

## Case Study

# Aerospace and automotive industries gain precise, safe and reliable material handling

### FORI AUTOMATION

**Customer:** Fori Automation, Inc. is a global leader in the design, build and integration of automated material handling, assembly, testing and welding systems for the automotive and non automotive industries.

**Challenge:** Enable AGCs and AGVs to transport payloads precisely and safely along specified paths across assembly plant floors and, in some cases, to identify specific parts and tooling for conveyance.

**Solution:** Deploy Siemens SIMATIC Ident high-frequency and ultra-high-frequency RFID systems for vehicle positioning and on-the-fly component parts identification.

**Results:** Delivers more price-performance, simplicity and compact size, while boosting the precision, safety of vehicle positioning and accuracy of inventory pulling processes.

## Using automated guided vehicles with Siemens RFID systems

One of the biggest challenges in aerospace, automotive, defense and most other manufacturing industries is getting the right components, sub-assemblies and tooling to production lines when they're needed – and doing so safely. Without timely and accurate materials and tool handling capabilities, both production efficiency and asset utilization can plummet. Without proper safety practices, accidents can damage or ruin costly components, disrupt production, potentially harm workers and, if the latter occurs, trigger expensive, time-consuming investigations.

**Old school.** In many factories, materials handling involves large, fixed conveyor systems that consume valuable floor space and lack flexibility when production lines must be reconfigured for new or different product. Then there are commonplace manual methods that have inherent risks.

Forklifts, for example, are typically used to move large pallets of components swiftly, but their human drivers can be prone to mistakes and distractions. They can pull the wrong inventory, overload their vehicles to the point of tipping them over, or bump into objects and fixed plant infrastructure, putting production or their payloads at risk.

**Avoiding heights.** Overhead cranes are another example. While extremely useful in moving large parts and work-in-progress around a factory, their operating heights create safety hazards. Even if personnel are not in harm's way, accidents can damage the payloads and disrupt production.

To help manufacturers address these issues, Fori Automation offers a wide range of automated guided carts (AGCs), automated guided vehicles (AGVs) and rail guided carts (RGCs). Its portfolio consists of a variety of product lines, including standard products such as RGCs, Tunnel AGVs and Tugger AGVs, as well as fully customized, high capacity AGVs. The sophisticated AGVs can transport massive, multi-million-dollar components and tooling, with capacities up to 250,000 pounds (113,636 kg). Various levels of automation are available, with the most capable AGVs being able to synchronously lift, level and position their giant payloads to within fractions of an inch.



Fori Automated Tuggers capable of transporting up to 35,000 lbs. improve safety and ensure on-time delivery.

### **Challenge: Enable AGVs to move large payloads precisely and safely along specified paths across large assembly plants and, for some models, to identify specific parts and tooling for conveyance.**

Founded in 1984 and based outside Detroit, Michigan, the global firm's 620 employees operate from its headquarters as well as from offices and facilities in Brazil, China, Germany, India, Mexico and South Korea. Fori Automation's line of AGCs and AGVs have complex operational, control and safety requirements. That's because they're designed to move large and expensive payloads and tooling through production floors that often resemble obstacle courses of assembly lines, machinery, aerial fixtures, parts and people.

According to Greg Stegner, the company's AGV controls supervisor, synchronizing the control and operation of many AGVs at the same time on one plant production floor can get complicated quickly.

"Our AGVs typically move through large plant spaces doing different tasks with workers walking all around," he says. "We build them to operate safely, but it's not just the floor configuration that loaded AGVs must navigate. They also must sense and avoid drawbridges, overhead cranes and other elevated fixtures a plant may have. That's why an AGV control system needs to know where the vehicle is at all times. A lot of positioning systems that are available on the market don't necessarily guarantee an AGV's location, and we needed one that could."

