SiliconGraphics
Computer Systems

Cray® Hardware Solutions

PRODUCT BROCHURE

Creating the Supercomputing Industry

Silicon Graphics supercomputing power is built on decades of supercomputing excellence. For nearly a quarter of a century, Cray supercomputers have led the world in unrivaled power to worldwide government, industry, and academia. The robust power of Cray hardware and software solutions is used to model and analyze a broad range of phenomena that are too complex, costly, time-consuming, or simply impossible to analyze in any other way. Cray created an industry by providing supercomputing tools for simulation, which today is a common method for product development used by companies and organizations throughout the world. One by one, industries have begun to embrace supercomputing as a critical part of their businesses or missions. From automotive and aerospace design to the discovery of new drugs and materials, petroleum exploration, weather and climate research, Wall Street financial analysis, and advanced scientific research, Cray systems are giving these industries capabilities previously unimaginable. Supercomputing future products from Silicon Graphics will far surpass current performance levels with industry-leading price/performance gains.

BAYER AG

BEAR STEARNS & COMPANY

CHRYSLER CORPORATION

ELECTRONIC DATA SYSTEMS

ELI LILLY COMPANY

FORD MOTOR COMPANY

ISUZU MOTORS LTD.

JAGUAR

MERCK & CO., INC.

MERRILL LYNCH

NASA

NATIONAL CANCER INSTITUTE

NIPPON TELEGRAPH AND TELEPHONE

PHILLIPS PETROLEUM

PIRELLI

PSA PEUGEOT CITROËN

THE DOW CHEMICAL COMPANY

UK METEOROLOGICAL OFFICE

Leading the Industry

Silicon Graphics has developed a business model that focuses on high-end supercomputing customers and their requirements. Cray-branded supercomputing products—each the global market leader in its category—include the CRAY T90™ Series of high-end vector processing systems; the CRAY SV1™ Series of scalable vector processing systems; the CRAY® Origin2000™ Series of scalable RISC systems; and the CRAY T3E-1200E™ Series of distributed memory scalable parallel processing systems.

CRAY SV1

CRAY T90

Each Cray supercomputer was designed to handle the unique needs of various high-performance computing users. The CRAY SV1 is the fourth generation CMOS vector system designed to handle a broad range of vector application workloads; the CRAY T90 supercomputer is the worldwide leader specializing in large vector workloads; the CRAY Origin2000 system is well-suited to mainstream technical, commercial, and visualization applications scaling to 128 processors; and the CRAY T3E-1200E system is perfect for highly parallel problems scaling from hundreds to thousands of processors.

CRAY Origin2000

All Cray systems are designed to support the open-systems standard and run the high-end UNIX® operating systems: UNICOS®, UNICOS/mk™, and IRIX®. Cray supercomputer systems uniquely support the most demanding applications, hundreds of users and processes, petabytes of data, and mission-critical requirements.

