

Cessna Aircraft Company

Cessna captures corporate knowledge with CATIA V5



Overview

■ Challenge

Reduce design cycles, optimize quality and promote standardization and re-use of Cessna's intellectual property.

■ Solution

Cessna used the Knowledgware technology built into the CATIA V5 design solution to create standardized, re-usable templates for families of commonly used sheet metal parts.

■ Benefits

Cessna anticipates a minimum 25 percent reduction in design cycle time for each templated part, multiplied by thousands of uses per design.



"We wanted to get consistency from part to part, and CATIA V5 Knowledgware is helping us accomplish that by building a lot of our business knowledge into each template."

Julia Waterbury, Senior Engineer,
Cessna Aircraft Company

80 years of knowledge with a single click

Cessna Aircraft Company began nearly 80 years ago as a small aircraft company with a big idea – to build a monoplane with no struts or braces. Today, Clyde Cessna's cantilever design remains the industry standard, and innovation, ingenuity and initiative remain the company's hallmarks.

Cessna has built almost 190,000 airplanes to date, and nearly half the planes flying today are Cessnas. The company's 5,000 delivered Citations comprise the world's largest fleet of business jets. The newly certified Citation Mustang was the first aircraft in a new class of entry-level jets to achieve certification. Using the advanced technology of CATIA V5, the Cessna team took the Mustang from concept to certification in four years.

With its emphasis on innovation, it's no surprise that Cessna is a long-time user of Product Lifecycle Management (PLM)

solutions from Dassault Systèmes, starting with CATIA V2 more than 20 years ago. Today Cessna uses CATIA V5 for design and ENOVIA VPLM for management of geometric work-in-process data. This has enabled Cessna to improve processes, automate repetitive tasks and change sequential development activities into concurrent ones, reducing cycle times and delivering better airplanes at lower costs. Cessna's PLM processes now extend from initial concept through Design and into Manufacturing, where 3D CATIA geometry is used to generate tooling early in the development cycle.

Over the years, Cessna has adopted a process of PLM evolution to take advantage of the latest technology on new aircraft programs without disrupting established ones. So when the company first adopted CATIA V5, it didn't try to leverage all of the software's rich functionality right away. Initially, Cessna used CATIA V5 exclusively to build geometry. Later it began using CATIA's





“We’ve been able to take 80 years of airplane development knowledge and build that into CATIA V5 design tables that the engineers can use again and again.”

Jim Strawn, Engineering Specialist,
Cessna Aircraft Company

relational design capabilities, which allow a designer to take existing geometries and change the parameters to create new parts. Only recently has the company begun to experiment with CATIA V5 Knowledgeware, which is used to capture engineering knowledge, rules, and best practices to ensure that parts are designed and re-used according to corporate standards, while eliminating trial and error.

Senior Designer Julia Waterbury was intrigued with CATIA’s Knowledgeware capabilities and began to experiment, using it to design routine hydroformed sheet metal parts such as brackets. “CATIA V5 has some awesome capabilities, and Knowledgeware is one I felt Cessna needed to take advantage of,” Waterbury said. “I believed that if we could master this capability, we could improve our cycle times and our quality simultaneously. You can’t even count the number of brackets in one of our planes. Why should we spend valuable time designing that part again and again, with modeling variations from one designer to the next?”

25 percent time savings on thousands of parts

Mark Thomas, Business Integration Leader for Virtual Product Definition at Cessna, saw the value in Waterbury’s experiments. “Julia was exercising the application in an area we haven’t seen many CATIA V5 users go,” Thomas

said. “We very quickly saw the potential benefits of creating and using templates and finding the processes that would make them work for Cessna.”

The goal of her work, Waterbury said, was to group sheet metal parts into different families that have common features and are used repeatedly on an aircraft. She then built a series of design templates of the different part families. Initially, she targeted simple brackets, c-channels, and wing ribs for inclusion in the template project. “The primary objective was to make morphable parts that were very intelligent and robust, but easy for the downstream user to instantiate and modify as required,” she said.

