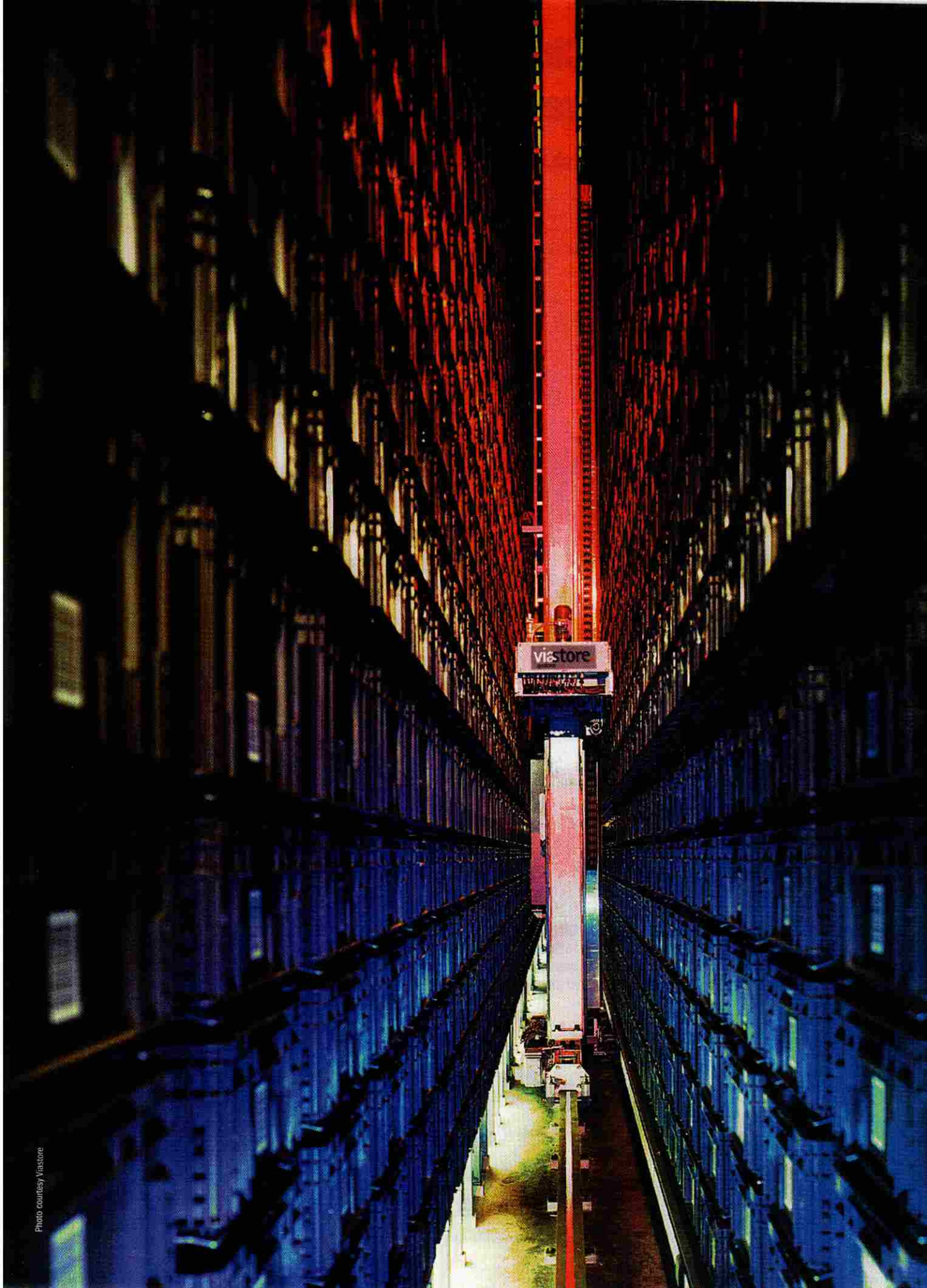


Photo courtesy Viastore

Warehouse of the Future

Software will choreograph tomorrow's warehouse work

BY D. DOUGLAS GRAHAM

The warehouse of the future will not be technology-dependent but technology enhanced—a blend of technology, machine, and manpower. Supply chain software, already a critical element today, will actually choreograph the work of this new highly automated warehouse, trimming fat, dumping waste, and eliminating redundancy wherever it is found. Workers will be fewer, but more qualified, better trained, and more motivated.

Orders will be smaller to accommodate just-in-time buyer requirements. Relationships between warehouses and customers will be tighter, as customers separate wheat from chaff in their search for value-added business partnerships. Warehouses will also partner more closely with suppliers, and as this trend matures into common practice old barriers will break down for the sake of expediency and efficiency.

