PRODUCTIVITY SOLUTIONS FOR DISTRIBUTION, WAREHOUSING AND MANUFACTURING



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AGVs roll into next frontier **44**

Esther Diedrich, Marshall Retail Group's director of distribution

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roll into the next In response to rapidly changing demands, autonomous vehicles of all kinds are making their way into the modern warehouse.

Consumer demands are driving massive change in manufacturing and distribution. As some companies work to bring or keep operations stateside to improve service levels, they face a more expensive and shallower labor pool.



AGVs have thrived in structured manufacturing environments and have faced steep challenges in distribution.

Automation in manufacturing continues to hunt for fractions of cents, but the pursuit of efficiency in warehousing and distribution applications has been called "the next frontier" for automation.

frontier By Josh Bond, Senior Editor

Cory Flemings, director of sales and marketing for AGVs at JBT Corp., suggests the majority of many companies' previous automation projects focused on more efficient manufacturing, but he sees plenty of signs that it's distribution's time to shine. Automatic guided vehicles (AGVs) are among the most flexible and scalable automation solutions, and have used these strengths to transition from steady performance in manufacturing environments to the more dynamic warehouse.

AGVs now handle applications including trailer loading and unloading, pallet storage and retrieval, full pallet replenishment, empty pallet delivery, crossdocking and goods-to-person picking. Flemings anticipates that it will soon seem strange to see operator-driven equipment performing any non-value-added task.

Achieving greater value

AGV is used here as an umbrella term to encompass automatic guided vehicles, carts, tuggers, driverless or semi-automated lift trucks, and guidance systems of all kinds. Simply because there are more existing facilities vs. new purpose-built facilities, most AGV implementations are introduced to the constraints of current layouts and processes. Although many AGVs are part of



wider projects or improvements, they are not always fully integrated into workflows and information technologies. Some merely take out the trash.

"In one of our smaller customer's repackaging area, workers built up mounds of plastic and cardboard and occasionally loaded it on a cart to haul it to a central location," says Nick Anderson, business unit manager for AutoGuide. "They now have just one AGV that roams the warehouse collecting trash, and workers can keep working."

Similarly, AGVs that support human pickers separate them from the unproductive time required to deliver picked orders. As one loaded pallet jack AGV departs for pack-out, another could pull in behind. The predictability of an AGV's driving habits might also provide a benchmark for ideal maintenance costs. "It's a lot easier to maintain since there's no revving, brake slamming, accidents or rapid direction and gear changes," says Joseph Mirabile, manager of application engineering for Seegrid. "Precise acceleration and deceleration make for a simpler planned maintenance (PM) schedule, and once you know how long a load wheel can last, you can try to get the same performance from human operators."

In places where an AGV replaces a

Some AGVs use familiar conventions like headlights and taillights to easily communicate with nearby workers.

For example, an operator who spots a problem with a product could use a tablet to direct the AGV to the quality control department instead of spending his next 15 minutes delivering and communicating the problem. If the equipment itself has an issue, Simon Drexler, director of industrial systems at Clearpath, notes a base customer expectation that a system needs to be maintainable by the facility staff.



Automation targets materials handling tasks that add no value.

conventional lift truck, the ROI is often clearer, since it is based on predictable costs. Equally as common are applications where the benefit of something like a mobile trash bin spreads across a group of employees. To further boost worker productivity, AGV suppliers have worked to enable an unskilled employee or supervisor to easily maintain the equipment.

"Modular, off-the-shelf components enable AGVs to minimize the amount of human interaction needed," Anderson says. "When the AGV does need to communicate something, it should make it easier to foresee and prevent catastrophic failure, allow monitoring and troubleshooting on-board, and make the unit more controllable by the workforce." Drexler says the goal is the ability to service or swap any component inside an hour.

As business conditions change, onsite employees might use AGVs less like autonomous carts and more like a tool with interchangeable bits. Don Heelis, sales manager of tire and AGV systems for Cimcorp Automation, describes 'appliances' that can be added to an AGV to allow it to interface in a number of different ways. "This could be as simple as a conveyor top or a lifting device of some kind," Heelis says. "The only limits are the limits of one's imagination."

Always give verification

Interestingly, the AGVs themselves can become valuable collaborators as their

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owners imagine the path forward. When fully integrated, AGVs interface with the physical world as well as that of planning, management and execution software. Drexler says this allows each unit to act as a real-world proxy for the enterprise resource planning (ERP) system, making all of its decisions based on that higher-level command. But it's a two-way street. "There's real-time input from the ERP or warehouse control system to the AGV, but it's not just taking orders," Drexler says. "It's feeding information back to help improve ERP performance, and you now have a closed loop of 100% traceable activity of whatever good is being moved."

