Success Story

SGI at Reflectone

The Leading Edge of Visual Flight Simulation

Picture this: your flight of three fast-jets takes off from RAF Valley airfield in North Wales. You fly your Hawk trainer south through bumpy, cloud-filled skies and talk over the radio to your wingmen. The familiar mountain terrain appears briefly through cloud breaks below. Seven minutes from base, the flight suddenly encounters hostile aircraft. Your pulse rate soars and your G-suit inflates as you dive steeply and pull tight turns. Outmaneuvered, the enemy aircraft flee. You continue to the bombing range at low level in tactical formation. You identify your target and complete your mission with a bomb run. Alarm! A brief moment of panic. You successfully handle the hydraulics failure and return to base for debriefing. And thanks to Reflectone, SGI image generation power, and the unique visual technology of Equipe Electronics, you have accomplished it all without ever leaving the ground.

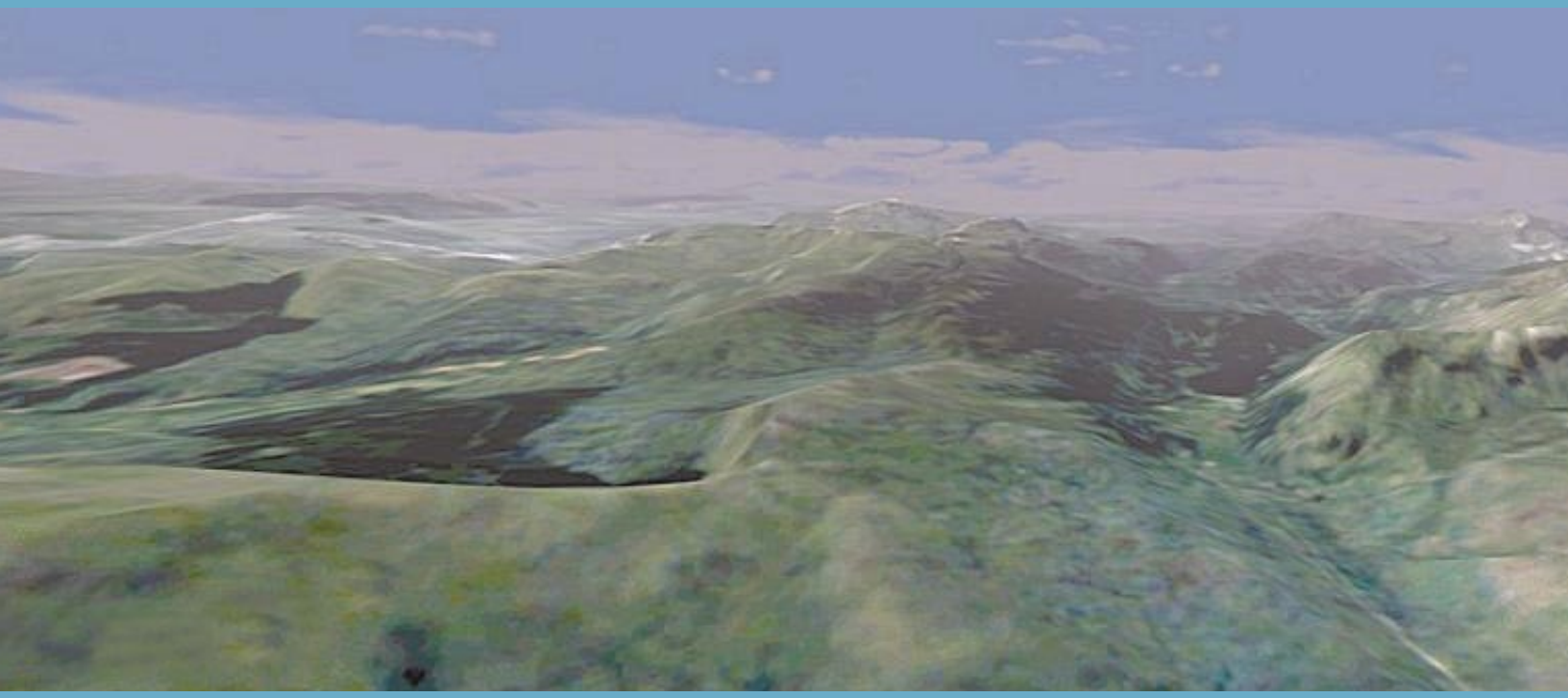
The Challenge: To Increase Simulator Training Fidelity

For over 20 years, the Royal Air Force has relied on its British Aerospace Hawk trainers for advanced flying and tactical lead-in training. The UK Ministry of Defence (MoD) contracted Reflectone to create a facility that would increase realism in flight training by simulation technology. The result is the Hawk Synthetic Training Facility (HSTF), a solution that takes simulation to the leading edge. Reflectone will have the HSTF—complete with simulators, instructors, maintainers, and classrooms—fully operational at RAF Valley on the island of Anglesey in North Wales by the end of 1999 and will operate it under contract to the MoD. The facility will be equipped entirely with SGI™ image generators and workstations.

