NAS Advanced Systems

MANAGEMENT SUMMARY

The NAS Advanced Systems family of IBM-compatible computers is aimed primarily at the IBM 4341, 303X, and 3081 markets. NAS's strategy is to offer performance levels equal to or greater than the comparable IBM models, usually at lower cost.

The current Advanced Systems family consists of 11 processor models: the AS/3000N, a successor to the Itel AS/3 and AS/4; the AS/3000, a redesign of the AS/5; the AS/5000N, AS/5000E, and AS/5000, which are based on the AS/7031; the AS/7000N, AS/7000, and AS/7000DPC, which are based on the AS/6; and the AS/9000N, AS/9000-2, and AS/9000DPC, which are an entirely new design.

The AS/3000 is equivalent in performance to the IBM 370/158-3. The AS/3000N, AS/5000N, and AS/5000E are replacements for the IBM 4341. According to NAS, the AS/3000N is equal in performance to the 4341 Model Group 1, the AS/5000N offers 20 percent better performance than the 4341 Model Group 1, and the AS/5000E is approximately equal in performance to the 4341 Model Group 2. The AS/5000 and AS/7000N are IBM 3031 and 3031AP replacements. The AS/5000 provides a performance improvement of up to 15 percent over the 3031, while the AS/7000N offers up to twice the performance capability of the 3031. The AS/7000 is aimed at the IBM 3033 market and offers up to 15 percent better performance than the 3033S. The AS/7000DPC is a dual-processor system that offers a performance improvement of up to 25 percent over the IBM 3033N. The target for the AS/9000N and AS/9000-2 is the IBM 3033, while the dual-processor AS/9000DPC competes against IBM's 3081. The AS/9000N ➢

The Advanced Systems family of computers consists of 11 models that are compatible with IBM's System 370/158, 4341, 303X Series, and 3081 processors. The NAS systems are functionally compatible with the IBM software, firmware enhancements, and peripheral equipment.

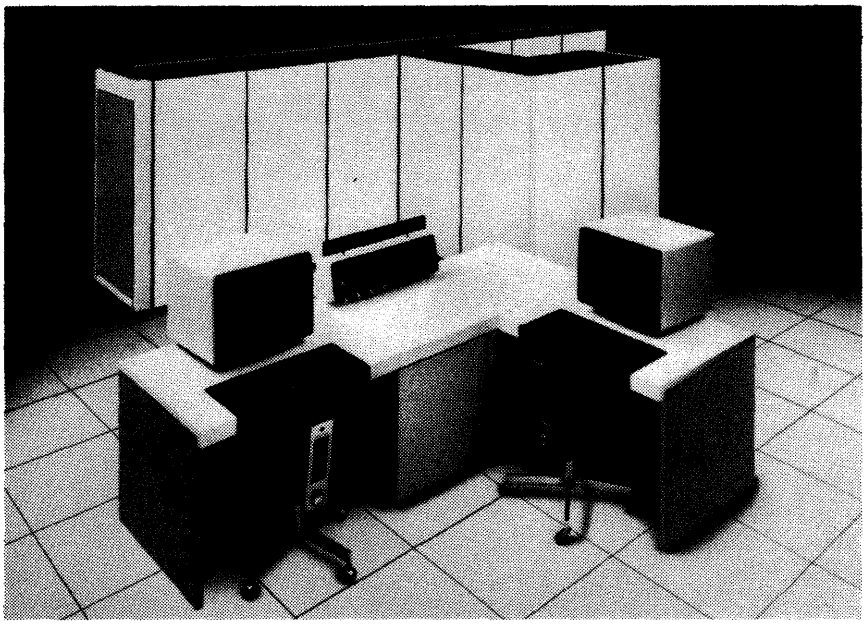
MODELS: AS/3000 Series, AS/5000 Series, AS/7000 Series, and AS/9000 Series.
CONFIGURATION: From 2 to 32 megabytes of main memory, 8K to 64K bytes of buffer storage, and 5 to 32 I/O channels.
COMPETITION: IBM 4341, 303X Series, and 3081; Amdahl 470 and 580 Series; Control Data Omega/480 Series; IPL 4400 Series; and Magnuson M80 Series.
PRICING: Purchase prices range from $220,000 to $4,650,000.

