

VANDERLANDE

WHITE PAPER

How Roaming Shuttles Improve Order Fulfillment Operations



MOVING YOUR BUSINESS FORWARD

Contents

Introduction	3
Comparing shuttle technologies	5
The advantages of roaming shuttle AS/RS	9
Meet the FASTPICK roaming shuttle AS/RS	11

Introduction

Implementing this goods-to-person automated storage and retrieval technology improves customer experience, optimizes operations, and maximizes profitability.

Automated material handling solutions offer retail supply chain, distribution, and fulfillment operations a more efficient, productive, and reliable means to address the numerous challenges their operations currently face. With the rapid expansion of e-commerce as a result of the shutdowns associated with the emergence of the COVID-19 pandemic, retailers are coping with continuous changes in customer demand; mis-picks and errors; dynamic inventory churn and growth; perpetually shifting stock keeping unit (SKU) velocities; shortened order cut-off times; shipping carrier capacity limits; and high volumes of returns.

Combine these daily headaches with one of the tightest labor markets ever seen in the U.S., and it's clear why companies are increasingly investigating — and investing in — automation for their warehousing and distribution facilities.

While a multitude of automated equipment options exist, goods-to-person (GtP) automated storage and retrieval systems (AS/RS) offer operations a comprehensive means to hold, organize, track, and access a large and highly variable volume of vastly different SKU profiles in a highly dense footprint. Instead of associates spending as much as 70% of their shift walking up and down miles of warehouse aisles searching for items to fill orders, required SKUs stored in the system are automatically retrieved and delivered to pickers (human or robotic) at specially equipped workstations. There, the picker is prompted to remove the required quantity of items from the storage tote and place them into a separate container for packout and outbound shipping.



AS/RS equipment as a category encompasses a broad variety of technologies and systems designed to place and retrieve inventory within an overarching storage structure in different ways. The first AS/RS systems were crane based, with items stored and retrieved from their positions within aisles of racking by a traveling crane. This vertical column — one per aisle — is outfitted with an extendible device that inserts or extracts required products, either stored on pallets (unit-load AS/RS), or in totes or trays (mini-load AS/RS).

Many crane based AS/RS installations are in use today. However, within the past two decades, shuttle based AS/RS technologies have been introduced and continuously refined. These systems deploy powered devices (shuttles) that travel independently throughout an extremely dense grid of multiple, closely spaced levels with designated storage locations that hold totes, trays, or cases of product — no fixed-aisle cranes required. As directed by the AS/RS' integrated control software and the facility's overarching warehouse management system (WMS) or warehouse execution system (WES) software, the shuttles use an integrated inserter/extractor to automatically store or retrieve items on demand.

Collectively, the AS/RS market is growing. A report published by Meticulous Research in November 2021 expects the total AS/RS market to reach \$7.04 billion by 2028, a compound annual growth rate (CAGR) of 5.8%¹. The report's authors emphasized the pandemic as a key driver of that forecasted expansion:

“The COVID-19 pandemic impacted manufacturing and distribution operations across various industries. Social distancing has become the new norm and is expected to have long-term effects on several sectors, including manufacturing, distribution, logistics, and supply chain. To reduce the threat of exposure to COVID-19, companies across the globe are reducing employee contact and interaction and adapting to stringent government guidelines. The deployment of automated storage and retrieval systems expedites processes, allows better access to work zones, and helps retailers manage huge product volumes.”²

Within the AS/RS market, shuttle systems have become the most deployed technology over the past few years. Even before the US experienced shut-downs due to COVID that prompted exponential adoption of online shopping by consumers, the author of ARC Advisory Group's *Automated Storage and Retrieval Systems Global Market Research*³ (published in January 2020), Clint Reiser, Director of Supply Chain Research, noted:

“Although the installed base of traditional unit-load and mini-load AS/RS is extensive, shuttle systems and cube-based automated storage systems are experiencing the greatest growth. Shuttle systems are well-established technologies that are well-suited to the needs of high-throughput, highly variable direct-to-consumer fulfillment operations.”⁴

