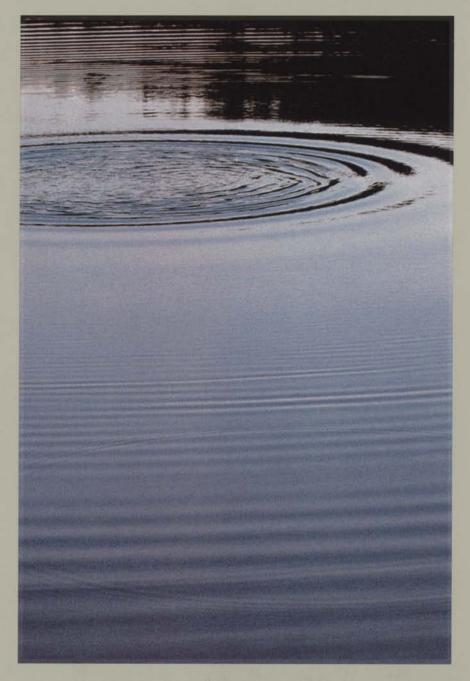
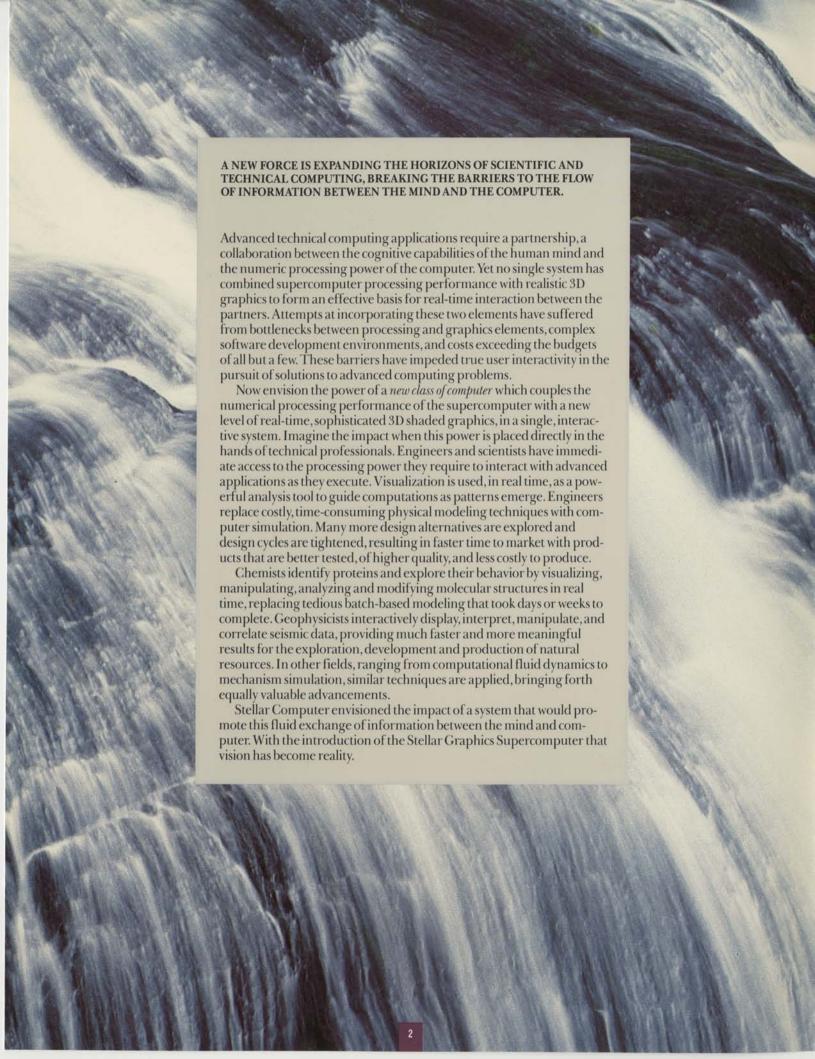
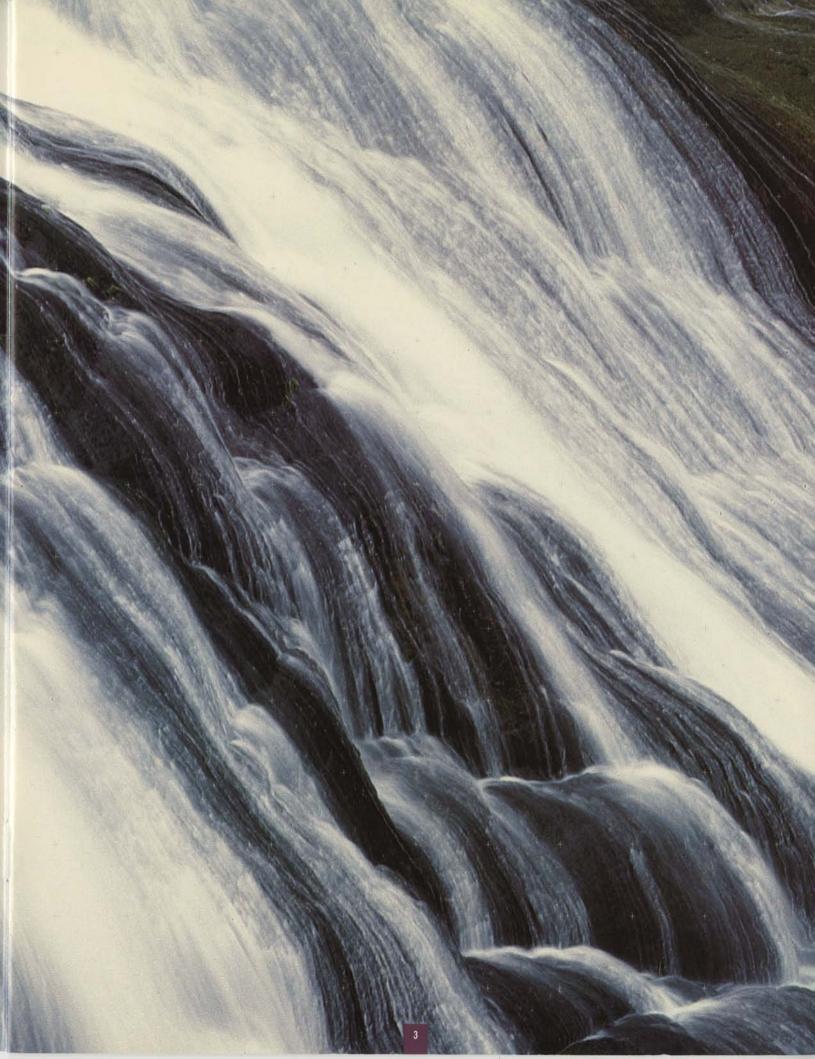
# Stellar