CHARACTERISTICS

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

MANUFACTURER: National Semiconductor Corporation, 2900 Semiconductor Drive, Santa Clara, California 95051. Telephone (408) 737-5000. Also Hitachi of Japan.

MODELS: AS/3000N, AS/3000, AS/5000N, AS/5000E, AS/5000, AS/7000N, AS/7000, AS/7000DPC, AS/9000N, AS/9000 Model 2, and AS/9000DPC. ➢



The large-scale AS/9000 Series is compatible with IBM's 3033 and 3081 systems. The basic AS/9000-2 system consists of a central processor with 12 megabytes of main memory, 64K bytes of buffer storage, 16 I/O channels, and a service processor console with 2 keyboard/display units and 2 floppy disk drives.

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CHARACTERISTICS OF THE ADVANCED SYSTEMS PROCESSOR MODELS

	AS/3000N & AS/3000	AS/5000N	AS/5000E	AS/5000	AS/7000N
SYSTEM CHARACTERISTICS					
Date of introduction	Jan. 1980	Sept. 1980	Sept. 1980	Jan. 1980	Jan. 1980
Number of central processors	1	1	1	1	1
Comparable IBM model	370/158, 4341-1	4341-1	4341-2	3031	3031
Principal operating systems	DOS/VS, DOS/VSE (370 mode), VM/370, OS/VS1, SVS, MVS	DOS/VSE, VM/370, OS/VS1, MVS	DOS/VSE, VM/370, OS/VS1	DOS/VS, DOS/VSE, VM/370, OS/VS1, SVS, MVS	DOS/VS, DOS/VSE, VM/370, OS/VS1, MVS, SVS
MAIN STORAGE					
Storage type	NMOS	NMOS	NMOS	NMOS	NMOS
Read cycle time, nanoseconds	920	460	460	460	360
Write cycle time, nanoseconds	690	460	460	460	360
Bytes fetched per cycle	8	8	8	8	8
Minimum capacity, bytes per system	2M	2M	2M	2M	2M
Maximum capacity, bytes per system	4M, 8M	8M	8M	8M	8M
Increment size, bytes	1M	1M	1M	1M	2M
Interleaving	No	No	No	No	4-way
BUFFER STORAGE					
Access time, nanoseconds	230	184	184	184	144
Bytes fetched per cycle	8	8	8	8	8
Capacity, bytes	8K, 16K	8K	32K	32K	16K
PROCESSING UNIT					
Machine cycle time, nanoseconds	115	92	92	92	72
Processing unit features:					
Clock Comparator & CPU Timer	Standard	Standard	Standard	Standard	Standard
Direct Control	Optional	Standard	Standard	Standard	Standard
Dynamic Address Translation	Standard	Standard	Standard	Standard	Standard
Floating Point	Standard	Standard	Standard	Standard	Standard
Extended Precision Floating Point	Standard	Standard	Standard	Standard	Standard
High-Speed Arithmetic	No	No	No	No	No
Firmware features:					
Reloadable Control Storage	8K 72-bit words	16K 72-bit words	16K 72-bit words	16K 72-bit words	6K 99-bit words
Assist features	VS1:ECPS, VMA	VS1:ECPS, VMA, VM:ECPS, 370 EF, VSE:ECPS	VS1:ECPS, VMA, VM:ECPS, 370 EF, VSE:ECPS	VS1:ECPS, VMA, VM:ECPS, 370 EF, VSE:ECPS, MVS/SP Assist	VMA, 370 EF, MVS/SP Assist
CHANNELS					
Maximum number of channels	5	6	6	6	8
Configuration:					
No. of Block Multiplexer Channels	4	4 or 5	4 or 5	4 or 5	5 or 6
No. of Byte Multiplexer Channels	1	1 or 2	1 or 2	1 or 2	1 or 2
Data Streaming support	No	No	No	Optional	Optional

offers 2.0 to 2.4 times the performance of the AS/7000, and the AS/9000-2 offers 2.8 to 3.0 times the performance of the AS/7000. The performance of the AS/9000DPC is 1.7 to 1.9 times that of the AS/9000-2.