HSTF is already using its Hawk Cockpit Procedures Trainer, driven by a Silicon Graphics® Octane® system, to train RAF pilots. The Hawk instrument flight simulator, with a collimated out-the-window SEOS display driven by a Silicon Graphics® Onyx2™ InfiniteReality® single-channel image generator, became operational in July. But the showpieces of HSTF are the two Hawk Weapons and Tactics Simulators (HWTS), the first of which entered operations in September 1999.

Under the Domes: An Immersive Training Experience

Pilots will enter one of two six-meter-diameter spheres to sit in an authentic Hawk cockpit. They will start the Hawk's engine, taxi to the runway, and take off. Each dome has a Silicon Graphics Onyx2 InfiniteReality 10-channel image generator.



The Onyx2 system drives a SEOS Acuview dome projection system that generates a complete visual environment of earth, sky, and other aircraft. Five fixed high-resolution CRT projectors cover the forward part of the dome and two fixed ultra-wide-angle LCD projectors cover the rest. When flying in formation, pilots see other aircraft displayed by two very high resolution Marksman target projectors that move in real time to display highly realistic images anywhere in the dome.

Because the Hawk is a very agile aircraft, the RAF requires exceptional image latency to make the simulator's response as realistic as possible. The HWTS takes advantage of SGI Host Integrated Computer Image Generator (HI-CIG) technology to accomplish this. The Onyx2 system performs real-time flight dynamics calculations as it generates images and drives the visual systems. HI-CIG allowed Reflectone to reduce risk by resolving host/graphics interfacing issues early in the simulator's development.

Reflectone's subcontractor, Equipe Electronics, is developing the visual system, which includes the Onyx2 image generators, SEOS displays, Equipe's Blue Sky visual run-time software, and databases that generate training experiences with powerful realism. Equipe is using its software, built on SGI IRIS Performer™, to create a highly detailed simulation database of nearly three-quarters of a terabyte. It draws from a broad range of real-world sources, including digital terrain geometry data, photographic texture data from LANDSAT color imagery, and aerial photography. Some elements of the scene, including airfields and target areas, are displayed in two-meter resolution. This is the first time high-level geospecific data has been applied to such a large geographic area—covering the majority of Wales. As a result, pilots will be able to simulate a complete sortie, navigating from their knee maps.

Andrew Martin, lead of Reflectone Visual Systems Design, commented that "Onyx technology has unleashed a new generation of visual systems. Pilots can turn their heads and see aircraft behind them. And the enormous amounts of texture make things

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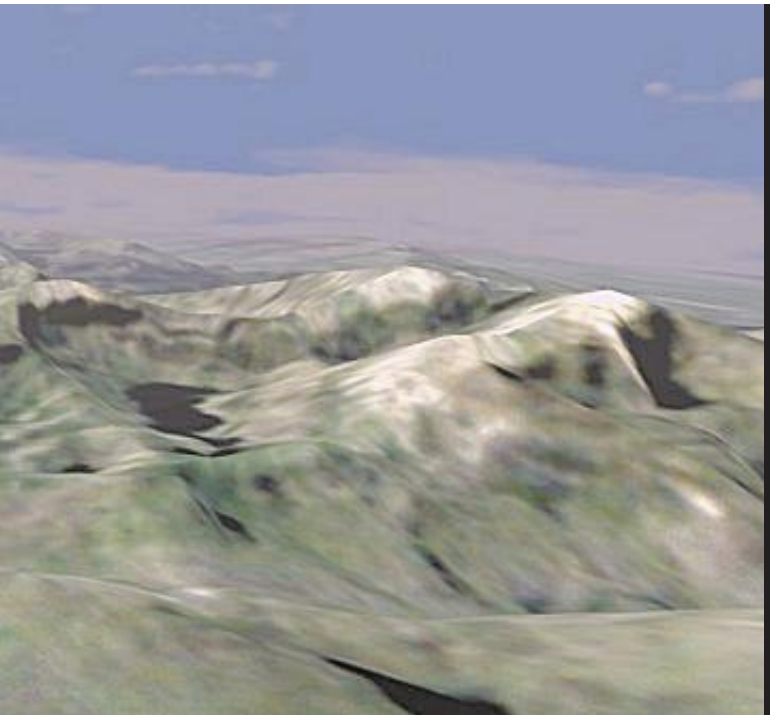

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Fully Interactive Training

The instructor sits at a four-screen console, powered by three Silicon Graphics® O2® workstations, to monitor the mission with a plan view of the tactical scenario or a view from the cockpit. He can reposition the Hawk or the target aircraft, control elements of the visual scene, and inject malfunctions into the scenario. He can waive transit flights and take pilots directly to the weapons range. He can choose weather and ground conditions. He can switch runway lights on or off. He can inject target aircraft flying programmed routes or take joystick control to turn himself into a role-playing wingman or adversary. The simulators are linked by Ethernet, so the instructor can control a mission in which the pilots in both simulators fly in the same environment or even engage in head-to-head combat.

