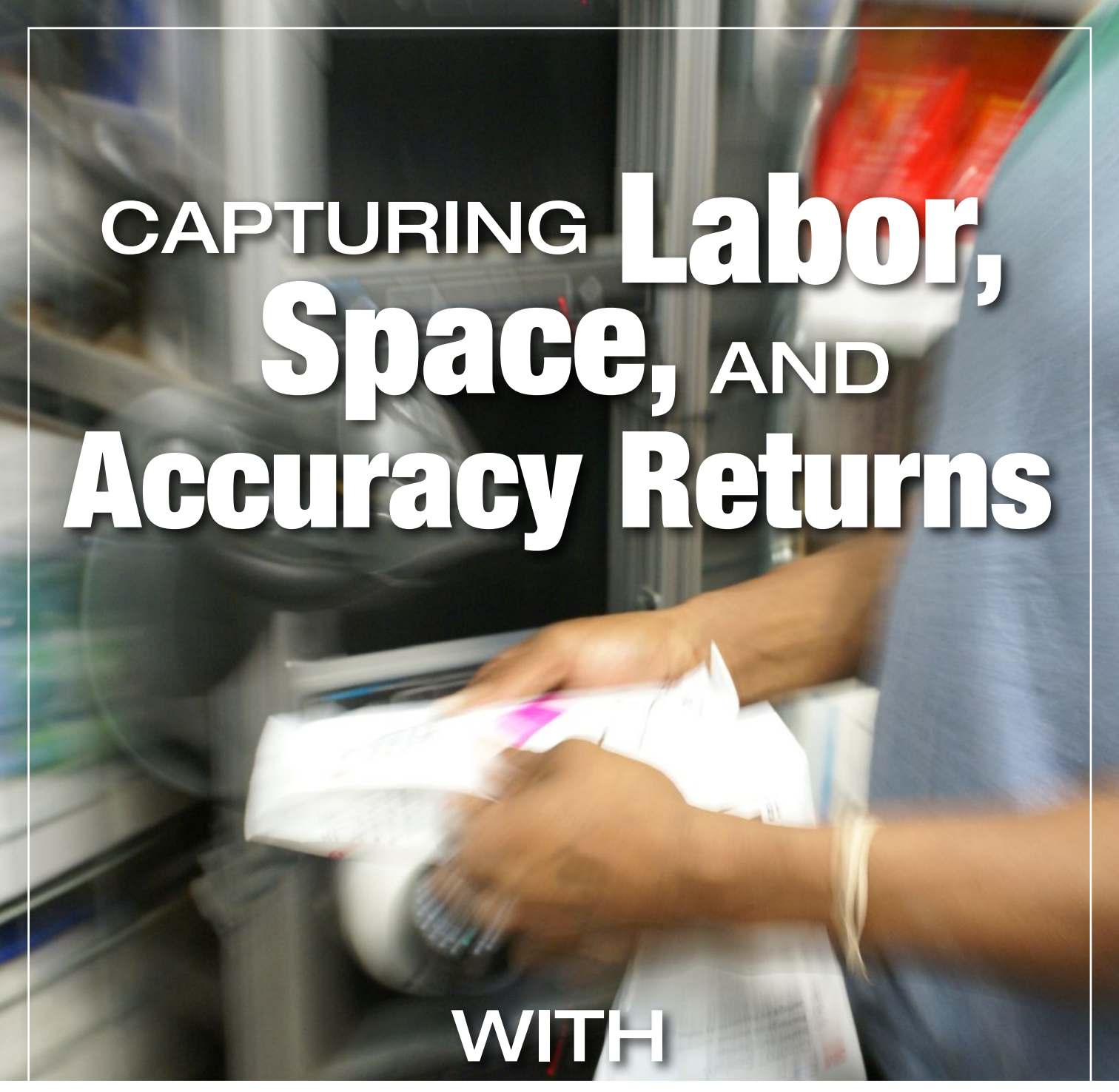

CAPTURING Labor, Space, AND Accuracy Returns WITH AS/RS

kardexremstar

MODERN MATERIALS HANDLING

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Welcome

The evolving role of AS/RS

It's nearly impossible to escape the importance technology and automation now plays across every aspect of warehouse and distribution center (DC) management in this brave new age of e-commerce. While equipment remains vital, it's now the digital orchestration and optimization of that equipment that's driving the most important productivity improvements—and often serving as the foundation of a company's core mission.

In this special digital edition, the editorial staff of *Modern Materials Handling* takes a closer look the evolving role AS/RS automation plays in distribution and manufacturing applications to take the static out of storage and keep product and enterprise on the move in terms of improved labor and space management as well as reducing the cost of inaccurate picks.

We also offer three case studies that illustrate how AS/RS is being put to work to dynamically scale operations for growth, and we share some of the latest Modern reader research that shares how warehouse and DC operations cross the country are more strategically investing in software and automation to keep pace with the demands of the digital world.

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Capturing **Labor, Space,** and **Accuracy Returns** with **AS/RS**

NOT ONLY DOES AS/RS AUTOMATION support big picture goals like e-commerce and customer service leadership, it holds clear, provable ROI across labor, space, and accuracy considerations. Find out how to prove these areas of ROI, and apply them to your operations.

The demand of e-commerce and digital age expectations means more each picking and increased order velocity in plants, warehouses, and facilities. Find out how these fundamental business shifts are driving the need to automate material handling with AS/RS solutions to improve labor productivity, save space, and reduce costs associated with inaccurate picks.

The macro-level drivers behind the need to automate materials handling are stunning. Just consider a few facts.

E-commerce grew by more than 15 percent last year, according to the U.S. Dept. of Commerce, while retail sales in stores increased by just under 4 percent. That makes e-commerce the driving force in retail growth, which means more each picking to fill online orders, and contributes to greater order velocity within supply chains.

More each picking, of course, adds more labor requirements. In a typical, non-automated distribution center (DC), the travel involved in order picking from shelves can constitute 30 percent or more of workers' time. Additionally, these associates are becoming harder to recruit and retain. Many DCs must rely heavily on temporary labor to get them through seasonal spikes in activity.

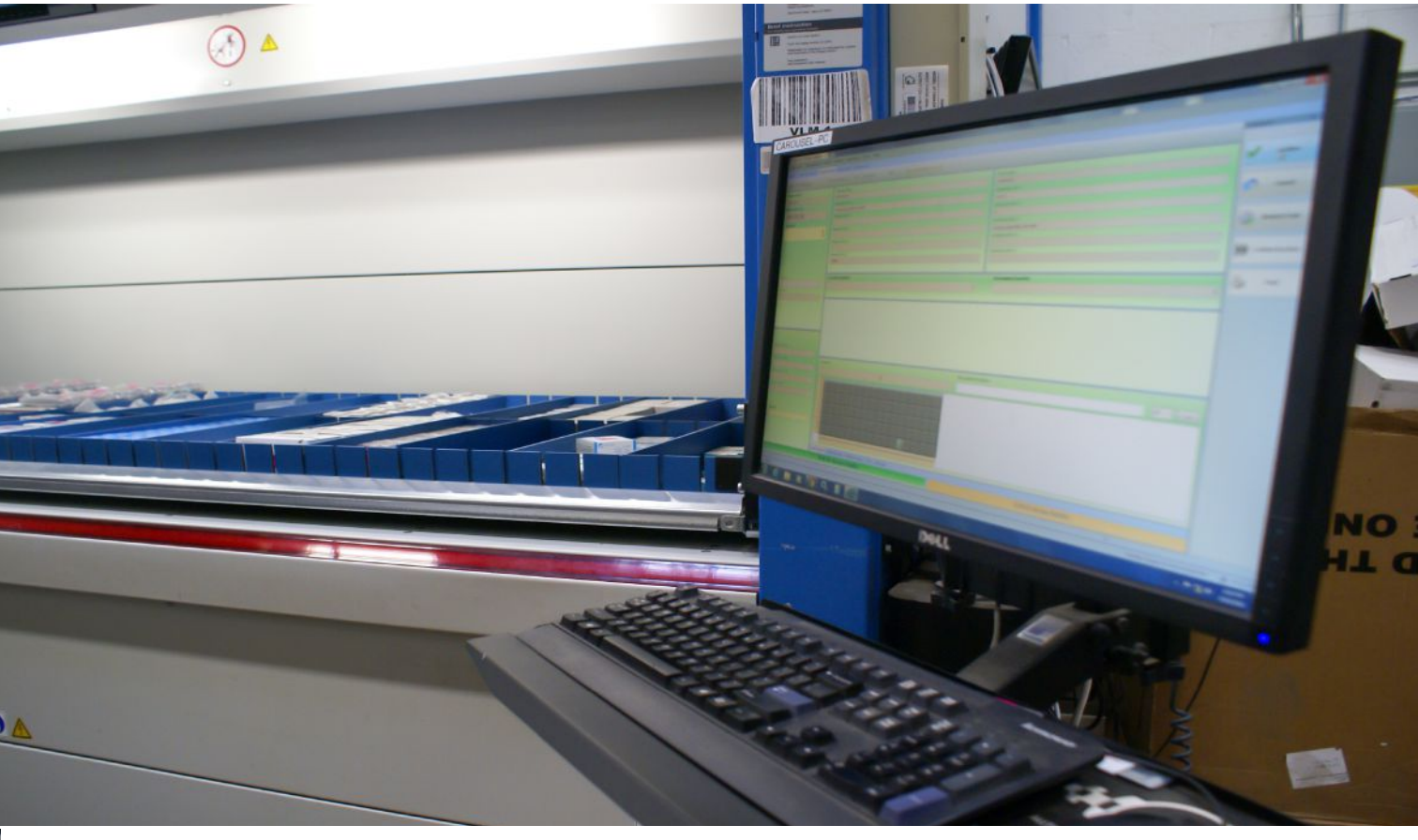
"Multiple areas of ROI can be calculated, using conservative improvement levels, across labor productivity, space savings, and improved picking accuracy. There are some 'soft benefits' as well, like improved ergonomics, but typically, we'll see hard benefits achievable in more than one area. A solution can bring major space savings, while also increasing labor productivity."

