

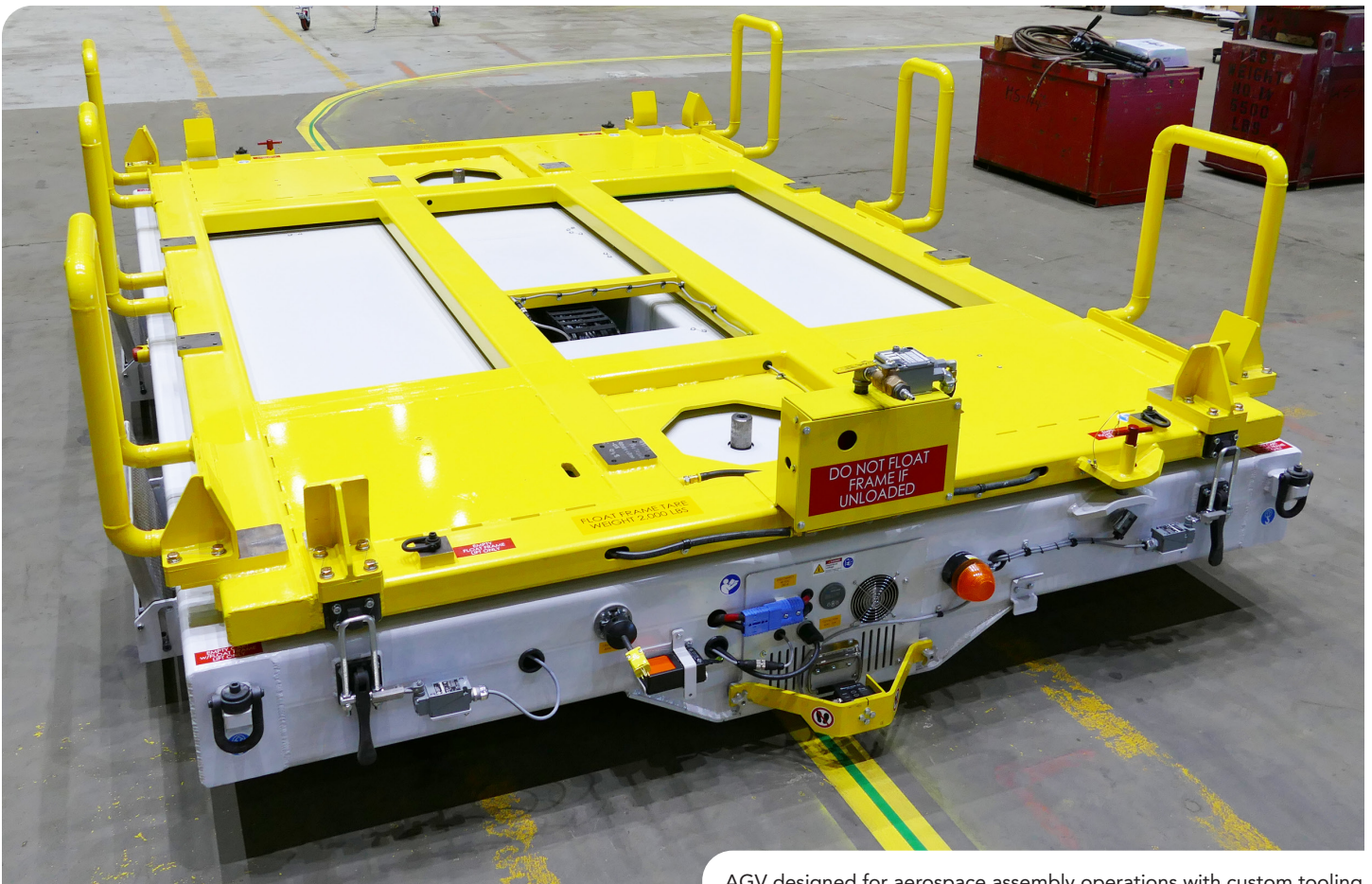
## A Buyers Guide: Automated Guided Vehicles (AGV)

### AGVs Contribute to the Automation of Your Business

AGVs contribute to the automation of your business. If you think about sustainable mobility solutions, electromobility plays a significant role. Automated guided vehicles play multiple roles in many industries' assembly, manufacturing, and MRO facilities.

