# Amdahl 580 Series

## MANAGEMENT SUMMARY

**UPDATE:** *As a manufacturer of IBM plug-compatible products, Amdahl has scaled profitable peaks and fallen into some less than profitable valleys. At the moment, Amdahl is perched on another peak. The volume shipment of Amdahl 5890-300 mainframes, which compete against the IBM 3090, in addition to the sale of double-capacity 6380E disks made 1986 a financially satisfying year for Amdahl, to say the least. After coming off a very profitable 1986, Amdahl responded to IBM's January 3090 "E" model announcements with the February introduction of a new three-way 5890-400E processor and the announcement of performance enhancements to existing 5890 models. Similar to IBM, Amdahl also appended an "E" to the end of each of its new and existing 5890 IBM-compatible machines. In January, Amdahl also announced a new 5890-190 uniprocessor which has since been upgraded to a 5890-190E. The new Amdahl 5890-190E, the first single-processor offering in the model line, establishes a new 5890 entry point for Amdahl 580 users contemplating a move to Amdahl's latest mainframe generation. The new three-way Model 400E is positioned between the 5890-300E dual processor and 5890-600E four-way system, and is said to have 1.35 to 1.45 times the internal execution rate of the -300E. All the 5890E models are scheduled to be delivered at various times this year. Older Amdahl 580 machines, meanwhile, are now in limited new production or can be obtained on a used basis. Besides the 5890 enhancements, Amdahl also announced in 1986 a 50 percent increase in data transfer rate between the 6680 EDAS semiconductor disk and all 580/5890 main-* ▷

Amdahl Corporation's 5890 Series is positioned as a price/performance alternative to the IBM 3090 Series. The older Amdahl 580 models are now in "limited new production," according to Amdahl.

**MODELS:** 5840, 5850, 5860, 5867, 5868, 5870, 5880, and 5890-190E, -200E, -300E, -400E, and -600E.
**CONFIGURATION:** One, two, three, or four CPUs, up to 512MB of main memory, and up to 128 I/O channels.
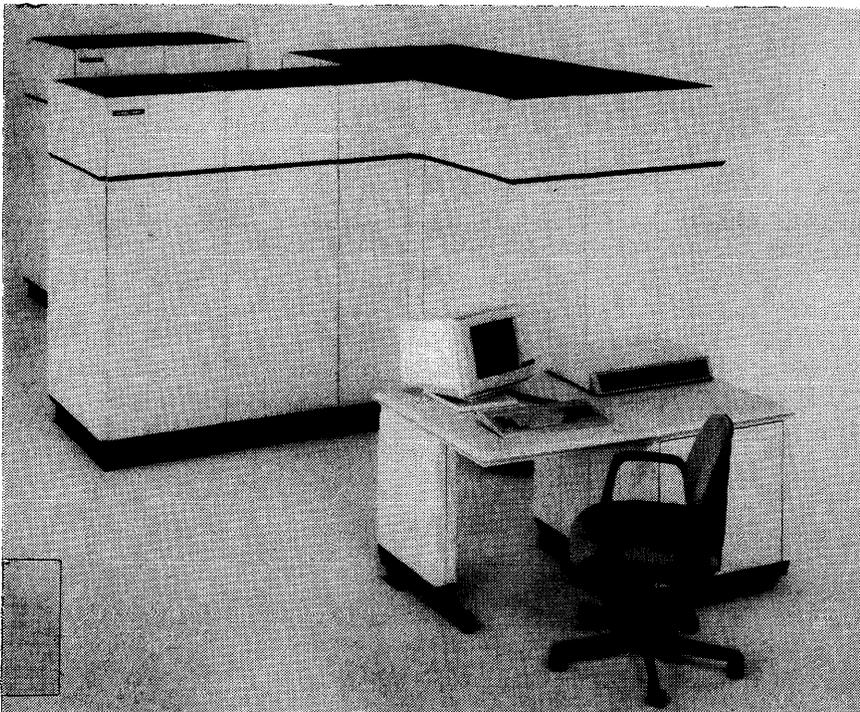**COMPETITION:** IBM 4381, IBM 308X, IBM 3090, NAS AS/XL Series.
**PRICE:** Prices range from $1,270,000 to $12,220,000.

## CHARACTERISTICS

**MANUFACTURER:** Amdahl Corporation, 1250 East Arques Avenue, Sunnyvale, California 94086. Telephone (408) 746-6000. In Canada: One First Canadian Place, Suite 3940, P.O. Box 123, Toronto, Ontario, Canada M5X 1B4. Telephone (416) 862-7479.

**MODELS:** Amdahl 580 Series processors include 5840, 5850, and 5860 single processors; 5867, 5870 dual processors, and 5868, 5880 two-way multiprocessors. 5890 Series processors include the Model 190E single processor; the Models 200E, -300E dual processors; the -400E three-way processor; and the -600E four-way processor. ▶



*The Amdahl Model 5890-300E is a tightly coupled dual processor which can be configured with up to 256 megabytes of main memory and 64 I/O channels. The 580/Expanded Storage feature is standard and the 580/Multiple Domain Feature is optional.*

# Amdahl 580 Series

## TABLE 1. SYSTEM COMPARISON

| MODEL | 5840 | 5850 | 5860 | 5867 | 5868 | 5870 |
|---|---|---|---|---|---|---|
| **SYSTEM CHARACTERISTICS** | | | | | | |
| Date announced | June 1983 | May 1983 | November 1980 | March 1984 | March 1984 | October 1981 |
| Date first delivered | Fourth Quarter 1983 | Third Quarter 1983 | Third Quarter 1983 | Third Quarter 1982 | Second Quarter 1985 | Fourth Quarter 1983 |
| Field upgradable to | 5850, 5860, 5867, 5868, 5870, 5880 | 5860, 5867, 5868, 5870, 5880 | 5870, 5880 | 5868, 5870, 5880 | 5880 | 5880 |
| Relative performance | .17* | .23* | .29* | .42* | .42* | .51* |
| Number of processors | 1 | 1 | 1 | 2 | 2 | 2 |
| Cycle time, nanoseconds | 23.25 | 23.25 | 23.25 | 23.25 | 23.25 | 23.25 |
| Word size, bits | 32 | 32 | 32 | 32 | 32 | 32 |
| Operating systems | MVS/370, MVS/ XA, VM/SP HPO, UTS/580 | MVS/370, MVS/ XA, VM/SP HPO, UTS/580 | MVS/370, MVS/ XA, VM/SP HPO, UTS/580 | MVS/370, MVS/ XA, VM/SP HPO, UTS/580 | MVS/370, MVS/ XA, VM/SP HPO, UTS/580 | MVS/370, MVS/ XA, VM/SP HPO, UTS/580 |
| **MAIN MEMORY** | | | | | | |
| Type | Dynamic NMOS | Dynamic NMOS | Dynamic NMOS | Dynamic NMOS | Dynamic NMOS | Dynamic NMOS |
| Minimum capacity, bytes | 16MB | 16MB | 16MB | 24MB | 32MB | 24MB |
| Maximum capacity, bytes | 128MB | 128MB | 128MB | 128MB | 256MB | 128MB |
| Increment size, bytes | 8MB, 16MB, 32MB | 8MB, 16MB, 32MB | 8MB, 16MB, 32MB | 8MB, 16MB, 32MB | 16MB, 32MB, 64MB | 8MB, 16MB, 32MB |
| Cycle time, nanoseconds | 280 | 280 | 280 | 280 | 280 | 280 |
| **BUFFER STORAGE** | | | | | | |
| Minimum capacity | 64KB | 64KB | 64KB | 64KB | 64KB | 64KB |
| Maximum capacity | 64KB | 64KB | 64KB | 64KB | 64KB | 64KB |
| Increment size | — | — | — | — | — | — |
| **INPUT/OUTPUT CONTROL** | | | | | | |
| Number of channels: | | | | | | |
| Byte multiplexer | 1 to 4 | 1 to 4 | 1 to 4 | 1 to 4 | 2 to 8 | 1 to 4 |
| Block multiplexer | 15 to 31 | 15 to 31 | 15 to 31 | 15 to 31 | 30 to 46 | 15 to 31 |
| Word | — | — | — | — | — | — |
| Other | — | — | — | — | — | — |

*Relative performance based on Amdahl Model 5890-300 equaling 1.0.

▷ *frames from 3 megabytes per second to 4.5 megabytes per second. The improvement came in anticipation of IBM plans to increase channel speeds, although at press time IBM had yet to announce any channel transfer enhancements.*

With the introduction of two new 5890 class processors, Amdahl now offers five IBM 3090-compatible mainframe models ranging from the single-processor 5890-190E to the four-way 5890-600E. A base -190E features 32 megabytes of main memory expandable to 256 megabytes and 16 channels expandable to 48 channels. It's been rated at an estimated 21 MIPS (millions of instructions per second). Amdahl is calling the -190E the most powerful single-processor mainframe it has ever offered. It's recommended for environments that run applications that don't make best use of dual-processor and multiprocessor configurations. Products falling under this category include single address space applications such as IBM's CICS and IDMS, applications which serialize on a single control region such as IMS, and user applications that serialize on a particular resource. It's upgradable to a 5890-300E dual processor, 5890-400E three-way processor, or 5890-600E four-way processor system and supports both System/370 and System/370 Extended Architecture environments.

The new 5890 Model 400E three-way processor can be configured with 128, 192, 256, 384, or 512 megabytes of main storage and 64, 80, or 96 channels. It's field upgradable to the -600E. A basic -400E model with 128 megabytes of memory and 64 channels lists for $7,275,000 and will be available during fourth quarter 1987.

In addition to the new processors, Amdahl increased the performance of the 5890-190E, -300E, and -600E by up to ▷

## ▶ DATA FORMATS

All data formats, instruction formats, and other architectural features are compatible with IBM System/370 architecture and System/370 Extended Architecture.

BASIC UNIT: Eight-bit bytes. Each byte can represent one alphanumeric character, two BCD digits, or eight binary bits. Two consecutive bytes form a half word 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; one half word (16 bits) or one word (32 bits) in binary mode.

FLOATING-POINT OPERANDS: One word, consisting of 24-bit fraction and seven-bit hexadecimal exponent in short format; two words, consisting of 56-bit fraction and seven-bit hexadecimal exponent in long format; or four words in extended-precision format.

INSTRUCTIONS: Two, four, or six bytes in length, which usually specify zero, one, or two memory addresses, respectively.

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

## MAIN MEMORY

The Amdahl 580 Main Storage Unit (MSU) on all models except for the top-end 5890 mainframes uses four-way line interleaving and four-way quarterline (each quarterline is eight bytes in length) multiplexing to provide up to 256 megabytes of storage. The data bus paths are 72 bits (double word) wide, and transfer eight-byte messages, plus parity, between the MSU and the Memory Bus Controller (MBC) every cycle. The most common data bus transactions are MSU data fetches, an activity for which the 580 bus system has been optimized to support.

The main storage unit on 5890-200E and 5890-300E models uses eight-way interleaving and contains data and key stor- ▶

# Amdahl 580 Series

## TABLE 1. SYSTEM COMPARISON (Continued)

| MODEL | 5880 | 5890-190E | 5890-200E | 5890-300E | 5890-400E | 5890-600E |
|---|---|---|---|---|---|---|
| **SYSTEM CHARACTERISTICS** | | | | | | |
| Date announced | November 1980 | January 1987 | February 1987 | February 1987 | February 1987 | February 1987 |
| Date first delivered | Second Quarter 1985 | June 1987 | March 1987 | June 1987 | Fourth Quarter 1987 | Fourth Quarter 1987 |
| Field upgradable to | — | 5890-300E, 5890-400E, and 5890-600E | 5890-300E, 5890-400E, 5890-600E | 5890-400E, 5890-600E | 5890-600E | — |
| Relative performance | .51* | .54* | .82* | 1.00* | 1.35* | 1.70* |
| Number of processors | 2 | 1 | 2 | 2 | 3 | 4 |
| Cycle time, nanoseconds | 23.25 | 15 | 15 | 15 | 15 | 15 |
| Word size, bits | 32 | 32 | 64 | 64 | 64 | 64 |
| Operating systems | MVS/370, MVS/XA, VM/SP HPO, VM/XA, UTS/580 | MVS/370, MVS/XA, VM/SP HPO, VM/XA, UTS/580 | MVS/370, MVS/XA, VM/SP HPO, VM/XA, UTS/580 | MVS/370, MVS/XA, VM/SP HPO, VM/XA, UTS/580 | MVS/370, MVS/XA, VM/SP HPO, VM/XA, UTS/580 | MVS/370, MVS/XA, VM/SP HPO, VM/XA, UTS/580 |
| **MAIN MEMORY** | | | | | | |
| Type | Dynamic NMOS | 256K-bit NMOS | 256K-bit NMOS | 256K-bit NMOS | 256K-bit NMOS | 256K-bit NMOS |
| Minimum capacity, bytes | 32MB | 32MB | 64MB | 64MB | 128MB | 128MB |
| Maximum capacity, bytes | 256MB | 256MB | 256MB | 256MB | 512MB | 512MB |
| Increment size, bytes | 16MB, 32MB, 64MB | 32MB, 64MB | 32MB, 64MB | 32MB, 64MB | 64MB, 128MB | 64MB, 128MB |
| Cycle time, nanoseconds | 280 | — | — | — | | |
| **BUFFER STORAGE** | | | | | | |
| Minimum capacity | 64KB | 96KB | 96KB | 96KB | 96KB | 96KB |
| Maximum capacity | 64KB | 96KB | 96KB | 96KB | 96KB | 96KB |
| Increment size | — | — | — | — | — | — |
| **INPUT/OUTPUT CONTROL** | | | | | | |
| Number of channels: | | | | | | |
| Byte multiplexer | 2 to 8 | 0 to 12 | 0 to 16 | 0 to 16 | 0 to 24 | 0 to 32 |
| Block multiplexer | 30 to 46 | 16 to 48 | 32 to 64 | 32 to 64 | 64 to 96 | 64 to 128 |
| Word | — | — | — | — | — | — |
| Other | — | — | — | — | — | — |

*Relative performance based on Amdahl Model 5890-300 equaling 1.0.

four percent and also increased the performance of the -200E by 13 percent. Amdahl improved performance through the use of faster 256K-bit memory chips. The company achieved additional performance improvements in the -200E through modifications to its instruction pipeline.