—Christina Dube, director of marketing for Kardex Remstar

With e-commerce clearly established and growing at this pace, business-to-business (B2B) customers are expecting a similar level of service, pushing facilities toward more each picking. If nothing is done to automate, costs will escalate, while the ability to sustain high customer service levels will degrade.

These larger trends are important, but the broader picture may not be enough to convince senior management to sign off on automated picking solutions such as automated storage & retrieval systems (AS/RSs). Here is where managers at the DC, plant, or facility level have a clear task: break down the benefits of automation, tying those benefits into larger strategic goals of the company such as customer service excellence.

Fortunately, AS/RSs with integrated inventory management software carry clear, provable benefits in at least three areas, explains Christina Dube, director of marketing for Kardex Remstar, a leading provider of AS/RS solutions. The three areas of benefit are labor productivity, space savings and order picking accuracy. In fact, the white papers that are packaged in this special edition include simple "calculator" formulas that give managers a way to prove out return on investment (ROI) in these three critical areas.



"Multiple areas of ROI can be calculated, using conservative improvement levels, across labor productivity, space savings, and improved picking accuracy," says Dube. "There are some 'soft benefits' as well, like improved ergonomics, but typically, we'll see hard benefits achievable in more than one area. A solution can bring major space savings, while also increasing labor productivity."

For instance, TSC, a Canada-based interactive, multi-channel retailer recently installed six Kardex Remstar Megamat vertical carousels to manage jewelry fulfillment. The solution saved 75 percent of floor space compared to previous shelving and increased the pick rate from a previous average of 40 lines per hour per person, to an average of 165 line per hour per person. At peak times, the system handles 240 lines per hour per person. Overall, productivity in jewelry fulfillment has increased by 600 percent.

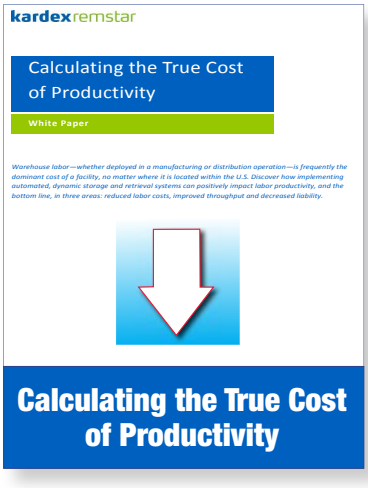
Besides order velocity/picking speed, other nuances of the products being handled can influence the type of system that best suits a particular site, explains Dube. For instance, while one would assume a site with relatively high pick velocity that isn't pinched for floor space would gravitate to a horizontal carousel, variability in the product mix might mean a VLM is a strong choice.

"You have to take into consideration the needs of each site and its product mix," says Dube. "VLMs, for example, can be pretty fast when slotted properly, and their compartments can be easily adjusted to handle different-sized products, which suits sites with higher product variability."

More with less

Labor productivity and space savings via AS/RSs can help keep pace with the intensive picking involved with the ecommerce era, while slashing costs relative to less automated methods.

Since the recovery after the 2009 recession, unemployment has steadily improved to the point where today, companies needing to attract material handlers are finding it hard to find and keep good people. In fact, according to Bureau of Labor



AS/RS solution types

All AS/RS solutions operate on a "goods to person" principle in which the unit delivers needed items to fulfill an order to ergonomic workstation with pick to light (PTL) functionality to guide a human on what to pick. This differs from many traditional operations where human pickers walk up and down aisles picking orders. They might have radio-frequency (RF) devices instructing them on where to go and what to pick rather than a paper pick list, but it's very much a "person to goods" method that involves significant travel by pickers.

One type of AS/RS is the horizontal carousel. Consisting of bins mounted on an oval track, the carousel rotates them horizontally to deliver stored items to an operator. Horizontal carousels are one of the fastest types of AS/RSs. While they can save of 60 percent of floor space versus static shelving, they do not offer the height and vertical storage capacity of other systems.

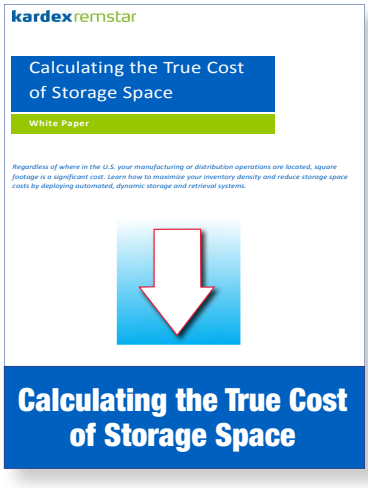
Vertical carousels use a series of shelves that rotate around a track to deliver items to an ergonomic work center. The can make more use of vertical space in a facility compared to horizontal carousels, with the ability to save up 75 percent of floor space versus traditional static shelving/rack. The shelf heights are fixed, making vertical carousels a good solution for operations with similar sized products.

Vertical Lift Modules (VLMs), an enclosed type of AS/RS, uses two columns of shelving with a central inserter/extractor that automatically locates and retrieves stored trays from both columns, presenting them to the operator at an ergonomic, waist-high level. These systems can be acquired in various height configurations, up to 90 feet high, making them vertically dense systems that can save up to 85 percent of floor space vs. static shelving. The compartments in VLMs can be easily adjusted to accommodate different sized goods.

Statistics (BLS) figures, unemployment in the Transportation & Warehousing Sector dropped from 5.1 percent in August 2016 to 3.1 percent in November 2016, while for the summer months of 2017, it has held fairly steady at just over 4 percent.

AS/RS reduce the labor requirement warehouses, factories, and other facilities by eliminating nearly all the travel involved in order picking. Operators at an AS/RS workstation can fill orders at an ergonomic working height, with their productivity enhanced by lighted-directed instructions. Picking becomes a rapid, accurate set of movements in one place, rather than walking up and down aisles.

Inventory management software integrated with AS/RS can also facilitate efficient batch picking that further speeds up the activities of human operators versus straight order picking, notes Dube, while the elimination of order picking moving through aisles eliminates congestion problems. "If you've got a warehouse with shelving and traditional picking methods you eventually get to the point we it gets so congested that you can't physically fit more pickers into the aisles," says Dube.



When it comes to space efficiency, AS/RS also hold major benefit potential by making fuller use of vertical storage space. This is especially important with new warehouses having greater clear heights. According to commercial real estate firm CBRE, the average height of a new warehouse in the U.S. market was 33 feet last year, compared to 30.19 feet in 2010.

Solutions such as VLMs and vertical carousels can fully utilize the storage and through-

put potential of taller facilities. They can also be paired with a new solution from Kardex Remstar called a Vertical Buffer Module (VBM), which can be used to buffer inventory used to replenish an AS/RS, or feed materials to a production area. These modular VBMs can be configured to reach tall heights to leverage the vertical potential of nearly any facility.

To help facilities capture the ROI of AS/RSs, Kardex Remstar developed a set of white papers, with one looking at labor productivity, another at space savings, and another examining savings from reducing mispicks.

The papers include simple calculations that, with the input of a few specifics about an operation, can estimate ROI. For example, with labor savings, the calculator looks at the cost of an employee per hour, the current pick rate per hour under existing methods, and the achievable pick rate using dynamic storage. Importantly, the calculator uses the lower end of the typical improvement range, so that ROI is clearly achievable.

Mispick reduction

The ergonomic workstations that are part of Kardex Remstar solutions also typically improve order picking accuracy, because the operators have light-directed technology that ensures they complete picks accurately.

"When you add up all of cost centers involved in a mispick, even an improvement of 1 percent or 2 percent in order picking accuracy can turn into a huge number that you're losing annually."

—Christina Dube

The lights act as message centers that show the operator information the includes the precise spot within the carrier for a pick, the part number or description, and the quantity to be picked. Kardex Remstar VLMs even offer a software driven light pointer that aims a beam of light at the precise position on the VLM storage for picking or replenishment.