The AS/3000N and AS/3000 have a processor cycle time of 115 nanoseconds, five I/O channels, and a minimum of two megabytes of main memory. Main memory can be expanded in one-megabyte increments to a maximum of four megabytes in the AS/3000N and eight megabytes in the AS/3000. The AS/3000N has 8K bytes of bipolar buffer memory, while the AS/3000 has 16K bytes of buffer storage. Both models include a system console with a keyboard/display unit. The AS/3000N can be upgraded to an AS/3000.

The AS/5000N, AS/5000E, and AS/5000 have a machine cycle time of 92 nanoseconds, six I/O channels, and two to eight megabytes of main memory. The AS/5000N has 8K

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 4 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.

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CHARACTERISTICS OF THE ADVANCED SYSTEMS PROCESSOR MODELS (Continued)

	AS/7000	AS/7000DPC	AS/9000N	AS/9000-2	AS/9000DPC
SYSTEM CHARACTERISTICS					
Date of introduction	Jan. 1980	Jan. 1980	Jan. 1981	Sept. 1980	Jan. 1981
Number of central processors	1	2	1	1	2
Comparable IBM model	3033S	3033	3033	3033/3081	3081
Principal operating systems	DOS/VS, DOS/VSE, VM/370, OS/VS1, MVS, SVS	VM/370, MVS	VM/370, OS/VS1, MVS	VM/370, OS/VS1, MVS	VM/370, MVS
MAIN STORAGE					
Storage type	NMOS	NMOS	NMOS	NMOS	NMOS
Read cycle time, nanoseconds	360	360	336	266	266
Write cycle time, nanoseconds	360	360	288	228	228
Bytes fetched per cycle	8	8	8	8	8
Minimum capacity, bytes per system	4M	4M	4M	12M	16M
Maximum capacity, bytes per system	16M	16M	24M	32M	32M
Increment size, bytes	2M	2M	4M	4M	4M
Interleaving	4-way	4-way	8-way	8-way	16-way
BUFFER STORAGE					
Access time, nanoseconds	144	144	96	76	76
Bytes fetched per cycle	8	8	8	8	8
Capacity, bytes	64K	64K/CPU	32K	64K	64K/CPU
PROCESSING UNIT					
Machine cycle time, nanoseconds	72	72	48	38	38
Processing unit features:					
Clock Comparator & CPU Timer	Standard	Standard	Standard	Standard	Standard
Direct Control	Standard	Standard	Optional	Optional	Optional
Dynamic Address Translation	Standard	Standard	Standard	Standard	Standard
Floating Point	Standard	Standard	Standard	Standard	Standard
Extended Precision Floating Point	Standard	Standard	Standard	Standard	Standard
High-Speed Arithmetic	Standard	Standard	Standard	Standard	Standard
Firmware features:					
Reloadable Control Storage	6K 99-bit words	6K 99-bit words	16K 160-bit words	16K 160-bit words	16K 160-bit words
Assist features	VMA, 370 EF, MVS/SP Assist	VMA, 370 EF, MVS/SP Assist	VMA, 370 EF, MVS/SP Assist	VMA, 370 EF, MVS/SP Assist	VMA, 370 EF, MVS/SP Assist
CHANNELS					
Maximum number of channels	16	24	16	24	32
Configuration:					
No. of Block Multiplexer Channels	6 to 12	9 to 23	5 to 15	9 to 23	12 to 30
No. of Byte Multiplexer Channels	2 to 4	1 to 6	1 to 4	1 to 6	1 to 8
Data Streaming support	Optional	Optional	Optional	Optional	Standard

bytes of buffer storage, while the AS/5000E and AS/5000 have 32K bytes. Memory expansion is in one-megabyte increments. All AS/5000 Series systems include a system console with CRT, keyboard, and light pen. A console printer is standard on the AS/5000 only. The AS/5000N can be field upgraded to an AS/5000E or AS/5000, and the AS/5000E can be field upgraded to an AS/5000.

