MODERN
MATERIALS HANDLING

MAKING THE CASE FOR

Collaborative, Highly Efficient Fulfillment Solutions

The scarcity of labor resources and high costs of robotics ownership are pushing companies to rethink their fulfillment strategies and look to harness the power of collaborative, highly efficient person-to-goods (P2G) assisted picking solutions to improve utilization while enhancing overall operational performance and profitability.

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Optimize Every Second of Every Workflow With up to 30% Fewer Robots Than Legacy Systems

Legacy autonomous mobile robot (AMR) fulfillment solutions use either the Swarm or Follow Me picking methodologies. Swarm often leads to undirected, unbalanced loads and low AMR usage. For example, one picker may be assigned to many robots or there may be extended dwell time in the aisles, at induction and at drop-off. With Follow Me, each worker is assigned to a specific robot, so pickers are limited by the AMR's speed.

The challenges can go largely undetected in a typical collaborative robotic-assisted fulfillment operation, where AMRs are caught in a cycle of inefficiency, waiting in queues that waste valuable capital. In legacy systems, robots frequently remain idle, whether they're waiting for work to be inducted, standing by in aisles for pickers to locate them, or parked at drop-off points queued for work to be removed. This waiting is not a productive use of resources; rather, it represents costly downtime that undermines the return on investment made in these robots.

This inactive time is costing companies money as other people, processes and technologies continue plugging along. Multiply this problem across dozens of robots — and across multiple facilities — and the financial impact can be substantial. Moreover, the lost productivity can lead to poor customer service in today's demanding fulfillment landscape.

"Traditional AMR fulfillment methodologies haven't been designed to optimize the client's profits. Person-to-goods pick solution designs have been stagnant for over 10 years," said Cody Upp, head of marketing, sales and solutions at Zebra Robotics Automation. "The market has become inefficient and the same two vendors dominate the space."

THE LIMITATIONS OF SWARM AND FOLLOW ME

The AMR-enabled P2G pick assist automation space traditionally has been comprised of two viable methodologies, Swarm and Follow Me, each of which presents its own set of limitations. For example, Swarm picking may work in high-density environments, but congestion and decreased throughput both come into play as more AMRs are put into service. Solutions using the Follow Me methodology can slow down your fastest pickers. This 1:1 relationship between robot and picker makes for an expensive solution because you need one robot per picker in an aisle and also require robots to be available at induct and drop-off points.

Swarm uses zone picking and sends picking tasks to designated zones where pickers have been assigned, but this creates an entirely different set of challenges. For example, it leads to excessive, undirected human travel. Pickers spend some of their time looking for the next robot to pick. Also, the Swarm strategy of positioning robots in front of pick locations — without a task assignment given to a human operator — can create lengthy robot dwell times in the aisle. This, in turn, increases the number of robots required and decreases overall asset utilization.

Follow Me provides a directed workflow, but at the cost of the speed of the operator. That's because an operator is only as fast as the slowest robot. The Follow Me strategy also requires undirected, out-of-pick tour travel to "meeting points" — a process that can impact overall pick rates. Robot dwell time at meeting points drives the need for even more robots while also decreasing overall asset utilization.

Cash flow is another obstacle for companies that are investing in AMRs and other automated options. "We've reached a point where simply swapping out labor operating expenses (OpEx, or an expenditure incurred as a result of normal business operations) with robot OpEx is no longer a viable strategy," Upp explained, referring to a time when "trading costs for costs" was a suitable option if it lessened a company's labor requirements.

"Companies were exchanging robot costs for labor costs in an effort to reduce reliance on direct labor in a market where labor was scarce, and it was considered a sufficient investment," said Upp. The tides have turned, and companies can no longer afford to shell out major robotics and automation investments in hopes that they lessen their reliance on labor. The requirement is that automation investments deliver real cash flow improvements.

