

Build Test Scale

delivering
THE FUTURE




Build, Test, Scale: Inside the Innovation That's Enhancing Speed, Efficiency and Safety at Amazon

Amazon has pioneered the use of automation and machine learning models for decades. We have now reached a stage where novel generative AI is accelerating how we use technology within our operations to benefit our customers and improve our workplace. Earlier this year, we announced that we delivered to Prime members at our fastest speeds ever in the U.S. and globally, with more than 5 billion items arriving the same or next day. This achievement was driven in part by leveraging advanced machine learning to optimize inventory placement. We have also become the world's largest manufacturer of industrial robotics, where 75% of all customer orders globally are delivered with the assistance of robots working within our operations.

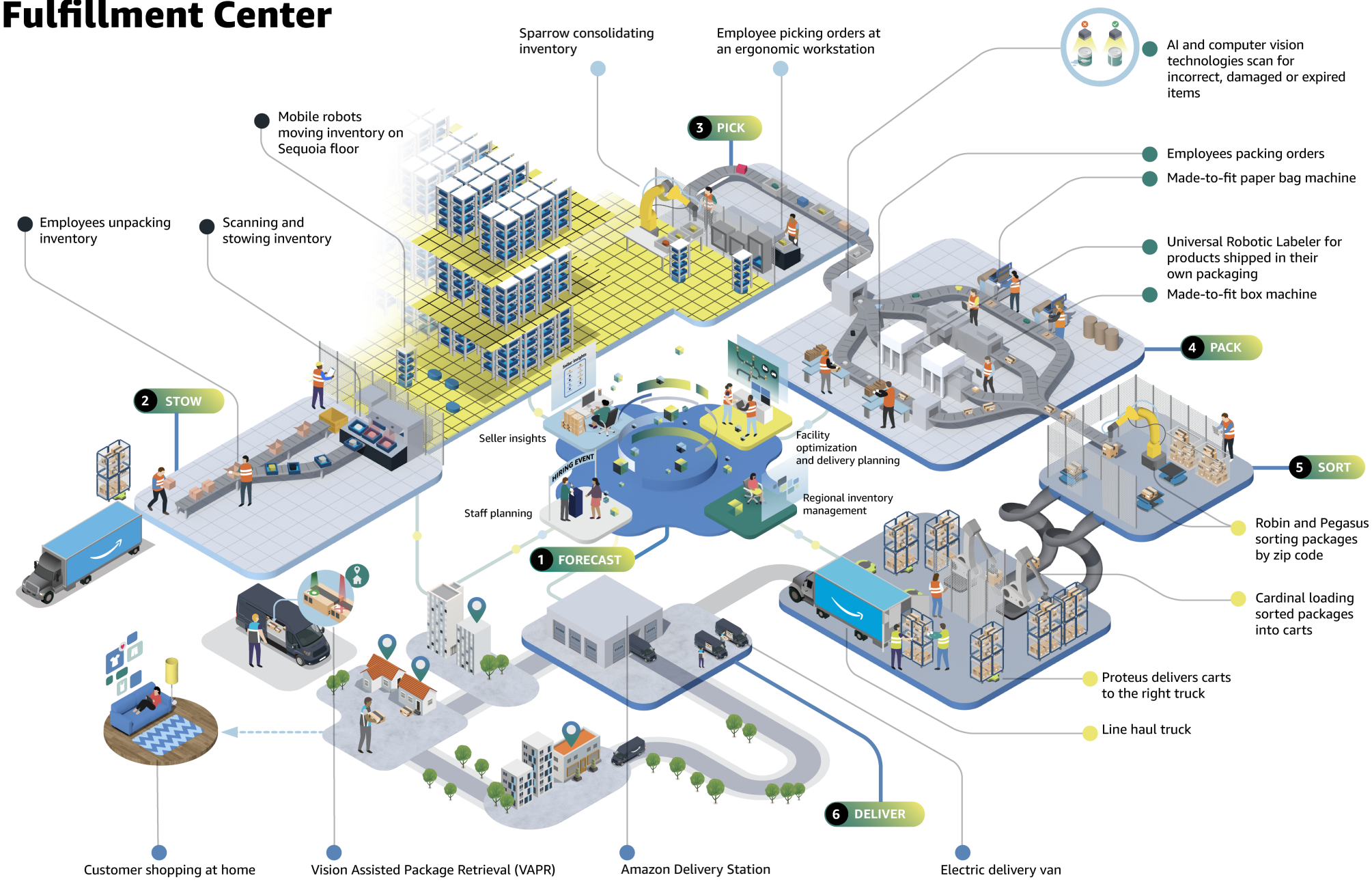
Today, Amazon's next-generation operations sites integrate all the automation, robotics, and AI technologies we have meticulously built and tested over the past few years, now all under one roof for the first time at our new facility in Shreveport, LA. This site will support a safer and more