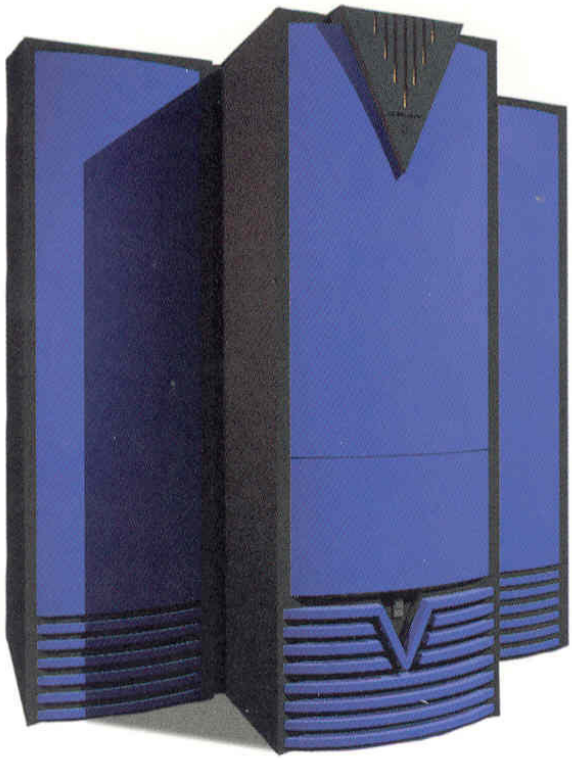
CRAY T3E-1200E

CRAY SV1

The CRAY SV1 Series takes supercomputing to new levels of performance, affordability and scalability. As the first member of the Silicon Graphics scalable vector product line, the CRAY SV1 supercomputer combines world-class single-processor performance with outstanding price/performance, scalability from entry-level to teraflops-level sizes, and the ability to run the industry-leading library of third-party vector applications. The CRAY SV1 processor has a peak performance rate of four gigaflops. This single-processor performance is matched by scalability to a teraflop of peak performance from hundreds of processors. The CRAY SV1 supercomputer uses the proven UNICOS operating system to provide a flexible, stable software environment. Customers in manufacturing, government, and science and research use the CRAY SV1 supercomputer to design new products, conduct research, protect national security, create weather forecasts, and many other critical applications.

	CRAY SV1-1A	CRAY SV1-1	CRAY SV1-4	CRAY SV1-8	CRAY SV1-32
NUMBER OF SMP NODES	1	1	4	8	32
PEAK PERFORMANCE	8–16 GFLOPS	8–32 GFLOPS	32–128 GFLOPS	64–256 GFLOPS	256–1024 GFLOPS
MEMORY SIZE	2–16GB	4–32GB	16–128GB	32–256GB	128–1024GB
NUMBER OF CPUs: 4 GFLOPS CPUs PLUS 1 GFLOPS CPUs OR IF ALL 1 GFLOPS	 Up to 3 4+ 8–16	 Up to 6 8+ 8–32	 Up to 24 32+ 32–128	 Up to 48 64+ 64–256	 Up to 192 256+ 256–1024
CPU CLOCK (MHz)	250	250	250	250	250
MEMORY TECHNOLOGY	DRAM	DRAM	DRAM	DRAM	DRAM
COOLING OPTIONS	Air	Air	Air or Water Assisted	Air or Water Assisted	Water Assisted

Series



Highlights:

- Has a peak performance of one teraflop and one terabyte of memory.
- Features two types of processors: an ultra-performance four-gigaflop Multi-Streaming Processor (MSP) and a standard processor with one gigaflop of peak performance. This combination allows customers to efficiently match computing needs with CRAY SV1 resources. For maximum flexibility, MSPs can be broken down into four standard processors.
- In its maximum configuration, a single node can contain six MSPs and eight standard processors. System is scalable up to 32 nodes.
- Increases effective memory bandwidth by running vector computations through high-bandwidth, custom-streaming cache memory.
- Unites leading CMOS and DRAM technologies with unmatched performance standards. For nearly a decade Cray-branded products have led CMOS-based supercomputing technology.
- Uses UNICOS operating system and is fully compatible with the expansive and highly tuned UNICOS application catalog.

CRAY T90

The CRAY T90 Series of supercomputers is the company's premiere line of general-purpose supercomputing systems. Based on Cray high-speed vector processors, a CRAY T90 supercomputer provides nearly 60 billion calculations per second (gigaflops) of peak computing power on an unmatched range of third-party and proprietary supercomputing applications. CRAY T90 systems employ an array of innovative technologies, including pioneering connectors that eliminate internal wiring.

The CRAY T90 Series includes three models: the CRAY T94™ system, offered with air- or liquid-cooling that scales up to four processors; the CRAY T916™ system, a liquid-cooled system that scales up to 16 processors; and the top-of-the-line CRAY T932™ system, also liquid-cooled with up to 32 processors. CRAY T90 system customers include large global organizations such as Ford Motor Company, Chrysler Corporation, Electronic Data Systems (EDS), Kia Motors, Nippon Telegraph and Telephone, Japanese auto firms, as well as national research centers and weather and climate organizations around the world.

