Success Story

SGI SuperHigh Definition Analysis Lab

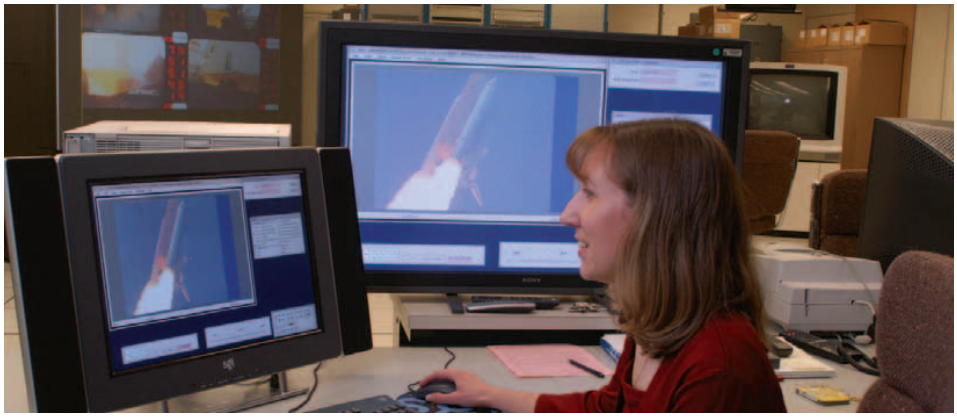

Image courtesy of NASA

NASA Readies for Shuttle Return to Flight

"We have capabilities that we never had before."

– Armando Oliu
NASA-KSC Ice/Debris Team lead

NASA, United Space Alliance (USA) and Silicon Graphics, Inc. have teamed to create one of the world's highest performing visual film analysis systems. With the complete state-of-the-art, greater than high-definition imaging solution, provided by SGI, scientists are currently analyzing and manipulating images from previous shuttle flight data at the NASA Ice/Debris Team's Image Analysis Facility at Kennedy Space Center (KSC), Florida, in preparation for the space shuttle fleet's return to flight. From the next space shuttle flight, now slated for September 2004, and in the future, the Team at NASA-KSC will rely on SGI® high-performance computing capabilities to deliver a visual analysis system that meets hard-core government specifications to ensure the safety of manned space flight.

Prior to the Columbia accident on February 1, SGI had discussed upgrading the Image Analysis Facility with NASA, a longtime SGI customer. Following the accident, NASA requested that SGI immediately design a system that could produce extremely high-resolution 4K scans from various speeds of 16mm and 35mm film and video taken from their almost 70 on-site cameras. The majority of cameras are in fixed positions, providing a 360-degree view of the launch pad. Others are in optimal locations throughout KSC—some fixed and some on manned moving platforms—to capture short-range and long-range tracking images of the vehicle as it ascends. The Ice/Debris Team's job is to review the mountain of visual information taken from all possible angles to determine if anything fell off or impacted the vehicle—i.e., bird strikes, lightning, ice on the external tank—that could cause a problem in flight.

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"With the upgrades we were already planning, including installation of some high-definition cameras as well as exploring the possibility of night launches, we wanted a package that would encompass all this, plus help us do the image analysis we needed," says Armando Oliu, NASA-KSC Ice/Debris Team lead. "Since we're still using film, we needed a very high-end scanner that takes film data and converts it digitally. The Imagica IMAGER XE scans at a very high resolution—16mm at roughly 2Kx2K, and 35mm at roughly 4K—but that's the minimum. It has the capability of a much higher scan resolution than that. The data goes from the scanner to the hard drives of a very powerful computer system, the SGI Onyx 3000 supercomputer. We have software tools that help us clean up the image:

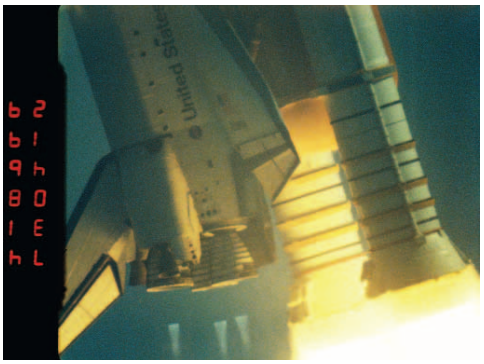

Image courtesy of NASA

we can do tracking of the different parts, measure components and things on the vehicle, do engineering analysis, and see, manipulate, and review any debris that might come off the vehicle. Silicon Graphics compiled the system for us, and it's just incredible compared to what we had. And it's ready to support any future upgrade fairly easily."