productive workplace by introducing new ergonomics and automating physically demanding tasks while also advancing sustainability efforts through the elimination of single-use plastic delivery packaging. In the coming years, we plan to deploy this set of technologies to new and existing facilities as well. Today, all the electricity used in our operations is matched by 100% renewable wind and solar energy, helping decarbonize the grid.

Since 2020, Amazon-developed generative AI models have optimized demand forecasting and supply chains. By 2022, we embedded these models into our robotics, rapidly advancing their ability to perceive and interact with the physical world. The speed and effectiveness of these systems have scaled exponentially, with technologies tested just a year ago at our robotics R&D facility in Boston now ready for broader deployment.

Here's a closer look at the latest AI-driven innovations powering our next-generation fulfillment centers.

Amazon's Next Generation Fulfillment Center



1. Forecast

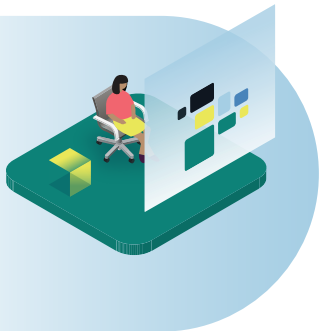
The strategic command center of Amazon's operations is powered by SCOT (Supply Chain Optimization Technologies), a team that works on some of the world's most complex supply chain issues with a suite of AI, machine learning, and other systems that analyze vast data sets. SCOT can forecast demand for Amazon products based on region, determine inventory needs, inform staffing needs, organize our

fulfillment centers, and calculate the optimal routes for delivery drivers. SCOT also provides our independent sellers with unprecedented insights that they can apply to their businesses and inventory management.



IMPACT

Updates to the AI systems for demand forecasting increase prediction accuracy for our busiest shopping periods and deal events by over 10% nationally. These innovations lead to inventory placement closer to customers, lower costs, and faster delivery.



2. Stow

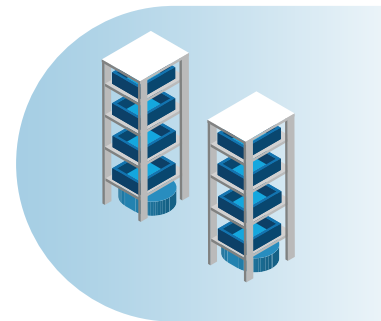
Trailers filled with inventory from independent sellers and vendors arrive at the fulfillment center by appointment and are greeted by a team of employees who unpack the items into storage containers. From there, items are scanned and identified in bulk in their container by AI-enhanced