**The right moves.** Another challenge is moving large tooling, such as that of an aircraft builder, into proper position for the next stage in production. "These tools can range up to 110 feet long and come in various configurations," Stegner explains. "So you need to be very specific about which tool goes to which location. Moving these tools into place can be quite time consuming using large crane systems, and our customers needed a faster means of doing this."

In addition to moving tools in place quickly and accurately, positioning them properly and precisely is imperative – and a matter of plant safety.

"These tools are typically surrounded by sophisticated platform systems designed with a very specific profile for that tool," Stegner says. "That's why it's absolutely critical that you know which tool your AGV is carrying and then be able to place it precisely. If not, collisions can occur."

**See more.** Inventory visibility while parts are being pulled for production and in transit to the line is another issue that Fori Automation wanted to solve for its customers.

"They need to know that the right set of components are pulled from stock and headed to production," Stegner says. "Some plant operators can pull up to three dozen different components at a time. If even one component is wrong, then the delivery must stop while the entire set gets sorted through to find it, then someone has to go pull the correct part and hand-deliver it. That can take a lot longer than just a few minutes."



Fori Automation's automated guided vehicle (AGV) for transporting "drill & fill" tooling in manufacturing large commercial aircraft.

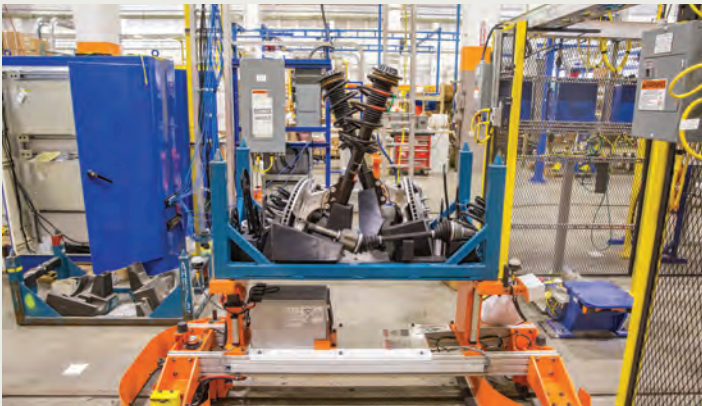
### **Solution: Deploy Siemens SIMATIC Ident high-frequency and ultra-high-frequency RFID systems for vehicle guidance and positioning plus on-the-fly component parts identification.**

To address these challenges, Fori Automation chose to deploy Siemens SIMATIC Ident high-frequency (HF) and ultra-high-frequency (UHF) RFID systems as key components in several lines of its automated vehicles. The main distinction between HF and UHF RFID systems is the latter provides longer read distances, more simultaneous reads and faster speeds compared with HF. However, it is important to note that UHF

is not “better” than HF, but just expands the range of RFID industrial applications.

Specifically, the Fori Automation automated vehicle lines and their Siemens SIMATIC RFID solutions are:

- **Fori “Flex Rail” rail guided carts for module assembly.** As replacements for traditional fixed conveyor systems, the RGCs utilize SIMATIC RFID systems to provide stop locations for the vehicles as well as station identification and vehicle tracking. It does this by means of an onboard SIMATIC RF260R HF RFID reader that reads Siemens D246 tags that are embedded about a half-inch into plant floors. The reader communicates with the Fori Vehicle Management System (VMS) that operates via a Siemens SIMATIC S7-1500 PLC, also onboard the RGC.



Fori Flex Rail Systems decrease system installation time and minimize fixed monuments versus traditional conveyors for assembly and material handling.

- **Automated guided vehicles for automated equipment transport.** Aerospace manufacturers use these AGVs to transport large, massive tooling and automated equipment, such as drill & fill systems and mobile robots. The latter is used to assemble the side panels of large commercial aircraft. Upon arrival in each production station, the AGV must accurately position the automated system within +/- 2mm.

In effect, the automated equipment moves to the part versus traditional systems where the part has always moved to the tool or machine station. This minimizes part handling and reduces or eliminates the use of cranes. The AGV verifies positioning with an onboard SIMATIC RF260R HF RFID reader and Siemens D246 tags in the floor.

