 processor model. NAS has increased the minimum memory capacity for the entire AS/6600 family to 8 megabytes and expanded the maximum channel capacity to 12 channels on the AS/6650 and to 8 channels on the AS/6620 and AS/6630. In addition to the performance improvements, NAS is now providing the High Speed Arithmetic feature on all AS/6600 Series processors.

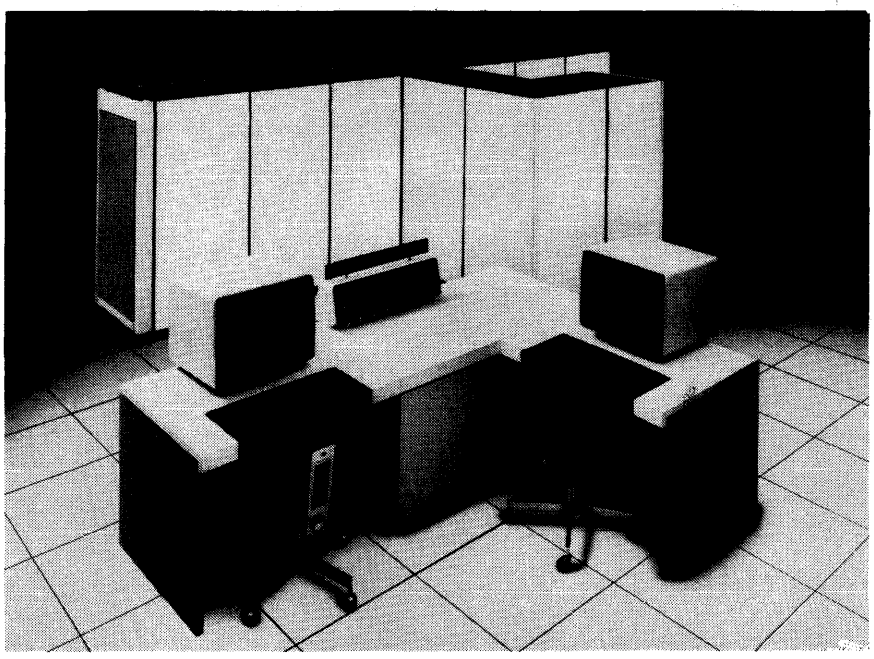
The NAS Advanced Systems family currently consists of 14 models that are compatible with IBM's 4341 and 4381 processors, and the 303X and 308X Series processors. The Advanced Systems are functionally compatible with the IBM software, firmware enhancements, and peripheral equipment.

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, and AS/9080.
CONFIGURATION: One or 2 CPUs with from 8 to 64 megabytes of main memory, 16K to 256K bytes of buffer storage per processor, and 8 to 32 I/O channels.
COMPETITION: IBM 4341, 4381, 303X, and 308X Series; Amdahl 470 and 580 Series; and IPL 4400 Series.
PRICING: Purchase prices range from $255,000 to $4,740,000.

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, and AS/9080.



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.

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

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 new AS/8043 is designed to provide up to 10 percent greater performance than the IBM 3083EX. 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. The new AS/8023 competes with IBM's 4381-2 and the high-end AS/8083 opposes the IBM 3081KX.

NAS also targets 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 and the AS/9080 is aimed at the IBM 3084 market.

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 to this new family of mainframes at no additional charge. This commitment towards protecting customer investments is further reinforced with the introduction of the high-end AS/91X0 series. The new AS/91X0 series marks NAS's entrance into the realm of vector processing. Although not standalone computer systems, the new AS/91X0 series fits in the same enclosure as AS/9000 processors and accesses the same system resources as the AS/9000 processor with which it integrates. 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 and scientific research, aerospace and defense development, and automative 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 high-end AS/90X0 series, the new AS/9140, AS/9150, AS/9160, AS/9170, and AS/9180 computers are designed to perform

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

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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 the new 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.