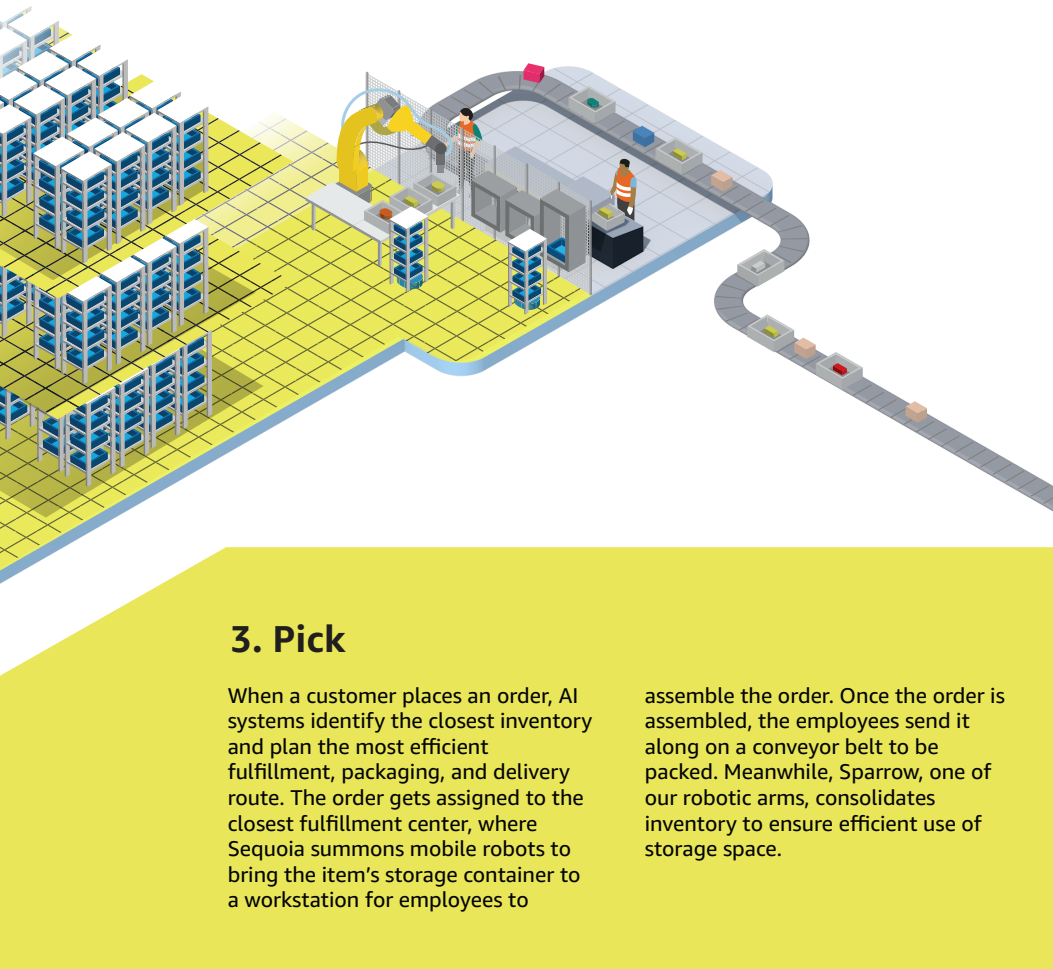
systems, making them available for purchase within seconds. Once the inventory is fed to Sequoia, our latest inventory management system, mobile robots transport it on carts to a storage area, where it remains until it is needed to fulfill a customer's order.



IMPACT

Sequoia coordinates robots, robotic arms, and employees to speed up inventory processing, identifying and storing items 75% faster and cutting order fulfillment time by 25%.





3. Pick

When a customer places an order, AI systems identify the closest inventory and plan the most efficient fulfillment, packaging, and delivery route. The order gets assigned to the closest fulfillment center, where Sequoia summons mobile robots to bring the item's storage container to a workstation for employees to

assemble the order. Once the order is assembled, the employees send it along on a conveyor belt to be packed. Meanwhile, Sparrow, one of our robotic arms, consolidates inventory to ensure efficient use of storage space.

IMPACT

Sequoia's ergonomic workstations reduce risk-related movements for employees by keeping work in their power zone, between mid-thigh and mid-chest height. This eliminates the need to reach above their heads or squat down to pick or stow products.



4. Pack

Just before packing, the order passes through a tunnel equipped with AI-backed computer vision to scan for incorrect, damaged, or expired items. Any problematic items are isolated for further investigation by employees.