THE STELLAR" GRAPHICS SUPERCOMPUTER BRINGING NEW VISION TO TECHNICAL COMPUTING





The Stellar Graphics Supercomputer – High-Performance Graphical and Computational Supercomputing in an Interactive Environment. The Stellar Graphics Supercomputer was designed to give you direct insight into advanced computing problems in a way that no other system can. It bridges the gaps between today's most advanced graphics workstations and minisupercomputers, providing a new class of computer that melds the latest trends in both of these technologies to cost-effectively meet the interactive visualization needs of scientists and engineers.

The Stellar Graphics Supercomputer is a system that tightly integrates supercomputer computational performance, advanced real-time 3D graphics capabilities, and high-performance networking in an interactive, multi-window system environment. It gives engineers and scientists the ability to generate three-dimensional models of complex objects, and lets them observe, analyze, interact with, and manipulate those models, even as the computer is processing them. This enables the user to visualize the results of extensive computational calculations and quickly assimilate and comprehend complex information.

The Stellar Graphics Supercomputer goes far beyond the capabilities of today's workstations in computational and graphics performance, while retaining all of the autonomy, availability, ease-of-use and networking benefits that engineers, scientists, and designers have come to expect. Moreover, Stellar has provided this capability at a price comparable to high-end workstations, making interactive graphics supercomputing not only practical, but very cost-effective.

A System Architecture Custom-Designed for Graphics Supercomputing. Every aspect of the Stellar Graphics Supercomputer is designed to bring the power of graphics supercomputing to demanding applications, beginning with its innovative machine architecture. Stellar has taken advantage of the most recent advances in hardware technology, using custom-designed, highdensity Application Specific Integrated Circuits (ASICS) to build a new, highly-integrated, computer architecture tailored to the performance and cost require-

ments of interactive graphics supercomputing.

This unique architecture was designed with two primary objectives in mind: eliminating the system bottlenecks which prohibit interactive user involvement in complex problemsolving, and exploiting the commonalities between the requirements for supercomputing and high-performance graphics. The Stellar Graphics Supercomputer's performance is derived from multiple parallel functional units coupled with a central high-bandwidth DataPath <sup>™</sup> facility. The DataPath enables transfers between all functional units – including supercomputer-size main and cache memories, a multi-stream processor (MSP), an integral vector floating-point processor (VFP), and a dedicated graphics renderer (RP) – at speeds up to 1.28 gigabytes per second. This high-bandwidth, multi-stream approach makes possible the tight integration of all the elements critical to high-performance computation and visualiza-

tion in an economical, compact, desk-side system.

The power of the hardware architecture is delivered to applications through a UNIX®-based software environment designed to allow the user to fully exploit the computational and 3D graphics capabilities of the system. It includes superior vectorizing, parallelizing and optimizing compilers supporting both fine- and coarse-grained concurrency, transparent support for concurrency management, and leading-edge graphics interface tools. Equally important, the architecture of the Stellar software environment is built upon innovative, high-performance implementations of industry standards in operating systems, programming languages, graphics, interactive user interfaces, and networking protocols. And, the Stellar Graphics Supercomputer has been tailored to provide outstanding performance for workgroup computing in both homogeneous and multi-vendor environments.

Applications. The Stellar Graphics Supercomputer delivers exceptional levels of computational performance. The integer performance, and the scalar and vector floating-point performance of the Stellar Graphics Supercomputer are equivalent to that of far more costly minisupercomputers. The system can execute in excess of 20 million instructions per second and up to 40 million double-precision floating-point operations per second. And the unique architecture of the Stellar Graphics Supercomputer allows it to deliver a greater percentage of this peak power directly to the application.

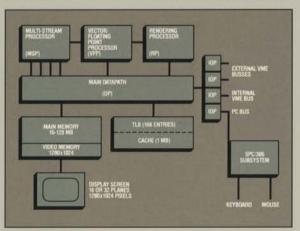
Stellar's multi-stream architecture provides four pipelined instruction execution streams. This feature, unique to the

Stellar Graphics Supercomputer, is known as the Synchronous-Pipeline Multi-Processor (SPMP) architecture. A uniform instruction set allows each stream to process all machine instructions including integer, scalar and vector floating point, graphics, concurrency control and I/O.

