Robotics247

SPECIAL FOCUS ISSUE
JUNE 2024

Orchestrating Mobile Robot Fleets for Success

PEERLESS
CONTENT CREATION

CONTENTS

EDITOR'S NOTE

Organizations working with mobile robot fleets can be overwhelmed with data. Establishing ideal performance metrics and sifting through the abundance of data for the key performance indicators are integral parts of fleet management software. Businesses need to find the proper balance with their fleets and pertinent data to succeed.

Whether they're called fleet management or fleet intelligence or anywhere in-between, software suites gather this abundance of data and provide insights to warehouse management to parse. The decision-making process, now coupled with artificial intelligence and machine learning insights from this data, is key to optimizing robots in or across warehouses.

In this Special Focus Issue, we'll examine how companies have developed their fleet management platforms in conjunction with various robots. We'll also explore how organizations have integrated the latest physical and digital technologies to provide warehouse managers the clearest data possible to generate ROI on robotic deployments.

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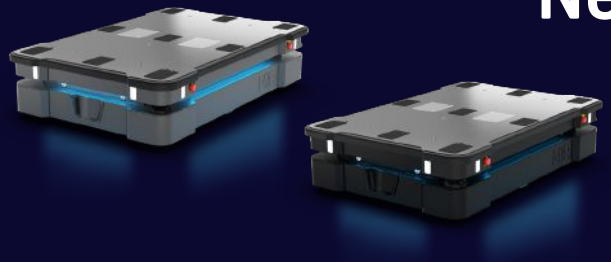

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Working alongside Scythe Robotics autonomous mowers

Kali Hamilton, Billy Otteman share features of the built-in M.52 control panel and app-based interfaces

BY DONALD HALSING

Landscapers drive their fleet of Scythe Robotics M.52 mowers out to a property. Once the robots are in their respective mow zones, the operators simply press start to begin autonomous Scythe mode. Source: Scythe Robotics

Landscaping crews operate on the principle of efficiency. But monotonous mowing tasks take away from time that they can spend performing detail tasks, such as edging and trimming or managing planters.

Scythe Robotics developed its autonomous commercial mower, the M.52, to help landscapers improve their operational efficiency. With support from Scythe's engineers, implementation team, and customer support services, landscapers can automate mowing large areas, gaining back time to complete detail work.

From machine testing to customer deployment training

Kali Hamilton, field robotics engineer at Scythe, said field service is primarily focused on the mechanical and electrical health of M.52 robots, but are also the first point of contact when something goes awry. "We need to be intimately familiar with all the ways an operator can misuse the robot."

As the company's first field hire, Hamilton started by fixing M.52 autonomous mobile robots (AMRs) in the production warehouse and supervised technicians. Over time, Hamilton became responsible for fleet management metrics, including availability and mean time between failures.

Mitigating issues starts with run-in testing. Once an M.52 mower rolls off the production line, Hamilton's team performs hardware reliability testing to collect data and identify workmanship issues, such as cable routing that survived initial testing but did not hold up during run-in.

"We tend to catch those in run-in, in the first 20-25 hours of a robot's life," Hamilton said. "Then we consider robots deployable to customers." Just before deployments, Hamilton's team updates robots to the latest soft-

Before and during the first days of a customer deployment, Scythe's Implementation team explains the M.52 autonomous mower and teaches landscapers how to use built-in and app-based interfaces. Source: Scythe Robotics

ware, firmware, and engineering design changes.

Scythe deploys its M.52 mowers through a robotics-as-a-service (RaaS) model. Hamilton said Scythe's implementation team works closely with customers to identify the best ways to incorporate autonomous mowers into landscaping teams and locate the best properties to use them at. The implementation team provides Scythe's customers with an overview of how to use the M.52.

"We - from beginning to end - try and work on the landscape crew's schedule," said Billy Otteman, senior director of brand at Scythe. "We want to be as efficient as possible. We don't want to slow the crew down."

Otteman said landscaping crews function like well-oiled machines, so Scythe's integration team thinks carefully about how and where to train new operators. "We really have to be able to integrate our training into those days and into those executions," he said. "We also want our training to be fast. We want our training to be intuitive and easy."

"By the end of that first day, the customer loads the robots on their trailer, and our team drives off with an empty one," Hamilton added.

Teaching landscapers strategies to manage fleets efficiently

Scythe's implementation team trains landscapers how to use the M.52's built-in Robot Control Panel (RCP). Through the RCP, operators can set mowers into one of four modes: park, neutral, drive, and Scythe. Before robots begin mowing autonomously in Scythe mode, they need to be told where to mow and where not to go. Operators use drive mode to generate that navigation information.

Hamilton said in drive mode, operators choose between manual mowing or zone creation. Before creating a zone, operators choose between creating a mow zone or a no-go zone. Operators can drive the robots around to map mow zone perimeters and larger or irregularly-shaped no-go zones, such as fenced areas. For smaller obstacles - including trees, poles, and large rocks - operators can drive the front of the mower up as close as possible and drop a location point onto the map, setting a radius for the no-go zone.

Hamilton said Scythe's mowers are not currently set up for "swarm robotics," or deploying multiple robots in the same mow zone simultaneously. But that doesn't mean each robot runs in isolation. She said zone sharing allows an operator to use one robot to map and set up zones while a second operator moves additional mowers into each zone to start mowing.

"We're working towards more efficiency, and all the ways we can reduce touch points for operators when they're mowing with multiple robots," Hamilton said.

Scythe's M.52 mowers back up their zones to the cloud, but an on-robot planner performs navigation using Scythe's software code base. When landscaping crews return to a customer location, they simply drive a robot back into the zone, and the RCP prompts them to either edit the task or start autonomous mowing. Operators can configure ground speed, blade speed, pattern, and other options, or reload a previous task with all its configurations.

"Every time those configurations change, the planner re-plans to maximize efficiency and also the type of plan to make sure our quality is good," Hamilton said.

Through the M.52's Robot Control Panel (RCP) interface, operators can instruct the mowers to record mow zones and no-go zones, and manage autonomous mowing tasks. Source: Scythe Robotics

Because mow zones are simply the outline of an area, the M.52's onboard planner can be instructed to change patterns through the RCP interface without having to remap zones. Hamilton said Scythe is currently focusing on providing a good cut quality for linear stripes, but also supports curves and may bring back spirals.

"Any changes to those configurations then become the most recent configurations for that task," Hamilton said. "So it does allow crews to both edit in the moment, and also - if they've really nailed down on the configurations that they want for that mow zone - it is persistent both for that robot and across the fleet."

Even though zones can be shared through the cloud, operators still need to evaluate dynamic conditions daily. Hamilton said Scythe's implementation team trains landscape crews to configure the autonomous mowers for temporary changes, such as adding a no-go zone around a wet spot one day and removing it the next day.

"There can be some strategy around: do you do a no go zone, or do you create a mow zone that does not include this obstacle?" Hamilton said. "That can affect the plan efficiency pretty greatly."

Customer training is all about efficiency - both learning how to use robot interfaces as well as maximizing the M.52's capabilities. "For folks who aren't used to autonomy or robotics, it does take several touch points for that to sink in," she said.

"We'll often even mow alongside them the day of," Hamilton added. "So that way you can hit the same property as you would have if we weren't here."

Otteman said after shadowing landscaping crews, Scythe's team follows up over the next few weeks to make sure they are using the mowers up to the level that they could be.

Camera data used to improve machine learning models

For localization to navigate through mow zones, the M.52 uses data from a real-time kinematic (RTK) positioning provider, which is received via antenna from a global navigation satellite system (GNSS). Cameras mounted around the robots provide 360 degrees of real-time obstacle detection.

Otteman said as Scythe's camera-based machine vision gets more sophisticated, they can rely on it as a complementary data source when satellite coverage might be blocked, such as underneath a tree canopy. Hamilton and Otteman also said ultrasonic sensors are embedded in the M.52 frames for development of the next generation of mowers.

As Scythe's robots autonomously mow, camera images are streamed for logging. Images are also collected from run-in, development, and test robots.

"We have an employee who somedays literally takes out the robot to various properties, just so we can make sure that we're capturing a variety of images, obstacles, dogs, trees, and brush," Hamilton said.

Scythe's data machine learning (ML) team works with a third party to categorize all the images to build AI training datasets. Otteman said obstacle images are prioritized based on frequency and importance. Humans, dogs, and trees are the most commonly encountered obstacles and the most important to avoid.

Otteman said the data ML team identifies where they need to increase the sophistication and breadth of the database as Scythe moves into new geographic markets.

Because M.52 robots are deployed across the U.S. - from Scythe's Longmont, Colo. headquarters to Texas, Florida, and recently Ohio - the ML model has learned to differentiate similar items of the same class, such as grass and fire hydrants of different types and colors. "We have the largest database of landscape scenes of this kind that exists to our knowledge," Otteman said.

Hamilton said the constant stream of data to improve ML

models is incorporated in regular software releases. Part of her job is managing latency issues for software and firmware deployments.

"Part of field robotics that's exciting is when your robots aren't in a warehouse, and might be on a trailer or at the back of the shed," Hamilton said. Scythe's team must wait until customers finish mowing before sending updates. "We never want them to be surprised, and landscaping crews work on a pretty early schedule. So the field team - we have to be prepared to be up on their schedule as well."

Otteman said the fleet management assigned to Hamilton's team is more complex compared to warehouse and manufacturing applications.

"That kind of fleet management is one level of difficulty," he said. "But then you add in the layers of being in a field, being a mobile robot, being a B2B [business-to-business] robot - trying to make sure you fit in this operational flow of a business and actually save them time - it's just incredibly complex."

The work that Kali and her team are doing is foundational to not just our success, but the success of our customers," Otteman added.

Scythe's goal is to allow landscapers to focus on detail work, such as edging and trimming, while autonomous M.52 robots mow large areas. Source: Scythe Robotics

Scythe app allows operators to interact with robots at a distance

Hamilton said when M.52 robots are unsure about what an obstacle is, they perform a safety stop. If the path ahead is clear, or the obstacle moves out of the way, operators can select a resume task option. The robots can pick up near where they left off or move over to the next stripe.

Operators can walk over to stopped robots and clear them through the RCP. But Hamilton also said operators can ping a customer support line, allowing them to keep working on their own tasks while Scythe's team recovers stopped mowers.

Another interface option is Scythe's mobile app, which provides the same functions as the RCP.

"The intent is to be able to do everything from the machine itself," Otteman said, "so that an operator is not having to take their phone out in the field. They might be fumbling with work gloves, they might have dirt on their fingers, that kind of thing.

"However, we do also want the ability for an operator to interact with the machine from a distance," Otteman added. "There's a few things that the mobile app just allows for better."

Within the Scythe app, operators can see the location, status, and battery charge level of all robots assigned to their company. They can also see all the mow zones assigned to robots, and rename, reclassify, or regroup zones.

"This is visible on the robot control panel as well, but there's much more detail in the app since there's the ability to have more compute power and more functionality," he said.

Otteman added Scythe is building functionality into its app to enable operators to check on the completion status of autonomous mowing jobs. This feature will provide landscapers with data that can allow them to plan their detail work around when the robots will finish their tasks. •

The Scythe Robotics team recently held a launch party at their expanded production line in Longmont, CO. Source: Scythe Robotics

***Donald Halsing** is Associate Editor of* Robotics247.com

RC Mowers adds split pattern plan and bilingual interface

Fleet management and Spanish support developed in response to customer feedback

BY ROBOTICS 24/7 STAFF

RC Mowers added a Spanish interface option and split mowing pattern fleet management tool to its Autonomous Mowing Robot based on customer experiences. Source: RC Mowers

Robotic mower manufacturer RC Mowers recently announced new features of its Autonomous Mowing Robot, also branded as "AMR," which include a new split plan mowing pattern feature and a bilingual English and Spanish operator interface.