Combined with performance improvements announced in August 1986, Amdahl claims it has implemented a total performance improvement of 14 percent. The 5890 Series has now been given two performance boosts since it was initially announced in October 1985. With the announcement of E models, Amdahl published performance measures for specific models. The -300E dual processor is said to have 1.04 times the throughput of the 5890-300. The −190E provides 0.51 to 0.54 times the instruction execution rate of the -300E and up to 1.04 times the throughput of the -190. The -200E dual processor provides approximately 0.82 times the throughput of the -300E, and approximately 1.13 times the throughput of the -200. The −400E three-way processor provides 1.35 to 1.45 times the internal execution rate of the -300E. The -600E four-way processor provides from 1.7 to 1.9 times the internal execution rate of the -300E when operating in single-image mode and up to 1.04 times the throughput of the -600. The -600E approximates the performance of the -300E on each side of the partition operating in partition mode.

First customer shipments of the enhanced -200E began in March. Enhanced -190Es and -300Es were to be shipped by June, and the enhanced -400E and -600E will be shipped by fourth quarter 1987. Customers who acquired a 5890 between February 12 and date of first customer shipment will

age arrays for up to 256 megabytes of main memory. The two top-end processors, the Models 5890-400E and -600E, have maximum main memories 512 megabytes.

Mainframes can also be configured with the 580/Expanded Storage feature. Users can allocate any portion of main memory as 580/Expanded Storage at initialization time to reduce the paging and swapping load to channel-attached paging and swapping devices. Expanded storage is specified in four-megabyte increments.

STORAGE TYPE: Dynamic NMOS; 64K-bit chips or 256K-bit chips.

CAPACITY: Please refer to Table 1.

CYCLE TIME: Amdahl specifies a memory cycle time of 280 nanoseconds for all 580 models. Cycle time for 5890 models has not been disclosed.

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.

RESERVED STORAGE: The 580 processors reserve an area in lower memory for such purposes as interrupt handling routines, CPU ID, channel ID, and machine-check logouts. Storage protection facilities are comparable to those implemented in the IBM System/370.

## CENTRAL PROCESSOR

The 580 Series makes extensive use of large-scale integration (LSI) chips, using high-performance emitter-coupled logic (ECL) circuitry. Up to 400 of these circuits can be contained on a single LSI chip, compared to only 100 circuits per chip on the older technology 470 Series. In spite of an increased packing density, a 580 chip generates only slightly more heat than a 470 chip. This allows the 580, like the older 470, to be air-cooled.

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▷ get an upgraded E version. Customers with installed 5890s can upgrade them to a corresponding E model for $120,000.

Amdahl first launched the 5890 processor line in October 1985, about eight months after IBM first introduced its new 3090 generation of processors. At the time of the announcement, Amdahl was criticized for taking so long to respond to the IBM introduction. Amdahl took the extra time to work out system bugs that invariably show up in a new product line. According to Amdahl, the wait paid off in the long run since the company wasn't forced to correct costly problems after the units were shipped.

Amdahl manufactures its own computer systems using components obtained from Fujitsu of Japan, an early Amdahl investor which now owns almost half of the company's stock. Amdahl has also developed proprietary systems software and microcode designed specifically for Amdahl machines. Since Amdahl maintains a substantial research and development effort to maintain a competitive edge over IBM, Amdahl top execs resent being called a "marketing arm" of Fujitsu.

To further diversify its product line and make the company less exposed to the ups and downs of IBM product cycles, Amdahl has been expanding its offerings to include mass storage products, communications processors, and Fujitsu supercomputers that are channel attached to Amdahl mainframes.

In 1982, the company entered the storage business with the introduction of the 6280 Disk Unit and 6880-A2 Storage Control Unit. The company now offers four mass storage product lines including the 6380E double-capacity disk, introduced in December 1985, and the 6680 Electronic Direct Access Storage (EDAS), introduced in April 1986. The 6380E, which has a capacity of 5.04 gigabytes per unit, became available by fourth quarter 1986. In April 1986, Amdahl announced the 6680 EDAS product, a solidstate semiconductor memory consisting of the 6880 Models S2 or S2E Storage Control Unit and the 6680 Electronic Storage Unit. An optional 6681 battery unit provides power backup to the Electronic Storage Unit in the event of power failure. The 6680 uses 256K-bit dynamic RAM chips and is said to be 80 times faster than rotating magnetic disk units. Depending on configuration, storage can range from 32 megabytes to 512 megabytes.

In September 1986, Amdahl enhanced both the 580 Series and the 6680 EDAS subsystems by increasing the channel rate from the standard 3 megabytes per second to 4.5 megabytes per second. The optional 580/EDAS High-Speed Channel Feature improves response time and system throughput. The channel feature was scheduled to be available by second quarter 1987.

To further differentiate the Amdahl product line from IBM offerings and give users more than just an IBM price/performance alternative, Amdahl introduced the 580/Multiple Domain Feature (580/MDF) in June 1985 and has ▷

▶ High-speed, 4K-bit and 16K-bit RAM modules were developed by Amdahl to handle such functions as Distributed Microcode control storage, high-speed buffer (HSB) storage, and system registers.

Amdahl combines up to 121 RAM, logic, and register chips on a Multiple Chip Carrier (MCC). This increased packing density, with almost three times the number of chips per MCC as the 470 Series, permits the implementation of an entire system function on a single MCC. Each system MCC is arranged in three-dimensional stacks. Each stack can contain 13 to 15 MCCs. The MCCs are interconnected through 12-layer printed circuit board side walls. Single-processor systems contain one stack, two-processor and two-way multiprocessor systems contain two stacks, and four-way multiprocessors contain four stacks.

Combining all functional units together are two data buses, the A-Bus and B-Bus. Each bus moves unidirectionally and has a 72-bit-wide data path. The two buses are integral parts of the stack side walls. They provide shorter data paths and simplified physical connections, while reducing the number of connections required among functional units. In 580 systems other than the 5890 models, the A-Bus transports data from the Console, I/O Processor (IOP), and CPU to the Memory Bus Controller (MBC). The B-Bus returns data to these units from the MBC. In 5890 systems, the A- and B-buses carry data among the External Director, the Input/Output Processors, and the System Support Processor. These 580 and 5890 components are described fully in succeeding paragraphs.

The Amdahl 580 CPU has two instruction functions continuously performed in parallel: Instruction Fetch (I-Fetch) and Instruction Execution.

The I-Fetch component provides a double word of instruction flow and holds it in the Instruction Word Buffer (IWB) in the I-Unit until needed for execution. With each cycle, instructions are moved in and out of the IWB at the rate of one, two, or three halfwords of instruction data.

The I-Unit controls instruction execution and processes system interrupts. Specific functions of the I-Unit include:

• Instruction fetching, decoding, and buffering

• Determining effective operand addresses

• Providing register access for operands

• Maintaining overlapped pipeline processing technique via control of Storage Unit (S-Unit), Execution Unit (E-Unit), and I/O Processors (IOPs)

After an instruction is fetched, a five-phase pipeline operation takes over. The pipeline concept permits the I-Unit to have several instructions in various phases of execution simultaneously. With each processor cycle, another instruction enters the pipeline from the IWB. The instruction preceding it moves into the next phase of execution. By the fifth processor cycle, at maximum execution rate, five instructions are in the pipeline simultaneously in different execution phases. Since instruction flow involves five basic steps at the maximum execution rate, the result is an effective rate of one instruction per machine cycle. For comparison, the older 470 Series executed at a maximum rate of one instruction per two cycles. This increased execution rate permits the 580 to execute twice as fast as Amdahl's previous top-end system, the 470V/8.

Extensive parity checking is performed throughout the I-Unit. All incoming instructions are checked for parity, and the results are checked again after completion of execution. ▶

▷ since installed 100 systems. According to published reports, IBM is also working on its own version of MDF. MDF lets users divide a single processor complex into up to four *real* machines or domains. Multiple System Control Programs (SCPs) can run independently in their own domains. The feature now makes it possible to run MVS/XA production in one domain and run MVS/XA tests in another domain during regular working hours. Users can also place CICS and TSO applications in separate domains to improve performance or use MDF to help with conversion from MVS/370 to MVS/XA. MDF is being offered as an alternative to VM, since the feature requires less system overhead, eliminates redundant license fees, maintenance, and related items.

Another 5890 feature now common to all other 580 mainframes is 580/Expanded Storage (580/ES). The 580/ES feature lets 580 users set aside a portion of main memory for expanded storage. Similar to the IBM expanded storage feature available with the 3090, the 580/ES is designed to improve system throughput by reducing the paging and swapping load to channel-attached devices in storage-constrained and heavy paging environments. The Amdahl expanded storage feature moves 4K pages between expanded storage and main memory to cut back on direct access storage device paging. Amdahl believes the 580/ES feature, now standard on all 580 systems, will be particularly beneficial to users who need additional memory but whose operating systems or systems facilities, such as VM/SP HPO and IMS Virtual Fetch, cannot use regular main memory greater than 64 megabytes. The expanded storage option is available either from the plant or as a field upgrade.

As an IBM environment-compatible vendor, Amdahl's primary mission is to maintain IBM operating system compatibility. The 5890 processors can operate in either System/370 or 370-XA mode and support the current releases of MVS/SP Versions 1 and 2, VM/SP High Performance Option (VM/SP HPO), and VM/XA Systems Facility (VM/XA SF). The Model 600 supports VM/XA SF when operating in partitioned mode.

The VM Performance Assist feature (580/VMPA), now a standard feature on all 580 models, supersedes Amdahl's VM/Software Assist. The 580/VMPA feature improves the performance for both VM/CMS and preferred real machine environments. The feature is available directly from the plant or as a field upgrade.

In January 1986, Amdahl announced UTS/580 Version 1.1, a product Amdahl calls the first standalone Unix implementation to be made commercially available for large System/370 architecture processors. UTS/580 can run as a system control program on an Amdahl 580 Series processor, can operate in a domain under Amdahl's 580/Multiple Domain Feature, or can run as a guest under VM/ ▷ SP or VM/SP HPO.

▶ All control registers and the program status word are checked each time they are used. In addition, parity is checked for the timer and the address generation function, and parity is also maintained for all program-referrable data.

The 580 I-Unit is compatible with the IBM System/370 Principles of Operation opcodes. These elements are implemented within the CPU by a mixture of hardware, microcode, and a new class of firmware called Macrocode. Critical system functions are implemented in hardware for fastest execution, while other less critical functions can be implemented in microcode resident on the MCC used by the I-Unit.

All I-Unit data requests are processed by the S-Unit. Virtual-to-absolute address translations are performed in the S-Unit, which includes a Translation Lookaside Buffer (TLB) to facilitate rapid virtual-to-absolute translations. Data traffic between the CPU data buffers and main memory is controlled by the S-Unit. It also provides the bus interface between the CPU and the rest of the 580.

A double word of data is accessed each cycle by the S-Unit from its high-speed buffers (HSB). The four storage arrays in the S-Unit (the data array, the data select array, the tag array, and the TLB array), are accessed simultaneously during this activity. The data array has 512 thirty-byte lines organized within its primary and alternate partitions, and contains the actual data lines. The tag array mirrors the data array in organization, and contains TLB pointers that indicate the pages to which the data lines belong. The data select array facilitates the virtual address selection process. The TLB array contains the virtual-to-absolute address translations.

Since the 580 processes I-Fetch and execution functions separately, two high-speed buffers (HSB) for instructions and operands are provided. Both the Instruction Buffer (I-Buffer) and the Operand Buffer (O-Buffer) have 32K bytes of storage (5890 systems have a 64K-byte O-Buffer and 32K-byte I-Buffer), are two-way, set-associative, and are organized into primary and alternate partitions of 512 thirty-two-byte lines. If a line of requested data is not present within an HSB, the S-Unit sends a message to main memory requesting the desired line.

The high-speed TLB has 512 entries organized into primary and alternate partitions of 256 translations to speed virtual-to-absolute address translations. Within each TLB entry is Segment Table Origin (STO) information which eliminates the need for a separate STO stack as in the 470. Address translations conform to the System/370 structure.

The E-Unit executes the arithmetic and logical instructions contained in the 580's instruction set. Operands and opcodes are received from and returned to either the O-Buffer or the I-Unit Register Facility as required by the specific instruction. Performance is enhanced within the instruction pipeline via concurrent activity on two separate instructions by the E-Unit Logic Unit and Checker (LUCK) and the various execution-cycle processes (multiply, add, shift, pack, and decimal correct). LUCK and execution phase operations require one processor cycle. In addition, the 580 uses an eight-byte-wide data path, compared to a four-byte wide path in the 470. Amdahl has optimized certain logic algorithms used with frequently executed instructions to improve execution speeds.

