SIEMENS

John Deere

Robot programming time drops by up to 50 to 70 percent while downtime due to robot reprogramming declines by a factor of three

Product

Tecnomatix

Business challenges

Extremely short product development schedule ruled out manual robot programming

Keys to success

RobotExpert in the Tecnomatix portfolio

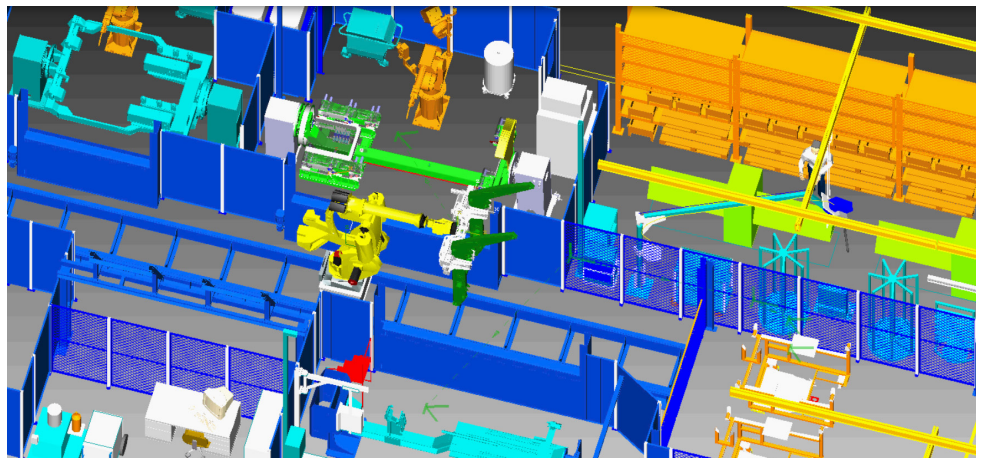Siemens PLM Software worldwide support

Results

Shorter product development/factory lead times

Robot programming time drops by up to 50 to 70 percent – from one week to 2 to 3 days

Production downtime due to robot reprogramming reduced by a factor of three

Concurrent engineering allows for optimization of design and manufacturing processes

Automated line: handling robots' accessibility simulation.

## John Deere extends its digital factory to include offline robot programming using RobotExpert

Factory with deep farming roots

John Deere Usine de Arc-les-Gray, a subsidiary of Deere & Company, is a factory in a region of France with deep farming roots. The factory, which is spread over approximately 14 hectares (35 acres) and has 440 employees, manufactures round balers, square balers, mower-conditioners and front-end loaders for tractors.

The plant exports its products to more than 70 countries, primarily in Europe but also to the United States, New Zealand, Australia and Japan. "Our factory has a very wide international footprint, but it is based on a strong local foundation," says Sylvain Munier, the factory's manufacturing engineering manager, explaining that the factory's origin dates back to 1848 and the Thiébaud family's harvesting equipment business.

John Deere is a leader in the market for round balers, as well as a major player in the other areas such as mower-conditioners and front-end loaders. "The spirit of innovation is very present at our site," Munier explains. "During the last ten years, more than 245 patents have been filed to protect our products and our technology. A new, unique type of round baler, which offers a very real increase in productivity, is protected by more than 30 patents."