RC Mowers said the new features can allow landscapers to complete jobs more efficiently and add autonomy to their fleets.

"These new features show our commitment to ongoing innovation," said Tim Kubista, RC Mowers vice president of sales and marketing. "We consistently engage with our customers to learn from their AMR experience, and then innovate to provide them with new features that help them meet today's landscaping challenges."

New features help employees focus on higher value tasks

The new split plan fleet management feature allows operators to set a single mow plan for an area and then deploy multiple autonomous mowers to determine the most efficient way to mow the area. Splitting a plan can save landscapers time by allowing the AMR app to divide a new or previously saved plan between multiple mowers. This results in a uniform presentation with mowers completing the task in concert. Operators can also replicate the stripe angle and overlap between mowers.

The other major feature change is the addition of a new English- and Spanish-language operator interface for both the app and the machine display. The bilingual interface allows operators to toggle between the language of their choice, helping to overcome language barriers.

"Many of our customers have workforces that are primarily Spanish-speaking, and adding this interface makes it easier and more efficient to implement the autonomous mowers within their fleet," Kubista said. "These machines can take care of the routine mowing that consumes valuable yet scarce labor, allowing landscapers to reallocate workers to the detailed work that impresses the customer and results in repeat business and more clients."

RC Mowers' AMR first hit the market last year and has helped users address labor shortages, RC Mowers said. The RC Mowers Robotics team, which includes professionals in aviation safety and experts who worked on developing autonomous vehicles for the U.S. Department of Defense, designed and constructed the mowers. The team is led by experts who developed weapons guidance systems for the U.S. military. •

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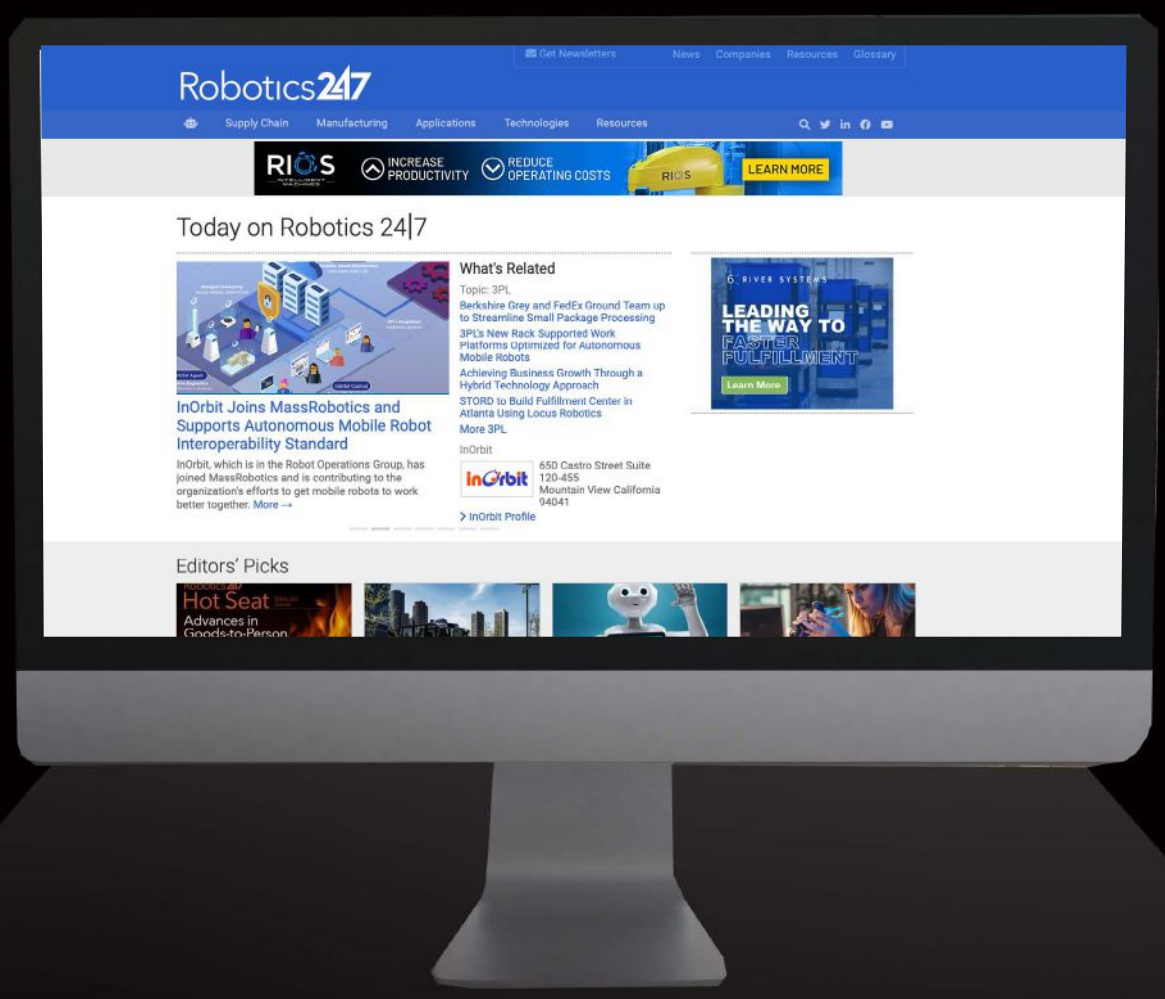

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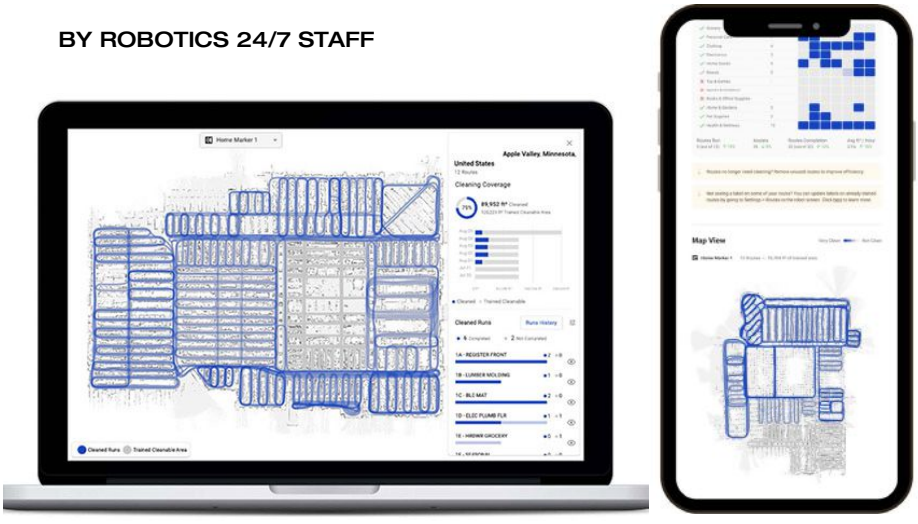
Site maps feature joins Brain Corp's BrainOS to give facilities managers visibility into robot operations

Site Maps provides real-time visual representations of a site to help optimize routes, plan schedules and maximize coverage for BrainOS-powered robots

BY ROBOTICS 24/7 STAFF



Site Maps is a new feature in BrainOS for real-time facility visualization It is available through the web. Source: Brain Corp

Brain Corp recently announced the Site Maps feature for its BrainOS software for autonomous mobile robots or AMRs. The company said it offers insights to facility managers about operational efficiency and proof of work.

A major challenge for facilities managers is determining what work has been completed or not. "This is especially true when it comes to facility cleaning and trying to understand what areas have been cleaned and what tasks still need attention," Brain Corp said in a release.

The company also said in a release that AMRs using BrainOS can provide data insights and tools so that this information is easily accessible.

"Site Maps have been a great way for our customers to receive a more comprehensive story of their operations from the data shared by robots," said Nicole Holzman-Schneider, a customer success specialist at Tennant Company. "This has enabled our customers to really break down their progress week over week so that they are more intelligent and efficient with their operations."

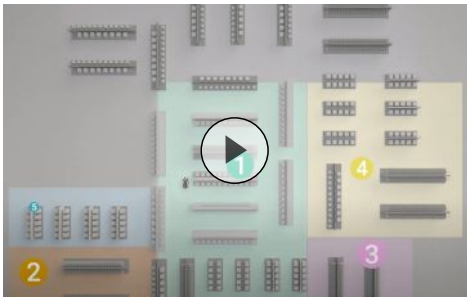
BrainOS Site Maps to help tune operations

The new Site Maps feature extends the visibility provided of BrainOS by providing a visual representation of an environment, according to Brain Corp. It said the enhanced data visualization can help facilities managers to better understand, in real time, the progress of operations.

Through accessing these visualizations, sites can train more efficient routes for their robotic fleets, plan optimized schedules and identify areas that need additional attention to maximize coverage and reduce overlaps, the company said. The feature also offers new capabilities for the BrainOS suite, such as performance grades and tables that summarize how well robots completed their operations in a facility during given a week.

Site Maps can be accessed through the web-based BrainOS Fleet Ops Portal, the BrainOS Mobile App and e-mail reports. This feature provides flexibility and convenience for monitoring and managing cleaning operations remotely.

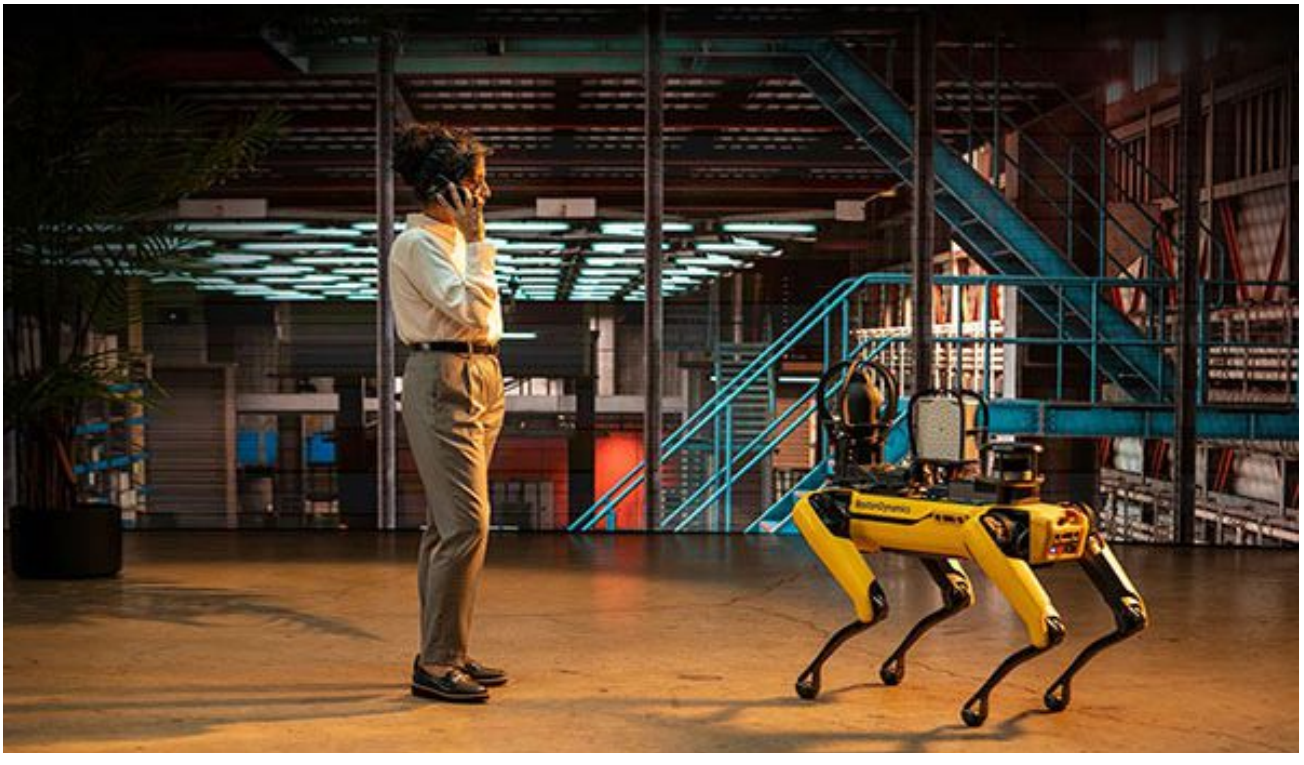
BrainOS said customers can contact their equipment manufacturers to enable Site Maps for their facilities. •



