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# INTRODUCING THE AMDAHL 580

## The Logical Evolution of Performance, Compatibility, and Availability

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This is the Amdahl 580: the fastest, most powerful computer the Amdahl Corporation has ever produced.

It has an average processing power of two times the Amdahl 470V/8 in a typical commercial environment—an increase which is the result of significant advancements in system architecture and design, Large-Scale Integration (LSI) circuitry, and circuit packaging.

Beyond its raw speed and power, beyond the technological innovations and advanced design techniques it incorporates, the Amdahl 580 represents the highest order in the evolution of a philosophy that has guided Amdahl and its product development from the beginning.

### The Benefits of the Amdahl Philosophy

Amdahl is committed to providing large-scale, general purpose computers which deliver three primary benefits:

**Performance**, because the accelerated development of new applications and the growth of existing applications demand it.

**Compatibility**, because hundreds of billions of dollars have been invested by users in application software, employee training, and peripheral equipment, and this investment must be protected.

**Availability**, because the more powerful a computer, the more critical is its availability for productive work.

Amdahl first offered these benefits to the worldwide computer market with the Amdahl 470, the world's first IBM compatible, large-scale, general purpose computer alternative.

The Amdahl 580 represents the logical, evolutionary extension of these benefits in concept and magnitude.

### Performance, Compatibility, and Availability of the Amdahl 580

First, the Amdahl 580's improved performance and price/performance ratio reduce the hardware investment required to meet the demands of increasingly complex application development and accelerated application growth—while improving productivity and reducing operating cost.

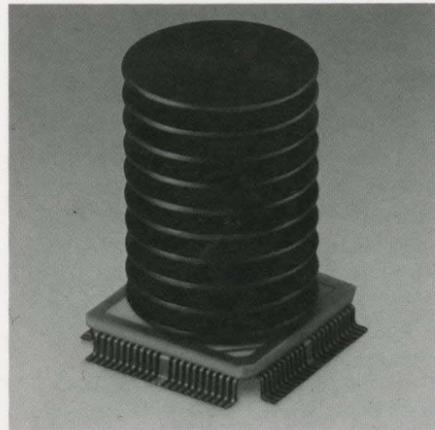
Second, the Amdahl 580 is compatible with IBM's large-scale computer systems, and with Amdahl's 470 series computers. Software developed on any of these systems, except that which is model dependent, will run on the Amdahl 580 without modification.

The Amdahl 580, however, takes compatibility one step further: it is designed with the enhanced flexibility to adapt to future changes in industry standards.

Finally, the Amdahl 580's availability increases the user's return on his computer investment by providing more hours of usable computer time.

The following is a summary of the benefits provided by advanced design and technological innovation in the Amdahl 580.

## EVOLUTION IN PERFORMANCE



Until now, the Amdahl 470V/8 was the most powerful, IBM compatible, uniprocessor computer.

This distinction now belongs to the Amdahl 580.

The Amdahl 580 achieves an average processing power of twice that of the Amdahl 470V/8 in typical commercial environments. This significant increase is made possible by improvements in two crucial areas: the average number of machine cycles per instruction and the machine cycle time.

### Improvements in Machine Cycles per Instruction

The fewer machine cycles needed to complete an instruction, the more instructions a computer can process in a given unit of time.

In the Amdahl 580, the average number of machine cycles per instruction has been significantly reduced by incorporating the following improvements:

1. The instruction pipeline for the Amdahl 580 Central Processing Unit (CPU) allows overlapping execution of five instructions at one time. The pipeline has fewer phases, which improves branch performance. And it can now complete one instruction per cycle at its maximum rate.

2. Primary data paths are eight bytes wide to enable more data to be processed per cycle.
3. Two 32-kilobyte High-Speed Buffers (HSBs)—one for fast access to instructions, and the other for fast access to data—reduce the interference between the instruction fetching and execution processes.
4. The algorithms used by the Amdahl 580's Instruction and Execution Units require fewer cycles on the average—especially for decimal operations which are frequently used in commercial installations.

### Improvements in Machine Cycle Time

The machine cycle time of the Amdahl 580 has also been improved, primarily as a result of evolutionary technology and packaging advances.

The Amdahl 580 uses new, faster Large Scale Integration (LSI) logic chips with gate delays that have been reduced to 400 picoseconds (trillionths of a second).

These new chips accommodate up to 400 circuits, four times that of previous chips. But even though chip density is greater, the total heat generated per chip is about the same. This allows the continued use of air cooling, which is less expensive and logistically simpler than liquid cooling.

