## Apollo's Personal Supercomputer Delivers Range of Industry Firsts

Apollo Computer Inc.'s new Personal Supercomputer™, based on the *PRISM* (Parallel Reduced Instruction Set Multiprocessing) architecture, delivers a broad range of advanced technologies never before incorporated in a workstation.

APOLLO'S PERSONAL SUPERCOMPUTER IS **THE FIRST WORKSTATION TO DELIVER...**

- **Apollo's new PRISM architecture**, which incorporates a 64-bit architecture, parallel instruction single-cycle execution, new data flow compiler technology, multiprocessing capabilities, and a powerful instruction set.

- **A high-performance CPU design** which incoroporates tightly coupled integer and floating point processing units.

- **Separate 128KB instruction and 64KB data caches** per processor.

- **A high-speed** 150 megabyte-per-second, 64 bit synchronous bus.

- **Shared virtual memory multiprocessing.**

- **Support for up to 128MB of main memory.**

- **An industry-standard** IBM® PC/AT®-compatible bus and industry-standard VME bus.

- **High-performance mass storage** supporting up to four 5-1/4-inch ESDI fast actuator disk drives.

- **Disk striping** to deliver the high bandwidth required by a balanced system.

- **Scan path technology** to ensure a high degree of reliability.

- **Full source-code and binary-data compatibility** with Apollo's entire product line.

- **The platform necessary to deliver** the next generation, leading-edge graphics workstations.

-30-

# News Release

apollo

CONTACT:   Paul Sorensen
           Public Relations
           (617) 256-6600, x4235

MARKET OVERVIEW

**...Endorsements Boost New Apollo Entry...**

## TOP SOFTWARE, HARDWARE SUPPLIERS
## SUPPORT APOLLO'S NEW PERSONAL SUPERCOMPUTER

BOSTON, Massachusetts, March 1, 1988 -- In a demonstration of the broad industry accep-
tance of Apollo Computer Inc.'s new *PRISM*-based personal supercomputer, 20 prominent in-
ternational software and hardware solution suppliers today announced their support for the firm's
advanced *PRISM* architecture and Series 10000™ Personal Supercomputer™.

The companies -- including leading suppliers of systems for electronic design automation
(EDA), computer-aided design and manufacturing (CAD/CAM), and architecture/engineering/
construction (AEC) -- are committed to integrating Apollo's new Personal Supercomputer into
their product lines, to offer their applications on the new system, and to provide other software/
hardware support.  Apollo is presently working with nearly two dozen other solution suppliers that
will also be announcing their support for Apollo's Personal Supercomputer in the near future.

The endorsements position Apollo's Personal Supercomputer family as the leader in the emerg-
ing supercomputing segment of the workstation market.  With application solutions such as
those offered by these 20 OEMs and third-party software vendors, Apollo will deliver a new level
of performance for traditional workstation applications.

Apollo offers the workstation market's largest selection of third-party solutions for technical and
business applications. Apollo's new Personal Supercomputer is source-code compatible with
the rest of Apollo's workstation family, giving its users access to an extensive library of more
than 1800 application solutions. The Personal Supercomputer also provides supercomputer-
class performance in a personal system solution for other applications previously confined to
expensive supercomputers.

<center>-MORE-</center>

# TOP SOLUTION SUPPLIERS SUPPORT APOLLO PERSONAL SUPERCOMPUTER/2

The companies supporting Apollo's Personal Supercomputer are: AIDA Corporation; Analog Design Tools, Inc.; CAECO, Inc.; Cimatron Ltd.; Danford Corporation; Dynamic Graphics; ECAD, Inc.; Evans & Sutherland Computer Corporation; HHB Systems; Intelligent Light Inc.; Manufacturing and Consulting Services, Inc.; Marc Analysis Europe; Mentor Graphics Corporation; PDA Engineering, Inc.; Pisces International; Racal-Redac Systems Ltd; SDA Systems; Siemens AG, E Division; Silvar-Lisco; and VLSI Technology, Inc.

## AIDA Corporation -- EDA

AIDA™ is a supplier of an entire family of integrated workstation-based computer-aided engineering (CAE) design tools for designers of medium and large digital systems that utilize application-specific integrated circuits (ASICs).

"The new Apollo Series 10000, used with the AIDA Design System, allows designers of large systems using ASICs to increase their productivity with affordable workstation tools that achieve mainframe performance," said R. James Dickie, vice president of marketing for AIDA.

## Analog Design Tools, Inc. -- EDA

Analog provides Analog Workbench™, an integrated set of tools for designing analog circuits and systems. It features an intuitive user interface and includes schematic entry, editing, analysis, instrument display, and device libraries.

"Apollo platforms are popular with our users," said Charles Miller, senior vice president of product development. "Since our applications are computation intensive, we're pleased that Apollo is offering this level of performance."

## CAECO, Inc. -- EDA

CAECO is a solution supplier of VLSI design tools for full custom and ASIC applications.

"Our products will be dramatically faster on the new Apollo Personal Supercomputer," said Mark Miller, CAECO's director of marketing. "We are truly excited about not only the performance increase the Series 10000 offers but the revolutionary multiple processor architecture as well."

## Cimatron Ltd. -- MCAD

Cimatron provides complete solutions for mechanical CAD/CAM, including 3-D design, surface modeling, drafting, numerical control, and finite element modeling.

TOP SOLUTION SUPPLIERS SUPPORT APOLLO PERSONAL SUPERCOMPUTER/3

**Danford Corporation -- Hardware/Software**
Danford provides a variety of utility software and peripheral hardware for the complete line of Apollo workstations.

**Dynamic Graphics -- Earth Sciences**
Dynamic Graphics develops advanced computer mapping tools for the calculation, manipulation, and analysis of highly accurate surface models from spatial data. Capabilities include high-quality two- and three-dimensional graphic representations of these models.

**ECAD, Inc. -- EDA**
ECAD is a major supplier of IC layout design and verification tools. Its two major product lines are SYMBAD™, for IC layout design, and DRACULA™, for design rule and electrical checking.

**Evans & Sutherland Computer Corporation -- MCAE**
As an Apollo solution supplier, Evans & Sutherland provides ROMULUS D™, a solids-based design tool that fully integrates design, drafting, and management of design data.

"The increased memory and power of the Series 10000 will give a strong advantage to our users, enabling them to design more complex and detailed assemblies and components in a responsive, interactive environment," said Bernard Williams, product services manager.

