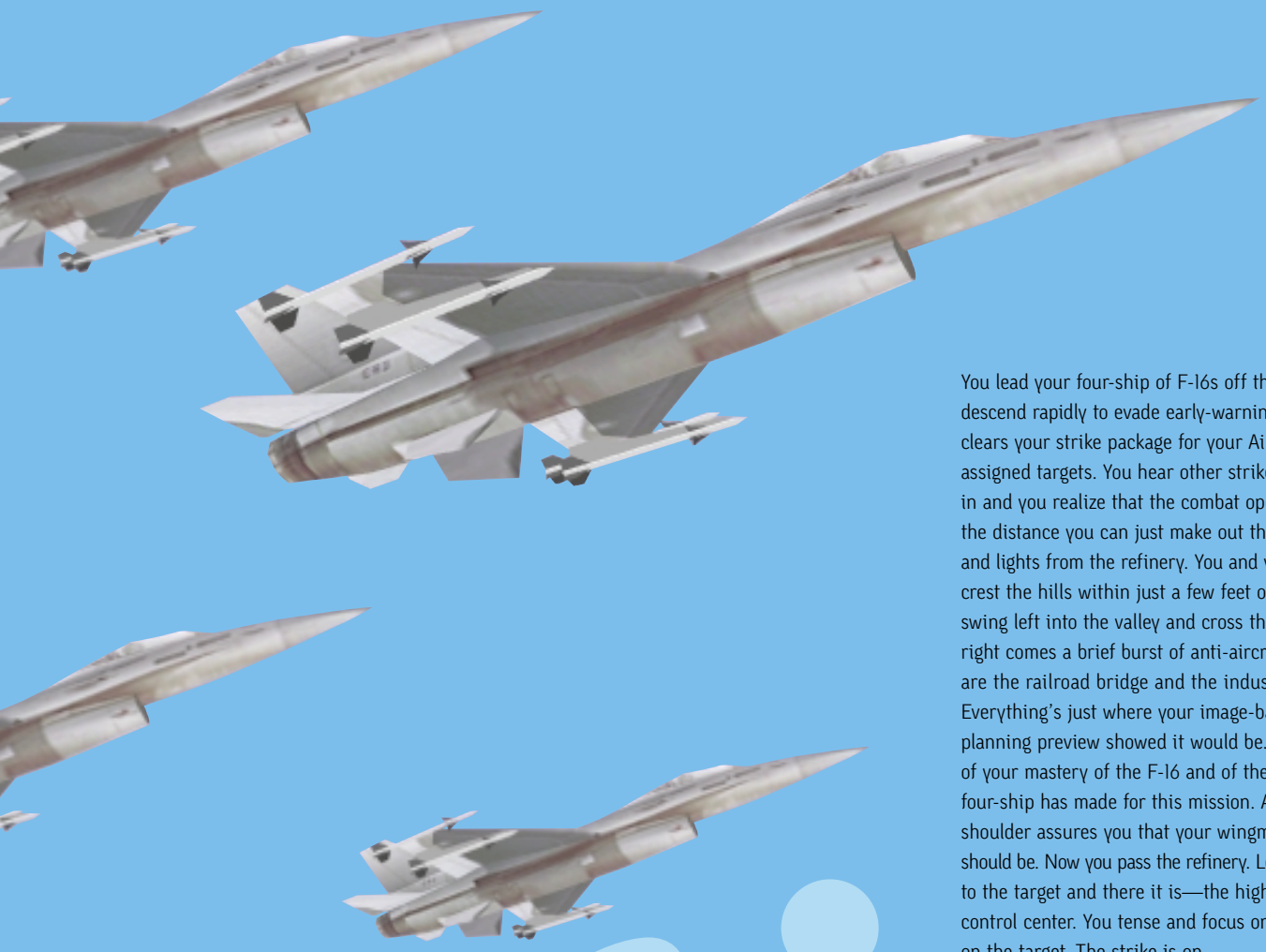
Success Story

SGI and DMT: Bringing the Real World into Simulation



You lead your four-ship of F-16s off the tanker and descend rapidly to evade early-warning radar. AWACS clears your strike package for your Air Tasking Order assigned targets. You hear other strike packages check in and you realize that the combat operation is on. In the distance you can just make out the oil drilling rigs and lights from the refinery. You and your wingmen crest the hills within just a few feet of the peaks and swing left into the valley and cross the river. From the right comes a brief burst of anti-aircraft fire. To the left are the railroad bridge and the industrial complex. Everything's just where your image-based mission-planning preview showed it would be. You're confident of your mastery of the F-16 and of the preparations your four-ship has made for this mission. A glance over each shoulder assures you that your wingmen are where they should be. Now you pass the refinery. Less than 15 seconds to the target and there it is—the highly camouflaged control center. You tense and focus on putting weapons on the target. The strike is on.

The enabling technologies that come together to form this highly realistic, networked combat training environment between ground-based aircraft simulators are called Distributed Mission Training (DMT), and the photographic realism of the Silicon Graphics® Onyx2® image generator is the heart of the reality.