A new, high-speed, LSI Random Access Memory (RAM) chip has also been developed to implement the HSBs, the registers, and the microstores for Distributed Microcode.

These new RAMs are intermixed with logic chips on the Amdahl 580's new Multiple Chip Carriers (MCCs), which are, in themselves, impressive improvements in packaging density.

MCCs are made up of 14 layers and can hold up to 121 LSI logic and RAM chips. One MCC can implement an entire system function. Only eight MCCs are required to build the basic Amdahl 580 with 16 Block Multiplexer channels, and only one additional MCC is required to add 16 more Block Multiplexer channels.

All the MCCs are mounted horizontally in a 5.6 cubic foot stack, the walls of which are printed circuit boards used to interconnect the MCCs. This advance in packaging reduces data path length and improves the speed of the processor.

### The Balance of Performance

To balance the performance of the CPU, the basic Amdahl 580 system includes up to 32 megabytes of main memory and as many as 34 Input/Output (I/O) channels. Additionally, the Amdahl 580 is designed to be expanded beyond the current 32 megabyte limit.

The Amdahl 580 provides up to 32 Block Multiplexer channels and up to two Byte Multiplexer channels. Each of these channels has the maximum allowable number of subchannels—256. The I/O channels, together with the dual bus communications structure, create a fast and efficient I/O system in which individual channels can handle up to six megabytes per second, and the aggregate I/O system can handle up to 50 megabytes per second.

In addition, Subchannel Queuing has been included to avoid the software overhead normally associated with restarting I/O operations which have been rejected by busy channels or devices.

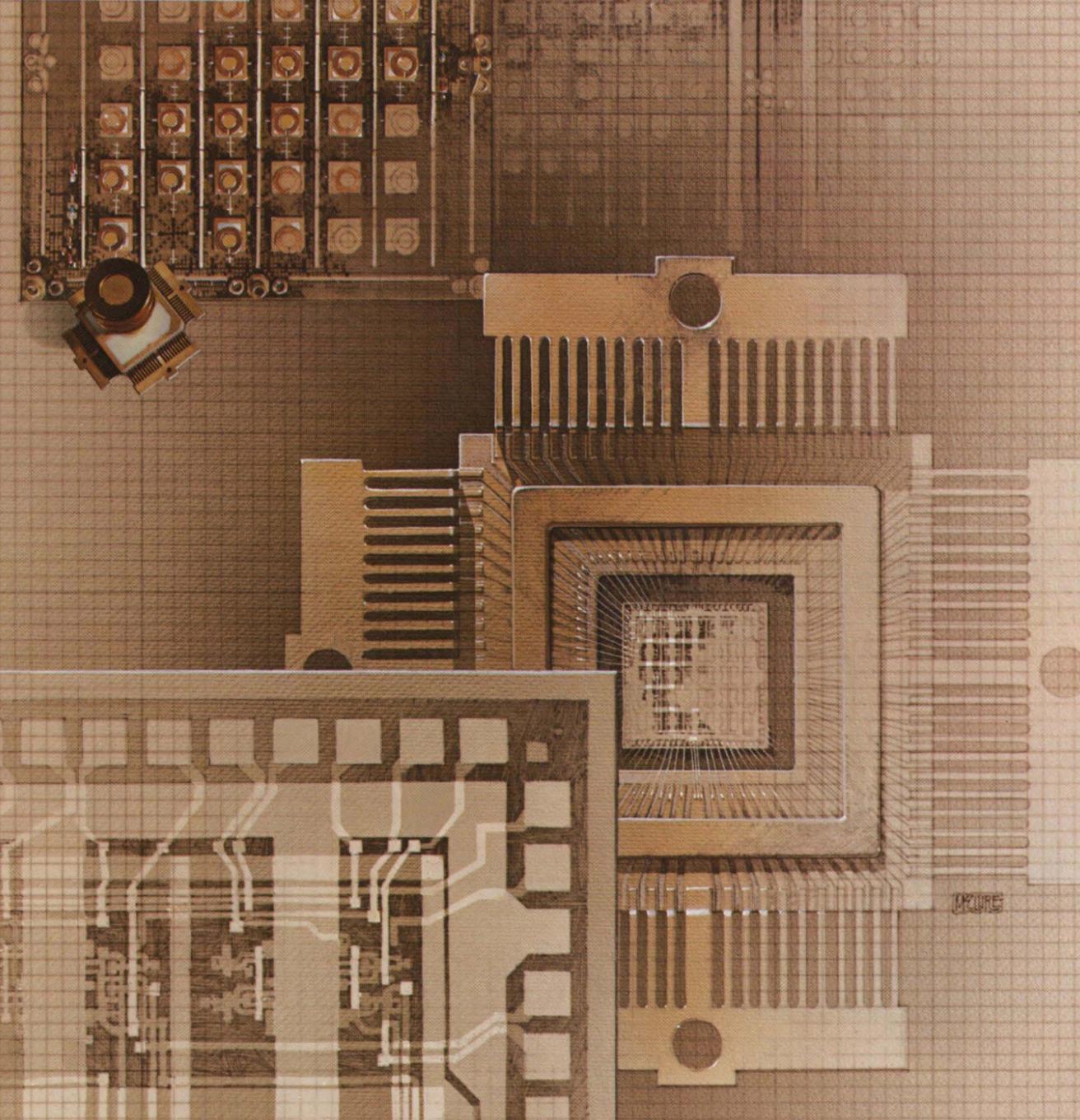
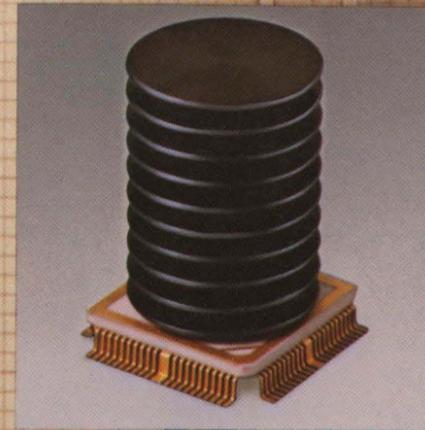
### Performance Growth Path

