

Manufacturing Streamlining the airframe fastener management process

Thousands of pieces of unmanaged fastener data are generated in the airframe design-to-manufacturing process. Information based on this data must be delivered accurately and completely into assembly sequences aligned with the associated manufacturing systems to build the airframe. The tasks necessary to define and communicate this information are both tedious and complex.

The development team must communicate design information to manufacturing engineers so they can plan the successive assembly states that the airframe goes

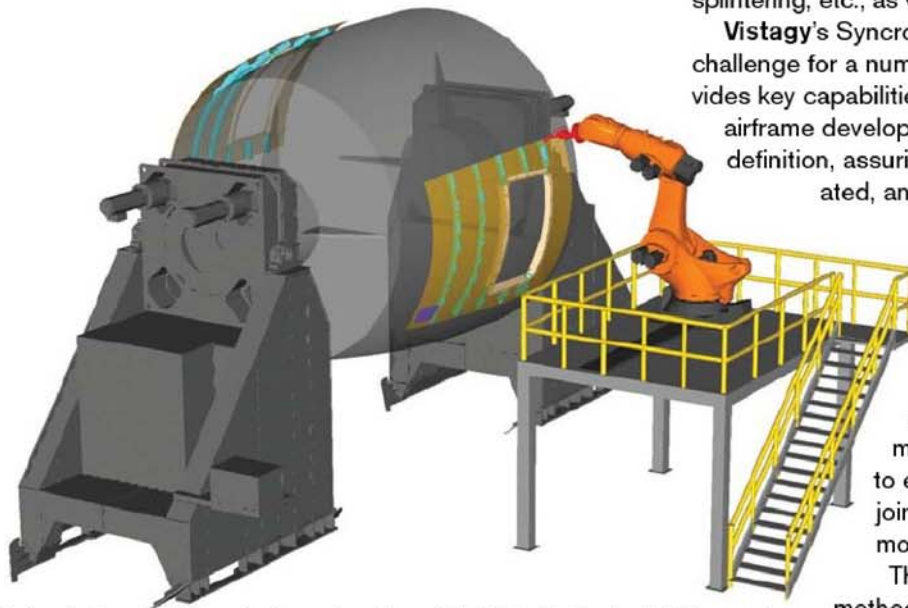
through while effectively managing production in spite of the huge number of fasteners in these designs (and the volume of information associated with them).

This challenge was difficult enough with traditional aerostructures, but the move toward composite aerostructures makes it even greater because of the interactions between composite designs and the assemblies in which they reside. And, given the fragility of composites, there needs to be precise control of speeds and feeds in the drilling process to avoid the possibility of delamination, splintering, etc., as well as to ensure high throughput.

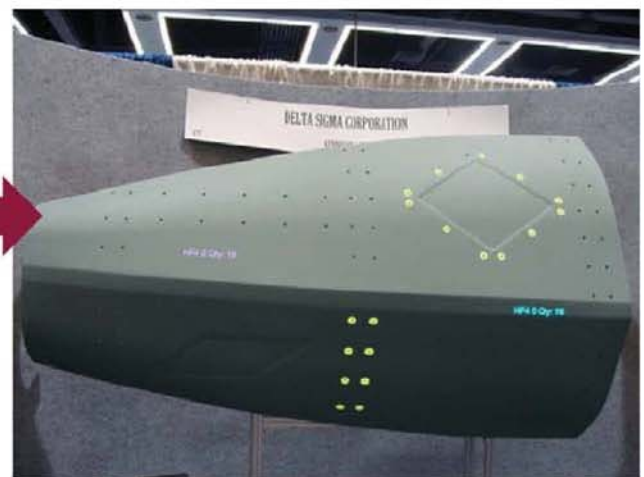
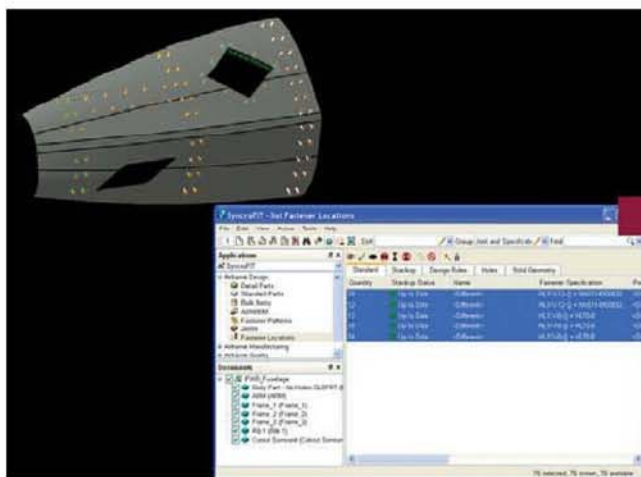
Vistagy's SyncroFIT is deployed as a solution to this challenge for a number of airframe manufacturers. It provides key capabilities for addressing the complexities of airframe development by simplifying the process of definition, assuring that a complete definition is created, and streamlining the communication of fastener data to manufacturing systems.

