Sega Saturn

Defining the Next Generation

Sega of America
255 Shoreline Drive
Redwood City
California 94065
www.segaoa.com

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There's been no shortage of hype about the "next generation" in video game systems. Almost a dozen manufacturers have hopped on the next-generation bandwagon and hope to capture the consumer's attention and a slice of his or her home-entertainment budget. Each vendor promises game systems that are faster and more capable than today's 16-bit video game devices -- with more dramatic special effects and greater realism and interactivity.

But where does the hype leave off and reality begin? What's it really going to take to dazzle consumers and make them eager for more? Sega will leave no room for debate by providing the ultimate gaming experience with Sega Saturn. Once consumers compare the next-generation game systems, Sega Saturn will prove the hands-down choice.

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'Way Beyond Mere Technology

There's endless talk about next-generation technology -- state-of-the-art microprocessors, polygon counts, texture mapping, etc.-- but most consumers aren't concerned about the technical marvels that lie "under the hood." Instead, their focus is on the experience of playing games on the system: Are the games fun? Close to the edge? Full of surprises? Realistic enough to make you forget that it's a creative illusion? To the person at the controls, the underlying technology is irrelevant unless it makes possible an exhilarating, one-of-a-kind gameplay experience.

This is exactly the philosophy behind the design of the Sega Saturn -- which was introduced in Japan in November 1994 and is on a steep curve to sell more than 2 million units in its first year. Sega has designed the Sega Saturn from the silicon up to transport consumers into an entirely new realm of interactive entertainment. The Sega Saturn makes it possible for software to immerse players in stunningly realistic worlds of 3D modeled graphics, dynamic perspective with ever-changing points of view, true 3D audio, and gameplay speed that far surpasses the most powerful multimedia PC.

More than any other video game maker, Sega has its finger on the pulse of the consumer and is able to transform raw technology into major fun for millions of people. No one else combines a 40-year arcade history with a wildly successful in-house publishing effort. Add to this Sega's solid relationships with third-party developers, who will add depth and dimension to Sega's own game library for Sega Saturn. All told, the Sega Saturn game-development universe involves hundreds of creative and innovative programmers intent upon taking Sega Saturn (and its players!) to the limit of immersive experiences.

THE RIGHT TECHNOLOGY IN THE RIGHT HANDS

Up until now, advances in video game technology have been incremental. True, CD players and other enhancements in graphics, speed and player control have given gamers more bang for their buck with 16-bit games. But today's technology -- in the right designer's hands -- makes it possible to make a quantum leap into the future. The software on Sega Saturn will take players right *inside* the game experience with compelling visual, audio and kinesthetic effects.

Essentially, Sega Saturn uses the same technology found in commercial arcade systems. It's the only home system to use state-of-the-art "massive parallel processing," which provides immersive, first-person gameplay. Parallel processing, found in super computers, divides computing tasks into pieces which are then assigned to powerful specialized processors. In contrast, competing game systems assign all computing tasks to a single central processor, like the processing schemes found on small personal computers.

Sega Saturn's parallel, or "ensemble" processing, broadens the programming capabilities for the system, enabling software developers (and, ultimately, gamers themselves) to go where they've never dreamed to go before with video games. Think of the limited musical range of a one-man band (a la the competing single-processor systems) versus the symphonic possibilities of a fully scored orchestra. There's no comparison.

Because the technology is similar to that of Sega's Titan arcade system, Sega Saturn also paves the way for hot game titles to migrate from Sega's interactive theme parks to its commercial arcade systems down to the home-based Sega Saturn system.

The Indisputable Logic of the Sega Saturn Design

Sega views video games as a set of logical components -- and in the Sega Saturn assigns each component its own computer chip or subsystem. A total of eight microprocessors in the Sega Saturn (three of which are powerful 32-bit RISC chips) work together as a sophisticated suite of "coprocessors" to create a whole that is greater than the sum of its parts. The main components of the Sega Saturn architecture include (see graphic):

- Two SH2 32-bit RISC processors, which provide the main processing engine for the Sega Saturn and work in concert with the system's more specialized chips. Having dual processors means double the potential processing power. The SH2 was especially designed for the Sega Saturn by Hitachi.