With these light technology's as part of an AS/RS solution, picking accuracy can be raised above 99 percent. Even if a facility already has a decent

"When you add up all of cost centers involved in a mispick, even an improvement of 1 percent or 2 percent in order picking accuracy can turn into a huge number that you're losing annually."

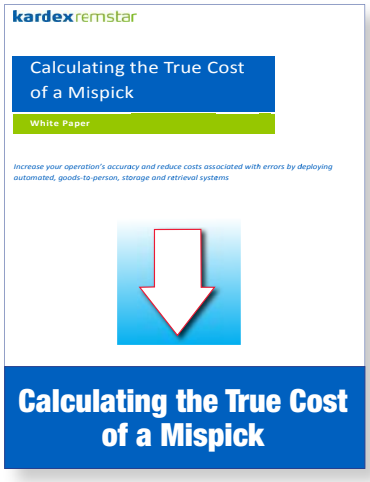
—Christina Dube

accuracy rate of 97.5 or 98 percent, just this small improvement can add up to major cost reductions when you consider that the "true" cost of a mispick spans not only cost of shipping out a replacement, but the labor to pick the replacement, the processing of a return if a wrong item has been sent, and with some customers, possible penalties for inaccurate orders.

"When you add up all of cost centers involved in a mispick, even an improvement of 1 percent or 2 percent in order picking accuracy can turn into a huge number that you're losing annually," says Dube.

Mispicks also tend to degrade the customer experience. Most customers will have a poor impression if they must go through the hassle of returning an incorrect item, or were shorted by an item or two and must wait for a new part to be delivered.

With major e-commerce giants reliably and quickly filling consumer orders, the bar has been raised for distributors or manufacturers filling B2B orders, notes Dube. This puts pressure on B2B fulfillment to be as efficient and accurate as that of an Amazon. "B2B customers are accustomed to seeing their consumer orders filled quickly and accurately, with many delivery options," she says. "So there is a spill-over affect with B2B orders. Today, everyone expects orders fulfilled quickly and accurately."



Scalable and flexible

While there are clear cut labor, space savings, and accuracy benefits to AS/RS-based automation, some companies may be reluctant to pull the trigger because they perceive automation as a high cost investment that once implemented, is inflexible to changes in demand. However, these are misperceptions—AS/RS providers can offer modular solutions with software that can easily scale the automation to support more (or fewer) human operators.

With Kardex Remstar AS/RSs, one single unit can serve the needs of a smaller work zone, or for larger operations, multiple units can be combined and managed by the solution's software as a "pod" capable of much higher throughput. Even with AS/RS pods capable of high throughput, the software can be easily configured to feed picks to multiple operators during busy times, or during slower times, to just one operator at a workstation.

"Flexible solutions in which you can scale the number of operators are important for seasonality, so you can adjust the solution to work for your operation all year round," says Dube. "Automation can seem inflexible or overwhelming, but it's not if you have a flexible solution, and one that lets a facility start small, maybe just with one carousel or VLM for a single work area. You can prove the solution in one zone, gain benefits, and then phase more units into other areas of your operation. You can gain the benefits of automation without risk."

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CASE STUDY **DC Dental** Baltimore, MD

Scaling Warehousing Operations for Growth with Automation

Batch picking orders utilizing a pick and pass fulfillment strategy with two VLMs, four horizontal carousels and carton flow rack; DC Dental has handled a 54% volume increase with 67% less labor and 73% floor space savings.

A startup company founded in 2002, DC Dental has shaken up the dental supply industry with their commitment to value, delivery speed and high quality customer service. They are the fastest growing, full service dental supplier in the country, delivering competitively priced supplies to dental professionals in the mid-Atlantic region.

Using a flexible, client-oriented business approach they are able to create more personalized relationships with the dentists they serve. To support this, DC Dental inventories over 20,000 of the most commonly used dental products–from burs to bibs to curing lights - in their Baltimore, MD warehouse. Their success is dependent on getting the correct product from the warehouse to the dentist as quickly as possible while maintaining the best price.

DC Dental uses the latest warehouse and distribution technologies and innovative systems to keep efficiencies high and overhead low, allowing them to pass these cost savings along to their customers. They hit a bump in the road after a 2012 acquisition increased warehouse volume by 54% overnight. As their existing 30,000 square foot facility was quickly nearing capacity and product began to fill the aisles in the warehouse, Howie Friedman, CFO/COO, set out to find a solution. "We considered outsourcing to a 3PL, but it was important to us to keep distribution in house to ensure we maintain our customer commitments of speed and value that have made us successful," said Friedman.

Not wanting to partner with a 3PL provider, Friedman narrowed in on automated storage and retrieval solutions to fill the gap between what people and software could accomplish. The integrated solution, utilizes a pick and pass fulfillment strategy with a 20 position batch cart that moves between three zones (zone one - two 21 foot tall Shuttle Vertical Lift Modules (VLMs), zone two–four 56 foot long horizontal carousels and zone three - carton flow rack), all managed by Power Pick Global inventory management software. Since the implementation, within that zone, DC Dental has handled a 54% volume increase with 67% less labor and 73% floor space savings.

Efficiencies Gained

The warehouse picks an average 2,500 lines per day to fill roughly 480 orders using only 4 order pickers (compared to 12 order pickers previously required). "The system has the ability to handle up to 3,500 lines per hour with our current labor resources, but we haven't needed it yet," says Friedman. Important for a fast growing company like DC Dental, the system is designed to handle extreme scale. "We could double in size and only need to add about 3 additional people in our warehouse," said Friedman.

Due to productivity gains, DC Dental was able to extend order cutoff time by an hour. "Orders

DC Dental has achieved a 54% volume increase with 67% less labor and 73% floor space savings with automation.

placed before 4:00 pm EST ship out the same day, furthering our commitment to our customers with even faster delivery," said Friedman.

Using Space Savings as Justification

Using automated storage and retrieval systems, roughly 13,000 square feet of shelving was consolidated into 3,500 square feet, a 73% space savings. This recovered floor space allowed DC Dental to reduce the overall footprint of the facility from 30,000 square feet to 20,000 square feet. They resigned their lease, saving nearly $1 million dollars in rent and utilities over the next 10 years. Combining this savings with the 67% labor savings, ROI justification for this project was easy.

Fast & Accurate Orders

Using light directed technology for picking and putting activities in addition to a scan verification step has increased pick accuracy from 94% to 99.5%. The combination of these measures has created a strong image for DC Dental in the market place as a supplier that provides quick and accurate orders.

In addition, DC Dental installed cameras above each put station so that every single item put into a customer order is recorded. Cameras were also installed above the shipping stations, so each package is captured just prior to being sealed along with the shipping labels being applied. This provides great control and insight into the picking and shipping process. "When a customer called to say a box was damaged, I was able to pull up the entire 4 box order with just a few clicks to see what went wrong and quickly fix it," said Friedman.

The Order Details

What sets DC Dental apart from the competition is the way they interact with their customers. Dentists can place orders in various ways–in person, over the phone, via email or online. However the order is placed, it comes into the inside sales group.

Once reviewed and approved by the inside sales group, the order is marked as pending fulfillment within the ERP system (NetSuite) and is ready for the warehouse to begin processing. The majority of orders are filled from the warehouse in Baltimore, MD.

NetSuite's WMS first separates case picks from overpack picks. When a dentist orders a full case of product, it is filled from another zone within the warehouse–the case is picked, a label is applied and it is shipped. Case picks account for roughly 30% of all packages.

The rest of the order must be overpacked in corrugated boxes. NetSuite first determines the box size required for the order (small, medium or large), and

DC Dental continued

depending on the order size, will split one order into multiple boxes when needed. The WMS then passes the box information to the inventory management system (Power Pick Global) for fulfillment.

Filling Orders

In the warehouse, replenishment is done each morning from 7:00 am to 10:00 am and order fulfillment starts at 10:30 am. Orders are fulfilled in batches of 20. The batch cart is designed to hold 20 boxes. An order operator sorts the waiting orders in Power Pick Global by box size and manually selects the first batch of orders (4 large, 10 medium and 6 small) to be filled.

All items required for these orders are stored in 3 pick zones–the VLM zone manages roughly 12,000 SKUs, the horizontal carousel zone manages roughly 7,000 SKUs and the carton flow zone manages roughly 850 SKUs.

After the order operator has selected the orders for the first batch, an order picker takes the batch cart to zone one–carton flow–where items are picked from the carton flow and put into the orders on the batch station to complete them. Picks in each zone are date and time stamped to provide traceability and accountability.

The order picker then moves the batch cart to the second zone–the horizontal carousels–and lines the batch cart up with the put lights. Similarly, with the click of a button, the 4 horizontal carousels spin to deliver the product required to the operator. Lights on the horizontal carousels direct the picker where and how many items to pick from the carousel and put lights in front of the batch station direct the operator where to put items. To ensure accuracy, the operator must scan verify the item as it is placed into the box on the batch cart to verify the correct item is placed into the correct order.