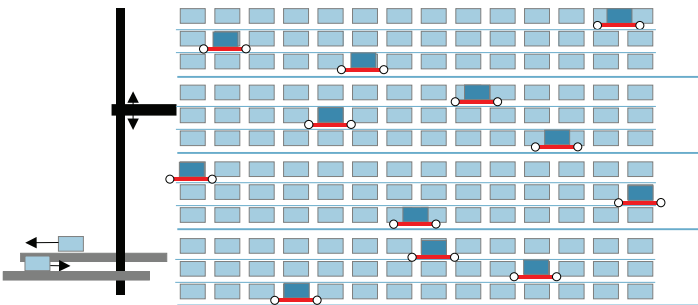
Further, Reiser attributes the demands of e-commerce to the increased interest and investment in shuttle based AS/RS. “E-commerce fulfillment requirements are driving demand for warehouse automation, and shuttle systems offer the exceptional throughput, storage density, and agility that these operations require for success in today's rapidly evolving marketplace⁵,” he said.

The total AS/RS market to reach \$7.04 billion by 2028, a compound annual growth rate (CAGR) of 5.8%.

While the deployments of shuttle based AS/RS are increasing, selecting the most appropriate type for a given operation is imperative to the successful application of the automated solution. This white paper explores the different types of AS/RS shuttle technologies currently available. It also details how and why an AS/RS equipped with roaming shuttles improves the customer experience, optimizes operations, and maximizes profitability.

Comparing shuttle technologies

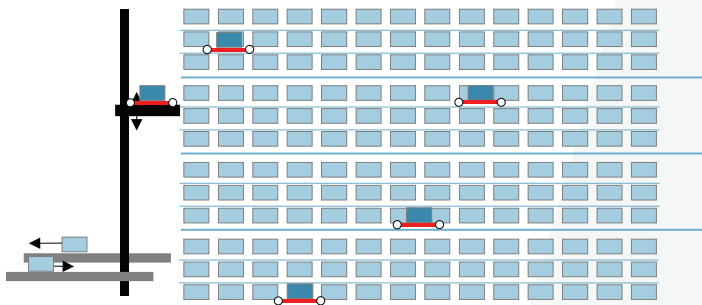
There are several types of shuttles used in AS/RS. While they all travel through the storage structure independently, shuttles differ in their movement capabilities. That is, their ability to travel forward and backward, side to side, and up and down the structure as they store and retrieve inventory. The degree of directional mobility offered by each shuttle type impacts the overall performance of the system, as well as the number of auxiliary components required to support the overall functioning of the solution.



One-Dimensional Shuttles

The first shuttle designs can be thought of as “one-dimensional.” A fleet of shuttles are distributed through the storage structure but can only travel forward and backward within one aisle and are restricted to a single level. While the concept of decoupling the inserter/extractor device from a fixed aisle crane was revolutionary, the initial travel limitations of the technology often result in low shuttle utilization.

Since one-dimensional shuttles cannot leave the level in which they’ve been inducted, they aren’t very adaptable to changing order profiles and volumes. Meaning there can be a lot of inactive shuttles in a given level if no inventory in that area is required for order fulfillment. This makes one-dimensional shuttle AS/RS ideal for applications with limited SKUs and consistent order profiles, such as manufacturing and kitting applications.



Two-Dimensional Shuttles

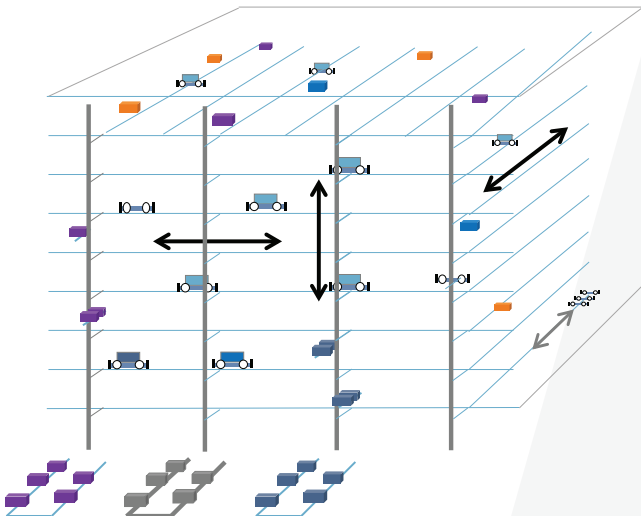
The next generation of “two-dimensional” shuttles were designed to improve utilization rates. Equipped with two sets of wheels the shuttles can travel forward and backward, as well as side to side across aisles within the storage structure minimizing idle time and increasing productivity.