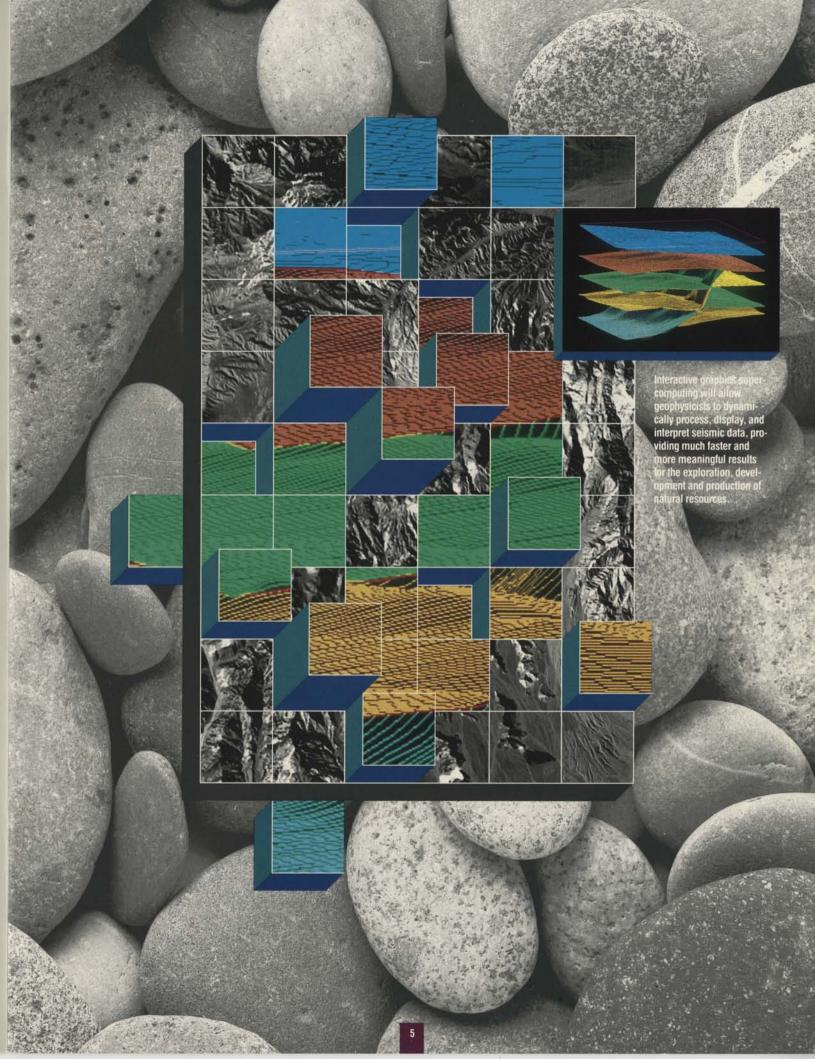
The SPMP architecture provides highly efficient concurrency mechanisms which allow for the synchronization of the streams at any level of granularity. To optimize the performance of a single large application, the Stellar Graphics Supercomputer can act

as a tightly coupled parallel processor with stream synchronization on an instruction-by-instruction basis. When a mix of applications or processes is required, the system can act as a loosely coupled multiprocessor, optimizing system utilization without changes to hardware or system software. In fact, when multiple applications running concurrently have varying requirements, the system automatically adapts to synchronization requirements and dynamically balances system resources for maximum efficiency. In addition, the Stellar Graphics Supercomputer takes advantage of opportunities for parallelism at all levels in both hardware and software. In compilers, operating systems, application environments, and user interfaces, parallel techniques have been utilized to allow both programmers and end-users to receive the maximum benefit of the Stellar Graphics Supercomputer.

Stellar's SPMP architecture brings unique benefits to



The Stellar Graphics Supercomputer is based on an innovative machine architecture known as Synchronous-Pipeline Multi-Processor (SPMP).





applications. The balanced use of instruction streams and other system resources optimizes throughput, allows a greater percentage of peak performance to be applied directly to the application, dramatically reduces application runtimes, and provides a highly productive environment for both application development and use.

Integrated Vector Processing Brings Supercomputer Power to the Individual Technical Professional. In addition to the multi-stream processing (MSP) unit, Stellar has implemented a special purpose functional unit, the vector floating-point processor (VFP), for scalar and vector floating-point computations. This integrated vector processor, with a full vector instruction

set including chained operations, provides capabilities typically found only in larger, more expensive supercomputers. The vector floating-point processor executes floating-point instructions in-line and in parallel with all other machine instructions, and provides six 32-element doubleprecision vector registers per stream. Register loads and stores occur at speeds of up to 1.28 gigabytes per second.

For applications with demanding graphics requirements, the VFP provides superior performance for geometric matrix-vector transforms and other

matrix operations. The system's instruction set includes graphics instructions, allowing the VFP to perform fast object manipulation and coordinate transformation in preparation for object rendering. The VFP is also fully available for performing general-purpose floating-point computations, eliminating the need for expensive, special-purpose graphics and transformation hardware. When an application mix has both graphic transformation and general-purpose floating-point needs, the VFP simultaneously addresses both requirements, automatically balancing the load for maximum responsiveness

Exceptional Graphics Capabilities Bring New Vision to Advanced Computations. Stellar's graphics capabilities are equally as powerful and are fully integrated with the exceptional computational performance. Because Stellar's unique architecture eliminates the slow link between the device computing the image and the device displaying it, it can provide graphical rendering faster than systems costing considerably more. Specifically, the Stellar Graphics Supercomputer can render 100-pixel Gouraud-shaded, hidden-surface removed, pseudo-colored triangles at up to 150,000 per second, and can transform and display 600,000 3D vectors per second.