The tags provide both guidance and permission for the drill & fill system. When traveling between automation stations, an AGV’s operator will choose specific moves for it, but if the RFID tag cannot be verified by the AGV’s RFID reader, the vehicle will not accept the move and send a fault to the operator.

- **Automated guided vehicles for aerospace assembly.** This Fori Automation solution tethers two AGVs together to move tooling around the assembly plant, but the movements of both AGVs must be highly synchronized for precise guidance

and safety. To identify the tooling, the AGVs rely on the SIMATIC RF685R UHF RFID reader and RF640T tags placed on the tooling. The tags hold specific AGV drive and safety parameters to support the different tools and ensure their movements are perfectly aligned as the AGVs move toward their destinations, resulting in safe and predictable operation of the equipment.



Synchronization of multiple vehicles for large Aerospace tooling transport increases flexibility, allowing various lengths and styles of tooling to be transported by a single vehicle design.

- **Product identification for automated tuggers.** For this AGV solution, Fori Automation integrates SIMATIC RF680R UHF RFID systems into multiple automation stations. The RFID readers scan tags that are located on a plant’s rack of component parts. Each tag carries information on the type of part and quantities available.

If the part matches what is in the pick-and-pull order, then the forklift operator releases the product to the AGV. Once aboard, the AGV proceeds to an unloading station. If the RFID reader cannot identify the product, the system will not allow the forklift operator to load the product. The information is relayed between the plant production system and the Fori Vehicle Management System (VMS) via an onboard Siemens SIMATIC S7-1500 PLC and Siemens SCALANCE wireless communications system.

**Results: Delivers more price-performance, simplicity and compact size, while boosting the precision, safety of vehicle positioning, and accuracy of inventory pulling processes.**

The benefits of the Siemens SIMATIC RFID systems are two-fold: those for Fori Automation as an OEM of automated vehicles; and those for its end-customers.

According to Stegner, Fori Automation chose the Siemens SIMATIC Ident RFID systems for several reasons. Most important are price-performance, simplicity and compact size. “The Siemens RFID solutions are cost-effective, which help us reduce the cost for our customers and ensure we remain competitive,” he says. “In addition, their simplicity makes our manufacturing easier and reduces sparing requirements for our customers. Finally, their relatively small size saves us valuable real estate on our vehicles.”

**Easy programming, integration.** Another key factor was the simple integration and programming with other Siemens components used in the vehicles, such as the advanced SIMATIC S7-1500 PLC and SCALANCE wireless communications from the Siemens Totally Integrated Automation (TIA) portfolio. To program the RFID systems, for example, Stegner and his team used the Siemens TIA Portal, a common engineering framework.

“We use TIA Portal’s ready-to-use code libraries to define the RFID operations and interactions with our Fori VMS,” Stegner says. “The TIA Portal saves us valuable programming time, especially its many built-in features compared with competitors, such as its library functions that enable us to easily transfer RFID code from project to project. Also, I can get our new team members trained much more quickly.”

**Extra safety.** Improved safety is another big benefit for Fori Automation customers. “Although we use Siemens safety-integrated PLCs to enable a wide range of safety features on our AGVs and RGCs, the RFID systems provide an extra safety layer with automated start and stop points as well as permissives for human-controlled operations,” Stegner says.

“These help prevent collisions and reduce the potential for accidents due to human errors. After all, even small incidents can disrupt production significantly, while larger ones can be matters of life safety. And the Siemens RFID systems fortunately help us help our customers reduce the chances of those happening.”

**Global backing.** Siemens global footprint helps Fori Automation sell its automated vehicles worldwide and support them as well.

*“We support many top global brand names in aerospace, automotive, defense and other industries and having Siemens stand behind us practically anywhere in the world boosts their confidence levels, because they know support is never far away,” Stegner says.*

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