Thanks to this confluence of mind, machine and muscle, fulfillment tasks will be transacted faster, easier and more profitably. Tomorrow's warehouses will perform a whole lot better.

Future trends are usually augured by current conditions, and so it is with warehouse operation. Driven by rising costs, greater expectations on the part of customers and intense competition, the warehouse of the future must operate lean and mean. That reality will persist as the new century gets under way, assisted by improved technologies, methodologies and increasing customer demand for value-added service.

"Several developments portend imminent change in the supply chain," says Bob Carver, vice president of marketing for LIS Inc., a Charlotte, N.C. supply chain control and execution manufacturer. "One of the most important [advances] will be low-cost, radio frequency identification technologies (RFID) [where] we seem to be on the precipice of a major advance. Up to now the methods you had for identifying product were labels, printed bar codes, stenciling by inkjet, and spray-on technologies. With RFID you have the ability to encode additional data, allowing you to track merchandise more precisely. A related development is read/write tags, which make it possible to modify the data associated with a product, on-site. This technology is still a few clicks away from general warehouse deployment, but R&D efforts are focused on it right now."

This new era will replace the era of the automated warehouse that occurred during the 1990s as scanning, bar coding and RF-based technologies all trickled their way to fulfillment operations, accompanied by advanced material handling solutions like automated pickers, tilt tray sorters, and pick-to-light. Lured by technology's siren song, warehouses wound up with hardware and software they couldn't afford to use. It was a costly blunder that will not be repeated in years to come.

"Future warehouse solutions will be designed and implemented with serious payback in mind," says Juergen Conrad, president and CEO of viastore systems Inc., a designer and manufacturer of automated storage and retrieval systems, and a developer of WMS for automated material handling

systems, headquartered in Stuttgart, Germany.

"The new technologies will accelerate throughput numbers and speed things up at picking stations. Devices will be highly flexible, very user friendly and of good quality.

A day in the life

Through what steps will an average order leave the warehouse of the future? The process, suggests David Landau, director of product management, Manhattan Associates Inc., could look something like this. First, the order enters the facility via EDI, the corporate Web site or the call center. From that point, it progresses to an enterprise resource planning system (ERP), a corporate platform that transacts all billing, business and inventory issues. ERP complements the warehouse management system (WMS) by managing all the planning aspects of a business.

The order is passed to the WMS once the ERP system decides that the warehouse has sufficient inventory to fill it. Then the WMS will look at its work outstanding, and map out a plan for order processing. The logic entailed in the WMS's decision-making process will include constraint factors on labor, replenishment, possible bottlenecks, and the time and energy spent in value added functions. All constraints will have to be optimized by WMS to maximize efficiency. Once this important mission is accomplished, the system will create tasks and dispatch employees to do the work. These tasks may include retrieving a single item or carton, or piece-picking a larger order. There may be other jobs to attend to as well, such as valued-added processing or assembly. The employee will take the order to an automated value-added processing station, where he will receive instructions.

Next, the merchandise moves to a packing station where it is placed in shipping containers. The system will guide this process as well, governing when and where the processed order should be transferred to the loading docks, and how it should be loaded on the trailer. The WMS will govern the whole shebang from cradle to grave, and print all accompanying documentation, including shipping labels and manifests. Warehouse workers will interact with this Space Age system comfortably, as if, for all intents and purposes, it were another employee.

"Material handling equipment will play a supporting role in all of this," Landau says. "Order staging, picking, pulling down cases, and other functions mostly done with human effort today, will be accomplished with automated sorters, conveyors, robots and tilt trays. The mission of all of them will be to take labor out of the process, so that people can work most efficiently using their best asset—their brains." **FS**

The warehouse will be highly automated, and warehouse management systems (WMS) will interact directly with automated material handling equipment. Right now, this link can be made, but it's not automated. You have to add another level of software, but in the future direct interface will be commonplace. There will also be a convergence of software and people. Warehouse workers will be wired into the system through touch screen or voice-activated technology. All of this will add efficiency where redundancy exists today."

In addition, expect fulfillment functions to become "more network-based over the next few years, expanding the warehouse beyond its four walls," says Rob Sweeney, vice president, product management, Yantra Corp., a supply chain software provider based in Boston. "Processes will be networked so that any provider or supplier will be able to access them. There could be some order consolidation, which will transpire at multiple warehouses. Relationships will be more open than [in the past] and there will be fewer secrets between partners. The [idea] will be to provide visibility all along the supply chain for the sake of coordination, cost-savings and efficiency."