"F-16 MTC provides a significant enhancement to the fidelity of flight training [and] gives pilots a full-fidelity environment that is visually equivalent to what they get in actual flight."

—John Burwell
Director
Government Industry Marketing
SGI

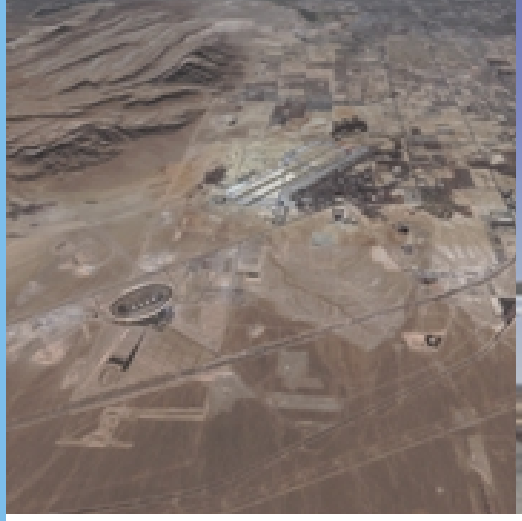
The DMT Initiative: Making Simulation Pay

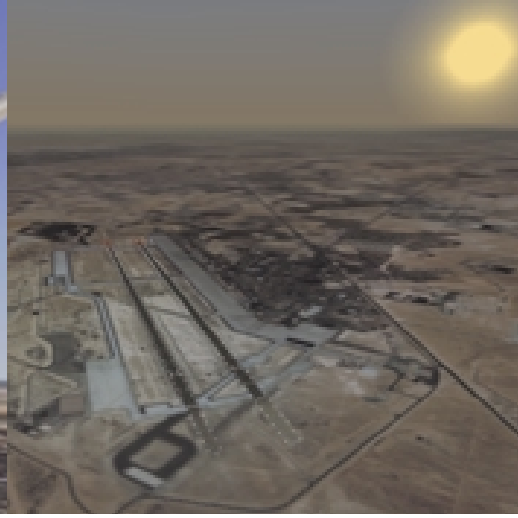
Here's the problem. The training goal of the U.S. Air Force Air Combat Command [ACC] is to provide for combat forces a highly realistic, fully integrated environment capable of training across the entire spectrum of flight operations. This includes flight in enemy territory [border crossing and combat operations], engaging enemy fighters, SAMs, AAA, and radar, full-spectrum command and control, air-to-ground weapons deployment, large package deployment, and operating in the "fog of war." These objectives have historically been met using semiannual flag exercises, such as "Red Flag," "Maple Flag," and "Cope Thunder," but with the severe opstempo and perstempo of today's Air Force, the dwindling training resources, and the more restrictive availability of training airspace, a new solution was needed.