- Two sophisticated graphics processors derived from Sega's advanced arcade systems -- VDP1 and VDP2 (Video Digital Processor) -- each of which handles separate graphics tasks. VDP1, the advanced geometry engine, generates all of the character and gameplay images via polygons and sprites (graphical "objects"), while VDP2, the background and scrollplane processor, creates the graphics "behind" the gameplay. By applying special effects to polygons and sprites, VDP1 gives characters and other game elements three-dimensional realism. VDP2, meanwhile, can display as many as five background planes, as well as rotate two playfields, giving dynamic depth and perspective to gameplay.

  By dividing up the graphics tasks in this way, the visuals are smooth, fast and able to move with "real-time" speed and fluidity, so that characters have lifelike motion. Working in tandem, the two video processors create a single visual experience that can't be mimicked by a single graphics chip.

- A formidable Sega Custom Sound Processor (SCSP) from Yamaha, which includes a 128-step digital signal processor (DSP) and provides up to 32 voices and CD-quality audio. The audio subsystem also includes a 68EC000 chip that allows programmers to create sensational effects such as 3D sound and reverb. Because audio is handled by its own dedicated processor, its performance and capabilities are maximized. This creates the opportunity for phenomenal music sequences, sound effects and other audio extravagances.

- A 32-bit SH1 chip that acts as the controller for the CD-ROM subsystem. Besides having this dedicated processor -- which is able to decompress data from the CD on the fly -- the Sega Saturn's double-speed CD-ROM drive also has its own dedicated 512K of cache memory. This means that none of the main system overhead goes into accessing data from the CD drive.

Because the CD drive functions independently and has its own memory cache, the Sega Saturn can optimize the CD medium to its fullest potential. Typically, a CD is used as a delivery mechanism only -- the game is loaded from the CD into the system's memory and that's that. With this optimized subsystem, a game can continually access video and other data from the CD as the game requires it. It also means that there will be a significant increase in the speed of loading the game and moving from level to level, so there's no slowdown in gameplay.

Thus, the massive storage of the CD is used to the greatest effect. It is something that no cartridge-based system -- or any competing CD-based system -- can provide.

- An SMPC (System Manager and Peripheral Controller), which is built around a Hitachi microcontroller and manages input from peripherals such as the game controller.

- A system control unit (SCU), which acts as the "glue" of the system and includes a DSP high math chip and a DMA memory handler. The SCU synchronizes the activities of various subsystems and processors through the bus system. It is the "conductor" of the Sega Saturn multiprocessor orchestra.

The Price is Right

The sum of these perfectly orchestrated parts is the potential for arcade-quality performance in a compact, affordable system. At a price between $350 and $450, the Sega Saturn will attract the sophisticated consumer who appreciates the knock-your-socks-off, can't-find-it-elsewhere home entertainment experience of Sega Saturn game titles.

Consumers will also be able to buy Sega Saturn systems under other brand names, at different price points. Hitachi, Yamaha and JVC (all of which are supplying Sega with critical technology for the Sega Saturn board) will each be marketing the Saturn under their own brand names. This type of arrangement is typical among Japanese companies and demonstrates the respect and credibility Sega has established among major Japanese manufacturers. Together, the original Sega Saturn along with the private-label versions (all of which will display the Saturn icon) will create more choices for customers -- and a larger, more vital market for software developers.

HARDWARE + SOFTWARE = THE ULTIMATE GAME EXPERIENCE

Every company offering a next-generation video game system will make a case for the superiority of its technology. But the question always remains: how well can the company exploit the technology for the consumer's maximum amazement? Are polygons rendered because they can be, or do they add up to a never-before-seen, immersive experience that takes the player *out there*, past the fringes of known experience?

In Sega's case, the company is primed and ready to use Sega Saturn as a platform for inspiring its developers and astounding its customers. No other competitor has Sega's unique relationship with the consumer market that comes from Sega's long-standing arcade heritage and in-house software success. Sega stands out as the only next generation manufacturer that offers complete integration of hardware and software capabilities. Creating its own game titles makes Sega that much smarter about what its customers want and what it takes to design great game system hardware.

"Consumers don't buy a game system for its own sake," says William White, vice president of Sega of America marketing. "They buy it for the fun they anticipate that the *game software* will provide."