The Stellar Graphics Supercomputer's Rendering Processor (RP) is dedicated to the job of generating geometric primitives, and to the high-performance rendering of complex shaded images. It is a special-purpose single-instruction, multiple-data (SIMD) engine which can render up to 80 million pixels per second. Graphics instructions are automatically channeled from the MSP to the VFP and then to the RP for execution. Since the RP has been specifically designed for computations involving complex, shaded solid images, it provides unmatched performance for operations such as lighting, Gouraud and Phong shading, depth-cueing, and stereo viewing. The Rendering Processor also performs anti-aliasing, providing exceptionally high image quality. And these advanced capabilities are all available under programmer direction, which allows the user to make many choices and trade-offs

between image quality and computation time.

Another technical innovation unique to the Stellar Graphics Supercomputer is the use of the Virtual Pixel Maps™ rendering technique, permitting flexible, high-performance viewing and windowing operations. Rather than render images into the dedicated frame buffer, the Stellar Graphics Supercomputer renders them instead as pixel maps into virtual memory. Virtual Pixel Maps allow for an arbitrary number of bits per pixel for image processing, and facilitate new, innovative rendering techniques. They significantly increase the user's flexibility in manipulating screen displays and generating images and allow the Stellar Graphics Supercomputer to

support Z-buffering without the cost of extra, special-purpose hardware.

Virtual pixel maps may be of almost any resolution or dimension, irrespective of the size of the physical frame buffer or the window which will ultimately display the image. Visible portions are transferred to the video buffer, as needed, with a very high-speed PIX BLT operation, under control of the X Window Manager. This strategy provides users with easy and highly efficient window operations such as window push/pop, resizing, panning and smooth scrolling. In addition, users

can overlay on-screen images without destroying underlying

images, and have full access to these images for additional processing and manipulation. And Stellar's multi-windowed environment gives users the flexibility to display multiple images with display mode selectable by window. For example, a user might wish to simultaneously employ double-buffering for images in some windows but not for images in others.

The Stellar Graphics Supercomputer couples highperformance geometric graphics with high-speed bit-map operations to meet the requirements of the broad range of applications which require a combination of graphical modeling and image processing. And Stellar's rich set of rendering capabilities allows the interactive rendering of objects with much higher quality and at speeds much faster than is possible using other systems in its price range.

**Outstanding System Throughput Maximizes Computation** and Graphics Capabilities. At the heart of the Stellar Graphics Supercomputer's architecture is the DataPath facility. This provides exceptional internal bandwidths between the functional units and makes possible the tight coupling between computational and graphical capabilities. The DataPath eliminates the bus-oriented bottlenecks which exist even in highperformance computers today. For example, the Stellar Graphics Supercomputer can transfer data to and from cache memory at 1.28 gigabytes per second. Memory bandwidth for graphical operations is in excess of 400 megabytes per second. And the movement of computational data to and from main memory can occur at 320 megabytes per second. There is no system bus to contend for as the system's DataPath acts as a very wide, fast switch and multiplexor/demultiplexor between the main and cache memories and the instruction streams. The DataPath also manages DMA I/O from the Stellar Graphics Supercomputer's four I/O channels, each of which has a sustained capacity of 16 megabytes per second.

The I/O features of the Stellar Graphics Supercomputer are comparable to those found in minisupercomputers, and are

The integration of advanced computation with

3D graphics will provide mathematicians with the

capability to generate and animate detailed images in

three- and four-space in the investigation of the geometry of surfaces.

matched to large application requirements. Stellar provides a minimum main memory of 16 megabytes, expandable to 128 megabytes, a one-megabyte cache memory, and a 16K-entry TLB. The Stellar Graphics Supercomputer supports multiple, high-performance disk drives in a variety of sizes and capacities, with more than three gigabytes of disk storage configurable in the main system cabinet alone. The system also supports disk striping, another technique typically found only in far more expensive systems, in which individual files may be interleaved across multiple physical disk drives. This allows simultaneous read/write operations and provides completely overlapped I/O for an effective multiplication of the file transfer speed. The system's internal VME bus provides four useraccessible industry standard slots. Also provided is support for two additional external VME busses to allow significant I/O expansion capabilities tailorable to individual user and application requirements.

In all categories – processing power, graphics capabilities, I/O capacity, and system throughput – the Stellar Graphics Supercomputer meets the demanding requirements for both advanced computation and the dynamic manipulation of

detailed 3D models.

Maximum Reliability, Availability and Maintainability
Designed In. Demanding, complex, compute-intensive applications naturally require a system that provides for both high

functionality and high uptime.

Because the core hardware of the Stellar Graphics Supercomputer consists of 61 ASIC components designed by and manufactured to Stellar's specifications, Stellar can control the quality of its products at the component level. Employing fewer components also reduces the number and types of cables and connectors needed, reducing difficult-to-isolate connection problems. To further ensure system reliability and maintainability, Stellar has implemented Scan Path Diagnostics for its entire system. This allows Stellar to verify the full func-

tionality of each ASIC in a running system in a fraction of the time required by traditional software diagnostics. Further, Stellar's scan path diagnostics provide coverage of all board level and system level interconnects, assuring unsurpassed levels of detection of system interconnection problems. The system's Remote Diagnostic capability allows Stellar to provide remote "hands-on" expertise, determine the cause of a hardware malfunction in just minutes, and have the correct replacement part available and on its way for installation in the shortest possible time.

An Open Architecture, A Standard Operating Environment, and Powerful Software Tools Bring Graphics Supercomputing to a Wide Range of Applications. The Stellar Graphics Supercomputer provides a standard environment for applications and fits easily into existing system networks. Stellar has ensured complete integration with current user environments by creating an open-systems architecture and strictly adhering to industry standards in operating systems, languages, graphics and user interfaces, and networking protocols. But Stellar has gone much further, taking advantage of the unique capabilities of the Stellar Graphics Supercomputer, to deliver the highest-performance implementation of standards in all categories. Further, Stellar has provided a comprehensive set of

tools to allow users to exploit the vector/parallel machine architecture and utilize the Stellar Graphics Supercomputer in optimizing the performance of current applications and developing their next generation of applications software.

