

Automating Aircraft Overhaul

Güdel and Aerobotix team up to build a giant robot work cell for painting large aircraft.



Industry

Aerospace, General Manufacturing, Materials Handling, Ship/Submarine Industries



Process

Güdel engineers a 100-foot free-span gantry bridge to enable a robot to automatically remove surface coatings, inspect, sand and repaint large aircraft with a high degree of precision.



Key Data

- Together, Güdel and Aerobotix engineer a fully automated, lights-out FANUC robotic painting system that improves cycle times, quality, coating consumption and final finish while reducing painters' exposure to hazardous environments.
- Modeled around Güdel's TrackMotion Overhead (TMO) beam, the gantry robot delivers high rigidity and optimum load distribution.
- Güdel's giant gantry design optimizes robot performance while ensuring safe, reliable and quiet operation.



Güdel Engineers a 100-Foot Free-Span Gantry Bridge to Automate Aircraft Repainting Operations

It can take weeks to apply a new coat of paint to an aircraft, even with three crews of more than a dozen people working in shifts over a 24-hour period. Removing old paint and sanding the aircraft surface only extends the cycle time and risk of damage. Meanwhile, downtime and labor costs can accrue rapidly.

These and other issues led one aviation client to seek Aerobotix's help in replacing manual operations with a faster and more efficient automated solution for painting, sanding and inspecting aircraft. Together, Aerobotix and Güdel developed and deployed what could be the world's largest robotic work cell designed for such operations.

A Massive Challenge

The challenge underlying this project was, in a word, scale. For the system to encompass large aircraft,

its work area had to measure roughly 200 by 100 by 30 feet. Aerobotix's design incorporated four heavy-payload FANUC R-2000 robots positioned on floor tracks that allowed them to run the length of each side of an aircraft.

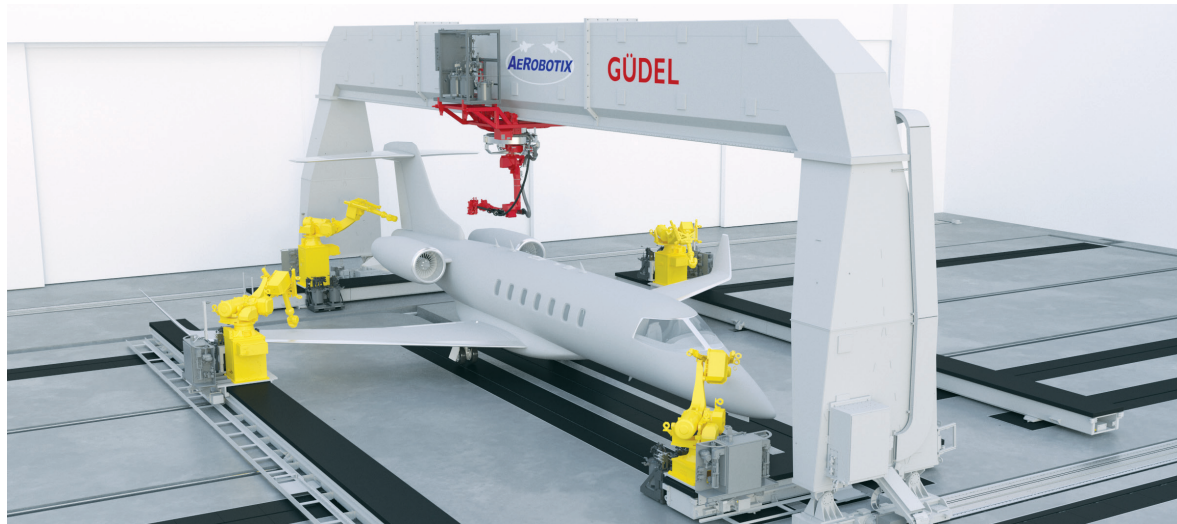
A fifth robot — a FANUC P-350 paint robot — presented the biggest challenge. Like the bots running along the floor, it is an NFPA Class I, Division 1-rated paint robot from FANUC sized to accommodate a spray gun, measurement sensors or a triple-headed, force-compliant sander. Unlike the other bots, it needed to be mounted on an overhead gantry with a 100-foot free-span bridge, moving along 200-foot rails embedded in the hangar floor. Adding to the challenge: Due to confidentiality agreements, Güdel had to engineer its largely customized gantry without visiting the application site.