This is frequently seen in certain applications that place shuttles on every other level to increase their utilization while reducing the overall cost of the system. As directed by the system software, a two-dimensional shuttle travels automatically to a lift to be carried up or down and inducted into a different storage level where pick volumes are higher. This makes two-dimensional shuttle AS/RS ideal for applications that require GtP picking, those with lower throughput requirements, or handling of medium- to low-velocity SKUs.

Three-Dimensional Shuttles

Capable of moving in all three planes — forward and backward, side to side, and up and down — are “three-dimensional” shuttles. The up and down travel is self-propelled by the shuttle; no separate lift required. Because of this full range travel capability, each shuttle is sent by the control software to deliver its payload directly to a picking workstation integrated into the side of the AS/RS structure.





Roaming shuttle AS/RS deliver high throughput performance at rates up to more than 600 totes delivered to a single workstation per hour

However, since three-dimensional shuttles are traveling up and down within the system, carrying loads destined for picking or return storage, they don't necessarily deliver the degree of productivity required in a high order volume operation. Instead, they can be held up in the system, waiting their turn to travel to the pick stations. These shuttle traffic jams negatively impact overall system capacity and performance. This makes three-dimensional shuttle AS/RS ideal for applications with lower throughput requirements — including GtP picking and handling of medium- to low-velocity SKUs — because although the three-dimensional capabilities increase shuttle availability, it simultaneously lowers throughput.

Roaming Shuttles

To address the limitations of two- and three-dimensional shuttles, the “roaming shuttle” AS/RS was developed. These systems combine two-dimensional shuttles for placement and retrieval of required items with integrated product lifts and buffering conveyors. When an item is needed, the shuttle closest to the storage location travels to that position, removes the full tote, tray, or case, and travels to a product lift platform designated for picks. It deposits its payload for movement to a picking station via conveyor. Separate lifts pick up totes sequenced for return to storage.

The shuttles never leave the storage system; rather their delivery of totes to the inbound and outbound lifts is sequenced and buffered by the software. This ensures all the totes with items required for an order are routed as a group to a designated picking workstation by either lift or conveyor, depending on the system's configuration. This makes roaming shuttle AS/RS ideal high order volumes, dynamic inventory profiles and quantities, and operations that require exceptional throughput rates to meet consumer demand.

The advantages of roaming shuttle AS/RS

Because of their design, roaming shuttle AS/RS deliver high throughput performance at rates up to more than 600 totes delivered to a single workstation per hour. This makes them ideal for high volume picking operations, such as those supporting direct-to-consumer e-commerce order fulfillment. They also deliver the following benefits:



Improved Order Accuracy

Roaming shuttle AS/RS pre-sort and sequence retrieved totes by individual order, delivering them in groups for associates to pick at their individual workstations. Most workstations incorporate a touchscreen display that visually prompts pickers, showing an image of the required item and its pick quantity. This eliminates mis-picks or errors, delivering a consistently high degree of order fulfillment accuracy. Not only does higher accuracy ensure happy customers, but it also eliminates the costs associated with the return of a wrong item, which can be as high as two-thirds of the original price, according to recent research⁶.



Increased Flexibility in Day-to-Day Operations

Capable of storing up to 60% more than conventional storage racking and shelving, roaming shuttle AS/RS allow a larger variety of SKUs to be stored in a smaller footprint. Further, the system's control software can direct item storage independent of inventory velocity classifications. Because the shuttles travel quickly to retrieve items, fast-, medium-, and slow-moving inventory can be stored anywhere within the system, yielding higher throughput rates. Conversely, in a peak period, fast moving inventory can be removed from the roaming shuttle AS/RS and reallocated to a manual picking process while still maintaining high throughput volumes. Further, the system is both modular and scalable for easy expansion with the addition of more roaming shuttles or picking workstations at different levels to accommodate business growth.