Highlights:

- Based on the Cray Vector Processor, the proven workhorse architecture for scientific, technical, and engineering applications
- Up to 32 processors and nearly 60 GFLOPS of peak performance, offers the highest sustained-to-peak performance on a wide range of supercomputing applications
- Nearly 1TB of memory bandwidth, speeds overall processing
- 512 to 16,384MB of central memory, gives customers expandable memory options for their varying workloads
- Aggregate I/O bandwidth of more than 30GB/sec, provides fast delivery of solutions to users
- 64-bit IEEE floating-point CPU improves interoperability with engineering workstations
- Binary compatibility with previous CRAY C90 line, saves time because no recompilation is needed for applications that run on CRAY C90 systems
- Data center-ready, runs proven UNICOS operating environment based on UNIX System V, providing customers with the software features needed to run mission-critical workloads at the enterprise level
- Runs the fully optimized Cray-product applications suite for the most common scientific, technical, and engineering programs

	CRAY T94	CRAY T916	CRAY T932
NO. OF CPUS	1–4	8–16	16–32
PEAK PERFORMANCE	1.8–7.2 GFLOPS	14–28 GFLOPS	28–56 GFLOPS
MEMORY SIZE	.5–2GB	2–8GB	4–16GB
PEAK MEMORY BANDWIDTH	100GB/sec	450GB/sec	900GB/sec
MAX. NO. OF GIGARING™ CHANNELS	8	16	32
PEAK I/O BANDWIDTH	8GB/sec	16GB/sec	32GB/sec
COOLING TECHNOLOGY	Air or liquid	Liquid	Liquid

CRAY Origin

The CRAY Origin2000 leads the industry in distributed shared-memory and is well-suited for mainstream technical, commercial, and visualization applications. The systems represent the high end of the Silicon Graphics Origin™ line of systems, all of which are binary compatible and based on industry's leading CC-NUMA implementation.

With its unique CrayLink™ and MetaRouter technology and the scalable IRIX operating system, the Origin architecture today scales to 128 processors – an industry benchmark.

The CRAY Origin2000 systems support a novel approach to supercomputing: tightly integrated, high-performance visualization capabilities and scalable high-performance computing within a single system. The CRAY Origin2000 system can support up to eight Silicon Graphics world-renowned InfiniteReality® visualization subsystems, providing a truly unique supercomputing capability not available from other vendors.

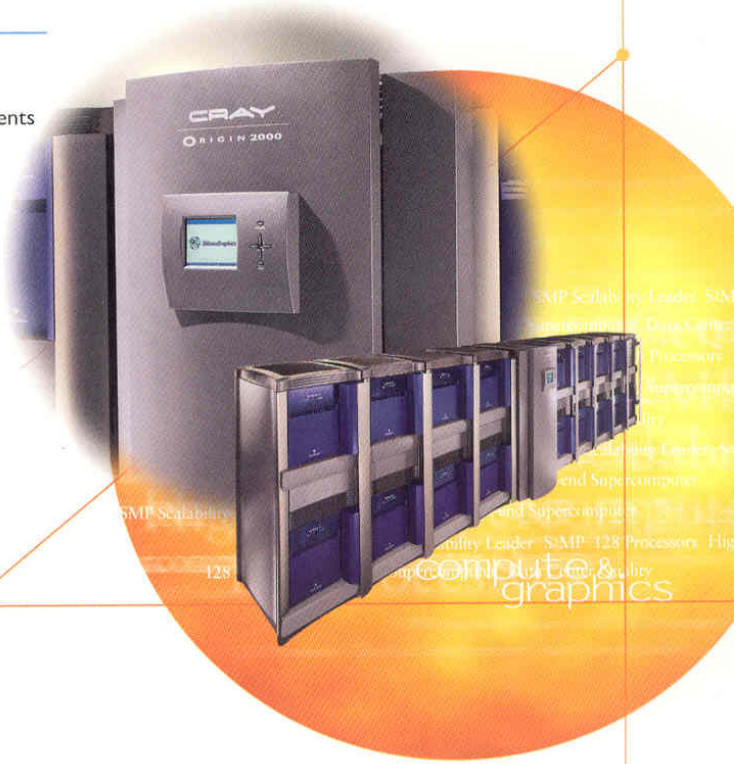
Highlights:

- The industry's highest scaling CC-NUMA system
- The high-end supercomputing product in the Silicon Graphics Origin line of systems
- Tightly integrated graphics allow faster solutions to mission-critical problems through large, complex visual simulation and multidimensional data
- A range of advanced interface technologies support immersive visual supercomputing environments
- Revolutionary XIO channel provides speed and scalability for the most demanding I/O bandwidth needs
- Incorporation of Cray computer-class hardware including CrayLink interconnect technology and the MetaRouter allows the system to scale beyond 64 processors
- Key supercomputing software from UNICOS supported on IRIX includes network queuing environment (NQE), data migration facility (DMF), tape management facility (TMF), and the new supercomputing API
- Systems undergo rigorous quality assurance testing to ensure that these large SMP configurations meet demands of high-end supercomputing customers

n2000 Series

	CRAY Origin2000
No. of CPUs	33–128
Processor MHz	195*
Peak performance	50 GFLOPS*
Memory size per processor	128MB–2GB
Architecture	CC-NUMA
Bisection bandwidth	20GB/sec
XIO cards	44
Peak I/O bandwidth	80GB/sec
Cooling technology	Air

*Future field-upgradable performance enhancements planned every 6-9 months



CRAY T3E-

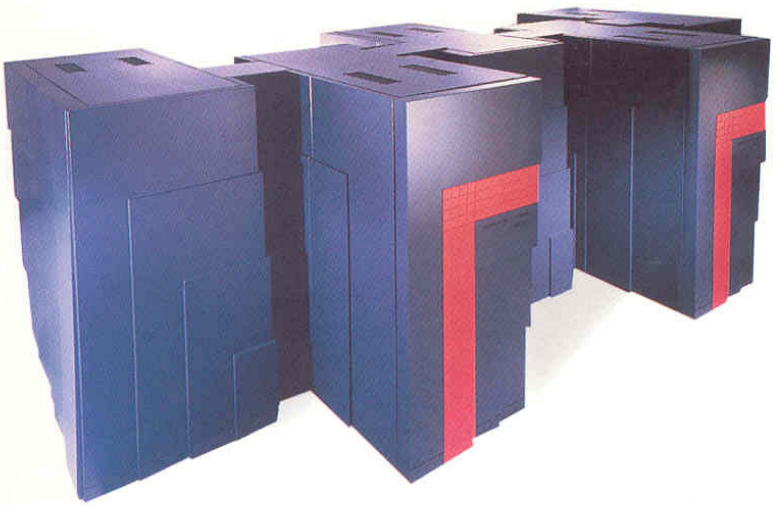
The CRAY T3E-1200E Series, the most powerful product line Silicon Graphics offers, efficiently scales performance and price/performance from tens to thousands of processors and up to 2.4 trillion calculations per second (teraflops). The CRAY T3E-1200E distributed-memory parallel processing system follows the successful CRAY T3E™ system with twice the performance and four times the memory. Breakthrough technologies establish the CRAY T3E-1200E as the world's first globally scalable supercomputer series—every element of the system (OS, I/O, memory, bandwidth) efficiently scales upward with the number of processors. The CRAY T3E-1200E system demonstrates superb performance for highly parallelized applications, such as 3D oil exploration and weather simulation. Customers include Department of Defense Naval Oceanographic Office, Electronic Data Systems (EDS), Exxon, German Research Center Forschungszentrum Juelich (KFA), Mobil Oil Company's Exploration and Producing Technical Center, NASA's Goddard Space Flight Center, National Energy Research Scientific Computing Center, National Oceanographic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory, System Engineering Research Institute in Korea, United Kingdom Meteorological Office, and the U.S. Army High-Performance Computing Center.