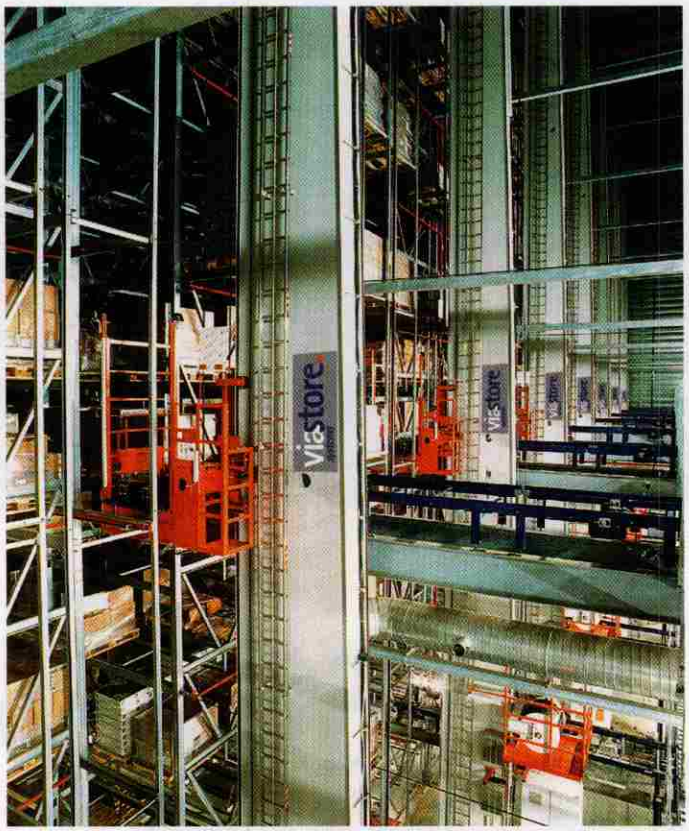
What's more, IT will hold "a greater link" to the entire supply chain and reduce processing time in the distribution center, and the length of time that products are warehoused, adds Hal Wilson, senior vice president for distribution and transportation services for Big Lots Inc., a Columbus Ohio-based retailer with approximately 1,400 stores in 48 states. "All of this will minimize operating cost, accelerate the distribution of product, and streamline the process of getting the right product to the right place at the right time, and [at] the right price. These things are goals in today's fulfillment, but in the warehouse of the future they will be bottom line."

The future is now

Big Lots already has a warehouse of the future, four of them in fact. The company trades in closeouts. It buys at opportunistic periods and keeps inventories in four strategically located distribution centers, each containing approximately 100,000 storage pallets. Roughly 350 stores are replenished by one of the four warehouses on a weekly basis.

Big Lots uses a batch wave fulfillment system to do weekly replenishment. Each day the warehouse picks for 60 to 65 stores. A conveyor system equipped with a bar code reading photo eye sorts the merchandise by store and diverts it to the appropriate shipping lane. There are 50 doors in the dock area, each representing an individual store. Store designations are rotated every four hours so that all 350 locations are accommodated.

All activities are choreographed by a state-of-the-art EXE warehouse management system. Using product information and purchase orders, the system identifies merchandise on the receiving end, noting overages, shortages and substitutions in the process. A bar-coded "license plate" is applied to every pallet, which is scanned by a lift truck operator linked to the WMS via radio frequency technology. The WMS tells the operator where to put pallets in the warehouse, and later identifies pallets to be pulled so that shipping labels can be applied to cartons of merchandise. The WMS prints labels by product, along with the manufacturer's bill of lading, and the address of the store for which the merchandise is intended. The same process occurs at all four warehouses.



Future automation will include a direct link between warehouse management systems and material handling equipment.

An even more futuristic fulfillment operation was recently completed by ES3 LLC of Keene, N.H., a third party grocery logistics supply chain management company. Its 441,000-square-foot warehouse, or "tower", was erected on a 250-acre site configured for eight towers in all. Tower One holds 140,000 pallet positions and is 110 feet high. The purpose of this vertical design, explains executive vice president, Geoffrey Davis, was space savings. A fulfillment center with the same pallet capacity and 35-foot ceilings would be spread out over 1.2 million square feet, and that, he says, would prove to be a very inefficient use of space.

The tower is highly automated. Robotic pickers work side by side with conveyors, pallet invertors, Web-enabled pallet jacks and forklifts. Everything coming into the warehouse is validated physically and logistically. Order management software and WMS are proprietary. A WhereNet tracking and locating system runs the yard, an Elogex Transportation Management System manages the company's delivery fleet. Projected capacity for Tower One is 200 truckloads in and out per day. Storage is high-density, so picks are very close together. At present less than 100 employees man the site.