When all items required from the horizontal carousel zone have been filled, the operator moves the batch of orders to the third and last zone–the VLM zone–and lines the batch cart up to the put lights. With the click of a button, the 2 Shuttle VLMs start to deliver trays containing the required products to the operator. Directed by pick to light technology, the picker removes the item(s) from the VLM tray and turns to disperse them among the 20 orders on the batch cart as directed by the put lights. Once done, the operator confirms the put and the VLM lights up the next pick. The operator continues to pick form the 2 VLMs and put into the correct order on the batch cart until all items required from this zone have been picked and placed into the orders.

As soon as the last part is put into the order, Power Pick Global communicates the complete order to NetSuite WMS and the order is marked as shipped and the customer is invoiced, even before it physically arrives at shipping. When all of the orders in the batch are completed, the picker moves the batch cart to a waiting area. The order operator retrieves and delivers the batch cart of completed orders to shipping.

Orders are picked directly into boxes to eliminate the task of repacking. At shipping, the original pick label is scanned and an invoice is generated if required by the customer. Shipment tracking information is automatically sent back to NetSuite for reference.

Project Implementation

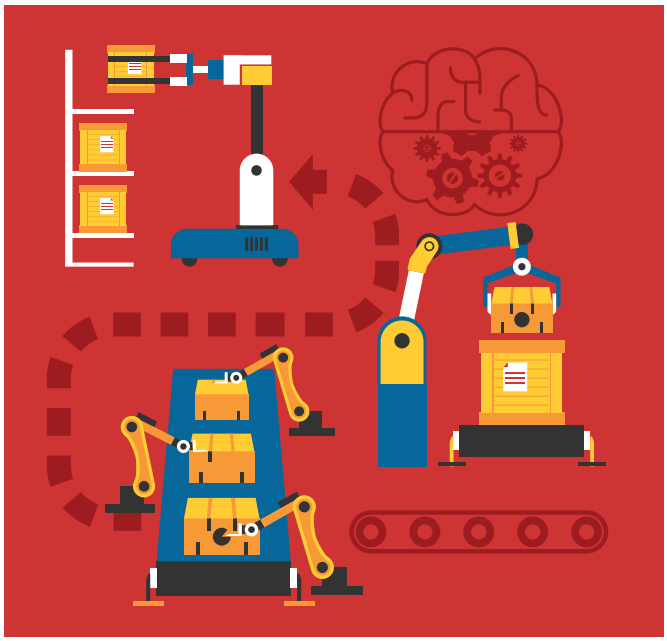
"The people at AHT took this project personally, our customers were their focus. Anytime we hit a bump in the road, they took ownership and worked with us to find a quick solution. There is a caring quality that's hard to define but it's essential to a major project like this and AHT has it," said Friedman.

Summary

"Our innovate material handling strategy has influenced our reputation in the industry as a reliable, fast, customer centric dental supplier and has helped us obtain the rights to represent additional partners and product lines," said Friedman.

Automation Study: The State of Automation

By Bridget McCrea, Editor at Large



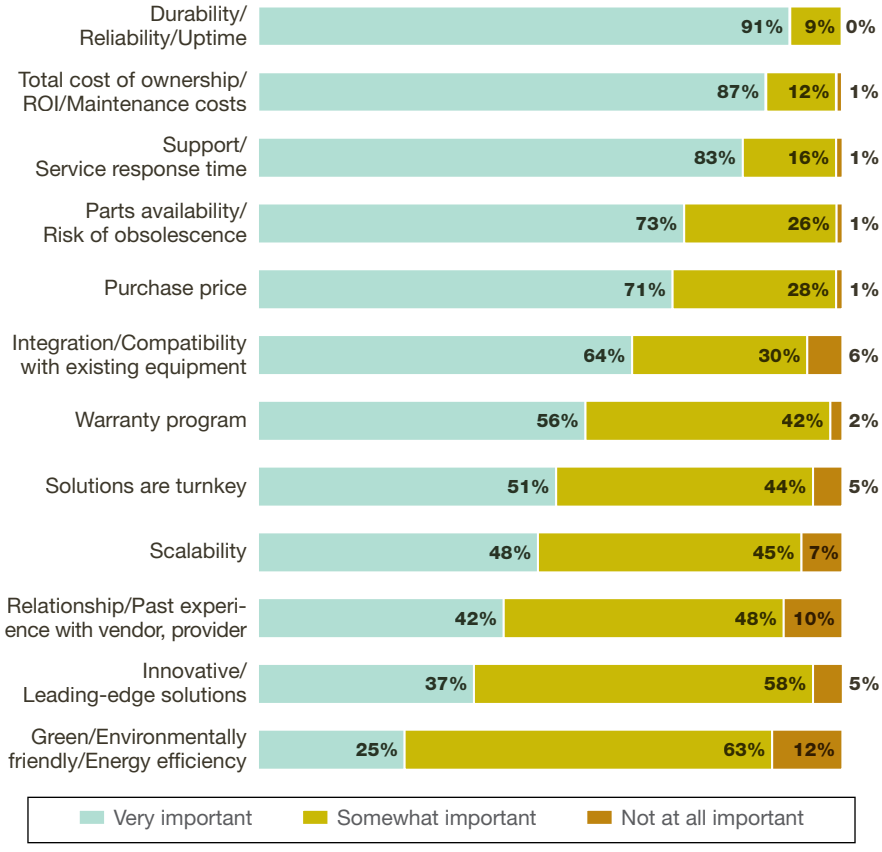
As automation makes its way into more warehouses and DCs, a growing number of companies told *Modern* they're looking to upgrade existing or add new equipment and software over the next two years.

The image of the autonomous warehouse is coming into clearer focus as more hardware and software manufacturers develop innovations that remove much of the "human" component from the distribution process. From flexible shuttle systems to robotics equipped with embedded intelligence to automatic guided vehicles (AGVs), warehouses and DCs around the globe are becoming a hotbed for automation implementation and experimentation.

And while the number of innovations and pioneering approaches implemented by e-tailing giant Amazon are becoming humdrum, one can hardly argue with the company's early adoption of automation for warehouse picking and packing. Having acquired Kiva Systems in 2012, the e-tailer is automating its fulfillment center operations with features like autonomous mobile robots, control software, language perception, machine learning, object recognition, and semantic understanding of commands, according to Amazon Robotics' Website.

The question is, what is the rest of the manufacturing, distribution and logistics community doing on the automation front? And, how are companies putting these solutions to good use in today's fast-paced distribution environment? To find out, Peerless Research Group (PRG), on behalf of *Modern Materials Handling*, conducted a survey to assess the usage and purchase intentions for automation systems and solutions used in warehouse and DC operations.

How important are each of the following when evaluating automation systems and solutions for possible purchase?



Source: Peerless Research Group (PRG)

For the report, *Modern* looked at factors and features considered important when evaluating automation systems and solutions for possible purchase; the extent to which specific warehouse processes are automated; areas that operations will be looking to improve during the next two years; order fulfillment activities currently running; and tasks companies will look to improve/implement. Here's what we learned.

The case for automation

With primary operations in industries like food, beverage, tobacco, automotive/transportation, chemicals/pharmaceuticals, industrial machinery, and paper/printing, respondents to the survey had warehouse/DC operations spanning 50,000 square feet or less (29%) all the way up to 250,000 square feet or more (29%). Most of the facilities (44%) employ fewer than 100 people, and 32% have 100 to 499 workers, with the average across all respondents being 658 workers. The bulk of respondents (30%) work for firms where revenues are less than $10 million, while 18% have $10 million to $49.9 million, and 13% have between $1 billion and $4.9 billion in average revenues. The average annual revenue for respondents was $872 million.

Of the 221 respondents who took part in the automation survey in January and February of 2017, most (91%) see durability, reliability and uptime as the most important criteria when evaluating automation systems and solutions for possible purchase. Other key yardsticks that come into play include total cost of ownership (TCO), return on investment (ROI), and maintenance costs (87%); support and service response time (83%); and parts availability and risk of obsolescence (73%). Factors like purchase price, integration with existing equipment and warranty were further down the list.

Asked to what extent numerous processes are currently automated, respondents said their fully automated systems include reporting (20% of participants), labeling (14%), retrieval (6%) and packaging (5%). And, 43% of companies have partially automated reporting systems, while 38% have partially automated their labeling systems. The top warehouse and DC systems that companies plan to automate in the near future include packaging (25%), storage (25%), retrieval (24%) and replenishment (23%).

Over the next two years, respondents want to improve their warehouse capacity utilization (65%), picking efficiency or lines picked per hour (63%), labor reduction (60%), order accuracy (60%) and order cycle time (50%).

Addressing a fast-paced business world

In the fast-paced e-commerce and omni-channel distribution environment, companies are handling numerous different fulfillment activities in their warehouses and DCs. Eighty-six percent use their facilities for warehousing and storage; 64% for individual pick, pack and ship wholesale distribution fulfillment; 59% for full and mixed pallet load fulfillment; and 57% for case and mixed case fulfillment.

