Automated Guided Vehicles (AGVs)

- Aerospace AGVs
- AGVs for Material Delivery
- Chassis Marriage AGCs
- Component Assembly AGVs
- Dock N’ Lock AGVs
- Drill & Fill AGVs
- Module Assembly AGCs
- Nuclear Refurbishment AGVs
- Material Handling AGVs
- RGCs for Module Assembly
- RGVs for Module Assembly
- Tugger AGVs
Aerospace AGVs for Component Assembly

Product:
- AGVs

Guidance Technology:
- Magnetic bar

Capacity:
- 120,000 lbs. / 54,431 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Siemens open architecture
- Vehicle management system
- Full-auto guidance

Keys to Success:
- Two custom designs
- Continuous moving line, as little as 4” / 10 cm an hour
- Pontoon style AGV for operator work platform

Results:
- Personnel injuries have been minimized
- Crane utilization has been greatly reduced
- Continuously moving line resulted in increased throughput and process control

Solutions:
- Automated guided vehicle
- Vehicle management system
- Siemens integrated safety
- Magnetic guidance
- Integrated operator lift platforms

Fori was enlisted to design and build two styles of AGVs for the Bombardier C-Series project. These vehicles were customized to work within Bombardier’s specific build process. The AGVs pictured are utilized within the production process for the bombardier C-Series. Project requirements included the AGV needing the ability to move as slowly as 4” / 10 cm per hour in order to meet production, while still being a moving line. Each vehicle was required to fit within the tooling parameters while being multi-purpose for the different tools and product. Total rated capacity for the AGV was 14,000 lbs. / 6,350 kg. The vehicle was required to minimize deflection and side loads during tooling transport. Additional project hurdles included the ability to coordinate the automated continuous movement among the eighteen vehicles. The vehicles were also required to include integrated operator work platforms and lifts that would aid in the cockpit assembly.
Aerospace AGVs for Component Assembly

Product:
- AGVs

Guidance Technology:
- Magnetic bar
- Laser contour

Capacity:
- 120,000 lbs. / 54,431 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Siemens open architecture
- Vehicle management system

Keys to Success:
- Custom designed chassis
- Custom designed lifts and casters for tooling support and reduced point loading

Results:
- Personnel injuries have been minimized
- Crane utilization has been greatly reduced
- Simplified Autoclave loading results in reduced permanent infrastructure and reduced labor

Solutions:
- Automated guided vehicle
- Vehicle management system
- Siemens integrated safety
- Magnetic & laser guidance

Fori specializes in design, build and integration of customized vehicles for a variety of different industries. Flexibility and capabilities enable Fori to meet its customers ever changing demands.

The AGV pictured was a highly customized design for the Aerospace Industry. Project requirements included the AGV to mimic the tooling footprint, the tool was roughly 30' long and wedge shaped. Total rated capacity for the AGV was 120,000 lbs. One of the most important features of the vehicle was to loads during tooling transport. The vehicle utilized a dual guidance technique, this requirement was based on the ability to transport tooling in and out of an Autoclave. Previous methods include a large rail system and a large pusher to locate the tool within the autoclave, these methods are labor intensive and risk damaging the product. Fori was able to accomplish this feat utilizing automated laser contour and magnetic bar guidance, this method allowed us to repeatable locate the tool within +/- 2 mm.
Aerospace AGVs for Drill and Fill System

Product:
- AGVs

Guidance Technology:
- Magnetic bar

Capacity:
- 18,000 lbs. / 8,165 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Siemens open architecture
- Semi-automated guidance

Keys to Success:
- Use of inclinometers and servo control for auto-leveling
- Highly accurate and repeatable
- Simple user interface

Results:
- Personnel injuries have been Minimized
- Crane Utilization has been greatly reduced
- Continuously moving line resulted in increased throughput and process control

Solutions:
- Automated guided vehicle
- Auto-leveling
- Siemens integrated safety
- Magnetic guidance

Fori designed and built two AGVs for a Drill and Fill system that is used within the build process of the Airbus A350 panels at Spirit AeroSystems.