The result of this integration is that Sega has become a "screaming" success (as any Sega TV ad will attest, concluding with its hallmark "Sega scream"), with a stronghold over the Japanese arcade business and the number one position in the U.S. 16-bit video game market. In fact, Sega essentially invented the 16-bit market with its Sega Genesis system, which has reached an installed base of almost 20 million since its introduction in 1989. Sega Genesis has achieved hit status to a large extent because of Sega's astute software design decisions, such as the development of Sonic the Hedgehog, a game character that has one of the most recognizable "personalities" among school-age children. Overall, the Sega brand is one of the top five coolest brands among U.S. teenagers, alongside household names like Nike.

An Unparalleled Arcade Heritage

First and foremost, Sega's forte and creative core is its arcade business. Sega Enterprises Ltd., parent company of Sega of America, was founded in 1954 as a coin-operated entertainment business and has parlayed its 40 years of experience into a formidable arcade franchise. Sega essentially owns the arcade market in Japan, and some of the game programmers in its Japanese arcade software division, AM2, have achieved rock-star celebrity status among Japanese gamers.

Sega of Japan is known far and wide for taking risks and creating over-the-top games that no one has dared to build -- leading the way with innovations like 3D characters and lifelike visuals. In fact, Sega of Japan first conceptualizes the game experience and then designs its high-end arcade hardware around it.

Arcade games have thus far offered the ultimate gaming experience because the hardware -- until now -- has been exponentially more powerful than what could be delivered in the home. After all, not too many consumers can afford a seven-foot-tall arcade unit containing the most expensive, sophisticated technology and costing tens of thousands of dollars. To get access to the state-of-the-art in video games, consumers have been obliged to drop their quarters in video arcades.

Because Sega has produced so many runaway successes for the arcade market -- like Virtua Fighter and Daytona USA, to name just two -- it knows better than any other video game maker what it takes to make an adrenaline-producing, console-pounding arcade game. And now that arcade-quality technology is making its way into the home via Sega Saturn, Sega will be there with the most in-demand arcade titles in Sega Saturn versions -- Virtua Fighter and Daytona USA among them. Essentially, Sega's arcade business can now serve as a test-bed for the hottest, wildest and most compelling arcade-style games -- the best of which will be converted to Sega Saturn and sold at retail.

This kind of "inside" market research is something that Sega's competitors simply can't get: Only Sega has the full depth of video game products that reach from the highest-end arcade to the average living room -- and only Sega can take advantage of the synergy among them.

Knowing the Consumer Like No One Else

For the consumer at the controls of a game system in his or her living room, Sega has also developed a booming "homegrown" software business. Sega keeps them continually on the edge of their seats with the world's largest library of 16-bit games. Game software revenues comprise a full 40 percent of Sega of America's business.

To support Sega Saturn, Sega is spending tens of millions of dollars on the development of Sega Saturn games. As it did with the 16-bit Genesis system, Sega will apply its unrivaled creative and technical resources to creating hit titles that drive the market and to blaze a trail for other game developers.

A select range of proven titles will be converted over from Sega's arcade systems, but many others will be developed from the ground up specifically for Sega Saturn. After all, the entertainment-seeking consumer does not necessarily live by arcade-style games alone. Sega will ensure that there's something for everyone: adventure buffs, sports aficionados and anyone else who wants to have some serious fun.

The Sega Sports Franchise

Sports titles will be particularly important because the Sega Saturn buyer may very well be either 1) a serious gamer who will lust after the dynamic, fast-moving sports action possible on Sega Saturn, and/or 2) a sports enthusiast who'll be awed and impressed by Sega Saturn sports games, which offer league statistics, game action and realistic participation that can't be had anywhere else.

Through its Sega Sports label, Sega already has an unparalleled franchise in sports software development. Close to 40 percent of Sega's software business derives from the Sega Sports family of sports action games. Titles range from basketball, hockey and baseball to tennis and golf. Some of today's biggest sports stars -- such as Joe Montana, Deion Sanders, David Robinson, Mario Lemieux and Fred Couples -- lend their expertise to the development of Sega Sports games.

Sega Sports has also obtained licenses from leading sports organizations -- the National Football League, National Basketball League, National Association of Stock Car Auto Racing and Major League Baseball, to name but a few -- to ensure the most authentic and realistic gameplay possible. No other video game maker has established these kinds of relationships, or has anywhere near the depth and breadth of sophisticated sports titles.