**HHB Systems -- EDA**
HHB is a leading supplier of simulation systems for design verification, performance analysis, and fault simulation, as well as for automatic test program generation. These simulation tools are integrated with a hardware modeler and accelerator, which are shared resources via both Ethernet® and Apollo Domain® links.

**Intelligent Light Inc. -- Animation**
As a supplier of software for 3-D animation and scene simulation, Intelligent Light provides complete solutions for engineers, industrial communicators, and communications professionals involved in scientific visualization and simulation, including computational fluid dynamics, aesthetic design, scene simulation, and video animation production.

"We believe that Apollo's new high-end product line will allow image rendering and animation to occur at near real-time speeds," said Steve M. Legensky, president of Intelligent Light.

-MORE-

### Manufacturing and Consulting Services, Inc. -- MCAD

A major supplier of 3-D CADD/CAM software products, Manufacturing and Consulting Services provides Apollo with ANVIL-5000™, a software program with a complete range of design, drafting, and manufacturing capabilities for mechanical engineering.

"With the introduction of the Apollo Personal Supercomputer, the combination of Apollo workstations and MCS software -- already proven to be a winner -- reaches new heights of productivity," said Dr. Patrick J. Hanratty, president of MCS. "Particularly with complex designs, the Apollo Series 10000's enhanced processing capabilities will cut the time needed to get the job done."

### Marc Analysis Europe -- MCAE

Marc Analysis Europe offers the Marc Finite Element Analysis package and the Mantat pre- and post-processor. Both products, already available on the current Apollo platform, will be made available and optimized for the Series 10000.

### Mentor Graphics Corporation -- EDA

The leading vendor of electronic computer-aided engineering systems and an Apollo value-added reseller, Mentor Graphics' products allow electronic engineers to design, test, and verify integrated circuits and printed circuit boards.

"Multiprocessor architecture is the wave of the future for EDA to keep pace with the breakneck speed at which design complexity grows," said Gerry Langeler, president and chief operating officer of Mentor Graphics. "While we are pleased that Apollo's new Personal Supercomputer offers superior performance for our design and analysis tools, it is just as important to note that Apollo has maintained source-code and data-code compatibility with their 68020-based workstations. This simplifies the task of moving our software to this new workstation, and makes it easy for our customers to mix and match 68020 and RISC workstations in the same network. Apollo's commitment to software compatibility is unsurpassed in the industry."

### PDA Engineering, Inc. -- MCAE

PDA Engineering is a supplier of computer-aided engineering solutions that support the entire Apollo product line. PDA's PATRAN II® software combines 12 integrated modules for conceptual design, advanced geometry modeling, finite element modeling and analysis, thermal analysis, and solids modeling.

<div align="center">-MORE-</div>

### Pisces International -- MCAE

Pisces International provides Pisces, a finite difference analysis package specifically designed for impact and penetration analysis.

### Racal-Redac Systems Ltd. -- EDA

Racal-Redac is the leading supplier of PCB design products worldwide. The firm's VISULA™ is a CAE/CAD/CAM system for intelligent heirarchical schematic capture, PCB design, professional simulation, 2-D drafting, and manufacturing.

"This is a highly tuned integrated system which can be well utilized in an open systems environment," said Peter Lever, marketing director. "Apollo is continuing to remain at the forefront of the workstation market with this product. Racal-Redac has already ordered it, and we look to utilize the computing power immediately, especially for highly compute-intensive tasks in a network environment."

### SDA Systems -- EDA

As a software supplier for Apollo, SDA Systems provides and supports a complete line of EDA systems for the development of advanced ASICs, particularly for layout, simulation, and verification.

### Siemens AG, E Division -- EDA, MCAD

Siemens, one of the world's largest electrical and electronics corporations, uses Apollo workstations as the standard computer hardware for all of Siemens' workstation-based systems. Siemens offers a wide range of software and hardware products for the technical office and the computer-integrated manufacturing market.

### Silvar-Lisco -- EDA

Silvar-Lisco provides a complete line of CAE software products for all stages of electronic design, from system or architectural design to PCB and IC design.

Herman Beke, vice president of marketing for Silvar-Lisco, said, "The availability of our products on Apollo's Personal Supercomputer provides price/performance capabilities unequalled in a workstation environment."

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## Apollo's Personal Supercomputer
## Markets and Applications

Apollo's Series 10000™ Personal Supercomputer™ is designed for a wide range of demanding applications that traditionally have required supercomputer-class performance. The Personal Supercomputer's multiprocessor configuration and reduced instruction set architecture make it ideal for complex applications in all established workstation markets, particularly electronic design automation (EDA), mechanical computer-aided design and engineering (MCAD/MCAE), financial services, artificial intelligence, and database management.

The new computing architecture -- *PRISM* (Parallel Reduced Instruction Set Multiprocessing) -- will serve as the platform for next generation, leading-edge graphics workstations. This makes Apollo's Personal Supercomputer ideal for integrating high-performance graphics with supercomputer-class performance for applications in emerging workstation markets such as energy development and production, computer-aided molecular design, and data visualization. In addition to the existing applications in Apollo's library, the Personal Supercomputer will attract new applications traditionally run on supercomputers and mini-supercomputers.

## ELECTRONIC DESIGN AUTOMATION (EDA)

Apollo's new Personal Supercomputer is particularly suited to the ever-increasing computational tasks of designing, simulating, and verifying today's complex integrated circuits (ICs) and printed circuit boards (PCBs). Some of its key capabilities include:

*IC and PCB simulation* – The Apollo Personal Supercomputer provides the raw processing power and large virtual memory capacity necessary for routing and simulating large and complex designs. Floating point-intense applications such as circuit simulation are easily accommodated by the Personal Supercomputer's fast floating point processors.

*Multiple processing* – The multiprocessor capabilities of Apollo's Personal Supercomputer allow simulation, design verification, and routing to occur simultaneously, thus dramatically improving design throughput.

*Compatibility* – Because the Personal Supercomputer is source code and data compatible with the entire family of Apollo workstations, it can be added to existing networks for immediate performance enhancement. The Personal Supercomputer can be used as a computational server within a network of other workstations, using lower-end systems for documentation, schematic capture, creating libraries, waveform analysis, and small-scale physical layouts.