The AGV pictured was a first for the Aerospace industry. The vehicle was required to accurately position within +/- .005” / .127 mm when in station. The frame for the vehicle was designed around a strict .03” / .762 mm frame deflection requirement to ensure the drill machine did not deflect during transport. The final requirement was for an auto-leveling function that would level the tooling within .004 degrees, having no more than .005” / .127 mm of deflection after leveling. Utilizing the Fori AGV to transport the drill machine versus the standard method for this process significantly improved efficiency, reduced manpower requirements and improved cycle time. Most importantly from a health and safety perspective, drill and fill applications can wreck havoc, the automated system eliminated that concern.
Automated Guided Vehicle (AGVs) for F-35 Lightning II Assembly

**Product:**
- AGVs

**Guidance Technology:**
- Magnetic bar

**Capacity:**
- 16,000 lbs. / 7,257 kg.

**Safety:**
- Safety scanners
- Safety bumpers
- Siemens safety PLC

**Controls:**
- Siemens open architecture
- Integrated production system
- Vehicle management system
- Full-auto guidance

**Keys to Success:**
- Siemens integrated production system
- Increased system safety
- Locking arbors to decrease tool CG

**Results:**
- Robust and reliable system
- Safety interlocks to ensure personnel injuries have been minimized
- Crane utilization has been greatly reduced
- System that fit within current skill sets of employees

**Solutions:**
- Automated guided vehicle
- Vehicle management system
- Siemens integrated safety
- Magnetic bar guidance

Fori was selected as the supplier for three AGVs for the Lockheed Martin F-35 Lightning II Project. The vehicles were custom designed around a fully integrated lean manufacturing methodology. Project requirements included a very high priority on system safety. Uniformity of equipment across Lockheed Martin sites. A fully integrated traffic management system was required to schedule traffic and ensure process flow. Another item for concern was to have the system be intuitive enough where the skill set of the current workforce could utilize the AGVs. This was accomplished through a simplified user interface for the AGV operation. Fori also offered training with plant personnel for operation and maintenance. Additional project hurdles included the ability to fit within the proposed process, dimensionally and functionally meet requirements. High level of importance on data collection and communication among the flow lines (16) cells. Communication with the plant and other pieces of equipment and compatibility with the existing manufacturing system.
AGVs for Vertical Wing Assembly

A Fori AGV was utilized for a 60’ / 18.3 m long wing assembly build process. The vehicle was 40’ / 12.2 m long and was the strong-back for the tooling and part, minimizing deflection.

The most important item addressed in the project was centered around the tool and part deflection. While moving the FAJ tooling and part the AGV frame was required to deflect less than 3/16” / 9.5 mm. Fori was also asked to develop some tooling accessories or “TOACS”, the blue stanchions pictured (below right) were leveled for placement in station. The “TOACS” included a locking mechanism that reduced CG and ensured a rigid, repeatable drop and pick point.

The vehicle started out as a manual operation and overtime the end user has decided to turn this process into a semi-automated process. The vehicle will track magnetic bar for lateral placement and the operator will adjust speed for the fore-aft travel. Once in front of station the operator will initiate a preprogrammed move and utilize a “hold to run” operation that will locate the tool within +/- 2mm for drop off in station.

Product:
- AGVs

Guidance Technology:
- Magnetic bar

Capacity:
- 60,000 lbs. / 27,216 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Siemens open architecture
- Semi-automated guidance

Keys to Success:
- Custom designed chassis and components for process
- Highly accurate and repeatable
- Simple user interface
- Locking stanchions for decreased tooling deflection

Results:
- Robust and reliable system
- Safety interlocks to ensure personnel injuries have been minimized
- Crane utilization has been greatly reduced
- System that fit within current skill sets of employees

Solutions:
- Automated guided vehicle
- Vehicle management system
- Siemens integrated safety
- Magnetic guidance
AGVs for Power Plant Refurbishment

Fori recently designed and built an AGV that is being utilized for nuclear power plant refurbishment. The vehicle was required to run 24/7 and be halogen free for the environment.

The pictured vehicle needed to be highly accurate and have some unique abilities in order to fit within the plan for the power plant refurbishment. Initial concepts included rail and cart system, but through further investigation it was determined that the process could only be completed utilizing an AGV. This was based on the plant layout and floor conditions.

Fori was able to repeatably achieve +/- 10mm. Outside of tight tolerance guidance requirements, the vehicle needed to be able to carry a total of 68,000 lbs. and interface with multiple pieces of tooling.

