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## Zappos.com goes Space Age

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Craig Adkins  
vice president, services and  
operations, Zappos.com

# Zappos.com goes S

**The online retailer recognizes order fulfillment as the key component of its mission and views the distribution function as its major competitive advantage. Here's how it adopted Space Age automation to realize skyrocketing productivity and meteoric sales growth.**

BY MAIDA NAPOLITANO, CONTRIBUTING EDITOR

If you're like most online consumers, you're not ordering in case or pallet quantities. You're buying only one or two pieces of one or two different items, and you almost certainly want your order the very next day—for free, of course. This growing consumer demand is exactly what's putting the pressure on online retailers to find automated order fulfillment solutions that can improve the productivity and accuracy of the piece-pick order while reducing the fundamental reliance on costly, manual labor.

So, if you're an Internet retailer, you better be paying attention.

One retailer that's worked to uniquely position itself to meet increasingly finicky consumer need is Zappos.com. Founded in 1999, this retail maverick started out selling just shoes; however, now it offers over three million items including shoes, clothes, handbags, and accessories from over 1,000 brands. By focusing on providing customers with the widest selection imaginable and the quickest service, sales grew from \$597 million in 2006 to \$840 million in 2007—that's an amazing 40 percent in one year.

And despite the bleak retail picture in today's economy, the company still expects sales to grow to about \$1 billion in 2008. It's no surprise really, because to savvy Internet shoppers, this service-oriented company is doing everything right. Their site offers free, 365-day returns, 24/7 personalized customer service, and free shipping on every order with no minimum order size required. And the kicker: Zappos.com makes every attempt to get your order to you the very next day.

They believe that speed is the key to their success. In fact, they're making sure that items get picked and ready to ship about 12 minutes after customers click the "submit order" icon. And to make that happen, they keep careful stock of everything that they sell and they don't make an item available for sale unless it's physically present in their Shepherdsville, Ky., facility.

The bottom line: Zappos.com recognizes that order fulfillment is an integral component to its business mission and views the distribution function not as a money pit, but as a competitive asset. By investigating innovative ways to increase capacity and improve order picking, its order fulfillment operation has improved at light speed. Here's how they did it.

## GROWING PAINS

From its inception in 1999 all the way through 2006, the company had been processing shoe orders in mostly manual operations using paper pick lists with very little automation. By 2006, with sales escalating, the company moved from a 280,000 square-foot building into a 832,000 square-foot fulfillment center in Shepherdsville, Ky., just 12 miles from a main UPS shipping hub. Leaving half of the space empty for expansion, Zappos installed a state-



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of-the-art, radio-frequency (RF) driven order processing system in 416,000 square-feet of space.

The new system included a four-story, rack-supported mezzanine filled with steel shelving, a four-story, 32-pod horizontal carousel system transporting products to pickers on mezzanines, and a network of powered conveyors and sortation systems to move and sort products from receiving to shipping. This mechanized system was designed to handle larger shipment volumes of shoe orders with shorter order cycle times than previous manual operations.

By early 2008, plans were already underway for the retailer to eventually sell "anything and everything." But with product expansion came a small issue: According to Craig Adkins, vice president of services and operations, "Over the past year, we've seen a significant increase in apparel and we knew we'd eventually be branching into sporting goods like as tennis rackets and golf clubs...and we already had some limited cosmetics," says Adkins. "But our current mechanized equipment was really just designed for shoes." Shelving units and conveyors were optimized for shoe boxes and not meant for plastic-wrapped apparel.

The broadening SKU assortment, coupled with triple-digit annualized sales growth, was slowly creating gaps in capacity. Adkins knew it was time to put serious thought to equipping the adjacent empty expansion space with a cutting-edge order fulfillment system that would help the retailer further realize its vision of being the premiere store online.

## **EVALUATING TRADITIONAL OPTIONS**

Together with his project team, Adkins quickly evaluated three tried-and-true options: adding more static racking optimized for apparel; using carousels exclusively; and rolling back into their previous 280,000 square-foot building where they had already static shelving and conveyors built in.

But there were mounting concerns. "As instruments of traditional distribution, these systems weren't really optimized for our type of business," says Adkins. The shelving/carousel system still required extensive manual material handling support and downstream sortation which increases labor costs and the time an order spent in the facility.

Adkins also wanted flexibility within the operation. "If we didn't like the layout, we wanted to be able to change it with ease, and that's tough when dealing with four stories of mezzanines, racking bolted onto the floor, and 23,000 feet of conveyor," he says. The pick modules also had to handle the broad and rapidly changing SKU assortment expected by their e-commerce customers. "We wanted something that would be able to handle just about any kind of category, whether it's as big as a set of golf clubs or as small as a deck of cards."