The Amdahl 580 design will allow future attachment of additional processing power to extend further the Amdahl growth path.

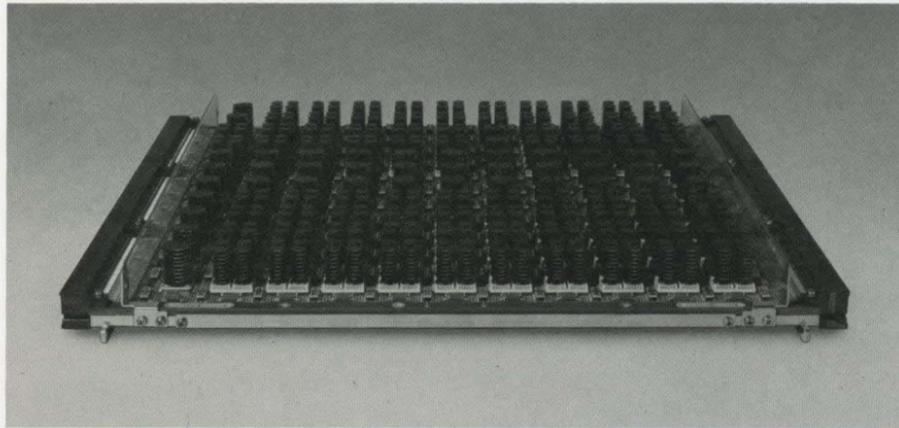
The level of performance represented by the Amdahl 580 is the next step in an evolution beyond the Amdahl 470V/8. Amdahl 470 series customers can feel confident that, should increased performance be required, an attractive and compatible growth path is available.

**Inset:** The Amdahl 580 LSI logic chip has gate delays of only 400 picoseconds and contains up to 400 circuits. Actual size: slightly more than 1/8" square.

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## EVOLUTION IN COMPATIBILITY



To protect the Amdahl customer's investment, the Amdahl 580 is designed to be compatible with IBM's large-scale systems and the Amdahl 470 series computer systems.

One would expect an Amdahl system to be designed with this kind of compatibility, but the Amdahl 580 goes one step further.

### Present Flexibility for Future Compatibility

In anticipation of future demands, the Amdahl 580 is designed with enhanced flexibility to help maintain compatibility with future extensions to industry software and peripheral interface standards. Several advanced design approaches provide this flexibility.

### Microcode, Macrocode, and Beyond

One of these design approaches is the extensive use of Distributed Microcode. Microcode is a technique for controlling the flow of data through the system and allows limited modification or addition of function.

