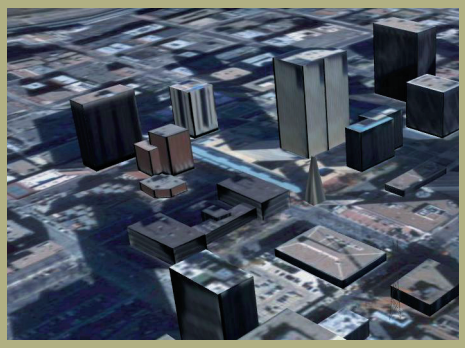
Success Story

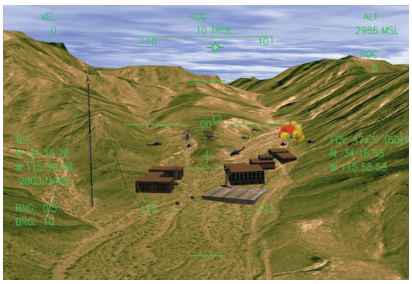
SGI and TOPSCENE at the Naval Air Systems Command: Making Mission Rehearsal Real



Twelve Minutes, 18 Seconds from the Carrier
The plane banks left and streaks low over the bay, over the tidal flats of the delta, and into the lazy curves of the river. There's the levee, ahead on the right; there's the pier, in midstream; there's the barge. The pilot pulls the nose up for the bridge ahead, then quickly gets back on the deck. The riverbanks and the hills scream by, but the pilot's eyes are focused on the scene ahead: wharves, warehouses, military ships, and cranes. This is the mission's end, in precise, photographic detail, looking just like it should. A Silicon Graphics® Onyx2® computer and TOPSCENE software have powered a simulation that puts the pilot into the real world. He steps out of the simulator, smiling and confident after seven simulated missions up the river to the port. Come mission time tomorrow, he'll be ready.

Real-World, Real-Time Images: Combat -Tested
Tactical Operational Scene (TOPSCENE) is a mission-rehearsal system developed by Lockheed Martin Vought Systems of Dallas for the Naval Aviation Training Systems Program Office and used by the Navy, Marines, Army, and Air Force. It converts imagery from satellites and other sources to create 3D fly-throughs and walk-throughs of real-world terrain in staged battlefield scenarios. In the words of Carrier Air Wing One, reviewing its operations in Bosnia, "It is the ability to practice that makes TOPSCENE indispensable." According to Alan Herod, program manager for TOPSCENE Mission Rehearsal Systems, TOPSCENE's indispensability has been established in nearly 100 deployments in Bosnia, Haiti, Somalia, the Persian Gulf, and other locales. TOPSCENE makes it possible to study a hostile environment from all angles before entering it. And because TOPSCENE can create a database from image sources in about two hours, it can re-create the battlefield in near real time. It provides the choice of motion and controls for fixed-wing aircraft, helicopter, or guided missile seeker. Walking and driving modes simulate ground-level pace. In all modes and at all altitudes, the outstanding fidelity of the images creates a remarkable training experience.

SGI: Power and Deployability
TOPSCENE was originally developed as a proprietary hardware/software system. But by the mid-1990s, the Navy had begun using commercial off-the-shelf (COTS) systems from SGI to make it more deployable and cost-effective. With each new release of SGI™ systems, performance has increased dramatically while prices have decreased. Model 4000, the most recently released TOPSCENE product, is powered by a Silicon Graphics® Onyx2® InfiniteReality® deskside system that serves as host computer and image generator. It includes four MIPS® R10000® processors, 64MB of texture memory, a single InfiniteReality graphics pipeline, and 200GB of removable digital storage.



TOPSCENE 400, which offers midrange performance at significantly reduced cost, runs on the Silicon Graphics® Octane® desktop workstation. The Model 400 uses the same database as the Model 4000, but its hardware economics make it far more deployable. Its simulations are much like those generated by the Model 4000, but at reduced frame rates and resolutions.