Stellar's programming languages, Fortran-77 with VAX® extensions, and System V.3 C, are provided as optimizing compilers which allow existing programs to take advantage of the high performance of the system without application recoding. These compilers incorporate proven, highly advanced vectorizing and parallelizing compiler technology not previously found outside the supercomputer product class. While they conform to standards from the programmer's perspective, the compilers inherently recognize opportunities for vectorization and parallelism in applications. Programs are automatically decomposed into fine-grained units of work called "threads," which can be executed in parallel on different streams.

The Stellar Graphics Supercomputer's compilers go well beyond the local parallelism detection of most compilers today, implementing a proprietary traversal method which allows for the evaluation of code on a more global scale. This global detection/global optimization technique allows these compilers to detect opportunities for parallelism not only in loops, but also in linear code segments. Since a great deal of code does not include loops, numerous parallel opportunities are detected by the Stellar Graphics Supercomputer which would go undetected by other systems. In some cases, the programmer can augment these automatic facilities with directives to the compilers which further increase application performance. With Stellar's compiler technology, programs are automatically fully optimized, and matched to the benefits of the system's architecture, providing both exceptional performance for today's applications and the tools to enable the development of new classes of future applications.

Stellar's Stellix™ operating system, based on UNIX System V Release 3.1 with Berkeley extensions, provides a multiprogram-

ming, multi-tasking environment which exploits the concurrent facilities of the hardware. Stellix is also responsible for the efficient management of fine-grained concurrency at the thread level, which provides minimum time-to-solution for a single application. The Stellix operating system's kernel and other critical system components are *multithreaded* for maximum throughput. A UNIX-based, interactive multi-stream profiler and debugger for optimizing application performance and rapid software development are included. Also provided with Stellix is

Coupling high-quality 3D graphics visualization with computational chemistry allows chemists to better understand the space filling nature of the molecules under study, as in evaluating the fit of the inhibitor into the enzyme active site as shown above.

the popular EMACS screen editor.

The Stellar Graphics Supercomputer includes a SPC/386 ™ processor to also provide an integrated 80386-based PC and fully compatible "MS-DOS® in a window" capabilities. The SPC/386 also acts as a Service Processor for the system, managing system initialization, diagnostics, and error control.

The Stellar Graphics Supercomputer supports the X Window System,™ Version 11, which allows for multiple, overlapping windows and network-transparent computing, and has augmented its capabilities with a 3D graphics library (XFDI), and unique user-interface facilities. Stellar also supports the Programmer's Hierarchical Interactive Graphics System (PHIGS), an emerging standard for real-time 3D interactive



graphics. And Stellar has taken a leading role, in conjunction with other vendors and users in the computer graphics community, to define PHIGS + , a set of extensions to PHIGS which takes advantage of the sophisticated lighting, shading, depthcueing and advanced geometry features of Stellar's graphics architecture. In fact, Stellar's comprehensive implementation of PHIGS + , tightly integrated with the X Window system, is one of the first available in the industry.

To further underscore Stellar's commitment to an open systems architecture, the Stellar Graphics Supercomputer offers a variety of expansion and configuration alternatives and includes both standard VME and AT busses to easily attach a

wide range of popular peripherals.

High-Performance Networking Brings Compatibility in Multi-Vendor Environments. The networking capabilities of the Stellar Graphics Supercomputer make it ideal for workgroup computing, whether communicating with other systems of its kind, or with other workstations or high-performance systems in a heterogeneous environment. Stellar supports Ethernet,™ TCP/IP, and the Network File System (NFS)™ to provide transparent access to the most popular networking resources in technical computing environments. As with operating systems and languages, Stellar's networking implementations are designed to take advantage of the system's

multi-stream architecture, and to eliminate bottlenecks that typically exist in networking protocols. Stellar provides numerous performance enhancements to network services to make it easy to access information from, and communicate with, systems in multivendor environments.

The Stellar Graphics Supercomputer also includes unique enhancements to provide an ideal environment for workgroup computing in Stellar-Stellar networks. Stellar's Global Name Space facility, an extension to NFS, allows unmatched ease of network configuration, growth and management for homogeneous communication. It also allows other vendors' computers to function as servers integrated into the work-group in the heterogeneous environment.

The Stellar Graphics Supercomputer couples the power of the supercomputer with a new level of sophisticated 3D shaded graphics, in a single, interactive system.

For higher-speed networking requirements, Stellar will support existing optical networks and FDDI-conforming networks as they become available. Stellar also plans to support crossindustry ISO/OSI protocols, and has joined the Network Computing Forum, an association of both manufacturers and users, in order to actively participate in the continuing expansion of the power and facilities of networks.

The Stellar Graphics Supercomputer – Expanding the Vision of Advanced Computing Applications. The benefits of using the Stellar Graphics Supercomputer apply to a broad range of application areas. For the first time, users will be able to apply their innate cognitive skills to a new class of advanced computing problems in areas such as computer-aided design, computer-aided chemistry, general scientific research, image

processing, and geophysics. Never before has a wide range of users had the ability to observe, analyze, interact with and manipulate three-dimensional models of complex objects at the same time the computer is processing and modifying those models. The ability to visualize the results of complex computations and simulations provokes new insights by allowing engineers and scientists to interpret what is happening during the computational process. It allows users the opportunity to steer the results of calculations in real time and to see the effects of changing parameters, resolution or representation. Such capabilities can provide the freedom for greatly expanding conceptual design alternatives, while significantly tightening final design cycles, in a range of engineering and scientific disciplines.