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: eight channels and eight megabytes on the 8023; eight channels and eight megabytes on the 8043, 8053, and 8063; and sixteen channels and sixteen megabytes on the 8083.

The Advanced Systems processors are compatible with IBM's System/360, System/370, 4300, 303X and 308X 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 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

Aside from the aforementioned IBM system targets, NAS retains a highly competitive position in the plug-compatible market. Other chief competitors 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, along with a number of enhancements to existing 580 Series models has strengthened its market standing. Among the 580 Series enhancements, the increase of main memory to 128 megabytes and the availability of 48 input/output channels on all 580

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, and AS/9100 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/8000 and AS/9000 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, and the AS/9000 Series.

The Extended Addressing feature is standard on the AS/8000 and AS/9000 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.

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.

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 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

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TABLE 1. SYSTEM COMPARISON

	AS/6620, AS/6630	AS/6650, AS/6660	AS/8023	AS/8043, AS/8053	AS/8063
SYSTEM CHARACTERISTICS					
Date of introduction	Jan. 1983 (6620), Oct. 1982 (6630)	Oct. 1982 (6650), Sept. 1984 (6660)	April 1984	April 1984	April 1984
Number of central processors	1	1	1	1	1
Comparable IBM model	4341-12 (6620), 4381-1 (6630)	4381-2	4381-2	3083EX (8043), 3083BX (8053)	3083BX
Principal operating systems	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS	VM/SP, DOS/VSE, MVS/XA	VM/SP, DOS/VSE, MVS/XA
MAIN STORAGE					
Storage type	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS	256K-bit NMOS
Read cycle time, nanoseconds	420	350 (6650), 301 (6660)	360	360 (8043), 333 (8053)	315
Write cycle time, nanoseconds	420	350 (6650), 301 (6660)	360	360 (8043), 333 (8053)	315
Bytes fetched per cycle	8	8	8	8	8
Minimum capacity, bytes	8,388,608	8,388,608	8,388,608	8,388,608	8,388,608
Maximum capacity, bytes	16,777,216	16,777,216	33,554,432	33,554,432	33,554,432
Increment size, bytes	8,388,608	8,388,608	8,388,608	8,388,608	8,388,608
Interleaving	2-way	2-way	4-way	4-way	4-way
BUFFER STORAGE					
Cycle time, nanseconds	60	50 (6650), 43 (6660)	20	20 (8043), 18.5 (8053)	17.5
Bytes fetched per cycle	8	8	8	8	8
Capacity, bytes	64K	64K	32K	32K (8043), 64K (8053)	64K
PROCESSING UNIT					
Machine cycle time, nanoseconds	60	50 (6650), 43 (6660)	40	40 (8043), 37 (8053)	35
Processing unit features:					
Direct Control	Optional	Optional	Optional	Optional	Optional
Channel-to-Channel Adapter	Optional	Optional	Optional	Optional	Optional
Extended Addressing	No	No	Standard	Standard	Standard
Extended Architecture Mode	No	No	Optional	Standard	Standard
Firmware features:					
Reloadable Control Storage Assist features	16K 72-bit words VSE/ECPS, VM/ECPS, 370EF, ECPS/MVS	16K 72-bit words VSE/ECPS, VM/ECPS, 370EF, ECPS/MVS	16K 126-bit words MVS/SP Assist, Ext. Address, Ext. Arch., Seg. Protect, VMA, PMA	16K 126-bit words MVS/SP Assist, Ext. Address, Ext. Arch., Seg. Protect, VMA, PMA	16K 126-bit words MVS/SP Assist, Ext. Address, Ext. Arch., Seg. Protect, VMA, PMA
CHANNELS					
Maximum number of channels	12	12	24	24	24
Configuration:					
Block multiplexer channels	5, 6, 8, or 10	5, 6, 8, or 10	7 to 23	7 to 23	7 to 23
Byte multiplexer channels	1 or 2	1 or 2	1 to 6	1 to 6	1 to 6
Maximum channel transfer rate:					
Block multiplexer, bytes/sec.	3MB	3MB	3MB	3MB	3MB
Byte multiplexer, bytes/sec.	100KB	100KB	100KB	100KB	100KB
Aggregate data rate, bytes/sec.	13MB	16MB (6650), 22MB (6660)	60MB	60MB	60MB
Data streaming support	Standard	Standard	Standard	Standard	Standard