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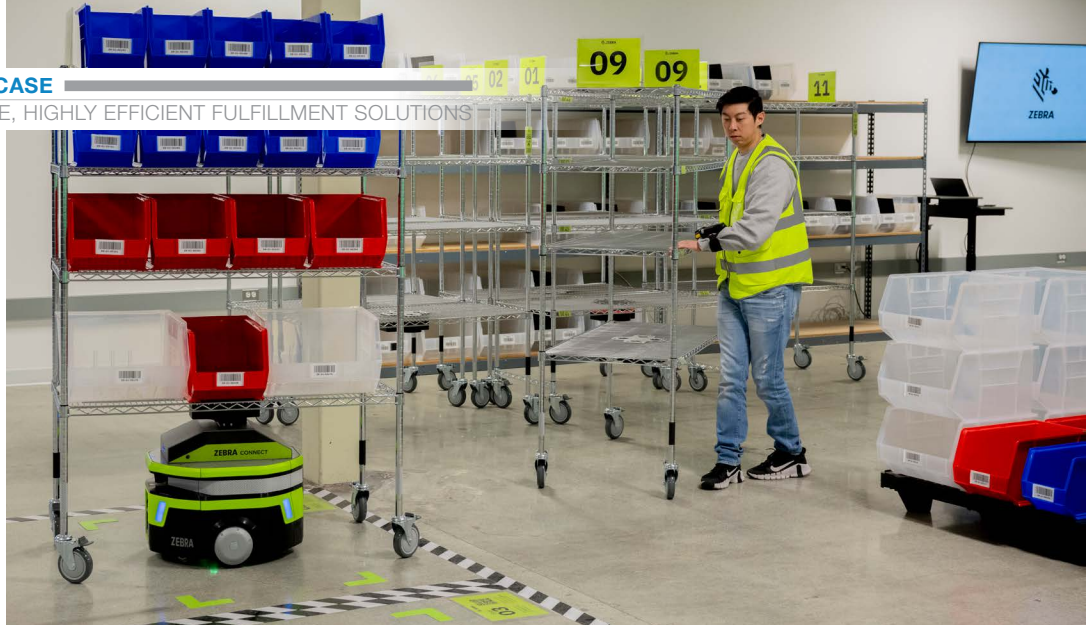
MAXIMIZE UTILIZATION, MINIMIZE DOWNTIME

Legacy collaborative AMR-enabled P2G solutions are getting more expensive, which effectively drive up the total cost of ownership (TCO). Robots that "stagnate," waiting around for a human operator to find it, or robots that slow down pickers, are inherently underutilized, pushing organizations to rethink their AMR deployment strategies. They're looking for solutions that maximize utilization, minimize downtime, and deliver a tangible return on investment (ROI) to justify the upfront and ongoing costs.

The answer lies in a collaborative, highly efficient fulfillment approach where every order is assigned to a robot, every robot is assigned to a picker, and the work is allocated intelligently and efficiently. More orders mean better batching and fewer robots, and efficient batching (and fewer robots) creates significant cost savings. Unfortunately, this ideal scenario is out of reach without a directed, orchestrated workflow with teams of robots and pickers, and where robots cannot decouple from the carts to keep the robots productive.

"Most of the waste, and as a result, cost of an AMR solution occurs when robots are waiting for operators, and when operators are engaged in undirected work, so the industry needs a way to eliminate AMR dwell time," said Upp. "When your robots or pickers are idle, that impacts your bottom line and hinders your firm's ability to compete in today's demanding business environment."

This Making the Case delves further into the top challenges that companies are dealing with on the robotics front right now and reveals how a collaborative, productive fulfillment environment can help them overcome these hurdles, operate more efficiently, and enhance overall operational performance and profitability.



Optimizing AMR Utilization for Peak Performance

Autonomous mobile robots (AMRs) can only go so fast, so they all must perform optimally in order to achieve the desired return on investment (ROI). Too many companies have overlooked this fact as they rushed to trade "labor cost for automation cost" amid persistent labor constraints and are now paying the price for this oversight.

"Many organizations were unaware of the utilization of the investment itself," Cody Upp, head of marketing, sales and solutions at Zebra Robotics Automation, pointed out. "The questions are, 'How many robots do you need for the job,' and 'What percentage of time are those robots waiting around for work'?"

The answer to those questions directly correlate with the amount of money wasted on siloed idle robots. The good news is that there's a way to start getting more benefit from every robotics investment, and quickly. "Our Zebra Symmetry Fulfillment solution requires 30% less robots for the same throughput," said Upp.

FROM CHAOS TO COHESION OVERNIGHT

When AMRs use the Swarm approach, the system is notoriously chaotic and confusing. Workloads are unbalanced, and underused robots spend time waiting for undirected workers to find them. And Follow Me pickers can only interact with the AMRs that they're following, and the robot restricts the speed. Guidance is limited and employees who naturally work faster are held back.

