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Amazon's Quest for the 'Holy Grail' of Robotics

Automating some warehouse functions could let the giant do more with its existing workforce—or the retailer may not require all the humans it employs today



By *Christopher Mims* [Follow](#)

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For decades, one of the hardest problems for robot developers to crack has been something seemingly mundane: how to replicate the human hand's ability to pick up stuff.

Amazon.com has just come a lot closer to achieving this elusive goal, with a leap in its automation prowess that promises far-reaching effects for its huge workforce and its future growth ambitions.

The tech giant last month unveiled a collection of new robots, one of which is suited to replacing humans in the most common job at Amazon – picking up items and placing them elsewhere. The linchpin of this new kind of automation is a robot arm – appropriately named Sparrow after the tenacious, pervasive bird – that combines advanced artificial intelligence, a variety of grippers, and the speed and precision that is now standard in off-the-shelf industrial robotic arms.

The announcement was easy to miss, coming as it did amid a run of news that, in part, illustrated some of the challenges Amazon is trying to tackle with its automation effort. The company began layoffs of corporate employees in mid-November, part of a sweeping cost-cutting effort to deal with the aftereffects of its rapid expansion during the pandemic.



An Amazon Sparrow robot demonstrates how it can handle packages at an Amazon innovation center.
PHOTO: M. SCOTT BRAUER/BLOOMBERG NEWS

The company's workforce more than doubled during that period, to exceed 1.6

million as of early this year. The vast majority of those employees were added in Amazon's sprawling logistics operation, which delivers packages to e-commerce customers. Amazon has been struggling to manage the size and morale of that group of employees, some of whom have grown restless over the demands of their highly repetitive jobs. The company in October beat back an attempt to unionize a facility in New York state by a nascent labor group that vowed to continue its campaign.

One of Amazon's long-term solutions to these issues is robots that could make the roles that many of these workers now occupy obsolete, although that's not the way the company talks about its automation efforts. Instead, Amazon couches its automation in terms of benefits to its workers.

Amazon's recently unveiled robots could help the company lower both injury rates and turnover in its warehouses, says Tye Brady, chief technologist at Amazon Global Robotics. "Robots are good at repetitive tasks and heavy lifting – I want to automate out mundane and repetitive tasks," he says.

The Sparrow is singular in its capabilities, and the scale of Amazon's ambitions for it. On its face, the robot has the potential to someday save Amazon billions of dollars in wages and benefits. Or, as leaders at Amazon like to put it, it will allow the company to continue to grow, despite its recent labor challenges. "Our goal is to augment our people with the tools they need to do their jobs more efficiently and safely," says Mr. Brady. "It's my belief that collaborative robotics is really an unlock to more productivity, and it can also better the employee experience," he adds.



Amazon's Proteus robot is its first fully autonomous goods-moving robot.

PHOTO: JOSEPH PREZIOSO/AGENCE FRANCE-PRESSE/GETTY IMAGES

Amazon, along with a collection of other robotics companies developing similar machines, are chasing what experts in the field call the “holy grail” of robotics — machines as dexterous, quick and adaptable as a human arm and hand.

Such a robot could someday be capable of handling any of the thousands – or in Amazon's case, millions – of different goods carried in a typical e-commerce fulfillment warehouse.

Amazon's robotic arm is still at an experimental stage. For the company to continue working on it, it must prove its worth, as even Amazon's robotics division has not escaped broader cost-cutting. A company spokesperson told the Journal Amazon would lay off 2% of workers in this division, part of a process of deciding which robotics research projects to trim and which to double down on.

Sparrow's first task will be as part of an experimental, automated goods-handling system that the company unveiled in June. Typically in an Amazon warehouse, robotic “drive units” ferry tall, soft-sided shelves to humans, who pick items from those shelves and drop them in bins. Those bins then ride on conveyors to elsewhere in the warehouse, for packaging and delivery.

Amazon's newest robot has impr...



In Amazon's new system, instead of being stored in shelves, items are stored in plastic bins that ride atop drive units. These bins can then be automatically placed in front of humans, at an ergonomic height, making picking items from them less taxing, says a company spokesman.

Sparrow is an attempt to someday replace human pickers in this stage of the operation. What's ergonomic for a human warehouse worker today is also, not coincidentally, appropriate for a future robot arm like Sparrow.

Other robots Amazon unveiled recently include Robin and Cardinal, both of which sort packages. In June, Amazon announced Proteus, the company's first fully autonomous goods-moving robot. Proteus can lift and move large carts, weighing up to 800 pounds, while navigating through areas full of humans.