The vehicle was designed considering a 24/7 operating time, this was accomplished by using a high voltage Lithium Ion battery and high output charger.

Product:
- AGVs

Guidance Technology:
- Magnetic bar/tape

Capacity:
- 68,000 lbs. / 30,844 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Siemens open architecture
- Semi-auto guidance

Keys to Success:
- Rigid platform for reactor tooling and flask transport
- 24/7, 365 days a year operation
- Employee friendly system

Results:
- Personnel injuries have been minimized
- Repeatable locating for operator flask loading
- Increased throughput
- Decreased infrastructure

Solutions:
- Automated guided vehicle
- Siemens integrated safety
- Magnetic guidance
Nuclear Material Handling AGV for Refurbishment

Product:
- AGVs

Guidance Technology:
- Magnetic bar/tape

Capacity:
- 18,000 lbs. / 8,165 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Siemens open architecture
- Semi-automated guidance

Keys to Success:
- Chassis that allows the AGV to fit through a 38”/.97 m door
- Halogen free wiring for nuclear environment
- High voltage, small footprint Li-Ion battery

Results:
- Robust and reliable system
- Personnel injuries have been minimized
- System that fit within current skill sets of employees
- Decreased infrastructure

Solutions:
- Automated guided vehicle
- Siemens integrated safety
- Magnetic guidance

Within the recent Nuclear project for was required to design and build an AGV that could fit within the current building layout and carry at least one “ask, totaling 18,000 lbs. / 8,165 kg.

The most critical design requirement for the AGV pictured was that it needed to be less than 38”/.97 m Width and 30”/.76 m in height. These requirements were derived from the width and height of an airlock door that the vehicle needed to travel through. The AGV clearance through the door was less than 10mm on each side. Both AGVs were controlled by plant personnel and have preprogrammed moves based on different areas in the plant. The preprogrammed moves are initiated by the operator and the “hold to run” option is active during vehicle movement. Doing so increased safety and reduced concerns on potential product damage or accidents. These vehicles were also required to be intuitive enough where personnel could be trained easily, operators are only able to be within a nuclear work environment for a limited number of hours.
Automated Guided Vehicles for Product Delivery

Product:
- AGVs - Dock N’ Lock

Guidance Technology:
- Magnetic bar
- Inertial with pencil magnets
- Capable of 0 degree turn

Capacity:
- 20,000 lbs. / 9,072 kg.

Safety:
- Safety scanners
- Safety bumpers
- Fail safe PLC

Controls:
- Vehicle management system
- Siemens open architecture
- Full-auto guidance

Keys to Success:
- Chassis and coupler designed around customer process
- Siemens open architecture, that matched customer strategy

Results:
- Increased safety
- Increased reliability
- Decreased throughput

Solutions:
- Automated guided vehicle
- Standard drive package
- Inertial guidance

The Fori Dock N’ Lock is a unique AGV product line meant to replace a fork lift or standard Tugger AGV for material handling.

The Dock N’ Lock AGVs offer increased automation versus a standard Tugger AGV. Whereas a Tugger AGV requires an operator to hitch the transport cart, a Dock N’ Lock automatically backs into the station and actuates a pin that enables auto-docking. The docking method utilized for the Dock N’ Lock, partnered with a companion cart allow the vehicle to be bi-directional.

The Dock N’ Locks overall capacity is 20,000 lbs. / 9,072 kg. the total capacity can be customized by utilizing different options of off the shelf drive wheel, gearbox and motor combinations. The Dock N’ Locks are currently capable of speeds up to 200 feet / 61 m per minute. A siemens PLC is used for safety and navigation, resulting in an open controls architecture.
Automated Guided Vehicles for Product Delivery

Product:
- AGVs - Tuggers

Guidance Technology:
- Magnetic bar
- Inertial with pencil magnets
- Capable of 0 degree turn

Capacity:
- 20,000 lbs. / 9,072 kg.

