Success Story

SGI behind Lockheed Martin and Pratt & Whitney JSF Award

"SGI is proud of the role it has played in helping Lockheed Martin to create the most combat-capable, efficient, and lethal family of multirole strike fighters in the history of military aviation. The pilots who will fly this low-cost, next-generation fighter aircraft will benefit from its superior performance."

—Bob Bishop, Chairman and CEO, SGI.

On October 26, 2001, the Pentagon awarded the Joint Strike Fighter (JSF) contract to Lockheed Martin. The win signaled a go-ahead for the company to produce an initial 22 aircraft as part of a U.S. Department of Defense System Development and Demonstration (SDD) phase.

To power the JSF aircraft, the Pentagon selected the Pratt & Whitney® F135 engine, a derivative of the company's F119 engine now used in the military's F-22 fighter aircraft. It was an equally big win for Pratt & Whitney, the world's leading manufacturer of gas turbine aircraft engines.

Instrumental in helping both Lockheed Martin and Pratt & Whitney land the JSF contract were SGI™ advanced visualization and high-performance computing (HPC) technologies. Throughout the design selection process, Silicon Graphics® Onyx® family systems, SGI™ Origin® family servers, and optimized modeling software used by these two leading aerospace companies enabled them to reduce costs, minimize risk, and maximize the accuracy and performance of their respective designs.

"Our JSF approach [enabled by SGI visualization technology] will radically reduce the cost of sustaining U.S. airpower by ensuring affordability during SDD, production, operations, and support and by achieving operational excellence throughout the program," said Tom Burbage, executive vice president and general manager, Lockheed Martin JSF Program.

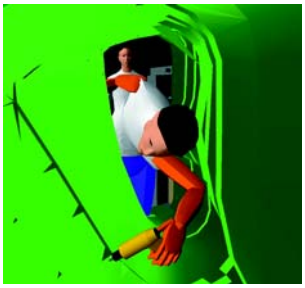
The Road to Success

In 1994, the U.S. Air Force, Navy, and Marine Corps, together with British allies, announced a mission to develop and field an affordable next-generation strike fighter aircraft—the Joint Strike Fighter. Lockheed Martin was one of two finalists selected to vie for the $200 billion JSF program, which would eventually create a fleet of some 3,000 aircraft.

JSF program requirements stated that the aircraft were to be built around three distinct design specifications —conventional takeoff and landing, carrier variant, and short takeoff/vertical landing. Additionally, all three designs were to share key high-cost components, including propulsion systems, and have a "cost commonality" of 70% to 90%. The goal: realize significant cost savings in the development, manufacture, and maintenance of the aircraft.

With affordability and performance issues at the core of the JSF program, Lockheed Martin and Pratt &

Whitney chose to rely on SGI advanced visualization and HPC technologies, respectively. Powered by SGI Onyx family systems and SGI Origin family servers, the technologies helped both companies generate higher quality, lower cost, and more competitive designs that could be simulated, prototyped, and visualized in 3D in their entirety before any assembly began.



Virtual Development, Real Collaboration

Lockheed Martin addressed JSF design requirement issues through a Virtual Product Development Initiative (VPDI), a program in which everyone involved in the JSF project had direct access to all relevant information and the most current design iteration.

Combined, the VPDI and JSF programs utilized over 450 SGI workstations to run CATIA®, Deneb, and EAI applications as well as several Silicon Graphics® Onyx2® systems and SGI™ Origin® 2000* servers spread across multiple disciplines. SGI visualization tools enabled project teams to review, rework, and reintroduce optimized component designs while the project was still in a virtual state, thereby avoiding costly and untimely design changes in the latter stages of aircraft development.

According to Mary Ann Horter, program manager for VPDI, Lockheed Martin, "We have focused on eight key high-payoff initiatives, which include a combination of process change, hardware, and software. In some areas we are seeing reductions in cycle time and cost savings in excess of 70% to 80%. Virtual simulations have been key components in helping us meet these targets."

Testing Flightworthiness

Because the JSF will use a higher percentage of composite materials than previous military aircraft, Lockheed Martin used SGI visualization technology in conjunction with its own Laser Ultrasonic Technology system to verify, part for part, the material flightworthiness of the JSF. According to Horter, "In addition to reducing test cycle times by more than 90%, this cutting-edge technology virtually eliminates setup, simplifies operator interface, and provides design feedback to enhance affordability."

"SGI is proud of the role it has played in helping Lockheed Martin to create the most combat-capable, efficient, and lethal family of multirole strike fighters in the history of military aviation. The pilots who will fly this low-cost, next-generation fighter aircraft will benefit from its superior performance," said Bob Bishop, chairman and CEO, SGI.

Propulsion Optimization by Design

In its efforts to secure the JSF win, Pratt & Whitney utilized HPC technology for finite element structural analysis and computational fluid dynamics (CFD) modeling software to ensure accuracy and performance in the engine design.

SGI has a long history as a supplier of HPC solutions to various Pratt & Whitney divisions. SGI HPC and solver technology has enabled Pratt & Whitney Canada to develop effective simulation models of mechanical, thermal, and aerodynamic loads on engine components and systems. The company has also used the technology to move beyond traditional modeling disciplines to those such as acoustics or even multidiscipline interaction and optimization.

According to Bernard Proulx, director of Component Engineering at Pratt & Whitney Canada, "We see SGI high-performance computing as key to the successful development of full engine simulation and modeling capabilities as we reach our goal of a virtual engine design environment."

Proulx reports that "[SGI HPC and solver technology has improved] simulation turnaround performance as much as 20-fold, enabling our analysts to increase their modeling resolution for improved accuracy." In short, modeling a full-size engine on SGI systems and using the models for CFD evaluation will reduce engine-development costs, allow for the direct transfer of engine design information to manufacturing, and significantly reduce performance certification time.

At present, Pratt & Whitney Canada employs SGI Origin 2000 and SGI™ Origin® 3000 series systems, with hundreds of MIPS® processors and more on the way.

Visualizing the Future

Advanced visualization and high-performance computing technology solutions from SGI enable collaborative decision making, expedite insights to complex problems, and streamline project analyses. From advanced 3D modeling and simulation, digital prototyping, and digital manufacturing to group visualization, SGI transforms product-development processes, thereby enabling the aerospace industry to arrive at design optimizations in less time, experience enormous cost savings, and reduce the time-to-market for new aircraft.

*SGI Origin 2000 is now marketed and sold as the SGI™ 2000 series.

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

© 2001 Silicon Graphics, Inc. All rights reserved. Specifications subject to change without notice. Silicon Graphics, Onyx, Onyx2, and Origin are registered trademarks and SGI and the SGI logo are trademarks of Silicon Graphics, Inc. MIPS is a registered trademark of MIPS Technologies, Inc. used under license by Silicon Graphics, Inc. All other trademarks mentioned herein are the property of their respective owners. Engine image courtesy of Pratt & Whitney. Plane image and Mechanic image courtesy of Lockheed Martin.

3191 (12/2/2001)

J13228