When asked which operations they plan to improve over the next two years, 37% of respondents said they want to do a better job with individual pick, pack and ship for e-commerce fulfillment, and 34% would like to improve their case and mixed use fulfillment. Other areas in need of improvement include order customization, repacking and value-added services (34%); individual pick, pack and ship wholesale distribution fulfillment (33%); and full and mixed pallet load fulfillment (30%).

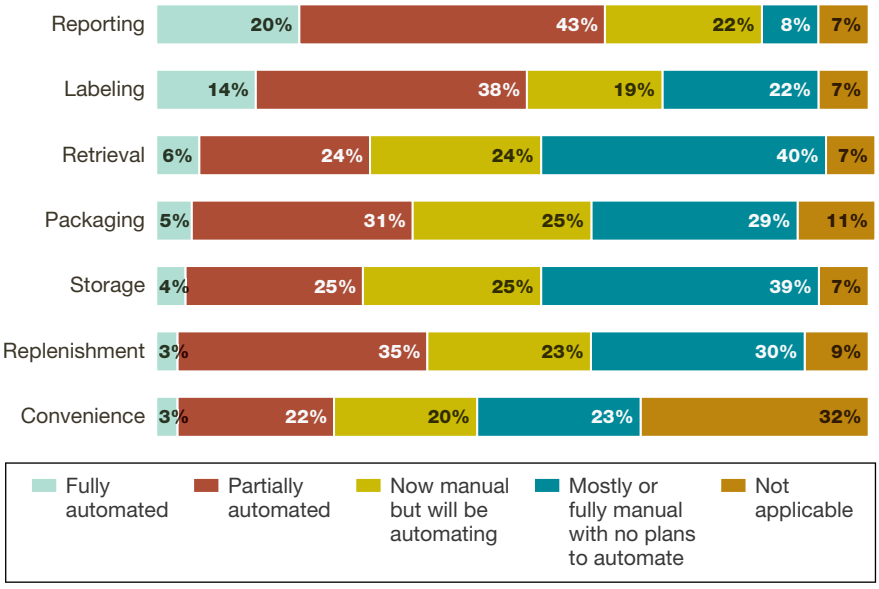
In describing their order fulfillment operations, the highest percentage of companies (51%) said they use a combination of automated and manual processes. Forty-two percent said they rely on mostly or all manual approaches, while 5% characterize their operations as being "highly automated."

Conventional vs. automated, side by side

The modern-day warehouse and DC continues to rely heavily on conventional equipment and vehicles to run efficiently. For example, 93% of firms use lift trucks, 83% use storage and packaging equipment (e.g., palletizers, pallets/totes, bins, containers/rack, and shelving), and 82% use dock equipment. Fifty-six percent of respondents have no plans to upgrade or implement new equipment in this area right now, although 23% would like to enhance their storage and packaging, and 21% want to improve their hoists, cranes and monorails over the next 24 months.

In terms of automated equipment, an equal number of respondents (55%) are using conveyor/sortation systems and weighing, cubing and dimensioning equipment. Thirty-eight percent use goods-to-person picking solutions (i.e., where donor totes are delivered

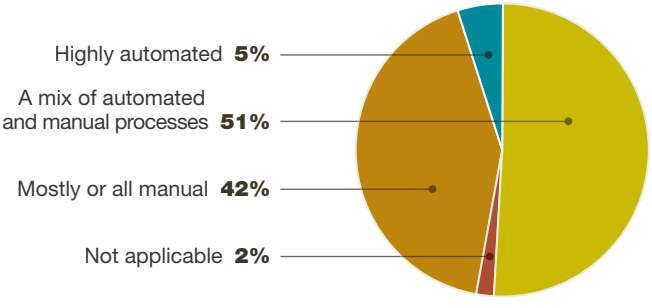
To what extent is each process automated?



Source: Peerless Research Group (PRG)

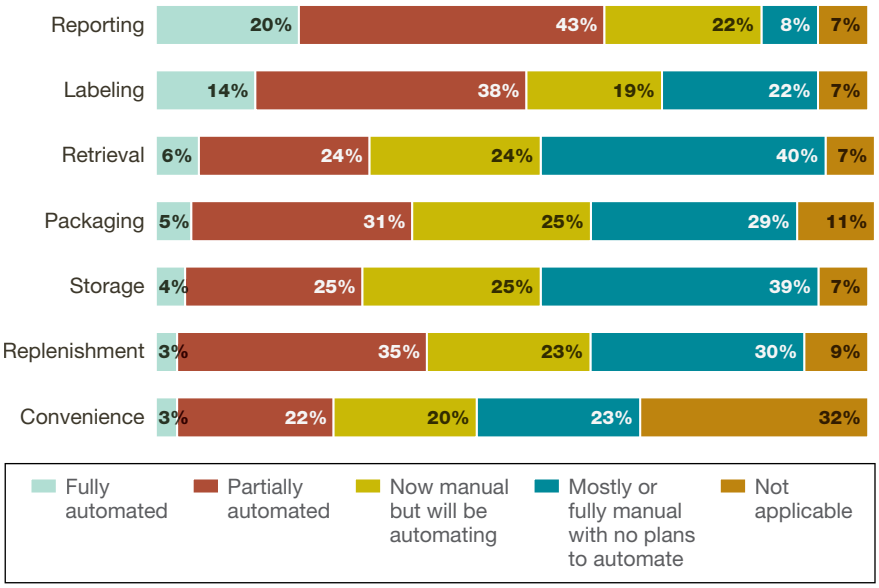
Over the next two years, 52% of companies want to either upgrade existing or implement new automated packaging systems, while 45% will focus on robotics (e.g., palletizing, picking or other solutions), and 43% are interested in conveyor and sortation systems, automated storage, and automatic guided vehicles.

How would you best describe your order fulfillment operations?



Source: Peerless Research Group (PRG)

To what extent is each process automated?



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to workstations); 25% use automated packaging solutions; and 24% rely on automated storage solutions like AS/RS, mini-loads, carousels and vertical lifts.

Over the next two years, 52% of companies want to either upgrade existing or implement new automated packaging systems, while 45% will focus on robotics (e.g., palletizing, picking or other solutions), and 43% are interested in conveyor and sortation systems, automated storage, and automatic guided vehicles. Other warehouse and DC automation that companies are interested in includes shuttle systems, goods-to-person picking solutions, and weighing/cubing/dimensioning equipment.

Right now, the automated equipment that is used most includes conveyor and sortation systems (55%); weighing, cubing and dimensioning equipment (55%); goods-to-person picking solutions (38%); and automated packaging solutions (25%). Over the next 24 months, the majority of respondents (52%) plan to upgrade or implement automated packaging solutions. Also of interest are robotics (45%), conveyor and sortation systems (43%), automated storage (43%), and automatic guided vehicles (43%).

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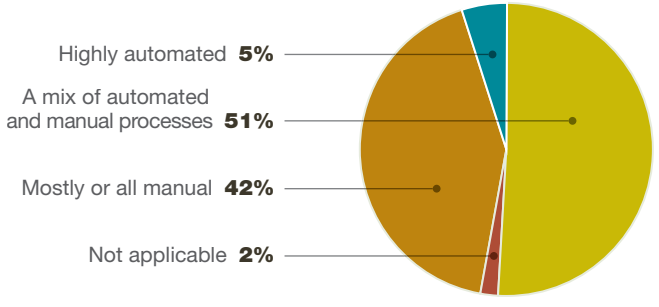


Source: Peerless Research Group (PRG)

The driving factors

Of those respondents that plan to evaluate or purchase automated materials handling equipment, technology or software over the next two years, the biggest driving factor is the need to fill orders faster to meet customer service level agreements and expectations. Other key reasons include the increase in piece picking and packing (driven by the growth in e-commerce orders); the need for new go-to-market strategies; and a drive to keep up with the competition (which is automating).

For data collection, the bulk of companies (89%) rely on bar code scanners while 67% are using mobile/wireless technologies. Forty-four percent use RF terminal technologies and 18% rely on voice-directed picking technologies. When asked which of these technologies they plan to integrate or upgrade over the next 24 months, an equal num-

ber of respondents (37%) are looking at voice-directed picking technologies and pick/put-to-light technologies. Another 34% of respondents want to use RF terminal technologies, 30% want to use mobile/wireless technologies, and 26% are interested in bar code scanners.

In terms of software, 78% of respondents use warehouse management systems (WMS), 39% use transportation management systems (TMS), 34% use warehouse control systems (WCS), and 31% rely on labor management systems (LMS). Of those companies that plan to upgrade or implement new supply chain execution software over the next 24 months, 34% plan to invest in WMS, 31% in parcel rating systems, and 30% in WCS.