Safety:
- Safety scanners
- Safety bumpers
- Fail safe PLC

Controls:
- Vehicle management system
- Siemens open architecture
- Full-auto guidance

Keys to Success:
- Chassis and coupler designed around customer process
- Siemens open architecture, that matched customer strategy

Results:
- Increased safety
- Increased reliability
- Decreased throughput

Solutions:
- Automated guided vehicle
- Standard drive package
- Inertial guidance

Fori Automation’s Tugger AGV is a cost effective material handling solution that increases safety and throughput. The Tugger AGVs were designed and built to fit within existing plant environments and each plant respective material handling strategy. The Tugger AGVs were commissioned to replace non-value added material handling tasks, many of which are completed by Fork Lifts. Not only is the return on investment favorable on the Tugger AGV system, but the related product damage and safety concerns have been reduced. The Fori Automation Tugger AGV is based on the same architecture and design as the Dock N’ Lock. The only difference between the vehicles is the Tugger does not include the auto-docking feature. The Tugger requires operator interface for hitching the carts. These vehicles can be customized based on specific weights, speeds and total throughput.
Automated Guided Vehicles for Chassis Marriage

Product:
- AGVs

Guidance Technology:
- Magnetic bar / tape

Capacity:
- 8,000 lbs. / 3,629 kg.

Safety:
- Safety scanners
- Safety bumpers
- Fail safe PLC

Controls:
- Allen Bradley Controls
- Vehicle management system
- Full-auto guidance

Keys to Success:
- Custom design for customers preferred process
- Expansive controls experience allows for seamless Allen-Bradley transition

Results:
- Robust and reliable system
- Increased process flexibility
- Decreased infrastructure versus rail guided vehicle
- System that fits within current skill sets of employees

Chassis marriage has primarily been a process that has been completed utilizing Rail Guided Vehicles. Which result in additional infrastructure and decreased flexibility.

Fori's main focus for the Chassis Marriage AGVs was to work within the customers controls strategy. Although Fori has expansive knowledge with Allen-Bradley control systems, this system was the first to be integrated that was Allen-Bradley PLC based. Fori has long used a PLC based control system that allows for an open architecture, eliminating the standard “Black Box” that is used by a large number of it’s competitors. The vehicles utilized a magnetic bar guidance. This allowed for a high level of accuracy and repeatability, while keeping infrastructure costs low. Lithium Ion batteries were used to power the vehicles, an off the shelf drive wheel and lift was used. This resulted in a low cost, commercially available solution for the customer.
Rail Guided Carts - RGCs for Module Assembly

Product:
- RGCs

Guidance Technology:
- Rail guided

Capacity:
- 1,500 lbs. / 680 kg.

Safety:
- Safety bumpers
- Fail safe PLC

Controls:
- Vehicle management system
- Full-auto guidance

Keys to Success:
- Cost effective robust design
- Standardized unit, customizable tooling plates for any product
- Opportunity charge system for continuous usage

Results:
- Increased reliability
- Increased throughput
- Decreased plant infrastructure
- Reduced installation time

Solutions:
- Rail guided vehicle
- Standardized control package
- Vehicle management system

Fori has recently developed a new low cost conveyance solution to replace the bulky and expensive conveyance systems that are normally used within automotive assembly plants.

The RGCs are a simplistic design which contains one spring loaded drive wheel that tracks a above floor mounted rail. RGCs are a great option when a fixed path will be used and there is a high level of importance placed on cost and long term flexibility. The top of the vehicle can be customized for any product, pallet, etc. RGCs are modular and can be easily swapped out in the event of a failure.

The RGCs were designed and built considering an open controls architecture. Low cost lead acid batteries are utilized and the opportunity charging option makes for seamless manufacturing solution where the vehicles never have to leave the assembly loop. The RGCs use commercially available components to keep costs down and minimize any associated lead times.
Automated Guided Carts-AGCs for Chassis Marriage

Product:
- AGCs

Guidance Technology:
- Induction wire

Capacity:
- 5,000 lbs. / 2,268 kg.

Safety:
- Safety scanners
- Safety bumpers
- Siemens safety PLC

Controls:
- Full-auto guidance
- Vehicle management system

Keys to Success:
- Custom chassis to fit within customers process
- Customizable tooling plates
- Induction system for operation

Results:
- Robust and reliable system
- System that fits within current skill sets of employees
- Low maintenance system
- Decreased total cost of ownership

Solutions:
- Automated guided cart
- Vehicle management system
- Standardized control package
- Induction power & guidance

Automotive chassis marriage has widely been accomplished using rail guided vehicles, Fori has decided to use induction wire for power and guidance in order to reduce plant infrastructure costs and increase long term flexibility. The vehicles pictured were a simple design which contained two drive wheels and a slewing ring with linked steering in order to navigate through the assembly area. Steering was accomplished utilizing a differential steering technique. The marriage was accomplished using floor mounted lift arbors.