Boston Dynamics announces Orbit robot fleet management software, Spot enhancements

Orbit offers a single portal view of site, robots and equipment with analysis

BY TIM CULVERHOUSE



Boston Dynamics announced its Orbit fleet management software and enhancements to Spot. Source: Boston Dynamics

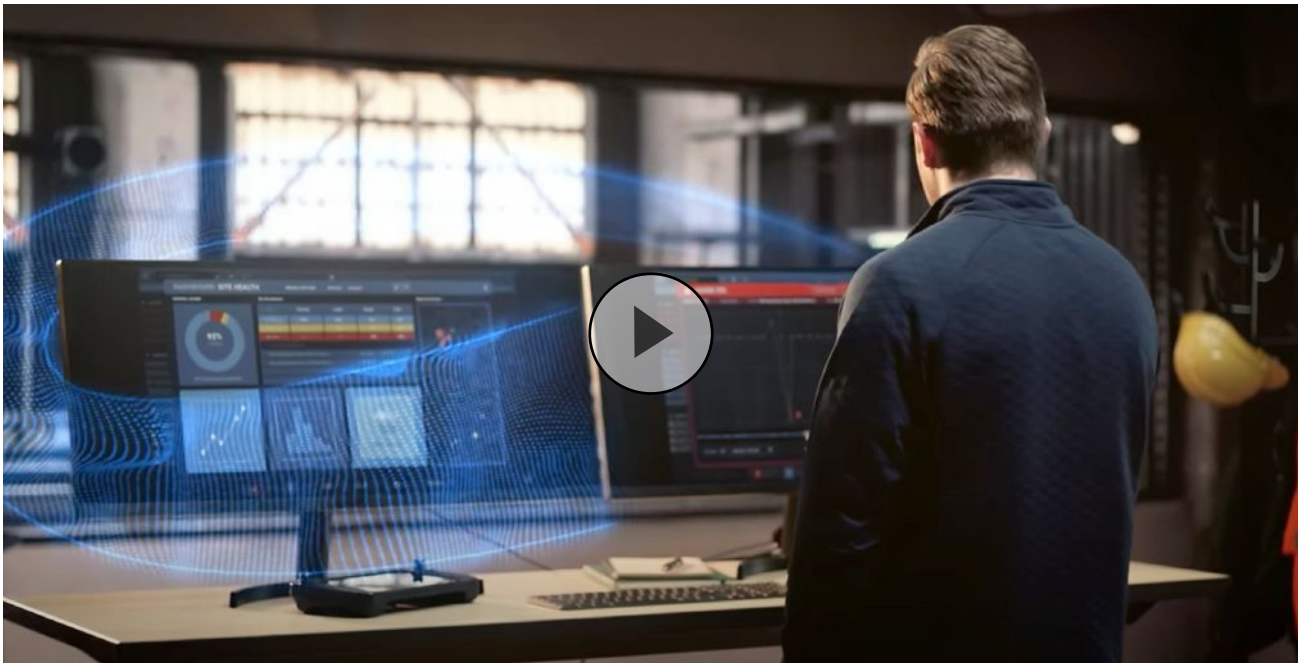
Boston Dynamics recently announced the release of a new robot fleet management software, called Orbit. The Orbit portal utilizes AI, in conjunction with enhancements to the Spot robot, to increase control of robot operations, better visibility into an organization's facility and extra flexibility for data analysis.

Orbit offering to bring real-time, predictive intelligence

Boston Dynamics newest solution, according to a statement, will "bring a whole new suite of fleet management capabilities and will unify your ecosystem of Boston Dynamics robots, starting with Spot."

Users can start with Orbit by creating a site map drawing of their facility and importing them into the portal. The software then overlays real-time information about the robots in use over the facility drawing, showing the user live robot locations, active missions and inspection alerts.

Users can create and modify mission recordings, allowing



organizations to record multiple sessions – with multiple robots over multiple days – and merge this information into a single map in Orbit. The offering also creates more mission scheduling flexibility to loop based on user-designated preferences. For example, users can choose to loop within a launch window, specific days and times or other designated timeframes. Timeframes can also include exclusions, such as weekends or other downtimes.

Orbit is currently available as a cloud offering for North American customers, with more locations coming soon, according to Boston Dynamics. The software eliminates the need for a hardware connection, integrating with an organization's Wi-Fi, LTE or cellular connection to Spot. However, the Site Hub option still exists for on-premise installation.

The software release also improves how alerts are displayed and shared to users. Inspection alerts are displayed on the portal homepage and users can click through the alert to see further analysis of visual, thermal and acoustic anomalies. Users can customize email notifications based on urgency relevancy to the personnel required for the update.

Spot updates pair with Orbit debut

The Waltham, Mass.-based company also coupled the Orbit release with enhancements to its Spot mobile robot offering. The Spot API now supports live signal data and telemetry displays in the Spot table and Orbit portal. Spot users can create a continuously updated display of readings from the robot during operation, and utilize contextual information, sensor readings and alert specifications to assess its performance.

As part of the Spot enhancements, customers will see adjustments to manual controls that improve comfort and command, according to Boston Dynamics. Spot will not return to a neutral position until it starts walking again, a marked difference from current movements under manual control.

Users can also send Spot autonomously to any accessible dock or recorded location in the Orbit site map without manual operation, including better operation around objects and stairs. •

Tim Culverhouse is the Editorial Director of Robotics247.com.

PIT's xBridge innovation center helps Ottonomy evaluate use cases

Pittsburgh International Airport deploys innovative technologies

BY DONALD HALSING

Airports are home to a variety of industries and businesses. Airside operations function alongside cargo and baggage ground handling logistics. Customer-facing terminals house security checkpoints and retail outlets. Runways, taxiways, ramps, and large grass fields make up most of the land area, while restaurants and stores inside terminals are compressed into expensive real estate.

"When I think of an airport, it's like a small city," said Cole Wolfson, director of the xBridge innovation center at Pittsburgh International Airport (PIT). "There's just about every industry that you can think of that operates here. And so there's boundless opportunities to find new and better, or more efficient ways of doing things."

As the director of xBridge, Wolfson helps innovative technologies spread their wings and find practical use cases to perch on. With such a diversity of spaces connected by complex technical operations, there's always room for growth and improvement.

With help from the xBridge Innovation Center, autonomous mobile delivery robots made by Ottonomy are now navigating the Pittsburgh International Airport. Source: Ottonomy

Real-world deployment testing offered by xBridge

Unlike other automation opportunities, where companies seek a solution for their operational challenges, xBridge is not demand-driven based on the needs of the airport. Wolfson said xBridge approaches innovative technology candidates not by asking what problems they can solve for PIT, but instead offers a resource to develop technology and explore potential applications.

"We're kind of doing it backwards," he said. "Instead we're saying, 'Hey, we have a resource here. Come on tech, you come here and take advantage of that resource.'

The xBridge works with companies to deploy prototypes, perform testing in real-world operating environments, and develop new products and services.

"The way that we work with companies is we essentially tell them, 'Hey, the door's open here," Wolfson said. "And in doing so, we're bringing in the people that operate the airport to kick the tires on these technologies and say, 'You know, if you took this and turned it five degrees this way, that could have

a really interesting opportunity in the airport,' that the company founders or directors hadn't thought of."

Wolfson said the first collaboration step - especially for off-airfield technologies - is developing a technical proof of concept to ensure the technology will work within PIT's operating environment. From there, they perform a business use case pilot to evaluate if the technology can deliver its expected value.

Wolfson said xBridge tests and deploys new technologies not just for PIT's benefit - and the aviation industry at large - as a means of improving customer, employee, and partner experiences.

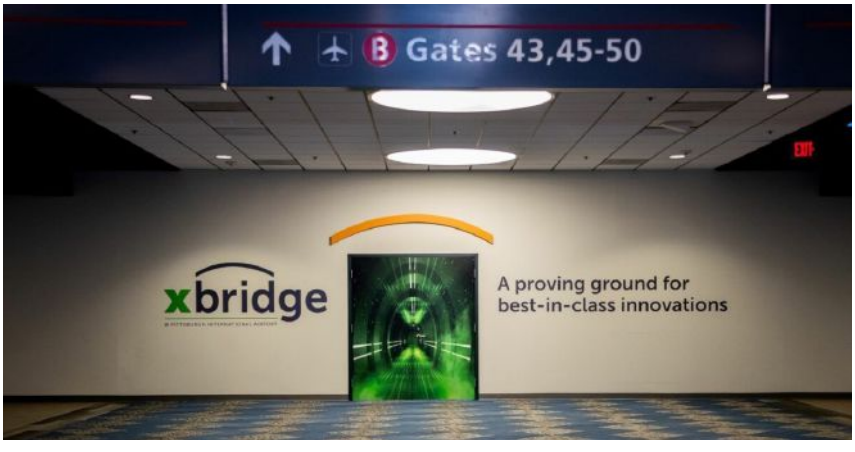
Some companies specifically targeting aviation applications have deployed robots within the airfield perimeter. "These companies are a lot more intentional in their commitment to the aviation industry as a market," Wolfson said.

Because they could not yet perform autonomous operations on the active airfield, one company tested its autonomous aircraft servicing technology on a mock-up fuselage. Wolfson said two companies xBridge is working with currently are approaching baggage operations from two very different perspectives.

While some companies have targeted aviation-specific applications, others had success deploying within more generalized spaces at PIT. Wolfson said xBridge also tests and deploys new technologies and materials that have not yet entered the aviation industry. "We're not necessarily looking for tech that is trying to sell into aviation, but rather tech that can have some sort of impact on the aviation industry."

Applications on the customer-facing side of the airport include retail outlets, food and beverage operations, and moving people around the campus."Actions that widely occur within an airport lend [themselves] to all sorts of generalized robotic applications that already exist in the world," he added.

Wolfson said one company had proven several use cases for its autonomous delivery technology, and utilized xBridge to test out aviation as a potential market. That company is called Ottonomy.



The Pittsburgh International Airport launched its xBridge innovation center in November 2020. Companies can test their new technologies across the airport terminal and grounds. Source: Pittsburgh International Airport

Ottonomy finds applications for autonomous delivery robots

Before starting Ottonomy, CEO Ritukar Vijay worked for a company called Aptiv in Germany, leading the development of BMW's urban autonomous cars. He realized creating a viable business model would require more time to develop the technology, sort out legality, and change public perceptions.