Built by SGI Professional Services, the multi-display system is designed to allow everything from multiple-person collaboration to highly detailed manipulation and evaluation of specific imagery. NASA scientists can now perform preliminary video analysis within an hour of a shuttle launch and view more detailed film analysis the day after launch.

NASA accumulates the raw imagery on the advanced SGI® InfiniteStorage TP9500 data management system with 30TB of RAID storage. The data is accessible at a bandwidth of 2GB per second and can easily store the estimated 10TB from a normal non-event mission, and potentially15TB of raw film data that could be ingested after a single launch. "We have three file systems set up," Brad Lawrence, United Space

Image courtesy of NASA

Alliance, explains. “We do all our ingest on one 17TB file system. Eight to 8.5TB is dedicated to our playback systems, and we have another 4TB for online storage. The Silicon Graphics system is controlled by 12 CPUs; each has one GB of RAM. They’re all connected by an SGI NUMAlink link that allows us to use 100 percent of all 12 CPUs at the same time, so we have phenomenal throughput.”

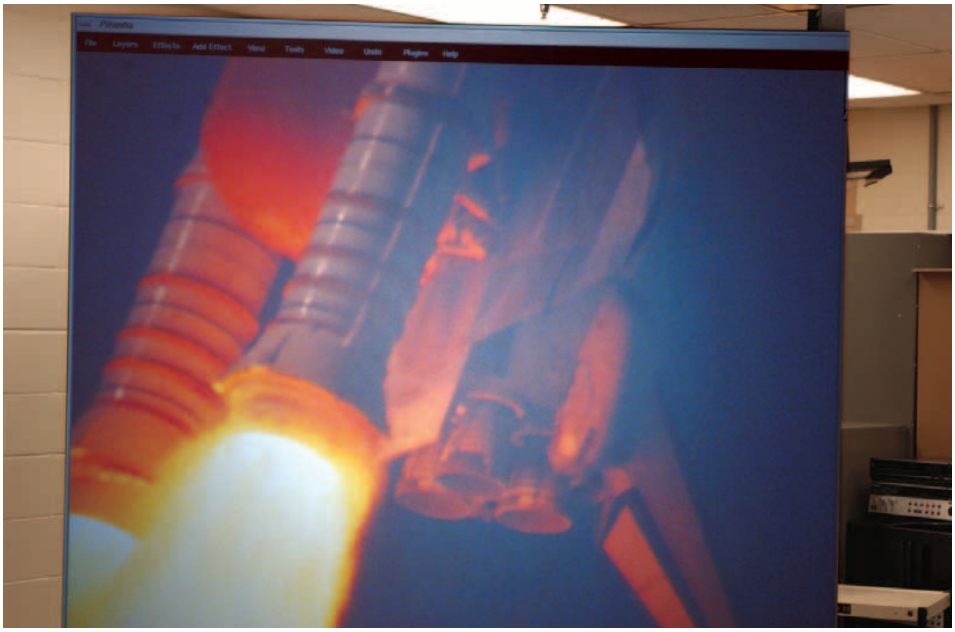

Image courtesy of NASA

Once the imagery is scanned in, instead of relying on the limited capabilities of a film projector and the naked eye, NASA scientists are viewing an extremely high-definition picture on a fully implemented SGI® Reality Center® facility. The Reality Center Insight™ 7-foot display is powered by the 12-processor SGI® Onyx® 3000 visualization supercomputer with two InfiniteReality4™ graphics pipes. Silicon Graphics® Octane2™ visual workstations are fed non-real-time 4K images that can be visualized on a super-high-resolution IBM® T221 flat panel monitor. With the new system, NASA’s Ice/Debris Team now can analyze full-frame, real-time, standard-definition and high-definition video at 1280x720 pixels and can analyze 16mm and 35mm film data at 4096x3112 pixels. The system was designed to process 150,000 frames of film and 300,000 frames of video within two weeks of a launch.

