

CSCMP 2018 Supply Chain Innovation of
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How BuySeasons Achieved Record eCommerce Order-Fulfillment Productivity



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EXECUTIVE SUMMARY

Summary of the Initiative:

This case study describes how BuySeasons, a major online retailer of costumes, accessories, seasonal decor, and party supplies, planned and implemented a new order-fulfillment system that more than tripled picking speed while accommodating a peak-season surge in shipping volumes with significant reductions in direct labor costs. The impressive increases in picking speeds resulted from replacing BuySeasons' legacy voice-picking technology with 40 batch-picking carts employing multimodal picking technologies and from the introduction of optimized picking strategies.

Innovation Statement:

The BuySeasons order-fulfillment system employs three key innovations for enhancing productivity. The first is multimodal, batch-picking technology—utilizing a combination of voice, barcode scanning, and light-directed placement—that enables pickers to fulfill multiple orders simultaneously in a hands-free, eyes-up manner without having to look at a piece of paper or a computer screen. The second is an overarching emphasis upon optimization of the order fulfillment processes. A highly-effective optimization algorithm is employed to assign orders to carts in a manner that minimizes the total travel required to gather items for pending orders. Additionally, at every stop in the picking area, a second optimization procedure is employed to discover orders that have SKU's in common so that the picker can distribute items into multiple customer orders with a single pick. The third key productivity enhancement is a bulk-picking strategy that was found to be optimal for a large portion of BuySeasons' orders. The bulk-picking strategy enables a picker to make one trip through the picking area, gathering as many as 24 different SKUs for numerous single-item orders. This strategy is particularly effective since pickers can quickly retrieve items for perhaps hundreds of orders on a single trip through the picking area.

Impact Statement:

The average picking rate across all pickers—including inexperienced temporary workers—increased from 38 items/hour to 132 items/hour. The current picking rate is nearly 3.5 times the picking rate achieved using the voice system prior to installing the new technologies and picking strategies. The average picker productivity now substantially exceeds that of the top five pickers using the legacy voice system.

Applicability:

The technologies and optimization strategies employed to enhance BuySeasons' order fulfillment processes are generally applicable to eCommerce order fulfillment operations.

INTRODUCTION

The explosive growth of eCommerce during the past decade has drastically changed traditional fulfillment strategies. Traditional fulfillment strategies were largely designed for distributing products in bulk packaging such as pallet loads and cases. With the emergence of eCommerce, companies began to experience a dramatic upsurge in the number of orders per day, but with fewer items per order. Since the fulfillment strategies designed for distributing pallets and cases are not well suited for eCommerce orders, distribution centers have sought to change their order fulfillment strategies to handle products in a more efficient and cost-effective manner.

Distribution center upgrades to accommodate the growth of eCommerce have focused largely upon improving picking, packing, and shipping. Since picking is often the most labor-intensive portion of distribution operations, efficient picking solutions can provide significant improvements in throughput while lowering operating costs.

Decision makers are faced with a variety of options for improving picking speed and accuracy. Key considerations when considering order-picking technologies are: projected throughput performance, capitalization costs, and operating costs. An equally important consideration is the flexibility of the technology to be scaled up or down to accommodate changing demands.