After the sortie, the instructor meets with the pilot (or pilots) in the debriefing room, where a Silicon Graphics Octane system displays selected parts of the mission. The pilot can review his successes and failures. Instructors can pull up schematic drawings of the aircraft to explain simulated mechanical failures.

"The goal," Reflectone Programme Manager Brian Read stated, "is to conduct as much training in the simulator as possible. There are some things you can't do in the simulator. But you can fail an engine or cause a total electrical failure or a hydraulics leak—which you certainly wouldn't do in the aircraft."

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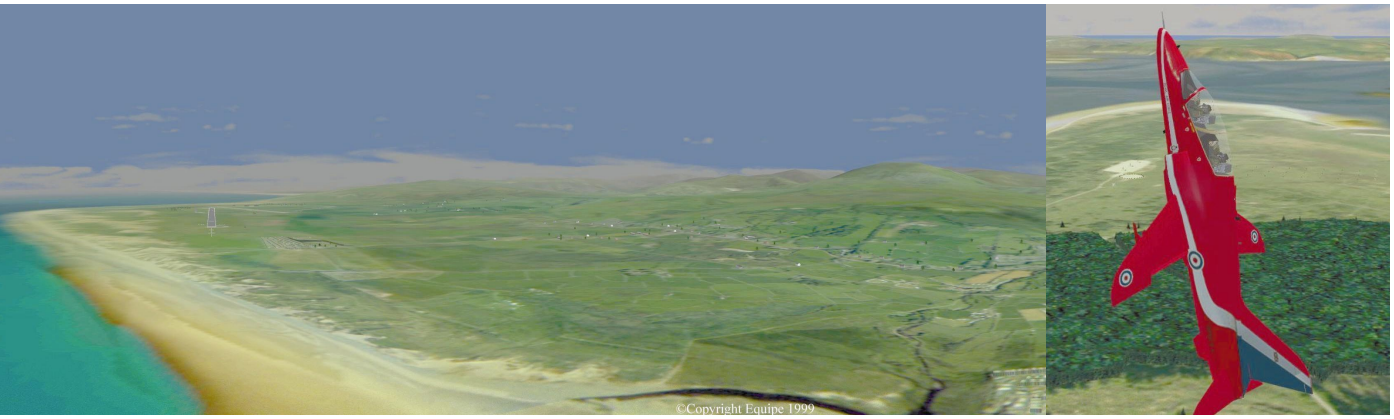
—Terry Burns
Managing Director
Equipe



The greatest benefit of the HSTF program, however, is an economic one. It simulates every aspect of flight training that would normally be done in a Hawk aircraft, from cockpit orientation to instrument flight. By reducing the number of hours student pilots need to spend in the aircraft, it saves the costs of aircraft operation and maintenance, including fuel and ordnance, reduces flight risk to new pilots, and reduces the impact of training on the environment.

Graphics and Compute Power: Exclusively SGI

When development of HSTF began, selection of systems for image generation was a high priority. "The only things that could match the Onyx2 system were proprietary futureware," said Martin. "Onyx2 is a commercial off-the-shelf system (COTS) and much less expensive. And one of the great things is, because they're building blocks, we were able to buy no more than we needed for development at the onset and buy the remainder 18 months later. That can make a significant difference, financially."

Reflectone, a longtime SGI provider, has recently delivered another large SGI system to the UK Ministry of Defence. Reflectone General Manager Bob Ison stated, "Our partnership with SGI has been an enabling factor in our success. Most simulator manufacturers have a mix of different systems. We've got SGI throughout, which means one maintenance contract, one supplier."

Equipe worked with SEOS Displays and SGI to create its breakthrough dome technology for Saab Aircraft. That success led to the HSTF contract with Reflectone. "We've been in the visual simulation turnkey business since 1994," said Equipe Managing Director Terry Burns. "And we believe in scalable, upgradable COTS hardware. Saab was Generation One, Hawk is Generation Two, and we are bidding Generation Three today. And because of SGI they are all upwards-compatible.

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