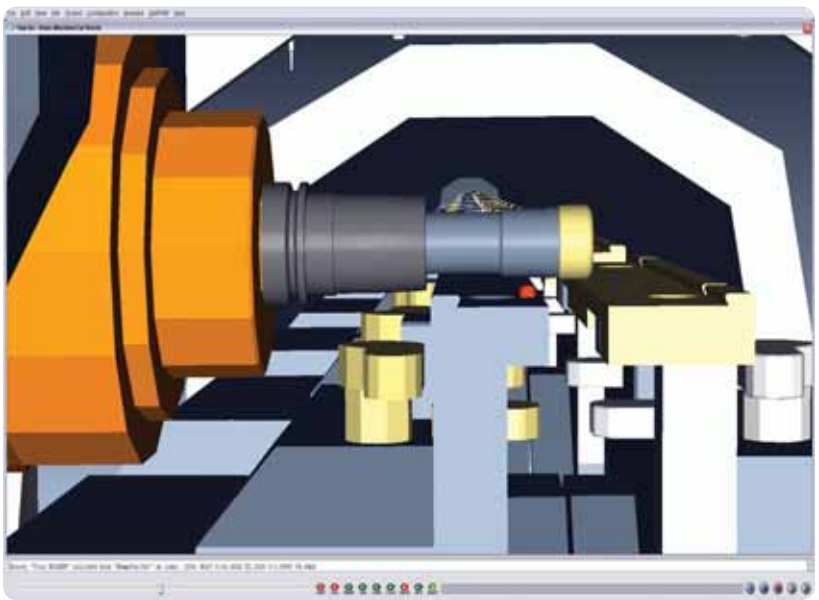

AEROSPACE SIMULATION

Software solutions for new-age challenges

Triumph Aerostructures, a software solution division of Triumph Group, pushes the level of simulation software enabling it to overcome hurdles in innovative ways, at the company's Nashville manufacturing plant.

Utilising state-of-the-art CNC simulation software, Vought Aircraft Division of Triumph Aerostructures has been able to quickly adapt to new machines, significantly shortening the time for first-part production, and eliminating the chance of machine collisions. A subsidiary of Triumph Group Inc, a leading global manufacturer of aerostructures for commercial, military and business jet aircraft, it possesses complete fabrication capabilities. Its range of products includes fuselages, wings, empennages, nacelles and helicopter cabins. The company's customer base consists of the world's leading aerospace OEMs. Triumph Aerostructures employs about 6,000 people in its six facilities in the US.

One of the sites, located in Nashville, TN, produces individual parts and sub assemblies for Airbus, Gulfstream, Cessna and Lockheed. With approximately 900 employees spread over two million sq ft of work space, the Nashville site has 10 large CNC gantry mills, nine large assembly riveters, and a variety of smaller CNC equipment. In the machining area, there are more than 35 CNC spindles making chips.

"The Nashville facility focusses on parts that are 'long and large'. Mostly everything we undertake is longer than 30 ft," says Kevin Chandler, Numerical Control (NC) Manager, Triumph Aerostructures.

Part verification

Despite changing ownership several times, the facility has a history of employing NC simulation software. It first began utilising *Vericut* software for material removal simulation in 1991, when it was Textron Aerostructures. In 1996, it was purchased by The Carlyle Group, and in 2003, it became a part of Vought Aircraft Industries. Vought Aircraft Industries Inc was acquired by Triumph Group Inc in June 2010 and was renamed Triumph Aerostructures-Vought Aircraft Division.

Vericut is a software program that interactively simulates and displays the material removal process of an NC program. NC programmers utilise *Vericut* to verify the quality and accuracy of their NC programs while its 3D simulation of the CNC machine checks for collisions. But the goal of simulation is not simply a collision-free and efficient NC program. The first goal is to have an NC program that produces the correct workpiece. *Vericut's* accurate model tells the NC programmer whether or not his NC program makes a correct part. For example, many NC programs utilise circular interpolation.

Vericut emulates the circle motion and creates an as-machined cylinder feature that can be measured to ensure its correctness. Most internal simulations do not emulate circle motion, but instead divide the circle motion into a series of linear motions approximating the cylinder. These segments are not measurable as a cylinder.

CNC machine simulation

The complete CNC machine simulation of the machine takes verification to another level. "Machine simulation has been the major key to everything we do here. Our machines have become much more complicated and the risk of collision between vises, bolts, tool changers, and other components is greater than ever. Simulation is so much more than cutting the part," explains Bill Gwinn, NC Programmer, Triumph Aerostructures.

Chandler and Gwinn are two of the most experienced *Vericut* software users in the world. Combined, they have more than 35 years of experience utilising the software. "Experience has shown us that the more we can simulate on the screen, the less issues we will have down the road. We both agree on the advantages provided by machine simulation," reveals Gwinn.

Machine simulation detects collisions and near-misses between all machine tool components such as axis slides, heads, turrets, rotary tables, spindles, tool changers, fixtures, workpieces, cutting tools, and other user-defined objects. A user can set up near-miss zones around the components to check for close calls, and detect over-travel errors.

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Before *Vericut* was implemented, the Nashville facility was utilising *Catia V4*, and programming in APT, which had a slow check process using a flat-bed plotter. Then they machined the first few parts out of foam, or few other non-production material.

Chandler avers, "With the introduction of *Catia* and *Vericut*, our first-time useable part started functioning at 90 per cent. With the introduction of machine simulation we improved even more significantly. A tested and proven result of this happened in 1995 when a new 4-axis machining centre was purchased for small parts. Utilising *Catia* solid models, *Vericut* and *Auto-Diff*, we were able to achieve 96 per cent first-time usable part programs, and 90 per cent of those were never modified past Issue 01. Since then, all programs are required to be run through *Vericut* before they are released to the machine. As a result, we are achieving up to 98 per cent good, first-time parts. Since that first test, it has been easy to convince that *Vericut* is a necessary tool to invest in. It cuts the machining hours down to a fraction of what it would have been."

According to Gwinn, "When a program is ready, we do not even go to the shop anymore. Once it is passed through *Vericut*, there is nothing major that can go wrong. We know it will be cut correctly."

For example, a new high-speed 5-axis *Handtmann PBZ* milling machine is being employed to machine stringers that are over 60 feet long. To hold the stringers in place during machining, the Triumph Aerostructures Numerical Control (NC) Group designed dovetail-shaped fixtures that they refer to as 'scuff plates.'

"We call it a scuff plate because it is okay to hit it with the cutter. We insert a value of -0.022 inch in *Vericut's*