Overview of BuySeasons

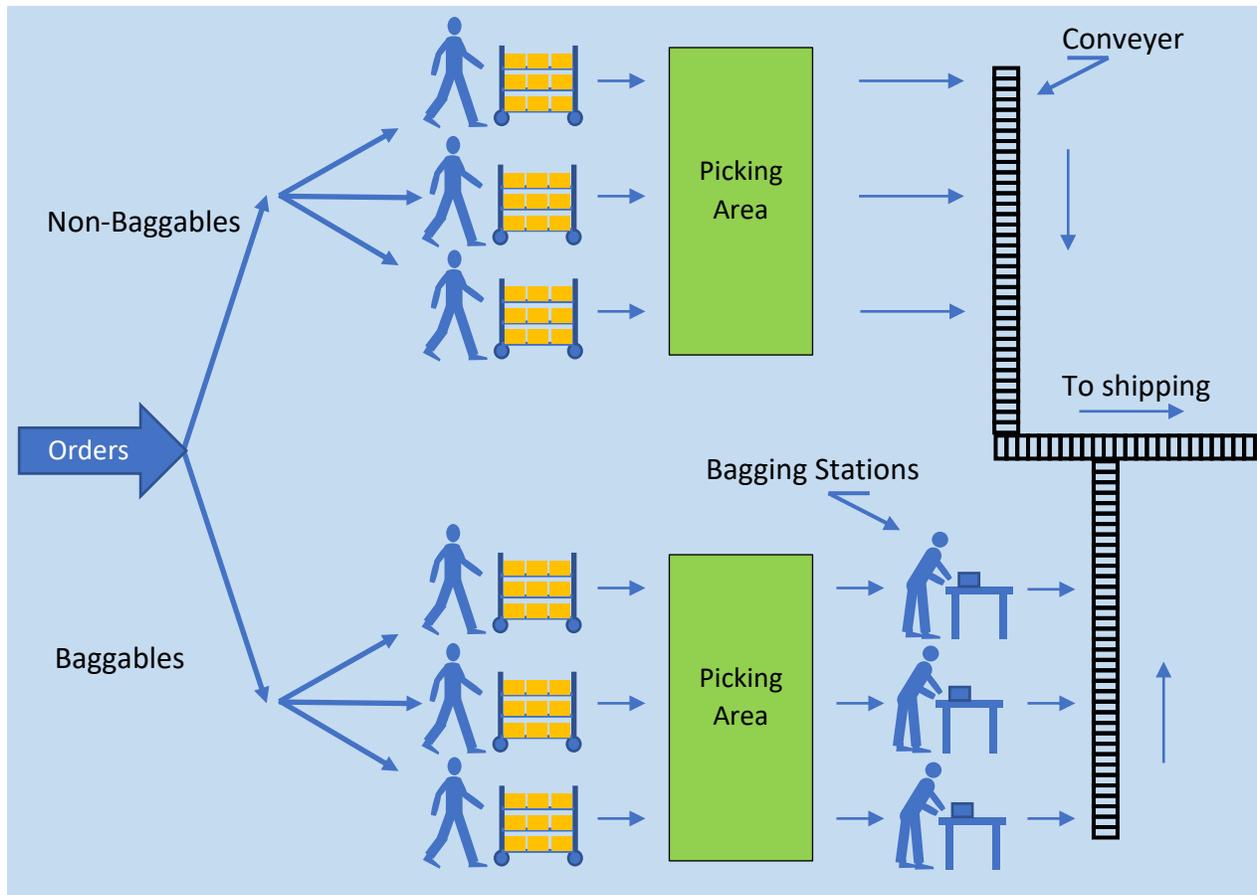
BuySeasons is a major online retailer of costumes, accessories, seasonal decor, and party supplies. Product offerings include costumes for children and adults, makeup, jewelry, wigs, masks, party favors, and party tableware. The Company operates from a 380,000 square foot operations and distribution facility in New Berlin, WI. In addition to its own eCommerce customers, BuySeasons also fulfills eCommerce orders from major retailers including Walmart, Amazon, Target, and JCPenny.

Legacy Order-Fulfillment Operations at BuySeasons

As depicted in the illustration below, the legacy picking strategy deployed at BuySeasons separated orders into two classes: Baggage orders (e.g., costumes) and non-baggage orders (e.g., party supplies, makeup, and jewelry). The non-baggage items were picked into shipping cartons and dropped off to a conveyer that transported completed orders to the shipping area. The baggage items were picked into totes and dropped off at a bagging station where they were manually matched with the order paperwork, labeled, and packaged into bags before being sent to the shipping area.

Using a manual selection process, groups of orders were assigned to individual carts. Although the manual assignment process sought to assign orders to carts so that travel through the picking area would be largely confined to a minimal number of zones, the manual assignment process was far from optimal. As a result, carts typically traversed multiple zones in order to pick all required items.

A voice-picking solution from a major supplier was employed to guide pickers to pick locations and to provide pick quantities. Approximately 100 voice-picking headsets were employed to handle peak demands. The voice-picking system was supplemented with RF guns to provide additional picking capacity as needed.