With Zebra Symmetry™ Fulfillment and the Team Intelligence picking methodology, employees use wearables that direct them on a precise, optimized path. Teams of AMRs "leapfrog" to ideal locations ahead of human workers, allowing more items to be picked in less time. Workers and robots always have orchestrated work assignments, which means there's never a robot without a picker (or a picker without a robot). The system uses multiple carts, which helps reduce overall robot count by up to 30% while still handling anywhere from 150 to 300% more capacity.

Developed to help companies realize the full potential of AMR-assisted picking, the solution uses this three-pronged approach to helps workers pick more items in less time while reducing robot fleet sizes:

1. *Utilization balance:* Achieve more cost-effective accumulation by buffering with inexpensive carts, instead of additional robots or labor.
2. *Greater cubic capacity:* Carts eliminate AMR wait times and boost pick density, reducing your robot count by up to 30% compared to AMR solutions with integrated payloads while handling 150 to 300% more capacity.
3. *Optimized pick paths:* Workers and robots always

have orchestrated work assignments. There's never a robot without a picker or a picker without a robot.

Zebra's Team Intelligence methodology helps workers pick more items in less time by coordinating each picker with a team of robots in a precise, directed workflow with a perpetual picking cycle.

company helps robots and pickers work more efficiently and effectively. This optimized workflow minimizes robot idle time, producing significant cost savings and a faster ROI.

This integrated approach also helps organizations be more agile and adaptable in a rapidly evolving fulfillment picking environment.

"This streamlined process not only reduces the time span between picks but also enhances the precision of each individual pick," Arvind continued. "Employees receive precise instructions on what to pick and where to pick it from, accelerating the entire operation. Additionally, warehouse managers gain real-time visibility into all activities, enhancing operational oversight.

"The solution factors in time, space and charge when deciding how to allocate work to the pickers and to the robots," he continued. The solution itself uses a combination of artificial intelligence, multi-robot/multi-agent optimization and game theory to create an optimal fulfillment scenario.

Organizations that embrace a collaborative, highly efficient fulfillment strategy can avoid the waste inherent in traditional AMR deployments. Zebra's innovative solution leverages advanced technologies like automated planning and scheduling AI to sequence, allocate and optimize workflows, minimize robot idle time, and give workers real-time guidance. These drive significant cost savings while also helping businesses address fulfillment complexities with greater efficiency, confidence and ease.

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This innovative approach improves throughput, reduces cost per unit, and empowers operational decision-making.

GETTING MORE OUT OF YOUR ROBOTICS INVESTMENT

In a typical manual fulfillment operation, pickers start their day with a given set of labels, a handheld device and a cart to place orders on. They walk around picking orders and then bring the cart to a drop-off station. Then they go back and do it all over again and keep repeating the process throughout their shift. As mentioned in the last article, robotics, specifically AMRs, were brought in to help speed up the process and make it more efficient, but many of those expensive AMRs sit idly.

Zebra Robotics Automation is helping busy fulfillment operations optimize labor resources while increasing throughput without sacrificing performance rates, quality or reliability. By combining a collaborative fulfillment approach with an advanced picking methodology, the environment where order volumes and customer demands can change on a dime. "Carts are inducted and dropped off through guidance from the wearable, and robots autonomously handle carts that have been inducted and drop off carts that have been picked, eliminating any wait time at induction and drop-off" explained Achal Arvind, director of robotics solutions at Zebra Technologies. "Pickers no longer need to concern themselves with induction areas or moving fully picked carts to the drop-off process. The decoupled AMRs seamlessly bring robots from induction to the next picking location, optimizing efficiency and creating a perpetual