The primary data traffic manager within the 580 is the Memory Bus Controller (MBC). In 5890 systems, similar functions are performed by the System Director and External Director. ▶

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## TABLE 2. MASS STORAGE

| MODEL | 6280 Models AA4, AAF, B4, B4F | 6280 Models AU4, AUF, BU4, and BUF | 6380 Models AA4, M4, B4 | 6380E AE4 and BE4 | 6680 EDAS |
|---|---|---|---|---|---|
| Cabinets per subsystem | 1 to 4 | 1 to 16 | 1 to 4 | 4 to 8 | 1 to 2 |
| Disk packs/HDAs per cabinet | 4 | 4 | 4 | 4 | NA |
| Capacity | 1.27GB per unit | 1.78GB per unit | 2.52GB per unit | 5.04GB per unit | 32MB to 256MB per unit; 512MB per subsystem |
| Tracks/segments per drive unit | 16,650 | 16,660 | 13,275 | 26,550 | NA |
| Average seek time, msec. | 18 | 18 | 15 | 17 | NA |
| Average access time, msec. | 25.6 | 25.6 | 23.3 | 25.3 | 0.3 |
| Average rotational delay, msec. | 7.6 | 7.6 | 8.3 | 8.3 | NA |
| Data transfer rate | 1.52MB or 1.86MB per sec. | 1.86MB per sec. | 3.0MB per sec. | 3.0MB per sec. | 3.0MB to 4.5MB per sec. — |
| Controller model | 6880-A2 | 6880-A2 | 6880-G2 or 6880-G2E | 6880 Models G2 or G2E | 6880 Models S2 or S2E |
| Comments | 6880-A2 features two-channel switch pair; 8 megabytes of cache controller memory is optional. | 6880-A2 is available with two-channel switch pair and two storage directors | 6880-G2/G2E cache controller features 8, 16, 24, or 32 megabytes of dynamic cache memory in the storage control units; the G2 also features a two-channel and eight-channel switch. | 6880-G2/G2E each feature two storage directors; the G2 models can have 2, 4, or 8 shared channels per storage director and the G2E can have 8 channels per storage director. | The 6680 Electronic Direct Access Storage (EDAS) product uses 256K bit RAM semiconductor memory to improve response time. |

NA—Not Applicable

## ▷ COMPETITIVE POSITION

While mainframe rivals NAS and IBM market both medium- and large-scale mainframes, Amdahl has concentrated on large-scale mainframe systems exclusively. Now that Amdahl has achieved a worldwide installed base of more than 1,200 systems, company officials believe thay have built a sizable enough critical mass to remain profitable. At a time when profits in the mainframe world have become more elusive, Amdahl has more than held its own within the last year. For 1986, Amdahl reported net income of $41.8 million on sales of $966 million, compared to 1985 earnings of $28.7 million on sales of $862 million. This represents an earnings increase of 45.7 percent. Worldwide value of Amdahl shipments grew to $750 million, giving the company a 4.3 percent market share, up slightly from the 4.1 percent share of 1985, according to International Data Corporation, the Framingham, Massachusetts market research firm that follows the computer industry. IBM 1986 market share was 81.5 percent, up slightly from the 81.1 percent share posted for 1985.

First shipments of the 5890 Model 300 dual-processor complex and the 6380E double-capacity storage disk in no small part accounted for Amdahl's respectable showing. The company is scheduled to ship the full 5890 processor line—which now includes five models—at various scheduled shipping dates during 1987. The two biggest systems, the three-way Model 400E and the four-way Model 600E, still won't be available until the fourth quarter of this year. IBM announced its new top-end Model 600E and enhanced Model 400E will be available by the third quarter of this year. NAS also plans to deliver its top-end AS/XL-100 by the third quarter.

Pricing for the new Amdahl systems has remained stable through 1986 and the first half of 1987 thanks to a soft mainframe market and sluggish IBM sales. To stimulate 1987 sales, in January IBM improved 3090 cycle times ▷

▶ The MBC, a key element in the instruction execution process of the 580, receives requests from the CPU, I/O Processor, or console over the A-Bus. The MBC includes the following components:

- Data Integrity Unit, which assures that copies of a currently accessed data line which also exist in other system elements, such as the MSU and the two HSBs, contain the same data

- Interrupt Router, which directs external system interrupts to the CPU

- Timer Complex, which provides System/370 timing facilities such as the time-of-day clock, clock comparator, CPU timer, and interval timer

- I/O Router, which translates logical channel addresses to real addresses, formats them for IOP or console action, and facilitates channel reconfiguration

- Main Storage Controller (MSC), which provides the correct control signals for MSU memory requests, and generates error checking and correction (ECC) codes

Once a request has entered the MSU from the MBC, the MSU accesses four quarterlines from one of the four interleaves present and latches them within the Main Storage Data-Out Register. The quarterlines (actually a 32-bit data line) are then routed over the B-Bus (move-in data path) to the appropriate component, such as the S-Unit, IOP, or console.

The System Director in 5890 systems controls and monitors, but does not execute, all requests for data and access to main memory and all storage protect key functions to insure data integrity. The External Director in 5890 systems provides a logical and physical interface between CPUs, System Director, and Main Storage Unit, and the Input/Output Processors and System Support Processor. The External Director handles I/O interrupt routing, 370-XA I/O path selection, and message routing from the CPUs.

The Amdahl 580 operates in the Extended Control (EC) mode. 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 Trans- ▶

# Amdahl 580 Series

▷ slightly without raising prices. IBM even lowered the prices of the entry-level 3090 Model 150E and the four-way Model 400E.

Amdahl followed the IBM announcements with its own performance increases, also without an increase in price. Additionally, Amdahl made it possible for users to upgrade an installed system directly to a corresponding Amdahl E model for $120,000. IBM users must upgrade to the next highest IBM "E" model to take advantage of the performance increases.

The appearance of a so-called "mid-life kicker" along with aggressive pricing comes fairly early in the IBM 3090 product cycle. To put it simply, the new IBM mainframe generation has not been selling as a strategic IBM product line is supposed to sell. According to IDC, reasons for poor 3090 acceptance have not changed much from the year before. The now defunct IBM 308X line remains attractive from a price/performance standpoint for many users. The need for more computer horsepower measured in MIPS (millions of instructions per second) is not as compelling as some observers and industry players had originally thought. And finally, potential customers have apparently not been captivated enough by new 3090 attractions such as expanded storage, vector processing capabilities, and one-megabit memory chips.

While Amdahl has kept pace with IBM 3090 enhancements, its IBM plug-compatible rival, NAS, hasn't been standing still either. Earlier this year, NAS enhanced its top-end AS/XL line with the announcement of the AS/XL 70, a dyadic processor, doubled maximum data transfer speed to six megabytes per second, and introduced one-megabit dynamic random access memory (DRAM) chips. Additionally, maximum main memories can now go up to two gigabytes.

Amdahl's former 580 Series competition, the IBM 308X Series and the NAS 80X3 and 9XX0 Series, are only available as used boxes. Similar to Amdahl, these older product lines, for the most part, have been superseded by more powerful machines. The NAS AS/XL, for instance, now overlaps the performance of older NAS AS/9XX0 machines, which can only be obtained on an "as available" basis. New NAS medium-range IBM 4300-compatible processors, which were expected to be announced as this article went to press, are expected to replace the NAS AS/80X3, which also can only be obtained on an "as available" basis.

## ADVANTAGES AND RESTRICTIONS

With the announcement of new 5890 top-end mainframes and price/performance enhancements for existing 580 processors, Amdahl has extended the growth path for its customers, has made larger configurations possible on existing 580 mainframes, and has augmented savings in the operating systems software area.

The announcement of 5890 processors gives the mainframe user community a price/performance alternative to ▷

▶ lation (DAT) and other new system control functions; therefore, virtual-storage-oriented operating systems must be used.

The 580 can also operate in the Extended Architecture (XA) mode. This capability supports 31-bit addressing with real and virtual address sizes of 2 billion bytes. Normal EC mode supports 24-bit addressing with a maximum of 16 million bytes of real and virtual address space per user program. The 580 supports a dynamic channel subsystem and bimodal operation, which permits user programs with 24- and 31-bit addresses to execute concurrently.

Sixteen 32-bit general registers are used for indexing, base addressing, and as accumulators. Other program-visible registers are the same as in the System/370. Machine-dependent registers contained in the 580 processors are not visible to the user and may differ from the System/370.

The Amdahl 580 instruction set consists of the complete System/370 Universal Instruction Set, including the five System/370 instructions for Dynamic Address Translation.

The Console Complex is the command center of the 580, and provides an operator's console interface. It is the primary means of conducting both local and remote system diagnostics. The Console Complex and its associated components are implemented in microcode and contained in a single MCC.

The Console Complex includes the following:

- Microcoded System Support Processor with two megabytes of memory, capable of executing a subset of the Amdahl 580 instruction set

- An I/O channel, associated with one hard disk and two diskettes

- Up to three remote CRT keyboard units, comparable to IBM 3277s

- A system scanning facility

- Modem control facilities for access to Amdahl Diagnostic Assistance Center (AMDAC)

- A Bus Handler for attachment to the system's A-Bus and B-Bus

In 5890 systems, the console subsystem consists of operator consoles, a System Support Processor, Console Support Processor, and System Activity Monitor. Operator consoles include a system console to handle system control functions and monitoring; an operator console to handle controlling and monitoring functions that involve the System Control Program; a maintenance console to monitor system functions and to diagnose problems, and an AMDAC console for communicating between dual-processor systems and the AMDAC.

The System Support Processor (SSP) handles system initialization and reset, monitoring, diagnostic, and system recovery and repair functions. The SSP includes a processor, a hard disk, two diskette drives, up to four terminals at the operator consoles, and a modem for connection to the AMDAC.

The System Activity Monitor displays system status information, such as CPU busy or channel busy. The monitor formats data in rows, columns, and graphs. Up to 18 horizontal graphs together with titles and headings can be displayed. ▶

# Amdahl 580 Series

▷ IBM. Just the same, Amdahl 580 users who plan to migrate to the 5890 will be faced with a processor swapout, since no field upgrade is possible between existing 580 processors and the new 5890 Series. It is possible, however, to field upgrade the seven existing 580 processors from the entry-level 5840 to the 5880.

Besides the new 5890 systems, Amdahl has made it possible for existing 580/5890 users to expand processing power and processing flexibility. The optional 580/MDF, now extended to all processors, lets users consolidate multiple computer systems on a single processing complex and operate multiple System Control Programs (SCPs) on a single processor. MDF requires substantially less system overhead than VM, according to Amdahl. MDF lets users partition a single processor into four separate domains that can each run a different operating environment. Users can operate MVS/XA in one domain and XA test work in another domain without either one interfering with the other. Users can also set up separate domains to run CICS, TSO, and general MVS production work. Each domain can be assigned a subset of main storage, channels, and processing time that correspond to the needs and requirements of each operating environment.

In another hardware area, Amdahl offers a 40-channel configuration option on multiprocessors for users who don't need full 48-channel configurations. Additionally, users who need more than four byte multiplexer channels can now allocate up to eight possible byte multiplexer channels on multiprocessors. The new 580/Expanded Storage option, now available for all Amdahl processors, will be particularly beneficial to users who need additional memory but whose operating systems or systems facilities, such as VM/SP HPO and IMS Virtual Fetch, cannot use regular main memory greater than 64 megabytes.

The Multiprocessor Coupling feature lets users couple two identical 580 single-processor models to make it possible to eliminate redundant software licenses and reduce software costs. The feature also makes it possible to operate in single image and partition mode, making it practical for users to run larger system work loads and experience faster throughput.

A new hardware/firmware product called Macrocode supports the machine-check and channel-check capabilities of the 580. Macrocode along with hardware and microcode is used on the Amdahl 580 to implement System/370 Extended Architecture.

## USER REACTION

Datapro's 1987 survey of mainframe users drew responses from 29 users of Amdahl 580 Series systems. Of the 29 systems rated, nine were 5880s, five were 5890s, four were 5860s, three were 5840s, three were 5850s, two were 5868s, two were 5870s, and one was a 5867. The average age of these installed systems was 18.79 months at the time the survey was taken. Some 65.52 percent of the respondents said they purchased their systems from Amdahl, while ▷

▶ SPECIAL FEATURES: Other features of the System/370 found in the Amdahl 580 processors include control registers, direct addressing, double word buffer, machine check handling, multiple bus architecture, channel command retry, channel indirect addressing, byte-oriented operand feature, console audible alarm, remote console, remote data link, console file, extended control mode, program event recording, VM Performance Assist, and 580/Expanded Storage.

• Machine check handling analyzes errors and attempts recovery by retrying the failed instruction if possible. If retry is unsuccessful, it attempts to correct the malfunction or to isolate the affected task. Channels have the capability to perform channel command retry, a channel and control unit procedure that causes a command to be retried without requiring an I/O interruption. Channel Indirect Addressing (CIA) is a companion feature to dynamic address translation, providing data addresses for I/O operations. CIA permits a single channel command word to control the transmission of data that crosses noncontiguous pages in real main storage. If CIA is not indicated, then channel one-level (direct) addressing is employed. The byte-oriented operand feature permits storage operands of most nonprivileged operations to appear on any byte boundary. Instructions must appear on even byte addresses. The console audible alarm is a device activated when predetermined events occur that require operator attention or intervention for system operation. Remote consoles are available in addition to the standard console. The remote data link allows establishment of communications with a technical data center to remotely diagnose system malfunctions. The console file is the basic microprogram loading device for the system, containing a read-only file device. The media read by this device contains all the microcode for field engineering device diagnostics, basic system features, and any optional system features. The extended control mode (EC) is a mode in which all features of the System/370 computing system, including dynamic address translation, are operational. Program event recording is a hardware feature used to assist in debugging programs by detecting and recording program events.

• The optional Channel-to-Channel Adapter (CCA) permits direct communications between an Amdahl 580 and an IBM System/370, 303X, or 308X via a standard I/O channel. It can be attached to a block multiplexer channel and uses one control unit position on either channel. In an interconnection between an Amdahl 580 and an IBM processor, either system can be equipped with the Channel-to-Channel Adapter, and it is required on only one of the interconnected channels. Up to two CCAs can be implemented in a system.

• The Two-Byte Interface, with up to four available per IOP, doubles the bandwidth of the data path between the channel and the control units which support this option.

• The 580/Multiple Domain Feature (580/MDF) lets users consolidate multiple computer systems into a single processing complex, and operate multiple System Control Programs (SCPs) on a single processor. Each SCP resides in a domain, which has all the resources necessary to operate the SCP. The 580/MDF supports up to four domains on any model and up to eight domains on partitioned multiprocessors. Features include concurrent native support of S/370 and 370-XA; performance of at least 95 percent of native mode; no additional SCPs or software modifications required; hardware isolation and protection for each domain; dynamic allocation and redistribution of CPU time; flexible allocation of main memory and channels from a resource pool; full-screen menus; and predefined domain characteristics. The characteristics of the ▶

# Amdahl 580 Series

▷ 17.24 leased the equipment and 17.24 percent leased it from a third party.