multiprocessor models gives Amdahl the competitive edge. Both the Amdahl and NAS system enhancements feature full compatibility and field upgradability across the entire product line, unlike the older IBM 308X models which cannot be field upgraded to the newer models. However, 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 perfor-

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 and AS/9000 Series also feature enhanced I/O logout and a stage tracer for fault logging. On the AS/9000 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, and AS/9000 Series also have a remote support capability that allows information from a failing CPU to be accessed by a remote

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TABLE 1. SYSTEM COMPARISON (Continued)

	AS/8083	AS/9040 AS/9050	AS/9060	AS/9070	AS/9080
SYSTEM CHARACTERISTICS					
Date of introduction	April 1984	September 1982	May 1982	January 1982	May 1982
Number of central processors	2	1	1	2	2
Comparable IBM model	3081KX	3083BX (9040), 3083JX (9050)	3081GX	3081KX	3084QX
Principal operating systems	MVS, MVS/XA, VM/SP	MVS, MVS/XA, VM/SP	MVS, MVS/XA, VM/SP	MVS, MVS/XA, VM/SP	MVS, MVS/XA, VM/SP
MAIN STORAGE					
Storage type	256K-bit NMOS	64K-bit NMOS	64K-bit NMOS	64K-bit NMOS	64K-bit NMOS
Read cycle time, nanoseconds	315	315	270	315	270
Write cycle time, nanoseconds	315	315	270	315	270
Bytes fetched per cycle	8	8	8	8	8
Minimum capacity, bytes	8,388,604	8,388,604	16,777,126	16,777,126	16,777,126
Maximum capacity, bytes	33,554,432	50,331,648	67,108,864	67,108,864	67,108,864
Increment size, bytes	16,777,126	8,388,604	8,388,604	16,777,126	16,777,126
Interleaving	8-way	8-way	8-way	16-way	16-way
BUFFER STORAGE					
Cycle time, nanseconds	17.5	17.5	15	17.5	15
Bytes fetched per cycle	8	8	8	8	8
Capacity, bytes	64K per CPU	64K	256K	64K per CPU	256K per CPU
PROCESSING UNIT					
Machine cycle time, nanoseconds	35	35	30	35	30
Processing unit features:					
Direct Control	Optional	Optional	Optional	Optional	Optional
Channel-to-Channel Adapter	Optional	Optional	Optional	Optional	Optional
Extended Addressing	Standard	Standard	Standard	Standard	Standard
Extended Architecture Mode	Standard	Standard	Standard	Standard	Standard
Vector Processing Facility		Optional	Optional	Optional	Optional
Firmware features:					
Reloadable Control Storage	16K 126-bit words	16K 160-bit words	16K 160-bit words	16K 160-bit words	16K 160-bit words
Assist features	MVS/SP, Assist Ext. Address, Ext. Arch., Seg. Protect, VMA, PMA	MVS/SP, Assist Ext. Address, Ext. Arch., Seg. Protect, VMA, PMA	MVS/SP, Assist Ext. Arch., Ext. Address, Seg. Protect, VMA, PMA	MVS/SP, Assist Ext. Arch., Ext. Address, Seg. Protect, VMA, PMA	MVS/SP, Assist Ext. Arch., Ext. Address, Seg. Protect, VMA, PMA
CHANNELS					
Maximum number of channels	32	24	24	32	48
Configuration:					
Block multiplexer channels	7 to 31	7 to 23	7 to 23	7 to 31	7 to 47
Byte multiplexer channels	1 to 8	1 to 6	1 to 6	1 to 8	1 to 12
Maximum channel transfer rate:					
Block multiplexer, bytes/sec.	3MB	3MB	3MB	3MB	3MB
Byte multiplexer, bytes/sec.	100KB	100KB	100KB	100KB	100KB
Aggregate data rate, bytes/sec.	80MB	60MB	72MB	80MB	96MB
Data streaming support	Standard	Standard	Standard	Standard	Standard

