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December 2020

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Mark Schmitt, chief
logistics officer and
senior vice president of
global logistics, Caleres

Answering the call for micro-fulfillment

Automation vendors, including several startups, are lining up to meet the growing interest in micro-fulfillment centers. Automation characteristics like high storage density, rapid access to totes, and high uptime are vital to success, but vendors also point to the need to iron out supply chain issues like replenishment.

BY **ROBERTO MICHEL**,
SENIOR EDITOR

When major grocers like Walmart, Carrefour, Albertsons and H-E-B start trying out automation at the local level to facilitate fulfillment of online orders—other retailers take notice. The trend is called micro-fulfillment, and it involves the use of automated order-picking systems that boast

a level of sophistication once found only in larger warehouses.

The bet by these retailers is that, with the right type of automation, they can fill consumer orders for home delivery or store pickup faster and with much less labor than with a manual approach.

In fact, most of these early forays into micro-fulfillment were started before the pandemic disrupted how we all live, eat and shop, with online grocery sales growing by 300% during the early part of the pandemic, according to research by FMI-The Food Industry Association. By 2025, according to a study by Mercatus, online grocery will account for 21.5% of total grocery sales.

This rapid shift to online buying, especially in the grocery industry, has led to increased interest in using automation within stores or at relatively small, but highly automated facilities in densely populated areas. Micro-fulfillment calls for the shrinking down of automation,



Goods-to-person robotic order picking automation is part of the micro-fulfillment trend, but so are broader supply chain issues.



One concept envisioned by Alert Innovation is to combine conventional consumer shopping for fresh goods on one level of a store with automated micro-fulfillment for fast-moving grocery items on another level of a store.

especially “goods-to-person” systems, to create efficient points for fulfillment close to customers.

“Some well-known companies had already taken micro-fulfillment up before Covid-19, and now with all the change caused by the pandemic, it’s just further accelerated the trend,” says Colman Roche, vice president of sales and consulting for e-commerce and retail with Swisslog, a warehouse automation provider that also offers micro-fulfillment solutions. “With e-commerce becoming a bigger percentage of overall retail sales, retailers have to take a look at their strategies and say, ‘Alright, how quickly are we going to go into micro-fulfillment?’ It’s become much more urgent.”

While it will take time for retailers to roll out a substantial number of automated micro-fulfillment sites because of the scale of retailing, the online buying surge during the pandemic gives the trend greater urgency, says Dwight

Klappich, vice president of supply chain research at Gartner. “Retailers are starting down this journey to micro-fulfillment, and they are starting now,” he says.

The opportunity to offer automation to thousands of retail stores has numerous vendors coming out with micro-fulfillment automation solutions. Some of these providers are established vendors of warehouse automation who’ve developed solutions they say can scale down to the store level. The trend also has given rise to several startups focused on scaled-down solutions.

While the systems offered by these vendors vary, some characteristics are common. Most solutions use dense, automated storage with some form of robotic carriers or mobile robots to bring bins from the storage to the workers at light-enabled pick stations. The idea is to eliminate most of walking involved in processing orders and have a relatively small, but “dense” storage and a picking

solution that can quickly process orders.

Klappich says it’s too early to tell which vendors will win out, but it will take solutions that can be implemented quickly without all the time and systems integration work often involved with automation solutions for large warehouses. “They can’t be bespoke systems that take two years to stand up at every micro-fulfillment center,” he says. “The solution providers have to take a more manufacturing-focused approach, rather than a systems integration-driven approach.”

The pandemic has dramatically accelerated online grocery buying, but interest in micro-fulfillment has been building for a few years, with retailers closely watching moves by the likes of Amazon and Walmart, says John Lert, founder and CEO of Alert Innovation, a micro-fulfillment solution vendor. Since traditional grocery chains can use their physical stores as an asset

for e-grocery, the pandemic, plus the already existing recognition of deep industry change, has made micro-fulfillment high priority, he says.

“The surge in online grocery buying has been dramatic, but the importance of e-grocery was building well before,” says Lert. “The pandemic sort of seals the deal. I don’t think there’s any food retailer around today who will tell you, ‘we just don’t see online grocery as being very important.’ They know they have to be competitive at it to be long-term sustainable.”

Automation needs

Lert should know what the big grocers are thinking, as his customers include Walmart. Alert’s “Alphabot” solution has been in use at a Walmart Supercenter in New Hampshire since January 2020. The system uses mobile robots that can move in all three dimensions within a multi-level storage structure to create a scalable, automated storage and retrieval system (AS/RS) and automated each picking system.