## MECHANICAL CAD/CAE

Mechanical computer-aided design and analysis has become increasingly complex with the advent of surface and solid modeling, as well as with the common usage of finite element modeling techniques. The Apollo Personal Supercomputer's powerful computational throughput increases the interactive processing of these tasks, greatly enhancing productivity. When placed in a network of workstations, the Personal Supercomputer can act as a computational server, increasing total throughput for all of the workstations. Apollo's Personal Supercomputer has several important applications in mechanical design and analysis:

*Analysis computation* – In the case of complex computations, such as finite element modeling, the Apollo Personal Supercomputer's floating point engine can handle the workload without sending the entire finite element model to a supercomputer for batch processing.

*Finite element analysis* – Analytical capabilities of the Personal Supercomputer include structural analysis, magnetic field analysis, heat transfer, and fluid dynamics.

*Simulation* – Crash testing, kinematics, and animation can all be simulated in-process by the Personal Supercomputer.

*Simultaneous design and analysis* – Apollo's Personal Supercomputer's multiprocessors can handle the throughput of design and analysis interactively, resulting in a more cost-effective design.

*Complex object design* – The Personal Supercomputer is ideal as a platform for adding 3-D color solid geometry for realistic, interactive representation and manipulation of objects.

## FINANCIAL SERVICES

Apollo's Personal Supercomputer serves as a real-time engine for computational applications and fast database access. Its compute power makes it ideal for various financial services,

including securities trading, portfolio management, econometric modeling, data feed delivery, arbitrage identification, and back-office accounting. Instant analysis of market data -- an important element in the financial services industry -- is readily delivered by the Personal Super-computer's four processors and high-speed bus, which allow it to handle massive amounts of information.

*Real-time data analysis and delivery* - The Apollo Personal Supercomputer's large physical memory makes it a real-time data server, and its fast processors allow it to manage high-speed data communications. Complex calculations and delivery of the results are all accomplished in real-time by the Personal Supercomputer's floating point processor.

*Graphical display* - By using the Personal Supercomputer as a server in a network of workstations, a local workstation is free to provide quick, accurate graphical displays, allowing for timely assimilation of complex financial data.

*Financial modeling* - With its high-speed bus and fast actuator disk, Apollo's Personal Super-computer is ideal for integrating large financial databases with real-time data and modeling software.


## DATABASE MANAGEMENT

Apollo's Personal Supercomputer is well suited to meet the compute intensive data server requirements for distributed data management in the technical markets. Today's applications demand concurrent access to massive amounts of available data among large numbers of users.

*High volume performance* - The multiple processor architecture supports and schedules compute-intensive queries transparently. This ensures delivery of the speed and power required by the complex multi-vendor environment of distributed network data management applications. The design of the *PRISM* architecture -- including disk striping, a high-speed bus, and large physical memory -- provides the throughput to eliminate input/output bottlenecks common in intensive data access environments.


## ARTIFICIAL INTELLIGENCE

Apollo's Personal Supercomputer is the ideal AI workstation for developers. Providing special software calls and hardware components for the acceleration of LISP, the Personal Supercomputer is uniquely suited to handle the large compute tasks of LISP-based AI. Its large memory capacity and multiple processors enhance Apollo's AI product offering in many areas, including the following:

*Multiple compiles and builds* – With the Personal Supercomputer, a LISP developer will be able to do multiple compiles on a single node or server, greatly increasing programming productivity.

*Natural languages* – The Personal Supercomputer's multi-processors can segment their process-rich applications for fast processing. As an example, a process can gather speech/keyboard input, begin interpreting the information, and then disperse it to other processes, which then explore the appropriate databases. This allows for interactive database query for the user.

*Financial modeling* – AI currently serves as an inseparable, and often invisible, piece of large modeling systems, presently done on expensive LISP engines. These decision-support systems require rapid and continued access of data from one or several databases. The Personal Supercomputer provides analysts with a powerful system for intelligent manipulation of large financial databases and integration with real-time data and modeling software.

*Symbolic math* – Not only will Apollo's Personal Supercomputer significantly improve floating point calculations, it will also help with symbolic math programs that are often LISP-based. The ability to run LISP very fast should also allow factoring of algebraic problems to simplify solutions.

*Robotics and vision technologies* – By 1990, nearly all robotics applications will have vision assistance, requiring very fast processing for data acquisition, floating point calculations, and expert system interpretation. The Personal Supercomputer's multiple processors will be able to handle each task in this process.

## ENERGY

The energy market requires high-performance computing and the ability to process massive databases for both exploration and production of energy resources, including oil, gas, and nuclear. Two key applications of Apollo's Personal Supercomputer include exploration data analysis and production facility design.

*Exploration data analysis* – The Personal Supercomputer meets the industry's needs for powerful processing capabilities required to analyze huge data files generated in the field. Today, exhaustive surface and subsurface modeling, based on input from satellite, seismic, and well-log survey sources, are generally required before major funds are committed to any development project. Analyzing such massive amounts of data has been the realm of the supercomputer; Apollo's Personal Supercomputer now brings this capability to the desk.

*Production facility design* – As the designs of energy production plants become increasingly complex, high-end data processing tools are required. The compute power of the Personal

Supercomputer can handle the multiple, interrelated disciplines of plant design, making it the only workstation currently capable of modeling an entire complex facility such as a nuclear power plant.

## COMPUTER-AIDED MOLECULAR DESIGN

The pharmaceutical, general chemical, and agri-chemical industries increasingly are using computer-aided molecular design techniques in the design of new drugs, peptides, plastics, and chemicals. Research and development in these fields demand intensive data computation for molecular analysis. With its powerful *PRISM* architecture, Apollo's Personal Supercomputer has important applications in this emerging market:

*Molecular simulation* – Simulating the behavior of molecules requires a level of computational power previously available only in supercomputers or mini-supercomputers. The processing speed of the Personal Supercomputer, particularly in floating point calculations, allows researchers to perform many simulations on a single workstation or compute server. Applications include molecular dynamics, energetics, and electronic properties simulation.

*Molecular graphics* – For researchers who need to represent and interact with molecular structures, Apollo's Personal Supercomputer provides mini-supercomputer compute power that, when integrated with real-time, 3-D graphics technology, will provide true integrated molecular modeling.