mance level of the AS/91X0 series is 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. At any rate, the integration of the NAS vector processors into the firmly established Advanced Systems product family provides NAS with additional amunition in the price/performance race against 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

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, and AS/91X0 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, and AS/9080 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 sys-

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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 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 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 requirements. Additionally, all Advanced Systems computers are air cooled. Also, as the only mainframe manufacturer to utilize the 256K chip, NAS achieves a technological edge over its competition. However, at the present time, NAS does not offer the 128-megabyte memory capacity found on both the Amdahl and IBM machines.

The 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 1984 User Ratings of Computer Systems Survey, we received 13 responses from the users of installed NAS computer systems. Five systems were purchased, four systems were leased from the manufacturer and four systems were leased from a third party. The 13 respondents were involved in a variety of industries including: retail/wholesale, health care/medical, education, chemical/petroleum, and computer software. In addition, three of the systems were installed by service bureaus and two were installed at government locations. The most common applications being processed included accounting/billing, payroll/personnel, order processing/inventory, purchasing, manufacturing, sales/distribution, engineering/scientific, and health care/medical.

The majority of the respondents reported that over 60 local and remote terminals/workstations were installed. Most of the systems featured from 8 to less than 16 megabytes of main memory. The most frequently used programming language was Cobol, and typical operating systems included OS/VS1, DOS/VSE, VM/VS1, MVS, and MVS/SP. When asked about future acquisitions, the NAS users revealed intentions to expand present hardware and data

tem. A Channel Cross-Call feature allows control of input/output operations to be switched to the available processor.

VECTOR PROCESSORS: The AS/91X0 series extends an AS/9000 processor with the ability for array processing. Field upgradable from existing AS/9000 Series models, the AS/91X0 series is designed to accelerate vector processing by up to 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 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 as standard, 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. (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. Data streaming 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.

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.

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 NAS 7803/7420 Magnetic Tape Subsystem is plug-compatible with IBM's 3803/3420 Magnetic Tape Subsystem. (See Reports 70D6-655-01 and 70D6-655-02 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.

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communications capabilities along with adding additional proprietary software from other suppliers. Furthermore, 10 respondents endorsed the NAS equipment with recommendations for other users while 3 respondents indicated that they would not recommend the system to potential users.

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.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	6	6	1	0	3.38
Reliability of mainframe	11	1	0	1	3.69
Reliability of peripherals	6	5	1	0	3.42
Maintenance service:					
Responsiveness	8	4	1	0	3.54
Effectiveness	7	5	1	0	3.46
Technical support:					
Troubleshooting	4	9	0	0	3.31
Education	2	9	0	1	3.00
Documentation	2	9	1	0	3.08
Ease of programming	3	6	0	0	3.33
Ease of conversion	3	5	1	0	3.22
Overall satisfaction	4	5	0	0	3.44

*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 first spoke with an individual in the petroleum industry who had converted to an AS/6650 from an IBM 4341. Stating that "there was nothing to it," the company spokesman indicated that the conversion went very smoothly. An hour after the old IBM equipment had been wheeled out and the new NAS equipment had been wheeled in, the system was up and running. Although this person had not yet encountered any performance problems with the NAS equipment, he had favorable impressions of NAS service representatives and therefore anticipated no drawbacks if a problem should occur.

We also received a favorable response from an NAS user at a government installation. This individual emphasized reliability as the major system strength. Unable to identify any significant system weaknesses, this government official wholeheartedly endorsed his NAS equipment and felt that technical support far surpassed that of IBM. Although they had converted from NAS AS/5000 equipment, they had IBM's DL/I data base management package and were not satisfied from both a performance and support viewpoint.