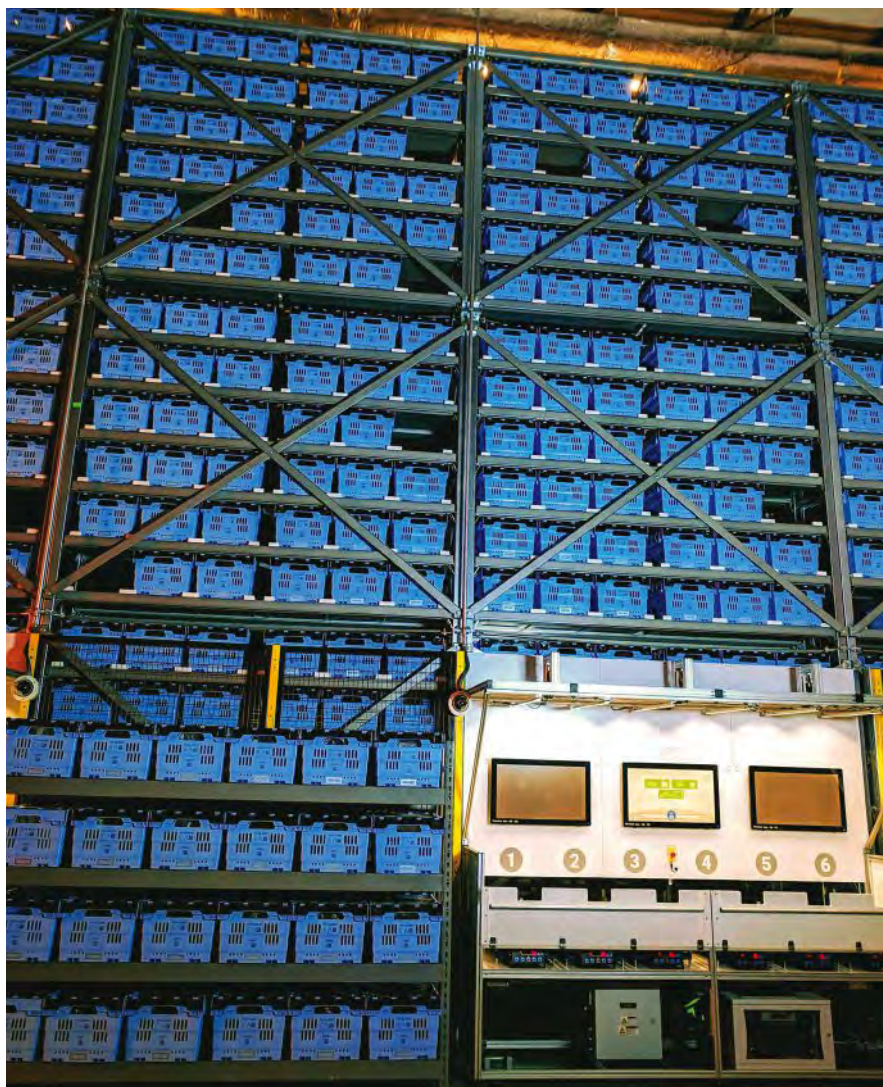
Lert says retailers clearly have a need for micro-fulfillment solutions, but more

importantly, they need automation that can scale down to the store level—and they need an approach that ends up being profitable. In terms of automation, Lert says a 3D design with mobile bots makes sense because it offers dense storage, high throughput, high reliability, and can be scaled up or down.

The approach marries mobile robot and AS/RS technologies, but what makes it unique is that rather than only operating in two horizontal dimensions, each robot has wheels for horizontal travel and pinions on its sides for vertical travel, which enables each bot to get to any storage or workstation location, and move horizontally at the new elevation. The system retrieves totes with needed items to a workstation like an AS/RS does, but by using mobile bots there is no single point of failure from a lift mechanism like a crane.

Without the need for fixed lifts, this makes the Alphabot easier to scale, says Lert, because you can add more totes and structure to increase storage capacity, or more bots or workstations for higher throughput, without having to install lifts or cranes. “Being able to scale down is key,” says Lert. “Our ability to separate the storage requirement from the throughput requirement means that you can put in a system with enough robots and workstations to support the volume of each store, and scale up as needed.”

Because micro-fulfillment is aimed at urban or suburban consumer concentrations where real-estate costs are higher and available space is tight, this makes both high-density storage and good



Dense storage and ergonomic workstations for human pickers results in rapid order turnaround in very little space.

