



SUPPLY CHAIN EVOLUTION

from Unit Loads to Mini-Loads

The latest generation of automated storage and retrieval systems focus on speed, flexibility and energy efficiency.

» By Jim McMahon

Many industries—from food & beverage to apparel, home furnishings, electronics and wholesale distribution—are in the midst of a supply chain evolution. The need to move less-than-unit loads throughout the warehouse has become a critical and growing function. Bulk processing of product SKUs by unit loads has increasingly given way to the demand for a larger number of smaller quantity orders, with more varied packaging containers and just-in-time ordering requirements from retailers and consumers.

Retailers have reduced in-store inventories to make room for stocks of new SKUs, and to open up shelf space for these new products. This has pushed stores to place more frequent just-in-time orders to manufacturers, for smaller quantities of a larger number of SKUs, and with shorter lead times required for fulfillment. Storage requirements are being pushed

back to the manufacturers and regional distribution centers (DCs), which are required to speed up their warehousing and distribution capability to manage these evolving parameters.

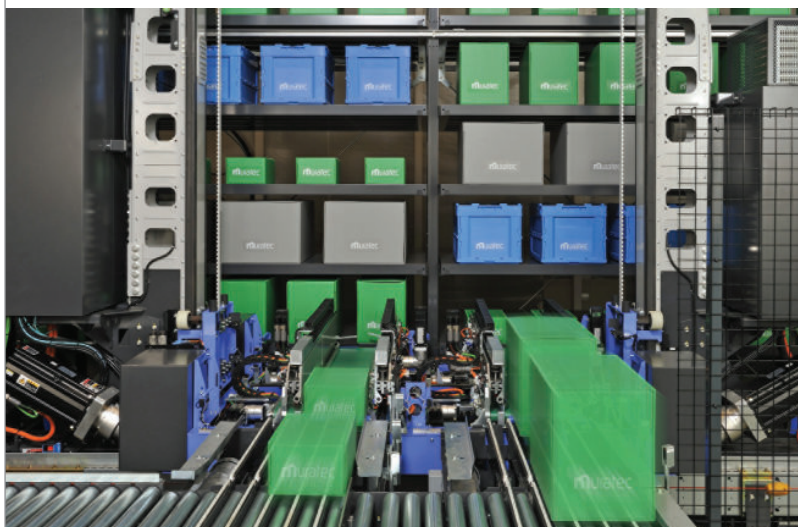
An increasingly larger percentage of mixed-SKU pallets, roll cages and dollies need to arrive at stores pre-sorted by aisles and grouped by product family. Such store-ready deliveries reduce in-store labor requirements and cut the time it takes to restock shelves.

Fast-turnaround and time-and-temperature-sensitive products, such as chilled and frozen foods and pharmaceuticals, more so than ever, require efficient handling with timely delivery, particularly in light of recent and more stringent Food & Drug Administration track-and-trace requirements.

The impact of e-commerce on direct-to-consumer distribution continues the metamorphosis away from unit-load requirements with its focus on high-volume, small-quantity orders, but with the necessity to offer a tremendous number of SKUs to consumers, and delivery within a 24- to 48-hour window, or even same-day.

Similarly, e-commerce retailers are leveraging their wholesalers to become shipping points for direct-ship to customers. Wholesale distributors are getting more pressure from large e-commerce companies to become the fulfillment arm for many of their products, particularly slow-turning SKUs that an e-retailer would not want to carry in its DC.

These factors are creating a steady but radical shift away from traditional pallet-based, single-SKU loads, and more toward multi-SKU layered pallets, single-case picks and small-quantity picking of individual products into totes, trays and crates.



Highly-automated mini-load AS/RS, such as the FX-Quad developed by Murata Machinery, have evolved to facilitate rapid and accurate throughput of increased numbers of SKUs and smaller order quantities.



Mini-Load AS/RS Versatility

To manage this evolving and diverse distribution model, warehouses require automated systems to handle this throughput efficiently and cost-effectively.

Systems need to have the flexibility to adjust to market conditions very quickly and accurately, like for increases in SKU range and shortened lead times, and monitoring production batch expiration dates. In a word, the keynote is automation flexibility. The right automation can be optimally utilized to achieve improvements in product flow, order accuracy, labor allocation, facility size and operating costs.