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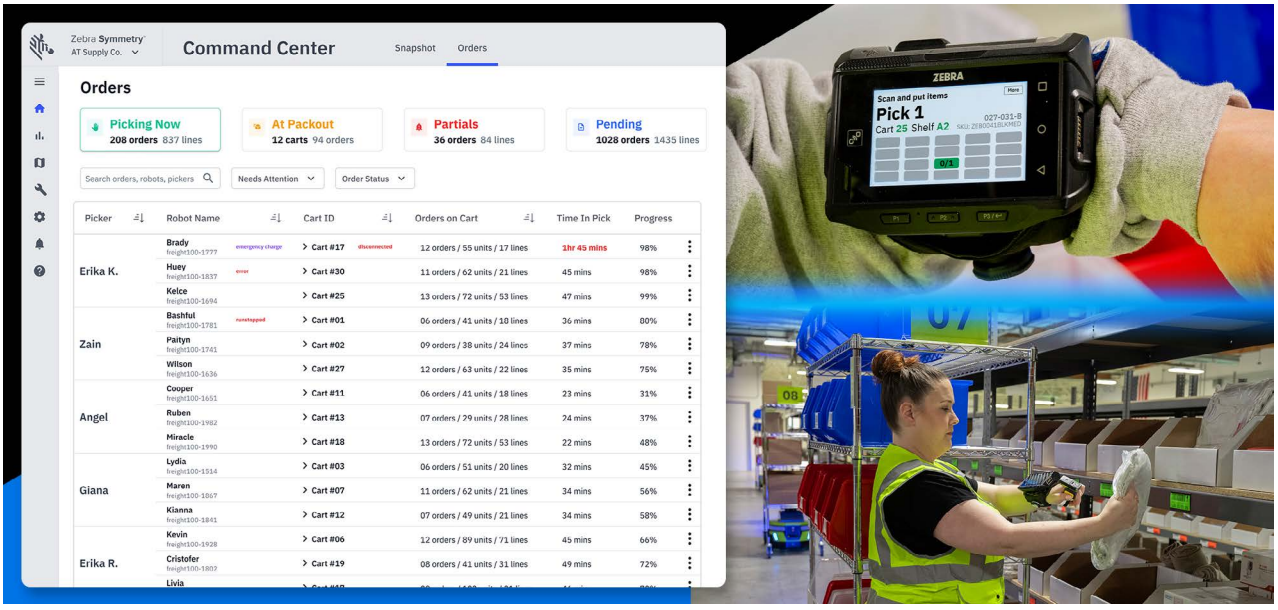

Collaborative Fulfillment Drives $700,000 in Savings

When robots can intelligently communicate with each other and with overall warehouse systems, they can dynamically adjust their routes, anticipate bottlenecks, and optimize utilization of both robots and people. This real-time coordination minimizes idle time and ensures that robots are always productive and maximizing their return on investment (ROI).

To help bring this concept to life for businesses evaluating its Zebra Symmetry™ Fulfillment solution, Zebra created a model to highlight the impact utilization imbalance would have on a warehouse or DC floor. The simulation proves that fewer robots would be required when using Zebra's solution versus other legacy solutions.

For this example, a company was processing 2,400 orders per day using 8-hour shifts and an average of 3.75 lines per order. This reflects the actual order characteristics of an e-commerce order pool while acknowledging that there's no such thing as a typical "average" in daily warehouse operations.

Before using Zebra's Symmetry Fulfillment system and decoupling carts from autonomous mobile robots (AMRs) at both induction and drop-off, the company needed 50 AMRs to process its daily order volume.

Without changing anything other than the concept of decoupling the cart and using Zebra's additional cubic capacity, the company reduced its robot requirements by 15 AMRs (taking the system down to just 35 AMRs). This 30% reduction in automation operating expenses (OpEx, or an expenditure incurred as a result of normal business operations) was passed directly through to the company, which is saving $234,000 annually, or $702,000 over the course of the usage term.

This is just one of many ways Zebra Symmetry Fulfillment helps organizations optimize the efficiency of their robotic investments to achieve optimal fulfillment performance.