Currently, Sparrow can only handle about 65% of the items that are in a typical Amazon warehouse. Those items range from hardback books to bottles full of liquids to T-shirts in plastic bags. Eventually, once Sparrow is good enough at this task, replacing humans as pickers is the goal, says Mr. Brady.

Other companies have developed similar robots, although they're intended to handle a narrower range of products than the Sparrow robot. They include Ambi Robotics, which provides parcel-handling robots to the U.S. Postal Service, and RightHand Robotics. That company's robotic arm can grab thousands of different types of items out of storage bins, and is being used in warehouses by Paltac, one of Japan's largest wholesalers of consumer packaged goods.



AI-powered robotic arms do picking tasks in warehouses, including this one, by RightHand Robotics.

PHOTO: RIGHT HAND ROBOTICS

One thing that is helping with adoption of these robot picking systems is that the technologies to automatically store bins full of goods, and deliver just the right one to a robot, have been falling in cost quickly, says Yaro Tenzer, chief executive of RightHand Robotics. “We sometimes joke here, ‘God bless all the companies that can move totes to our robots.’”

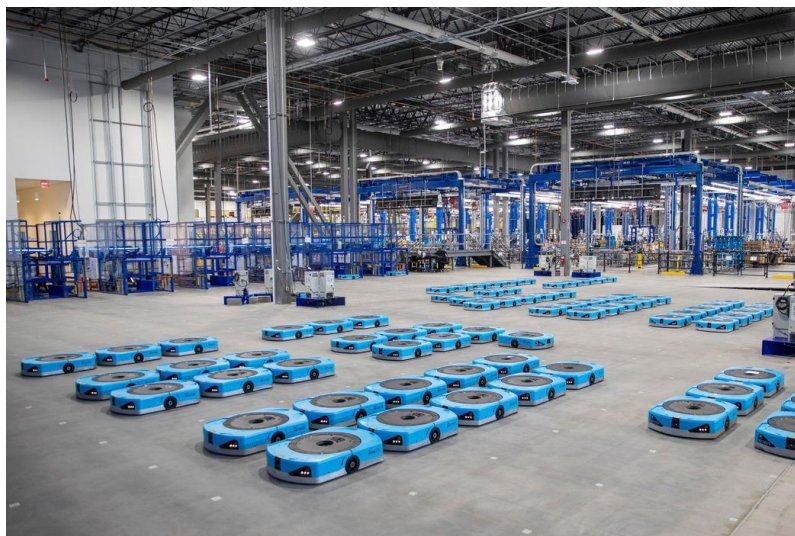
Companies offering these robotic storage systems include Attabotics, AutoStore, Alert Innovation and Dematic.

That said, Amazon hopes to operate on a much larger scale and with a much greater degree of complexity.

“What we’re doing is unlike anything that’s been done in human history—the scale we’re working at,” says Mr. Brady.

New kinds of automation can serve business goals other than reducing head count at a company. For example, Amazon has long been reliant on certain types of automation in its warehouses, and yet it has continued to hire more warehouse workers – over a million since 2012. All that hiring is in part because the primary way Amazon has leveraged automation, so far, is to keep costs low while getting items to consumers ever faster.

In the future, as workers are shifted out of roles like picking, they will be moved into other roles where they help the company better serve the customer, says Mr. Brady. He doesn’t know precisely what those roles will be, he adds.



Robots lined up in an Amazon innovation lab.

PHOTO: SCOTT EISEN/ASSOCIATED PRESS

History holds lessons for those who would use automation to increase productivity. A great many people have jobs today that didn't exist at the founding of the U.S., when more than two thirds of Americans were farmers. (The figure today is less than 2%.) So it's not clear that a world full of strong, dexterous, indefatigable, artificially intelligent robotic arms will mean that all the workers who are displaced by them will still be working for Amazon.

It is possible that in the near term, Amazon's claims that automation will simply help it do more with its existing workforce – like achieving even faster delivery – will prove true. Further into the future, it's not at all clear that even Amazon's most ambitious goals will require all the humans the company employs today. Indeed, given the dozens of companies offering robots like those Amazon is building, and the efficiencies those robots will allow Amazon's competitors to achieve, if Amazon's automation doesn't allow it to reduce its reliance on humans, it could represent a threat to the long-term viability of the company's retail operations.

From that point of view, innovation in robotics at Amazon would seem to be an existential question for the company. And its ongoing investment in the technology suggests its leaders know it.

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