The AS/7000N, AS/7000, and AS/7000DPC feature a processor cycle time of 72 nanoseconds. The main memory capacity is from 2 to 8 megabytes on the AS/7000N and from 4 to 16 megabytes on the AS/7000 and AS/7000DPC. Main memory can be expanded in increments of two megabytes. Buffer storage capacity is 16K bytes on the AS/7000N, 64K bytes on the AS/7000, and 64K bytes per CPU on the dual-processor AS/7000DPC. The AS/7000 Series computers have a service processor console with CRT, keyboard, and light pen. A console printer is standard on all three models. The AS/7000N can be upgraded to an AS/7000, which in turn can be upgraded to an AS/7000DPC.

The AS/9000N has a processor cycle time of 48 nanoseconds, a main memory capacity of 4 to 24

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

MAIN STORAGE

STORAGE TYPE: 16K-bit negative metal oxide semiconductor (NMOS).

CAPACITY: From 2 to 32 million bytes, in 1-, 2-, or 4-million-byte increments, housed in 1 or 2 cabinets. (See the tables for capacities of the individual models.)

CYCLE TIME: See table.

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 or one 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 of storage, are standard in all models.

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megabytes, 32K bytes of buffer storage, and up to 16 I/O channels. The AS/9000-2 and the dual-processor AS/9000DPC offer a machine cycle time of 38 nanoseconds and 64K bytes of buffer storage per processor. Main memory on the AS/9000-2 ranges from 12 to 32 megabytes, while the memory capacity on the AS/9000DPC ranges from 16 to 32 megabytes. Memory is expandable in four-megabyte increments. The maximum number of I/O channels is 24 on the AS/9000-2 and 32 on the AS/9000DPC. The AS/9000 Series features a microprogram-driven service processor console that includes two 4-color keyboard/display units, two independent service processors, and two floppy disk drives. Up to four printers are available as options. The AS/9000N can be upgraded to an AS/9000-2, which can in turn be upgraded to an AS/9000DPC.

The AS/7000 Series and AS/9000 Series processors feature a pipelined technique that provides overlapped instruction decoding and execution. The dual-processor AS/9000 model can be reconfigured to operate as two independent uniprocessors, a capability that is not available on comparable IBM systems.

The Advanced Systems processors have fewer components than their IBM counterparts, thus reducing power consumption, heat dissipation, and floor space requirements. All Advanced Systems computers are air-cooled.

The Advanced Systems processors are compatible with IBM's System/360, System/370, 4300, 303X Series, and 3081 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, and MVS. 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, and MVS/SP Assists. The AS/5000 Series processors also support VSE Extended Control Program support. 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.

In June 1981, NAS reached an agreement with IBM that allows users to select NAS to serve as their support agent for selected IBM licensed programs. The agreement enables NAS to use IBM's support centers on behalf of the users, thus providing the customers with a single vendor contact. The new NAS Support Agency service will be provided initially for MVS/SP Version 1, VM/SP Release 1, and DOS/VSE Advanced Functions, effective in April 1982. A number of additional licensed programs will be supported as of July 1, 1982.

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. The AS/5000 Series processors have also implemented the 13 additional instructions in the 4300 instruction set.

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).

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.

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 standard on the AS/5000 Series and the AS/7000 Series, and optional on the AS/3000 Series and the AS/9000 Series.