"That's how we thought, 'Where can these autonomous systems help?' Vijay said. "And we focused around the delivery space, which was not so crowded. But, there were whitespaces because most of the delivery robots are heavily dependent on GPS positions and doing outdoors, they're small, they're modular. So that's how we started doing delivery robotics as a mainstream business."

Vijay said labor shortages and rising hourly wages make goods-to-person deliveries a good candidate for automation. Technology presents an opportunity to alleviate the impacts of labor challenges on businesses, allowing human employees to do more tasks that involve decision making while automating other functions. "You're not removing people, but we are just filling in the gap," Vijay added.

Ottonomy's Ottobot autonomous mobile robot (AMR)

The Aeroporti di Roma (ADR) Ventures and Ottonomy teams showed off autonomous delivery robots at Rome Fiumicino International Airport (FCO) in 2023. ADR made an investment in Ottonomy. Source: Ottonomy

platform is designed to operate across a variety of indoor and outdoor scenarios. One application the company targets is intralogistics, especially for manufacturing and warehousing industries. Vijay said large facilities currently use road vehicles to transport parts and supplies between buildings. "It's not the cost of the vehicle, but it's the cost of the person who's driving it," he said.

Ottobots are suitable for hyperlocal curbside last-mile package and parcel deliveries, as well as food and beverage delivery at large public hospitality spaces, such as airports, malls, and casinos. Although different delivery environments might be similar, Vijay said workflows vary depending on the commodities being transported. For example, perishable commodities and food orders need to be delivered within a limited timeframe, while mailed packages can be delivered by the end of the day.

Ottonomy has deployed its robots to customers across the United States, Europe, and Middle East, most recently expanding into Singapore. Cincinnati International Airport (CVG) was the company's first airport deployment.

Ottobots are now live at Leonardo da Vinci–Rome Fiumicino Airport (FCO) in Italy. "Their corporate venture arm also invested in us, so that's a great validation," Vijay said, adding that airports across the globe become value-added partners for the company. "They help us grow in those particular markets."

Airports provide multiple use cases for Ottonomy

Airports are a good testing ground for delivery robots because they have some level of control. "People won't do really crazy crazy stuff," Vijay said, "But at the same time, it has its own dynamicity.

"Some people will stop and interact with the robots, while others might not even notice them as they run to catch a flight.

He added airports across the globe are similar, which allows customer behaviors and problems to be replicated. "Running in public space also adds real value. It's different from a warehouse, where everything is controlled," Vijay said. "But it is also different from a city where even the infrastructure has its own variations."

With business to consumer (B2C) deliveries, customers waiting at departure gates can order items from vendors within

Ottonomy made its first deployment in the airport space in late 2021 at Cincinnati/Northern Kentucky International Airport (CVG). Source: Ottonomy

terminals, and those items are delivered directly to them. Vijay said B2C deliveries open up the reach of retailers and restaurants who are geographically far from certain gates by providing an additional distribution channel, allowing them to reach customers who don't want to walk across terminals to shop and dine.

Ottobots also fulfill storefront replenishment roles. Vijay said airport terminal real estate is expensive, causing businesses to store their products in distant parts of the airport - sometimes more than half a mile away.

An auxiliary function of Ottonomy's robots is data collection and inspection, specifically to monitor health as well as security. Vijay said with regards to communicable diseases, such as with the COVID-19 pandemic, monitoring health conditions can help airports prevent further spread.

Using contextual AI, Ottonomy's autonomous mobile delivery robots navigate through crowds within PIT's terminal, learning how to interact with a variety of people. Source: Pittsburgh International Airport

Dynamic assignment can provide wholesome ROI

A cloud-based scheduler assigns orders to each robot. Vijay said the scheduler accounts for the battery charge levels, which robots are in closest proximity, and maximum utilization of onboard space. With multiple lockers on each robot, Ottobots can perform multiple deliveries during the same trip through order batching.

Vijay said the top platform of Ottonomy's robots can be customized for each application, allowing specialized equipment or different compartments to be added. When equipped with the right compartments, dynamic assignment allows Ottobots to change from one workflow to another based on demand.

At airports, Ottobots can deliver B2C orders during peak times, and then switch to store replenishment roles when there is less retail customer demand without changing the compartments. Vijay said dynamic assignment allows better asset utilization based on where and how Ottobots can be used, all while collecting security and health data.

"That makes it a wholesome ROI for everybody," he said. "The underlying technology is the same, so our effort has gone into standardizing the operations."

Decentralized communication systems provide interoperability, allowing Ottobots to interact with infrastructure elements - such as traffic lights, automated doors, and elevators - as well as robot-to-robot communication. Centralized communication through a browser-based network operations console provides airport administrators with monitoring capabilities. The console also allows telemetry, navigation, and operational data to be collected and even shared with other robots.

Vijay said during initial deployment, only one or two robots are needed to map the operating environment, sharing the data with other robots through the network. Over the course of a few days, Ottonomy's robots use 3D lidar sensors and cameras to collect both geometric and semantic data to produce a high-information map that provides primary navigation information for the robots.

During the mapping process, Ottonomy works with airports to set up no-go zones that robots need to avoid, such as staircases and moving sidewalks. They also provide tools for airport operators to add or modify restricted areas at a later stage.

While all the navigation is achieved through edge comput-

ing, Ottonomy can create a digital twin map as a post-process product which can be used for other purposes. The company's robots are suitable for brownfield deployments because they do not require any external beacons or other infrastructure for navigation. Multimodal sensors allow the same software stack to provide navigation indoors and outdoors - even around aircraft.

Onboard each Ottobot, contextual AI allows the robot to determine where it is and where it needs to go next. Vijay said robots with a use case to engage with people will move toward crowds, while those performing deliveries will avoid them. Contextual AI enables Ottobots to recognize and respond differently to elderly people, pets, children, and people looking at their phones, for example.

"It's not just about detecting people or classifying them, but also it's very important to understand what they're doing," he said. "Those are the things which create a good testing ground for us, and that's why airports are super interesting."

Ottonomy's goal is to provide fully autonomous operation, but if robots become surrounded by people or encounter an emergency situation, they can be controlled remotely through teleoperation.

PIT and xBridge host Future Travel Experience conference

Vijay said Ottonomy has a very active engagement with PIT through xBridge. "We ran the robots last year, and now we are working with them to unlock some other use cases within the airport."

He added xBridge helps Ottonomy explore potential applications by bringing together different companies. "There's so many possibilities there, and it's difficult to do all by ourselves," he said. One scenario xBridge helped Ottonomy test out was mounting a beer dispenser from Cooler Keg and credit card reader on an Ottobot.

Vijay said he is thankful for Ottonomy's airport customers, especially PIT and xBridge. "They are forward looking," he said. "That is something which I think becomes a reference point for all airports across the globe."

Wolfson said xBridge can help the aviation industry access emerging technology. "The Pittsburgh Airport has firmly placed this flag as a leader within the industry when it comes to the deployment of new technologies," he said.

Wolfson mentioned that the University of Pittsburgh and Carnegie Mellon provide top-ranked robotics programs. "It's kind of a natural match if you have this in your own backyard."

With access to education, research, and deployment facilities, PIT recently hosted the second annual Future Travel Experience (FTE) conference.

Christina Cassotis, CEO of PIT, said the airport is an ideal location for the FTE conference because of its focus on emerging technologies, passenger experience, and operational excellence.

"The airport and our region provide the perfect setting for showcasing the latest trends and developments in the future of travel," she said. "It's our hope that this conference sparks further collaboration between the aviation and robotics communi-

PIT CEO Christina Cassotis speaks at the signing of a Memorandum of Understanding between Pittsburgh International Airport and Carnegie Mellon University. Source: Pittsburgh International Airport

ties in a variety of areas,"

The Henry L. Hillman Foundation recently contributed a $75,000 grant, which Cassotis said will allow the foundation, PIT, and FTE to select an idea from the conference to move forward to the next stage of development.

Cassotis said the vision behind xBridge was to create a platform where technology start-ups, entrepreneurs, and established companies can collaborate and test new ideas. As a result, PIT has benefitted by implementing systems that enhance the passenger experience and improve operations, all while fostering partnerships with technology companies and airlines.

"Working with robotics and tech companies is part of PIT's larger organizational philosophy that an airport should be part of its community," Cassotis said. "PIT is not just the gateway to the region - we want to bring forward its best assets."

In 2023, Ottonomy deployed its autonomous delivery robots at Rome Fiumicino International Airport (FCO). Aeroporti di Roma (ADR) Ventures also invested in Ottonomy. Source: Ottonomy

Future applications in airport terminals, reverse logistics

Wolfson said large-scale adoption of robotic systems in the aviation industry is limited because both aviation and robotics companies need to more fully understand needs and requirements of certain applications. It's more than just technical questions about how to make the robots work.

"How would you price a robotic solution so that it actually makes sense in that environment?" Wolfson said. "How do you craft the business around this that will actually move the needle for the industry?"

While aviation companies realize that processes can be automated, robotics companies might ask if the cost and time to develop a solution is worthwhile. Wolfson said a better method is to address the biggest pain points and bottlenecks, integrating with current processes, and then determine if another iteration of automation is necessary.

"I think that the quick, low-hanging fruit within aviation is going to be anything that happens outside of the airfield," Wolfson said. "I think we're going to start seeing all sorts of roboticized operations when it comes to that flying experience, because, again, I think the market opportunity is much broader than just aviation, and I think that the barrier to entry is lower."

Vijay expects robots will continue to help airport staff create a better customer experience in the future. "These are public robots - they are moving in public areas, interacting with people - but yet solving core business problems."

Automating ecommerce returns is one application where Ottonomy can help people live better lives in the future. Instead of reverse logistics shipping, or bringing returns to a specific place, people will be able to summon lockers to their homes.

"Five years from now these things are going to be the way of life," he said. "The real estate value of a particular area will be dependent on what technologies they have."

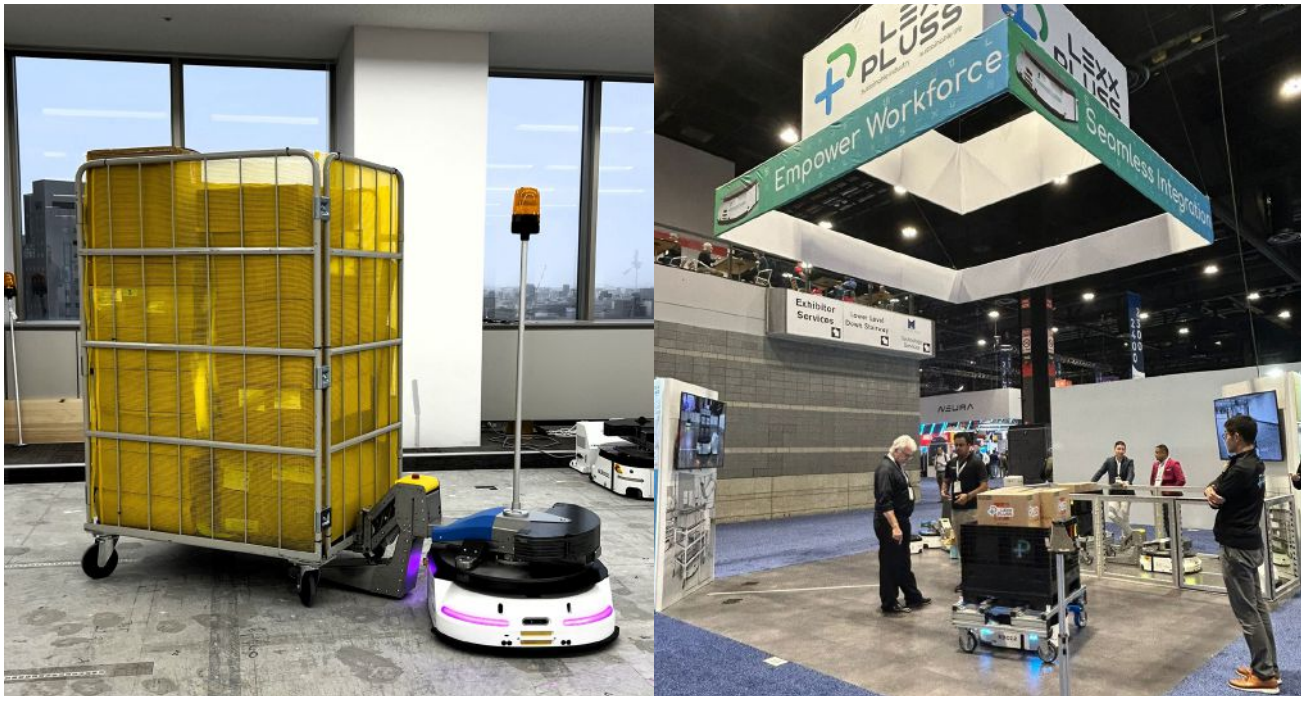
Vijay said robots entering consumer applications mirrors the rise of smartphones in the 2010s "Every decade or 15 years there's a big transition that's happening," he said. "Robots - especially public robots - are something where we are in the middle of it." •

Donald Halsing *is Associate Editor of* Robotics247.com.