## DATA VISUALIZATION

Research scientists and engineers have traditionally relied on supercomputers for the compute power required in areas such as computational fluid dynamics, windflow, molecular dynamics, advanced mathematics, and physics. The Apollo Personal Supercomputer brings supercomputer performance out of the computer room and into the local, single-user environment. The integration of leading-edge graphics into the *PRISM* architecture will address the needs of researchers to graphically see the results of complex computations or simulations, providing significant enhancement over current supercomputer and mini-supercomputer solutions. Particular applications include:

*Graphics data visualization* – The unique features and speed of the Personal Supercomputer provide the researcher with the flexibility to simulate and visualize problems in either of two ways: visually post-processing the results of supercomputer simulations by translating the re-
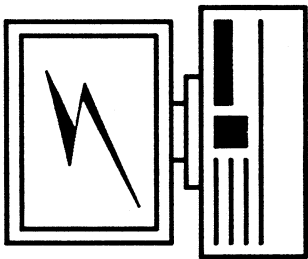
# APOLLO

## FROM PERSONAL WORKSTATIONS TO PERSONAL SUPERCOMPUTERS — THE BROADEST PRODUCT FAMILY IN THE WORKSTATION MARKET
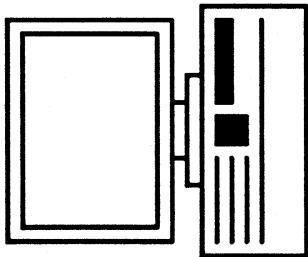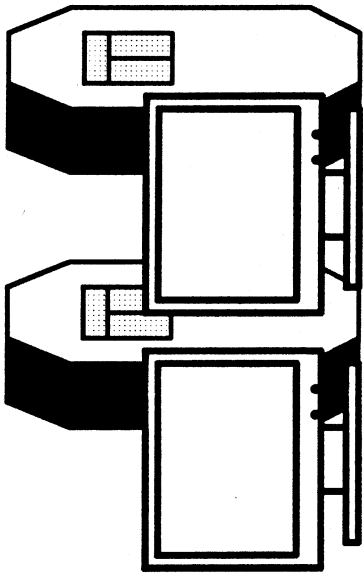
**Series 3000**

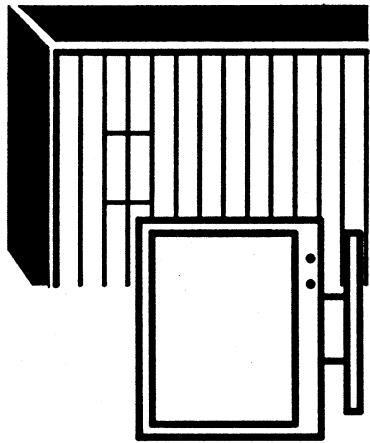entry-level Personal Workstation with prices beginning at less than $5,000

**Series 4000**

Personal Super Workstation offering 4 MIPS at prices beginning at under $14,000

**DN580 & DN590**

powerful graphics workstations designed for high-performance 2-D and 3-D applications

**Series 10000**

*PRISM* architecture-based Personal Supercomputers delivering supercomputer-class performance at prices beginning at under $70,000

**News Release**

apollo

CONTACT:  Chris Woodward
          Public Relations
          (617) 256-6600, x4420

COMPETITIVE OVERVIEW

**...New Personal Supercomputer Delivers Unprecedented Workstation Performance...**

# APOLLO PERSONAL SUPERCOMPUTER ROCKETS PAST COMPETITION; BEATS MICROPROCESSOR-BASED WORKSTATIONS FROM DEC, HP, SILICON GRAPHICS, SUN

BOSTON, Massachusetts, March 1, 1988 -- In virtually every performance benchmark, Apollo's new Personal Supercomputer™ far outpaces the competition, including high-end systems from Digital Equipment Corp., Hewlett-Packard, Silicon Graphics, and Sun Microsystems™.

The Personal Supercomputer combines Apollo's new *PRISM* (Parallel Reduced Instruction Set Multiprocessing) architecture with supercomputer technologies to achieve a quantum leap in price/performance -- levels far greater than those offered by competitive systems.  Unlike Apollo, other suppliers have relied solely on improved microprocessor technology, achieving limited improvements in performance.

Apollo's Personal Supercomputer configured with a single processor can deliver from 15 to 30 times the total throughput of DEC's® VAX® 11/780*, while multiple processor configurations can deliver from 60 to 100 times VAX 11/780 throughput -- far outperforming the competition's high-end workstations. The Personal Supercomputer delivers:

- up to 13 times the total throughput of the Sun 4/200;
- up to 25 times the total throughput of HP's 9000 825SRX;
- up to nine times the total throughput of Silicon Graphics' IRIS 4D/70GT.

– MORE –

* An accepted benchmark for high-performance workstations, the total throughput of the VAX 11/780 is generally considered to equal 1 MIP (million instructions per second).

In addition to superior performance, Apollo's new Personal Supercomputer offers distinct advantages over systems being introduced by new superworkstation-class suppliers. Unlike these other suppliers, which offer only point products, Apollo delivers:

- a complete and compatible product family, including entry-level Personal Workstations™ (Series 3000™), mid-range Personal Super Workstations™ (Series 4000™), and high-performance 2-D and 3-D graphics workstations (DN580, DN590), as well as the new Personal Supercomputers (Series 10000™);

- a large installed base of users -- more than 2300 corporate accounts worldwide;

- More than 1800 software packages from over 750 leading software and hardware solution suppliers, the largest selection of workstation applications in the industry;

- a reputation as the pioneer of the workstation industry and a computer technology leader backed by sales, service, and customer support operations in more than 20 countries worldwide.

-30-

The attached competitive comparison guide is based on published competitive data supplied by the vendors themselves for analysts' reports and news media. Where no data was available, Apollo estimated as accurately as possible.

Apollo is a registered trademark and Personal Supercomputer, Personal Workstation, Series 3000, Personal Super Workstation, Series 4000, and Series 10000 are trademarks of Apollo Computer Inc. Sun Microsystems is a trademark of Sun Microsystems, Inc. DEC and VAX are registered trademarks and VAXstation is a trademark of Digital Equipment Corp.

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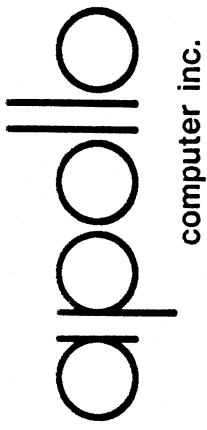
computer inc.