Highlights:

- The industry-leading highly scalable supercomputer
- Offered in configurations from 6 to 2,048 processors, provides flexibility for customer acquisitions
- Global scalability allows customers to buy what they need
- More than 2.4TFLOPS peak performance, offers the greatest amount of power for parallel applications
- Supports large parallel workloads with up to 4TB central memory
- Industry-leading bisection bandwidth in excess of 122GB per second speeds overall performance on applications
- I/O bandwidth of up to 128GB per second delivers solutions fast
- Easily installed in standard computer facility

1200E Series

	CRAY T3E-1200E
NO. OF CPUS AIR-COOLED LIQUID-COOLED	 6–128 32–2048
PROCESSOR MHz	600
PEAK PERFORMANCE	More than 2.4TFLOPS
MEMORY SIZE PER PROCESSOR	256MB–2GB
INTERCONNECT TOPOLOGY	3D bidirectional Torus
MAX. BISECTION BANDWIDTH	122GB/sec
MAX. NO. OF GIGARING CHANNELS	128
PEAK I/O BANDWIDTH	128GB/sec



Performance Throughput Productivity

These are the benefits high-performance computing can bring to your organization. But delivering these benefits and keeping your valued computer resource operating at peak efficiency requires more than fast processors. Cray supercomputers are well-known for their balanced system designs that match fast processors with industry-leading input/output (I/O) and networking technology. Silicon Graphics knows that getting data into the computer system and kicking solutions out is the key to your organization's overall productivity. That's why Silicon Graphics developed the GigaRing I/O channel to support all of the Cray high-end supercomputing systems. The GigaRing channel helps Cray systems to be the highest performing in the industry. Another benefit to GigaRing technology is its scalability, allowing customers to buy only what they need when they need it. The GigaRing channel supports a wide variety of peripheral devices, including high-performance disks, tape devices and automated tape robot systems, and industry-standard networking protocols, including HIPPI, FDDI, Ethernet™, and ATM.

"...Cray systems have played a significant role in improving quality, reducing costs, and shortening development time in Nissan's car development processes since 1986...We place a high value on Cray's long-term leadership in the worldwide HPC marketplace and its close relationship with a wide variety of software and engineering companies..."

Joji Masuda, General Manager, Engineering Systems Department
Business Process Innovation Division
Nissan Motor Co., Ltd.

"The (Cray) systems have proven that they can take on the challenge of our biggest, most complex problems."

Dr. Bruce Ross, Assistant Director
National Oceanic and Atmospheric Administration
Geophysical Fluid Dynamics Laboratory (GFDL)

"Using our Cray parallel-vector system to shorten development time allows us to bring new products and vehicles to market more quickly...reducing the number of prototypes we have to build and saving materials in one-step tooling translates to substantial cost savings."

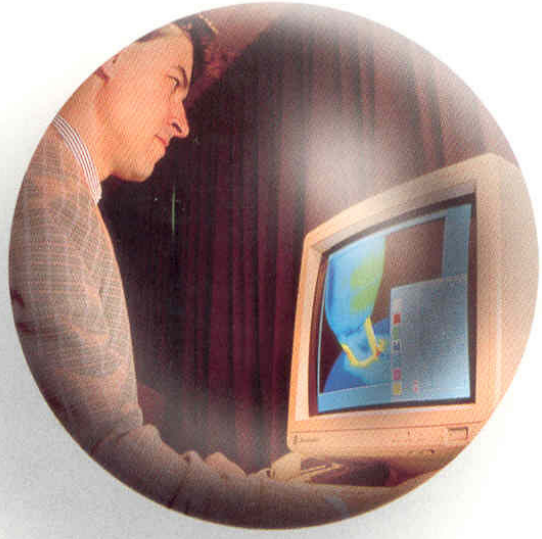
Messaoud Youcef-Ouali, Manager
Scientific Computing Strategy
PSA Peugeot Citroën

"The Cray system is used...in analyzing new vehicle platforms to meet corporate and customer requirements. This work would be next to impossible without the Cray (system)."

Ron Bienkowski, Executive Engineer
Technical Computing Center
Chrysler Corporation

"Cray (Silicon Graphics) has made the paradigm shift from pure research to providing what industry needs. They understand what it takes to provide real-world solutions and have taken business risks to help make Dow more competitive."