LexxPluss launches AMR conveying for U.S. manufacturers

Interoperability with existing systems through fleet management, IoT tools

BY ROBOTICS 24/7 STAFF



LexxPluss demonstrated its Lexx500 AMR, LexxTug towing interface attachment, LexxFleet fleet management system, and its IoT LexxHub interoperability system at Automate. Source: LexxPluss

Japanese AMR conveyance systems provider LexxPluss recently launched its portfolio of four automation systems at Automate 2024 in Chicago.

LexxPluss featured its Lexx500 AMR, LexxTug towing interface attachment, LexxFleet management system and its internet of things (IoT) LexxHub system, which facilitates interoperability with existing systems.

LexxPluss said its products can provide U.S. manufacturers and logistics companies of all sizes with intralogistics automation, removing barriers to scaling up and integration with existing equipment - starting from as little as a single Lexx500 AMR and using existing carts with the LexxTug towing interface.

"We are delighted to officially launch our portfolio of automated conveyance products and solutions in the U.S. at Automate 2024," said Rizo Itakura, LexxPluss COO. "Our technology is generating lots of interest in North America because of our commitment to safety, sustainability, and open architecture,

ensuring the effective interoperability of automated systems.

Safety systems and scalability using existing carts

Multiple sensors, including lidar, ultrasonic sensors and depth cameras protect the safety of workers and objects being transported. LexxPluss' open architecture approach allows for integration with existing systems. AMRs can be managed together with most field devices and the status of the entire site can be monitored in real time on a tablet.

Lexx500 automated transfer robots with multi-sensor safety features can be deployed from just a single unit and increased to a multi-AMR fleet, providing scalability. The Lexx500 requires no fixed equipment and can automatically transfer loads up to 300 kilograms, about 660 pounds, with minor modifications, or 500 kilograms, about 1100 lbs, as is with LexxTug attached.

Additional Lexx500 features include a turning radius of 380 millimeters, about 15 inches, stopping accuracy of +/- 1 millimeter, about 0.04 inches, 18 hours of continuous operation when not in tow, hybrid control of autonomous driving and high-precision trajectory driving, bumper contact sensor, and automatic charging function.

The LexxTug towing interface attachment allows manufacturers to use general-purpose carts such as cage carts and 6-wheel carts without modification. It has an automatic detachment function to enable it to fit into existing operations without major changes.

The LexxPlus Sagawa can carry boxes on a cart above the AMR. Source: LessPluss

Fleet management systems enable interoperability

The LexxFleet management system delivers task management, group control management of multiple units and system integration. The fleet management system provides users with Lexx500 transport status management, map display, multiple task execution and reservation capabilities, RESTful API integration and a remote emergency stop function.

LexxHub is an IoT system that enables collective automation of existing systems by allowing existing equipment to connect to the network and work with a fleet of Lexx500 AMRs. Collaborative tasks such as calling an elevator, production equipment lines, or fire prevention functions such as shutters and alarms can be controlled in time with AMR movements.

"We are heavily investing in the US market and have established a U.S .subsidiary, opened our U.S. sales office in Indiana last year, and we are actively expanding our team in North America," said Morgan Chang, LexxPluss U.S. business development manager. "We are also interested in forming new partnerships in the region and our open architecture approach lends itself to developing collaborative, interoperable solutions."

LexxPluss hosted an open house event in May at its demonstration facility located in the Indiana IoT Lab in Fishers, Ind. The facility was first announced in June 2023. •

Agility Robotics brings operational visibility to deployment of Digit fleets with launch of Agility Arc

Company introduced cloud automation platform at MODEX 2024

BY ROBOTICS 24/7 STAFF

Agility Robotics, creator of the bipedal Mobile Manipulation Robot (MMR) Digit, unveiled Agility Arc, a cloud automation platform for deploying and managing Digit fleets. The Oregon-based company released the news at MODEX 2024 in Atlanta.

Agility Robotics announced the release of its Agility Arc cloud fleet management software for Digit at MODEX 2024. Source: Agility Robotics

Agility Arc to manage Digit deployment lifecycles

As customers begin deploying Digit for use in their operations, Agility Arc is designed to simplify the deployment lifecycle. From facility mapping and workflow definition to operational management and troubleshooting, Agility Arc hopes to make managing Digit fleets smooth and straightforward. Furthermore, Agility Arc can streamline fleet support, making it easier to see alerts, troubleshoot problems and contact customer support when needed, all in one place.

"Smart companies are looking to multi-purpose mobile manipulation solutions like Digit to automate themselves out of a very serious labor gap," said Melonee Wise, CTO of Agility Robotics. "Agility Arc lets warehouse operators put Digit to work quickly and easily in the most critical workflows, starting with bulk material handling in warehouses, distribution centers and manufacturing sites."

In its first iteration, Agility Arc will provide customers with operational visibility into critical KPIs like uptime, throughput, Mean Time Between Incidents (MTBI) and robot status, allowing customers to understand what's happening in the workcell and how Digit is performing.

Additionally, Agility Arc will provide industry standard APIs to simplify integration with existing Warehouse Management Systems (WMS), Warehouse Execution Systems (WES), and Manufacturing Execution Systems (MES) among others.

As a cloud platform, Agility Arc will provide continuous software releases to enhance the customer experience. By leveraging the software-as-a-service (SaaS) model and industry-grade cloud capabilities, Agility Arc removes the hassle of managing infrastructure and provides unmatched security and scalability.

"Agility Arc will provide unprecedented levels of transparency into the operation of Digit fleets," Wise added. "Our customers will be able to understand what is happening in their workcells and act upon that information, making it easier for them to design, commission, operate, and support their mobile manipulation fleets."

Over the past year, Agility has worked closely with early adopter customers in the Agility Engagement Program (AEP) to understand their warehouse workflows and pain points, starting with tote handling use cases.

Agility Arc incorporated key insights and feedback from AEP participants about their deployment lifecycles and automation management needs. AEP participants will continue to have opportunities to influence the development of new Agility Arc features, as well as new skills and capabilities for Digit based on their real-world use cases. •

AFORMIC showcased low-profile AMRs at Automate 2024

Qursor fleet management software can integrate with enterprise systems

BY ROBOTICS 24/7 STAFF

AFORMIC's low-profile F12 AMR is designed for automating transportation logistics operations within manufacturing plants. Source: AFORMIC

Autonomous intralogistics solutions provider AFORMIC showcased its AMRs for flexible manufacturing and warehousing at Automate 2024 in Chicago.

AFORMIC said its smart robotics solution is a choice for real-time intralogistics management, providing automation in material handling to reduce operational expenses and increase efficiency in manufacturing and warehouse processes. The solution includes an AI-powered integrated software management system called Qursor, as well as customized AFORMIC F-series AMRs.

"AFORMIC offers end-to-end solutions that include robotics, innovative technology, and software from a single source," said Tim Meyer, vice president of AFORMIC. 'Understanding the potential of Industry 4.0, we have designed a solution that not only automates the flow of materials within the company, but also allows for changing the logic of the production process itself."

Simulation used to test and optimize AMR deployments

At Automate 2024, AFORMIC showcased its latest models of AMRs from its F series, including the F12, a safe, low-profile AMR designed for automating transportation operations within manufacturing plants. With a maximum payload of 800 kg, or 1,760 pounds, and a speed of 1.5 meters per second, or 3.4 miles per hour, AFORMIC said the robot offers ergonomic and efficient handling of complex logistics processes.

AFORMIC's robots are implemented using process simulation to test and optimize their behavior in virtual environments. AFORMIC's AMRs can move materials and products around a factory floor, adapting to changing production needs and minimizing human intervention.

"Customization applies to both the software system and the mobile robots from the AFORMIC AMRs family, as well as other devices and equipment that are part of the vehicle's setup," Meyer added. "We can indeed integrate our solution with the entire factory and warehouse environment, including MES/WMS systems, the traffic control system, access management to special zones, and many other processes."

Thanks to AI and machine learning methods, AFORMIC AMR vehicles can be autonomously managed, without operator supervision, by the Qursor fleet management system. This software solution ensures smooth communication with any production and WMSes as well as real-time process monitoring. •

Flexibility, scalability at the 'Hub' of Locus Robotics' offerings

LocusHub warehouse intelligence engine offers AI-enabled guidance

BY TIM CULVERHOUSE

"When Locus Robotics started, getting 10 robots to work together on the floor - work well together - was a big, big challenge. Now, we have customers running nearly 1,000 robots over a million square feet."

Neil Bentley, senior director of product management at Locus Robotics, succinctly described the history of the Wilmington, Mass. company. Locus recently surpassed the 3 billion pick mark across its deployments, a major milestone and one that grew from 2 billion to 3 billion item picks in just over eight months.

Previously, it took seven years to eclipse the one billion pick plateau.

Employees view the LocusHub dashboard. Source: Locus Robotics

The chicken or the egg?

As Locus received funding and developed its offerings, the question of whether it was a software or hardware company came to the forefront. Locus' Origin and Vector AMRs represent its physical entities, while the LocusOne warehouse automation system and the new LocusHub AI-enabled business intelligence engine make up the software side of its roster.

"In terms of where we started, it's interesting because our heritage as a warehouse operator is really where our roots begin," said Kary Zate, senior director of marketing communications at Locus. "One of the things that the original founders of the company focused on was using the data for forecasting, planning and looking forward. Even long before we had this notion of, 'How do we capture this data,' we had been looking at that data."

In terms of looking forward, with Locus' robotics-as-a-service (RaaS) business model, the chicken or the egg conundrum spearheaded development between the hardware and software sides of the company. However, it never became a what's going to come first conversation.

"It really is hand-in-hand," Zate said. "As far as the company's concerned, the data was something that helped drive not only operations, but design too."

Locus' team has a wide background in warehouse and supply chain spaces. The resulting design of hardware and software for the company's products now plays a key role in these operations, along with managing the volatility of day-to-day operations in these industries.

"There's still so much that's variable in warehouses," said Kait Peterson, vice president of product marketing at Locus Robotics.