When the project is fully implemented, the company will save design time that could be put to better use – trimming at least 25% off the time traditionally spent on designing a plane’s most routine parts. But Cessna also would be assured of design consistency from one bracket or one rib to another, which drives up quality. Manufacturing, too, would benefit if an entire category of parts were designed in precisely the same way, which allows for greater consistency in tooling design and manufacturing processes.

“When the engineer’s downstream customers know that the solid model



will always be built this way and always be based off the same conventions, they can spend less time trying to figure out what the engineer did and more time building the tools and parts they need,” says Engineering Specialist Jim Strawn.

Waterbury set about collecting the company’s design knowledge and capturing it into templates, basing them on engineering formulas such as the distance that must separate a fastener hole from the edge of a bracket. “Ensuring that the edge distance is correct satisfies the design requirements set forth by the Structural Integrity group,” Waterbury said.

The templates can be used for any hydroformed sheet metal part with features that Cessna commonly uses. CATIA V5 sheetmetal solutions offers a robust set of common features, which can be outfitted with design table references based on existing company standards, facilitating easy selection of approved configurations. The 25 percent design time savings become significant when multiplied by the large number of similar part families covered by the templates and the fact that most of the parts are repeated hundreds of times in a design.

Pilot program proving its worth

To date, Cessna has developed templates for 10 families of parts, and

is researching the potential for templates for other part families. One advantage of the templates is that they apply to certain types of parts regardless of aircraft model, allowing the same templates to be used on multiple programs. CATIA V5 Knowledgeware, using Product Knowledge Template functionality, provides extensive coverage for this need.

By ensuring that standard design conventions are followed for each of the covered parts, templates also help to reduce the number of “problem worksheets” or change orders that will be generated. “The biggest improvement is in the consistency of parts, along with some of the built-in mistake-proofing techniques,” Strawn said.

Cessna is currently piloting the templates with its early adopters, ensuring that the design tables work the way they were intended to work and that there are no hidden stumbling blocks. “We aren’t in full-blown production, but we have scattered individuals who are using it,” Strawn said. “As the early adopters progress and see the value, word will get around and everyone will want to start using it. That’s when we’ll go to general release.”



“CATIA V5 Knowledgeware lets engineers think like engineers. They can think of a rib in terms of webs and flanges, rather than points, lines and surfaces, which are required only for the creation of geometry.”

Mark Thomas, Business Integration Leader,
Cessna Aircraft Company

How each business uses the efficiencies it gains is left to its executives. "When we do something like this that improves efficiency, we always try to state the business case in terms of hours saved and let the business decide whether to apply that savings to reduce the cycle time or to increase the iterations," Thomas said. "If we can eliminate routine work and increase the number of iterations, that's inherently valuable because it gives our engineers an opportunity to develop better designs."

Future applications beyond metal forming

When Cessna completes its work on creating templates for sheet metal forming, Waterbury would like to turn her attention to machined parts. Beyond that, the team members believe the technique can be applied to applications outside the airframe – for example, interior cabinetry.

They're also looking forward to upgrading to CATIA V5 R17, which has more advanced Knowledgeware solutions. The upgrade will make the template creation process easier and faster, Waterbury said.

In the meantime, however, the team is excited about the potential of Knowledgeware to continue its contribution to improved efficiency at Cessna. The real power of Knowledgeware, the team believes, is its ability to ensure that a new designer can take advantage of the company's accumulated design process knowledge as effectively as someone who has been working at the company for years, while eliminating routine work that detracts from the potential for creativity.

"CATIA Knowledgeware is allowing us to capture rules that have been developed over 80 years of experience with airplane development and to build that into CATIA V5 design tables the engineers can use directly in their models," Strawn said. "Instead of having to think about what the rules are and where to find them, they can think about the design. Instead of having to think about the geometry, they can think about the features. We think it's going to be very powerful."

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