BuySeasons' Legacy Voice-Picking Operations

Especially during the peak season, the majority of BuySeasons' orders are single-item, baggable orders. BuySeasons therefore adopted a bulk-picking strategy to improve the efficiency of retrieving SKU's for single-item baggable orders. Their bulk-picking strategy utilized a cart to retrieve multiple units of a single SKU and deliver those items to the bagging area where they were matched with the order paperwork, labeled, packed into a bag, and placed on the conveyer destined for the shipping area.

Multi-item, baggable orders were picked by assigning groups of orders to carts containing totes. Although items for multiple orders were retrieved as the picker traversed the picking area, the batches of orders assigned to carts were not optimized to speed picking. Accordingly, pickers typically had to traverse a substantial portion of the picking area to gather the required items. Upon gathering the required items, the totes were dropped off at a bagging station.

Because their business is highly seasonable, BuySeasons needed to employ approximately 600 associates—most of them temporary workers—to meet peak order-fulfillment requirements in the two months before Halloween. After the peak season, most of the associates were terminated as workloads fell back to normal levels.

CHALLENGES

At the outset of the project, BuySeasons' historical order records were analyzed in order to compile statistics characterizing their orders. The key characteristics of BuySeasons' order profile were:

- A relatively large number of SKU's with a high percentage of slow movers
- A small number of items per order
- A sizable percentage of single-item, baggable orders
- Extreme surge in peak-season order volume

Because of the reliance upon temporary workers to meet peak-season order volumes, worker training presented a major challenge. In addition to the high labor cost associated with hiring many seasonal pickers and having to train those pickers each year, new distribution centers in the area tightened the labor market and made it increasingly difficult to recruit enough temporary workers to meet order demands at peak season.

BuySeasons' voice-picking system did not provide the productivity levels needed to accommodate peak-season demands. Although voice-picking enabled pickers to pick multiple orders on a single trip through the picking area, the batches assigned to the carts were not optimized. Accordingly, carts typically had to travel through much of the picking area to fulfill each batch. Furthermore, voice picking could not readily take advantage of the opportunities for cluster picks where items from a single pick location are distributed into multiple order locations on a cart.

After analyzing the current situation and working in concert with BuySeasons' management to project future needs, the following goals were established for a new order-picking system:

- 1) Double picking productivity
- 2) Significantly reduce the time required for training new workers
- 3) Provide ample agility to accommodate both peak-season and normal order volumes
- 4) Provide ample flexibility and scalability to accommodate future needs
- 5) Provide a short ROI