The Images: Remarkable Fidelity and High Resolution
Lockheed Martin Vought's TOPSCENE software turns a general-purpose Onyx2® deskside workstation into a mission-preparation device. To generate interactive images, it processes 2D and 3D data in real time to produce detailed, high-resolution, real-world images 30 times a second. It provides fly-throughs and walk-throughs complete with geospecific cultural features like buildings, trees, cables, towers, and bridges. It simulates night missions with night vision goggles, an infrared display, or a synthetic aperture radar display. It simulates unfavorable weather. It provides data-fusion features so trainers can create and overlay mission-specific threats. It can vary speed from 0 to 1,200 knots and altitude from 0 to 40,000 feet. TOPSCENE's heads-up display includes everything from velocity to radar warning, and its configurable instrument display includes at least 10 parameters. Trainers can colorize images to enhance depth perception and visual acuity.

To simulate real-world out-the-window and sensor imagery, TOPSCENE must process and integrate huge quantities of data. At facilities at Fallon, Nevada, and Dallas, Texas, TOPSCENE tools exploit the fast graphics, rapid retrieval, and CPU performance of Silicon Graphics multiprocessor Onyx2® systems to construct databases up to country-size. The Data Base Generation System combines assets from the National Imagery and Mapping Agency with 3D terrain data to create a geospecific database not more than 24 hours old for any locale on the planet in about two hours. TOPSCENE's high-resolution images clearly display details, resolving elements of the scene that may be less than a square foot in size.

Making a Difference: TOPSCENE's Power to Train
Forty-three TOPSCENE systems are now in use on base or aboard ship for mission-preview work. How effective are they? "We recently surveyed 25% of active Navy and Marine Corps aviators," says Herod. "About 10% had experienced TOPSCENE. We asked them all, 'How confident are you going into an operation?' Those who hadn't experienced TOPSCENE gave answers that ranged from admissions of serious concern to no concern at all. But all the aviators who had experienced TOPSCENE moved into the high-confidence range when it came to things like knowing where the targets were and how to reach them." One mission commander in Bosnia flew a missile launch 30 times on TOPSCENE to raise his confidence level to the maximum.

TOPSCENE's effectiveness can be judged in other ways. For example, it has been declared mission-critical by its users. The Navy is purchasing additional deployable TOPSCENE units, which are scheduled for use aboard carriers and at the Naval Strike and Air Warfare Center at Naval Air Station Fallon, Nevada. The Army has purchased five. The Air Force has purchased seven. Talks are under way on the purchase of additional units for several unified commands and government agencies. Not to be ignored in all this is SGI's remarkable record for dependability. "I've seen TOPSCENE units bubble-wrapped and moved from carrier to carrier, with a stop on a small ship in between," says Herod. "I've seen them soaked in fire-retardant foam, hosed off, wiped down, and started right up again."

The Future
According to Herod, two trends are clearly part of TOPSCENE's future: systems will shrink in size and databases will grow. "TOPSCENE," says Herod, "is clearly evolving from large, proprietary computers to compact high-end systems that will do the same things. COTS is very attractive to me, because we get worldwide support and we benefit from the research and development that industry conducts.

"We're working with databases that range from 12 to 100GB, and we're moving into the terabyte range. We're very pleased that the current systems give us the speed and throughput to handle this huge computational load."

Herod foresees a time when TOPSCENE's current battlefield data will be readily shared in combat situations. "We recently conducted an exercise aboard the *Theodore Roosevelt*. We installed an ATM asynchronous transfer system between a TOPSCENE system in the Ready Room and one in the Intelligence Center. This means that an aviator in the Ready Room can call up files and take a quick last look before launch time. The technology exists, although it has yet to be funded.

"Battlefields are changing. Real-time information exchange is becoming indispensable." SGI will be there.

For more information about TOPSCENE Mission Rehearsal Systems, contact Lockheed Martin Vought Systems at (972) 603-9040 or NAVAIR PMA205 at (301) 757-8136.

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