By integrating the floor lifts (pictured right) into the plant versus the vehicle, allowed the cost to be reduced greatly as well as reducing the complexity of the carts. Utilizing the inductive wire for guidance and power allowed Fori to remove the need for batteries and the associated chargers. These long term costs have lowered the total cost of ownership and reduced the amount of carts required for the project.
Assembly systems have largely been monuments which include bulky conveyance systems, that require large installations and are not flexible. Utilizing an AGC system that is powered and guided via inductive wire, provides a flexible solution and reduced plant infrastructure.

Inductive wire allows for an opportunity to reduce the number of vehicles required for the system, this is accomplished based on the continuous power source provided by the inductive wire. Power can also be supplied from the vehicle to any power tools and equipment that the operators could potentially use for the build process. Primary focus for the project was to provide a clean, sustainable solution that would provide long term reliability, remove the need for constant battery charging and replacement, as well as ensure a system that would be self sufficient for years to come.
Automated Guided Carts for Module Assembly

Product:
- AGCs

Guidance Technology:
- Magnetic bar / tape

Capacity:
- 4,000 lbs. / 1,814 kg.

Safety:
- Safety scanners
- Fail safe PLC

Controls:
- Siemens open architecture
- Full-auto guidance

Keys to Success:
- Cost effective design
- Integrated controls system
- Simple operation and setup
- Flexible system

Results:
- Robust and reliable system
- Flexible system
- Cost effective solution

Fori has designed and built a flexible, low cost solution to replace standard conveyors. Utilizing Automated Guided Cart (AGC) removes the need for large conveyor installations and retrofits, providing reduced infrastructure and operating costs while increasing flexibility. As an automation supplier, conveyor systems have been a mainstay in the assembly process. Based on customer demand for a more flexible solution, the Fori AGC has been developed to meet the ever changing needs of its customers and their products. The AGC utilizes a magnetic bar path and Fori patented sensor for guidance. The magnetic bar increases flexibility and reduces setup time and facility work. The AGC is based on a standardized controls architecture and commercially available components. Utilizing commercially available components has allowed Fori to maintain consistent quality product, while reducing the costs incurred by its customers. Standardized components have reduced total cost of ownership and reoccurring maintenance costs for end users.

Solutions:
- Automated guided cart
- Vehicle management system
- Siemens integrated safety
- Magnetic bar guidance
Automated Guided Carts for Component Transfer

Product:
- AGVs

Guidance Technology:
- Magnetic bar/tape

Capacity:
- 25,000 lbs. / 11,340 kg.

Safety:
- Safety scanners
- Fail safe PLC

Controls:
- Vehicle management system
- Full-auto guidance

Keys to Success:
- Improved push / pull mechanism for cart transport
- Low voltage system utilizing commercially available parts
- Opportunity charge system for continuous uptime

Results:
- Increased reliability
- Increased safety
- Increased throughput
- Decreased infrastructure

Solutions:
- Automated guided vehicle
- Standard drive package
- Mag-gyro (inertial) guidance

Fori was approached to design and build an AGV that will be used in the manufacturing process of catalytic converters for the automotive industry.

The vehicles were designed and built to fit within an existing manufacturing process. The vehicles were required to locate within +/- 10 mm. Once in station, the vehicle interfaced with an existing automated rail system. Each vehicle was outfitted with a three stage push/pull mechanism (middle picture). The push/pull mechanism needed to be capable of pulling a 25,000 lbs. / 11,340 kg. cart off of the rail system and loading to the AGV and transport to the dunnage area, where the cart would be pushed back onto the automated rail. The primary focus for the project was centered around increased safety and reliability. The current vehicles were failing frequently, Fori’s design was a more robust solution which has proved to be an excellent fit for their current build process. The flexibility of the guidance solution provided was also an added benefit for the end user.
Fori Standard Components: Lifters
Fori specializes in the design and build of custom lifts, the lifts pictured below were used on previous systems. Fori has the ability to design and build a lift to accommodate any project requirements.