When it comes to supply chain management software, 54% of companies use enterprise resource planning (ERP), 53% rely on order management systems (OMS), and 46% are using customer relationship management (CRM) solutions. Of the respondents that plan to upgrade or implement supply chain management solutions over the next two years, 29% will invest in supply chain planning (SCP), 29% in network design/optimization software, and 29% in CRM.

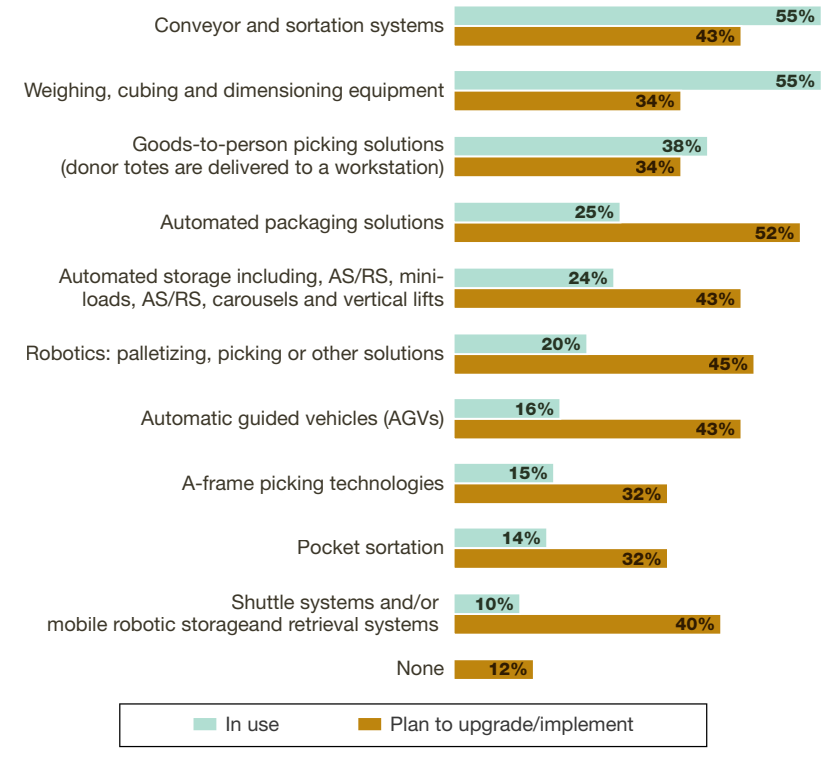
The dollars and cents

This year, most companies (35%) expect to spend less than $100,000 on all materials handling equipment and solutions, followed by 22% of companies that expect to spend $100,000 to $499,000. An equal number of respondents (12%) plan to allocate either $500,000 to $999,999 or $5 million or more to such investments. Thirty-four percent said this number is higher than 2016's investment, while 34% said it would be the same as last year. Eleven percent of respondents said their 2017 investments would be lower than last year.

Asked about their existing sources of order fulfillment solutions, 64% said they work with distributors/dealers, 58% buy direct from the manufacturer, and 39% work with system integrators. For future purchases, the largest percentage of companies (60%) plan to work with system integrators while 52% and 51% (respectively) will work with distributor/dealers or manufacturers.

And, when handling the repair and maintenance of materials handling automated equipment, most companies (68%) rely on an internal maintenance crew. Forty-three percent use a service contract with their OEM and 39% use a service contract with a third party.

What automated equipment is presently in use in your organization and which will you be upgrading or implementing during the next 24 months?



Source: Peerless Research Group (PRG)

CASE STUDY **Diversco Supply** Cambridge, Ontario

Diversco Supply Expands Vertically with Shuttle VLMs

Three Shuttle VLMs help Diversco Supply expand inventory by recovering 92% floor space and increase order fulfillment productivity by 460%.

Three Shuttle VLMs help Diversco Supply expand inventory by recovering 92% floor space and increase order fulfillment productivity by 460%.

Diversco Supply is nothing less than a Canadian success story. Founded in 1986, they quickly became a leading equipment wholesaler in the gas industry; specializing in equipment and supplies for propane, natural gas and compressed air. To position themselves for growth, they sought to expand into additional business segments. Their deep roots in the scuba diving and propane industry have evolved into watersports equipment and supplies.

The largest of six warehouses throughout Canada, located in Cambridge, Ontario, inventories and distributes parts and supplies for all four business segments: propane and gas, compressed air, scuba and watersports. Managing a combination of smaller parts (valves, regulators, hoses, snorkels, fins, etc.) and large parts (kayaks, paddle boards, etc.) added another layer of complexity to the fulfilment process. As the 52,000 square foot warehouse quickly running out of space, Diversco set their sights vertically. "With a 40 foot ceiling, adding more rack didn't make sense," said James Huddle, purchasing and operations manager at Diversco Supply, "it was more economical to go up than out."

A Winning Combination

Diversco now uses a combination three 32 foot tall Shuttle Vertical Lift Modules (VLMs) with Power Pick Global inventory management software to manage the smaller parts inventory (4,500 SKUs) and standard rack and shelving with handheld RF scanning technology for large item inventory (400 SKUs). "It was a complete transformation from a manual picking environment of walking and searching to a semi-automated process," said Huddle, "The compact storage, time savings and ease of use completely offset the cost of the system."

Going Vertical

Small parts inventory was previously stored on 5,000 square feet of shelving. Using handheld RF scanning technology workers would walk through the shelving scanning and picking parts as directed by the RF gun, each worker often walking several miles per day. Now, these parts are inventoried in three VLMs that occupy just under 360 square feet–a 92% floor space savings.

With the floor space recovered, Diversco has expand large item inventory by 84%, previously handling 8 containers of inventory per season to now handling 50 containers of inventory per season. This has specifically expanded inventory for the watersports division, giving customers more options and quicker delivery times.

Improved Efficiencies

While labor requirements have remained the same, efficiencies have skyrocketed. With five full time workers (one worker in the small parts VLM area, two workers in the large item rack area and two workers in shipping); Diversco is filing orders faster than ever. Productivity has increased from 25 lines per hour to 115 lines per hour (and added a bag and tag step) resulting in a 460% increase in productivity.

Diversco Always Delivers

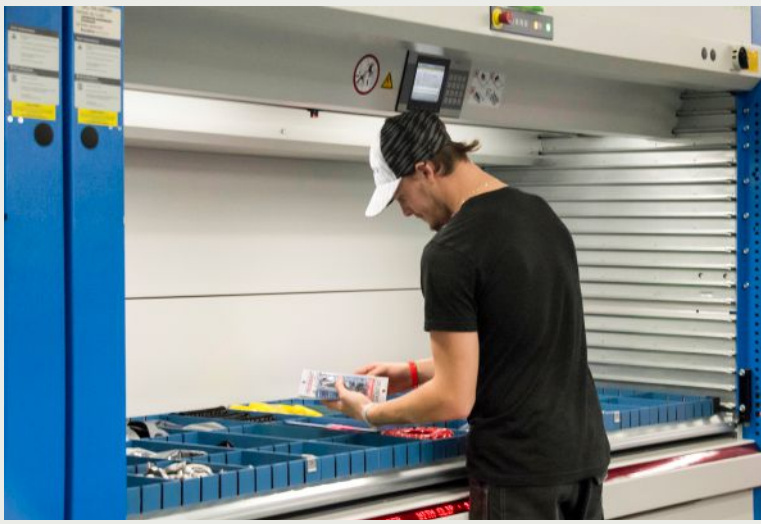
Now, the web based ERP sends small part VLM zone orders to the Power Pick Global (PPG) inventory management software for fulfillment. The operator selects up to eight orders from the order list in PPG for fulfillment. A tote is assigned an order ID and a customer ID and is placed in an open position on the batch station. When ready, the operator starts the fulfillment process with the click of a button and the VLMs move to retrieve the parts required for the selected orders.

Using pick to light technology, the transaction information center (TIC) located on the front of the unit in combination with the laser pointer located inside the work station direct the operator to the exact location within the tray to pick from. The TIC displays the part number and location to pick, while the laser pointer uses a light beam to highlight the location of the item required. The operator picks the correct quantity of the item, confirms the pick and turns to the batch station to distribute the items among the orders as directed by the put lights on the batch station.

While the operator is picking this item from the VLM and putting it into the individual orders on the batch station, the other VLMs are retrieving additional inventory required for the batch of orders. The operator is rarely waiting for parts, the VLMs are always working one step ahead of the operator.

The operator works round robin picking from the VLMs and putting into the orders until all parts for the order are filled. When an order is complete, the operator pushes the tote onto take away conveyor as directed by the put batch lights. The order is then taken to the large item fulfillment rack area for additional inventory or routed directly to shipping.

When an order arrives at the large item inventory rack zone for further fulfilment, the worker scans the order ID with a handheld RF device and is directed through the zone to gather the parts required. Once these additional parts are added and the order is complete it is then routed to shipping where the order is repacked and shipped via common carrier.