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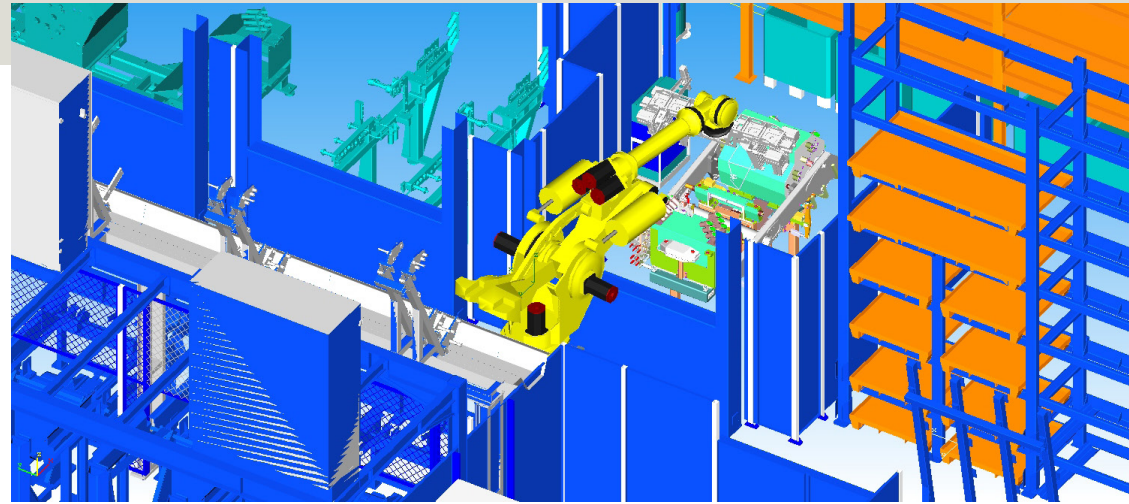
Handling robot: gripper design validation.

Very short timeframe demands offline programming

The operations performed in this factory are primarily sheet metal laser cutting and bending, as well as manual and robotic metal inert gas (MIG) welding of chassis parts, drawbars, rotors and other components, and painting and assembly.

Currently the factory operates 25 industrial robots, but this number grows annually as the product line expands. "At the end of 2013, we introduced a new round, fixed-chamber baler in the 400 series that needed to be ready for delivery at the beginning of 2014," says Munier. "This project involved the installation of three new robotic units."

The tight deadline for the new baler left an extremely short timeframe between the delivery of the new robots and the beginning of production. Waiting for the arrival of the robots to begin programming would have been impossible since the welding programs were relatively complex, with cycle times of 45 minutes to an hour. "The window was much too short. We only had three months to begin production," recalls Munier.
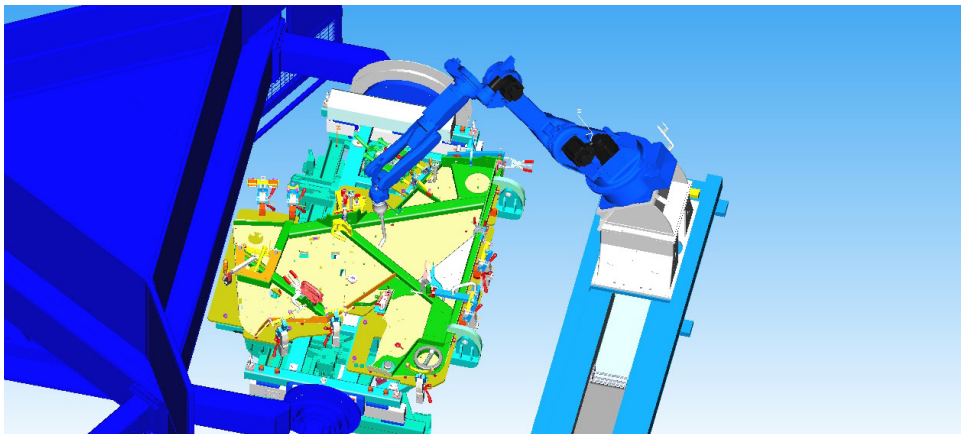
"To speed up the process, we planned on offline programming the robots, before even installing them," Munier adds. But at the time, the factory had no offline programming software. They did have an extensive digital factory environment consisting of computer-aided design (CAD), computer-aided manufacturing (CAM), and plant design and manufacturing simulation software.