# COMPETITIVE COMPARISON

# APOLLO SERIES 10000 PERSONAL SUPERCOMPUTER

# ANNOUNCEMENT

# MARCH 1988

*The information contained herein is based on published competitive data supplied by the vendors themselves for analysts' reports and news media. Where no data was available, Apollo estimated as accurately as possible.*

# COMPETITIVE COMPARISONS

## APOLLO VS SUN:

**FEATURES**

| | APOLLO | SUN |
|---|---|---|
| | ========== | ======== |
| MULTI-PROCESSING | Yes | No |
| PARALLEL INSTRUCTION EXECUTION | Yes | No |
| 64-BIT ARCHITECTURE | Yes | No, 32-bit |
| DATA FLOW COMPILER TECHNIQUES | Yes | No |
| FLOATING POINT | Full Custom | Weitek |
| DUAL CACHE | Yes | No |
| INTERLEAVED MEMORY | 4 Way | No |
| HIGH SPEED BUS | Yes | No |
| DISK STRIPING | Yes | No |
| SCAN PATH TECHNOLOGY | Yes | No |

# COMPETITIVE COMPARISONS

APOLLO SERIES 10000 vs. SUN 4/200 SERIES.    APOLLO PROVIDES . . .

- NEW SUPERCOMPUTING SYSTEM  vs. ENHANCED MICROPROCESSOR

- MULTIPROCESSOR vs. UNI–PROCESSOR

- UP TO 13 X TOTAL THROUGHPUT OF SUN–4/260

- 64–BIT BUS vs. 32–BIT BUS

- OVER 7 X THE BANDWIDTH OF SYSTEM & MEMORY BUS

- PARALLEL INSTRUCTION EXECUTION vs. SERIAL INSTRUCTION EXECUTION

- DISK STRIPING

- SUSTAINABLE WORKSTATION PERFORMANCE LEADERSHIP

# COMPETITIVE COMPARISONS

## PRICING CONFIGURATIONS

| APOLLO | SUN |
|---|---|
| **DN10010-E** | **4/260C** |
| ———— | ———— |
| PRISM | SPARC |
| 8MB memory | 8MB memory |
| 19", 1024 x 800 display | 19", 1152 x 900 |
| 8-plane color | 8-plane color |
| 348MB disk | 280MB disk |
| ===== | ===== |
| $79,900 | $65,400 |

**$15,980 / MFLOP**        **$59,454 / MFLOP**

*"Apollo's New Personal Supercomputer Delivers*
*Unprecedented Levels of Performance at a Premium Price"*

*March 1988*

# COMPETITIVE COMPARISONS

## PRICING CONFIGURATIONS

| APOLLO | SUN |
|---|---|
| **DSP10010** | **4/260S** |
| —— | —— |
| PRISM | SPARC |
| 8MB memory | 8MB memory |
| 348MB disk | 280MB disk |
| ===== | ===== |
| $69,900 | $54,400 |

**$13,980 / MFLOP**     **$49,454 / MFLOP**

*"Apollo's New Personal Supercomputer Delivers*
*Unprecedented Levels of Performance at a Premium Price"*

# COMPETITIVE COMPARISONS

## APOLLO SERIES 10000 VS HIGH-PERFORMANCE WORKSTATIONS:

| SYSTEM | APOLLO<br>SERIES 10000 | HP<br>9000 825SRX | SG<br>IRIS 4D/70GT | SUN<br>4/260C |
|---|---|---|---|---|
| ARCHITECTURE | PRISM | HP SPECTRUM | MIPS RISC | SPARC |
| # OF CPUS | 1 – 4 | 1 | 1 | 1 |
| INTEGER | custom | custom | MIPS | custom |
| FLOATING POINT | custom | custom | MIPS | Weitek |
| SYSTEM BUS | 64–bit | 32–bit | 32–bit | 32–bit |
| BUS BANDWIDTH | 150 MB/sec | N/A | 20 MB/sec | 20 MB/sec |
| MEMORY | 8 – 128MB | 8 – 48 MB | 8 – 16MB | 8 – 128MB |
| CACHE | 192 KB per CPU | 16 KB | 96 KB | 128 KB |
| DISK STRIPING | yes | no | no | no |

# COMPETITIVE COMPARISONS

## APOLLO SERIES 10000 VS HIGH-PERFORMANCE WORKSTATIONS:

| | APOLLO<br>DN10010 | HP<br>9000 825SRX[1] | SG<br>IRIS 4D/70GT | SUN<br>4/260C |
|---|---|---|---|---|
| | single processor | single processor | single processor | single processor |
| **PERFORMANCE** | | | | |
| *Throughput Relative*<br>to VAX 11/780 | 15–30 X | 14 X | 10 X | 10 X |
| DHRYSTONES | 27,000 | n/a | 19,800 | 17,647* |
| WHETSTONES | | | | |
| SP | 18,500 K | n/a | 8,600 K | 5,300 K |
| DP | 17,000 K | n/a | 6,200 K | 3,500 K |
| LINPACK (MFLOPS) CODED BLAS | | | | |
| SP | 9 | n/a | 4.3 | 1.6 |
| DP | 5 | 2.0 | 1.6 | 1.1 |

