

## AC&E Case Study

### Boeing uses CSR simulations to raise productivity of large riveting machine for fuselage assemblies



**Leading aerospace company Boeing is using CimStation Robotics and SoftMachine simulation software from Applied Computing & Engineering to increase the productivity of large riveting machines used in the construction of aircraft fuselage assemblies at its Kansas production facility.**

Boeing's Wichita, Kansas facility (now Spirit AeroSystems Inc.) produces part of every Boeing commercial jetliner except the 717. For the Next-Generation 737-600/-700/-800/-900 and Boeing Business Jet models, Wichita joins the forward and aft fuselage assemblies into one unit prior to shipment by rail to its sister division in Renton, Wash., where final assembly and delivery takes place.

Producing programs for drilling and riveting large assemblies can be both complex and very time consuming. Boeing was looking for ways of developing new processes to speed up the programming, with the aim of achieving a consistently high quality of program generation. The overall aim of this project was to produce error-free programs. This, in turn, would allow manufacturing to produce the product as originally designed and give a realistic goal of enhanced product quality of the manufactured product. It also held out the prospect of impressive quality gains which would include the visual detection of errors during the programming process.

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## **Simulation of Riveting Operation**

One of the most challenging project application areas was the riveting of the fuselage assemblies. To be successful here, it was realised early on that third party software would have to be introduced in combination with 3D digital models of the product.

A combination of CimStation Robotics (CSR) with SoftMachines software was selected for this task. There were significant productivity benefits arising from utilising 3D machine simulations during program development, particularly the ability to automate tedious steps in the programming process.

The Wichita division has more machines programmed using robotics off-line programming than any other division of Boeing. This includes nine Multi Task Gantry Riveting (MTGRS) machines. CSR real time simulation and off-line programming plus verification stages rolled into one step has proved to be particularly effective in programming the MTGRS equipment which consists of Gantry and Frame riveting machines.

To get the best from using CSR some items must be modelled with precision, whilst for others, the detail can be reduced somewhat to enable the CSR simulation to be fast and realistic. Boeing has been able to refine its simulations to take maximum advantage of this. CSR itself contains features to allow users to 'turn on' greater visualisation when required, without reducing the performance of the software.

## **Direct CATIA translation**

Boeing uses CSR's direct CATIA translator to bring in accurate engineering 3D models into their proper location before programming commences. The robot simulation software was also used to model [and recall when required] specialist tooling for the cells - this tooling included specialist motion which is easily introduced using CSR's library facilities. The final steps in the programming process allow for manual and automated program generation, making the process both fast and accurate.

CSR also provides full collision detection, which was used by the Boeing team to produce accurate working programs for three distinct types of collision detection scenarios. This was done quickly and easily during program creation, on a completed program or overnight in a batch mode checking several programs. As a final stage in the production process, CSR was used to assist with the tape proving process - to ensure that the actual programs will run exactly as expected from the initial simulations.

Future plans for CSR at Boeing include new translators [CATIA V5] as well as the development to handle retrofit controllers [Siemens 840D] planned for the existing machines. There is a continual requirement to simplify and improve the programming environments, and CSR's flexibility enables users to customise the software to mirror their usual [and desired] ways of working.

Boeing has been developing additional manufacturing knowledge from its use of CSR for over a decade. A Boeing spokesman said, "We have found CSR particularly practical because it is very robust, highly efficient to use and the software support has been incredible." He added, "When we began all those years ago we were keen to see how far simulation with a powerful system like CimStation, could help. Now we view the use of CSR as an essential part of the production process."

For more information on CimStation Robotics call +44 (0)1925 830085, e-mail: [info@acel.co.uk](mailto:info@acel.co.uk) or visit [www.acel.co.uk](http://www.acel.co.uk).