Success Story

"We've been using SGI graphics supercomputers since 1996 to help us create both display simulation and exterior image generation."

—Andreas Ladell,
Saab Aerospace Systems Engineer

The Challenge

- Create the first fourth-generation fighter aircraft and do so under strict Swedish government cost constraints
- Develop a flight simulator that envelops a test pilot in a fully immersive real-time environment virtually indistinguishable from the actual world
- Create a system to test and rapidly reconfigure digital cockpit controls as well as pictograms viewed through a helmet-based head-up display

The Solution

- Create a flight simulator powered by an SGI® Onyx® family graphics supercomputer with InfiniteReality4™ graphics
- Deliver 1GB of dedicated 3D texture memory to create and rapidly reconfigure virtual controls, pictograms, and real-time external environments accurate to an effective resolution of one meter

The Result

- Saab Aerospace is first to market with the world's most-advanced combat aircraft
- By being able to rapidly alter instrument configurations, Saab shaves development time while creating the best human-machine interface
- The Gripen's instruments can be rapidly tested and altered as new technologies are developed, extending the life of the program

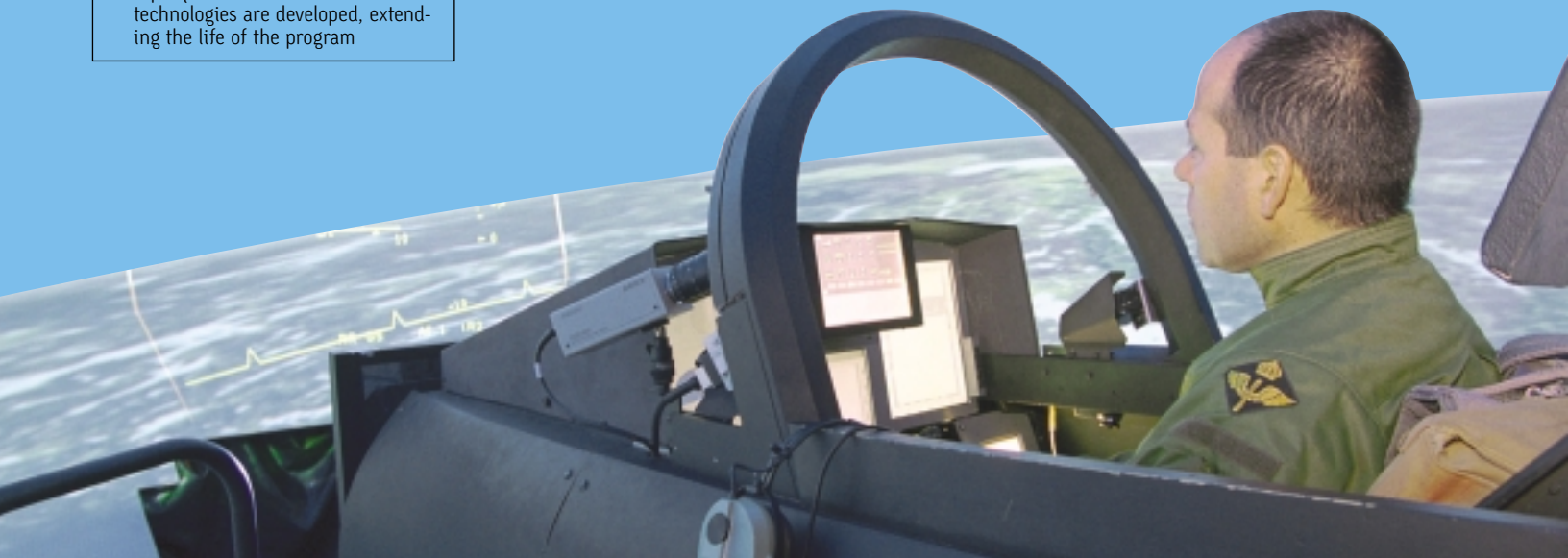
Saab's Gripen: Creating the World's First All-Digital Combat Aircraft

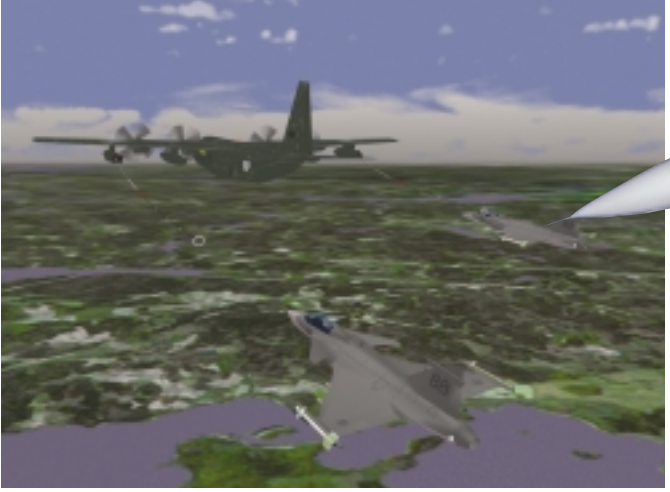
When creating a high-technology aircraft designed to secure a nation's borders, one needs to have a budget sufficient to do the job. Yet, before Saab Aerospace could begin development of the supersonic Gripen, the world's first fourth-generation combat aircraft, it received a serious fiscal challenge from the Swedish government.

When the Gripen project began, production and development costs were rising exponentially. One of the Swedish government's conditions for ordering a new Swedish fighter was that this trend be broken. The Gripen has met or surpassed all the original requirements in this respect. It also has significantly lower life-cycle costs than those of older competitor aircraft. With the Gripen, Saab Aerospace has developed a highly cost-effective defense system to compete on the international market.

