

SEPTEMBER 2006

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Collaborative design
pushes F-35 aircraft
development to
new heights

Joe Fowler
Director of PLM
deployment
Lockheed Martin



Photography by Marc Berlow

Joe Fowler, Lockheed Martin's director of product life-cycle management deployment, says successful collaboration is a business process—not just a technology function.

Before selecting **Lockheed Martin** to manage the largest military aircraft program in U.S. history, the Department of Defense wanted to put penalty clauses in the agreement because the Fort Worth, Texas-based contractor planned to work with other companies on the aircraft's design.

"We were able to convince them that having design partners would not negatively impact the program," says Joe Fowler, Lockheed Martin's director of product life-cycle management (PLM) deployment. "But even we didn't envision collaborating on such a broad scale. We thought there would be three primary collaboration partners. Now, we are working with roughly 35 partners that design some portion of the aircraft; and hundreds—if not thousands—of suppliers that build parts from design prints."

These companies are building the F-35 Lightning II. This supersonic, radar-evading aircraft—also known as the Joint Strike Fighter—has been designated the next-generation fighter for three branches of the U.S. military, as well as those of several allied countries.

The \$40.5-billion program is in the system-development and demonstration phase, with the first of 23 test aircraft already assembled and scheduled to begin flight testing by the end of the year. And Lockheed Martin is confident the plane will perform well in those tests.

"This plane has gone together better than any we have built," Fowler says. "The assembly is so accurate that our

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Collaborating on product designs speeds time-to-market, improves quality, boosts revenues

By Sidney Hill, Jr.
Executive Editor

starting point for fit rejections—[incidents in which parts designed to join together don't mesh properly]—is much better than what other planes have achieved after years in service, and with fit problems addressed.”

Fowler attributes this degree of accuracy to Lockheed Martin's 3D design modeling practices and the widespread design collaboration—both of which are driven by state-of-art PLM software tools. The central piece of the Joint Strike Fighter's collaborative network is an application called Teamcenter from UGS.

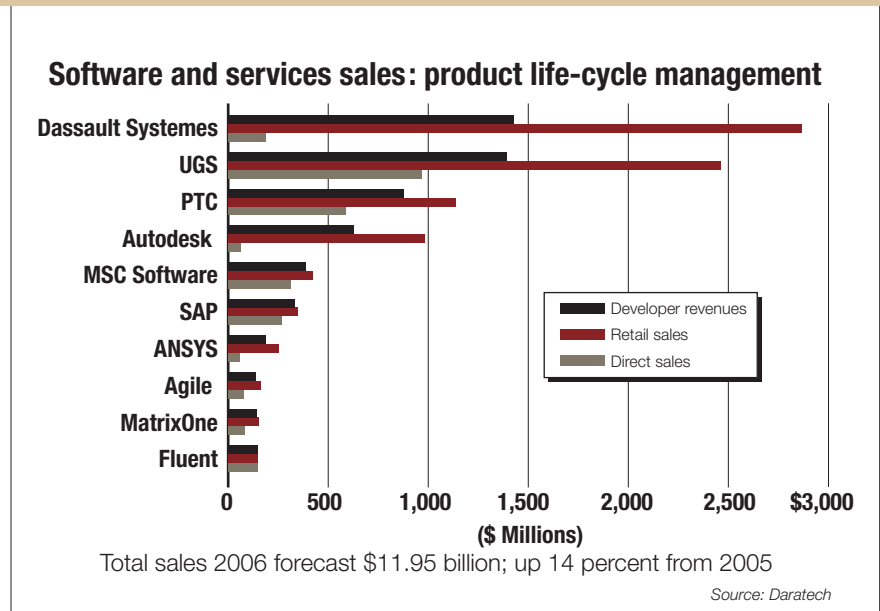
Secure data sharing

An instance of Teamcenter is located at Lockheed Martin's Fort Worth headquarters, where it holds all of the information related to the F-35's design. The system contains a number of features that allow Lockheed Martin to grant partners easy access to data while also ensuring that the data always remains secure, accurate, and up-to-date. For instance, a rules feature enables an administrator to set parameters for what data particular users can access, and what they are allowed to do with that data once it's retrieved.

Fowler says a replication feature was instrumental in Lockheed Martin's selection of Teamcenter because “it allows us to move files between sites online, in real time. I can be anywhere in the world and see current data on this system.”