Amdahl sites surveyed were primarily concentrated in government (31.03 percent), manufacturing (20.69 percent), insurance (13.79 percent), public utilities (10.34 percent), and education (6.90 percent). Principal applications respondents cited most often were accounting and billing (62.07 percent), payroll and personnel (55.17 percent), order processing and inventory (37.93 percent), and purchasing (31.03 percent). Other major applications listed in order of times cited were engineering/scientific, insurance, and manufacturing (each 24.14 percent); sales/distribution and process control (each 20.69 percent); mathematics/statistics (17.24 percent); health and medical (10.34 percent); education/scheduling/administration (10.34 percent); banking/check processing/loans/savings (6.90 percent); and construction and architecture (3.45 percent).

To gauge the size of Amdahl sites surveyed, users were asked to specify the size of their terminal and memory configurations. Some 89.66 percent said they had more than 60 local terminals and 65.52 percent had more than 60 remote terminals. Some 34.49 percent said they had from one to 60 remote terminals. Some 35.71 percent installed more than 64 megabytes of main memory and 60.72 percent installed between 16 megabytes and 64 megabytes of memory. Some 67.86 percent also had disk space capacity equal to or greater than 10 gigabytes. Some 25 percent had disk space ranging between 600 megabytes and 10 gigabytes.

For all of the users surveyed, the major source of applications programs originated with in-house personnel (96.55 percent). Another 58.62 percent said they used contract programming; 37.93 percent obtained packaged programs from the manufacturer; 31.03 percent obtained software from independent suppliers; and 3.45 percent obtained software from the manufacturer's personnel. The major programming language was Cobol, while Assembler was a distant second.

As part of system expansions planned for the year, 55.17 percent said they planned to obtain additional software from the manufacturer (either Amdahl or IBM), and 82.76 percent planned to obtain proprietary software from other suppliers. None of the 29 respondents implemented Amdahl's version of Unix and none said they planned to install Unix within the next year. Interestingly, Amdahl offers Unix-based systems and is a major Unix proponent in the mainframe world. On the hardware side, 86.21 percent said they planned to add to their present hardware, and 82.76 percent said they planned to expand data communications facilities.

In other survey categories, 79.31 percent said they now have an information center, and 72.41 had a disaster recovery plan, while 10.34 percent said they planned to implement a plan this year. ▷

▶ domain (architectural mode, amount of main storage, channels, and CPU time allocation) are specified during domain definition, and are entered at the 580/MDF master console. The domain console is identified during domain definition, and can either be a Main Operator Console (MOC) or a 580 Remote Operator Console (ROC). The MOC may be used for both the 580/MDF master console and the domain console functions, but Amdahl recommends that the 580/MDF master console be assigned to the MOC and each domain console be assigned to a separate ROC. Main storage is allocated to each domain in multiples of 64K bytes. The 580/MDF provides support for only MVS/370, MVS/XA, and VM/SP HPO software environments. If the 580/MDF feature is removed, the system is restored to its original configuration. The 580/MDF makes it possible to test SCPs and applications during prime shift without the need for separate processors. It also lets users convert from one SCP to another, or to convert subsystems and applications. Finally, the feature lets users combine operations running on multiple systems to a single system. By doing this, Amdahl contends, users may be able to reduce operating and software costs.

• The 580/Accelerator provides users of Amdahl's 5840 and 5850 with the ability to mimic a more powerful processor during periods of increased demand. Depending on the installed processor and desired performance level, the user can select one of three options: 5840 accelerated to 5850 level, 5850 accelerated to 5860 level, and 5840 accelerated to 5860 level.

• The 580/Conversion Feature assists users of systems converting from IBM MVS/370 to the MVS/XA operating environment. This feature combines 580 hardware circuitry with macrocode to split the 580 system into two logical systems with MVS/370 operating in one environment and MVS/XA operating in another.

• The High-Speed, Floating-Point feature is designed for use by large-system users with significant scientific processing needs. The feature provides additional computational capabilities that let 5840, 5850, 5860, 5867, 5868, 5870, and 5880 processors make use of the floating-point instruction set.

• 580/VM Performance Assist, a standard feature on all 580 systems, is said to enhance VM performance.

• 580/Expanded Storage, a standard feature on all 580 mainframes, lets users allocate a portion of main storage to expanded storage to reduce the paging and swapping load to channel-attached paging and swapping devices. Users can specify the size of expanded storage at system initialization time in four-megabyte increments. Up to 512 megabytes of expanded storage can be configured, depending on model.

**PHYSICAL SPECIFICATIONS:** Environmental conditions for 580 processors are included in the following table:

| | |
|---|---|
| Temperature Range | 60° to 90° F (16° to 32° C) |
| Underfloor Temperature | 50° to 66° F (10° to 19° C) |
| Relative Humidity Range (noncondensing) | 50% to 80% |
| Maximum Wet Bulb Temperature | 78° F (26° C) |
| Heat Output (Btus/hr) | 51,500 |
| Power Consumption | 6.0 to 16.4 kVA at 60 Hz |
| | 7.4 to 17.6 kVA at 50 Hz |
| | 13.1 to 55 kVA at 400 Hz |
| Power Source | 200V, 60 Hz, three phase |
| | 208V, 60 Hz, three phase |
| | 220V, 60 Hz, three phase ▶ |

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As part of the survey, users were asked to rate their Amdahl equipment from excellent to poor. As the results show, Amdahl received some of its highest marks in maintenance service responsiveness, reliability of the mainframe, and ease of operation. Lowest rated areas centered around software-related categories and ease of conversion. This last area is especially critical to a plug-compatible vendor trying to lure customers away from the IBM world.

| | Excellent | Good | Fair | Poor | WA* |
|---|---|---|---|---|---|
| Ease of operation | 16 | 10 | 0 | 0 | 3.62 |
| Reliability of system | 21 | 8 | 0 | 0 | 3.72 |
| Reliability of peripherals | 11 | 17 | 1 | 0 | 3.34 |
| Maintenance service: | | | | | |
| Responsiveness | 20 | 8 | 1 | 0 | 3.66 |
| Effectiveness | 15 | 12 | 1 | 0 | 3.50 |
| Technical support: | | | | | |
| Troubleshooting | 13 | 15 | 1 | 0 | 3.41 |
| Education | 15 | 10 | 3 | 0 | 3.43 |
| Documentation | 8 | 17 | 3 | 0 | 3.18 |
| Manufacturers software: | | | | | |
| Operating system | 4 | 24 | 0 | 0 | 3.14 |
| Compiler & assemblers | 2 | 25 | 1 | 0 | 3.04 |
| Application programs | 3 | 22 | 2 | 0 | 3.04 |
| Ease of programming | 0 | 23 | 4 | 0 | 2.85 |
| Ease of conversion | 1 | 23 | 3 | 1 | 2.86 |
| Overall satisfaction | 6 | 22 | 0 | 0 | 3.21 |

*Weighted Average on a scale of 4.0 for Excellent.

To obtain additional comments, Datapro contacted four Amdahl user sites involved with government data processing, manufacturing, and education. A Southern state government site installed a Model 5880, a major federal agency based in Washington, DC installed a 5890-300, a Southern manufacturing site installed a 5840, and an Ohio university installed a 5868.

While each of the four sites use Amdahl machines for varying applications, their selection of Amdahl was largely based on price/performance considerations followed closely by hardware reliability and the quality of service from the vendor.

"Amdahl beats IBM in service," according to a spokesperson at the state government site. "It's a solid piece of iron," said the 5890 user at the federal site. "It seems to have lived up to its billing. So far I haven't heard any grumbling about it."

The 5840 user said his firm installed the system in August 1985. "It hasn't failed yet. I don't know what maintenance service is like since we haven't had to use the maintenance," he said.

The spokesperson at the state government site said they have had two Model 5880 failures since 1985. "We came in with a Model 5868 and upgraded to the 5880. We've had two hardware failures: one major and one minor." He said the systems were restored in a much degraded state immediately. It took personnel about two hours to fully resolve problems during one failure and took 30 minutes to correct problems after another failure.

240V, 60 Hz, three phase
380V, 60 Hz, three phase
200V, 50 Hz, three phase
220V, 50 Hz, three phase
240V, 50 Hz, three phase
380V, 50 Hz, three phase
415V, 50 Hz, three phase
208V, 400 Hz

The dimensions and weights for Amdahl mainframes are listed in the following chart:

| | Width (in.) | Ht. (in.) | Depth (in.) | Wt. (lb.) |
|---|---|---|---|---|
| Amdahl Mainframes | | | | |
| Models 5840/5850/5860 (Covers in place) | 147 | 70.5 | 36 | 3,833 |
| Models 5867/5868 (Covers in place) | 196 | 70.5 | 36 | 5,252 |
| Model 5890-190E | See text* | — | — | 6,461 |
| Models 5890-200E/-300E (Covers in place) | 153.8 | 70.5 | 104 | 6,482 |
| Model 5890-600E | See text* | — | — | 13,992 |

*Model 190E weight is given for a configuration involving 32 megabytes of main memory and 16 channels. Model 190E dimensions for this same configuration are 81.1 square feet without service clearance and 232.4 square feet with service clearance. Model 600E weight is given for a configuration involving 128 megabytes of main memory and 64 channels. Model 600E dimensions for this same configuration are 162.2 square feet without service clearance and 442.1 with service clearance.

## CONFIGURATION RULES

The Amdahl 580 is built from several interrelated components. Each element is implemented in a Multiple Chip Carrier (MCC), which contains all logic and circuitry required in a compact package. All functions are housed within the 580 mainframe and include the following:

- **Instruction Unit (I-Unit), which processes instructions and controls the CPU**

- **Execution Unit (E-Unit), which performs the required computations**

- **Storage Unit (S-Unit), which manages the system's storage and retrieval activities**

- **Instruction Buffer (I-Buffer), which provides high-speed buffer storage for instruction streams**

- **Operand Buffer (O-Buffer), which provides similar storage capabilities for operand data**

These components make up the Central Processor Unit (CPU). For 580 processors other than the 5890 models, additional elements include:

- **Input/Output Processor (IOP), which manages I/O requests and provides up to 16 channels**

- **Console Processor, which monitors CPU functions, provides maintenance and diagnostic routines via the System Support Processor (SSP)**

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▷ Although the user at the state government site has been generally pleased with Amdahl since they installed their first Amdahl system in 1979, he said he was not happy with the upgrade process when the site converted from the Model 5868 to the 5880. "The conversion was not at all up to Amdahl standards," he said. Some of the replacement parts needed for the upgrade initially failed. "I was not pleased with that." Now that the earlier upgrade problems have been corrected, the new upgraded system has performed well, he said.

Aside from processors, the four user sites also said they were pleased with Amdahl disk and communications products. A couple users said they only wished Amdahl offered other peripherals such as tapes and printers. "Tapes would be an advantage, if they were as reliable as the disks," said the 5840 user.

As multivendor shops, the four sites tended to be less reticent about using other IBM-compatible peripherals such as Memorex and Storage Technology magnetic tape drives. Fears that Amdahl would not survive in a Big Blue world have diminished somewhat, although one user did note that IBM continues to raise questions about Amdahl's future viability. "IBM can exert a lot of pressure," the user said. Even though Amdahl equipment has proved to be reliable and just as good as IBM hardware, the user said Amdahl and other IBM-compatible vendors continue to face acceptance problems among corporate officials who still make the major corporate purchase decisions. "It was a big decision for us. We've been using IBM since 1979," the user said.

When all 29 users surveyed were asked whether their systems did what they expected them to do, 96.55 percent of the respondents said "Yes," and no one said "No," although 3.45 percent did not answer the question. When asked whether they would recommend their systems to others, the answers were identical. □

▶ • Memory Bus Controller (MBC), which controls data accesses to the Main Storage Unit (MSU), data bus transfers, and provides overall system coordination and timing facilities

An additional IOP can be configured, giving the 580 a maximum of 31 block multiplexer channels per CPU (48 per system). Up to 128 channels are ultimately possible in 5890 systems.

Major 5890 mainframe components include the Processor Unit (PRU), Main Storage Unit (MSU), System Support Unit (SSU), and Power Supply Unit (PSU). An optional Channel Extension Unit (CEU) may also be configured in systems with more than 32 channels, or more than two Channel-to-Channel Adapters. Additional 5890 system components include a power distribution unit, main operator console, and up to three optional remote consoles. In addition to identical central processing units and a main storage unit, 5890 systems also include these other functional units:

• Channel Subsystem containing two, three, or four integrated I/O Processors, each containing 16 I/O channels

• System Director, which controls data transfers between the MSU, the CPUs, and the External Director

• External Director, which is the logical and physical interface between internal system elements, such as the CPU, System Director, and MSU, and external elements, such as the IOPs and the System Support Processor

The 580 Series features the Models 5840, 5850, and 5860 uniprocessors; the Models 5867, 5870, 5890-200E, and 5890-300E dual processors; the Models 5868 and 5880 two-way multiprocessors; and the Model 5890-600E four-way multiprocessor complex. Multicomputer complexes are all tightly-coupled, sharing main memory, channels, and a single copy of the operating system.

The 5840, 5850, 5860 single processors feature 16 megabytes of main memory expandable to 128 megabytes, 16 I/O channels expandable to 32 channels, a Main Operator Console, and a Power Distribution Unit. Up to two optional Channel-to-Channel Adapters and three Remote Operator Consoles are available.

The 5867 and 5870 dual processors feature 24 megabytes of main memory expandable to 128 megabytes, 16 I/O channels, expandable to 32 channels, a Main Operator Console, and a Power Distribution Unit. Up to two Channel-to-Channel Adapters and three Remote Operator Consoles are available.

The 5868 and 5880 two-way multiprocessors feature 32 megabytes of main memory expandable to 256 megabytes, 32 I/O channels expandable to 48 channels, two Main Operator Consoles, and a Power Distribution Unit, expandable to two. Up to four optional Channel-to-Channel Adapters and up to six Remote Operator Consoles are available.

