SiliconGraphics
Computer Systems

Silicon Graphics in Bosnia

Mission Rehearsal/Mission Preparation

"We have seconds to identify the target... PowerScene [and Silicon Graphics] help us recognize the target faster. The bottom line is a higer percentage of our bomb runs has been successful"

—Major Bob Beletic
USAF 555th squadrom

Cambridge Research: Creating the Virtual Attack

In the early morning on a hot August day, a flight leader from a U.S. squadron enters a secure building near Italy's Adriatic coast to be briefed for the day's mission. An ammunition depot in eastern Bosnia is his designated target. The rules of engagement are stringent: No collateral damage. No civilian casualties. Strike only the target. His four-plane flight of F-16s will be coming up on the target at 650 miles per hour. He will have a few seconds to make a strike/no strike decision.

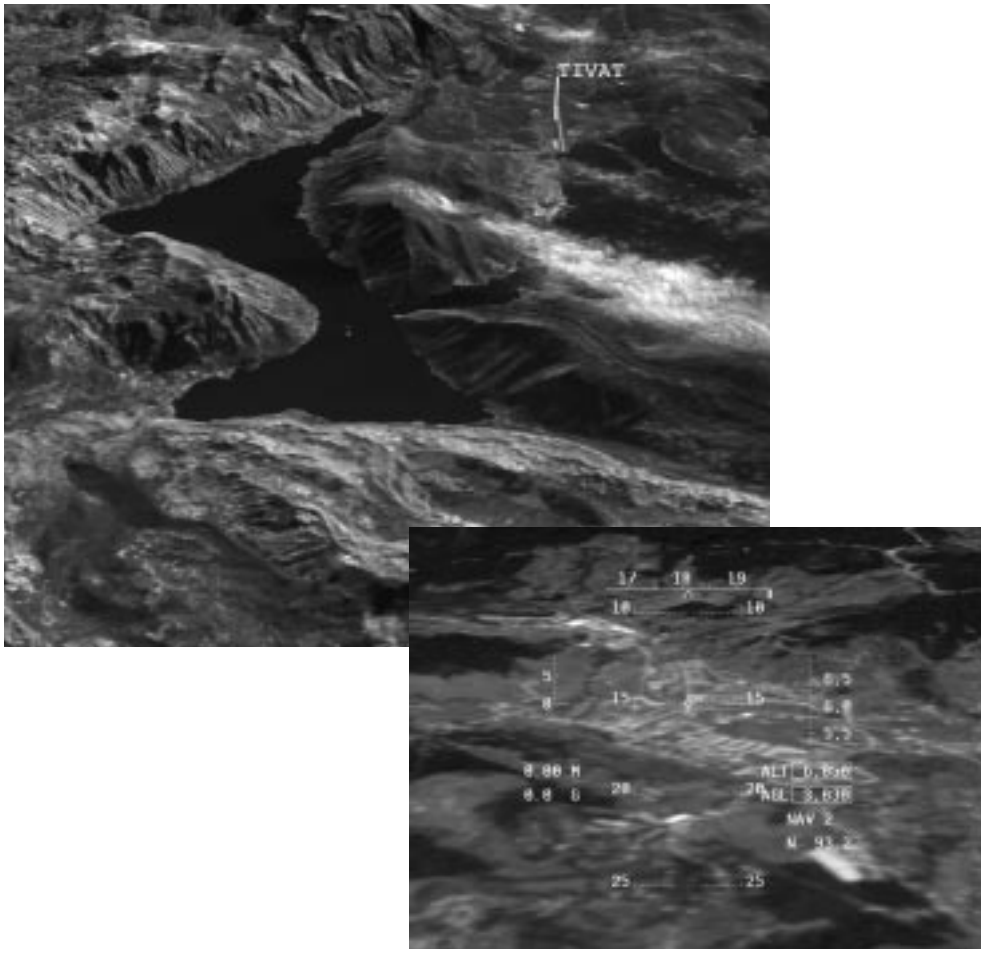
Inside the Intelligence Center, the flight leader sits before a computer display that presents a high-fidelity view of the flight path he will take today. The topography and landmarks are precisely accurate. Below the windscreen, he sees a synchronized plan view of the flight path showing map coordinates.