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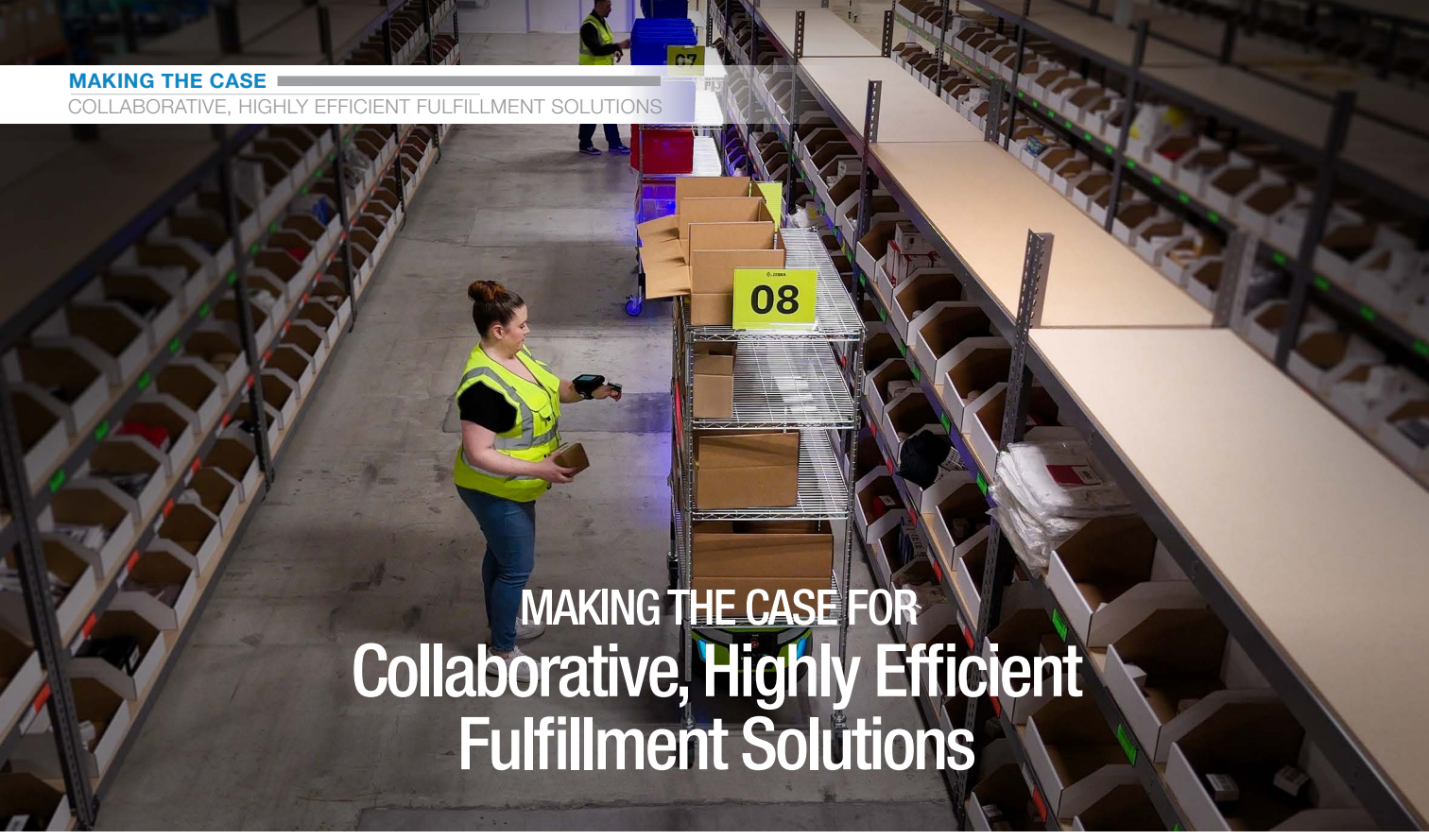

MAKING THE CASE FOR Collaborative, Highly Efficient Fulfillment Solutions

When companies embrace collaborative, highly efficient fulfillment solutions, everyone wins.

FOR THE VP OF OPERATIONS: Responsible for the day-to-day operations of their companies, VPs of operations are one of the biggest beneficiaries of a collaborative, highly efficient fulfillment environment where autonomous mobile robots (AMRs) work in harmony with human workforces, driving up efficiencies and streamlining workflows. These VPs can also expect full system control, wave management and accountability — all of which help keep the operational wheels turning at an optimal rate.

Managers and VPs have real-time activity dashboards that provide up-to-the-minute feedback on what's happening in the facility. This supports timely decision-making about stockouts, delays and other issues that may impede customer service. Cody Upp, head of marketing, sales and solutions at Zebra Robotics Automation, said Zebra's solution helps VPs of operations break away from their robotics vendors' "black box mentality" and gain more control over their operations. "If you're retroactively managing conditions on the floor due to a lack of control over that environment," he said, "all you're doing is wasting money, time and energy that could be put to much better use."

Getting new or temp employees trained and operational quickly is another area that VPs of operations are concerned about; but a fulfillment solution with a directed workflow and intuitive user instructions can help solve this. "The average time it takes to be productive is much shorter with Zebra's system because the solution is so intuitive," said Achal Arvind, director, robotics solutions at Zebra Technologies. "Someone just has to follow the instructions on the screen and they're good to go."