The 5890-190E single processor features 32 megabytes of main memory, expandable to 256 megabytes, and 16 channels, expandable to 48 channels, one Main Operator Console, one Power Distribution Unit, four optional Channel-to-Channel Adapters, and three optional Remote Operator Consoles.

The 5890-200E and -300E dual processors feature 64 megabytes of main memory expandable to a maximum of 256 megabytes, 32 I/O channels expandable to a maximum of 64 channels, one Main Operator Console, and one Power Distribution Unit. Up to four optional Channel-to-Channel Adapters and three Remote Operator Consoles are available.

The 5890-400E three-way processor features 128 megabytes of memory, expandable to 512 megabytes, 64 I/O channels, expandable to 96 channels, two Main Operator Consoles, and two Power Distribution Units. Up to eight optional Channel-to-Channel Adapters, and six optional Remote Operator Consoles are available.

The 5890-600E four-way processor features 128 megabytes of main memory expandable to a maximum of 512 megabytes, 64 channels expandable to a maximum of 128 channels, two Main Operator Consoles, and two Power Distribution Units. Up to eight optional Channel-to-Channel Adapters and up to six Remote Operator Consoles are available.

## INPUT/OUTPUT CONTROL

The 580 Input/Output Processor (IOP) handles I/O operations. The IOP consists of three components, the I/O Controller (IOC), the Bus Handler, and the Interface Handlers associated with the channels. An IOP can support up to 16 I/O channels and each channel can have up to 256 subchannels. Channels may be configured as either byte multiplexer ▶

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► or block multiplexer channels. A block multiplexer channel can operate in either interlock mode or data streaming mode. Channel data rates in interlock mode are 1.86 megabytes per second, and channel rates in data streaming mode are 3 megabytes per second. A data transfer rate of 4.5 megabytes per second is possible on all 580 systems using the Amdahl 580/Electronic Direct Access Storage (EDAS) High-Speed Channel feature. The optional feature is available on all 580 processors using the 6680 EDAS subsystems. In addition to block multiplexers, users can optionally configure up to four channels per IOP as byte multiplexer channels. On 5868 and 5880 multiprocessors, users can now allocate up to eight byte multiplexers in single image mode and up to four on each side of the partition in partition mode. Users of 5890 mainframes can configure from 12 to 32 optional byte multiplexer channels, depending on size of machine. Byte multiplexer channels can transfer data in byte interleave mode at a maximum rate of 40K bytes per second, or in burst mode at a maximum data rate of 200K bytes per second. Refer to Table 1 for specific byte and block multiplexer combinations per model.

Data flowing in and out of the IOP moves over the 580's A- and B-buses. These buses are a connecting link for the major system components. The Bus Handler is the interface to the A-Bus and B-Bus for the IOP, and provides data buffering when needed. The IOC provides the processing capabilities of the IOP, and manages the Bus Handler and the Interface Handlers. The Interface Handlers provide a logical and electrical link to the peripheral device control units. They perform data transfer functions, including channel bus and tag manipulation and data buffering.

## MASS STORAGE

Amdahl offers the 6000 Series of Disk Storage Units (DSU) for the Amdahl 580 Series. The logical and physical characteristics of the 6000 Series are listed in Table 2.

The Amdahl 580 Series can also use all IBM System/370, 303X, and 30XX input/output and mass storage devices as well as their plug-compatible counterparts from independent vendors. Please refer to Volume 2 of *DATAPRO 70* for detailed coverage of many of these peripherals.

## INPUT/OUTPUT UNITS

Amdahl does not offer tape units or printers.

## TERMINALS

Amdahl does not offer terminals.

## COMMUNICATIONS

Amdahl has two communications processors, the 4705E and the 4705T. The 4705E was announced in April 1983 and the 4705T in February 1985. Both models are communications software-compatible with the IBM 3705-II and the IBM 3725 systems based on System/370 and System/370 XA. The 4705E and 4705T have approximately 2.4 times the power of the 3705-II, and can be configured with 256K to 1024K bytes of memory in 256K-byte increments. Up to 160 communications lines can be connected to the basic frame. Up to two 96-line expansion frames are available for a total of up to 352 communications lines. The host channels can be byte or block multiplexer, or selector channel. The access methods can be BTAM, QTAM, TCAM, or VTAM. The communications software supported is EP, PEP, NCP, and ACF/NCP, and the network architecture is SNA. The communications facilities supported on the 4705 Series can be half- or full-duplex, private, leased, or switched lines; EIA RS-232-C; CCIT V.24; CCIT V.35; and X.21. Transmission speed for both models is 64,000 bps. With the high-speed attachment, channel speeds of 4800 bps to 768,000 bps, and synchronous trunk speeds up to 2,048,000 bps are possible. Start/stop, BSC, and SDLC protocols are support-

ed. The 4705E and 4705T models are compatible with IBM 3705 communications software and access methods.

## SOFTWARE

OPERATING SYSTEMS: Amdahl offers complete functional compatibility with IBM 360/370/303X/30XX software. Operating systems supported include MVS, MVS/SP1, MVS/SP2, VM/SP HPO, VM/SP, ACP, and ACP/TPF. Support is included for such major IBM subsystems as TSO, TCAM, JES2, JES3, VTAM, RSCS, CMS, and IPCS.

*Universal Timesharing System (UTS):* This product provides a Unix-based timesharing system for use on System/370 architecture processors.

580/Multiple Domain Feature (580/MDF): This hardware feature allows the concurrent native support of S/370 and 370/XA.

PROGRAMMING LANGAUGES: Amdahl Systems run IBM language and compilers. Please refer to IBM 3090 and 308X reports for details about packages and products under this category

DATA BASE MANAGEMENT: Amdahl Systems run IBM data base management packages. Please refer to IBM 3090 and 308X reports for details about packages and products under this category

DATA MANAGEMENT: Amdahl systems run IBM data management systems. Please refer to IBM 3090 and 308X reports for details about packages and products under this category .

DATA COMMUNICATIONS: Amdahl systems handle IBM communications products. Please refer to IBM 3090 and 308X reports for details about packages and products under this category.

UTILITIES: Please refer to IBM 3090 and 308X reports for details about packages and products under this category.

OTHER SOFTWARE: Amdahl supplies two performance tools called Modeling and Analysis Package (MAP) and System Utilization and Reporting Facility/IMS (SURF/IMS).

## PRICING & SUPPORT

POLICY: The Amdahl 580 Series models are offered for purchase or for lease under monthly rental terms. Specific multiple-year lease plans should be worked out with Amdahl. Purchase credits are available at a rate of 20 percent of each monthly rental payment to a maximum aggregate credit of 50 percent of the purchase price. The purchase credit applies either to the original lessee or the current lessee.

SUPPORT: Monthly maintenance charges are not included in lease charges. Maintenance is provided for 24 hours per day and 7 days per week.

EDUCATION: Amdahl offers courses and consulting services through its Education and Professional Services Division. Amdahl currently offers more than 50 Systems Education courses covering such areas as MVS, VM, Communications Systems, and Data Systems. Amdahl's Systems Consulting Services provides consulting for DP managers and staff. In addition to consulting services, Consulting Services also offers seminars and workshops.

TYPICAL CONFIGURATION: Except for disk storage products, Amdahl does not offer its own terminals, printers, tape drives, and other supporting devices, making it impractical to suggest a typical configuration cost. ►

# Amdahl 580 Series

## EQUIPMENT PRICES

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **PROCESSORS AND MAIN MEMORY** | | | |
| **Model 5840** CPU Complex; includes two 32K-byte buffer storage units, one byte multiplexer channel, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below | | | |
| With 16 megabytes of main memory and: | | | |
| 16 channels | 1,270,000 | 8,200 | 108,330 |
| 24 channels | 1,400,000 | 8,400 | 119,170 |
| 32 channels | 1,530,000 | 8,600 | 130,000 |
| With 24 megabytes of main memory and: | | | |
| 16 channels | 1,354,000 | 8,600 | 116,670 |
| 24 channels | 1,484,000 | 8,800 | 127,500 |
| 32 channels | 1,614,000 | 9,000 | 138,330 |
| With 32 megabytes of main memory and: | | | |
| 16 channels | 1,438,000 | 9,000 | 125,000 |
| 24 channels | 1,568,000 | 9,200 | 135,830 |
| 32 channels | 1,698,000 | 9,400 | 146,670 |
| With 48 megabytes of main memory and: | | | |
| 16 channels | 1,606,000 | 9,800 | 141,670 |
| 24 channels | 1,736,000 | 10,000 | 152,500 |
| 32 channels | 1,866,000 | 10,200 | 163,330 |
| With 64 megabytes of main memory and: | | | |
| 16 channels | 1,774,000 | 10,600 | 158,330 |
| 24 channels | 1,904,000 | 10,800 | 169,170 |
| 32 channels | 2,034,000 | 11,000 | 180,000 |
| With 96 megabytes of main memory and: | | | |
| 16 channels | 2,062,000 | 12,200 | 182,330 |
| 24 channels | 2,192,000 | 12,400 | 193,170 |
| 32 channels | 2,322,000 | 12,600 | 204,000 |
| With 128 megabytes of main memory and: | | | |
| 16 channels | 2,350,000 | 13,800 | 206,330 |
| 24 channels | 2,480,000 | 14,000 | 217,170 |
| 32 channels | 2,610,000 | 14,200 | 228,000 |
| **Model 5850** CPU Complex; includes two 32K-byte buffer storage units, one byte multiplexer channel, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below. | | | |
| With 16 megabytes of main memory and: | | | |
| 16 channels | 1,450,000 | 9,350 | 129,170 |
| 24 channels | 1,580,000 | 9,550 | 140,000 |
| 32 channels | 1,710,000 | 9,750 | 150,830 |
| With 24 megabytes of main memory and: | | | |
| 16 channels | 1,534,000 | 9,750 | 137,500 |
| 24 channels | 1,664,000 | 9,950 | 148,330 |
| 32 channels | 1,794,000 | 10,150 | 159,170 |
| With 32 megabytes of main memory and: | | | |
| 16 channels | 1,618,000 | 10,150 | 145,830 |
| 24 channels | 1,748,000 | 10,350 | 156,670 |
| 32 channels | 1,878,000 | 10,550 | 167,500 |
| With 48 megabytes of main memory and: | | | |
| 16 channels | 1,786,000 | 10,950 | 162,500 |
| 24 channels | 1,916,000 | 11,150 | 173,330 |
| 32 channels | 2,046,000 | 11,350 | 184,170 |
| With 64 megabytes of main memory and: | | | |
| 16 channels | 1,954,000 | 11,750 | 179,170 |
| 24 channels | 2,084,000 | 11,950 | 190,000 |
| 32 channels | 2,214,000 | 12,150 | 200,830 |
| With 96 megabytes of main memory and: | | | |
| 16 channels | 2,242,000 | 13,350 | 203,170 |
| 24 channels | 2,372,000 | 13,550 | 214,000 |
| 32 channels | 2,502,000 | 13,750 | 224,830 |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.
NC—No charge.
NA—Not Available.

# Amdahl 580 Series

|  | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **PROCESSORS AND MAIN MEMORY (Continued)** | | | |
| With 128 megabytes of main memory and: | | | |
| 16 channels | 2,530,000 | 14,950 | 277,170 |
| 24 channels | 2,660,000 | 15,150 | 238,000 |
| 32 channels | 2,790,000 | 15,350 | 248,830 |
| **Model 5860** CPU Complex; includes two 32K-byte buffer storage units, one byte multiplexer channel, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below. | | | |
| With 16 megabytes of main memory and: | | | |
| 16 channels | 1,630,000 | 9,850 | 150,000 |
| 24 channels | 1,760,000 | 10,050 | 160,830 |
| 32 channels | 1,890,000 | 10,250 | 171,670 |
| With 24 megabytes of main memory and: | | | |
| 16 channels | 1,714,000 | 10,250 | 158,330 |
| 24 channels | 1,844,000 | 10,450 | 169,170 |
| 32 channels | 1,974,000 | 10,650 | 180,000 |
| With 32 megabytes of main memory and: | | | |
| 16 channels | 1,798,000 | 10,650 | 166,670 |
| 24 channels | 1,928,000 | 10,850 | 177,500 |
| 32 channels | 2,058,000 | 11,050 | 188,330 |
| With 48 megabytes of main memory and: | | | |
| 16 channels | 1,966,000 | 11,450 | 183,330 |
| 24 channels | 2,096,000 | 11,650 | 194,170 |
| 32 channels | 2,226,000 | 11,850 | 205,000 |
| With 64 megabytes of main memory and: | | | |
| 16 channels | 2,134,000 | 12,250 | 200,000 |
| 24 channels | 2,264,000 | 12,450 | 210,830 |
| 32 channels | 2,394,000 | 12,650 | 221,670 |
| With 96 megabytes of main memory and: | | | |
| 16 channels | 2,422,000 | 13,850 | 224,000 |
| 24 channels | 2,552,000 | 14,050 | 234,830 |
| 32 channels | 2,682,000 | 14,250 | 245,670 |
| With 128 megabytes of main memory and: | | | |
| 16 channels | 2,710,000 | 15,450 | 248,000 |
| 24 channels | 2,840,000 | 15,650 | 258,830 |
| 32 channels | 2,970,000 | 15,850 | 269,670 |
| **Model 5867** Attached CPU Complex consists of a 580 CPU tightly coupled to a 5850 CPU Complex; includes two 32K-byte buffer storage units per CPU, one byte multiplexer channel, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below. | | | |
| With 24 megabytes of main memory and: | | | |
| 16 channels | 2,474,000 | 12,500 | 214,170 |
| 24 channels | 2,520,000 | 12,700 | 225,000 |
| 32 channels | 2,650,000 | 12,900 | 235,830 |
| With 32 megabytes of main memory and: | | | |
| 16 channels | 2,474,000 | 12,900 | 222,500 |
| 24 channels | 2,604,000 | 13,100 | 233,330 |
| 32 channels | 2,734,000 | 13,300 | 244,170 |
| With 48 megabytes of main memory and: | | | |
| 16 channels | 2,642,000 | 13,700 | 239,170 |
| 24 channels | 2,772,000 | 13,900 | 250,000 |
| 32 channels | 2,902,000 | 14,100 | 260,830 |
| With 64 megabytes of main memory and: | | | |
| 16 channels | 2,810,000 | 14,500 | 255,830 |
| 24 channels | 2,940,000 | 14,700 | 266,670 |
| 32 channels | 3,070,000 | 14,900 | 277,500 |
| With 96 megabytes of main memory and: | | | |
| 16 channels | 3,098,000 | 16,100 | 279,830 |
| 24 channels | 3,228,000 | 16,300 | 290,670 |
| 32 channels | 3,358,000 | 16,500 | 301,500 |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.
NC—No charge.
NA—Not Available.