The pilot uses a joystick to guide himself up a steep Bosnian valley to the target. He repeats the run, experimenting with headings, altitudes, and maneuvers. At 15,000 feet, 16 miles from the target, he freezes the image, studies target pointers—a bridge, a village, a cluster of trees—and prints full-color copies of the scene. He flies to seven miles from the target, freezes the image again, and calls up a six-degree view up the narrowing valley. He orders more color prints, closes to four miles, and freezes the image again—this time with the target in plain view. He orders a final set of prints and a videotape of the simulated flight, and leaves the building.

An hour later, after he and three other pilots have reviewed the tape and verified the target coordinates, they fly the mission with the color prints in their laps. There are clouds in the valley but they identify the target with confidence and drop with accuracy.

"[With PowerScene and Silicon Graphics] pilots can reassure themselves of the accuracy of all the data they take with them."

—Tom Hickey
Cambridge Research



PowerScene: Mission Rehearsal over a Virtual Landscape

The system that generates the target area for a mission preview and virtual rehearsal is PowerScene™ (developed for operation on Silicon Graphics® Onyx® graphics supercomputers) by Cambridge Research Associates, Inc. in McLean, Virginia. Initiated under a U.S. Navy Research and Development program, it uses digital maps, orthorectified imagery, and digital terrain elevation data, all from the Defense Mapping Agency (DMA), to give pilots a pre-mission flight rehearsal that is precise, accurate, and realistic.

"We come at some targets at 600 to 700 miles an hour," says Major Bob Beletic of the USAF 555th Squadron. "We have seconds to identify the target or we don't drop. PowerScene helps us recognize the target faster and gives the angle we'll be looking from. That can make the difference between dropping and not dropping. The bottom line is, a higher percentage of our bomb runs has been successful."

One reason for this success is that pilots know exactly where their targets lie. The mission folder data they receive before each flight includes target coordinates that at times may be imprecise. "They use the system to crosscheck mission folder data," says Cambridge's Tom Hickey. "On PowerScene, they check the coordinates, which are very accurate. They reassure themselves of the accuracy of all the data they take with them."

Action in Bosnia: An Instant Success

PowerScene made its initial debut at the Pentagon, where high-ranking officers assessed a system prototype. As a result, DMA shipped a complete PowerScene system to Aviano Air Base in Italy, where Allied, USAF, U.S. Marine Corps, and Navy pilots were flying missions into Bosnia in a variety of aircraft. The system was being installed on a 30-day trial basis, but went into operational use so quickly that the installing technicians didn't sleep until it was functional.

"The timing was perfect," says Jerry Moore of Cambridge Research. "The system got there just in time to have a real effect when they started flying missions. They did not keep data, but everybody realized they were getting better than twice the efficiency of sorties because of PowerScene."

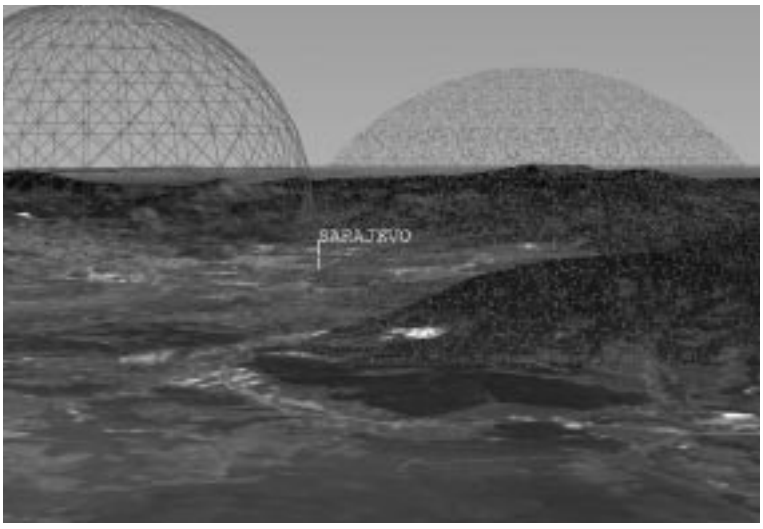
"People at Aviano Air Base were under a very stringent set of rules of engagement to ensure that collateral damage would be minimized. They wanted pilots to err on the side of safety, to be sure they had the right target before they dropped anything. PowerScene was an important part of that. The word among Air Force people was that there was less collateral damage than on any missions they'd ever performed."