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FOR VPS OF SOLUTION ENGINEERING OR CONTINUOUS IMPROVEMENT: Focused on translating customer requirements into innovative and effective technical solutions; streamlining processes; reducing waste; and improving overall organizational performance, these VPs have a lot on their plates right now. With collaborative fulfillment solutions in place, they know that workflows are always being properly directed, allocations are being continuously improved, and capacity is at or above targets. Hosted in the cloud, Zebra's Symmetry™ Fulfillment solution ensures that the system just keeps getting better without ever needing to make changes to its infrastructure. "Because our software is cloud-based, updates can be made without needing to be on-site," Arvind explained, "which allows us to provide incremental value while minimizing any downtime for customer operations."

Upp also reminds VPs of solution engineering or continuous improvement to carefully assess just how much their robotics investments have improved since initial implementation. In most cases, the answer to that question will be zero. Zebra's collaborative solution, on the other hand, yields about a 30% reduction in robots required. From there, the system continues to get better, more intelligent and even more impactful over time. "The warehouse automation game isn't about how fast you can get; it's about how fast you can get relative to the cost structure," Upp explained. "When you look at it that way, collaborative fulfillment clearly offers the lower cost of ownership."

FOR THE CFO: When robots are seamlessly integrated into the fulfillment workflow, it translates into reduced operational costs, fewer errors, optimized resource utilization and a healthier bottom line. This is music to a CFO's ears in today's resource-constrained economic environment. Collaborative fulfillment also boosts performance while reducing related costs through minimizing robot fleet size and through more efficient picking, depending on the specific application. "CFOs get more bang for their buck," said Achal Arvind, director, robotics solutions at Zebra Technologies. "They can also expect the lowest cost per unit compared to many other systems — or manual operations — and improved workforce productivity rates."

Zebra Symmetry Fulfillment and Team Intelligence also help CFOs distinguish between the "shiny objects" from solutions that produce real results and save substantial money on the DC or warehouse floor. This is an important win at a time when organizations have to do more than just replace "cost with cost" by swapping out labor with AMRs. "During the COVID years, CFOs grew comfortable with the idea of doing those swaps," said Cody Upp, head of marketing, sales and solutions at Zebra Robotics Automation. "Now they know that was a good operational move but a poor financial investment, and especially when you have to wake up every day and 'pay' these robots that are spending too much time sitting idle."

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You Can't Work Efficiently if Robots Aren't Doing Anything

If you didn't know that those expensive, underutilized autonomous mobile robots (AMRs) you purchased were sitting around idly on the warehouse floor for up to 30% of the time, you do now. This is inherent to legacy solutions on the market today, where the AMRs are permanently attached to the carts.

As more companies look to drive profits from their automation systems, they need solutions that help them bring their human and automated workforces onto the same page and focused on similar goals. Zebra's Symmetry™ Fulfillment and Team Intelligence help organizations connect the dots between their operations and their robotics investments for a more directed and collaborative fulfillment environment.

Innovation is sorely needed in a marketplace where the typical fulfillment AMR solution hasn't been updated in 10+ years, making them out of touch in a business environment that's evolved rapidly within the last 2 to 3 years alone. "Sure, there have been some software development efforts and improvements in stability and reliability, but the AMRs being sold today are fundamentally the same ones that companies were buying a decade ago," said Cody Upp, head of marketing, sales and solutions at Zebra Robotics Automation.

"Where's the innovation?" he asked. "It's not there, because improving robotic utilization by 25 to 30% means current manufacturers would sell less of them. That's the bottom line." Zebra solves the problem by offering a solution that helps companies optimize their AMR and other robotic investments both instantly and over time, requiring 30% fewer robots. "There's not been another option on the market that can meaningfully move a business in such a short amount of time," said Upp.

With e-commerce providers getting better at shipping orders fast and efficiently, Achal Arvind, director, robotics solutions at Zebra Robotics Automation, said now is the time for all companies to adopt collaborative, highly efficient fulfillment approaches. "It's imperative that warehouses have more control over their operations while also reducing costs and increasing productivity," he explained. "This is part of an ongoing effort to get work done faster and more affordably, but it's something that's hard to do when your robots are sitting idle for up to 30% of the time."

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