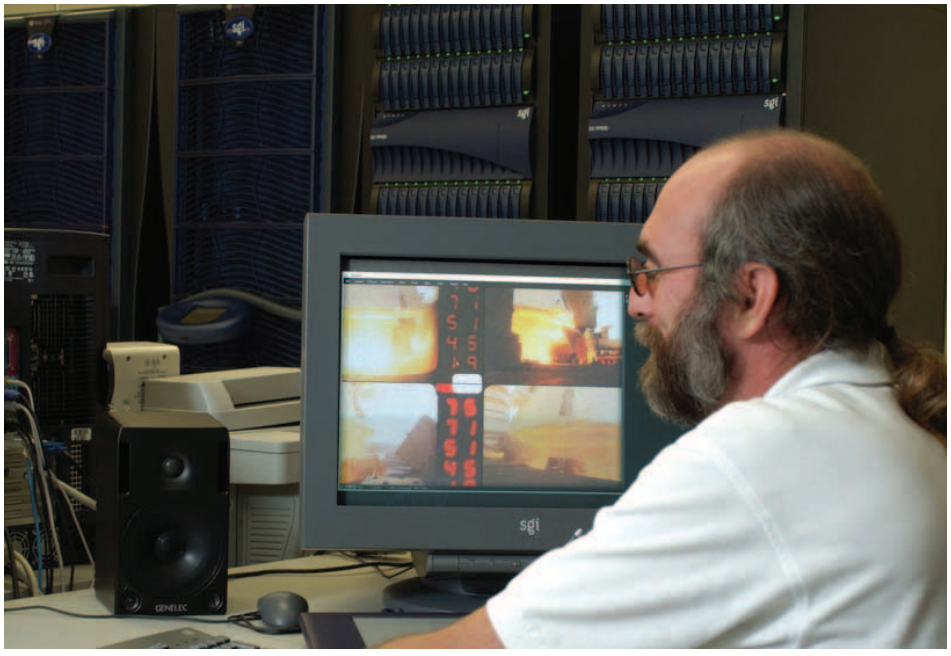

Image courtesy of NASA

“We have capabilities that we never had before,” Oliu adds. “We can take four independent views, scan them, manipulate them on software, and play them simultaneously—all synched up. We can watch all four views, seeing what’s occurring in each of the images. If we see a piece of debris on one screen, that gives us the benefit of being able to now simultaneously see when or if we can see it on another film. The film restoration software can enhance or filter the imagery. But the other beauty of it is being able to watch all four films at one time and have the team of the engineers doing the review sitting together watching it on this large screen, as opposed to sitting in front of a monitor and having to get five or six people to do the same thing. So watch-

Image courtesy of NASA

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> *NASA-KSC Ice/Debris Team lead*

ing it on the Reality Center environment is an incredible benefit."

"NASA now has all the additional abilities to change the color space, remove artifacts, remove jitter, and do all the things you need to do to get the visuals in their optimum viewing perspective, both from a color space and a temporal space," says Kevin Smith, SGI Professional Services systems engineer. "The Ice/Debris Team is using InteractiveFX's Piranha HD software for pan/tilt/zoom around the frame, to add real-time effects and for image isolation and filtering, as well as CORRECT film-restoration software from MTI Films—both traditionally Hollywood vendors who optimized their code to support the 4K file resolutions that NASA needed. These are very powerful tools in regards to changing the viewing perspective in many different ways to garnish additional information for NASA."

SGI systems engineers from the entertainment/Media Industries sector proposed the system based on their years of experience in designing systems to attain the most precisely detailed, highest quality visual images and effects possible. Customers have included EFILM, a Los Angeles cutting-edge digital cinema lab, and Ascent Media Group, the largest aggregation of post-production companies in the world. In addition to digital manipulation technologies from the film entertainment industry, SGI leveraged its expertise in image analysis capabilities installed throughout the commercial, medical imaging, and manufacturing industries, as well as the Department of Defense and other government agencies.

"The Kennedy Space Center Ice/Debris Team sought a system with the capacity to handle launch film for image analysis and evaluation," concludes Oliu. "SGI's experience with NASA's Kennedy Space Center and the entertainment film industry helped us meet our analysis goals. The new system is a valuable tool that has greatly enhanced our image analysis capabilities."

sgi

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