Customer Commitment

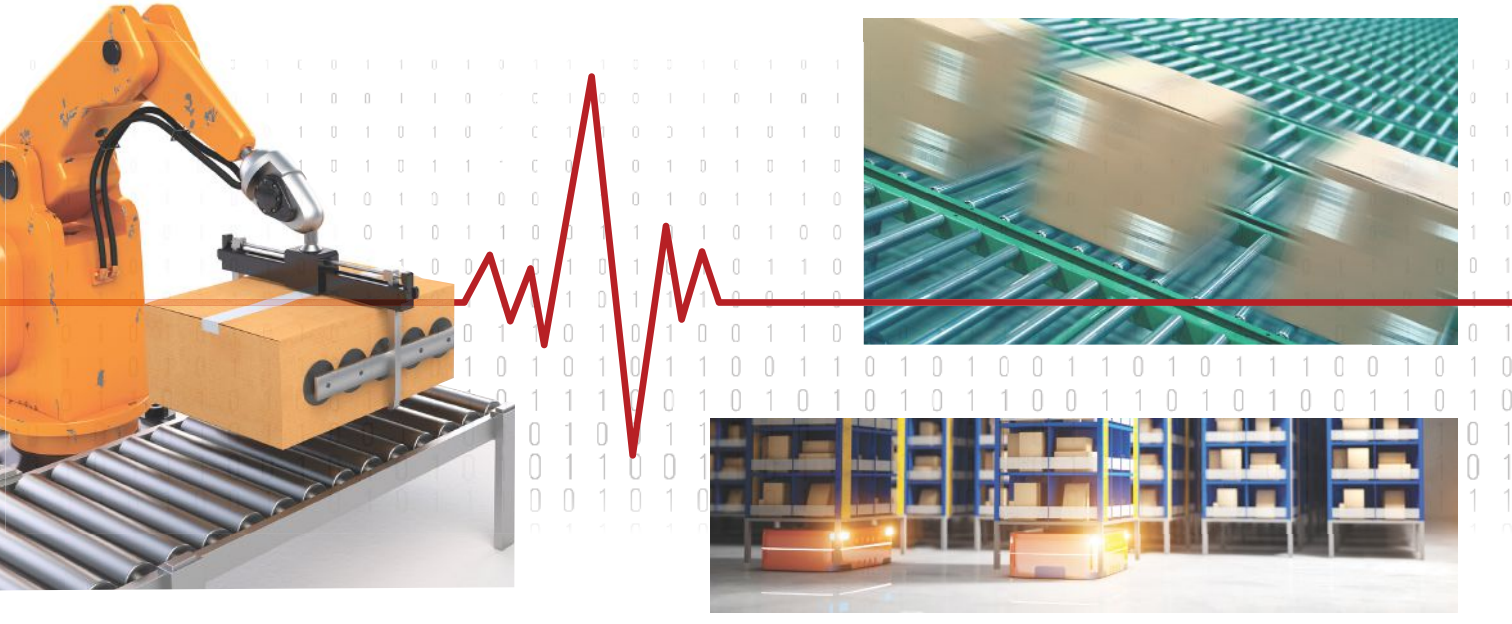
Diversco has a small amount of walk in orders that they need to accommodate within the picking process. To handle this, they use the hot pick module within the PPG software. This allows the operator to suspend the batch picking order they are working on to pick another hot order, usually for a waiting customer. “Even though walk-ins represent only about 5% of our orders, it was critical to our customer commitment that we had a way to fill these orders quickly and efficiently,” said Huddle.

Replenishment

All items are received into the ERP system to one temporary bin location. If the parts are for the VLM zone, PPG creates a put order. These orders are normally put away in the morning. A put order works just the opposite of a pick order. The operator scans the order ID and the VLMs move to provide the operator a location to store the items. Similar to picking, the operator is directed using the TIC and laser pointer to the exact location to store the items.

For increased inventory control and accuracy, discrepancy reports are automatically run daily. Any inventory variances found between the ERP and PPG are physically counted and adjusted, preventing the need for a full physical inventory or cycle counting activities.

What's at the heart



While automated equipment at today's warehouses can be at the heart of their success, any single piece of automation needs to be balanced with upstream and downstream processes, raising the importance of software to sync the flow of work and ensure the heart of the system keeps ticking.

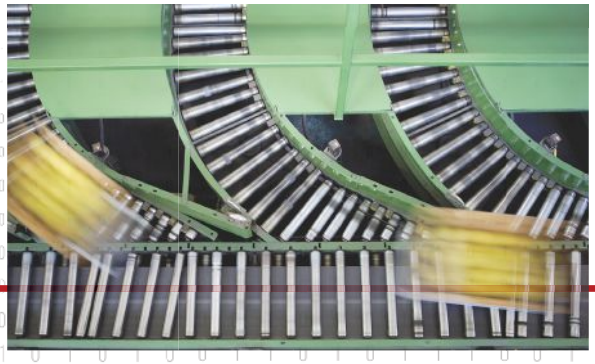
BY ROBERTO MICHEL,
EDITOR AT LARGE

It's tempting to copy the choices of distribution centers that have broken through to higher productivity after deploying automated materials handling. The pages of *Modern* are filled with examples of companies that have tapped solutions like mini-load shuttles, voice picking or goods-to-person robotics to achieve greater speed, labor savings and accuracy.

So, why not just install some of that equipment at your DC and wait for similarly dramatic benefits? The short answer, say consultants involved with warehouse automation, is that replicating the path taken at another DC may turn out to be disappointing if the automation installed doesn't support core goals or match the nuances of your facility's order profile.

"Copying what another facility has done can be the worst way to approach a project because it's the tail wagging the dog," says Chris Castaldi, vice president of sales for DMW&H, a warehouse consulting and systems integration firm. "You have to back up and really understand the nuances of a company's business and customer service requirements, and then from there, think about the tenets that will drive the systems and processes you should put in."

# of your system?



DMW&H clients such as REI, the outdoor goods retailer, have had success with specific types of automation, notes Castaldi, but he believes the key to REI's success was keeping core operational goals in mind as they selected methods and equipment.

Other consultants concur that deciding which automated systems should drive productivity—in effect determining what should be at the heart of your DC—goes well beyond an equipment capability focus. It starts with analysis of the order profile and throughput requirements, with close attention to stock keeping unit (SKU) characteristics such as products that are non-conveyable or difficult to bar code.

But DC projects also increasingly must address omni-channel requirements such as more each picking and tighter cycle times. These e-commerce pressures are driving a need for warehouse control system (WCS) solutions, also known as warehouse execution system (WES) solutions, to orchestrate a DC's automation and balance the flow of work to crank more orders through a facility in less time.

Speeding up picking with automation like voice may call for some automation at pack/ship stations to achieve balance.

Follow priorities

When REI came up with the systems for its new warehouse in Goodyear, Ariz., it followed a set of core goals or "tenets" that centered around sustainability and connection with the REI brand. As part of these tenets, REI wanted an order fulfillment method that was simple and efficient, and that would streamline the number of touches needed to pick orders for stores or e-commerce. These goals, says Castaldi, coalesced around REI's concept of one-touch production and eventually led to a system that combines an automated shuttle with pocket sortation to create workstations for omni-channel fulfillment.

At these workstations, for store orders, associates pick items to cartons; and for direct-to-consumer e-commerce orders, they pick to pockets in a pocket sorter. Pick-to-light displays in the workstations instruct the workers, while photo eye sensors catch misplacements. The system works well for REI, says Castaldi, because it constantly is filling store orders. DMW&H's WCS solution is used to match incoming e-commerce orders with store replenishment orders so that if a tote with the needed SKU is headed to a workstation, the e-commerce order can be picked concurrently with the store order.

"The driving idea was that one person can be filling retail orders while at the same time filling direct-to-consumer orders," says Castaldi.

And while the facility employs specific automated equipment to speed up and simplify picking, Castaldi adds, much of the success of the overall system is in how the automated solutions are combined, and how the WCS software dynamically assigns orders to the right totes and workstations. "We were tasked with making the DC super efficient," says Castaldi. "That efficiency is driven by software, or the 'brains' for the automated systems, which can be seen as the heart or muscles of the DC," says Castaldi. "If you want to be multi-tasking, which is what an omni-channel DC is all about, you need a smart brain."

The use of totes holding a single SKU, light-based picking instructions, and simplicity of the pocket sortation procedure ensures high order accuracy without having to build in extra bar code labeling or data collection procedures, says Castaldi. For DCs that often deal with small items or products like bagged garments where the bar code label isn't in a reliably readable position, bar code validation can create extra labeling and data collection work.

"The combination of shuttle and pocket sortation technology fit the nuances of what REI was trying to accomplish, which was to make things simple and accurate without creating extra steps," Castaldi says. "The starting point was ensuring the best possible customer experience, and from there, we looked at the best options that would allow us to streamline the fulfillment processes. It's important to keep your core goals in mind, and then see which options best align with those goals."