The Stellar Graphics Supercomputer brings significantly improved design capabilities to areas which require true interactive 3D solid modeling and realistic visualization and animation techniques. It offers greatly extended analysis capabilities, making it possible, for example, to integrate finite element analysis with conceptual design, or to utilize more sophisticated analytical techniques, such as computational fluid dynamics. It provides interactive control of the simulation in order to gain a full understanding of the model's dynamic behavior. Such capabilities reduce, and in some cases eliminate

altogether, costly, timeconsuming and often inflexible physical model-building and prototyping. In addition, the Stellar Graphics Supercomputer makes possible advances in areas like Computer Aided Molecular Design, as scientists will be able to interactively study phenomena, such as molecular dynamics, that are very difficult to observe experimentally.

The Stellar Graphics Supercomputer gives scientists and engineers a competitive edge by providing them with outstanding price/performance, substantial productivity gains, and valuable insight into complex problems.

Areas of application for the Stellar Graphics Supercomputer cover a wide range. Primary markets and related applications include:

Computer-Aided Design and Engineering

Solid Modeling Applications Finite Element Modeling & Analysis Computational Fluid Dynamics Simulation

Computer Aided Chemistry Molecular Modeling Molecular Mechanics and Dynamics, AB Initio Studies Crystallography

Scientific Research and Development High Energy Physics Astronomy and Astrophysics Materials Science Animation & Visual Simulation
Television and Film Production
Advertising and Graphic Arts
Industrial Video Production
Visualization in Scientific Computing

Image Processing Medical Diagnostic Imaging 3D Image Reconstruction Remote Sensing

Geophysical Modeling, Simulation and Analysis Mapping & Contouring Seismic Processing and Interpretation Reservoir Modeling Climatology & Environmental Studies A Wide Range of Industry Applications Available. The Stellar Graphics Supercomputer brings unique capabilities to significantly extend the performance and interactivity of third-party software in these advanced application areas. Stellar is not only providing a system with a compelling motivation for the porting of these applications, but is also actively assisting leading third-party developers in optimizing their applications for the Stellar Graphics Supercomputer. Stellar offers a range of marketing and technical assistance programs designed to ensure the availability of a wide array of applications software, and to actively encourage the development of the next generation of graphics supercomputing applications.

Stellar Computer – A Company Dedicated to Graphics Supercomputing. The Stellar Graphics Supercomputer was created by Stellar Computer Inc., a company that was formed for the sole purpose of developing this entirely new class of computer. Stellar's management is a team of the most accomplished and respected leaders in the computer industry. They are supported by an outstanding group of technical professionals with reputations for carving out new trends in technology. Among Stellar's ranks are individuals involved in the development of the first virtual-memory minicomputer, the first widely distributed engineering workstation, and now the first graphics supercomputer.

All of these people share a unique vision of graphics supercomputing as a vehicle to address the demanding technical computing needs of scientists and engineers. States John William Poduska, Sr., founder, Chairman and CEO, "The company and its vision are inextricably bound. Stellar was formed because no other company was providing adequate solutions for advanced computational and graphical problems, although the technology to do it was beginning to emerge. So we gathered some of the best people in the industry, who shared a common vision of what would become the graphics supercomputer. Stellar took this vision and made it a reality." The Stellar Commitment. As the creator of graphics supercomputing, Stellar Computer is committed to pursuing new areas of technology in order to develop competitive, state-ofthe-art products for our customers. As a prospective customer, you can be certain that Stellar will provide both the products and the assistance to allow you to capitalize on the capabilities offered by this powerful new computing technique.

As a company, Stellar has the talent, the tools and the technology to ensure its customers the regular development of new products and capabilities. Stellar's architecture is designed for high performance, economy, and product evolution, and ensures a compatible family of industry-leading price/performance products to meet your requirements today, and as they change, in the future.

Our commitment to innovative technology goes hand in hand with our dedication to excellence, and the highest levels of customer satisfaction. We invite you to share our vision by bringing the power of the Stellar Graphics Supercomputer to your applications.

For more information, contact Stellar Computer Inc., 85 Wells Avenue, Newton, MA 02159, (617) 964-1000.

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Guide to Images: Page 5 — Landsat image courtesy of NASA. Seismic image courtesy of Sierra Geophysics, Inc. Page 6 — Turbine inlet scroll pressure contours analysis by FLOTRAN," a product of PATRAN. Image courtesy of Compuflo Inc. Page 7 — Animated sequences of stereographic projections of the Sphere and Hypersphere as they are being rotated in three- and four-space respectively. Images courtesy of D. Laidlaw and H. Kocak. Page 8 — Docking of the benzamide inhibitor to the active site of beta trypsin. Image courtesy of Polygen Corporation. Page 9 — Human skin magnification 600X. Computer enhanced image of human heart/lung system by Howard Sochurek. Guanidinium transport through a gramicidin channel. Image courtesy of Rashid Ahmad, Brown University. Page 10 — (screen image) Binding of methotrexate, colored in pink, to the DNA double helix. Image courtesy of Polygen Corporation.

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## Stellar

#### Stellar Graphics Supercomputer Model GS1000

The Stellar Graphics
Supercomputer
couples the power
of the supercomputer
with a new level of
sophisticated 3D
shaded graphics in
a single, interactive
system.

