

Featured Partner: JMP & Associates • Cincinnati, Ohio

## XMC Powers Robotic Welding Application for NASA Space Shuttles

It costs \$10,000 for every pound lifted into orbit on the space shuttle. At that price it's easy to understand why aerospace engineers are continually exploring ways to reduce shuttle weight. In addition to being less expensive to operate, lighter shuttles can take on additional fuel or payload.

Friction stir welding is a manufacturing process that results in a lighter spacecraft, while improving structural integrity. Used on the external fuel tanks of the space shuttle, this unique and complex process increases weld strength by 30 percent, allows a 10 percent reduction in tank weight at the welded seams, and cuts weld times from 9 hours to just 3.5 hours. The bottom line is a 4,000-pound weight reduction, which translates into a potential savings of \$40 million.

JMP & Associates was responsible for providing the shuttle's primary contractor, Lockheed Martin, with the control system components for three robotic welding tools. Based in Cincinnati, JMP's automation-control expertise spans more than 20 years. The solution's components included industrial computers, PLCs, wiring and sensors, and logic and human machine interface (HMI) software for total machine-tool control. "There were other friction stir weld tools out there, but none with the sophistication in terms of the automation we're doing, the size of the panels we're welding, and the amount of data and operator interface," said John Priester, President of JMP.

### Needs

A cost-effective, off-the-shelf software solution that integrates equipment from different vendors and enables programming the five axes of motion control for a friction stir weld system.

### Solution

ROY-G-BIV's XMC software for machine tool connectivity, rapid development of motion control software, and integration of the motion system with hardware and software from multiple control vendors.

### Benefits

XMC enables a "best-in-class" solution by integrating a third-party motion controller with Rockwell hardware and software. The results were reduced programming and integration time, a shorter learning curve for motion control, and less time required to configure motion software applications.

<b>XMC OPC Server</b>	Used to monitor the machine's motion control behavior and alter controller variables that changed the behavior of downloaded motion programs.
<b>XMC for Visual Studio</b>	Used to rapidly build a custom Visual Basic application for generating large sets of point data later fed to the Galil motion controller.
<b>XMC Motion Studio</b>	Graphical editor used to create over-700-line motion programs downloaded to the Galil controller. It provides a multi-windowed, tree-view interface that dramatically reduces the time to program, debug, maintain and deploy custom motion programs.
<b>XMC Motion Administrator</b>	Central configuration tool used to communicate physical motion system settings such as motor types, gains, travel distances and encoder configuration to the XMC software products.



This was no easy task under any circumstances, but the process was complicated by the presence of multiple hardware and software vendors. JMP chose the PC-based Galil DMC 1780 motion controller to power Rockwell's Allen-Bradley ULTRA 200 drives and "F" series servo motors. A Rockwell ControlLogix 5500 PLC was used with two remote racks for sensor calibration, measurement, data linearization and critical parameter data logging, along with the Rockwell RSView32 HMI software package. JMP's challenge was to integrate the Galil motion controller with all the Rockwell equipment, and find a cost-effective solution to an extremely complex task — programming the five axes of motion required for the friction welding application.

Using ROY-G-BIV's XMC software platform and XMC software products, JMP was able to fully integrate Rockwell's ControlLogix and RSView32 with the Galil motion controller to provide seamless data communications between the control systems and the HMI software.

"ROY-G-BIV's high-performance XMC OPC server allowed us to log over 50 motion-related data points from the Galil controller into our OPC-tag database 10 times every second," said Priester. According to Priester, the powerful nature of XMC was just part of ROY-G-BIV's contribution to the project. "They were the primary source helping us develop the custom motion code required to make the tool operate per Lockheed Martin's specification," he explained. "I can't say enough about the support they provided us. Their motion control expertise combined with their outstanding support services far exceeded the industry norm."

"ROY-G-BIV's motion control expertise and support was absolutely essential to our project's ultimate success. XMC allowed us to do all the development of the motion control software in a friendly environment that was automatically translated into the Galil motion controller."

John E. Priester P.E.  
President  
JMP & Associates



"The XMC Motion Studio emulates the Galil native code, simplifying the translations and shortening the learning curve from months to days. Depending on the project's complexity an engineer might not have to know the Galil native code at all. Plus, they've got the only OPC driver available for the Galil controllers, which saved us months of programming effort."

Mark Mombourquette  
Project Engineer  
JMP & Associates



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