Employees work with Locus Vector AMRs with shelves. Source: Locus Robotics

"Every day is unpredictable in warehousing and supply chain. The biggest challenge with things like automating every single decision process with robotics and AI is that supply chain is just too unpredictable. People are really good at understanding the nuances and the unique challenges of their own operation."

Decision engine vs. recommendation engine

Artificial intelligence and machine learning are everywhere, and Locus is no stranger to these technologies. Locus utilizes advanced analytics, AI and machine learning to provide predictive insights to warehouse managers on how they can maximize productivity, optimize workflows and ultimately, generate more ROI.

One key element of the platform is that LocusHub provides insights to human operators by suggesting optimal processes for their operation. It doesn't automatically move robots and staff around.

"We'll continue to add additional capabilities, additional AI, additional learning that will enhance that decision support and decision-making capabilities so we can start to make stronger recommendations. But at the end of the day, people are still needed, the expertise of humans is still needed," Peterson said.

"At the very highest level, humans make the decisions," Bentley added. "We're giving them data to help them make what we think is the best decision at the time. We're also able to then go back and look at our recommendations versus how things were executed and make our recommendations better over time as well."

How about the robots and the software in use?

Saddle Creek Logistics' deployment

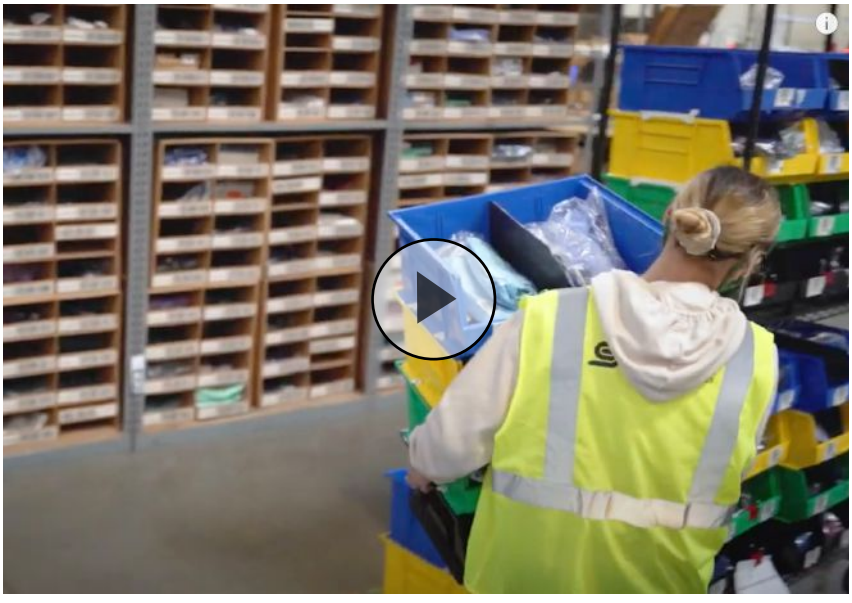
In 2020, Saddle Creek Logistics Services was in need of a more efficient way to provide ecommerce services for a Texas-based client. The resulting deployment of 20 Origin AMRs began a relationship between the company and Locus that still runs to this day across multiple Saddle Creek customers.

In 2022, Saddle Creek deployed 30 Origin and eight Vector AMRs in its customer's Kentucky warehouse. And since the release of LocusHub in early 2024, the company has utilized the business intelligence engine to get a better understanding of the data from each robot.

"I think that the easiest way to describe it is we're now able to speak with data and lead with data," said Jeremy Moore, senior director of fulfillment operations at Saddle Creek. "It has really improved our visibility and helped us to identify actionable trends."

As Moore, along with his warehouse managers and associates, have grown more comfortable with the LocusHub platform, they're also generating more useful data to be used in fun ways - such as associate picking competitions - and in conversations with Saddle Creek customers.

"I think it gives us the ability to put data on paper," Moore said. "I think boots on the ground, when customers are here, they're seeing the impact of Locus and they're seeing the impact that it has on their operation and how fast it's pushing



their operation through. It's not just a conversation in a business review. It's not just a conversation that we have on the phone. When they're here you can see the robots and how it's pushing out products as well."

"Saddle Creek has a mixed fleet of our Origin and Vector LocusBots," Zate added. "LocusHub helps them manage the two fleets based on the use cases that are necessary for those particular missions. It gives Saddle Creek the ability to say 'We've got the right bot for the role' and move that robot around, plus the right amount of people who are working in those particular sections.

Making good use of all the data for future improvements

The entire robotics industry, along with its deployments in various sectors around the world, is constantly evolving. LocusOne and LocusHub are no different. As Peterson notes, updates and new features can be rolled out at any time with continual deliveries. When Locus develops new features, they can be delivered to customers.

Another rollout on the horizon for Locus involves more flexibility with workflows and robot designation.

"We have customers that their workflow within a day or day-to-day might change substantially," Bentley added. "They might have a whole bunch of restocking in the morning, a whole bunch of picking in the afternoon. They might have days which are heavy for retail picking and other days heavy for ecommerce picking. So this new mass reassignment capability allows them to see all the work that's in the system and that's been passed to Locus, allow them, based on that, to make decisions on changing what the robots' run modes are or other elements of what the robot has been assigned to do."

At Saddle Creek, Moore mentioned always asking 'Can I have more data?' Specifically, trend data to help him and his colleagues decipher heat zones and patterns over periods of time.

"How can we see the trends and how can we see the learnings," Moore said. "How can we track that day-over-day, week-over-week, month-over-month and year-over-year? And how can we get that quick view that says 'Here's the progress that you're making."

One new feature, called "Glide Path" was rolled out by Locus to examine exactly that. Glide Path predicts when work will be completed based on the trend from the day so far, and the preceding days. The feature gives operators a way to see, at a glance, whether they are on target for the day based on work volume.

The relationship between Locus and its customers continues to spur development, echoing the creation of LocusHub.

"We had all this data," Bentley said. "We were delivering part of it and some insights through our legacy dashboarding, legacy reports through our customer success organization. But we knew we could do more with new technology like machine learning and AI. LocusHub at its simplest, just took several different touchpoints between the customer and the Locus solution and consolidated them. We also re-architected them so that we can make use of machine learning and AI and make things better and more efficiently in the future." •

Tim Culverhouse *is the Editorial Director of* Robotics247.com.

Piaggio Fast Forward announced launch of kilo mobile robot

Hands-free following robotic platform latest in PFF portfolio

BY ROBOTICS 24/7 STAFF

The PFF kilo mobile robot debuted at MODEX 2024. Source: Piaggio Fast Forward

Piaggio Fast Forward (PFF), a smart following technology subsidiary of the Piaggio Group, announced the launch of PFF kilo, the newest addition to its portfolio of mobile technology solutions for businesses.

Kilo is a 4-wheeled robotic flat bed with hands-free human following capabilities. With a payload of up to 300 lbs. and a maximum speed of 3 mph, kilo is designed to work alongside humans, enabling users to move materials more naturally and without the risk of repetitive motion injuries. The kilo marks the first introduction of PFF's proprietary "Travel on Known Paths" autonomous behavior, allowing users to train robots on paths up to 100 meters in length and store up to 100 trips per fleet for future use. Piaggio had kilo on display at its booth during MODEX 2024 in Atlanta.

Moving ahead with PFF kilo

PFF kilo can be optionally outfitted with industry- or facility-specific carts or shelving to ensure the right platform configuration for any job. The offering is also equipped with PFF pro tools web portal and mobile applications, allowing for fleet management and regular software improvements.

"Our robotics technology is augmenting workforces around the world and PFF kilo is the newest model offering customizable options with the ability to utilize our latest software tools and data to manage the human-robot relationship," said CEO Greg Lynn. "From manufacturing to any industry that relies on the repetitive movement of goods across campuses and facilities, PFF's autonomous technology allows our robots to safely move with and around workers in complex environments and to help individuals in the workplace, streamlining workflows and increasing productivity."

The kilo is operated using a single intuitive button which indicates the functionality status and features of the robot through color, brightness and light patterns. The robot uses proprietary human etiquette algorithms, depth cameras and 4D radar. It is optimized for detecting and predicting human behavior while operating at pedestrian speeds.

The hands-free following allows for both indoor and outdoor use for a wide variety of environments and applications. PFF kilo is designed to augment workers with valuable efficiency and safety, enhancing rather than replacing workers and jobs.

The kilo is equipped with PFF pro tools fleet management software. The cloud-based and proprietary software tool is a fleet management offering built to optimize and augment the working relationship between humans and their robotic counterparts. PFF's next generation of robots provides integration and orchestration features, allowing teams to achieve more while collaborating with their robot partners. •

MiR showcased new AMR pallet jack for first time in U.S. at Automate 2024

Company previewed generative AI chat features for analytics software

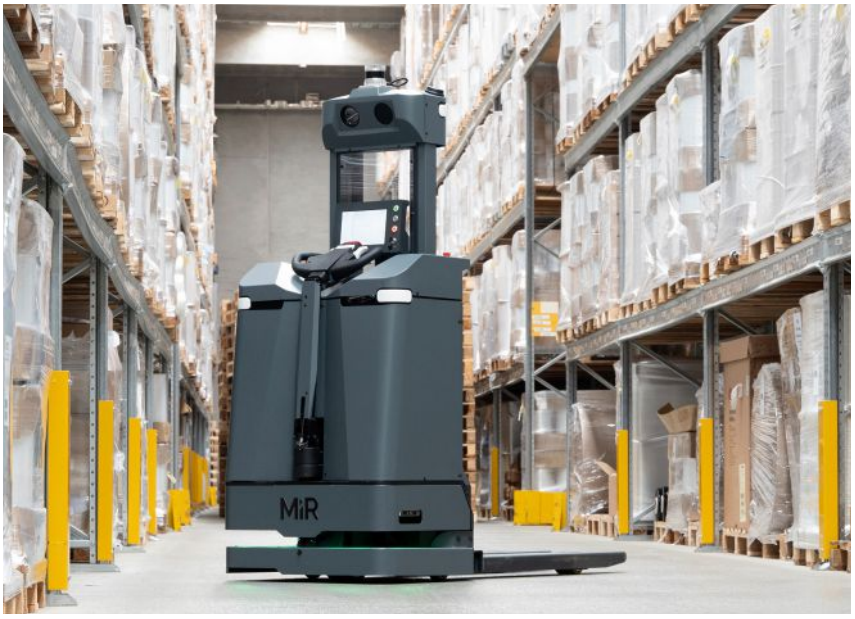
BY ROBOTICS 24/7 STAFF

Industrial robot manufacturer Mobile Industrial Robots (MiR) showcased its latest AMRs at Automate 2024 in Chicago.

The show featured the first U.S. showing of MiR's new AI-enabled MiR1200 Pallet Jack and a preview of a generative AI-powered version of its MiR Insights analytics software.

Attendees also saw MiR's range of AMRs for automating internal logistics in manufacturing and warehouse environments, including the MiR250, MiR600 and MiR1350. MiR showcased a mobile collaborative robot that integrates a MiR250 AMR with a cobot from sister company Universal Robots. MiR said this setup can enable the cobots to automatically and safely perform different tasks at different workstations.

"Not only will Automate visitors be able to see these AMRs in action, but they can experience the robotic collaborations with Universal Robots as well as the latest AI capabilities we've been working on," said Jean-Pierre Hathout, president of MiR. "With experts in AMRs, cobots and AI all in one booth, visitors can find all they need to safely, flexibly and cost-effectively automate a vast majority of their tasks while moving their difficult-to-find employees to more valuable assignments."