Then, with AI guiding the most efficient use of packaging, the order heads to the corresponding packing station. A retrofitted machine that previously created plastic bags now creates made-to-fit paper bags that can often go in household recycling bins. Another machine creates on-demand, made-to-fit packages for products that require more protection than a non-padded bag. This

machine measures an order's dimensions and then creates a right-sized, protective package using a type of corrugate that is flexible and lighter than the typical box. Some products don't require any Amazon-added packaging at all. Through Amazon's Ships in Product Packaging program, products are certified to ship in their original packaging, reducing waste and improving truck fill rates. Our Universal Robotic Labeler improves label placement and adhesion on paper bags and products shipped in product packaging. By automating label placement on smaller and uniquely shaped packages, we reduce materials, lower costs, and increase speed and efficiency.



IMPACT

Shreveport, LA is home to our second U.S. automated site to eliminate single-use plastic delivery packaging, advancing our effort to convert all North American centers to paper delivery packaging, a shift already completed in Europe. We've entirely replaced plastic air pillows with paper across North America.

In 2023, in the U.S., Canada, and Europe, more than 50% of Amazon's shipments were delivered in reduced delivery packaging, such as bags or envelopes, which are up to 89% lighter than a similar-sized box.

In 2023, 12% of orders shipped without any added packaging.

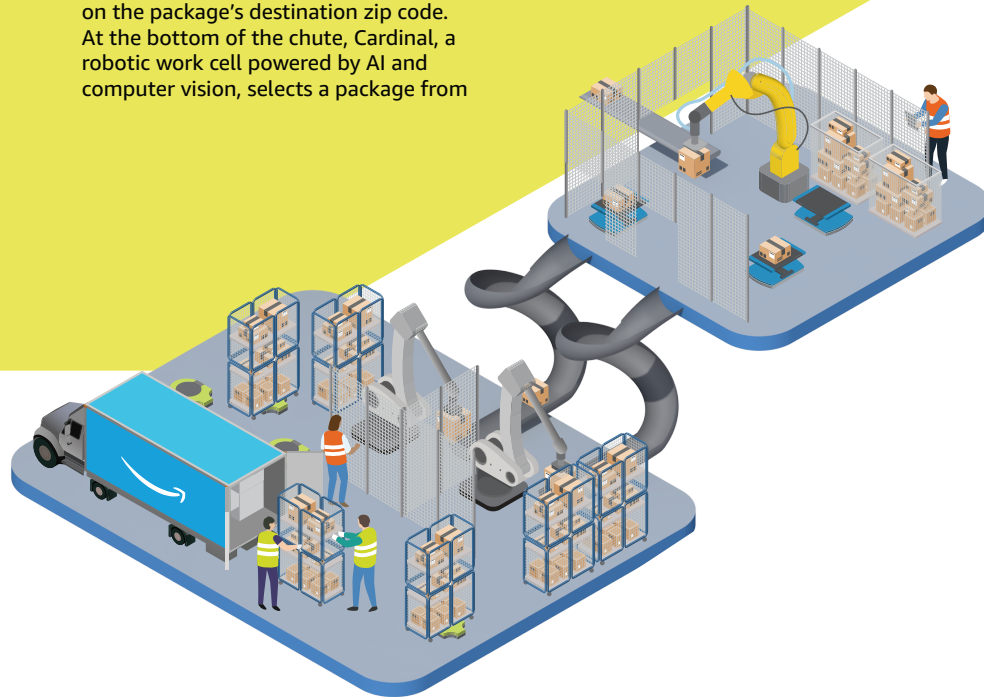


5. Sort

Once the order is packed and labeled, it is sorted based on its destination. Robin, a sophisticated robotic arm with eight suction cups on end, picks up one package at a time and places it on Pegasus, a wheeled robot with a tilting conveyor belt on top, which drops packages into chutes that lead down to loading bays.

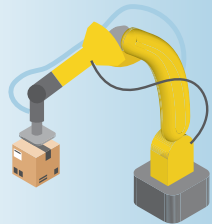
The appropriate chute is chosen based on the package's destination zip code. At the bottom of the chute, Cardinal, a robotic work cell powered by AI and computer vision, selects a package from

a pile, reads the label, and places it in a cart for the next step. Using advanced safety and navigation technology, Proteus is an autonomous mobile drive unit that moves through facilities alongside employees, assisting with tasks like lifting and pushing carts, improving safety and efficiency without needing to stay in restricted areas.