Designed for demanding scientific and technical applications, the Stellar™ Graphics Supercomputer Model GS1000™ couples the power and architecture of the supercomputer with a level of graphics performance far exceeding that of workstations and terminals. The GS1000 defines a new class of computing in both capability and price/performance for applications such as CAD/CAM/CAE, molecular modeling, computational fluid dynamics, computer animation, image processing, scientific visualization, and geophysical simulation and analysis.



The Stellar Graphics Supercomputer Model GS1000 is designed to permit a new partnership between user and machine, one in which human cognitive, intuitive, and visual skills can be closely integrated with the number-crunching power of the computer.

This cooperation is made possible by computational and graphical performance which allows the user to be "in the loop," directing the complex simulation and analysis as it happens.

#### **Processor Hardware**

The Stellar Graphics Supercomputer Model GS1000 is based on an innovative machine architecture known as Synchronous-Pipeline Multi-Processor (SPMP™). Using application-specific integrated circuits (ASICs), Stellar has designed and implemented a machine architecture which allows a single program to be run with optimal parallelism, irrespective of the level of granularity required. The Stellar Graphics Supercomputer Model GS1000 is equally at home with fine-grained parallel processing as it is with more traditional multitasking and multi-programming.

Stellar's DataPath™ concept enhances performance by allowing the individual parallel functional units to intercommunicate via wide, fast, dedicated pathways, rather than via sharing a common bus. This eliminates performance bottlenecks, and provides multiple, parallel data transfers at rates as high as

1.28 gigabytes per second. All machine instructions, including integer and general-purpose, scalar and vector floating-point, graphics, and concurrency, are executed by the Multi-Stream Processor (MSP) Unit, which includes four tightlycoupled processor "streams". Each stream has its own large register file as well as dynamically-shared concurrency registers to allow inter-stream communication. Stellar provides an integral Vector/Floating-Point (VFP) functional unit, as well as dedicated vector registers for each stream. All functional units share a single one-megabyte cache memory, and up to 128 megabytes of main memory.

The power of the
Stellar Graphics
Supercomputer
hardware is delivered to applications
through a UNIX®based software environment designed
to allow the user
to fully exploit the
computational and
3D graphics capabilities of the system.

#### Graphics Hardware and Software

Stellar's integral Rendering Processor (RP) is a sophisticated single-instruction multipledata (SIMD) parallel processor dedicated to rendering lines and solid objects with outstanding speed. In conjunction with the system's other functional units, the Rendering Processor can transform and display 600,000 3D short vectors per second, and can transform and render a remarkable 150,000 Gouraud-shaded triangular tiles per second. This power is made available to applications via Stellar's extensions to the X Window System™ (version 11), and through a highperformance implementation of the PHIGS + graphics library. A further innovation, Virtual Pixel Maps,™ allows images to be rendered into virtual memory, rather than directly into the frame buffer. This results in higher-performance windowing operations, and greater flexibility for rendering images of arbitrary resolution.

#### The Stellix™ Operating System

Based on AT&T UNIX® System V release 3, the Stellix operating system also contains numerous Berkeley extensions, including sockets and network utilities. Stellix, like other GS1000 system software, began with the standard and has been optimized to take advantage of the multiprocessor environment presented by the hardware. Stellar has added further performance enhancements, including a lightweight process construct (threads), an extent-based file system, and disk striping.

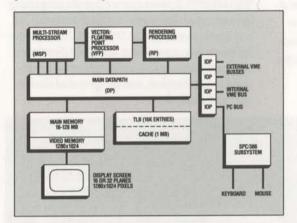
#### Networking and Distributed Processing

Stellar provides Ethernet™ and both TCP/IP and NFS™ implementations for the GS1000. Both of these key components have been optimized for performance in both Stellaronly and mixed-vendor environments. Stellar has added its own Global Name Space facility (an extension to NFS) for improved network file system usability.

#### Advanced Compiler Technology

Stellar's vectorizing/parallelizing/optimizing compilers, for Fortran-77 and C, automatically detect multiple levels of parallelism in

user source code and generate compact, multi-threaded object code matched to the architecture of the Model GS1000. Included is the detection of parallelism in both loops and sequential code, as well as code generation for both the vector unit and the parallel streams. Programmer-directed concurrency control, a multi-stream debugger, and an execution profiler are also provided.



#### Reliability, Availability, and Maintainability

A further benefit of Stellar's ASIC technology is the use of scan-path testing for all system components. Using this technique, which is designed into each custom chip and circuit board, Stellar can diagnose problems in a fraction of the time required by traditional software techniques. In addition, Stellar's Customer Support Center provides remote "hands-on" diagnostics, as well as a full range of hardware and software support services.

#### Peripherals and Configurations

The Stellar Graphics Supercomputer may be configured with 1-4 380 or 760 megabyte disks, 16-128 megabytes of main memory, 16-32 planes of frame buffer memory, 120-megabyte cartridge tape, Ethernet,™ stereo graphics capability, control dials, and broadcast video output. A keyboard and mouse are included in all configurations, as is Stellar's SPC/386™ processor, which performs system management and diagnostic functions as well as IBM®-PC emulation. Stellar's expansion unit allows additional large-capacity disk drives (up to 28 GB total) and open-reel tape drives to be connected to the system.

The Stellar Graphics
Supercomputer is
based on an innovative machine
architecture which
couples multiple
parallel functional
units with a central
high-bandwidth
DataPath facility.

