

# Computers in engineering

## COSMOSWorks solves closet case

The **Department of Transportation** in the 1990s gave airlines several years to comply with new rules requiring all 100-passenger or larger aircraft to have storage space for one full-sized wheelchair in the main cabin. The regulation applies to any aircraft ordered and delivered since the early 1990s, or those that have had significant interior modification since then. **Northwest Airlines**, which has a fleet of 481 planes serving 900 cities on six continents, had to redesign the closets in many of its **Airbus** aircraft to meet the regulations.

Traditionally, Northwest hired outside contractors to analyze the designs for such a project to ensure they would work as planned before submitting them to the **FAA**. For this project, however, Northwest's liaison engineering staff used COSMOSWorks Professional design analysis software from **SolidWorks**, a **Dassault Systemes** company, to simulate the new Airbus closet design in-house.

"We were going to lease an application and learn how to use it for this project, or outsource the project to a consulting firm, but in both cases we'd get a one-time result and no lasting asset," said Senior Engineer Craig Mueller. "By purchasing COSMOSWorks Professional to do the closet design analysis in-house, we spent what we would have to hire an outside firm, but we gained an asset. We've used COSMOS on several proj-

ects since, which has nearly eliminated the cost of outsourcing analysis work."

Although Northwest bought COSMOSWorks specifically for the closet project, Mueller said the airline has already used it for six other projects and plans to use it on more in the future.

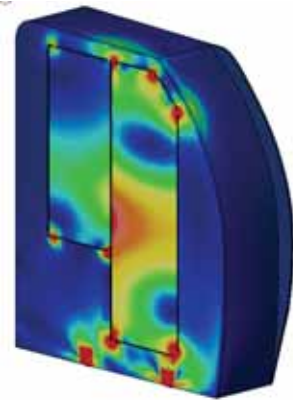
"The interiors of the aircraft came from different vendors. They had already certified the closets under the previously applied loads, but changing the design to accommodate the wheelchairs changed these applied loads. The vendors could have redesigned and analyzed the closets for us, but that would have cost much more," Mueller said. "We had the capabilities to redesign the closets, and we learned how to analyze the reaction loads and the structural loads with COSMOSWorks."

Northwest interior engineer Nanopodol Seniwong redesigned the closets using SolidWorks 3-D mechanical design software. He widened the closets and changed the door configurations to make room for the wheelchairs, which changed the loads on the aluminum footings that held the closet to the passenger compartment floor. The loading applied is based on FAR emergency landing load requirements, which are acceleration loads, the most rigorous of which is the 9 g forward scenario.

Mueller used COSMOSWorks Professional—which is integrated with the SolidWorks interface—to test the new loads on the footings. He modeled the footings' stiffness with the elastic support feature, and then applied the loads. COSMOSWorks revealed that the aluminum footings were not strong enough to hold the closet in place, regardless of how thick the Northwest engineers made them, and that smaller screws would fail under the test loads. The aluminum footings were replaced with stainless steel and bigger screws used to hold them in place. The new assemblies withstood the forces, as predicted.

COSMOSWorks also accurately predicted how much the closet would deform under certain loads.

"In our analysis, COSMOSWorks showed that the closet would deform 2.39 in, and the actual deformation in



**COSMOSWorks software predicted a maximum deformation of 2.39 in. Under physical testing the maximum deformation was 2.5 in.**

**FEA demonstrated that the existing aluminum footings were not strong enough to handle the higher loads, and a new component was designed in steel.**



the physical test was 2.5 in," Mueller said.

Before COSMOSWorks was available at Northwest, Mueller used hand calculations to validate designs. Integrated FEA software lets him do more in less time with greater accuracy. Its ease of use and tight integration with SolidWorks design software enabled Mueller to run analyses quickly and modify designs according to the results.

"We'll always have to do physical tests because we can't compromise safety, but COSMOSWorks gives us big financial and time advantages by reducing the number of prototypes we have to produce," he said.

In the future, Mueller said Northwest plans to use COSMOSWorks to certify loads on parts in other projects. For example, engineers will use the software to determine if a part with a nick or some other minor damage meets allowable limits.

David Alexander



**Northwest Airlines had to redesign the closets in many of its aircraft to meet new regulations for storing a full-size wheelchair in the main cabin during flight.**

## Smoothing data exchange

**Theorem Solutions**, a specialist in CAD/CAM product data exchange, has been closely involved in the double-deck **Airbus A380** program. During the aircraft's complex, multi-national design process, more than 50 Theorem CADverter licenses were installed and used at Airbus sites in France, Germany, Spain, and the UK. The software was needed to ensure seamless data exchange between different engineering applications, according to the company. The huge scale of the project meant that many Theorem translators have been employed across further CAD and associated systems within the Airbus supply chain.

Licenses in use include direct and standards-based CAD-to-CAD translators such as CADDs (from **PTC**) to and from CATIA (from **Dassault Systemes**), plus CADDs to and from STEP AP203 and AP214. Theorem also supplied CATIA-to-ProductView (also from PTC) translators to enable Airbus to fulfill its CAD-to-visualization needs. The



Source: Rolls-Royce

**Rolls-Royce** has increased the number of Theorem translators used to bridge design applications.

Theorem products are all integrated within the PTC Windchill PLM infrastructure, which synchronizes the Complex Configuration Management module with the digital mock-up, allowing designs to be reviewed, simulated, and shared—virtually—across Europe in a realistic 3-D space.

Several key partners in the A380

program, including **Rolls-Royce**, have recently increased the number of Theorem translators used to bridge the various design applications for product development teams and other collaborative partners.

The Theorem CADverter family includes CADviewer, DataXchange Navigator, and CADhealer.

*Stuart Birch*

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