1   New Upgrade

*   Benchmarked Number

*March 1988*

*Apollo Computer Inc.*

*Competitive Comparison*

# COMPETITIVE COMPARISONS

## SINGLE PROCESSOR PERFORMANCE COMPARISONS
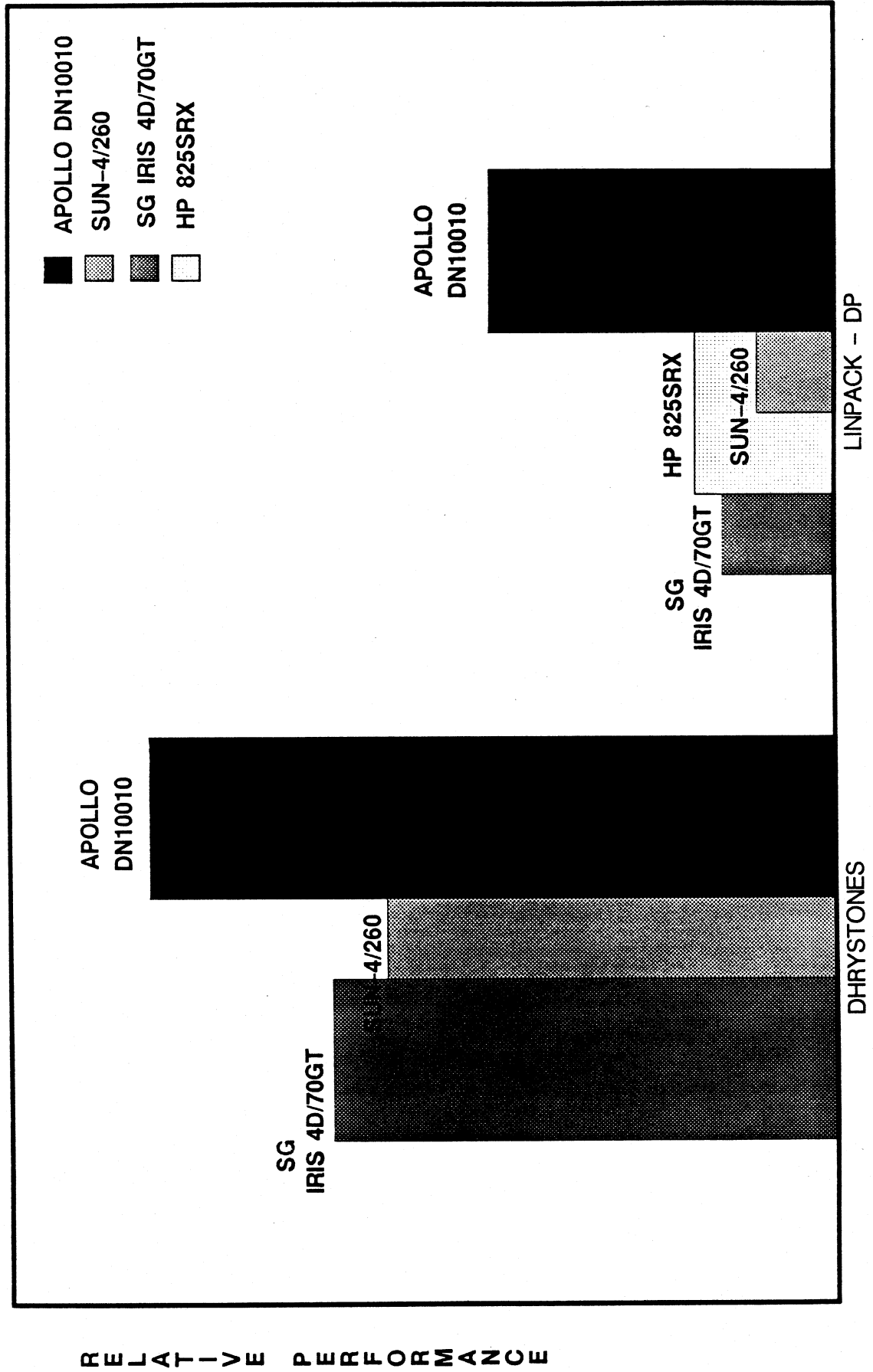
Competitive Comparison

March 1988

# COMPETITIVE COMPARISONS

## APOLLO SERIES 10000 VS HIGH-PERFORMANCE WORKSTATIONS:

- MULTIPROCESSOR vs. UNI-PROCESSOR

- UP TO 8 – 13 X THE TOTAL THROUGHPUT

- 64-BIT BUS vs. 32-BIT BUSES

- OVER 7 X THE BANDWIDTH OF SYSTEM & MEMORY BUS

- UP TO 8 X THE MEMORY CAPACITY

- PARALLEL INSTRUCTION EXECUTION vs. SERIAL INSTRUCTION EXECUTION

- DISK STRIPING

- SUSTAINABLE WORKSTATION PERFORMANCE LEADERSHIP

# News Release

CONTACT: Jim Barbagallo
Public Relations
(617) 256-6600, x4453

apollo
TECHNICAL OVERVIEW

**...Incorporates Powerful 64-Bit, RISC-Based, Multiprocessing...**

# APOLLO'S PRISM ARCHITECTURE/PERSONAL SUPERCOMPUTER BREAK NEW GROUND WITH SUPERCOMPUTING INNOVATIONS

BOSTON, Massachusetts, March 1, 1988 -- Apollo Computer Inc. today introduced the Personal Supercomputer™, based on Apollo's new *PRISM* architecture, advanced supercomputing technologies, and key breakthroughs in system design, delivering up to 100 times the throughput of a VAX® 11/780. Apollo's new *PRISM* (Parallel Reduced Instruction Set Multiprocessing) architecture incorporates several industry firsts -- a 64-bit architecture, parallel instruction single-cycle execution, new data flow compiler technology, multiprocessing capabilities, and a powerful instruction set -- all integrated into a supercomputer-based workstation designed for the office environment by Apollo.

Apollo's Personal Supercomputer family, the first implementation of the *PRISM* architecture, features a 128KB instruction cache and 64KB data cache to boost bandwidth; a fast system bus delivering sustained throughput for complex applications; up to 128MB of main memory; shared virtual memory multiprocessing; industry-standard PC/AT® and VME buses; up to 3 gigabytes (GB) of local mass storage; and other unique design innovations.

## Key Features Of Apollo's Prism Architecture

🔵 **First 64-bit Workstation Architecture** -- *PRISM* is the first workstation architecture to incorporate a 64-bit architecture. The 64-bit data paths minimize machine cycles per instruction, allowing most double-precision IEEE 754 floating point operations to deliver results in every cycle.

🔵 **Parallel Instruction Single-Cycle Execution** -- The *PRISM* architecture delivers significantly more application throughput than conventional architectures because its instructions can be dispatched and executed in parallel. This local parallelism allows for the execution of as many as three operations in a single cycle to increase overall architectural performance.

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- **Powerful RISC-based Instruction Set** -- The *PRISM* architecture incorporates unique, powerful instructions for addressing modes, bit field operations, floating point operations, and graphics operations, in addition to other key RISC features such as single-cycle execution, fixed-length instruction, and delayed branching.

- **New Compiler Technology** -- To deliver the intrinsic power of the *PRISM* architecture, Apollo developed state-of-the-art compilers. These new compilers employ sophisticated expert system techniques to take advantage of the *PRISM* architecture's powerful instruction set, and innovative data flow concepts to provide the basis for sophisticated, global optimization and instruction scheduling phases to exploit the inherent parallelism of the *PRISM* architecture as well as to avoid pipeline interlocks. The result maximizes the productivity of each machine cycle.

- **First Multiprocessing Workstation Architecture** -- The *PRISM* architecture supports advanced symmetrical multiprocessing, providing the computational range required by the industry's most compute-intensive applications.

**The Personal Supercomputer**
The first implementation of the *PRISM* architecture is Apollo's Personal Supercomputer family. Apollo has designed other new, key system innovations, and along with the *PRISM* architecture, has incorporated them into the Personal Supercomputer to deliver unprecedented levels of workstation performance.