Aircraft are highly efficient structures, meaning the joints in the assemblies must carry loads that are as equally distributed as possible. To achieve this, fasteners must be installed within tight tolerances to ensure there is no mismatch in the joint that would cause one fastener to be more highly loaded than another.

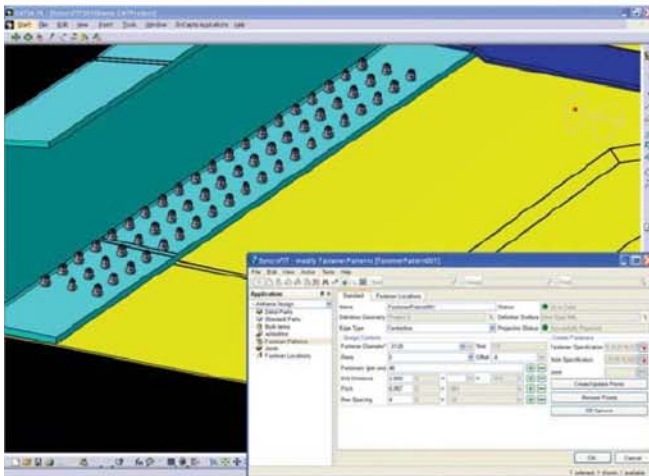
This requires specialized manufacturing methods. There are many rules associated with the design of fastened joints, with some unique qualities specific to airframe design.



Vistagy's SyncroFIT works in conjunction with CGTech's Vericut Drilling and Fastening NC programming and simulation solution to enable a direct feed of engineering data to drive automated drilling and fastening systems.



On the left is an aircraft fuselage panel with its fastener engineering completed with SyncroFIT. On the right is the same fuselage panel with the fastener locations projected using Delta Sigma's ProjectionWorks system to guide the installation and verification of the assembly. SyncroFIT provides a direct interface to all the necessary information to drive the ProjectionWorks system with the push of a button.



The Fastener Pattern capability in SyncroFIT 2011 incorporates design rules to position fasteners to satisfy edge distance, pitch, and tangent edge requirements while enabling a concurrent approach to part and assembly development.

These include distance to edge, fastener pitch distance, and acceptable grip length ranges. Finally, the holes that the fasteners go into must be defined with special finish operations and variations in assembly states for the design to be manufactured effectively.

The amount of information associated with this very complex kind of design is enormous. Providing an efficient means of transferring data in the correct format to manufacturing systems is a major obstacle to cost-efficient production.

Previously, the only solution was manual and tedious: grip lengths and edge distances were manually checked, fastener locations were laid out manually, and generating work instructions often led to errors and oversights.

SyncroFIT streamlines this process by enabling engineers to develop a precise definition of the assembly that is specific to the airframe development process and then uses this definition as a basis for building assembly states that map to the manufacturing work cells where the assembly process takes place. The specialized information relating to fasteners and holes must then be transferred directly to automation equipment and to assembly technicians through the use of projection equipment to indicate installation steps via visual work instructions.

SyncroFIT enables the easy definition of fasteners both in terms of specification and layout. It also checks for the ability of machine tools to install the fasteners and conducts the typical checks of fastener pitch and hole-to-edge distances, assuring design rules are met.

After the design is released to manufacturing, the system communicates the specifications and locations of holes and fasteners seamlessly to the automated hole-drilling and fastener-installation systems. This information is grouped by the assigned assembly state, making the

Reduce time spent searching for your test data



Image courtesy of Lockheed Martin

See why leading aerospace OEMs select nCode Automation to maximize their investment in testing:

- ▶ **Find** - search, query and generate reports from terabytes of engineering data
- ▶ **Automate** - analyze, trend and understand using server-side processing
- ▶ **Organize** - keep associated documents, images and video with the data
- ▶ **Share** - collaborate via secure web access from anywhere in the world.



Download our white paper to learn how Lockheed Martin uses nCode at:

www.hbm.com/ncode | ncode@hbm.com



task of process planning vastly more efficient. Typically, this information is consumed by off-line programming systems for simulating and programming auto-drilling and fastening machines before being sent to the machine controllers that guide the drilling machines. Having the fastener data grouped appropriately for the programming systems makes the process of planning more straightforward because it captures the logic of how the manufacturing engineer thinks.

This is complemented by optical projection assembly systems that enable manufacturers to install and verify thousands of fasteners quickly without using stacks of drawings and manuals. It avoids the old paper-based approach to the creation of manufacturing planning and work instructions. The net result is a faster, more accurate process that achieves higher measures of quality by removing ambiguity from the overall airframe assembly process.