The Extended Addressing option is available for the 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. The Extended Channel Adapter is a prerequisite.

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.

A High-Speed Arithmetic capability is standard on the AS/7000, AS/7000DPC, and the AS/9000 Series. This feature reduces the time required to process fixed- and floating-point multiply and floating-point divide instructions.

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 Channel-to-Channel Adapter, and it is required on only one of the interconnected channels. The Channel-to-Channel Adapter is standard on the AS/5000, AS/7000N,

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COMPETITIVE POSITION

Aside from the declared IBM system targets, the NAS Advanced Systems' chief competition comes from the M80 Series from Magnuson Computer Systems, the Omega/480 systems from Control Data Corporation, the 4400 Series from IPL Systems, and the 470 and 580 Series from Amdahl Corporation. The M80 processors are direct replacements for IBM's 370/138, 370/148, 4331, and 4341 systems. The Omega/480 processors are comparable to the IBM 370/138, 370/148, 4331, and 4341 systems. The IPL Systems 4400 Series processors are direct replacements for the IBM 4331 and 4341 systems. The Amdahl 470 Series is compatible with the IBM 303X Series, while the 580 Series is compatible with the IBM 3081 systems.

USER REACTION

Datapro's 1981 survey of general-purpose computer users yielded responses from 34 Advanced Systems users, most of whom had older Itel models installed. For the purposes of this report, we have included only those respondents who were using current NAS Advanced Systems models. There were nine such users—four with AS/5000 Series systems and five with AS/7000 Series systems. Of the AS/5000 Series systems, one was an AS/5000N and the remainder were AS/5000s. Of the AS/7000 Series systems, one was an AS/7000N, two were AS/7000s, and two were AS/7000DPCs.

The users' ratings are summarized in the following table. Two separate Weighted Average columns are provided for the AS/5000 Series and the AS/7000 Series, but the numbers of user responses for both systems have been combined. All of these systems were using IBM software and most were using IBM peripherals; therefore, we have eliminated the usual software and peripherals ratings.

	Excellent	Good	Fair	Poor	AS/5000 WA*	AS/7000 WA*
Ease of operation	7	2	0	0	3.75	3.80
Reliability of mainframe	7	1	1	0	3.25	4.00
Maintenance service:						
Responsiveness	4	5	0	0	3.25	3.60
Effectiveness	3	5	1	0	3.00	3.40
Technical support:						
Trouble-shooting	5	3	1	0	3.25	3.60
Education	1	5	2	1	2.50	2.80
Documentation	1	5	2	1	2.50	2.80
Ease of programming	2	6	0	0	3.25	3.25
Ease of conversion	5	2	0	1	3.50	3.25
Overall satisfaction	5	4	0	0	3.50	3.60

*Weighted Average on a scale of 4.0 for Excellent.

In all categories, the AS/7000 Series earned higher ratings in our survey than its predecessor, the Itel AS/6. The AS/5000 earned ratings that were equal to or better than its predecessor, the Itel AS/7031, in all categories except Maintenance Service.

In January we interviewed two of the survey respondents in order to gain further insight into their experience with the Advanced Systems.

AS/7000, and AS/7000DPC; it is optional on the AS/5000N, AS/5000E, AS/9000N, AS/9000-2, and AS/9000DPC.

The Two-Byte Interface option, available on the AS/7000 Series and the AS/9000 Series, doubles the bandwidth of the data path between the I/O channel and the control units that support this feature.

Dynamic Address Translation is standard on all AS processor models. The AS/3000 Series and AS/5000 Series have a 128-entry Translation Lookaside Buffer (TLB) that is used to store the most recently referenced addresses. The AS/7000 Series has a 256-entry TLB and a 5-entry Segment Table Origin (STO) stack that stores information on the size and main memory location of the segment table associated with TLB entries. On the AS/9000, the TLB contains 512 entries, while the STO contains 128 entries.

Instruction retry, command retry, and channel retry are standard on all models. The AS/7000 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/9000 also has 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.