Many computers have implemented microcode with a central control store. This method has several inherent disadvantages. In this configuration, functional units are farther away from the central microstore, data paths are longer, and consequently the units are slower. Because all functional units must obtain control words from this central store, there is a need for a contention resolution scheme. And since all the functional units must use the same type of control word, flexibility is limited.

In the Amdahl 580, the Instruction, Execution, Input/Output (I/O) Processors, and Console Units utilize microcode. The microcode control store is distributed to the same Multiple Chip Carrier (MCC) as the functional unit it controls. Thus, data paths are dramatically shorter, resulting in

better performance. Contention problems are eliminated. The microcode control word format can be customized to optimize the performance of each functional unit.

Another technique aimed at future compatibility is Macrocode, a new class of firmware and an Amdahl innovation. Macrocode can accommodate more significant changes in the software interface than microcode.

### Intelligent Design to Limit Redesign

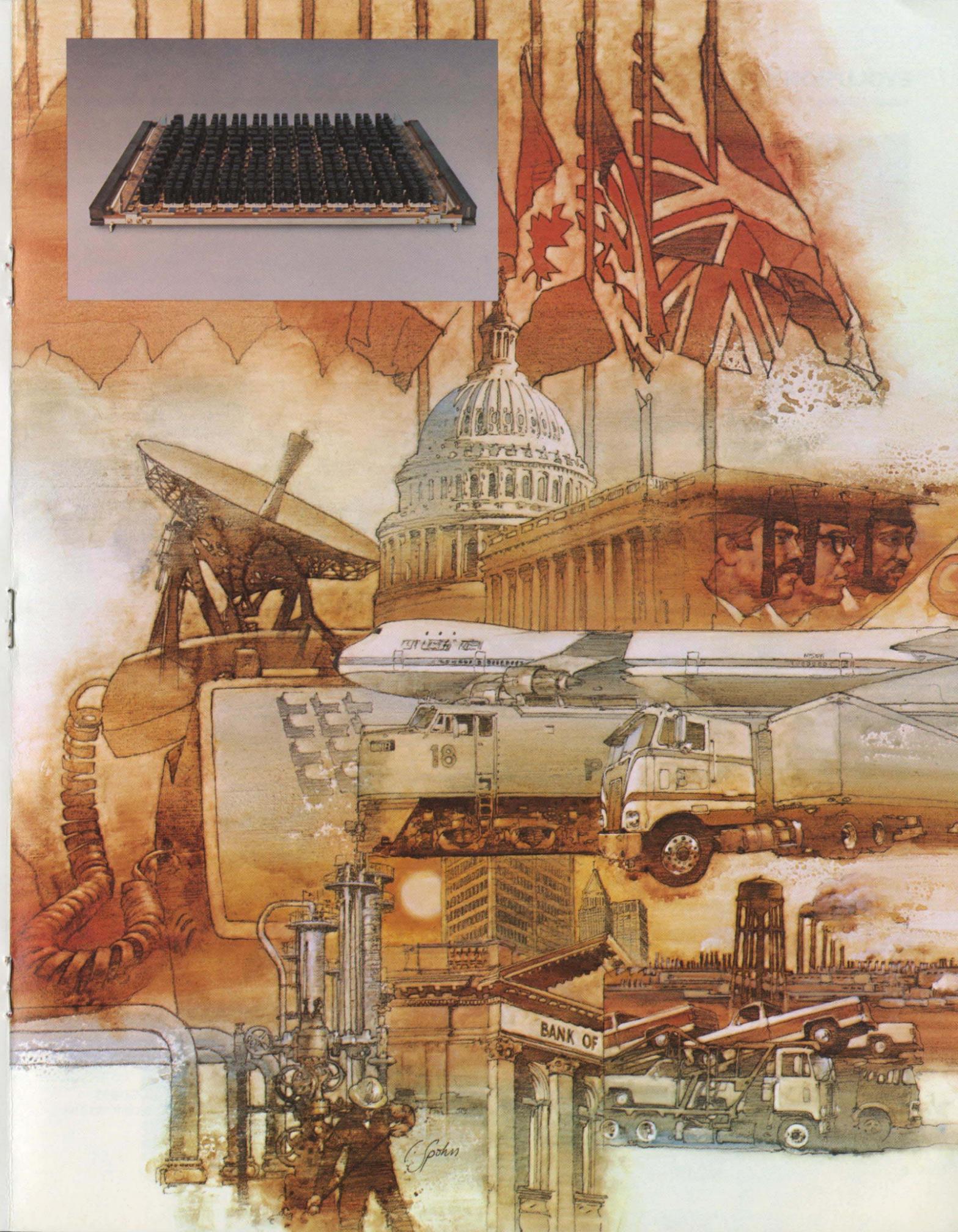
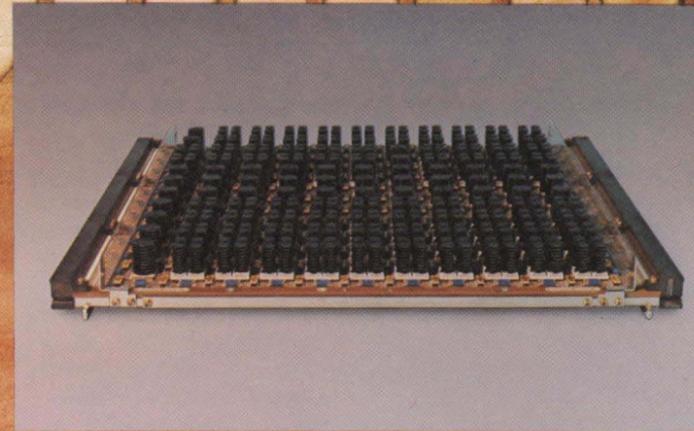
The Amdahl 580 is also designed and organized to permit continued peripheral device and channel compatibility.