Along with direction from the ERP, AGVs typically use their own traffic management software to coordinate activity. This allows for real-time responsiveness that provides further value to the higher systems. "Some of the ERP systems can be difficult to



As opposed to replacing a worker, an AGV unit that takes out the trash can boost the productivity of an entire team of employees.

modify," says Dave Noble, senior sales engineer for Jervis B. Webb, a subsidiary of Daifuku North America, "but if the fleet management software can determine that a specific vehicle is closer to the next task, it can reassign it on the fly and increase efficiency. When directions come down, each AGV can accept them, alter them, or accept and add a follow-up task. This creates a circular loop of improvement."

It can be easier to calculate the ROI

for an AGV that

replaces the well-

understood costs

of an existing lift

truck.

Metrics such as idle time, time to destination, route taken or time spent dealing with obstructions can tell a lot about what's happening in the environment, according to Todd Jedelsky, national sales manager for the logistics and automation division at Murata Machinery USA. "It will indicate whether there are physical areas within the facility that should be addressed or optimized," Jedelsky says, "or indicate where adjustments in the sequence of operation should be made at various stations or intersections."

Each unit's awareness of all others might help it determine that a particular aisle is crowded and that the next aisle over is the quicker path to its

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destination. Trends and patterns quickly emerge as the AGV fleet dynamically adjusts based on a changing order environment, and could inform facility layout, process design and wider decisions.

One of the benefits of combining operational and equipment data is the fleet's ability to self-diagnose and automatically right-size. Consider a fleet of 40 AGVs that feeds and offloads an automated picking system. If a cell is starving for product but there is a sufficient order queue, additional AGV units might be necessary. "On the other hand, if you see AGVs waiting around for work, you might think you have too many when in fact it could be the opposite," Heelis says. "There's a methodology to designing a system to size, but there are inherent elements of the process that are hard or impos-



Industrial AGVs are borrowing insights from the navigation technologies used by Google and Tesla Motors.

sible to predict. Your 40 AGVs suddenly wind up with lower utilization than you expected, but analysis could reveal you need 52 to make everything hum in an orchestrated fashion."

Automation's growing vision

Clearpath's Drexler also notes increased demand for interconnected systems among distribution customers, who he says are appreciative of the possibilities of systems that "speak" to each other. "Industrial clients are risk-averse," Drexler says, "but there is great interest in connectivity."

Ironically, these technological advancements might best be applied to the pallet. "It's a clear entry point for AGVs," Flemings says. "One client told me none of his customers pay him to move pallets around. There simply isn't value there. But

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many companies have been busy looking at upstream automation like mini-loads and haven't gotten to the pallet and AGV concerns. I'd say many are now at the level of process where they have an automated warehouse management system, an automated storage and retrieval system (AS/RS), and are now seeing the value of AGVs."

Just as lift trucks have borrowed from automotive technologies to enhance performance and ergonomics, AGVs are already using some of the same navigation technologies being pioneered by Google and Tesla Motors in self-driving cars. SLAM, or simultaneous localization and mapping, helps automated cars and pallet handlers make sense of their environment, while familiar features like headlights, taillights and turn signals immediately convey a unit's status and intent to nearby workers.

Roland Anderson, AGV applications

engineer for Amerden, says he's recently seen a new push for "natural guidance" technologies, or those that require no infrastructure or workspace changes. In the AGV business since 1979, Anderson says he's seen plenty of simple AGV systems using magnetic tape and more complex ones using wire guidance. He's also seen laser-guided systems, which orient themselves to within 1/4 inch by detecting ceiling-mounted tags and visionbased systems that can begin to build a context based on dynamic elements in their environment.

"Vision tends not to be as accurate, and might travel slightly longer distances because it guides itself more like you or I would," Anderson says. "If I ask you to walk back and forth in the woods a few times, your paths will deviate some."

The flexibility of these systems is

suited to dynamic environments, but the balance of precision and flexibility must be carefully managed, he says. "The technology has a ways to go," Anderson says. "There is more work to be done to use vision or natural guidance systems in a dynamic environment."

Companies mentioned in this article

- Amerden AGVS
- AutoGuide, a Heartland Automation Solutions Company
- Cimcorp Automation
- Clearpath Robotics
- Jervis B. Webb, a subsidiary of Daifuku North America
- JBT Corporation
- Murata Machinery
- Seegrid