The following compatibility features are standard on the AS/3000 Series and AS/5000 Series: IBM 14XX compatibility, IBM 70XX compatibility, and OS/DOS compatibility.

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/3000 Series includes a compact, desk-type console with built-in keyboard/display unit. The AS/5000 Series and AS/7000 Series feature service processor consoles with keyboard/display unit and light pen. The AS/7000 Series console also has an integral maintenance panel. Each service processor has its own Reloadable Control Storage (RCS). A remote console is available as an option. The AS/9000 Series' service processor console includes two 20-inch four-color display units, two independent processors, and two flexible disk drives. A remote diagnostic capability is provided. The AS/7000DPC and AS/9000DPC include two service processor consoles.

MULTIPROCESSING CONFIGURATIONS: The AS/7000DPC (Dual Processor Complex) and AS/9000DPC each consist of two independent processors that share a common main memory. The AS/7000DPC has a main memory capacity of 4 to 16 million bytes; the AS/9000DPC, of 16 to 32 million bytes. Buffer storage capacity is 64K bytes per processor. If one AS/7000DPC or AS/9000DPC 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.

INPUT/OUTPUT CONTROL

The AS/3000 Series and AS/5000 Series processors include five and six integrated I/O channels, respectively. The six I/O channels on the AS/5000 Series can be configured as one or

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The first user represented a government agency that had switched from an IBM 370/135 to an AS/5000N. He stated that he had experienced no problems during the conversion and that the software was completely compatible. He further stated that the CPU was "down a lot initially," but the situation had improved and he was "very well satisfied" with the system.

The second user, a manufacturer, had installed an AS/7000DPC system as an upgrade to an AS/5000, which had replaced an Itel AS/5. This user commented that the AS/7000DPC was "a definite improvement" over the earlier AS/5, and said he had experienced no problems with it.

All nine of the survey respondents said they would recommend the NAS Advanced Systems to other users.□

two byte multiplexer channels and four or five block multiplexer channels. The AS/7000N, AS/7000, and AS/9000N processors include one microprogram-controlled I/O Processor as standard, while the AS/7000DPC, AS/9000-2, and AS/9000DPC include two I/O Processors. The AS processors support from 6 to 32 channels. (See the tables for the exact number of channels available for each processor model.)

An additional I/O Processor must be added to the AS/7000 to support the maximum number of channels. To support the maximum number of channels on the AS/7000DPC, the Additional Channel option is required. With this option, channels can be attached to both processors. Expansion on the AS/9000 Series is via the optional Extended Channel Group, which provides an additional I/O Processor with eight channels, and the prerequisite Extended Channel Adapter. The Extended Channel Adapter provides for the attachment of the Extended Channel Groups, permits all channels except Channel 0 to be block multiplexer channels, and provides data streaming support on all block multiplexer channels. The Extended Channel Adapter is standard on the AS/9000-2 and AS/9000DPC and optional on the AS/9000N. It is a prerequisite for the installation of the Extended Addressing option, the MVS/SP Auxiliary Storage Management Assist and I/O Assist features, and the AS/9000N to AS/9000-2 upgrade.

Data Streaming support is optionally available for the AS/5000 and all AS/7000 Series models. Data Streaming can be added to a maximum of two block multiplexer channels on the AS/7000N, four on the AS/7000, and six on the AS/7000DPC.

Each I/O channel implements the standard IBM interface and is provided with 256 Unit Control Words. Block multiplexer channels have a data transfer rate of 1.5 megabytes per second on the AS/3000 Series, 1.86 megabytes per second on the AS/5000 Series, and 1.5 megabytes per second on the AS/7000 Series and AS/9000 Series. With the Data Streaming feature, the maximum data transfer rate is increased 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 or System/370 input/output and mass storage devices, as well as their plug-compatible counterparts from independent vendors.