Should the current I/O protocol be extended in the future, redesign is limited to a single printed circuit board, the Channel Interface Handler. The Channel Interface Handler communicates with the rest of the system over a well-defined interface. The value of this technique is that it isolates modifications and avoids complicated redesign.

Basically, four different techniques can be utilized to help maintain the Amdahl 580's future compatibility. Functions can be added or modified through (1) hardware modification, (2) microcode, (3) Macrocode, and (4) software emulation.

These techniques provide the Amdahl 580 with the flexibility to extend a growth path for Amdahl customers.

**Inset:** Multiple Chip Carrier (MCC) holds up to a total of 121 LSI chips. LSI logic chips and LSI RAM chips are intermixed on the MCC, and a single MCC contains an entire system function.



## EVOLUTION IN AVAILABILITY



The more powerful the computer, the more crucial is its availability. Since the Amdahl 580 is the most powerful computer Amdahl has ever built, it has also been designed to be the most available.

To achieve the required high level of availability, both reliability and serviceability have been improved.

### Improvements in Reliability

The Amdahl 580's improved reliability results from technology and packaging.

Because of improved chip and MCC density, there are far fewer components and interconnections required. Fewer components and interconnections enhance reliability; the

probability of component failure does not increase as much as the proportional increase in density; and interconnections are the most failure-prone elements of a complete system.

Reliability is further improved by the utilization of printed circuit boards integrated into the stack walls to provide interconnections among the MCCs.

The flexibility of the Amdahl 580's technology allows all of the Input/Output Processors (IOPs) and most of the Console to be implemented in LSI, which is considerably more reliable than third generation components.

In addition, parity checking, Error Checking and Correction (ECC), and residue checks are used as appropriate to detect errors and where possible, correct them.

### Improvements in Serviceability

Serviceability is made easier and faster on the Amdahl 580 because of some of the same advanced design and packaging techniques that contribute to its performance.

With increased MCC density, fault isolation is easier, because functions are contained on single MCCs. In addition, each MCC contains circuitry designed to help determine the source of the detected errors—and therefore the MCC to be replaced. This strategy greatly reduces the time required to diagnose a system failure.