The System: Hardware, Software, and Database

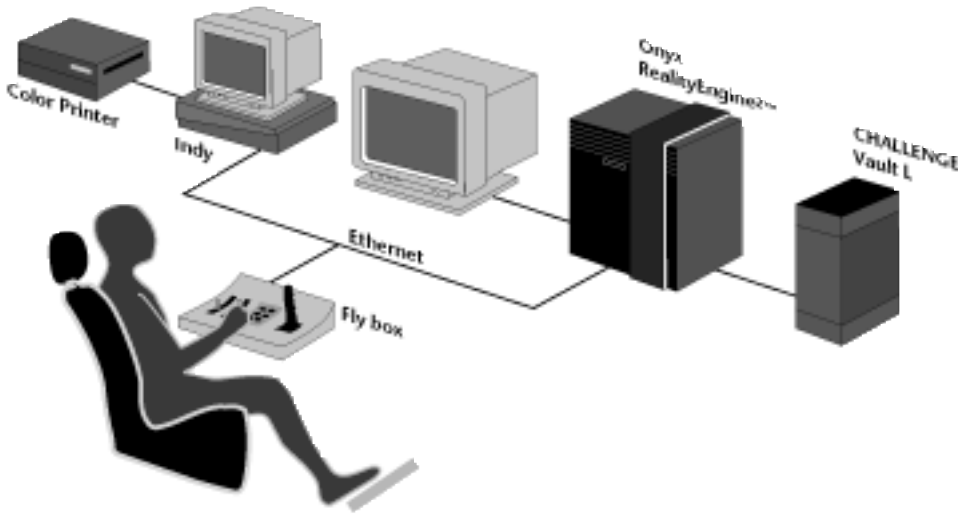
The system supplied to Aviano by the DMA includes a Silicon Graphics Onyx graphics supercomputer with RealityEngine2™ graphics, four 200MHz processors, and two or four raster managers. The Onyx system has four 4.3GB internal disk storage units, supplemented by a Silicon Graphics CHALLENGE® Vault L with an additional eight 4.3GB disks. The system is linked over Ethernet™ to a Silicon Graphics Indy® workstation, which runs PowerScene's graphical user interface (GUI) on its 17-inch monitor. The Onyx system's unique graphics power generates a 30Hz real-time interactive perspective view of the scene. The pilot interacts with the system through a joystick and throttles, changing heading, altitude, and speed to create a flight path to match the real-world mission. He records his flight in two ways, by printing out hard-copy screen captures on a photo-quality Kodak™ color printer, or by videotaping flight sequences through the Onyx system's internal VideoCreator board or Sirius Video™ board. He can review the tape alone or with other pilots, and take the prints on the mission.

The system uses classified and unclassified DMA data at a variety of resolutions. PowerScene integrates all these sources, always using the highest resolution available, to produce a seamless composite, draping the digital imagery over DMA's digital terrain elevation data. It also has the ability to pull target data from the daily Air Tasking Order (ATO), now published electronically, and convert it to both plan-view and 3D interactive graphic form. Because almost all available images are in black and white, the pilot looks at a monochrome scene of the terrain against a blue sky, with threat envelopes (anti-aircraft hazards) in color. The overall effect is a high-fidelity, full-color scene.

"The fidelity of this thing is outstanding. It's as good as you would see in real life. We're using it on every mission we can."



System Configuration



www.sgi.com/VisSim

Just How Good Is PowerScene?

Vic Kuchar of DMA's JC of S Command Support Team spelled out the effect of Onyx and PowerScene for the official record: "The quality control and mission rehearsal capabilities of the system were so successful that the Wing Commander directed that all U.S. and NATO aircrews in the provisional wing at Aviano were to review their targets and missions using PowerScene prior to flying any sortie."

Air Force Brigadier General (Sel) Charles Wald said, "I've reviewed the tapes from every target. We haven't had one guy from Aviano hit the wrong target. Period."

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