NAS currently markets the 7830/7330, 7350, and 7860/7360 Disk Storage Subsystems. The 7330 is a plug-compatible replacement for the IBM 3330 Disk Storage Facility, while the 7350 and 7360 are replacements for 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, 70D6-655-02, and 70D6-655-05 in Volume 2 for detailed descriptions of these systems.)

In addition, NAS supports IBM's 3880/3375 and 3880/3380 disk subsystems on the AS/5000 Series, AS/7000 Series, and AS/9000 Series. The AS/5000 Series also supports IBM's 3370 disk drive. Compatibility with IBM's Data Streaming feature, which allows data transfer at three megabytes per second, has been provided for the 3375 and 3380 disk drives. NAS will provide support for IBM's Speed Matching Buffer option, which allows the attachment of the 3880 control unit to channels with data rates lower than three megabytes, in the second quarter of 1982.

SOFTWARE

The Advanced Systems offer complete functional compatibility with IBM System/360, System/370, 4300, 303X Series, and 3081 software. NAS supports users of current IBM system software by providing new releases of the software and 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. In addition, the AS/5000 Series provides Virtual Storage Extended, Extended Control Program Support (VSE: ECPS) capabilities. All of these enhancements improve system throughput by implementing a number of frequently used system routines in microcode. (See the tables for the microcode assist features available on the individual AS processors.) For the AS/3000 and AS/3000N, NAS provides Extend, a proprietary software product that simulates 370 EF to enable the AS/3000 Series processors to support MVS/SE.

PRICING

Purchase prices for the NAS Advanced Systems are listed below. NAS did not provide lease prices, but stated that operating and full-payment leases of variable lengths are available from local NAS sales offices.

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 asistance 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.

In November 1981, NAS announced a new 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

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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 will be provided via a toll-free telephone number, and local support will be provided via local NAS Systems Support Representatives. The Support Agency service will provide support for MVS/SP Version 1, VM/SP Release 1, and DOS/VSE Advanced Functions Release 3 as of April 1982. Effective July 1, the following licensed program products will be supported: 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.*
PROCESSOR COMPLEXES			
AS/3000N	Processor with 2 megabytes of main memory, 8K bytes of buffer storage, 5 I/O channels, and system console with CRT and keyboard	$ 220,000	$ 937
AS/3000	Processor with 2 megabytes of main memory, 16K bytes of buffer storage, 5 I/O channels, and system console with CRT and keyboard	225,000	937
AS/5000N	Processor with 2 megabytes of main memory, 8K bytes of buffer storage, 6 I/O channels, and service processor console with CRT, light pen, and keyboard	250,000	2,646
AS/5000E	Processor with 2 megabytes of main memory, 32K bytes of buffer storage, 6 I/O channels, and service processor console with CRT, light pen, and keyboard	350,000	2,793
AS/5000	Processor with 2 megabytes of main memory; 32K bytes of buffer storage; 6 I/O channels; service processor console with CRT, light pen, and keyboard; and 120-cps printer	450,000	3,542
AS/7000N	Processor with 2 megabytes of main memory; 16K bytes of buffer storage; I/O processor; 6 I/O channels; power distribution unit**; service processor console with CRT, light pen, and keyboard; and console printer	950,000	8,000
AS/7000	Processor with 4 megabytes of main memory; 64K bytes of buffer storage; I/O processor; 6 I/O channels; 2 power distribution units**; service processor console with CRT, light pen, and keyboard; and console printer	1,100,000	9,280
AS/7000DPC	Dual processors with 4 megabytes of main memory; 64K bytes of buffer storage per processor; 2 I/O processors; 8 I/O channels; 3 power distribution units**; 2 service processor consoles with CRT, light pen, and keyboard; and console printer	1,700,000	11,708
AS/9000N	Processor with 4 megabytes of main memory, 32K bytes of buffer storage, 2 I/O processors, 6 I/O channels; 2 power distribution units**, and service processor console with dual 4-color CRTs, keyboards, and 2 floppy disk drives	1,995,000	9,953
AS/9000-2	Processor with 12 megabytes of main memory, 64K bytes of buffer storage, 2 I/O processors, 16 I/O channels, 2 power distribution units**, and service processor console with dual 4-color CRTs, keyboards, and 2 floppy disk drives	2,750,000	11,450
AS/9000DPC	Dual processors with 16 megabytes of main memory, 64K bytes of buffer storage per processor, 2 I/O processors, 16 I/O channels, 5 power distribution units**, and 2 service processor consoles, each with dual 4-color CRTs, keyboards, and 2 floppy disk drives	4,650,000	12,995
PROCESSOR OPTIONS			
AS/3000 Series:			
	Additional main memory for AS/3000N, each megabyte	12,500	38
	Additional main memory for AS/3000, each megabyte	12,500	38
	Console printer	7,000	156
	Direct Control feature	3,500	23
	AS/3000N to AS/3000 upgrade	35,000	—
AS/5000 Series:			
	Additional main memory, each 2-megabyte increment	50,000	69
	Remote console	25,000	30
	Console printer for AS/5000N and AS/5000E	7,800	147
	Data Streaming feature for AS/5000 only	40,000	TBA
	Channel-to-Channel Adapter for AS/5000N and AS/5000E	25,000	132
	AS/5000N to AS/5000E upgrade	100,000	—
	AS/5000N to AS/5000 upgrade	200,000	—
	AS/5000E to AS/5000 upgrade	100,000	—
AS/7000 Series:			
	Additional main memory, each 2-megabyte increment	100,000	400
	Each additional I/O channel	25,000	30
	Second I/O processor for AS/7000	75,000	500
	Second service processor console	40,000	295
	Two-Byte Interface for I/O processor	6,000	2
	Additional Channel Capability for AS/7000DPC; expands maximum number of channels from 16 to 24	TBA	TBA
	Data Streaming feature (per I/O processor)	40,000	TBA
	MVS/SP Assists	60,000	—
	AS/7000N to AS/7000 upgrade	350,000	—
	AS/7000 to AS/7000DPC upgrade	900,000	—