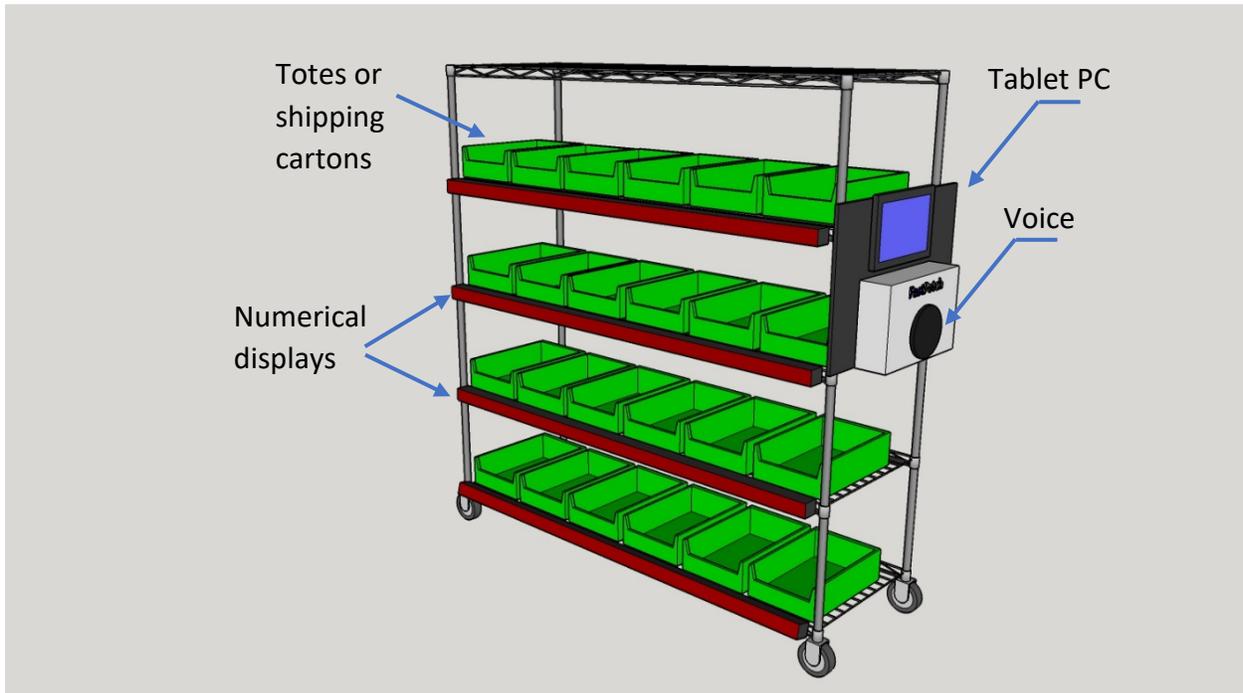
RECOMMENDATIONS

The FastFetch team made four key recommendations to improve BuySeasons' order fulfillment productivity. The four recommendations are discussed subsequently.

Recommendation 1: Adopt Batch-Picking Carts

Batch-picking carts can achieve high productivity by fulfilling multiple orders on a single pass through the picking area. As illustrated below, the recommended carts are equipped with a mobile tablet, a

barcode scanner, and lighted numerical displays beneath each cart location. All of the carts have 24 locations (either totes or shipping cartons) for storing picked items.



Batch-Picking Cart With Multimodal Picking Technologies

Carts employ three distinct technologies to increase the speed and accuracy of picking:

- **Voice** output directs the picker to the pick location and informs the picker of the pick quantity;
- **Barcode scanning** is employed to confirm that the correct product is picked;
- **Lighted numerical displays** highlight cart locations for each required put and display the quantity required.

The three technologies work in a complementary fashion to enable pickers to fulfill multiple orders simultaneously in a hands-free, eyes-up manner without having to look at a computer display or a piece of paper. This multimodal picking strategy yields fast and accurate picking with minimal training.

Recommendation 2: Maintain Separation Between Baggage and Non-baggage Picking Operations

Because baggable and non-baggable items are packaged differently, it was recommended that BuySeasons' legacy strategy of separating fulfillment activities between baggable and non-baggable items be maintained.

Recommendation 3: Pick Single-Item, Baggage Orders in Bulk

Since single-item, baggable orders comprise a high percentage of the total volume during peak season, creating an efficient strategy for fulfilling single-item, baggable orders was recognized as a key opportunity. While BuySeasons was already using a bulk-picking strategy for single-item, baggable orders, the individual carts retrieved multiple items of only a single SKU from the picking area and

delivered them to a bagging station. With the recommended cart configuration employing multimodal picking technologies, multiple quantities of multiple SKU's can be retrieved in bulk quickly and accurately.

Recommendation 4: Optimize Order Fulfillment Processes

Optimization of order fulfillment processes can provide a significant increase in throughput. The two aspects of BuySeasons' operations readily amenable to optimization were:

1. Minimizing the traversal path each cart takes through the picking area; and
2. Minimizing the number of picks required to fulfill a batch of orders.

Both opportunities are discussed below.

Minimizing the Traversal Path:

With batch picking, multiple customer orders are picked during a single trip through the picking area. But if orders are assigned to carts in a random fashion, carts will typically have to traverse a substantial portion of the picking area to gather all SKU's required for the batch. However, if orders are assigned to carts in a judicious manner, the required picks can be confined to fewer bays and the traversal paths required by the various carts will be minimized. FastFetch employs a proprietary algorithm to assign orders to carts in a manner that minimizes the total travel required to fulfill an entire wave of orders.