Resolved Labor Challenges

As a GtP picking solution, a roaming shuttle AS/RS supplements a facility's existing labor, enabling higher throughput without adding headcount. Likewise, as pickers no longer spend most of their shift walking up and down aisles to fill orders, throughput per person rises dramatically. The workstations are designed to maximize worker ergonomics, reducing the risk of fatigue and injury. They also support social distancing, as the workstations are spaced several feet apart.

Finally, because the workstations nearly always include an integrated display, new or temporary employees can be quickly and easily trained by the system as it prompts them with cues about which item and quantity to pick, and where to place it.



Shortened Order Lead/Cut-Off Times

Since roaming shuttle AS/RS combine GtP picking with the simultaneous presentation of all the items required for an order at a workstation, individual picker productivity rises significantly. Not only can this help to compensate for absent employees, but it also allows for later order cut-off times. Because the picking performance of the automated solution is more predictably reliable than that of manual picking operations, a facility can negotiate a later carrier pick-up, allowing customers to place an order later in the day and still receive it when they expect.



Reduced Downtime and Higher Availability

A properly designed roaming shuttle AS/RS will incorporate excess capacity to compensate should one portion of the system malfunction. That is, by combining multiples of moving parts — platform lifts, buffering and transport conveyor, and the shuttles themselves — if one fails, the other components provide high availability. The overarching control system can compensate by redirecting shuttles to needed areas with minimal impact to overall throughput. With a one-dimensional shuttle, which is held captive in a single storage aisle, that is not the case. In those systems, if a one-dimensional shuttle malfunctions, access to the inventory it serves is severed until the shuttle is repaired or replaced.

CONCLUSION:

Meet the FASTPICK roaming shuttle AS/RS

As a roaming shuttle AS/RS, the FASTPICK solution delivers all these competitive advantages to operations facing today's fulfillment challenges. FASTPICK combines ADAPTO roaming shuttles, GtP picking workstations, and a highly dense AS/RS that automatically sequences and presents picks to associates one order at a time for high levels of throughput and accuracy.

That makes FASTPICK the ideal solution for retail distribution and fulfillment centers struggling with continuously changing customer demands; mis-picks and errors; dynamic inventory churn and growth; perpetually shifting stock keeping unit (SKU) velocities; shortened order cut-off times; shipping carrier capacity limits; and high volumes of returns. Implementing a FASTPICK roaming shuttle AS/RS will improve the customer experience, optimize operations, and maximize profitability — both today and in the future.

To learn more about how a FASTPICK roaming shuttle AS/RS can help your retail distribution and fulfillment operations successfully address an unpredictable future, contact Vanderlande today.



References

1. Meticulous Market Research Pvt. Ltd.: "Automated Storage and Retrieval Systems Market Worth \$7.04 Billion by 2028 – Exclusive Report by Meticulous Research." <https://www.globenewswire.com/news-release/2021/11/10/2331643/0/en/Automated-Storage-and-Retrieval-Systems-Market-Worth-7-04-Billion-by-2028-Exclusive-Report-by-Meticulous-Research.html>.
Published November 10, 2021.
2. Meticulous Market Research Pvt. Ltd.: "Automated Storage And Retrieval Systems Market." <https://www.meticulousresearch.com/product/automated-storages-and-retrieval-systems-market-5159>.
Published November 2021.
3. Arc Advisory Group: "Automated Storage and Retrieval Systems." <https://www.arcweb.com/market-studies/automated-storage-retrieval-systems>.
4. Arc Advisory Group: "Automated Storage and Retrieval Systems (AS/RS) Market Driven by Shuttle System Sales." <https://www.arcweb.com/press/automated-storage-retrieval-systems-asrs-market-driven-shuttle-system-sales>.
Published January 6, 2020.
5. Ibid.
6. CNBC: "Retailers face rising holiday-return costs due to supply chain issues, a new report says." <https://www.cnbc.com/2021/12/16/retailers-face-rising-holiday-return-costs-a-new-cbre-optoro-report-says.html>.
Published December 16, 2021.

Vanderlande

1975 West Oak Circle
Marietta, GA 30062
United States of America
info.us@vanderlande.com

WSNA-WP-0222

This information is subject to change without notice and should not be construed as a commitment on the part of Vanderlande.
No rights can be derived from the photos and illustrations used in this publication.

› vanderlande.com/us