## **OPTION 4: DID SOMEONE SAY ROBOTS?**

Because the traditional options did not quite meet the project team's expectations for flexibility, throughput, and labor cost savings, Adkins and his team decided to explore a fourth option: a relatively new automated system that used a fleet of small, mobile, robotic drive units that would retrieve shelves of inventory and transport them to workers at picking stations equipped with pick-to-light technology.

Sound far-fetched? Let's break it down: When an order for six items hits Zappos' WMS, the WMS immediately communicates with the robotic fleet's central server to fill the order. If the items are located in six separate inventory pods, the system dispatches six robots to locate the correct pods and transport them to the pick station, forming a queue in front of the pickers.

Unlike traditional pick-to-light modules equipped with expensive built-in light displays, this particular picking station uses an overhead rotating laser pointer to direct the worker to pick from the correct bin. A monitor at each station indicates the number of pieces that must be picked. A worker picks the item, scans



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the UPC, and places the piece in the appropriate shipping box. To minimize robot travel, a picker works on multiple orders that require many of the same item—in short, travel once, fulfill many orders.

Robots navigate the DC using technologies that do not involve wire, rails, or laser guidance. Inexpensive 2D barcode stickers are applied on the floor. The robots use scanners and cameras to look up to identify the pods they are carrying and down to track where they are going. And there's no need to feed them. The robots charge themselves when they need it. Adkins explains that the charging schedule is built into the capacity of the number of robots so there are always robots being charged, but it doesn't slow down the operation.

Perhaps the key to this automated storage and retrieval system is its massive parallel processing system. Mitch Rosenberg, vice president of marketing for Kiva Systems, Inc., the system provider for this picking solution, explains: "By keeping track of the velocity of each item, we can project the maximum number of times at one single moment that an item will be demanded for orders and slot the items accordingly into multiple pods to accommodate the filling of simultaneous orders for that item."

Say goodbye to hours spent re-slotting. In fact, computer algorithms enable this mobile inventory to organize and re-slot itself, automatically adapting to changing product velocity and market conditions. If an item is ordered more frequently, robots locate the pods for quicker access to an area closest to the pick station. Complementary items, or items frequently ordered together, are kept within the same pod for quicker order completion.

While the system has worked well inside Zappos' specific need, it's not a cure-all solution. "If there was something that needed to be figured out...it would have to be how to go vertical," says Adkins. Rosenberg adds that the vendor does not recommend the system to process pieces that weigh more than 25 pounds, as it will need some sort of human assist. He adds that it also doesn't make much sense for high-volume cross-dock operations, for low-turn operations with items that move only two or three times a year, or for businesses with only a few hundred SKUs.

### COMPUTING THE BENEFITS

According to Adkins, on their traditional shelving/carousel system, from the time the customer clicks to submit an order until the order is on a truck, completely labeled and boxed, it takes Zappos an average of 48 minutes—which is pretty darn good. With the Kiva system, Adkins reports orders can be completed in just 12 minutes. With travel time eliminated, picker productivity has skyrocketed. "It's using

about 40 percent as much labor as a comparable volume on the other side of the building," he adds.

Wherever a robot can go, people are typically not allowed—keeping people safe and the product secure. According to Adkins, confining the robots to a limited area also results in substantial energy savings compared to traditional conveyor-driven racking systems. "You only have to light the area where the picking stations are. The robots can work in complete dark." This leads to a lower heat load on the facility, and with no conveyors transporting totes it generates considerably less noise.

Adkins also likes its portability. "We lease our building, and if I decide eight years from now that we're going to move into a different building, I can take the entire system with me—nothing's bolted down."

### CHECKING AND DOUBLE-CHECKING

Because it's a fairly new technology, applying some "investigative diligence" was vital to ease any up-front concerns. Adkins and the Zappos team visited two other Kiva-run fulfillment centers, observing the system in action and talking to management and operators on the floor.

The team also checked the bottom line. According to Adkins, its low-cost approach to automation made the robotic storage and retrieval option competitive with traditional mechanized systems involving powered conveyors and sortation systems. "We did a seven year economic analysis and we found that Kiva's system was the least expensive of the four options," says Adkins.

With its due diligence behind them, Zappos signed a contract in February 2008 and was up and running by July. "The Kiva team was really easy to work with and they customized our station designs to meet our needs." In total, 10 picking stations were installed with the ability to process about six orders at a time. Zappos' system now uses 72 robots to process non-shoe orders in 110,000 square feet of expansion space.

"It was the smoothest integration in my career," adds Adkins. "We don't use an off-the-shelf WMS. Our shopping cart, website, and WMS are all homegrown, so Kiva worked with our development team to make sure that all our communication sockets were in place."

As with any new automated technology, that first step can be the hardest step to take, adds Adkins: "If there hadn't been any other companies using it, I'm not so sure we would have wanted to take the risk. But I give all the credit to the company who became Kiva's first customer. They were willing to take the chance." ■

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