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# Amdahl 580 Series

| PROCESSORS AND MAIN MEMORY (Continued) | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **With 128 megabytes of main memory and:** | | | |
| 16 channels | 3,386,000 | 17,700 | 303,830 |
| 24 channels | 3,516,000 | 17,900 | 314,670 |
| 32 channels | 3,646,000 | 18,100 | 325,500 |

**Model 5868** Dual CPU Complex; includes two 32K-byte buffer storage units, two byte multiplexer channels, two consoles, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **With 32 megabytes of main memory and:** | | | |
| 32 channels | 2,850,000 | 13,950 | 252,500 |
| 40 channels | 2,980,000 | 14,150 | 263,330 |
| 48 channels | 3,110,000 | 14,350 | 274,170 |
| **With 48 megabytes of main memory and:** | | | |
| 32 channels | 3,081,000 | 14,750 | 269,170 |
| 40 channels | 3,148,000 | 14,950 | 280,000 |
| 48 channels | 3,278,000 | 15,150 | 290,830 |
| **With 64 megabytes of main memory and:** | | | |
| 32 channels | 3,186,000 | 15,550 | 285,830 |
| 40 channels | 3,316,000 | 15,750 | 296,670 |
| 48 channels | 3,446,000 | 15,950 | 307,500 |
| **With 96 megabytes of main memory and:** | | | |
| 32 channels | 3,474,000 | 17,150 | 309,830 |
| 40 channels | 3,604,000 | 17,350 | 320,670 |
| 48 channels | 3,734,000 | 17,550 | 331,500 |
| **With 128 megabytes of main memory and:** | | | |
| 32 channels | 3,762,000 | 18,750 | 333,830 |
| 40 channels | 3,892,000 | 18,950 | 344,670 |
| 48 channels | 4,022,000 | 19,150 | 355,500 |
| **With 192 megabytes of main memory and:** | | | |
| 32 channels | 4,242,000 | 21,950 | 373,830 |
| 40 channels | 4,372,000 | 22,150 | 384,670 |
| 48 channels | 4,502,000 | 22,350 | 395,500 |
| **With 256 megabytes of main memory and:** | | | |
| 32 channels | 4,722,000 | 25,150 | 413,830 |
| 40 channels | 4,852,000 | 25,350 | 424,670 |
| 48 channels | 4,982,000 | 25,550 | 435,500 |

**Model 5870** Attached CPU Complex consists of a 580 CPU tightly coupled to a 5860 CPU Complex; includes two 32K-byte buffer storage units per CPU, one byte multiplexer channel, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **With 32 megabytes of main memory and:** | | | |
| 16 channels | 2,770,000 | 16,300 | 255,830 |
| 24 channels | 2,900,000 | 16,500 | 266,670 |
| 32 channels | 3,030,000 | 16,700 | 277,500 |
| **With 48 megabytes of main memory and:** | | | |
| 16 channels | 2,938,000 | 17,100 | 272,500 |
| 24 channels | 3,068,000 | 17,300 | 283,330 |
| 32 channels | 3,198,000 | 17,500 | 294,170 |
| **With 64 megabytes of main memory and:** | | | |
| 16 channels | 3,106,000 | 17,900 | 289,170 |
| 24 channels | 3,236,000 | 18,100 | 300,000 |
| 32 channels | 3,366,000 | 18,300 | 310,830 |
| **With 96 megabytes of main memory and:** | | | |
| 16 channels | 3,394,000 | 19,500 | 313,170 |
| 24 channels | 3,524,000 | 19,700 | 324,000 |
| 32 channels | 3,654,000 | 19,900 | 334,830 |
| **With 128 megabytes of main memory and:** | | | |
| 16 channels | 3,682,000 | 21,100 | 337,170 |
| 24 channels | 3,812,000 | 21,300 | 348,000 |
| 32 channels | 3,942,000 | 21,500 | 358,830 |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.
NC—No charge.
NA—Not Available.

# Amdahl 580 Series

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **PROCESSORS AND MAIN MEMORY (Continued)** | | | |

**Model 5880** Dual CPU Complex; includes two 32K-byte buffer storage units, two byte multiplexer channels, two consoles, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| With 32 megabytes of main memory and: | | | |
| 32 channels | 3,180,000 | 17,600 | 294,170 |
| 40 channels | 3,310,000 | 17,800 | 305,000 |
| 48 channels | 3,440,000 | 18,000 | 315,830 |
| With 48 megabytes of main memory and: | | | |
| 32 channels | 3,348,000 | 18,400 | 310,830 |
| 40 channels | 3,478,000 | 18,600 | 321,670 |
| 48 channels | 3,608,000 | 18,800 | 332,500 |
| With 64 megabytes of main memory and: | | | |
| 32 channels | 3,516,000 | 19,200 | 327,500 |
| 40 channels | 3,646,000 | 19,400 | 338,330 |
| 48 channels | 3,776,000 | 19,600 | 349,170 |
| With 96 megabytes of main memory and: | | | |
| 32 channels | 3,804,000 | 20,800 | 351,500 |
| 40 channels | 3,934,000 | 21,000 | 362,330 |
| 48 channels | 4,064,000 | 21,200 | 373,170 |
| With 128 megabytes of main memory and: | | | |
| 32 channels | 4,092,000 | 22,400 | 375,500 |
| 40 channels | 4,222,000 | 22,600 | 386,330 |
| 48 channels | 4,352,000 | 22,800 | 397,170 |
| With 192 megabytes of main memory and: | | | |
| 32 channels | 4,572,000 | 25,600 | 415,500 |
| 40 channels | 4,702,000 | 25,800 | 426,330 |
| 48 channels | 4,832,000 | 26,000 | 437,170 |
| With 256 megabytes of main memory and: | | | |
| 32 channels | 5,052,000 | 28,800 | 455,500 |
| 40 channels | 5,182,000 | 29,000 | 466,330 |
| 48 channels | 5,312,000 | 29,200 | 477,170 |

**Model 5890-190E** CPU Complex; includes one 64K-byte buffer and one 32K-byte buffer, one main operator console, one power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels are listed below.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| With 32 megabytes of main memory and: | | | |
| 16 channels | 2,625,000 | 10,650 | 243,060 |
| 24 channels | 2,755,000 | 10,850 | 255,090 |
| 32 channels | 2,885,000 | 11,050 | 267,130 |
| 40 channels | 3,015,000 | 11,250 | 279,170 |
| 48 channels | 3,145,000 | 11,450 | 291,210 |
| With 64 megabytes of main memory and: | | | |
| 16 channels | 2,895,000 | 10,975 | 268,060 |
| 24 channels | 3,025,000 | 11,175 | 280,090 |
| 32 channels | 3,155,000 | 11,375 | 292,130 |
| 40 channels | 3,285,000 | 11,575 | 304,170 |
| 48 channels | 3,415,000 | 11,775 | 316,210 |
| With 96 megabytes of main memory and: | | | |
| 16 channels | 3,165,000 | 11,300 | 293,060 |
| 24 channels | 3,295,000 | 11,500 | 305,100 |
| 32 channels | 3,425,000 | 11,700 | 317,130 |
| 40 channels | 3,555,000 | 11,900 | 329,170 |
| 48 channels | 3,685,000 | 12,100 | 341,210 |
| With 128 megabytes of main memory and: | | | |
| 16 channels | 3,435,000 | 11,625 | 318,060 |
| 24 channels | 3,565,000 | 11,825 | 330,100 |
| 32 channels | 3,695,000 | 12,025 | 342,130 |
| 40 channels | 3,825,000 | 12,225 | 354,170 |
| 48 channels | 3,955,000 | 12,425 | 366,210 |
| With 192 megabytes of main memory and: | | | |
| 16 channels | 3,835,000 | 12,275 | 355,100 |
| 24 channels | 3,965,000 | 12,475 | 367,130 |
| 32 channels | 4,095,000 | 12,675 | 379,170 |
| 40 channels | 4,225,000 | 12,875 | 391,210 |
| 48 channels | 4,355,000 | 13,075 | 403,240 |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.*
*NC—No charge.*
*NA—Not Available.*

# Amdahl 580 Series

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|

### ➤ PROCESSORS AND MAIN MEMORY (Continued)

**With 256 megabytes of main memory and:**

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| 16 channels | 4,235,000 | 12,925 | 392,130 |
| 24 channels | 4,365,000 | 13,125 | 404,170 |
| 32 channels | 4,495,000 | 13,325 | 416,210 |
| 40 channels | 4,625,000 | 13,525 | 428,240 |
| 48 channels | 4,755,000 | 13,725 | 440,280 |

**Model 5890-200E** CPU Complex; includes one 64K-byte and one 32K-byte buffer per CPU, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below.

**With 64 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 3,825,000 | 15,250 | 354,170 |
| 40 channels | 3,955,000 | 15,450 | 365,000 |
| 48 channels | 4,085,000 | 15,650 | 357,830 |
| 64 channels | 4,345,000 | 16,050 | 397,500 |

**With 96 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 4,095,000 | 15,575 | 378,170 |
| 40 channels | 4,225,000 | 15,775 | 389,000 |
| 48 channels | 4,355,000 | 15,975 | 399,830 |
| 64 channels | 4,615,000 | 16,375 | 421,500 |

**With 128 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 4,365,000 | 15,900 | 402,170 |
| 40 channels | 4,495,000 | 16,100 | 413,000 |
| 48 channels | 4,625,000 | 16,300 | 423,830 |
| 64 channels | 4,885,000 | 16,700 | 445,500 |

**With 192 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 4,765,000 | 16,550 | 442,170 |
| 40 channels | 4,895,000 | 16,750 | 453,000 |
| 48 channels | 5,025,000 | 16,950 | 463,830 |
| 64 channels | 5,285,000 | 17,350 | 485,500 |

**With 256 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 5,165,000 | 17,200 | 482,170 |
| 40 channels | 5,295,000 | 17,400 | 493,000 |
| 48 channels | 5,425,000 | 17,600 | 503,830 |
| 64 channels | 5,685,000 | 18,000 | 525,500 |

**Model 5890-300E** CPU Complex; includes one 64K-byte and one 32K-byte buffer per CPU, console, power distribution unit, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below.

**With 64 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 4,500,000 | 16,350 | 416,670 |
| 40 channels | 4,630,000 | 16,550 | 427,500 |
| 48 channels | 4,760,000 | 16,750 | 438,330 |
| 64 channels | 5,020,000 | 17,150 | 460,000 |

**With 96 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 4,770,000 | 16,675 | 440,670 |
| 40 channels | 4,900,000 | 16,875 | 451,500 |
| 48 channels | 5,030,000 | 17,075 | 462,330 |
| 64 channels | 5,290,000 | 17,475 | 484,000 |

**With 128 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 5,040,000 | 17,000 | 464,670 |
| 40 channels | 5,170,000 | 17,200 | 475,500 |
| 48 channels | 5,300,000 | 17,400 | 486,330 |
| 64 channels | 5,560,000 | 17,800 | 508,000 |

**With 192 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 5,440,000 | 17,650 | 504,670 |
| 40 channels | 5,570,000 | 17,850 | 515,500 |
| 48 channels | 5,700,000 | 18,050 | 526,330 |
| 64 channels | 5,960,000 | 18,450 | 548,000 |

**With 256 megabytes of main memory and:**

| | | | |
|---|---|---|---|
| 32 channels | 5,840,000 | 18,300 | 544,670 |
| 40 channels | 5,970,000 | 18,500 | 555,500 |
| 48 channels | 6,100,000 | 18,700 | 566,330 |
| 64 channels | 6,360,000 | 19,100 | 588,000 ➤ |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.*
*NC—No charge.*
*NA—Not Available.*

# Amdahl 580 Series

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|

> **PROCESSORS AND MAIN MEMORY (Continued)**

Model 5890-400E CPU conplex; includes three CPUs; one 64K-byte buffer and one 32K-byte buffer per CPU, two main operator consoles, two power distribution units, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels are listed below.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **With 128 megabytes of main memory and:** | | | |
| 64 channels | 7,275,000 | 23,200 | 673,620 |
| 80 channels | 7,535,000 | 23,600 | 695,290 |
| 96 channels | 7,795,000 | 24,000 | 716,950 |
| **With 192 megabytes of main memory and:** | | | |
| 64 channels | 7,815,000 | 23,850 | 721,620 |
| 80 channels | 8,075,000 | 24,250 | 743,290 |
| 96 channels | 8,335,000 | 24,650 | 764,950 |
| **With 256 megabytes of main memory and:** | | | |
| 64 channels | 8,355,000 | 24,500 | 769,620 |
| 80 channels | 8,615,000 | 24,900 | 791,290 |
| 96 channels | 8,875,000 | 25,300 | 812,950 |
| **With 384 megabytes of main memory and:** | | | |
| 64 channels | 9,155,000 | 25,800 | 849,620 |
| 80 channels | 9,415,000 | 26,200 | 871,290 |
| 96 channels | 9,675,000 | 26,600 | 892,950 |
| **With 512 megabytes of main memory and:** | | | |
| 64 channels | 9,955,000 | 27,100 | 929,620 |
| 80 channels | 10,215,000 | 27,500 | 951,290 |
| 96 channels | 10,475,000 | 27,900 | 972,950 |

Model 5890-600E CPU Complex; includes one 64K-byte and one 32K-byte buffer per CPU, two consoles, two power distribution units, 580/Expanded Storage, and 580/VM Performance Assist; main memory and channels as listed below.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| **With 128 megabytes of main memory and:** | | | |
| 64 channels | 8,500,000 | 27,400 | 777,500 |
| 80 channels | 8,760,000 | 27,800 | 799,170 |
| 96 channels | 9,020,000 | 28,200 | 820,830 |
| 128 channels | 9,540,000 | 29,000 | 864,170 |
| **With 192 megabytes of main memory and:** | | | |
| 64 channels | 9,040,000 | 28,050 | 825,500 |
| 80 channels | 9,300,000 | 28,450 | 847,170 |
| 96 channels | 9,560,000 | 28,850 | 868,830 |
| 128 channels | 10,080,000 | 29,650 | 912,170 |
| **With 256 megabytes of main memory and:** | | | |
| 64 channels | 9,580,000 | 28,700 | 873,500 |
| 80 channels | 9,840,000 | 29,100 | 895,170 |
| 96 channels | 10,100,000 | 29,500 | 916,830 |
| 128 channels | 10,620,000 | 30,300 | 960,170 |
| **With 384 megabytes of main memory and:** | | | |
| 64 channels | 10,380,000 | 30,000 | 953,500 |
| 80 channels | 10,640,000 | 30,400 | 975,170 |
| 96 channels | 10,900,000 | 30,800 | 996,830 |
| 128 channels | 11,420,000 | 31,600 | 1,040,170 |
| **With 512 megabytes of main memory and:** | | | |
| 64 channels | 11,180,000 | 31,300 | 1,033,500 |
| 80 channels | 11,440,000 | 31,700 | 1,055,170 |
| 96 channels | 11,700,000 | 32,100 | 1,076,830 |
| 128 channels | 12,220,000 | 32,900 | 1,120,170 |

## FIELD UPGRADES

What follows are selected field upgrade purchase prices. Purchase prices for models, main storage, and channels equal the difference between any two given configurations. Prices listed here were all derived from basic configurations.