IMPACT

Robin takes on the heavy lifting and repetitive sorting so our employees can focus on other, more productive, higher-order tasks. Robin has sorted over 3 billion customer orders to date and was trained on millions of images and data sets to become the reliable system it is today.



6. Deliver

Delivery paths depend on the item and destination, with our regionalized network shortening travel distances. Many packages are taken directly from the fulfillment center to a local Amazon delivery station, sorted by route, and loaded onto delivery vehicles. Vision Assisted Package Retrieval (VAPR), our new AI-powered system, helps drivers in Rivian vans quickly identify packages along their route. Once the van arrives at a delivery location, VAPR uses a

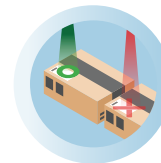
combination of advanced LED light projectors, overhead cameras, and ambient lighting to locate and scan barcodes on packages inside the van and cross-reference them with the route itinerary. If a package matches the itinerary, VAPR will shine a green "O" on those meant to be delivered and a red "X" on those not associated with that stop.

IMPACT

Deliveries are increasingly made with zero tailpipe emissions using 15,000 U.S. electric vehicles and various models across Europe and India, like e-cargo bikes and e-rickshaws.

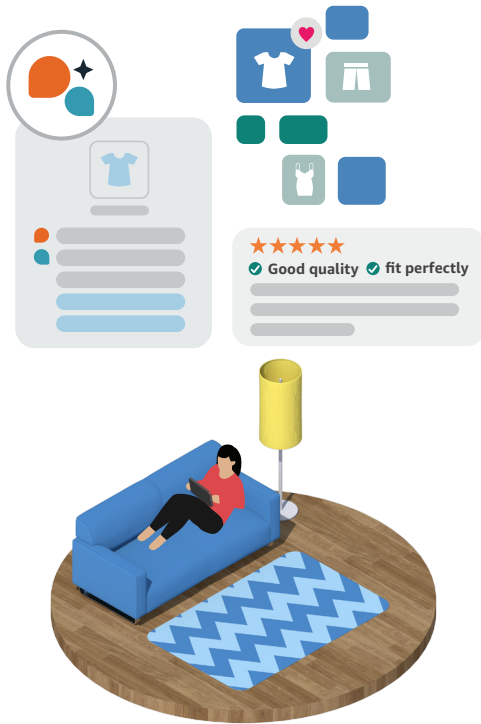
With VAPR, drivers no longer need to organize packages by stop or manually check shipping labels to ensure they have the right items. They simply have to look for the green light.

Based on early tests with VAPR, we saw an 88% reduction in reported package retrieval frustration, a 67% reduction in perceived effort for drivers, and more than 30 minutes saved per route.



Shopping AI

Three Ways Amazon Uses AI to Enhance Your Shopping Experience



Rufus, Amazon's AI-powered shopping assistant, helps customers understand product details, get product recommendations, compare options, and more, to help them make more informed shopping decisions.

Review Highlights uses AI to provide a short summary paragraph on the product detail page highlighting features and customer sentiment frequently mentioned to help customers determine at a glance whether a product is right for them.