Lead times at the factory have been notably reduced now that it is possible to prepare the programming without waiting for the robots to be installed.
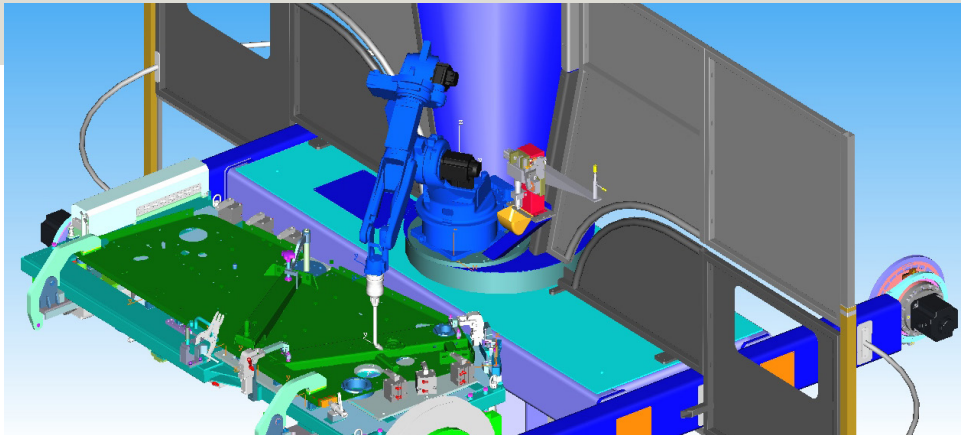
Validation and programming of welding process.

"At John Deere, all software is managed on a worldwide basis. It conforms to the John Deere standard," Munier explains. "The company has been using product lifecycle management (PLM) products from Siemens PLM Software for a long time." These include FactoryCAD™ software and FactoryFLOW™ software, both in the Tecnomatix® portfolio.

Choosing a programming solution

An ad-hoc task force was formed that included the factory's own specialists as well as representatives from other John Deere plants. Munier particularly wanted input from the welding and sheet metal competency center at John Deere's headquarters in Moline, Illinois. Other members of the task force included representatives from John Deere factories in Moline and Horicon, Wisconsin that were already doing offline programming of robots, and the John Deere design department in India.

The task force looked at all the potential suppliers within a week. Three were selected for comparison testing that included use on an actual robot installation. Siemens PLM Software's RobotExpert in the Tecnomatix portfolio best met the selection criteria, and John Deere signed a contract for the worldwide use of RobotExpert with floating licenses.

RobotExpert proved easy-to-learn and use. A new hire, just out of welding school, succeeded in modeling a robot installation and creating a part program simply by using the online tutorials and the demo version of the software. Today, two robot programmers create their programs using the software rather than by guiding the robot's arms physically step-by-step.

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Sylvain Munier
Manufacturing Engineering
Manager
France Plant
John Deere

Benefits of deploying RobotExpert in the virtual factory

Lead times at the factory have been notably reduced now that it is possible to prepare the programming without waiting for the robots to be installed. In the past, a week was needed for manual robot programming, with point-by-point learning using the robot' teach pendant. Using RobotExpert, that time has been reduced to two or three days, which includes a day at the most for physical tests and final touch-ups.

In the design of new products, the use of RobotExpert enables John Deere to practice concurrent engineering. Manufacturing processes can be simulated as soon as the 3D design models are ready. It is now possible to discover manufacturing problems, and to choose welding robots, their capacities and the number of workstations, very early in the development cycle. In addition, RobotExpert allows for preliminary studies aimed at defining best production processes, estimating the exact level of investment needed, obtaining good estimates of costs and validating the factory's production capability.

"With existing robot installations, a minor change to a part no longer requires a long break in production to reprogram the robot," notes Munier. "All that is needed is to prepare the program virtually, and then to stop production briefly to load and validate the program."

The factory is controlling more of its existing robots with RobotExpert, starting with the most-used. Munier is now planning the next step, which is the dynamic simulation of robotic processes to analyze and optimize the flow of parts into the shop. He explains, "After that, we want to simulate an entire and more complex robotic production process, combining several collaborating robots: welding robots, bending robots and handling robots. The ultimate objective is to use robots programmed to produce a completely finished part, ready to be used."

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