**Product:** Servo Tandem Lift  
**Capacity:** 60,000 lbs / 27,215 kg  
**Lift Stroke:** 8 in / 203 mm

**Product:** Chain Lift  
**Capacity:** 4,000 lbs / 1,814 kg  
**Lift Stroke:** 48 in / 1.2 m

**Product:** Servo Lift / Level Arbor  
**Capacity:** 12,500 lbs / 5,670 kg  
**Lift Stroke:** 6 in / 152 mm

**Product:** Servo Lift / Level Arbor  
**Capacity:** 8,000 lbs / 3,629 kg  
**Lift Stroke:** 8 in / 203 mm

**Product:** Locking Lift Arbor  
**Capacity:** 14,500 lbs / 6,577 kg  
**Lift Stroke:** 8 in / 203 mm

**Product:** Servo Lift / Level Arbor  
**Capacity:** 22,500 lbs / 10,205 kg  
**Lift Stroke:** 4 in / 102 mm

Fori Standard Components: Drive Steer & Lift
Fori specializes in the design and build of custom drive steers and lifts, the pictures show units used on previous systems. Fori has the ability to design and build a lift to accommodate any project requirements.

**Product:** Dual Drive Steer Lift

**Product:** Single Drive Steer Lift

**Product:** Triple Drive Steer Lift

Fori drive steer lifts are used to automatically lift the drive steer when picking up tooling and product. Lifting the drive steer greatly reduces the side to side loading on the tool and allows the AGV to “float” and locate the tool.
Fori Standard Components: Drive Steer & Lift
Fori specializes in the design and build of custom drive steers and lifts, the pictures show units used on previous systems. Fori has the ability to design and build a lift to accommodate any project requirements.

Product: DS-15
Capacity: 15,000 lbs / 6,804 kg
Radial Mode: 3,250 lbs / 1,474 kg
Speed: 24 in / 609 mm per second
Dimension (L x W x H):
24” x 24” x 16”
61 cm x 61 mm x 41 mm

Product: DS-25
Capacity: 25,000 lbs / 11,340 kg
Radial Mode: 6,000 lbs / 2,722 kg
Speed: 24 in / 609 mm per second
Dimension (L x W x H):
44” x 26” x 23”
112 cm x 66 cm x 58 mm

Product: DS-45
Capacity: 45,000 lbs / 20,041 kg
Radial Mode: 9,000 lbs / 4,082 kg
Speed: 48 in / 122 cm per second
Dimension (L x W x H):
45” x 30” x 23”
114 cm x 76 cm x 58 cm

Fori Standard Components
Suspended casters, high capacity swivel casters, automated charging stations, battery carts and custom automation equipment

Product: Quad Wheel Suspended Caster
Capacity: 19,000 lbs / 8,618 kg

Product: Dual Wheel Suspended Caster
Capacity: 13,000 lbs / 5,897 kg

Product: Dual Wheel Swivel Caster
Capacity: 13,000 lbs / 5,897 kg

Product: Opportunity Charge Contact Pad

Product: Battery Carts

Product: Custom Automation for AGVs
Fori Standard Guidance & Power Supplies

The best guidance and power solution will be determined based on each project's design requirements.

Guidance: Magnetic Bar or Tape

Description: Utilizing a continuous magnetic path, Fori is able to achieve accuracy of +/- 0.2 in / 5 mm. Magnetic bar is the most cost-effective and reliable method.

Guidance: Magnetic Gyro (Inertial)

Description: Magnetic markers and a gyroscope are used for the MagGyro method. Magnetic markers are placed at a predetermined distance and the vehicle will travel utilizing gyroscope feedback and corrections will be made at each magnetic marker.

Guidance: Laser Contour

Description: Safety laser scanners are used to guide the AGV in areas where magnetic bar placement is not possible. Guidance was completed by measuring the end and outer wall distance from the AGV and using that feedback to locate the AGV within +/- .08 in / 2 mm.

Power Source: Lithium Ion

Description: LiNMC batteries provide a high energy density and increased life cycle, but are more costly than lead acid options.

Power Source: Lead Acid

Description: There are a number of different lead acid options, sealed are the preferred option, larger footprint, reduced cycle life versus LiNMC but much lower cost.

Power Source: Induction Power

Description: Induction power allows for non-stop vehicle operation. Completed utilizing an in-floor power and communication cable. Decreased flexibility and increased cost versus battery options.