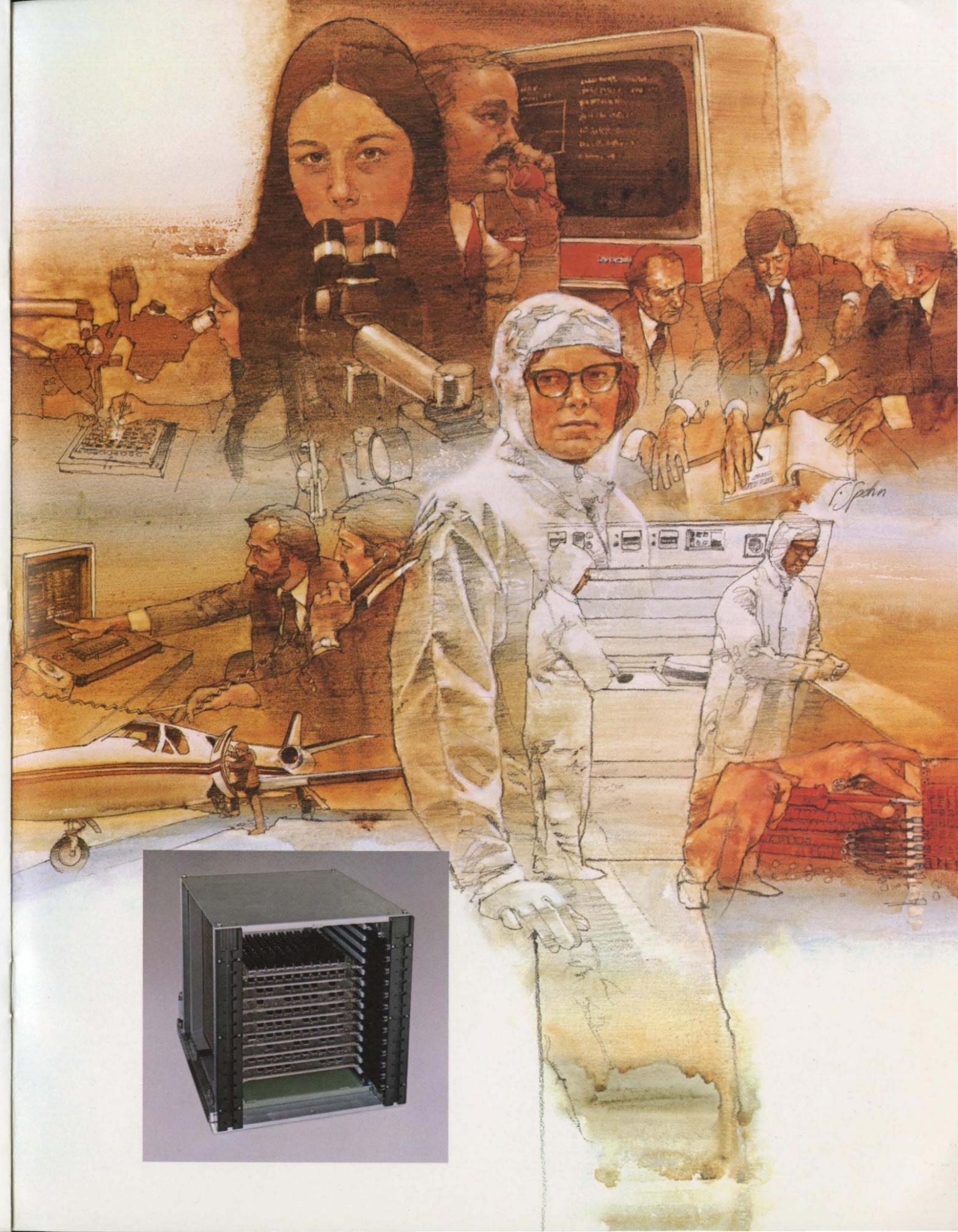
Microcode history RAMs, bus transaction history RAMs, last branch address registers, and Main Memory error history RAMs further increase serviceability by helping service personnel trace what is happening in the system.

### Service by Remote Control

The Amdahl 580 continues the use of Amdahl Diagnostic Assistance Center (AMDAC), which has been used so successfully to provide remote assistance on problems encountered on the Amdahl 470 systems. AMDAC allows a telephone link between the Console of the Amdahl 580 and an assistance center enabling additional experts to remotely observe or control the diagnostic process. Mean-Time-To-Repair (MTTR) is reduced because additional expertise can be quickly focused on a problem without the usual travel delays.

Improvements in reliability contribute to a greater Mean-Time-Between-Failures (MTBF). Improvements in serviceability contribute to a reduction in MTTR. Together, these improvements result in increased availability, which means more useful hours of work and a better return on investment.

**Inset:** Stack contains eight MCCs and printed circuit board MCC interconnections in just 5.6 cubic feet.



## THE AMDAHL 580 Evolution for the Future

The Amdahl 580 builds upon the success of the Amdahl 470 series. While many users may not immediately require the power of the Amdahl 580, it does provide the Amdahl customer and prospect with an orderly growth path that includes increased performance and improved price/performance, present compatibility and future flexibility, and availability in proportion to high performance needs.

For more information about how you can benefit from the Amdahl evolution in Performance, Compatibility, and Availability, contact your Amdahl representative.

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