- **High-Performance CPU Design** -- The Personal Supercomputer features an extremely powerful and uniquely designed CPU which incorporates tightly coupled integer and floating point processing units to maximize the high degree of local parallelism inherent in the *PRISM* architecture.

- **Large Dual Instruction and Data Caches** -- The Personal Supercomputer features separate 128KB instruction and 64KB data caches per processor, which boost bandwidth by continuously feeding the processors while delivering maximum throughput. The instruction cache is a full 64 bits wide, allowing integer and floating point instructions to be dispatched in parallel to fully exploit the *PRISM* architecture. The 64-bit wide data cache can be treated as two 32-bit single-precision words or one 64-bit double-precision word.

- **High-Speed System Bus** -- The Personal Supercomputer features an extremely high-speed 150 megabyte-per-second, 64-bit synchronous bus which significantly improves bandwidth from any CPU to main memory and other processors.

- **Shared Virtual Memory Multiprocessing** -- Programs running on the Personal Supercomputer share a common view of virtual memory. Cache coherency is maintained without unnecessary cycle stealing from the main processors. Tasks are free to migrate transparently across processors, and data is shared among all processes.

- **Advanced Memory Architecture** -- The Personal Supercomputer supports from 8MB to 128MB of main memory. The main memory is 4-way interleaved, allowing the system to handle full bus bandwidth in all memory configurations, thereby eliminating the bottlenecks typical to traditional memory architectures. Extensive write queuing and selective read promotion is provided to further improve performance. This parallel design supports heavy traffic over the system's high-bandwidth system bus, resulting in high-speed data flow to and from the main CPUs. Main memory is configured with 1 megabit DRAMs and is also designed to accept 4 megabit DRAMs when they become available, allowing future storage capacity as high as 512MB.

- **Industry-Standard Buses** -- The Personal Supercomputer includes both the IBM® PC/AT-compatible-bus and VME bus, allowing the system to utilize a broad range of standard peripherals.

- **High-performance Mass Storage** -- The Personal Supercomputer supports up to four 5-1/4-inch ESDI fast actuator disk drives -- with up to a 15 megabit-per-second transfer rate per drive -- providing up to 3GB of local mass storage.

- **Disk Striping** -- Sophisticated disk striping allows the Personal Supercomputer to provide the large bandwidth required by a balanced system. Disk striping, which is supported by new high-speed ESDI disk controllers and fast actuator ESDI drives, lets files span multiple drives, allowing high bandwidth access to data through multiple controllers. The system can stripe two or four drives.

- **Scan Path Technology** -- To ensure an extremely high degree of reliability, the Personal Supercomputer incorporates scan path technology -- a testing methodology first used in mainframes in the 1970's.

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Scan path technology provides the ability to "look" inside each VLSI chip designed for the Personal Supercomputer (there are up to 256 pins and 30,000 gates per VLSI chip) to determine a chip's state and functionality. This capability provides virtually 100 percent fault coverage of the VLSI components developed for the Personal Supercomputer, as well as component level fault isolation in manufacturing and repair centers. The scan path circuitry controlled by the MC68020 service processor provides a built-in self-test capability.

- **Compatibility** –– The Personal Supercomputer family is source-code and binary data compatible with Apollo's entire product family, giving users access to an extensive library of more than 1800 application solutions, the largest in the workstation market.

- **Graphics Technology** –– The Personal Supercomputer delivers unprecedented levels of workstation computational performance, thus providing the platform necessary to deliver the next generation, leading-edge graphics workstation. This workstation will be fully compatible with Apollo's full line of existing graphics resources.

### Personal Supercomputer Philosophy

Apollo engineered a new system design with its new Personal Supercomputer family of computational workstations, compute servers and file servers. Because the *PRISM* architecture and all other supercomputing technologies embodied in the Personal Supercomputer were designed together from a total systems approach, the Personal Supercomputer delivers unprecedented system performance.

### Designed For The Office Environment

The Personal Supercomputer family delivers supercomputer-class performance specifically designed for the office environment. These new computational workstations, compute servers and file servers easily slide under a standard office desk, or can be neatly abutted to a wall. The Personal Supercomputer is quiet and does not require special power. A high-resolution screen, 60Hz non-interlaced display, easy-to-use keyboard, tilt-swivel monitor, and a microprocessor-controlled cooling system combine to make the Personal Supercomputer as easy and comfortable to use as a personal computer.

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As a computational workstation, the Personal Supercomputer is ideally suited for electronic computer-aided design, artificial intelligence, and financial analysis. As a compute and file server, the Personal Supercomputer adds supercomputer-class performance to any network and is ideally suited for PCB routing, large-scale simulations, and network-wide file storage, among many other compute-intensive applications.

### Advanced Communications

As a fully compatible member of Apollo's workstation family, the Personal Supercomputer can be linked to the Apollo Token Ring or an Ethernet® LAN. The Personal Supercomputer will also take advantage of new communications technologies as they develop, such as FDDI (Fiber Optics Digital Data Interconnect) for rapidly moving data around a network. Through Apollo's advanced communications products, Personal Supercomputer users will be able to communicate with users of Ethernet and IBM SNA-based systems, VAX/VMS® computers, IBM PCs and PC-compatibles, Macintosh™ personal computers, and a variety of other systems.

### Choice Of Operating Systems

The operating system for the Personal Supercomputer is Apollo's new Domain/OS, a single, true distributed UNIX® operating system which offers users a choice of three operating environments -- AT&T's UNIX System V Release 3, Berkeley UNIX 4.3, and Apollo's Aegis™. Users can run either operating environment, or any combination of the three simultaneously on the same workstation, and have access to more than 1800 software packages from more than 750 leading third-party solution suppliers.

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# News Release

CONTACT: Donna Ruane
Public Relations
(617) 256–6600, x4416

apollo
ANNOUNCEMENT OVERVIEW

**...Personal Supercomputer Delivers Up To 100 Times Throughput of VAX 11/780...**

## APOLLO'S NEW PRISM ARCHITECTURE
## BRINGS SUPERCOMPUTING TO WORKSTATIONS

BOSTON, Massachusetts, March 1, 1988 –– Apollo Computer Inc. today introduced a family of Personal Supercomputers™ based on a new advanced supercomputing architecture –– the *PRISM* (Parallel Reduced Instruction Set Multiprocessing) architecture –– which delivers unprecedented power and performance to the desks of technical and business professionals.