Minimizing the Number of Picks:

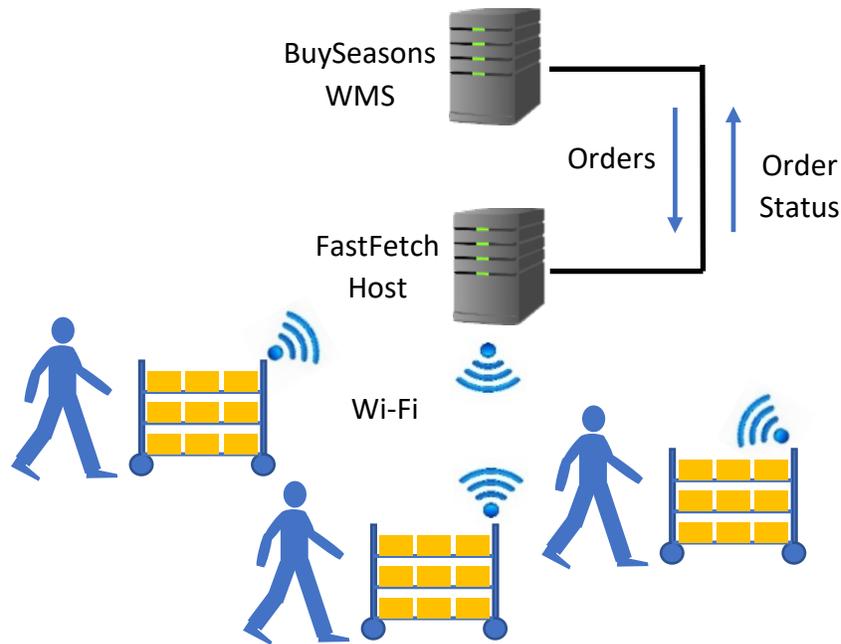
The order assignment algorithm tends to assign collections of orders to carts that have a substantial portion of SKU's in common or a substantial number of SKU's that are stored in close proximity to each other. Consequentially, when a cart arrives at a bay where products are to be picked, it is often the case that multiple orders require the same item. Picking time can be further minimized by recognizing opportunities for "cluster picking" where multiple items are gathered from a bay location and the required quantities of those items are distributed into all customer orders requiring the item. This form of picking is made possible by the use of numerical displays on cart locations to highlight put locations and put quantities.

THE SOLUTION

The system architecture recommended for BuySeasons is illustrated below. The BuySeasons WMS pushes orders to a FastFetch host which, in turn, assigns collections of orders to carts. Isolating the WMS from the picking processes eases the task of interfacing picking processes to the WMS and reduces risks that might potentially result from upgrades to the picking processes.

Order assignments are sent to the carts using a Wi-Fi link. Using a distributed database architecture, as items are picked, the cart tablets update their local databases as well as the central database maintained by the WMS. There is no requirement for continuous connectivity between the carts and the FastFetch host database. If a network link between the FastFetch host and a cart becomes

unavailable (for example, in a facility dead spot), the FastFetch host will synchronize its local database with the databases maintained on the carts whenever the network link becomes available.



Distributed Database Architecture

Bulk Picking of Single-Item, Baggable Orders:

Single-item, baggable orders are picked in bulk. The FastFetch host organizes single-item, baggable orders by SKU and identifies up to 24 distinct SKU's to be retrieved by each cart. The assignment strategy assures that SKU's assigned to a given cart are stored in close proximity to each other in the picking area. The assignment strategy therefore guarantees that each cart must traverse only a relatively small portion of the picking area in order to retrieve all required items.

The cart's tablet PC receives the list of SKU's required, the quantity of each SKU required, and the location of each SKU. Voice output, in the preferred language of the picker, is used to direct the picker to a pick location. When the cart arrives at a pick location, the picker scans the barcode on the pick location (or, alternatively, the barcode on the SKU itself), and the cart displays the required quantities of that SKU beneath the cart locations where the items are to be placed.