A few years ago the ACC Commander declared that ACC was ready to reevaluate the increased use of flight simulators to resolve these severe shortfalls in training. Flight simulation visual system technology had reached an extremely realistic level of fidelity using photographic imagery and high-resolution displays. These advances dramatically increased the value of simulation in ACC's training plan, moving it beyond basic procedural task training to full-fidelity advanced combat tactics training focused on training team and interteam skills.

On June 11, 1999, the Training Systems Product Group at the Aeronautical Systems Center, WPAFB, Ohio [ASC/YW], selected Lockheed Martin Integrated Systems, Inc., as the prime contractor for the F-16 Mission Training Center [MTC] program, with Lockheed Martin Naval Electronics & Surveillance Systems, Akron, Ohio, as the lead company. The F-16 MTC program will revolutionize the way the world trains F-16 warfighters, and Silicon Graphics® visualization supercomputers are providing the power for the revolution.

In a typical DMT training mission, a flight of four F-16C fighters from Shaw AFB, South Carolina will join a flight of four F-15C fighters from Langley AFB, Virginia. At the same time, mission controllers aboard an E-3 AWACS from Tinker AFB, Oklahoma, control the air attack targeted on an enemy formation of adversary fighters from Nellis AFB, Nevada. All of this is taking place in ground-based flight simulators, located hundreds and thousands of miles apart, connected on the DMT network. Each F-16 pilot flies a realistic flight simulator, views the imagery-based computer-generated air battle through high-fidelity displays, and sees the other air components and ground threats as he or she would in the real world.





DMT is the U.S. Air Force's training environment of the future. Its goal is to reduce the costs and increase the confidence levels of mission readiness. Simple economics tells the story: on a per-hour basis, training in a DMT simulator will cost significantly less than training flights in an actual aircraft. DMT will provide full-mission training any time, and the simulation hours will make the actual flight training far more effective. This will enable pilots to retain mission readiness at substantially reduced costs. Using live, virtual, and constructive entities, DMT will provide wartime training scenarios that are extremely difficult to duplicate in peacetime flying.

Unrivaled Photographic Real-Time Realism

When the first DMT F-16 simulators go operational at Shaw Air Force Base in mid-2002, they will introduce pilots to the most realistic images they have ever seen outside of a real airplane. Ground and air targets will be presented as they would appear from an F-16 cockpit in the real world. "This is immensely important to combat pilots, who have to base split-second decisions on the behavior of distant objects," says Guy Russell, senior business development manager, Modeling & Simulation, at SGI. "And Onyx2 is the only visual system in the world capable of delivering complete imagery-based mission training with the high resolution and expansive coverage of photographic realism."

"F-16 MTC provides a significant enhancement to the fidelity of flight training that, for the first time ever, gives pilots a full-fidelity environment that is visually equivalent to what they get in actual flight," says John Burwell, director, Government Industry Marketing. "They can fly with other aircraft as they would in actual flight operations—linked together, seeing each other, surveying the landscape, manipulating the sensors, locking on precision-guided weapons. They can execute missions in ways that aren't possible in current flight training, where they're airspace limited."

DMT will allow the linkage of disparate units—the different fighter squadrons, bomber squadrons, airlift squadrons, and tanker squadrons—and bring them together in a synthetic training environment where they can develop standard operating procedures and practice the rules of engagement in the variety of increasingly delicate and sensitive environments in which they operate. It will allow them to practice the tactics, techniques, and procedures that they must get right the first time they need to use them in combat.

F-16 MTC represents several firsts in simulation technology, including that it will be the first photo-derived training environment with a 360-degree field of view of realistic real-world landscapes.