With the introduction of the new Domain® Series 10000™ Personal Supercomputer, Apollo has created a new class of computers –– systems combining the power of supercomputers with the productivity advantages of high–performance workstations. Apollo's new Personal Supercomputer family is the first system to deliver supercomputer–class power in a personal system, a quantum leap in workstation price/performance.

The Personal Supercomputer's unique system design allows the Series 10000 to be configured with up to four RISC–based processors, with prices beginning at under $70,000.

**Far Outperforms Competition**

Apollo's Personal Supercomputer surpasses the competition in virtually every performance benchmark. The Personal Supercomputer configured with a single processor can deliver from 15 to 30 times the total throughput of Digital Equipment Corp.'s VAX 11/780*, while multiple processor configurations can deliver from 60 to 100 times VAX 11/780 throughput –– far outperforming the competition's high–end workstations. Apollo's Personal Supercomputer can deliver over 10 times the total throughput of high–performance workstations from Hewlett–Packard and Sun Microsystems™, and up to nine times the total throughput of Silicon Graphics' high–end workstations.

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* An accepted benchmark for high–performance workstations, the total throughput of the VAX 11/780 is generally considered equal to 1 MIP (million instructions per second).

Apollo's Personal Supercomputer family of computational workstations and high-performance servers is the first implementation of the new *PRISM* architecture. Apollo's *PRISM* architecture incorporates several industry firsts -- including a 64-bit architecture, multiprocessing capabilities, and a powerful instruction set -- all integrated into a supercomputer-based workstation designed for the office environment.

"The Personal Supercomputer is truly a leadership product whose development represents a direct response to customer needs," said Thomas A. Vanderslice, Apollo's chief executive officer and chairman of the board. "It is the culmination of research we completed with our customers in 1985 and 1986, and their requests became part of our stated, long-term strategy to bring ever more powerful systems to users.

"This is the first system of its class, one which I believe will set the pace for an entire new generation of workstations for many years to come," Vanderslice added.

### Applications for the Personal Supercomputer

The Personal Supercomputer brings technical professionals in the traditional workstation application areas -- such as mechanical computer-aided design and engineering (MCAD/CAE) and electronic design automation (EDA) -- unprecedented levels of performance and interactivity. In addition, the Series 10000 delivers the power and versatility necessary for demanding applications that were traditionally confined to large and expensive supercomputers, applications such as computational fluid dynamics, molecular modeling, atmospheric simulation, high-energy physics, and financial modeling.

Twenty prominent worldwide software and hardware workstation solution suppliers have already supported the Series 10000 and Apollo's *PRISM* architecture by committing to integrate them into their product lines, to offer their applications on the new system, or to provide other software/hardware support. These third-party vendors encompass all of the major workstation market segments, including EDA, MCAD/CAE, and architecture/engineering/construction (AEC).

The endorsements position Apollo's Personal Supercomputer family as the leader in the emerging supercomputing segment of the workstation market.

The Personal Supercomputer takes computational engineering to a whole new level, allowing users to process extremely compute-intensive applications -- such as scientific visualization -- interactively at their desks.

In traditional computing environments, a user would need to send this kind of compute-intensive application to a remote mainframe or supercomputer for processing. After processing is complete, the application is passed back to the workstation or terminal for graphical display. This two-step process is expensive, time-consuming, and most importantly, lacks interactivity. The Series 10000 allows the user to interactively process and monitor the same application on his own system.

### Joins Apollo's Workstation Family

The introduction of the Personal Supercomputer gives Apollo the broadest product family in the workstation industry, extending from Personal Workstations™ to Personal Super Workstations™ to Personal Supercomputers. In addition, the Series 10000 is source-code and binary data compatible with Apollo's entire product family, giving users access to an extensive library of more than 1800 application solutions, the largest in the workstation market. Through Apollo's next generation operating system -- Domain/OS -- Personal Supercomputer users can run AT&T's UNIX® System V Release 3, Berkeley UNIX 4.3, or both operating environments simultaneously.

The Personal Supercomputer is ideally suited for Network Computing System™ (NCS)-based applications. In a Network Computing environment, workstation users can distribute parts of applications around a network to other computing resources, such as the Series 10000.

The second major implementation of the *PRISM* architecture will be a dramatically new 3-D graphics system incorporating a new state-of-the-art 3-D graphics architecture, which complements and takes full advantage of the *PRISM*-based system architecture. This new real-time 3-D architecture will also be fully compatible with Apollo's Domain Graphics Resources. This high-powered graphics workstation is scheduled to be announced in the second half of 1988.

The Personal Supercomputer high-performance server includes from 1 to 4 processors, up to 128MB of main memory, and up to 3GB of local mass storage. Prices start at $69,900. The Series 10000 computational workstation includes from 1 to 4 processors, up to 128MB of main memory, up to 3GB of local storage, 8 planes of color, and a 19" 1024 x 800 display. Prices start at $79,900. Shipments of both the server and workstation configurations will begin in the third quarter of 1988.

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Apollo Computer Inc., headquartered in Chelmsford, Massachusetts, is the world's leading manufacturer of network-based workstations. The company is acknowledged as the market pioneer and has recorded more than $1.5 billion in sales since it introduced its first product in 1980. Apollo has full sales, service, and manufacturing facilities worldwide, including offices in 20 countries.

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# Domain Series 10000
# Personal Supercomputer Family

## Pricing

Apollo's Series 10000 ™ Personal Supercomputer ™ family is the first implementation of Apollo's new *PRISM* (Parallel Reduced Instruction Set Multiprocessing) architecture. The Series 10000 is initially available in high–performance server configurations and computational workstation configurations.

Entry–level Series 10000 high–performance server configurations include 8MB of memory, and a 348MB disk.

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| **DSP10010 (with 1 processor)** | $69,900 |
| **DSP10020 (with 2 processors)** | $89,900 |
| **DSP10030 (with 3 processors)** | $109,900 |
| **DSP10040 (with 4 processors)** | $129,900 |

Entry level Series 10000 computational workstation configurations include 8MB of memory, a 348MB disk, 8 planes of color, and a 19" 1024 x 800 color display.

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|---|---|
| **DN10010 (with 1 processor)** | $79,900 |
| **DN10020 (with 2 processors)** | $99,900 |
| **DN10030 (with 3 processors)** | $119,900 |
| **DN10040 (with 4 processors)** | $139,900 |

Shipments of the Series 10000 Personal Supercomputer family will begin in the third quarter of 1988.