"We were founded as OneSource, a division of C&S Wholesale Grocers of Brattleboro, Vt.," Davis says. "We spun off to ES3 in late 2000, and now provide consolidated order and management fulfillment services so that multiple manufacturer products can be sourced on a single order, fulfilled through a single facility, and arrive in a single shipment within 24 hours of order placement. What we are talking here is the first just-in-time solution in grocery. This approach benefits retailers in several ways. First, inventories on hand shrink from three weeks to one week. Warehouses and retailers now get the opportunity to drop from 8,000 to 10,000 SKUs to 2,500 SKUs, dramatically increasing throughput and internal efficiency. Selection footprint also becomes significantly more efficient due to travel time reductions between picks. That really sums up the shape of things to come for warehouses serving retailers and distributors. By having fewer SKUs on hand, and shorter footprints, the operations will be improved without having to significantly alter inventory."

Davis believes that the warehouse of the future will also use advanced automated storage and retrieval technology to perform repetitive tasks, including the movement of pallets, the de-palletization into layers and some re-palletization activities.

"There will be an extensive use of bar coding, advance shipping notification and IT beyond the walls," says Davis. It will be enabled by hosted, Web-based extranets that allow trading partners to obtain information and functionality from their desktops. These systems will include intranet-hosted applications and non-distributed software.

"ES3's internal software is all hosted on an intranet, which allows us to reduce our development and maintenance costs, and provides an ability to rapidly change and develop applications and workflow," he says. "It provides us with the ability to synchronize applications and processes.

ES3 is a process-mapped company, and all our applications are process-oriented. This frees us from the typical restraints of an AS400 mainframe or some other client server environment. All our handling equipment uses Windows 2000, hardened touch-screen LCD computers, which provide flexibility along with security, encryption and other crucial features. You can manage multiple, non-automated warehouses with the same WMS. Robots, conveyors and all the rest are not [needed]"

The key to an effective warehouse will be optimizing the utilization of resources such as labor and inventory.

Hot stuff

But what has everyone involved in material handling and warehouse management salivating are RFID systems that are made up of three components—an antenna or coil, a transceiver and a transponder, usually in the form of a tag. RFID tags have larger memory capacities, wider reading ranges and faster processing than bar codes. RFID tags are to bar codes what humans are to chimpanzees. The drawback: they are quite expensive compared to bar codes, and so far this has hampered their wide implementation in warehousing.

However, that is slowly changing, and, as prices drop, RFID tags are likely to see incremental adoption in fulfillment operations.

The primary advantage to RF tags is that they carry information with them, says John Pulling, chief operating officer at Provia Software, a Grand Rapids, Mich.-based supplier of software packages for supply chain execution. "This is not the case with bar codes."

While lower priced RFID tags will significantly affect warehouse operation in the near future, Pulling foresees a more phased introduction of RFID than some of the proponents of this technology. "The management of inbound and outbound inventory will be positively affected by the wider use of RFID because, with RFID tags, products identify themselves," he says. "Not only will this make accounting for inventory much easier, it will substantially reduce operator error (in shipping and receiving) and shrinkage."

Future warehouses will also enjoy greater optimization of their technological assets, adds Pulling. Today's WMS systems are designed to set up shipping schedules based on scans received and the constraints of the warehouse. They can't anticipate according to sequence or perform many other tasks that help a fulfillment operation reach its full potential.

Future warehouse management technologies will perform functions impossible today, including finite scheduling and the process sequencing of orders, allowing the operation to take advantage of its capacities while managing its constraints. Those constraints will include labor, physical space, yard capacity, order mix and value added processing, a factor that will loom large in warehouses to come. Even now warehouses are no longer simple repositories of inventory waiting to be shipped, but processing operations, where products are modified or even assembled to meet the demands of customers. This trend will pick up pace in the years ahead, as value added service increasingly becomes a nonnegotiable criteria for doing business.

In environments such as warehouses, where companies are managing large investments and high value assets, the key will be optimizing the utilization of resources, says Matt Armanino, vice president of business development for WhereNet Corp, a provider of wireless location and communications solutions for managing mobile resources, based in Santa Clara, Calif.

"One of the major factors driving this will be a need for better data for the location and utilization of resources," says Armanino. "Over the past decade companies have invested a lot of money in enterprise-level software intended to manage high-level assets. That represents a shift away from enterprise solutions that simply manage transactions. What's needed now is a way to collect information on a real time basis, an automated basis, in order to provide data that is always correct. This is not a novel concept. Four or five years ago people were talking about the need for velocity, variability, and visibility in supply chain management. Visibility has been the missing component, but in the warehouse of the future you will see a bridging of the data divide between information systems intended to manage assets, and the assets themselves. Systems will be available that will allow for constant connectivity with all the assets in the warehouse." **FS**