AGVs in heavy industry are what we will focus on here, advocating for sustainability and the automation of your facility. Heavy industry uses various AGVs to accomplish several modes of mobility in your plant. AGVs are battery-operated vehicles that will move products from point to point through automated means.

We will explore what AGVs are, looking at the different types of vehicles available and how they work. We look at the apparent benefits AGVs bring to your facility (the more you know...). Also, we'll talk about specialized tooling, batteries, navigation, steering, features, and cost considerations and review aspects of AGV ownership you should always consider before moving forward with any automatic guided vehicle investment.



AGV designed for aerospace assembly operations with custom tooling.

## Heavy-Duty AGV Type

A heavy-duty automated guided vehicle or AGV is – in fact - a type of robot called an autonomous guided vehicle or automatic guided vehicle. AGVs follow predetermined instructions to move from point A to B and C and so on while completing actions such as moving materials from work cell to work cell or assembly to shipping, etc. AGVs are considered a safe, efficient, and cost-effective electronic mobility solution over manual push carts and tuggers.

Heavy-duty AGVs are well suited to assembly, maintenance, repair operations, manufacturing, or any other application that requires heavy-load, repetitive material handling tasks to be completed promptly. AGVs do the necessary 'heavy lifting' to create a more ergonomic atmosphere in your facility.



AGV traversing 40,000 lbs. power-generation engine.

## Underride AGVs

An Underride AGV or Automatic cart is the most common automated guided vehicle in the assembly, MRO, and manufacturing industries because they move the product through its paces. These electric AGVs include customized tooling to fit the product securely to its platform while technicians work on the product from cell to cell. The heavy-duty underride AGV is also known as a self-driving cart and under-cart AGV. Underride AGVs drive underneath their payloads, using a hydraulic method to rise and capture the load, then secures the item with custom tooling fixtures.

## AGV Custom Tooling

A heavy-duty underride AGV's tooling can include many options, like a scissor lift to bring the product to specific, predetermined heights at each cell, head stock/tail stock rotators, and even tilters and turntables to position the product ergonomically. These AGV tooling positioners are meant to increase efficiency and safety during each application, such as manual welding, robotic welding, cutting and assembly, production welding, laser applications (welding, cutting), component assembly, cleaning, repair, and maintenance.



Product positioning AGV with head/tail stock rotator.

Additionally, the underride heavy-duty AGV tooling is designed to incorporate existing or new equipment, such as four-post overhead lifts, which remove the product from the AGV for further assembly, final inspection, and testing.

A single AGV design can be engineered to fit multiple tooling accessories to carry more than one product model at your facility. This offers a cost-effective option when your assembly, manufacturing, or MRO plant services more than one product or product type.



## Heavy Unit Load Carrier AGVs

Heavy unit load carriers are essentially the same type of AGV as an underride AGV in that they are often used in assembly and manufacturing production facilities. Unit load AGVs carry their payloads on top and are available with a range of transfer devices, such as conveyors and lift platforms. An everyday use for a heavy unit load AGV is to move product through work cells and final assembly lines.

## Battery Systems

Each automated guided vehicle comes complete with battery and charging systems built in. These battery systems can be custom engineered to run for as long as is needed before recharging. Employing more than one AGV in any design reduces downtime while the unit charges. The assembly or factory floor needs never experience downtime with an electrified assembly floor.



AGV battery power indicator and charger.



## Best Industries and Benefits for the Heavy-Duty AGV

AGVs were initially employed in rigid automotive assemblies like fixed automation equipment, i.e., robotic arms. But with the advent of sustainability in assembly, manufacturing, and MRO processes, the AGV has been widely implemented in other high-tech industries, such as the production of power-generation turbines and transformers, aerospace engines, rail engines, truck assembly, food & beverage production, paper and printing, steel production, and textiles. These industries employ automated guided vehicles because they work much more efficiently and safely than an outdated conveyor, tow-line carrier, or tugger system can.