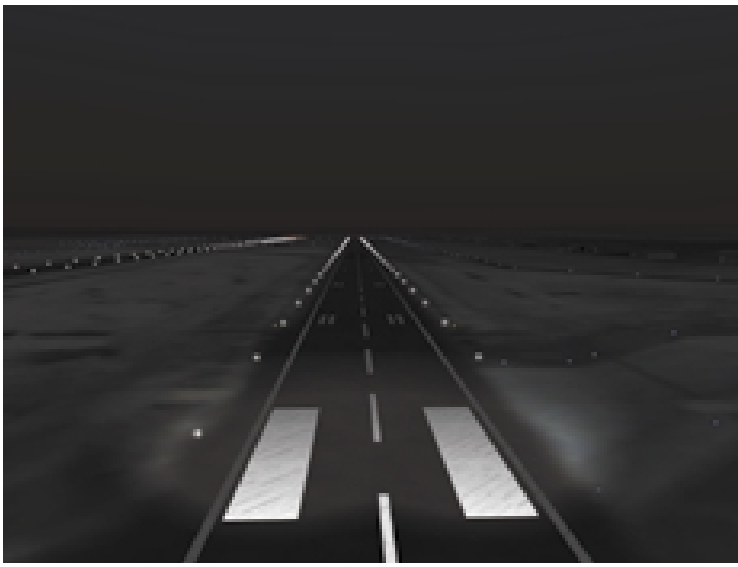
Multigen-Paradigm Inc. (MPI), Lockheed Martin, Boeing, and SGI have formed an integrated product team to deliver the visual system for the MTC program. MPI will provide the real-time software and database development tools for the image generator based on Flight IG™, Vega™, Creator™, and CreatorPro™ toolsets. The solution also includes the next-generation MPI modeling and terrain generation technology.

Boeing will provide the visual display system based on its VIDS™ technology. Pilots will sit in a cockpit that matches the F-16 in form, fit, and function, but without a canopy, in a 360-degree faceted dome of rear-projection flat-panel displays that present the highest resolution available from any image generator today, projecting Lockheed Martin's correlated visual and sensor databases. SGI® systems will drive the major simulations and provide the majority of the MTC's computer hardware requirements. The entire SGI product line will be utilized: An SGI® Origin® 2000 server will provide host computations, SGI® Onyx®3000 series systems will drive the graphics displays, Silicon Graphics® 540 visual workstations will serve as instructor operator

stations, an SGI® Origin® 200 server will provide the DRLMS (Digital Radar Landmass System) simulation, and a Silicon Graphics® Octane® system will drive the cockpit displays.

SGI technology will also make F-16 MTC the first networked, full-mission imagery-based F-16 flight simulator. Pilots will use F-16 MTC to perform nearly every training task they can perform in a real aircraft. For example, up to four pilots—in the same building or at other locations worldwide—will be able to fly LAN- or WAN-linked simulators simultaneously, communicate, and see other air assets. Using the same Air Force Mission Support System (AFMSS) planning and intelligence assets they would use in real situations, they will fly missions in interactive tactical environments that include airborne and surface threats. Instructors will use the threat stations to add as many as four friendly or hostile interactive aircraft to the scenario.

"When they walk in, they'll go through a full mission briefing as they would in actual combat operations," says Russell. "They'll go into the simulators and fly their missions networked to other aircraft and ground forces. After the mission, they'll go through a debriefing using a complete record of the mission to reinforce lessons learned in a way that's not possible with actual flight training exercises." MTC simulators will also contribute to pilot safety through safety-of-flight missions, simulating emergencies and dangerous situations that would put pilots at risk in real aircraft.



The Future: A Worldwide Training Simulation Network
A network will tie all DMT training sites together over the secure military Internet-like network and link them to platforms like F-15C, F-16C, and AWACS. DMT's flexible architecture will permit a variety of configurations. Entities can be linked for a joint mission or independent flight operations.

"F-16 MTC is the state of the art in simulation," says Burwell. "SGI is proud to provide the leading-edge image generators and computing technology that enable this next generation of tactical combat training."

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