### Stellar Graphics Supercomputer Model GS1000 Specifications

Functional Units		Distance from	
Multi-Stream Processor		System Unit	
Type	Stellar SPMP		(optional)
Execution Streams 4		I/O	
Registers	32 per stream, 32-bits each	Capacity	Internal I/O rate of 160 MB/
Performance	20-25 MIPS, peak	Capacity	second
Vector/Floating-Point Processor		Channels	
	IEEE-754 compatible, 32- and	Number	2 standard (internal), 2
	64-bit		optional (external)
Vector Registers	8 per stream, 64-bits each	Capacity Internal I/O Bus	16 MB/second per channel
Number		Type	VME, conforms to IEC 821 and
	32 per register, 64-bits each		
Performance	40 MFLOPS, single- or double-	Format	6U, double-height
	precision, peak	Slots	4 user-available
Vector Endpoint		External I/O Busses (requires Ex	pansion Unit)
Transformations/second 800,000		Type	VME, conforms to IEC 821
Rendering Processor		3/ Passesses	and IEEE P1014/D1.2
Type	Stellar Custom SIMD Array	Format	6U, double-height, or 9U,
Pixel Rate		rormat	triple-height
Maximum Rendered	vo minion second	Slots	
Image Dimensions	65 536 v 65 536		Table 4 Marks 5
	Up to 16, user-definable	Carial Danta	Expansion Unit
	600,000,3D,10-pixel,clipped	Serial Ports	DC 999C
		Type	
Polygons/second	150,000, Gouraud-Shaded,	Number	
	Z-buffered	Connector	DB-25
Physical Address Space	32 bits	SPC/386	
Unique Machine ID	Software-accessible	Processor Type	
V		Memory	1 MB (private), .5 MB (shared)
Memory		Expansion Slots	3 16-bit, 2 8-bit (one full-size)
Main		Other	
Capacity	16-128 MB dynamic RAM		battery-backed clock/calendar,
Transfer Rate	320 MB/second (640 MB/		speaker. IBM PC-AT compatible.
	second for block pixel	Hard Disk	
	transfers)		or 380 MB (unformatted),
Cache			shared with main processor
Capacity	1 MB static RAM	DI DIIDI (SDOSSOS II)	Participant Control of the Control o
Transfer Rate		Floppy Disk Drive (SPC/386 only)	
		Type	5.25-inch
Monitor		Capacity	1.2 MB
Format		Disk Drives	
Resolution		THE PROPERTY OF THE PARTY OF TH	
Frame Buffer	16 planes (12 color, 4 overlay),	ESDI (5.25-inch)	
	or 32 planes (24 color,		380 MB or 760 MB (unformatted)
	4 overlay, 4 mode control)		10 MHz. (380); 15 MHz. (760)
Pixel Aspect	District N. Francisco District Co. 180	Seek Time	
Ratio	I:1	Number per System	0-4 internal, 0-32 external
Refresh Rate	74 Hz. non-interlaced	SMD (8-inch; requires expansion	
Bandwidth	137 Mhz.	Capacity	600 MB or 1200 MB
	Power, brightness, contrast,		(unformatted)
	degauss	Data Transfer Rate	24 MHz.
Tilt		Seek Time	16 ms. (average)
Swivel		Number per System	
			AUANIA WA TATA PATA ATTA
Dot Pitch		Cartridge Tape Drive	
	P22 short-persistence	Type	1/4-inch OIC-190 format
		Appendiction	It I men, Qro-120 tot mac
Screen		Capacity	

Open-Reel Tape Drive	Power (system unit)
Type 10.5-inch open-reel, rack m	ount Voltage
Density	single phase
density	Frequency
Speed 125 inches per second	Current wall current not exceeding
Keyboard	12 Amps; full-configuration
	power consumption not
Layout Compatible with IBM	exceeding 2600 VA.
Enhanced, 101 or 102 keys	Power (monitor)
Distance from System	Voltage
Unit 50 feet (maximum)	Frequency
Mouse	
Type Three-button, mechanical	Dimensions
Distance from	Main and Expansion Units
System Unit 50 feet (maximum)	Width 59.8 cm (23.5 inches)
Control Dials (optional)	Height
	Depth
Type	(Main Unit)
	762 cm (30 inches)
Operating System	(Expansion Unit)
Type Stellix, based on UNIX Syst	em Weight
V release 3 with Berkeley 4.	
extensions	Monitor
Virtual Address	Width
Space	Height 50 cm (19.7 inches)
Performance Enhancements Multi-threading, extent-ba	Sed Depth
file system, disk striping	Weight
Networking	Keyboard
Berkeley extensions, Ethernet, TCP/IP, NFS, Stellar	
Global Name Space	Width 47 cm (18.5 inches)
	Depth
Programming Languages	Weight
Fortran-77 with numerous VMS® 3.0 extensions, and	Adjustable typing angle
System V.3 C. Automatic vectorization and parallelization,	Humidity
execution profiler, multi-stream debugger.	Operating 20%-80% (non-condensing)
Graphics Software/User Interface	Non-operating to 90% (non-condensing)
Window System MIT X Window System	Altitude
(Version 11) with toolkit and	The state of the s
Stellar Window Manager	Operating
Graphics Libraries X Toolkit, Stellar	F per 1000 feet additional altitude)
XFDI, Stellar PHIGS +	
Double-Buffering Hardware and software	Non-operating to 40,000 feet
support	Temperature
Stereo Vision LCD filter; passive eyeglass	es Operating 15-32 degrees Celsius
(optional)	(59-90 degrees Fahrenheit)
Environmental Specifications (meets or	Non-operating40-66 degrees Celsius
exceeds all of the following)	(-40-151 degrees Fahrenheit
	Acoustical
Emissions/Safety FCG 20780 (Class A) VDE 0871 level A	Output Less than 55 dbA (sound
UL478	power level)
CSAC22.2 (#154)	
VDE 0806 (GS Mark)	
IEC 380 and 950	
DC 5070	

BS 5850

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