Randy Collard, Director, Core R&D Computing
Modeling and Information Sciences
The Dow Chemical Company



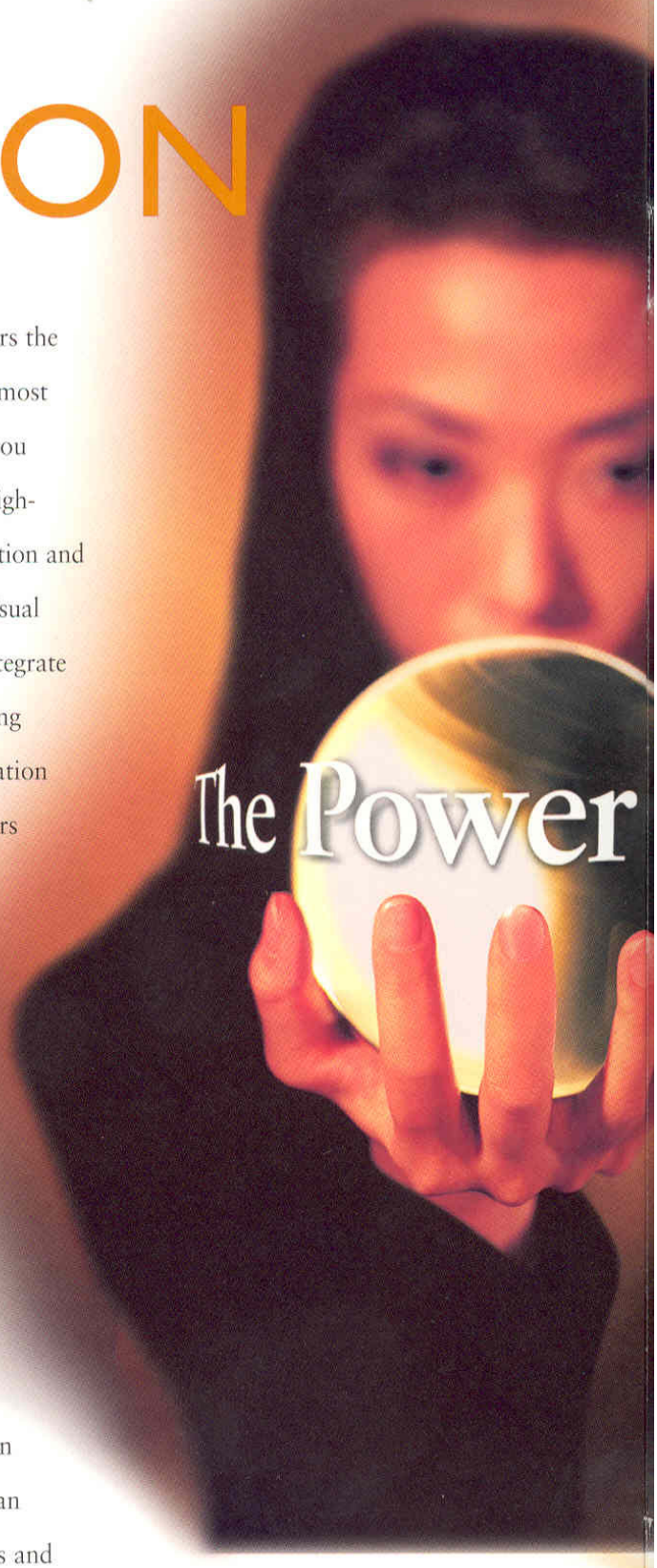
"The vector architecture has always provided speed, but its lack of scalability has limited it. The Cray scalable vector product line eliminates that concern for me."