Sports games comprise only a portion, though, of the Sega Saturn game titles under development at Sega of America. At U.S. launch in September, and on through the Christmas season, the company intends to roll out a range of ultracool titles that will appeal to the broadest audience possible. Sega's second and third wave of titles will follow not too much further in the future -- titles that will immerse the consumer even further in the amazing "realities" made possible by Sega Saturn.

RAISING THE BAR FOR GAME DEVELOPMENT

Besides enthralling customers with its own impressive array of titles, Sega's software development effort has an additional benefit: It creates a solid market for third-party developers and gives developers access to Sega's own programming expertise. More than 100 third-party developers are creating products for Sega Saturn and working closely with Sega to explore the universe of awesome opportunities that Sega Saturn provides.

Because Sega develops many of its own game titles, it sets an example for the third-party development community, setting high standards for game programming on the Sega Saturn system. Since the Sega development team creates games that showcase the Sega Saturn's unique features, developers can take their cue from Sega and learn how to gain the most pizzazz from the Sega Saturn themselves. They look to Sega's software development team to break new ground and define the parameters of possibility.

"We raise and set the bar for our developers in terms of what can be done with the technology, what kind of quality and features and performance Sega Saturn customers will expect," says Joe Miller, senior vice president of Sega of America product development.

Rather than competing with its third-party publishers, Sega actually creates the market for them. Third-party publishers appreciate not only Sega's programming finesse but also its in-your-face advertising and sense of fun and daring -- all of which have combined to make Sega the industry leader. They know that Sega will deliver a market that is primed and eager for a growing library of outrageous game experiences.

Meeting the quality standards that Sega sets won't necessarily be an easy task for some developers, but that's more of a benefit than a disadvantage because it *protects* the market. Because Sega paves the way with first-rate titles, it prevents the emergence of an avalanche of "schlockware" that's sloppily programmed or blindly ported over from other platforms or personal computers. In other words, Sega will ensure that consumers know from the get-go how Sega Saturn games should look, feel and play.

Power Tools for Creative Wizardry

Unlike some of the other next-generation systems, the Sega Saturn doesn't include a software layer which developers must work with when writing their code. Instead, Sega provides an additional benefit to programmers by encouraging them to write "directly to the hardware" in assembly language, meaning that their programs address the system components directly. By staying "close to the metal," developers get maximum

performance and greater control over their code. However, they are also free to write in higher-level languages if they like.

To make sure that game developers both large and small have equal access, Sega offers a development system that allows programmers to develop Sega Saturn games from either a personal computer or a Silicon Graphics workstation. Sega also provides a steady stream of sample code, documentation, programming libraries and other resources and tools to keep developers on the leading edge.

But some of the most valuable tools come from Sega's third-party partners -- companies that specialize in high-end graphics and other dazzling effects. Several top vendors are providing tools for Sega Saturn developers that enable programmers to apply state-of-the-art creative wizardry to the incomparable capabilities of the system. These partners include:

- Duck. Employing the industry's highest-quality video algorithm, Duck's TrueMotion technology provides true-television quality video images. Duck software works hand-in-hand with Sega Saturn's two Video Digital Processors (VDP) to let programmers generate character and background images simultaneously, bringing tremedous depth and perspective to gameplay.

- Q-Sound. Supported by Sega Saturn's sophisticated audio engine, QSound is a patented audio technology that provides "electronic ventriloquism." With it, programmers can make sound elements (music, sound effects) "appear" anywhere in a 180-degree arc in front of the gameplayer. The result is a far more realistic soundscape that envelops the listener in an immersive audio environment.

- Microsoft. Microsoft's Softimage 3D allows programmers to create extremely complex shapes and scenes -- in record development time. It also includes motion capture technology that developers can use to capture movement and facial gestures from a live actor and apply it to a 3D character. Other effects animate, rotate, illuminate, squash, stretch, scale and shrink images in startlingly naturalistic ways.

- Wavefront. Wavefront's GameWare lets game developers create characters that move with uncannily realistic motion, and to create natural-looking phenomenon like fire, smoke and rain, as well as effects like bouncing, melting and twisting. And Wavefront's Activation allows the creation of "smart objects" in "smart environments," optimized for 3D gameplay.

- Alias. Alias' suite of sophisticated tools brings developers the ability to create lifelike characters, futuristic vehicles, freeform surfaces and wonderfully detailed environments. Its latest tools support full-featured polygon modeling, which paves the way for wildly absorbing three-dimensional games.