That's important to the F-35 program because, as Fowler notes, “When you do things like interference checking—to see if there are potential conflicts between the parts you are building and other parts of the airplane—if you don't have current data, you're wasting your time.”

Industry analysts say there is a growing need for sophisticated PLM tools, and specifically those that support design collaboration. Cambridge, Mass.-based **Daratech** estimates manufacturers spent \$10.4 billion on PLM



The need to collaborate on product designs is among the factors driving strong growth in the market for PLM software and services.

software in 2005. That's a 13-percent increase over 2004, and Daratech expects that figure to rise another 15 percent—reaching \$11.95 billion—by the end of this year.

Globally dispersed product-development teams, like the one assembled for the F-35 program, are primary drivers of this trend.

Lockheed Martin, the prime contractor on the F-35 program, is building the aircraft's forward fuselage and wings in Fort Worth. **Northrop Grumman** is constructing the center fuselage in Palmdale, Calif., and **BAE Systems** is manufacturing the aft fuselage and tail in Sarnesbury, England.

Each of these lead partners relies on an extensive worldwide network of component suppliers. Northrop Grumman and BAE ship completed portions of the aircraft to Fort Worth, where final assembly of the plane takes place.

During all phases of design, manufacturing, and assembly, Lockheed Martin manages all collaboration between partners via the Teamcenter application. Lockheed Martin simplified the collaboration process somewhat by insisting that all design partners use the CATIA CAD package from **Dassault Systemes**. That means files don't have to be translated from various formats

before they can be shared. Still, the sheer size of many of the files—and the need for multiple revisions during the design process—makes collaboration challenging.

Teamcenter is configured to create new copies of any files that are changed, and immediately transmit those copies to servers at the major design partners' facilities. When a principal partner wants to view a file, they are given the replicated version that's stored on their local server. If they change the file, the new version travels to the central server in Fort Worth, where it's stored, replicated, and distributed back to the principal partners' servers.

Partners not authorized to change files—such as build-to-print suppliers—can tap directly into the central server when they need to retrieve information. The automatic replication feature ensures these partners are always seeing current data.

“We are replicating more than 100 gigabytes of data a week across 14 locations around the world,” Fowler says. “Typically, when a company implements a PLM solution, they do nightly or weekly file transfers. We're doing it real time. As soon as I change a design, I'm sharing it with everyone authorized to see it. And that applies to more than

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just CAD models. It applies to data on stress analysis on the airplane, and even changes to the software components on the airplane.”

Clear translations

Ontario-based **R&W Metal** has only about 100 employees, but its need to collaborate on product designs is just as critical as Lockheed Martin’s.

“We serve both the automotive and construction industries,” says Jim Fleming, engineering manager at R&W, which makes racks for storing and transporting automotive components and manufactured glass. “The real design collaboration issues tend to arise on the automotive side.”

R&W found itself squeezed between its larger automotive customers—who create designs primarily in Dassault’s CATIA program or the NX package from UGS—and its smaller suppliers,

which use a variety of PC-based CAD systems. “We used to ask our customers to translate files to a neutral format such as STEP or IGES, but there were always problems,” Fleming says. “I spent a lot of time repairing models after they had been translated.”

Roughly three years ago, R&W’s CAD software supplier, **Kubotek USA**, embedded an automatic translation feature into its KeyCreator package, and R&W’s collaboration problems were solved.

“We now tell customers we can read CAD in files in their native format,” Fleming says. “That makes them happy because it saves them work. Every time there’s a revision to a part, that’s one less translation they have to worry about.”

On the supplier side, says Fleming, “We simply ask what CAD system they are using, and we can give them data

in the format that best fits their needs. KeyCreator can kick out so many different types of formats that we have the flexibility to deal with all of our suppliers on their terms.”

There are internal benefits as well. “KeyCreator also comes with a viewing application that allows nonengineering staff to view CAD models,” Fleming says. “They can do things like take screen shots to create marketing materials.”

While each of these companies found the right software solution for its design collaboration needs, Lockheed Martin’s Fowler cautions against believing that successful collaboration is a function of technology alone.

“This is a business process,” he says, “and the hardest part was changing people’s minds about the way they did business. The culture at virtually every site involved in this process had to be modified to fit this model.” ■

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