Breaking constraints

DC projects have always started with careful analysis of order profiles, SKU characteristics and throughput targets, notes Carlos Ysasi, vice president of engineering for VARGO, a warehouse systems integrator and WES provider. "It all starts with the order profile, and what that is telling you," he says. "Then, you must consider the throughput that DC is going to need to achieve and start looking at the processing engine or automation you need to have in place to achieve that type of throughput. We break that down by the output by the hour and begin looking at what can actually handle that throughput."

VARGO served as an integrator and WES solution provider for American Eagle's omni-channel DC in Hazle Township, Pa. In that project, says Ysasi, the throughput requirement was 20,000 units per hour, which drove the need for some automated machinery.

The systems in use at the DC include an inbound conveyor and sortation system that routes incoming goods directly to where they are needed most—either for store orders or direct-to-consumer orders—and a large unit sorter and put walls for picking, as well as other picking methods, including ring scanners. Coordinating the various automated systems is VARGO's WES.

While specific types of automation may be needed to meet particular throughput goals, a good WES serves to ensure a smooth flow between the various solutions, says Ysasi, making decisions in near real time based on demand at the time. "WES is making all of these decisions and driving the flow of production through the building so we don't overwhelm a process, starve a process for work, or so we don't have to buffer in between processes," he says.

Art Eldred, VARGO client executive for systems engineering, adds that as omni-channel fulfillment has become a reality for more DCs, it has tightened order cycle times to such an extent that WES is needed to continuously match orders and work to the DC's resources and coordinate the flow of work between automated systems. While warehouse management system (WMS) solutions that batch work together in planned increments, or waves, tend to work well for more manual facilities doing traditional store fulfillment, they aren't dynamic or real time enough to serve as the brains for a highly automated omni-channel facility, says Eldred.

"Today, WES as the brains to make things come in and out of the automation becomes more important," says Eldred. "Driving down order cycle time and flow have become the top things to focus on, while efficiency, though still important, is becoming secondary. That's a change from where we were in the past."

Ysasi also sees a change in DC methods where omni-channel fulfillment centers want to get product moved quickly from receiving to the active picking environment without the extra touches involved in building pallets; storing pallets to a reserve storage area; and moving goods once again from reserve to a ready reserve or pick area.

With WES software, it's possible to quickly make decisions on where inbound cases of goods are needed most, and route them straight to the optimal picking area, thereby speeding up the overall flow, says Ysasi. "When you have fulfillment centers with all active inventory, where basically every piece is available at any possible time to get picked, packed and shipped, you've just opened yourself up really decreasing cycle time," he says.

Think lean

Some DCs may rely heavily on a major piece of automation to attain a pick rate, but for most DCs, the key to throughput is balance between pick, pack and ship operations, says Dan Hanrahan, CEO of The Numina Group. "I look at order fulfillment as a three-legged stool of picking, packing and shipping," he says. "If any one of those areas gets out of alignment with the others, it causes problems."

For example, says Hanrahan, if a DC adopts voice picking and ramps up the number of orders picked per hour, but has no pack automation in place, a bottleneck can easily occur at its pack stations. The better approach, says Hanrahan, is to look at ways to balance the flow of work through the overall system, rather than trying to accelerate just one area. One streamlining step could be to voice pick directly to cartons—using cartonization logic to select the proper cartons—rather than picking to a tote and sending the tote to a pack station. "You essentially are combining two main tasks when you do that," says Hanrahan.

WES/WCS software not only orchestrates that different automation along the same material flow, says Hanrahan, but also can manage parallel processes so order elements that use different machinery all get to outbound shipping at the right time. An example of this would be oversized items that are non-conveyable, but need to be shipped concurrently with smaller items going to the same customer. "The software is key—you need good warehouse execution/control software with a sophisticated picking module and wave management logic to allow for parallelism in picking across different zones, and then consolidating," says Hanrahan.

Ultimately, balance and flow between key areas of the DC work together to achieve fulfillment goals, says Hanrahan. "Your overall process is like an order fulfillment machine, so you need to keep pick, pack and ship processes in balance to ensure orders flow optimally," he says.

Companies mentioned in this article

- DMW&H
- VARGO
- The Numina Group

CASE STUDY **TSC** Mississauga, Ontario

TSC Chooses Megamat Vertical Carousels for Jewelry Distribution

Three Megamat Vertical Carousels with inventory management software enable batch picking for jewelry distribution–using 54% less labor and increasing productivity by 600%

Headquartered in Mississauga, ON, TSC is a leading interactive, multi-channel retailer, offering a vast assortment of exclusive products and top brand names to customers throughout Canada. With roots as a televised shop-from-home service reaching into over 7 million Canadian households, TSC expanded to online, growing into one of Canada's most innovative retailers. They provide customers shopping convenience with exceptional selections in Health & Beauty, Jewelry, Home/Lifestyle, Fashion/Accessories, and Electronics.

Over 15,000 quality products are available to customers 24-7 with the click of a button or quick phone call. Managing and distributing 15,000 rotating SKUs can be quite the challenge, but TSC is meeting customer delivery expectations at every turn.

TSC is supported by a 300,000 square foot warehouse equipped with the latest material handling technology, shipping roughly 10,000 orders a day. Accounting for 20% of the business, jewelry was prime for an operation makeover.

Operations Makeover

Three, 29 foot Kardex Remstar Megamat RS vertical carousels combined with Power Pick Global (PPG) inventory management software are used to manage the jewelry and coin inventory. "Because of the small size and high value, jewelry was perfect for carousel technology," said Sue McGibbon, Jewelry Manager.

Previously, jewelry was stored in open shelving within a cage area managed by a security officer. With growth year after year, jewelry was quickly running out of space and struggling to keep up with customer demand. With the transition to automated vertical carousels, over 8,000 jewelry and coin SKUs are now managed in 75% less floor space.

Order Fulfillment Flexibility

TSC has a flexible system that is driven by customer demand. "Our order volume is highly variable, depending on the shows and promotions some days have 600 orders and some days 100 orders. That was a big labor challenge for us in the past, especially at the peak when lines required to pick per day are as high as 2,000 lines per day with one shift," said McGibbon, "but with the carousels we're able to manage the fluctuation easily."

With the implementation of the carousels and moving returns handling to another department, jewelry distribution requires 10 people; down from 22 previously required to receive, pick, pack, ship and process returns. Further, throughput has increased from a previous average of 40 lines per hour per person to an average of 165 line per hour per person, now a standard facility KPI. At peak times the system handles 240 lines per hour per person. Meaning jewelry distribution now requires 54% less total labor and has increased productivity by 600%.

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TSC continued

As a leading employer in the area, TSC employs a dedicated and seasoned workforce, most employees in the jewelry area have been there for over 20 years. "The three carousels reduce the work area of the operator to 32 feet, and with ergonomic delivery there is no wear and tear on the body," said McGibbon, "There is definitely an element of employee satisfaction that comes with the carousels."

Order Processing Details

When customer orders are received via web or phone, jewelry orders are split separately from floor inventory. "Once the order is placed, then the fun really begins," says McGibbon. Orders for jewelry are downloaded into PPG for easy fulfillment.

To start, the operator scans a paper order followed by a tote license plate, placing the order paper into the tote cell - this ties the order to the cell location. Each tote has 12 compartments and there are 10 totes in a batch–allowing the operator to fill 120 orders simultaneously. Once each order is assigned a tote location the operator is ready to pick.

As directed by PPG, the Megamat vertical carousels deliver the required SKUs to the access window, pinpointing the exact location and quantity to pick using the transaction indicator center (TIC) located at the work counter. The operator picks the correct quantity and turns to the batch of 120 orders to distribute them.

Above each batch position is a display monitor that shows the operator the exact tote cell to place the item, and the quantity required. As each SKU is deposited into the tote cell, the operator confirms the put. Once all of the SKUs are distributed among the orders, the operator turns back to the vertical carousels to pick the next item. This allows the vertical carousels to always work one step ahead of the operator, minimizing operator wait time.

Upon completion, orders are sent to the shipping area where they are checked for accuracy by scan of the paper order and a scan of the item(s) within the compartment. "The pick to light on the carousels works, accuracy is steady at 99.9%," said McGibbon.

Stocking Inventory

If a show or promotion is planned for a jewelry item, it is inventoried in the floor area on a pallet due to the size of the inventory and the velocity of the anticipated orders. Once the show or promotion for the specific item has ended, the remainder of inventory is stored within the carousel.

Handling Returns

Returns are a challenge for any distribution operation, but especially retail. Jewelry sees an average of 2,500 pieces returned weekly. Returns starts as a manual process with all jewelry having to be thoroughly inspected and cleaned before it can be returned to inventory.

Once this process is completed and the item is deemed acceptable to return to inventory by the returns processing center, it is returned to jewelry. Upon receipt, the operator processes each return individually, assigning a storage location within the Megamat vertical carousel using the PPG software.

Jewelry Shines

Jewelry distribution is managing and filling orders faster than ever. "The carousel system has given us the flexible solution we need for our operations," Said McGibbon, "the installation and service support by our local Canadian distributor GN Johnston has been great."

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