MiR showcased its MiR1200 Pallet Jack AMR for the first time in the U.S. at Automate 2024, which uses NVIDIA Jetson AGX Orin machine vision for navigation. Source: Mobile Industrial Robots (MiR)

AI provides mobile robot navigation, troubleshooting

With AI pallet detection powered by NVIDIA Jetson AGX Orin, the MiR1200 Pallet Jack uses 3D machine vision to identify, pick up and deliver pallets. First introduced at LogiMat in Germany in March 2024, the MiR1200 Pallet Jack can interoperate with MiR's deck load AMRs, which the company said makes it ideal for large-scale enterprise customers who typically operate more complex workflows with larger fleets and multiple sites.

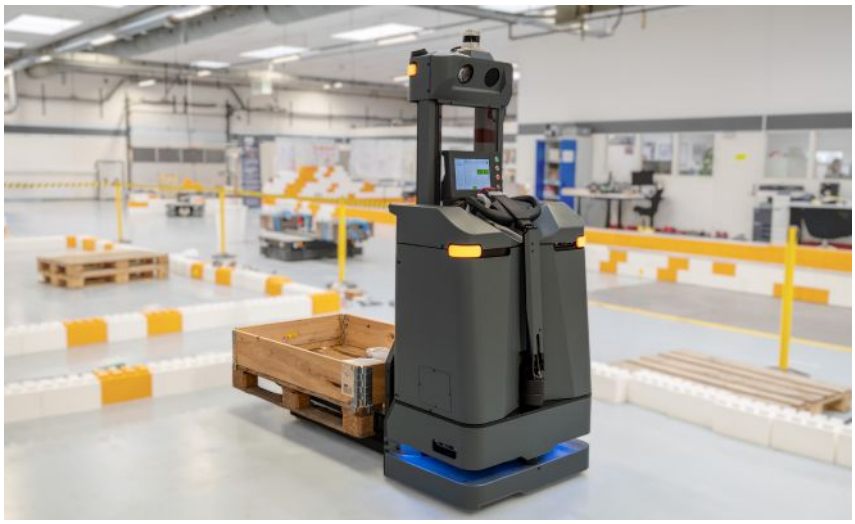
MiR said its AMRs can navigate smoothly and safely among people and other transport equipment in dynamic environments, even on busy trade show floors. Sensors, 3D cameras and laser scanning technology ensure 360-degree vision for precise and safe navigation, the company said.

With new AI-focused advancements to its MiR Insights, the company said its

fleet management software can enable fleet owners to not only track and analyze the operations of their robots and obtain actionable insights they can use to improve the robots' performance, but also more easily find and engage with the data.

At Automate, MiR previewed upcoming generative AI features to MiR Insights that can enable customers to:

- Interact with MiR knowledge bases, even without knowing the exact data base terms, to find the right information, which can speed up deployment and optimization processes.
- Chat with their data to conduct troubleshooting and optimization activities independently.
- Ask follow-up questions to get tailored answers that can deepen their understanding and inform decision making.



Through NVIDIA Jetson AGX Orin, the MiR1200 autonomous pallet jack combines data from four RGBD cameras and 3D LiDAR to detect obstacles and navigate autonomously. Source: MiR

Universal Robots collaboration provides mobile cobot arm

MiR said its open-platform design enables top-mounted modules to be added to its AMRs, which can allow different applications from the same robot. Many of these modules come from MiR partners through the MiR Go program, an ecosystem for AMR applications.

A mobile cobot from Enabled Robotics, comprising the MiR250 AMR and any collaborative robot arm from Universal Robots, is now MiR Go Approved, meaning it has been tested and approved by MiR and can be purchased directly from MiR. The mobile cobot offers the following:

- Connection between the MiR250 and the Universal Robot's cobot through a flexible modular platform.
- The ability to adjust the size of the cobot arm to accommodate the required payload.
- An all-in-one interface, which can enable efficient programming of both the AMR and the cobot arm.

"These new AI features to MiR's analytic software create another real-world example of our new AI offerings, with MiR Insights leveraging the latest advancements in generative AI on top its data processing capabilities," said Ujjwal Kumar, president of Teradyne Robotics. "At the combined MiR/UR booth at Automate, attendees can get a first-hand look at these enhancements in action."

MiR sponsored Women Empowerment Breakfast with Teradyne Robotics and Universal Robots

With Teradyne and Universal Robots, MiR sponsored the Automate 2024 "Empowerment Forum: Women Leading Change," breakfast. This event brought women in the automation industry together to share their experiences and aspirations as well as to build valuable connections and leadership skills. Jane Heffner, MiR VP of sales, Americas, and member of the A3 Robotics board, introduced the keynote speakers from ABB, 3M and Analog Devices. •

Logisnext exhibited Jungheinrich and Rocla AGVs and AMRs at MODEX 2024

Rocrich AGV Solutions showcased as North American provider

BY ROBOTICS 24/7 STAFF

Material handling equipment manufacturer Mitsubishi Logisnext Americas group (Logisnext) showcased Jungheinrich and Rocla automated robots at MODEX 2024 in Atlanta.

At MODEX 2024, Logisnext showcased Rocrich AGV Solutions as its North American provider of Jungheinrich and Rocla automated guided vehicles (AGVs) and AMRs. Jungheinrich and Logisnext announced their partnership to launch Rocrich in June 2023.

"We're excited to showcase our latest innovations in warehouse solutions at MODEX 2024," said Jerry Sytsma, executive vice president, sales and aftermarket services at Logisnext. "Logisnext remains dedicated to providing state-of-the-art material handling, mobile automation and fleet management solutions to meet the industry's changing needs."

Logisnext demonstrated AGVs, telematic fleet management system

Logisnext demonstrated a Rocla ART automated reach truck and a Jungheinrich EKS 215a AGV pallet stacker, as well as exhibited an EKX 516 turret truck with warehouse navigation along with an EKS 314 high-level order picker.

The company also showcased its Lift Link telemetry system, an onboard device that communicates with Logisnext's Lift Truck Solutions online fleet management tool. •

Logisnext demonstrated a Rocla ART automated reach truck at MODEX 2024. Rocrich AGV Solutions is Logisnext's North American provider of Rocla vehicles. Source: Mitsubishi Logisnext Americas

Logisnext exhibited several Jungheinrich lift trucks at MODEX 2024, including an EKS 215a AGV pallet stacker and an EKX 516 turret truck with warehouse navigation. Source: Mitsubishi Logisnext Americas

Robust.AI raises the bar with Grace fleet management software, Carter robot

Software suite and robot developed together for deployment

BY TIM CULVERHOUSE

Founded in 2019, California-based Robust.AI knew the bar was set high for its initial software and hardware rollout. Three years later, when its Grace software suite and Carter collaborative AMR debuted, Robust set out to differentiate itself from the marketplace.

Who knew it would all come back to the bar?

"Designed with humans in mind"

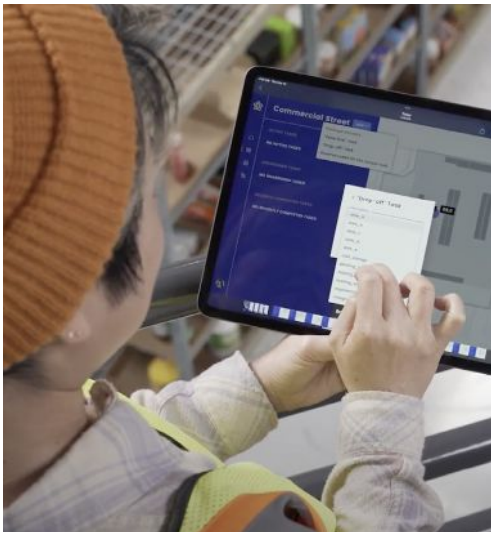
Kavitha Velusamy is the senior vice president of engineering at Robust.AI. She joined the company in 2021 and has played a major role in the development of Grace and Carter. One of the first things that users will notice about Carter, and one of the things Velusamy points out about the collaborative AMR, is its design.

Simply put, it has a handlebar.

"We have designed with humans in mind, from the ground up," she said. "What it does is to kind of raise the bar on collaboration. For example, the one thing we can talk about is the handlebar. Carter is autonomous when needed and it can be taken over by workers when needed as well. It empowers them. It's just a simple thing, but it actually helps a lot."

While it may sound like an oxymoron - a handlebar that allows humans to move an AMR - the added flexibility of this simple design element has provided a differentiator from other robots on the market. It all goes back to the initial development of the robot and its tie-in with the Grace software suite.

"The handlebar is such a simple thing, but it actually provides so much of our affordances in controlling what the robot can do," Velusamy said. "We don't have and we're not planning to have a remote operation center because of the way that we have designed a robot. We have a screen. We have a handlebar. We have other visual aids like LEDs. If the robot is in trouble for some reason, it can always indicate that, 'I need help.' Users can just take the handlebar, move Carter away and it can just go do whatever it's supposed to do."



The Robust.AI fleet management software suite, Grace, allows users to monitor Carter collaborative AMRs in action. Source: Robust.AI

"Grace is the brain and Carter is the braun"

What's a collaborative AMR without a software suite gleaming a plethora of data from the fleet of robots as they maneuver around the warehouse? While Carter can run without any connection to Grace, Velusamy mentioned that the ROI for these customers won't likely be as high as compared to running at full connection.

From the data perspective, Robust.AI needs a warehouse floor plan and layout to get started. Once a prospective customer provides that information, Robust runs simulations to evaluate robot workflows, fleet optimization and productivity gains. Next, Robust will map the physical location. Velusamy said the company recently mapped a customer's 250,000 square foot facility in about two hours.

Grace has all this information. Now what?

"We want to call Grace the brain and Carter is the braun," she said.

As the braun of the operation makes its way onto the warehouse floor, the robots are talking to each other and the Grace software suite in the sky. Grace's fleet-intelligence optimization system integrates with the customer's WMS and the Carter AMRs, generating a huge amount of data. That's when decision time comes in. And, as Velusamy describes it, Grace isn't a decision engine, it's a recommendation engine.

"Grace does make suggestions," she said. "It picks a specific order profile, the route plan and what the robots have to do, but that also determines what the workers should be doing. Having said that, the warehouse managers have complete control over what they want the robots to do."

"How do you move around humans?"

In February 2024, DHL and Robust.AI announced a collaboration that saw the companies piloting a deployment of Carter AMRs at the 3PL provider's locations. Powered by Grace's AI and machine learning capabilities, the deployment looks to enhance efficiencies in DHL warehouses.

Another integral design feature of Carter is its incorporation of visual SLAM. You won't find lidar on the AMRs, and this is an intentional design choice. As Velusamy noted, visual SLAM provides a rich set of data features for Robust to operate with. The resulting data feeds back to Grace, and Robust uses that data to build out better situational awareness for the robots.

"We built our stack in such a way that you can design pretty easily how you move around humans," she said. "How do you approach them? What kind of distance do you want? How do you move away from them? If you're coming behind them, how do you want to move?"

Identifying a human, or a forklift or any obstruction in the warehouse is just part of the equation. The next step, and something Robust is working on, involves optimizing the robot to eliminate wasted movement for warehouse staff.

> *"If someone is picking and the robot is coming and waiting for them to pick, what angle do you want the robot to arrive and stay for them to pick? What happens if they're right handed versus left handed? There are so many nuances that we are considering and enabling in our software stack. I think it's unique and I think it's super important for us to be successful now and in the future with where the entire logistics and warehouse space is going because humans are going to be an integral part of how we work."*

"We built the entire architecture together"

As Robust.AI turns the corner into the latter half of its first decade of existence, Velusamy echoed the same concept of intertwining the physical design of the Carter robots with the digital Grace fleet intelligence suite. One didn't come before the other, and the combination between the two is at the crux of its platform in a crowded marketplace.