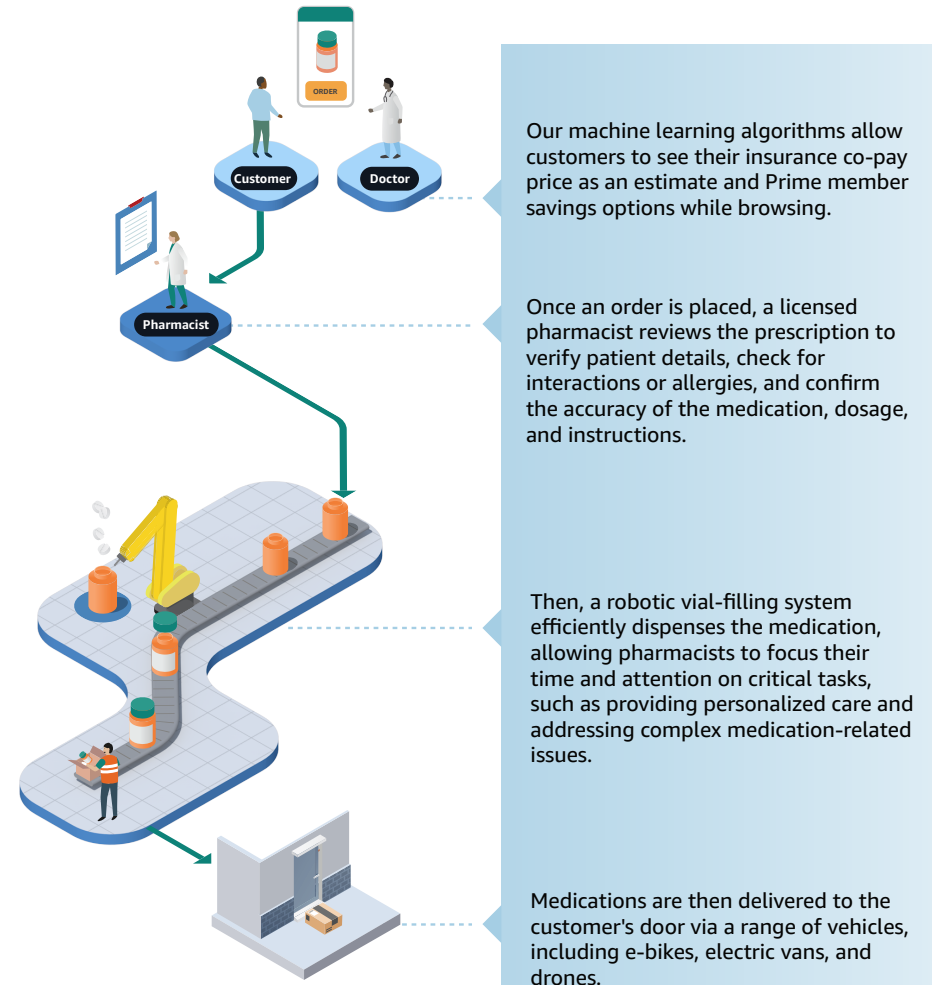
Announced today, **AI Shopping Guides** pair world knowledge and personalized guidance with Amazon's wide selection to help customers understand a category. Each guide provides content to help customers learn about different product types, understand key features and terminology, and identify top brands and customer favorites.

Rufus leverages AWS chips Trainium and Inferentia, AWS's elasticity and scalability, and a custom-built Large Language Model to answer shoppers' questions quickly.

Pharmacy

Fulfilling Prescription Medication at the Speed of Amazon

Amazon Pharmacy is building the fastest and most convenient service for the home delivery of prescription medications.



Our machine learning algorithms allow customers to see their insurance co-pay price as an estimate and Prime member savings options while browsing.

Once an order is placed, a licensed pharmacist reviews the prescription to verify patient details, check for interactions or allergies, and confirm the accuracy of the medication, dosage, and instructions.

Then, a robotic vial-filling system efficiently dispenses the medication, allowing pharmacists to focus their time and attention on critical tasks, such as providing personalized care and addressing complex medication-related issues.

Medications are then delivered to the customer's door via a range of vehicles, including e-bikes, electric vans, and drones.

Note: Graphic above reflects Amazon Pharmacy fulfillment at various Same-Day Delivery sites. Not specific to Amazon's fulfillment operations in Shreveport, LA.

Job Creation

Amazon supports 4.8 million jobs across the U.S. through the people we hire and our investment in communities.

- 1M full- and part-time jobs directly created by Amazon in the U.S. (as of December 2023)
- 2M+ jobs indirectly supported by Amazon's investments in areas like construction, logistics, and other professional services
- 1.8M jobs created by independent sellers—most of which are small and medium-sized businesses—selling on Amazon.com

Upskilling & Training

We've committed over \$1.2 billion on education, upskilling, and prepaid tuition to support our hourly employees' career goals. Our mechatronics and robotics apprenticeship for careers in robotics offers hourly wages up to nearly 40% higher for employees upon program completion.