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| 5840 to 5850 or 5850 to 5860 | 180,000 | — | — |
| 5850 to 5867 | 940,000 | — | — |
| 5850 to 5868 | 1,400,000 | — | — |
| 5860 to 5870 | 1,140,000 | — | — |
| 5860 to 5880 | 1,550,000 | — | — |
| 5870 to 5880 | 410,000 | — | — |
| 5890-200E to 5890-300E | 675,000 | — | — |
| 5890-200E to 5890-600E | 4,675,000 | — | — |
| 5890-300E to 5890-600E | 4,000,000 | — | — |
| 5890-190 to 5890-190E, or 5890-200 to 5890-200E, or 5890-300 to 5890-300E | 120,000 | | |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.
NC—No charge.
NA—Not Available.

JULY 1987

# Amdahl 580 Series

|  | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|

## ► PROCESSOR FEATURES

| | Purchase Price ($) | Monthly Maint.* ($) | Monthly Rental ($) |
|---|---|---|---|
| Channel-to-Channel Adapter; maximum of two on 5840, 5850, 5860, 5867, and 5870; maximum of four on 5868, 5880, 5890-190E, -200E and -300E; maximum of eight one the 5890-400E and -600E | 15,000 | NC | 1,250 |
| Dual Power Distribution Unit feature; Models 5868 and 5880 only | 50,000 | 175 | NA |
| 580/Accelerator; factory installation is $2,500; field installation is $3,000. Option 1: 5840 to 5850, $200/hour; Option 2: 5850 to 5860, $275/hour; Option 3; 5840 to 5860, $475/hour | — | — | NA |
| 580/Multiple Domain Feature (580/MDF) is available only on a monthly lease basis. The installation charge and lease rate are both based on processor category and are listed as follows: | | | |
| Category A includes the Model 5840; installation charge is $10,000 | — | — | 3,000 |
| Category B includes Models 5850 and 5860; installation charge is $10,000 | — | — | 4,000 |
| Category C includes Models 5867, 5868, 5870, 5880, 5890-190E; installation charge is $10,000 | — | — | 6,000 |
| Category D includes Models 5890-200E and -300E; installation charge is $15,000 | — | — | 8,000 |
| Category E includes the Models 5890-400E, -600E; installation charge is $15,000 | — | — | 10,000 |
| High-Speed Floating Point feature (HSFP); Models 5867, 5868, 5870, and 5880 require two HSFPs | 90,000 | 500 | NA |
| Multiprocessor Coupling Feature; Models 5868 and 5880 only | 175,000 | NC | NA |
| Remote Operator Console: maximum of three on Models 5840, 5850, 5860, 5867, 5870, 5890-190E, -200E and -300E; maximum of six on Models 5868, 5880, and 5890-400E and -600E | 10,000 | 50 | 835 |
| Hardware Monitor Attachment Feature (HMAF); price is per processor complex. Models 5867, 5868, 5870, 5880, 5890-200E, or -300E require two HMAFs; 5890-400E requires three; the -600E requires four. | 4,000 | — | — |
| Two-Byte Interface; not available on 5890s | 1,400 | NC | NA |
| 580/EDAS High-Speed Channel Feature; per four-channel group | 25,000 | NC | NA |

*Includes 24-hour/7-day service; applies to both purchased and leased systems.
NC—No charge.
NA—Not Available.

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

### MASS STORAGE

#### 6280 Series and Features

| | | Purchase Price ($) | Monthly* Maint. ($) | 1-Year Lease ($) |
|---|---|---|---|---|
| 6280-AA4 | 1.27GB Disk Storage Unit with associated controls | 41,900 | 155 | 1,893 |
| 6280-AAF | 1.27GB Disk Storage Unit with fixed heads and associated controls | 58,900 | 260 | 2,699 |
| 6280-B4 | 1.27GB Disk Storage Unit | 30,430 | 120 | 1,366 |
| 6280-B4F | 1.27GB Disk Storage Unit with fixed heads | 47,430 | 225 | 2,172 |
| 6880-A2 | Storage Control Unit for 6280 Series with standard two-channel switch pair | 65,700 | 175 | 3,338 |
| 8005 | Additional two channel switch pair | 12,750 | 45 | 672 |
| 8208 | 8MB Cache Controller Feature | 52,125 | 385 | 2,295 |
| 3005 | B4/B4F channel speed kit; 1.52 megabytes per second to 1.86 megabytes per second | 15,000 | — | — |
| 3006 | AA4/AAF channel speed kit; 1.52 megabytes per second to 1.86 megabytes per second | 15,000 | — | — |
| 3008 | B4/B4F channel speed kit; 1.86 megabytes per second to 1.52 megabytes per second | 15,000 | — | — |
| 3009 | AA4/AAF channel speed kit; 1.86 megabytes per second to 1.52 megabytes per second | 15,000 | — | — |

#### 6380 Series

| | | Purchase Price ($) | Monthly* Maint. ($) | 1-Year Lease ($) |
|---|---|---|---|---|
| 6380-AA4 | 2.52GB Disk Storage Unit with associated controls | 71,200 | 300 | **3,130 |
| 6380-M4 | 2.52GB Disk Storage Unit with associated controls | 38,950 | 75 | **1,835 |
| 6380-B4 | 2.52GB Disk Storage Unit | 48,700 | 220 | **2,299 |
| 6880-G2 | Storage Control Unit for 6380 Series with standard two-channel switch pair | 58,970 | 183 | **2,724 |
| 6880-G2E | Storage Control Unit for 6380 Series, with standard eight-channel switch pair includes 8005 and 8006 features | 134,480 | 370 | **6,220 |
| 8001 | Four-Channel Remote Switch; onetime field change charge is $800 per unit | 800 | | |
| 8003 | Additional Four-Channel Remote Switch; onetime field change charge is $800 per unit | 800 | | |
| 8005 | Additional Two-Channel Switch Pair | 14,730 | 36 | **691 |
| 8006 | Eight-channel switch allows attachment of up to eight channels, shared between two storage directors. Dual Frame Control is a prerequisite for the eight-channel switch on models with the Cache Controller Feature | 20,260 | 50 | **935 |
| 8008 | Dual Frame Control; onetime field change charge is $800 per unit. The field change charge applies only in those instances where Feature 8008 is to be installed on two previously installed 6880-G2s or -G2Es | NC | — | — |

*Maintenance prices are for 11 hours per day, 5 days per week.
**Two-Year Lease
NC—No charge.
NA—Not available.

# Amdahl 580 Series

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

► **MASS STORAGE (Continued)**

| 8308 | 8MB Cache Controller Feature | 54,900 | 387 | **2,680 |
| 8316 | 16MB Cache Controller Feature | 90,900 | 414 | **4,430 |
| 8324 | 24MB Cache Controller Feature | 126,900 | 441 | **6,180 |
| 8332 | 32MB Cache Controller Feature | 162,900 | 468 | **7,930 |

**6380 Upgrades**

| | 6380-AA4 to 6380-AE4 | 40,000 | — | — |
| | 6380-B4 to 6380-BE4 | 40,000 | — | — |
| | 6380-M4 to 6380-B4 | 9,750 | — | — |

**6380E Series**

| 6380-AE4 | 5.04-gigabyte Disk Storage Unit | 104,110 | 300 | **4,575 |
| 6380-BE4 | 5.04 gigabyte Disk Storage Unit | 78,510 | 220 | **3,705 |

*Maintenance prices are for 11 hours per day, 5 days per week.*
**Two-Year Lease*
*NC—No charge.*
*NA—Not available.*

| | | Purchase Price ($) | Monthly* Maint. ($) | 2-Year Lease ($) | 4-Year Lease ($) |
|---|---|---|---|---|---|
| **4705 SERIES COMMUNICATIONS PROCESSORS** | | | | | |
| | 4705E Communications Processor with 256K bytes of memory | 27,000 | 330 | 1,225 | 730 |
| | 4705T Communications Processor with 256K-bytes of memory, and high-speed voice and data attachment; includes redundant multiplexer, power supply, and trunk interface module, expansion cabinet, 3 synchronous I/O modules, network console with async interface, and associated cables. | 42,000 | 430 | 1,905 | 1,135 |
| **4705E and 4750T Series Features** | | | | | |
| EXPE | Expansion Unit | 12,000 | 50 | 545 | 320 |
| ILSE | Integrated Line Switch | 4,000 | — | 180 | 105 |
| MS3E | 256K-byte Memory Module | 6,000 | 30 | 270 | 160 |
| CA4E | Channel Adapter | 4,000 | 15 | 180 | 105 |
| RIPLE | Remote IPL | 2,000 | — | 90 | 50 |
| TCSE | Two-Channel Switch | 1,750 | 15 | 80 | 45 |
| CS2E | Type 2 Communications Scanner | 6,000 | 30 | 270 | 160 |
| CS3E | Type 3 Communications Scanner | 16,000 | 70 | 725 | 430 |
| SS2E | Single Scanner Attachment, Base Type 2 | 5,000 | — | 225 | 135 |
| SS3E | Single Scanner Attachment, Base Type 3 | 8,000 | — | 360 | 215 |
| LIB1E | Line Interface Base | 1,000 | — | 45 | 25 |
| LIB2E | Line Interface Base for high-speed asynchronous line speeds up to 9.6K bps. | 2,000 | — | 90 | 45 |
| HD1E | Analog Line Set, half-duplex, V.24, 4 lines | 2,400 | — | 110 | 65 |
| HD1LE | Analog Line Set, half-duplex, V.24, 4 lines, LPDA | 2,500 | — | 115 | 70 |
| FD1E | Analog Line Set, full-duplex, V.24, 2 lines | 1,200 | — | 45 | 30 |
| FD1LE | Analog Line Set, full-duplex, V.24, 2 lines, LPDA | 1,300 | — | 50 | 35 |
| HD1GE | Analog Line Set, wideband, half-duplex, Bell 300, 2 lines | 4,000 | — | 180 | 105 |
| FD1TE | Analog Line Set, wideband, full-duplex, Bell 303, 1 line | 2,000 | — | 90 | 50 |
| HD2E | Digital Line Set, half-duplex, V.35, 2 lines | 5,000 | — | 225 | 135 |
| FD2E | Digital Line Set, full-duplex, V.35, 1 line | 3,000 | — | 135 | 80 |
| NC1E | Analog Line Set, auto-dial, half-duplex, RS366, 2 lines | 1,200 | — | 55 | 30 |
| LA1C | Analog Line Set, low-speed asynchronous, local attachment, half-duplex, 4 lines | 2,400 | — | 105 | 65 |
| **4750T High Speed Features** | | | | | |
| HS20 | Synchronous I/O Module, 2 lines | 1,000 | — | 50 | 25 |
| HS40 | Asynchronous I/O Module, 1 line | 680 | — | 30 | 15 |
| HS45 | Voice I/O Module, 2 lines | 1,430 | — | 70 | 50 |
| HS30 | Integrated Limited Distance Data Set, 1.2K bps to 64K bps, speed specified by customer | 880 | — | 40 | 25 |
| HS34 | Integrated Limited Distance Data Set, 600 bps to 9.6K bps, combines up to four synchronous channels | 1,300 | — | 65 | 35 |