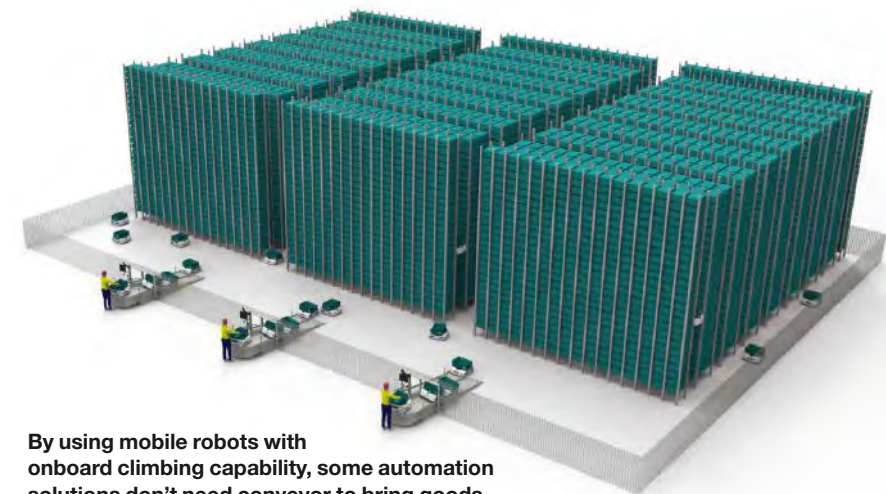
throughput performance important, says Roche. “You basically have to fit as much stuff as you can into as little space as you can,” he says.

Roche says Swisslog’s main solution for micro-fulfillment is AutoStore, a robotic storage and order picking system from Norwegian vendor AutoStore that’s deployed with Swisslog’s warehouse execution system software. AutoStore is well established as a solution for DCs, but Roche says Swisslog has come up with standardized implementation aimed at micro-fulfillment site sizes such as 10,000- and 20,000-square-foot sites. Swisslog recently notched a win for the solution with Texas-based grocer H-E-B, which plans to deploy it at multiple sites.

Goods-to-person automation is essential for efficiency, says Roche. However, the effective throughput rate in e-grocery is impacted by the need to carefully pack the orders, including not crushing fragile items, and the type of bag or container being used. “When you look at the throughput rate the automation can achieve, it matters what the operator needs to do at the pick station, and whether they are putting items into a bag or tote,” he says.

Through a more standard approach to the automation and software, Roche adds that AutoStore can be rolled out for micro-fulfillment in six to nine months. Getting the software configuration and interfaces right, including replenishment processes and integration with existing systems for inventory, can be the most time-consuming part of a deployment. “Software can be the long pole in the tent if there is customized functionality desired,” he says.

Attabotics built its automation solution specifically for each-item order picking for e-commerce, says the company’s CEO



By using mobile robots with onboard climbing capability, some automation solutions don’t need conveyor to bring goods out to the workstations.

Scott Gravelle, giving it the density and throughput to address micro-fulfillment sites. Attabotics’ solution is a 3D vertical storage approach in which robotic carriers can move on X, Y or Z axes and perform sortation within the structure.

“Our ability to have any of the robotic shuttles go and retrieve any load from any location in the storage structure, and then deliver it to any location on the perimeter of the storage structure in any sequence, means that we can do all the sortation requirements for each item picking,” says Gravelle. “The differentiator for us from some of other systems is that ability to do the sortation within the structure.”

Attabotics customers include omni-channel retailer Nordstrom. Gravelle says that Nordstrom has deployed the 3D system in a fairly unique way for a fulfillment center, though the Attabotics solution could scale down for “in-market” micro-fulfillment sites.

Micro-fulfillment automation solutions need to address several key needs, including offering dense bin and SKU storage, rapid deployment, and the ability to pick grocery orders in a matter of minutes, says Rudi Lueg, managing director of North America for Exotec, a French automation provider.

Exotec’s Skypod system, which has been deployed by retailers in Europe including Carrefour and E.Leclerc, uses mobile robots that can travel in three

dimensions though a dense storage structure, and then scoot out to light-enabled workstations.

According to Lueg, using mobile robots that can travel both horizontally and vertically on their own contributes to rapid deployments versus traditional shuttle automation because there’s no need for conveyor. Additionally, the storage infrastructure doesn’t need extra wiring for power or built-in lifts at each vertical position.

While Exotec can deploy a Skypod system in six months or less, it recently completed a deployment in just six weeks, says Lueg. “Using mobile robots that can move vertically and horizontally without the need for conveyors or lift mechanisms offers value in respect to lead time to deploy the solution, with maintenance, and with total cost of ownership,” he says.

Lueg also advises that companies don’t get too bogged down on throughput rates, since most micro-fulfillment automation vendors offer systems that can boast a higher rate than what human workers at the workstations can keep up with. The bigger concern, he adds, is how fast can the overall solution process most customer orders.

With the Skypod system, says Lueg, the bots have access to all the tote locations, so totes can be retrieved and presented to human pickers in one to

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two minutes, which contributes to a rapid cycle time for completing orders. "The cycle time that can be achieved is very important, because part of the strategy should be to improve the service commitment to customers," he says. "Retailers need to be able to meet today's customer expectation of wanting everything now. If it takes a couple of hours to complete a customer order, that might be too long for many consumers."