Of any area in storage and distribution that has been most affected by automation improvements, it may very well be in the storage and picking of individual cases and small-quantity, mixed-SKU products into totes, trays and crates.

Fully-automated and extremely efficient mini-load automated storage and retrieval systems (AS/RS) have become a key component in addressing this market challenge. These systems, of various configurations and capabilities, employ lightweight, high-speed cranes that are capable of handling, storing and picking individual totes, trays, cases and crates, enabling more streamlined storage and picking of smaller quantities of products.

The storage and retrieval functions are performed completely automated, without the need for direct human intervention. Integrated with these mini-load systems are streamlined order processing and product tracking to ensure order accuracy, and better product integrity and safety. As a result, high tote/tray/crate and case picking throughput in the warehouse environment can be realized.

Mini-load systems optimize cubic space usage, not only by their vertical stacking capability, but also by minimizing aisle cubic footage. By eliminating the need for forklift trucks, aisles can be made significantly narrower. This space can then be used for more storage positions. Those warehouses that are the most cost-efficient have achieved a high density of space utilization. This means they have a space configuration that allows for the maximum number of

storage positions to fit into the facility, optimizing footprint.

Mini-load systems can be adapted to deliver a broad spectrum of capabilities. For example, inbound single-SKU unit-loads can be stored in high-bay pallet locations, then subsequently case picked by mini-load AS/RS cranes for picking replenishment, or individual cases can be automatically retrieved in any sequence to build customized loads. Inbound unit loads can also be automatically de-palletized, and the products stored directly by mini-load cranes into high-bay shelves within trays or totes, with subsequent automatic mini-load retrieval for picking or shipping.

The introduction of standardized storage and transport units, which in many applications such as food processing enable a higher level of distribution efficiency, uniquely fit with mini-load configurations. Fresh meat and dairy production, for example, utilize standardized plastic totes and crates for in-plant movement and short-term storage of fresh products. Mini-load systems are capable of storing these date- and temperature-sensitive products, prior to being transported to stores. The mini-load, integrated to the facility's warehouse management system (WMS), coordinates with the plant's upstream production output and downstream delivery to retail stores. The most successful fresh food product producers are embracing these new supply chain challenges with such automated systems.

Faster Speed, More Flexibility

As good as mini-load AS/RS are, they continue to push the performance envelope to better meet the challenges of market demands.

Some recently introduced versions of mini-load AS/RS have significantly increased speed of order throughput, with precision accuracy. These newer systems provide very high throughput and cost-efficient distribution. They also deliver a higher density of storage capacity and increased flexibility.

These latest-generation cranes provide a flexible and modular design, equipped with a duo-fork or single-fork capability for transporting up to four totes, trays,

crates and cartons simultaneously, both for putting product into the high bay and for retrieval in picking. When a pick order is initiated, a crane moves to the designated high-bay location, selects the crates and deposits them on a conveyor at a pick station. The crane then automatically moves to fulfill the next order.

The cranes use integrated controls architecture for material flow control, enabling optimized speed and precision positioning. The controls instruct the cranes where to place incoming product, and where to retrieve it for picking. Direct integration to a WMS helps ensure that the mini-load stacker cranes always select the correct inventory and item numbers, and rotates the inventory properly.

Mini-load cranes provide precise and efficient tracking of products because of their integration to the WMS and ERP systems. A WMS, working in coordination with PLCs in the cranes, monitors batch numbers, production dates and weight as the product is stored and moved through the facility.

These next-generation AS/RS solutions are designed to reduce energy consumption by operating at variable speeds depending on the load demand in the warehouse. They also take advantage of electric power regeneration from recuperation modules on each crane. This means, for example, that energy can be fed back into the main plant network, to be used on another operating crane. This contributes to overall energy cost savings in the warehouse.

This latest generation of mini-load AS/RS helps maximize supply chain efficiency by automating key processes from inbound goods arrival, through inventory storage, to fulfilling outbound shipping orders. Such integrated functions optimize storage, improve delivery execution and maximize labor resources. Total inventory transparency permits the warehouse to link every process in the supply chain, streamlining the flow of goods. **MH&L**

Jim McMahon writes on logistics solutions.



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