"Our fleet intelligence system is tied to the robotic stack," she said. "We built all of them together, it's not an afterthought, The fleet management was not an afterthought. We built all of them, the entire architecture, together."

Robust.AI's Carter collaborative AMRs await instructions during a deployment in the warehouse. Source: Robust.AI

When Carters are rolling - either autonomously or by hand - in warehouses, they're collecting data. Grace receives and digests that data to warehouse managers in customer deployments. The hardware and software stack, collectively, are the figurative peanut butter and jelly of deployments for Robust customers.

"How the semantic information is populated on the perception AI side, how we plan paths, how we navigate, all of that is tied to the fleet," Velusamy said. "What information do the fleets need as well? They're architected together and what it ultimately gives us is to have the right control signals for the optimization that runs in the cloud. That means better optimization, better workflows, better ROI and better planning." •

***Tim Culverhouse** is the Editorial Director of* Robotics247.com.

InOrbit unveiled RobOps Copilot for AI-powered robot optimization

RobOps Copilot empowers robotics end users to maximize potential of every robot

BY ROBOTICS 24/7 STAFF

InOrbit.AI, a provider of robot operations (RobOps) offerings, introduced InOrbit RobOps Copilot at Automate 2024 in Chicago. This product harnesses the power of AI to turn robot operations data into actionable insights in order to optimize autonomous robot fleets.

InOrbit released its new RobOps Copilot at Automate 2024. Source: InOrbit

Actionable insights to handle data

As robotics adoption rapidly accelerates and enters new industries, from supply chain to healthcare, end users must grapple with the complexity of running hundreds of robots across multiple locations, collectively generating vast amounts of data.

Now, with RobOps Copilot, actionable insights are available to anyone regardless of technical expertise. By using the latest large language models (LLMs), RobOps Copilot enables users to ask questions in their preferred language, get detailed explanations, refine their analysis and arrive at key optimization decisions, seamlessly transitioning between their favorite messaging platform for casual queries and a fully integrated experience with chat-driven dashboard explorations.

Kärcher, a high-performance autonomous cleaning robot provider, had early access to this technology. "InOrbit RobOps Copilot is the latest innovation for optimizing robot operations," said Felipe Garcia Lopez, manager of robotic systems & software at Kärcher. "The interface is super intuitive, allowing our team to easily find the data insights needed to optimize our robots and drive value for our customers."

Along with the rest of the InOrbit platform, RobOps Copilot works with mixed, distributed robot fleets. InOrbit continues to expand the InOrbit Connect ecosystem, including the ability to define, execute and analyze missions that support integrations with WMSes, AMRs from different vendors and Goods-to-Person workflows.

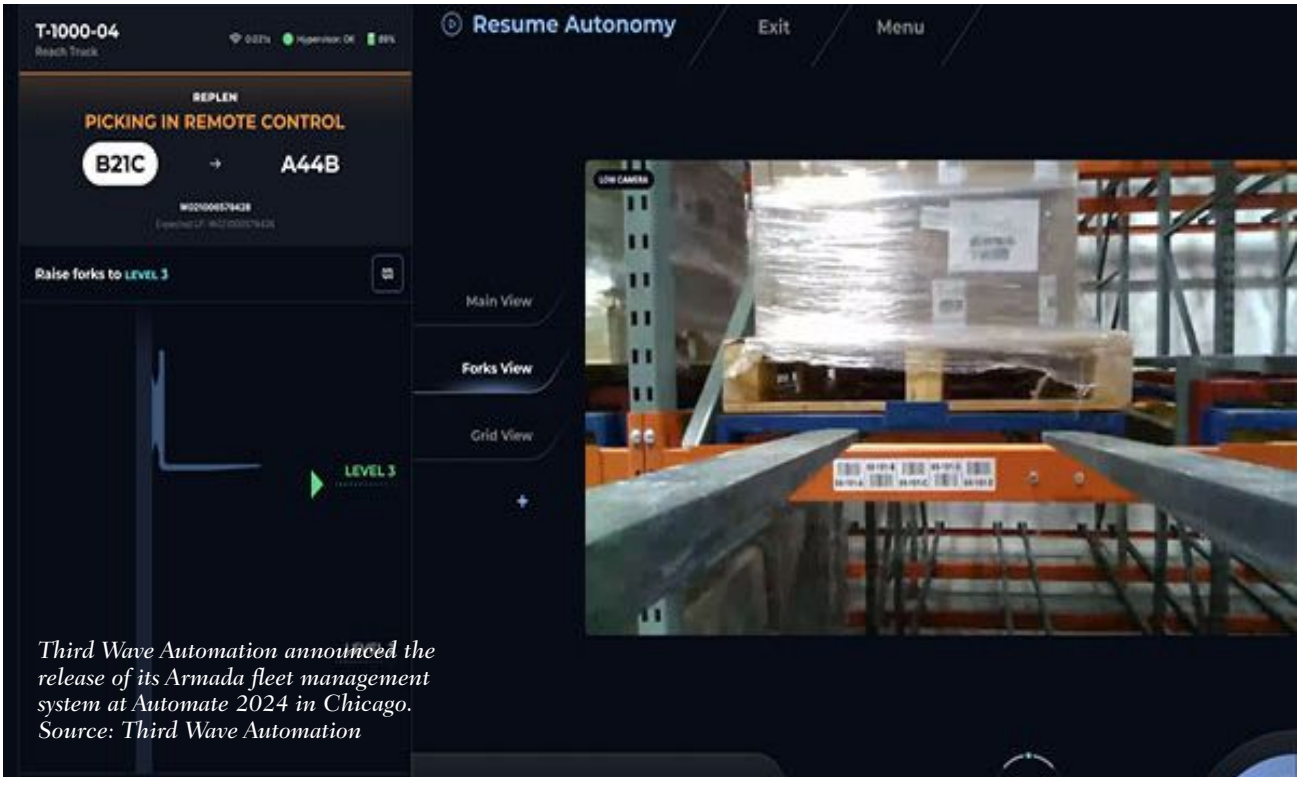
One recent addition is support for a novel Automated Storage and Retrieval System (AS/RS) developed by Instock, which is now in use at the InOrbit Robot Space in Silicon Valley and was part of InOrbit's live remote demonstrations presented at Automate.

"While there's a lot of hype about AI and robotics, we're actually putting the latest developments in machine learning and LLMs to work for real people optimizing real robots," said Florian Pestoni, co-founder and CEO of InOrbit. "InOrbit RobOps Copilot gives the operations team in warehouses, manufacturing plants or hospitals the power to understand and refine the behavior of their robots, making sense of vast amounts of data without needing a Ph.D. in robotics." •

Third Wave Automation announced Armada dynamic fleet management system at Automate 2024

Armada is now commercially available

BY ROBOTICS 24/7 STAFF



Third Wave Automation announced the release of its Armada fleet management system at Automate 2024 in Chicago. Source: Third Wave Automation

Third Wave Automation, provider of autonomous high-reach forklifts powered by Shared Autonomy, announced the commercial availability of its Armada fleet management system, the central interface for the company's Shared Autonomy platform. Third Wave Automation offers proactive collision avoidance and tools to minimize the time it takes to address delays that could impact pallet movement and throughput.

The Armada FMS enables a single operator to safely and effectively manage multiple TWA Reach and TWA Extended Reach forklifts simultaneously. Operators can execute and monitor workflows, and configure warehouse zones dynamically, all while integrating with other warehouse management systems. Third Wave Automation's Shared Autonomy Platform streamlines warehouse operations, dramatically increasing worker efficiency and safety.

Armada addresses warehouse operations challenges

Warehouse operators are facing significant challenges with labor, while demand for their services grows. According to the Bureau of Labor Statistics, warehouse operators have seen labor costs increase

by about 80% in the last five years, while staff turnover averages about 30% monthly. These staffing challenges hamper operators' ability to manage workloads and maintain a safe environment.

Third Wave Automation directly addresses these issues with its Shared Autonomy platform, comprised of the TWA Reach line of forklifts - which operate in four modes: fully autonomous, remote assist, remote operation and traditional manual operation - using Armada FMS.

"Third Wave Automation is driving smarter automation in the warehouse with its AI-powered Shared Autonomy Platform," said Arshan Poursohi, CEO and co-founder of Third Wave Automation. "However, this would not be possible without an intelligent fleet management system that provides a powerful connection between remote operators and the autonomous forklifts on the warehouse floor. Our Armada FMS is fundamental to achieving our customers' performance goals."

As the forklifts are deployed, Armada FMS enables warehouse supervisors and operators to benefit from:

- **Streamlined workflows through Shared Autonomy:** Robotic high-reach forklifts can be operated in various modes, supported by Third Wave Automation's Shared Autonomy platform. The platform handles new and unique workflows and various racking configurations to quickly address any challenges the forklifts encounter.
- **First-of-its-kind technology for improved visibility and collision avoidance:** Using obstacle detection systems, including lidar and camera feeds on the robotic forklifts, remote operators can gain insights into the location of potential obstacles, even those not visible to the naked eye; navigate around them; and get a better view of target pick and place locations than manual operators.
- **Intuitive assist queuing:** Support for multiple, efficient forklift paths resolves operational issues and increases autonomy time, improving throughput.
- **Responsiveness to dynamic warehouse conditions:** Armada extends beyond the capabilities of traditional warehouse management systems, providing tools like on-the-fly region block, task prioritization and schedule management, which enable supervisors to quickly and efficiently respond to real-time changes in the warehouse environment. •

TWA Reach is a high-reach automated forklift with four modes for varying levels of autonomy.Source: Third Wave Automation

Tompkins Solutions and Softeon partner to deliver warehouse orchestration software

Combined software systems to provide automation integration

BY ROBOTICS 24/7 STAFF

Tompkins Solutions, a supply chain consulting and material handling integration firm, recently announced a strategic partnership with Softeon, a global provider of supply chain software.

The companies said their collaboration will provide WMS, WES and warehouse control systems (WCS) to help organizations improve order fulfillment and overcome operational challenges.

"We're excited to join forces with Softeon to deliver customized, flexible solutions that enable our customers to drive value and future-proof their warehouse operations." said David Latona, CEO of Tompkins Solutions.

Tompkins Solutions, which showcased its offerings at MODEX 2024, will integrate its Cornerstone WES with Softeon's WMS in a new partnership to optimize orchestration. Source: Tompkins Solutions

Tompkins Cornerstone WES paired with Softeon WMS

Powered by Softeon, Tompkins Solutions' Cornerstone WES can orchestrate and optimize processes to increase throughput, efficiency and cost savings, said the companies. The vendor-agnostic communication platform acts as a central hub for warehouse operations, providing integration with a wide range of automation systems and technologies.

Cornerstone can be deployed as a standalone solution with true WES capabilities such as wave and waveless batch management, pick & put to light, packing, and full warehouse orchestration. It can also be deployed in conjunction with Softeon's WMS or an existing WMS in automated, manual or hybrid environments.

"Tompkins Solutions' expertise in warehouse design and implementation, coupled with our innovative software suite, enables us to fulfill our shared commitment of providing customer-centric, vendor-agnostic supply chain solutions that help organizations remain competitive and achieve long-term business success," said Jim Hoefflin, CEO of Softeon.

Both Softeon and Tompkins Solutions exhibited their systems at MODEX 2024. The trade show was held March 11-14 at the Georgia World Congress Center in Atlanta, GA. •