- Cross Products. Cross offers a complete Sega Saturn development system, called the SNASM2, that is compatible with existing programming tools and platforms but is completely optimized for Sega Saturn development.

The First Wave Won't be the Last

The first wave of Sega Saturn games will begin to showcase the capabilities of the system -- particularly the graphics coprocessors which enable fast-moving three-dimensional gameplay and allow for "dynamic perspective" (for example, changing the view of a hockey game on the fly -- viewing it from the perspective of the goalie, the guard, or even the puck, or watching from an overhead or sideline "camera"). With the advanced capabilities of the SCSP chip, Sega Saturn games can also surround the player with phenomenally realistic sound. The optimized CD subsystem allows developers to use more video footage than ever before, and to use it more creatively and flexibly, further immersing the player with the immediacy of full-motion video.

"The features of the Saturn allow us to give the game player a much more solid feel for being "in the world" that we've devised," says Robert Leyland, a lead programmer at Jumping Jack Software, developer of one of Sega's launch titles, Ghen War. "There's a massive improvement in speed, the graphics and backgrounds allow us to create a much more realistic "terrain" than we can with any other platform, and we can make the players' opponents much smarter -- all of which makes for a much more entertaining game."

But the first wave of games -- innovative and groundbreaking as they will be -- represent just the beginning. "There's a tremendous amount of "headroom" in the Sega Saturn system," says Joe Miller. "The potential for further exploration is vast."

As programmers get better acquainted with the capabilities of the Sega Saturn system, they will begin to discover additional ways to use its outstanding sound, video and graphics capabilities to involve the player's senses and emotions more completely and invent new types of gaming experiences.

"There's a lot of room for growth," says Jumping Jack's Leyland. "As our knowledge grows, we'll be able to do even more to amaze and surprise. We expect to be exploring the depths of the Sega Saturn for a good two or three years."

The Long-Term Pay-Off

This growth won't be possible on competing systems that offer a simpler architecture. It may be easier in some ways for developers to create programs for the competition because there's less to learn and work with from a technology standpoint -- but that means that developers are much more likely to run up against the limits of the system in a short span of time. The simpler structure of competing architectures also increases the chance that games will be "ported" from other systems (other game systems or even personal computers), which results in games that are generic and not optimized for performance and special features.

In contrast, the sophistication of the Sega Saturn pays off for both developers and consumers alike over the long term. Developers will continue to discover new ways to wield their creative talents, and game players will have an ongoing supply of new, inventive, out-there, beyond-cool titles for their Sega Saturn systems.

SEGA SATURN IN THE INTERACTIVE FUTURE

The Sega Saturn isn't just about immersing gameplayers in a new dimension of experience-- it's also a pivotal product in the massive transformation of home entertainment. Sega is well aware that the future doesn't belong to video games per se -- it belongs to the emerging world of interactive entertainment. And Sega is uniquely positioned to lead the industry into the interactive future.

Several trends are converging at once: Consumers have become incredibly sophisticated about special effects and seamless realism in their entertainment experiences. They are increasingly demanding two things: theater-quality production values *and* participatory experiences. At the same time, more and more people are frustrated with personal computers as one-size-fits-all devices and are looking for technology optimized for maximum performance -- but which also integrates with other products and services.

Keeping the parallel trends of sophistication and integration in mind, Sega is introducing the Sega Saturn as part of a sweeping technology agenda that will link home entertainment with the highest-end technology.

Among Sega's other state-of-the-art endeavors are the Sega Channel, which in its current form allows Sega Genesis customers to download and "test drive" the latest 16-bit games; Sega's World Wide Web server on the Internet, which has logged more than one million visitors since going online in late 1994; and Sega's newly piloted interactive theme parks, which feature leading-edge arcade and virtual reality games that can be linked together for unprecedented multiplayer experiences (for instance, as many as eight players can race against each other from their individual Daytona USA "pods.") The common thread, of course, is interactivity -- using the latest in communications technology to expand the game player's horizons and continually redefine the dimensions of video gameplay.

Because Sega plays off the synergy that comes from each of its many related entertainment businesses, it can lead the way with compelling, immersive experiences that begin in its theme parks and then migrate to its arcade and home-entertainment systems. As an optimized, sophisticated consumer system, the Sega Saturn will naturally play an integral role in Sega's prolific interactive future.