John O'Connor of Vistagy Inc. wrote this article for *AE*.

Simulation

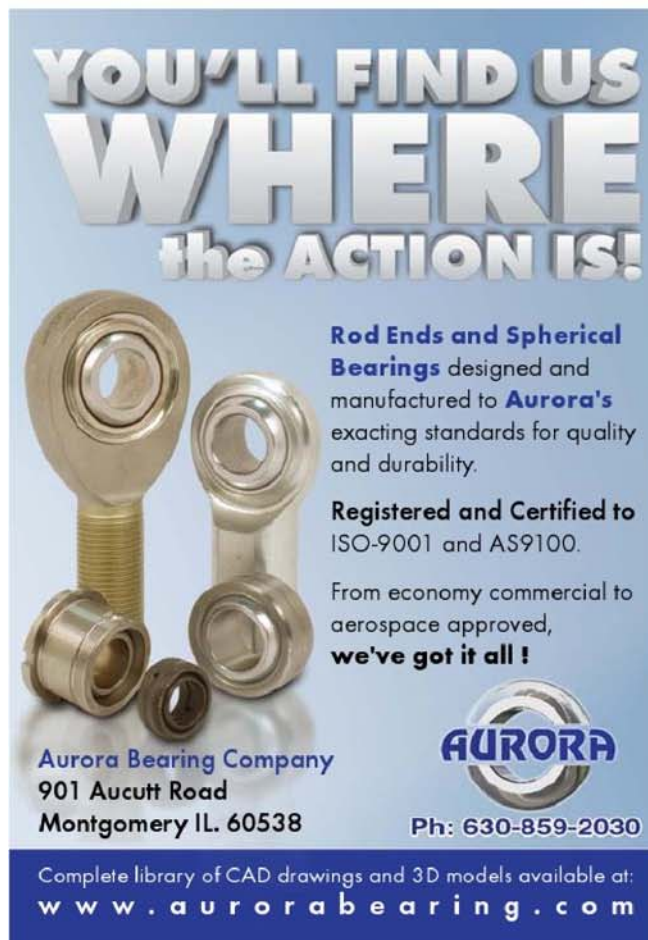
Bombardier launches PLM for new aircraft programs

"Our PLM maturity was not where we wanted it to be," explained Andrea Polatos, Director of Information Technology for **Bombardier Aerospace** to *Aerospace Engineering*. Under her guidance, the company recently completed an upgrade to its Product Lifecycle Management (PLM) infrastructure around CATIA V5 from **Dassault Systèmes**. Three new aircraft programs prompted the investment, in particular the CSeries regional jet as well as the **Learjet 85** and the **Global 7000** and **8000** programs. CATIA V5 was chosen as the product development standard for all three programs. "The CSeries program is the largest program this company has undertaken," she noted, in both program scope as well as physical size.

Like many of today's aircraft programs, it is also complex, requiring the collective talent of engineers worldwide. She explained that the complex outsourcing strategy for the CSeries had a big impact on the PLM transformation. "We needed to incorporate design centers in Montreal; Belfast, Ireland; and India—all over the world," she stated. "Doing that within Bombardier was challenging enough, but now we needed to exchange that design data with partners and suppliers." Suppliers and partners working in their own design environments and transferring files were no longer going to cut it. File transfer required manual reconciliation, errors were hard to find, or were found too late in the process when it was more expensive to correct. The process was slow, meaning fewer design iterations. "It was cumbersome to work that way," she stated.

In response, a key element of the new implementation is a centralized Digital Mockup (DMU) with real-time sharing of work-in-progress design data. While protecting intellectual property and conforming to export control regulations, the DMU needed to share that data in real time, 24/7. They defined an Overall Engineering Reference model that is the single source of information. This includes work packages as well as design data of all suppliers and partners. As she described it, this federated view of the complete digital mockup was available to Bombardier, but one supplier could not see what another was providing. This protects intellectual property and keeps them compliant with export controls.

The watchword for the new system is Remote Design, as Polatos described it. In this paradigm, major structural and system suppliers perform design and approval activities remotely in the Bombardier system, rather than in their own separate environments. A centralized, configured DMU, located in and controlled by Bombardier, "ensures quality and, specifically, that there are no conflicts



**YOU'LL FIND US
WHERE
the ACTION IS!**

Rod Ends and Spherical Bearings designed and manufactured to **Aurora's** exacting standards for quality and durability.

Registered and Certified to ISO-9001 and AS9100.

From economy commercial to aerospace approved, **we've got it all!**

Aurora Bearing Company
901 Aucutt Road
Montgomery IL. 60538
Ph: 630-859-2030

Complete library of CAD drawings and 3D models available at:
www.aurorabearing.com