"We really thought this project was impossible until we sat down with the team from Güdel," said Keith Pfeifer, engineering manager at Aerobotix. "Güdel had previous, similar experiences and was able to show us how they could reduce our risk, hit our schedule and deliver exactly what we needed."

Güdel's Solution

Güdel engineers began by drawing up a gantry concept modeled on the company's standard TMO beam, which is characterized by its high rigidity, quiet operation and optimum load distribution.

"This was definitely one of the largest clear-span gantries that we've ever worked on as a company," said Bob Rochelle, account manager for the US Southeast at Güdel. "Usually we try to space supports about every 20 feet between a gantry's



Güdel teamed with Aerobotix to develop a giant robot work cell to improve cycle times, quality and cost when processing large aircraft.

legs. This application required lengths that were three times more than that.”

The remarkable length of the gantry led Güdel engineers to anticipate that it would deflect a few millimeters at the center, and the team developed a design that would accommodate this to ensure that the robot and overall system could perform its job safely, reliably and repeatably.

“In order to maneuver the gantry robot’s end-of-arm tools around the top of the aircraft, the coating dispensing systems [CDSs] needed to be mounted to one side of the carriage,” said Rochelle. “That created an overhang load of about 2,000 pounds, which we support with double rollers. It required a lot of structural engineering to enable smooth, repeatable movement of the robot for this kind of dynamic load.”

Cycle Times Slashed

Aerobotix confirmed that Güdel’s concept supported its system operating specifications, and Aerobotix was further impressed that Güdel had taken the extra step to detail how to perform routine maintenance.

Given the size of the span, Güdel manufactured the gantry as three segments for easier transport. Even so, it took more than a dozen semitrailer trucks to move the gantry and floor track components to their final destination for assembly. Even though engineers had never visited the customer site or performed an in-house test assembly, the bolt holes in every component of Güdel’s precision-made

system matched up perfectly, and the overhead beam was assembled without any issues.

“They drive the aircraft in, park it under the gantry, close the hangar doors and push the start button,” said Rochelle. “The freshly coated plane is ready to be rolled out of the hangar in a fraction of the time that manual operations had taken.”

The assembled system solves a variety of problems facing aircraft manufacturers in the 21st century:

- The Güdel rails provide FANUC’s gantry robots with full access to all surfaces on a variety of aircraft sizes and large parts.
- The use of robotics allows for the recirculation of the temperature- and humidity-controlled air in the booth, which greatly reduces the operation and maintenance costs of running the air conditioners.
- The robotic paint systems remove human operators from the fumes and dust of dangerous chemicals, reducing illness and corporate risk.
- Automation allows nonstop, around-the-clock processing of high-value aircraft to minimize tack time or span time.
- The robotic system permits rapid tool changes to execute substrate inspections, coating thickness inspections, coating removal, scuff sanding, wash down and more to generate greater value from the investment.
- Robotic automation improves the final finish, reduces coating costs, promotes more repeatable coating thicknesses and offers other beneficial attributes.

Güdel Technology

- TrackMotion Technology
- High-Performance Gearboxes
- Rack and Pinion Drive System
- Linear Guideway Rollers and Flat Rails

About Güdel Inc.

Güdel Inc. is the US subsidiary of Güdel Group, a global manufacturer of robotic automation products, systems and services. Güdel supplies linear-motion modules, robot track motion units, gantry robots and components to OEMs, systems integrators and machine builders serving the automotive, aerospace, logistics, heavy industrial and power-generation industries. Güdel Inc. is located in Ann Arbor, Michigan, in a dedicated 45,000-square-foot facility, providing North American customers with engineering, design, production and support.

Güdel Group was founded in 1954. Headquartered in Langenthal, Switzerland, today Güdel operates in more than 30 locations worldwide.

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