As one way of helping reduce expenses while maintaining a wide technological advantage over the competition, Saab is teaming with SGI, amongst other partners, for the tools needed to develop a leading-edge cockpit. Using an advanced flight simulator powered by an SGI Onyx family graphics supercomputer with InfiniteReality4 graphics, Saab is now able to configure, test, and then quickly alter computer-generated virtual controls while a pilot maneuvers the simulator through a highly detailed virtual world rendered in real time. The goal is to create a complete set of instruments that instantaneously gives the pilot the information he needs and then allows him to set his course of action without delay.

The Gripen system is Saab Aerospace's most important product and the first fourth-generation combat aircraft in operational service. Gripen is designed to meet the demands of all current and future threats, while at the same time meeting strict peacetime requirements for flight safety, reliability, training efficiency, and low operating costs.

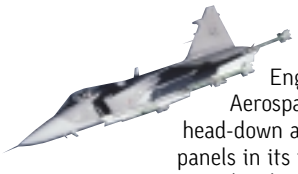




Earlier-generation aircraft were individually designed for air-to-air, air-to-ground, or reconnaissance roles. But the Gripen is built around a completely digital infrastructure, meaning that it is not only multi-role—able to perform all three types of missions—it is also swing-role. Simply by pressing a few buttons, the pilot can reconfigure the Gripen's systems in flight for it to be able to operate in more than one role during the same mission.

This digital infrastructure also means that the Gripen system can be continuously updated and developed. The possibility of cost-effectively incorporating upgrades means that the aircraft can always be kept modern to cope with emerging threats and new customer requirements.

With an all-digital cockpit, pilots control systems with their hands on the throttle and stick, as well as with buttons around the head-down displays. Data can also be combined from multiple sources, such as another aircraft or ground reconnaissance, and then shown simultaneously on a single display. In addition, the pilot has both a traditional wide-angle head-up display and a helmet-mounted display, which shows a variety of symbology indicating the presence of visual objects. The pilot not only sees the icons but simultaneously looks through them at the visual terrain.



The SGI Onyx family visualization system powers the VAPS software suite from Montreal's Engenuity Technologies. With VAPS, Saab Aerospace can test the human-machine interface of head-down and head-up displays by creating virtual control panels in its flight simulator and various pictogram designs in its head-mounted helmet display, both of which can then be changed at will. The SGI Onyx family visualization system is also used to create the simulated external environments, highly detailed aerial views of the surrounding countryside that are virtually indistinguishable from the real world and generated in real time. By "flying" through this simulated environment, pilots test the efficacy of both displays.

"We've been using SGI graphics supercomputers since 1996 to help us create both display simulation and exterior image generation," noted Andreas Ladell, Saab Aerospace systems engineer. Ladell considered other companies' solutions to replace his existing hardware, but chose SGI. "Not only was SGI technology priced appropriately, but with other suppliers, we would have been forced to use a closed system.

Using SGI's open IRIX operating environment, we were able to do our own software development and create just the right tools for the job.

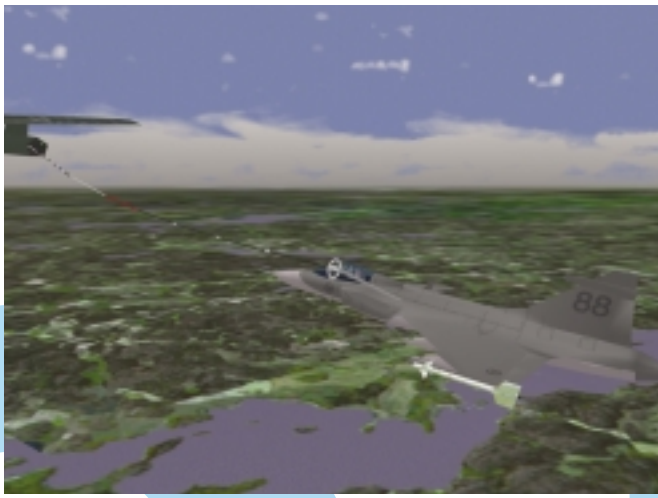
"Thanks to the 1Gbyte of dedicated 3D texture memory in our new Onyx system, we'll be able to create a real-time, fully textured environment and increase our resolution from two to less than one meter over large areas," Ladell said. "That's important to enable simulation of flight at very low altitude of 100 feet, an essential capability of the Gripen."

Saab test pilots will soon be working in flight simulators, powered by SGI® technology, that offer highly detailed, real-time images of the terrain around the Saab Aerospace factory, as well as the surrounding countryside and even large parts of Sweden. The images are generated using software mapping and database tools developed by Saab, which run on the Onyx family system. "With the new SGI solution, we're limited only by the amount of mapping data we can acquire, but not by our ability to process it," Ladell said.

Saab Aerospace has delivered 120 Gripen aircraft to the Swedish Defence Materiel Administration (Försvarets Materielverk), and others have been purchased by the governments of Hungary and South Africa. Gripen has also been selected to meet the national, NATO, and European defense needs of the Czech Republic.

Yet the work doesn't stop. With its digital infrastructure, the Gripen system will be continuously updated and developed, reducing the life-cycle costs as compared with those of older competitor aircraft.

"As new weapons and new sensors are developed, we'll be able to integrate them into the next generation of the aircraft and create the new control panels to operate them, quickly and economically," said Ladell. "SGI technology, as well as innovations from our other partners, has definitely given us a leg up over the competition."



sgi®

Corporate Office
1600 Amphitheatre Pkwy.
Mountain View, CA 94043
(650) 960-1980
www.sgi.com

North America 1(800) 800-7441
Latin America (52) 5267-1387
Europe (44) 118.925.75.00
Japan (81) 3.5488.1811
Asia Pacific (65) 771.0290

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