Supply chain coordination

Takeoff Technologies sees itself as a pioneer in the micro-fulfillment automation space, having launched in 2016 and building a customer roster that includes Ahold Delhaize USA, Albertsons, Big Y and Sedano's.

Takeoff based its automation solution on shuttle technology from KNAPP, using that as best-in-class hardware while focusing heavily on software functionality to help manage issues like inventory and replenishment, says Alfredo Millan, Takeoff Technologies' chief product officer.

"The automation is not necessarily where the only value is—the value also comes from understanding the supply chain of any grocery order and facilitating those end-to-end processes," Millan says. "That's our game."

In addition to proven automation for micro-fulfillment sites, Millan says Takeoff can provide a grocer with options such as an e-commerce platform, or inventory forecasting and replenishment tools. Some grocers may already have such software, but generally, Takeoff's focus is holistic support for micro-fulfillment, says Millan, rather than just the automation piece.

"We provide a platform that goes all the way from the ability to generate demand with an e-commerce platform, to the ability to pick, pack and ship

an order, to the ability to replenish a site and have accurate forecasting and replenishment," says Millan. "We take grocers by the hand, and we guide them through all these issues."

One size does not fit all

There's no single strategy for micro-fulfillment. Some retailers may choose a hub-and-spoke model in which an automated facility with no in-store shop-

Companies mentioned in this article

- Alert Innovation
- Attabotics
- Exotec
- Garner
- Swisslog
- TakeOff Technologies

ping—a "dark store"—serves a concentration of consumers and non-automated stores offering pickup.

Others may choose to put automation in many stores in densely populated areas. Lert says that the dark store model could be detrimental to retailers, as it could reduce traffic and sales volume for non-automated stores as online shopping becomes a bigger slice of the business.

While Alert Innovation's solutions can be retrofitted to existing stores, the Alhabot could also support a store concept where the center of the store or its second level contains the automation, and the main level or perimeter of the store is a more conventional store in which consumers select their own fresh goods such as produce, meat and dairy.

The automation could pick online items quickly enough so by the time consumers are done selecting their fresh foods, the automation has the rest of the order filled. The idea with this concept, says Lert, is

to use the automation to rapidly fulfill an assortment of fast-moving goods, while consumers pick their own fresh items, essentially turning each store into a profitable omni-channel fulfillment operation.

There remains work to be done in arriving at the right replenishment methods for micro-fulfillment, says Lert, but having automation that can scale down and still pick orders in 15 to 30 minutes, is foundational. "The demand is there for micro-fulfillment in terms of increased online grocery sales, but grocers want to be sure they have clear methods to do it profitably," he says.

Ultimately, adds Lueg, micro-fulfillment is more strategy than automation, so grocers and other retailers looking at these automation solutions need to address questions such as how many SKUs from the overall store should go into the automation, or how to most efficiently replenish goods.

With the Skypod system, human pickers can restock totes during hours a store is closed or during other periods when there's an adequate block of time. However, some companies may want to pursue a more networked model, with perhaps some totes for a micro-fulfillment site prepared at a DC.

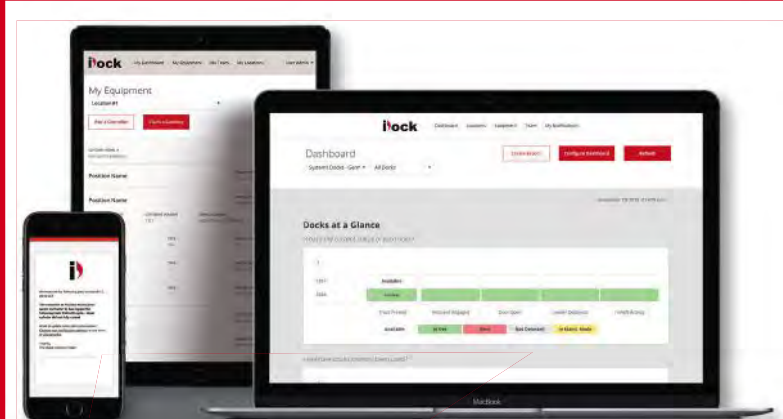
Demand-side factors should also be part of the strategy, adds Lueg, such as how to advertise the improved service levels to capture more market share, or how to run promotions on the goods in the automation to either bump up sales of items in the system, or on complementary and typically higher margin fresh foods offered in the store.

"Micro-fulfillment should be company-wide project, involving people with different perspectives and responsibilities so that you know how to really make the best use of the automation and make your operations more profitable," says Lueg. ■

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