Additionally, AGV systems don't require embedded tracks into a factory floor. This allows for more flexibility when redesigning an assembly or MRO floor plan. As a factory's needs change, an AGV system changes with them at low to no cost to the business.

Because an automatic guided system follows a virtual, programmed path using the vehicle's navigation software or painted line or colored tape, all that is required to alter your current floor plan is to reprogram, repaint or replace the tape that the AGVs follow with their sensors. If other duties are removed or added to the preprogrammed schedule, a simple code can be written to achieve your facility's specific needs.

Unlike with a fixed tow-line system which runs on rails and is embedded into the concrete floor, tearing up the floor to reroute your production system is bypassed, increasing your uptime while removing the excessive downtime involved with this kind of refurbishment.

Another benefit of employing AGVs over traditional material-handling vehicles is that AGVs are automated and thus involved in fewer accidents than manually operated vehicles. Fewer injuries follow this logic, potentially lowering business insurance rates and penalties.

Ongoing costs are typically much lower with an AGV because they move and operate in predictable ways, stopping and starting in a controlled manner following a set path and instructions. They are unlikely to be damaged because they are a part of an automated system.



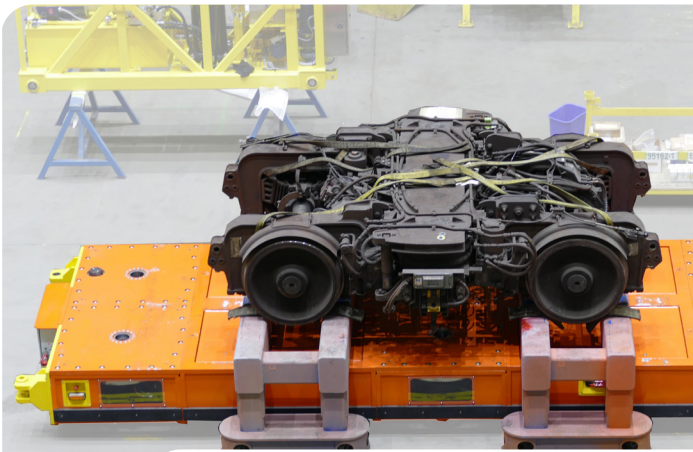
AGV moving truck bodies through assembly cells.

Eliminating human error and costs, the AGV will show its ROI in 1 to 2 years usually. Besides, human resources are becoming increasingly difficult to find to fill labor-intensive jobs the AGV can perform effortlessly.

Improving predictability, efficiency, and accuracy are essential benefits in the assembly, MRO, and manufacturing industries and are being met with the help of AGVs.

When an AGV is employed, human workers can focus on more high-value work.

## How does an AGV's Navigation Work?



AGV traversing rail bogies for maintenance operations.

In the assembly, manufacturing, and MRO scenario, automated guided vehicles travel along a pre-determined path, allowing technicians or robotic operations to perform their tasks. As mentioned, an AGV's paths can be marked on the floor with magnetic tape, tags, or virtually. When virtual, it is critical for an automatic guided vehicle system to know a vehicle's exact position to navigate the fleet effectively.

Navigation technologies should be able to identify a vehicle's position using a combination of sensor data

(such as data from laser scanners) and odometry. Advanced AGVs can work alone or as part of a more extensive connected fleet. To schedule tasks, distribute these between vehicles, and manage traffic, AGV fleet management is commonly used. This software is highly scalable both horizontally and vertically. It can run on-premises or on the cloud.

The software running your automated guided vehicle is integral to your overall AGV system and can not be overlooked. Just as you expect a robust frame and components to make up the AGV's physical features, the software must address mission simulations (for testing before operation), fleet monitoring, mission and fleet management, charging management, and traffic control.

AGVs are intelligent machines, and accuracy is integral to the AGV's function. Whether picking up, dropping off, positioning a product in a work cell, or docking to charge, the AGV must exhibit precise positioning to avoid accidents and equipment and product damage.

Often, an AGV will be outfitted with a tethered, hand-held controller an operator will use for removing an AGV from the line for maintenance operations or charging duties.



AGV positioning vehicle body for assembly.