Another NAS user we interviewed was disappointed with the performance of the NAS 7000 system the company had installed and reported that there was a problem with the VM operating system. Stating that NAS was unable to solve the performance inefficiencies caused when using VM, the user was forced to use OS/VS1 and was actively seeking another machine which would enable them to utilize the processing power of VM. □

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-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.

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 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,

NAS Advanced Systems

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.

EQUIPMENT PRICES

		Purchase ($)	Monthly Maint. ($)	1-Year Lease ($)	2-Year Lease ($)
PROCESSOR COMPLEXES					
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	668	10,010	8,580
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	777	12,035	10,315
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	927	14,465	12,400
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	16,160	14,145
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	3,024	24,160	21,325
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	35,950	31,755
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	51,805	45,515
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	66,870	58,695
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	106,605	93,340
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	48,660
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	58,785
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	71,425
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	103,855
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	114,745
PROCESSOR OPTIONS					
AS/6600 Series:	Additional Memory Increment, 2 megabytes (AS/6620)	19,000	28	—	—
	Additional Memory Increment, 4 megabytes	38,000	56	1,215	1,040
	Additional Block Channels Increment, 2 channels	20,000	40	815	700
	Additional Byte Channels, each	8,000	20	335	285
	Channel to Channel Adapter	20,000	25	800	680
	Direct Control	5,000	—	195	165
	High-speed Arithmetic (AS/6650 only)	80,000	250	3,355	2,885
	Hard Copy Printer	3,700	139	285	265
	AS/6620 to AS/6630 Upgrade	95,000	109	—	—
	AS/6630 to AS/6650 Upgrade	115,000	150	—	—

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PROCESSOR OPTIONS (Continued)		Purchase ($)	Monthly Maint. ($)	1-Year Lease ($)	2-Year Lease ($)
AS/8000 Series:	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	505
	Additional Console	29,000	300	1,300	1,165
	Console Printer	6,000	139	315	290
	High-speed Arithmetic	200,000	300	5,975	5,215
	Preferred Machine Assist	50,000	NC	1,925	1,160
	Extended Architecture (AS/8023 only)	150,000	NC	9,615	8,160
	AS/8023 to AS/8043 Upgrade	390,000	1,613	—	—
	AS/8043 to AS/8053 Upgrade	503,000	164	—	—
	AS/8053 to AS/8063 Upgrade	493,000	903	—	—
	AS/8063 to AS/8083 Upgrade	961,000	1,689	—	—
AS/9000 Series				—	—
	Additional Memory Increment for AS/9070 and AS/9080; 16 megabytes	246,000	904	8,965	7,885
	Additional Channel Group, 8 channels	123,000	132	4,165	3,620
	Channel to Channel Adapter	14,000	56	575	505
	Console Printer	6,000	139	315	290
	Additional Service Processor Console	139,000	417	5,775	4,960
	Direct Control	1,500	21	75	65
	Preferred Machine Assist	50,000	NC	3,655	3,065
	9140 Vector Processors	1,792,000	6,329	67,930	59,675
	9150 Vector Processors	2,209,000	7,232	79,480	69,800
	9160 Vector Processors	2,608,000	8,170	93,920	82,440
	9170 Vector Processors	3,849,000	11,790	143,410	125,795
	9180 Vector Processors	4,740,000	13,453	155,730	136,695
	AS/9040 to AS/9050 Upgrade	512,000	1,063	—	—
	AS/9050 to AS/9060 Upgrade	393,000	903	—	—
	AS/9050 to AS/9070 Upgrade	1,200,000	2,544	—	—
	AS/9060 to AS/9080 Upgrade	1,105,000	6,588	—	—
	AS/9070 to AS/9080 Upgrade	1,052,000	4,947	—	—

NC—No charge.

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 ■