Dr. Joseph Villafranca, Vice President
Macromolecular Structure
Bristol-Myers Squibb

OUR VISION

The Power To See is a new way of supercomputing that gives customers the ability to see new answers to their most challenging problems. Brought to you by Silicon Graphics, the leader in high-performance visualization, computation and high-end data management, these visual supercomputing solutions tightly integrate industry-leading capabilities, bringing forward powerful immersive simulation environments and tools that let users bring their simulations to new life. Users will actually *live* in their design or experiment data, letting them experience a new dimension in their problem solving and a new perception in their work—leading to better products, processes, discoveries, and insight.

With leading capabilities, simulation will become even more valuable than physical testing and more industries and



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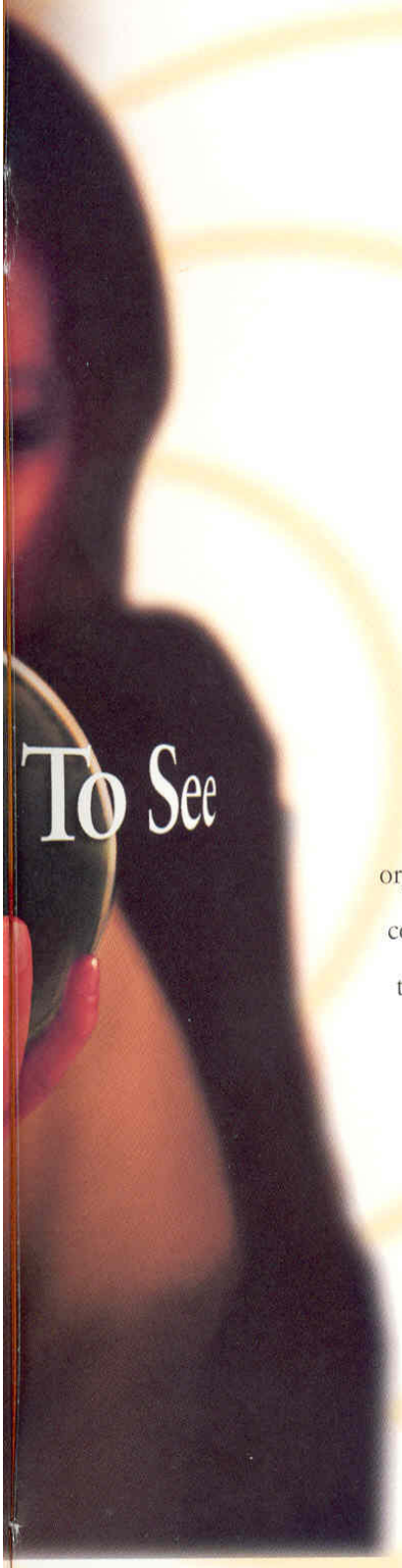

"I BELIEVE A NEW KIND OF COMPUTER IS GOING TO BE BORN OUT OF SILICON GRAPHICS—A SYSTEM THAT IS CAPABLE OF HIGH-SPEED COMPUTATION AND HIGH-SPEED GRAPHICS ALL IN ONE MACHINE...WE ARE NOW TRANSITIONING TO A TFLOPS—1,000 TIMES A GIGAFLOPS—AND USERS WILL WANT TO VISUALIZE WHILE COMPUTING. NO OTHER COMPANY WILL BE able TO MEET THIS NEED AS EFFECTIVELY AS SILICON GRAPHICS."

Larry Smarr, Director
National Center for
Supercomputing Applications

To See

organizations will come to know and use this predictive tool as a key component in what they do—from design, manufacturing, and durability testing to general scientific discovery.

The compute element is so powerful, the graphics interface so intuitive, the data management capability so effortless and seamless that even non-expert supercomputer users will apply this technology to their work. We believe this will revolutionize the world of supercomputing and touch more lives in the process. From better car safety to improved weather forecasts, Silicon Graphics solutions continue to impact the world.

DATA BIG COMPUTE

Silicon Graphics, Inc. is a leading supplier of visual computing and high-performance systems. The company offers the broadest range of products in the industry — from low-end desktop workstations to servers and high-end supercomputers. Key industries include communications, energy, entertainment, government, manufacturing and sciences. Silicon Graphics and its subsidiaries have offices throughout the world and corporate headquarters in Mountain View, California.

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