## AGV Steering Options

Because an automated guided vehicle is meant to replace multiple materials handling equipment such as tuggers, forklifts, manual carts, pallet jacks, or conveyors, the AGV has to be many things. It must fit in tight spaces, perform multiple roles, include omnidirectional steering, and do these things more efficiently than its predecessors. Of course, custom heavy-duty AGV bodies should be designed specifically for your facility and precise application requirements.

AGVs can employ extensive mobility options such as forward and reverse, left/right turning, side-to-side, diagonal, and zero-radius turning. These options make an automatic guided vehicle adaptable to complicated navigation through any facility. These omnidirectional features create a highly agile AGV that can navigate multiple floor layouts.

Electric AGVs typically perform jobs previously carried out manually using forklifts, manual carts, pallet jacks, or conveyor systems. Because these processes exist across multiple industry types, AGV technology suits numerous sectors.



Detail of AGV custom sensors, lights, and features.



## AGV Features

There are many options to consider building a reliable and robust AGV that performs to the specific application requirements of your facility. A technical salesperson can get you started with suggestions to increase safety and efficiency, and then the engineering support will build your custom requests into the AGV.

Such features include (but are not limited to):

- ✦ Central drive wheel modules and stabilizing casters
- ✦ E-Stops
- ✦ Hand-held controller (to put the AGV into manual mode)
- ✦ Safety lights
- ✦ On-board charger
- ✦ 50' cord on retractable cable reel mounted to the unit
- ✦ Access maintenance covers
- ✦ Accessible battery drawer
- ✦ Accessible utility drawer
- ✦ Forward, reverse, diagonal, side-to-side, zero-radius turning
- ✦ Dual motor controllers for traction and steering
- ✦ Non-marking polyurethane wheels
- ✦ Audible signals
- ✦ Motion sensors
- ✦ Travel limit switches
- ✦ Toe guards
- ✦ IIoT 4.0 technologies
- ✦ Specialized tooling
- ✦ Hydraulic wheel lifts Hydraulic cylinders and onboard hydraulic power unit

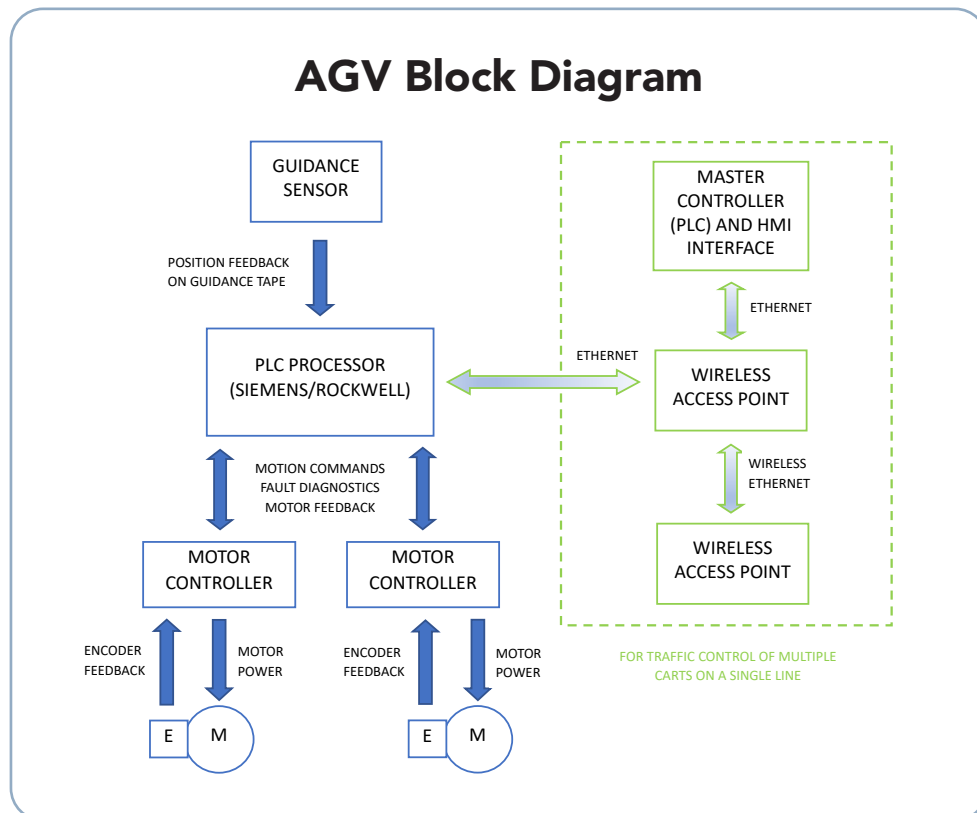
What you can include on your automatic guided vehicle is only limited by your facility's specific needs. Technical sales and engineering can assist in realizing your best AGV material handling solution.