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EQUIPMENT PRICES

PROCESSOR OPTIONS (Continued)	Purchase	Monthly Maint.*
AS/9000 Series:		
Additional main memory, each 4-megabyte increment	100,000	226
Additional service processor console	140,000	417
Two-Byte Interface for I/O processor	5,000	—
Channel-to-Channel Adapter (maximum of 3)	14,000	14
Printer (maximum of 2)	6,000	139
Direct Control feature	1,500	21
Extended Addressing	90,000	—
Additional Channel Group for AS/9000N; expands number of channels from 6 to 12	150,000	208
Additional Channel Group for AS/9000N and AS/9000-2; expands number of channels from 12 to 16	100,000	208
Extended Channel Group; includes additional I/O processor and 8 channels	150,000	208
Extended Channel Adapter (included on AS/9000DPC)	50,000	—
Data Streaming feature (per channel group)	40,000	110
MVS/SP Assists:		
Control Storage Extension	36,000	—
Dual Address Space	6,000	—
Auxiliary Storage Management	6,000	—
Real Storage Management	6,000	—
Input/Output	6,000	—
AS/9000N to AS/9000-2 upgrade	385,000	—
AS/9000-2 to AS/9000DPC upgrade	1,700,000	—

*Complete maintenance service for 24 hours/day, 7 days/week.
**Includes motor generator sets.
TBA—To Be Announced.

LOCAL PROGRAM SUPPORT

	Category A	Category B
AS 3000N	$ 485	$ 690
AS/3000	485	690
AS/5000N	485	690
AS/5000E	570	815
AS/5000	570	815
AS/7000N	630	900
AS/7000	660	940
AS/7000DPC	885	1,260
AS/9000N	1,050	1,510
AS/9000-2	1,320	1,890
AS/9000DPC	1,600	2,300■