*Includes 24-hour/7-day service*

►

# Amdahl 580 Series

# SOFTWARE PRICES

| | Monthly License Fee ($) | Monthly DSLO (1) ($) | Annual License Fee ($) | Annual DSLO (1) ($) | Initial Charge ($) |
|---|---|---|---|---|---|
| **MVS Product:** | | | | | |
| 4PZ0-C3-U  MVS/SP Assist (MVS/SPA) | 385 | 300 | — | — | — |
| **VM Products** | | | | | |
| 4PV0-P1  VM/Performance Enhancement (VM/PE); a VM/Performance Enhancement installation workshop is required before installation at all sites at a onetime cost of $2,000 | 2,200 | 1,650 | — | — | — |
| 4PV1-P2  VM/Software Assist (VM/SA) | 635 | 480 | — | — | — |
| **UTS Products*** | | | | | |
| UTS/580: | | | | | |
| 4SU1-PA  Category A; includes Model 5840 | 4,000 | 3,600 | — | — | 20,000 |
| 4SU1-PB  Category B; includes Model 5850 and 5860 | 6,000 | 5,400 | — | — | 20,000 |
| 4SU1-PC  Category C; includes Models 5867, 5868, 5870, 5880, and 5890-190E | 10,500 | 9,450 | — | — | 20,000 |
| 4SU1-PD  Category D; includes Models 5890-200E and -300E | 14,000 | 12,600 | — | — | 20,000 |
| 4SU1-PE  Category E; includes Models 5890-400E and -600E | 20,000 | 18,000 | — | — | 20,000 |
| **UTS/580 and 580/MDF package**** | | | | | |
| 4SU1-P1  Category A; includes Model 5840 | 5,000 | — | — | — | 25,000 |
| 4SU1-P2  Category B; includes Models 5850 and 5860 | 7,000 | — | — | — | 25,000 |
| 4SU1-P3  Category C; includes Models 5867, 5868, 5870, 5880, 5890-190E | 13,000 | — | — | — | 25,000 |
| 4SU1-P4  Category D; includes Models 5890-200E and -300E | 17,000 | — | — | — | 30,000 |
| 4SU1-P5  Category E; includes Model 5890-400E and -600E | 25,000 | — | — | — | 30,000 |
| 5PU0-F1-F  UTS/F | 275 | 250 | — | — | — |
| **Performance Tools:** | | | | | |
| 4UZ0-M2-1  Modeling and Analysis Package (MAP) | — | — | 12,000 | 9,000 | — |
| 4UZ0-M1-1  System Utilization Reporting Facility/IMS (SURF/IMS) | — | — | 8,000 | 6,000 | — |

*(1) The Amdahl Distributed System License Option (DSLO) allows the user to license additional, unsupported copies of an Amdahl licensed program product for a reduced fee.*
*\*All UTS products are licensed under an Amdahl UTS Software License Agreement. UTS/580 licensees must obtain source licenses for Unix System V Release 2.1 and the Documenter's Workbench from AT&T as a prerequisite for obtaining a UTS license.*
*\*\*580/MDF and UTS/580 are available as a package. The monthly charge varies with the processor. A separate 580/MDF lease agreement must be executed for 580/MDF, and an Amdahl Software License Agreement must be executed for UTS/580. Maintenance for 580/MDF is included as part of the lease agreement for 580/MDF. Concurrent installation of 580/MDF and UTS/580 will have a combined installation charge as previously outlined. This combined installation charge is in lieu of the installation charge for 580/MDF and the initial license fee for UTS/580.* ∎

# Amdahl 580 Series

# Product Enhancement

Amdahl Corporation marked an industry milestone with the announcement of a new mainframe generation that breaks through the 100 million instructions per second (MIPS) barrier. The Amdahl 5990 Series, a follow-on to the 5890 mainframe line, is now the most powerful IBM System/370-compatible processor available. The price/performance advantage may be short lived, however, because IBM Corporation is expected to announce enhanced models of its 3090 Series later this year.

## 5990 Series

The 5990 Series, announced on May 3, 1988, includes the Model 700, a dual-processor system rated at 63 MIPS, and the top-end Model 1400, a four-way multiprocessor system rated at 115 MIPS. In addition to a new mainframe generation, Amdahl also enhanced its existing 5890 mainframe line and brought out the 6100 Storage Processor Series storage controller and new single- and triple-capacity 6380 Direct Access Storage Devices (DASDs). With the new Fujitsu-based storage products, Amdahl becomes the latest vendor to introduce a triple-capacity DASD coupled with new controller technology. IBM and National Advanced Systems (NAS) announced similar storage products last year.

Amdahl is expected to deliver the first 5990-700 dual processors by June, and the Model 1400 with optional expanded storage will become available by the fourth quarter. Model 700-to-Model 1400 upgrades are scheduled for availability by the first quarter of 1989.

The Model 1400 is said to have 50 percent more throughput capacity than Amdahl's previous top-of-the-line system, the four-way multiprocessor 5890-600E. This performance level was achieved while running benchmarks in commercial on-line and batch environments. Gains as high as 100 percent were achieved running compute-intensive engineering and scientific programs, Amdahl claims. The company contends the 5990s are now the fastest scalar processors available. CPU cycle time has been reduced to 10 nanoseconds. By comparison, 5890 machines have a cycle time of 15 nanoseconds, and the fastest IBM 3090 machines have a cycle time of 17.2 nanoseconds.

The Model 700 is said to have 1.5 times the throughput capacity of the 5890-300E dual processor in commercial on-line and batch environments; 1.6 times the capacity in scientific batch environments. A Model 700, running compute-intensive floating-point applications, provided 2.0 times the performance of the Model 300E.

The Model 700 features 64 to 256 megabytes of main storage and up to 1 gigabyte of optional expanded storage. It can be configured with 32 to 64 channels. From 1 to 16 channels can be configured as byte multiplexer channels. The Model 1400 features 128 to 512 megabytes of main storage and up to 2 gigabytes of expanded Storage. The Model 1400 can be configured with 64 to 128 channels. From 2 to 32 channels can be configured as byte multiplexer channels.

In addition to main memory, 5990 systems feature two independent high-speed buffers, each with a 64-kilobyte capacity. One buffer handles instructions and the other handles operands. The Model 700 also comes with one main operator console and an optional remote operator console. The Model 1400 comes with two main operator consoles and up to two optional remote consoles.

Amdahl said the new processor line will support IBM's newest operating environment, Enterprise Systems Architecture/370 (ESA/370), announced in February 1988. Amdahl will reveal details about running ESA/370 on the 5990 when more information becomes available from IBM. Additionally, the 5990 will support MVS/XA, MVS/370, VM/XA, VM/SP HPO, and UTS, Amdahl's implementation of AT&T's UNIX.

Amdahl has announced the 5990 Series before the anticipated announcement of IBM 3090 F models, which are expected to offer greater price/performance than the current 3090 E models. The F models, probably the last 3090 performance upgrade, will pave the way for IBM's expected announcement of the Summit line, the 3090 follow-on series.

Amdahl's announcement of new, more powerful mainframes is indicative of a new marketing aggressiveness among vendors now supplying IBM plug-compatible mainframes. Like NAS, its IBM plug-compatible rival, Amdahl's new mainframe gear with superior price/performance was announced weeks or even ▷

# Amdahl 580 Series

# Product Enhancement

months before IBM could respond in kind. In recent years, PCMs working through their Japanese partners have been trying to become a technological leader of the mainframe world. Not too long ago, Amdahl and NAS were content to announce a new IBM compatible only *after* IBM announced a model line. The PCMs' marketing strengths depended upon products that could run IBM operating systems, but at superior price/performance levels. For example, IBM first announced the 3090 Series in February 1985; Amdahl did not respond until the following October.

## 5890-390E

The 5890-390E, a third new Amdahl mainframe announced in May, brings the number of 5980 E models to six. The company is marketing the two-way system as an entry-level multiprocessor that can be partitioned to operate as two uniprocessors. It's an apparent response to the IBM 3090 Model 280E, a dual processor that brought partitioning down to the two-processor level. IBM announced the 280E in February 1988.

The Amdahl Model 390E is positioned between the 5890-300E, a dual processor, and the 5890-400E, a three-way multiprocessor. Model 190 or 190E users can now upgrade to the Model 390E. A 390E may also be upgraded to either a 5890-400E three-way system or a Model 600E four-way system.

In partition mode, the 390E is said to have twice the throughput of a 190E and, in single-image mode, 0.9 times the throughput of the 300E dual processor.

The 390E can be configured with from 256 to 512 megabytes of main storage and 64 to 96 channels. It features two high-speed buffers per CPU, a 64-kilobyte buffer for operands, and a 32-kilobyte buffer for instructions. Up to 24 channels can be optionally configured as byte multiplexer channels. The 390E also features two main operator consoles and up to six optional remote consoles. Additionally, users can obtain up to eight channel-to-channel adapters to loosely couple the system with other Amdahl or compatible processors.

## Multiple Domain Feature

As part of its May 3 announcements, Amdahl brought out an enhanced version of its Multiple Domain Feature (MDF) first introduced in 1985. MDF lets users consolidate multiple system control programs (SCPs) on a single processor. An SCP is assigned to its own domain. A domain is really the logical equivalent of a computer that has access to its own set of physical resources such as memory and channels. Users can establish up to seven domains on the 5990 Model 1400 when running in single-image mode. In partition mode, users can set up four domains on each side of the partition. Users can establish up to four domains on the 5990-700 and on all 580 and 5890 Series processors.

Other MDF enhancements augment I/O capabilities, monitoring, capacity planning, and dynamic redistribution of central processing time. With the addition of an I/O Configuration Facility (IOCF), users can attach a larger number of devices to the system. Up to 16,384 physical devices can be attached, with up to 65,536 subchannels per system. The new IOCF allows each domain to have its own independent input/output configuration dataset.

With a new time distribution capability, MDF dynamically adjusts how much CPU time each domain can use to meet actual requirements. Under this arrangement, MDF can subtract CPU time from a domain with low activity and allocate the time to a domain with high activity. Reallocation is based on user-defined, CPU-share parameters.

An optional interface, MDFWATCH, lets software monitors report CPU usage in a domain as a percentage of system usage. Machine Readable Scheduler Data (MRSD), another optional interface, lets a program running in a domain retrieve statistics from MDF on domain CPU allocation. These statistics help users plan capacity more accurately for domains and for the total system.

MDF is similar to IBM's Processor Resource/System Manager (PR/SM), a product that enhances logical partitioning capabilities. PR/SM lets users set up four logically partitioned and independent operating environments on a single 3090 E processor complex and up to eight logical partitions on 280E, 400E, 500E, or 600E multiple processors operating in a physically partitioned configuration. PR/SM is a hardware

# Amdahl 580 Series

# Product Enhancement

▷ feature that lets users run a single processor as if it were four separate computers with different operating environments. IBM introduced PR/SM in February 1988 in response to the Amdahl MDF.

### 6100 Storage Processor

In the magnetic storage area, Amdahl brought out the 6100 Storage Processor family and two new disk devices, the 6380K triple-capacity DASD, and the 6380J single-capacity DASD. The 6100 storage controller family, consisting of four models, provides up to 32 channel attachments and can execute up to 16 concurrent data transfers to and from attached host processors to reduce channel bottlenecks.

To achieve optimum transfer rates, the 6100 line comes with a global cache and nonvolatile storage (NVS). Systems feature up to 512 megabytes of shared storage for caching and up to 16 megabytes of NVS. The 6100 Model 100 employs four data paths to achieve concurrent data transfers to and from the host. The Model 200 features eight paths, the Model 300 features 12 paths, and the Model 400 features 16 paths. All 6100 models can address up to 128 devices. The 6100 line can be configured with the new Model J and Model K DASDs and also accommodates the older 6380 and 6380E DASDs to protect user investments in older hardware. The 6100 features data transfer rates of either 3.0 or 4.5 megabytes per second.

### New 6380 DASDs

The 6380 Model K DASD, with four sealed disk enclosures (DEs), has a triple-density capacity of up to 7.56 gigabytes per unit and 1.89 gigabytes per DE. Average seek time is 16 milliseconds. The Model J, also with four DEs, has a single capacity of 2.5 gigabytes per unit and 630 megabytes per DE. Average seek time is 12 milliseconds. Both models use 10.5-inch platters rather than the industry-standard 14-inch platters, and both can be configured with optional quad pathing to provide four independent paths to each unit. J and K strings can operate in either dual or quad path modes. Users can also intermix J and K models on a single string. The Model K and J DASDs come with a one-year warranty and will be available during the first quarter of 1989.

Other announced availability dates include the following: 6100 Models 100 and 200—fourth quarter, 1988; Models 300 and 400—fourth quarter, 1989; 12- and 16-channel adapter configurations—first quarter, 1989; cache—second quarter, 1989; and MVS—second quarter, 1989. The 6100 line comes with a one-year warranty for service and parts.

The 6100 and Models J and K DASDs are a direct response to the IBM 3990 Storage Control and 3380 DASDs Models J and K, introduced in September 1987. The Amdahl products, however, offer several price/performance advantages. The IBM 3990 Storage Control family, for instance, features cache sizes ranging from 32 to 256 megabytes compared to the 6100, which features up to 512 megabytes of cache storage. The 3990 also features up to 4-path access compare to a maximum of 16 paths for the 6100. Both IBM and Amdahl models feature both 3.0 and 4.5 megabyte-per-second data transfer speeds. The 3990 will be available during the third quarter, while the first models of the 6100 are expected to be delivered during the fourth quarter. □

# Amdahl 580 Series

## Product Enhancement

## EQUIPMENT PRICES

|  | Purchase Price ($) |
|---|---|
| **5890 PROCESSOR** | |
| Model 390E    CPU complex; includes two CPUs, one 64K-byte buffer and one 32K-byte buffer per CPU, 256 mega-bytes of main storage, 64 channels, and two operator consoles | 6,975,000 |
| **5990 PROCESSORS** | |
| Model 700    CPU complex; includes two CPUs, two 64K-byte buffers, 64 megabytes of main memory, 32 channels, and one main operator console | 7,070,000 |
| Model 1400    CPU complex; includes four CPUs, two 64K-byte buffers, 128 megabytes of main memory, 64 chan-nels, and two main operator consoles | 13,140,000 |
| **MASS STORAGE** | |
| 6100    Storage Processor; four models support the 6380/6380E, 6380J/6380K Direct Access Storage De-vices (DASDs); provides up to 32 channel attachments, executes up to 16 concurrent data transfers, and features from 32 to 512 megabytes of shared cache storage | 99,000 to 264,000 |
| 6380    Additional 6100 cache memory; 32-megabyte increments | 90,000 |
|        Model J single-capacity DASD; 2.5-gigabyte maximum capacity | 53,100 |
|        Model K triple-capacity DASD; 7.56-gigabyte maximum capacity | 94,500 |
|        Head-of-String feature | 20,700 ☐ |