Of course, not all AGVs are created equal. The design itself must safely and efficiently carry your load through your facility and be able to work with your other material-handling equipment throughout the process.

Thus, the custom AGV must conform to your specific dimensions, load capacity, tooling fixtures, and options. This is where most AGV manufacturers cannot win your business with their limited capacity to customize an automated guided vehicle for heavy-duty processes. Purchasing a heavy-duty AGV off the shelf will not serve you or your facility. Custom AGVs offer exactly what you need and include free consultations on-site with an experienced material-handling professional who has seen it all. Custom AGV refers not only to the body, features, and capacity but also to the custom programming required to run your AGV system.



AVG interacting with other custom material handling equipment.





## Maintaining a Healthy AGV System

The Industrial Internet of Things is becoming increasingly important to companies with multiple heavy-duty equipment in an industrial setting. Monitoring equipment health is a daunting task, and IIoT offers assistance in the form of preventative maintenance by allowing the equipment to do the talking. Being proactive with maintenance and repair tasks for your AGV fleet will assist in eliminating downtime.

### AGV Costs

Yes, the upfront costs of AGVs are high, but the benefits that come with them lead to substantial ROI, often in as little as one or two years. Case studies concerning AGVs are available to review, and AGV sales professionals are eager to help your facility realize its highest level of safety and efficiency.

- ✓ When selling the business case for AGVs in your assembly, manufacturing, or MRO facility, there are many factors to consider when calculating this high-value investment.
- ✓ The initial cost of the automated guided vehicle
- ✓ The equivalent cost of the manual vehicle(s) an AGV is replacing
- ✓ The estimated annual maintenance cost the manual vehicle(s) an AGV is replacing
- ✓ The costs and overheads of the labor being replaced (for example, forklift drivers)
- ✓ The costs of the propane/diesel/natural gas being saved (for example, forklifts)
- ✓ The estimated costs of damage to goods caused by the manual vehicles being replaced
- ✓ The cost of installing (commissioning) the AGV(s)



AGV traversing 40,000 lbs. power-generation engine.

## AGV Installation

AGV installation time depends on the number of AGVs a company has purchased, the navigation type, and integration with any other material handling equipment within the facility.

The manufacturer should have an experienced installation team to get your equipment delivered and running to specified parameters. Training on-site would follow. Follow-up visits and parts and services maintenance is another primary consideration to keep the fleet running efficiently. Your AGV manufacturer should have a robust and active AGV parts & services department to assist you at every stage of your AGV journey.

Budgeting around 10% of an AGV's sticker price for maintenance per year is typical. This number may lower when IIoT is included in your software.

Are you looking to scale up your AGV system after a year or two or five? This should be far less labor-intensive than the initial installation. A new AGV can be programmed to fall in line with your other AGVs as you expand your operations and seamlessly join the queue.

Are you looking for one-on-one guidance to incorporate an AGV system into your facility? You can book a free consultation call with one of our technical sales experts at any time through our form.

## About Handling Specialty

Handling Specialty Manufacturing Inc. was incorporated in 1963 and has been designing, building, and supporting custom material handling equipment, including automated guided vehicle systems for industries such as advanced manufacturing, automotive, aerospace, entertainment, power-generation, rail & transportation, and iron & steel. Handling Specialty's experienced technical sales, engineers, manufacturing professionals, and parts & services departments are ready to create a safe and efficient facility for your assembly, manufacturing, and MRO needs.



Handling Specialty's 100,000sq ft Hamilton facility.