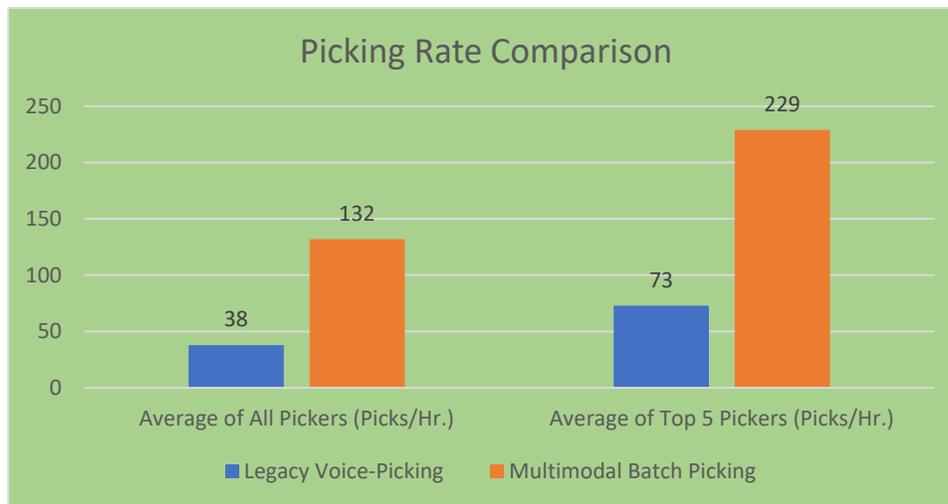
Upon picking the required quantity of the specified SKU, the picker waves a hand in front of the touchless light module (containing a light-sensitive proximity switch) to confirm that the pick has been completed. The tablet PC then uses voice output to direct the picker to the next pick location. This process continues until all required quantities of each required SKU are picked. When all required items have been picked, the totes and the order paperwork are dropped off at a packing station. The bulk-picking strategy for single-item baggable orders is quite efficient since the items required for perhaps several hundred orders are retrieved by a single cart on a single trip through the picking area.

Picking Multi-Item, Baggage Orders and Non-Baggage Orders:

Multi-item baggable orders and non-baggable orders are picked in the same way. However, baggable orders are picked into totes while non-baggable orders are picked directly into shipping cartons. The FastFetch host optimizes the assignment of orders to carts and sends the required picks to the tablet PC on each cart to update the cart's local database. Voice output, in the preferred language of the picker, is used to direct the picker to a pick location. When the cart arrives at a pick location, the picker scans the barcode on the pick location (or, alternatively, the barcode on the SKU), and the cart displays the required quantities of that SKU beneath the cart locations where the items are to be placed. The picker gathers the required items and confirms picks by waving a hand in front of the numerical display highlighting put locations on the cart. Not only is travel time through the picking area minimized as a result of the way the orders are assigned to carts, picking time is also minimized since the system recognizes opportunities to make a single pick and distribute those items into multiple cart locations highlighted by the numerical displays.

RESULTS

BuySeasons' legacy voice-picking system with 100 headsets was replaced by 40 multimodal carts. As shown in the chart below, BuySeasons' throughput rates (a combination of cart preparation, picking, and packing) improved substantially after installing the multimodal cart technology and implementing the recommendations for enhancing picking operations.



The average picking rate across all pickers—including inexperienced temporary workers—increased from 38 items/hour to 132 items/hour. The current picking rate is nearly 3.5 times the picking rate with the legacy system, handily surpassing the goal of doubling the average picking rate. Moreover, the picking rate for the top five pickers was more than tripled, from an average of 73 items/hour to 229 items/hour. The average picker productivity now substantially exceeds that of the top five pickers using the legacy system. Assuming a direct labor cost of \$15/hour, increasing the picking rate from 38

picks/hour to 132 picks/hour lowered the direct labor cost from 39 cents/pick to just 11 cents/pick. Replacing the 100 voice-picking units with 40 multimodal carts also lowered annual maintenance costs while yielding significantly higher reliability.

On BuySeasons' busiest day in 2016, using the legacy voice-picking system, 28,000 orders were shipped with 200 associates working in outbound (including pickers, packers, auditors, loaders, etc.). On their busiest day in 2017, using the FastFetch system, 40,000 orders were shipped using only 175 associates. This represents **a 63% increase in productivity**.

CONCLUSIONS

The installation of FastFetch's cart batch picking technology has been successful by every measure. Picking rates across all workers is now more than 3 times the rates achieved with BuySeasons' legacy voice-picking system. The productivity of the average pickers now substantially exceeds that of the very best picker using the legacy voice-picking system. Training time is no longer an issue. New pickers are now trained in about 10 minutes.

The new system excelled in accommodating peak-season order volumes. On BuySeasons' busiest day, the number of orders shipped with the new system increased by 12,000 over the busiest day in the previous year using their legacy system. As explained by Joe Plassmeyer, BuySeasons' Director of Operations, "During last peak season, we were able to ship 43% more orders with 12% less labor on our biggest day. We now have plans to scale back from three full shifts down to a single 12-hour shift during our next peak season."

The cart-based, batch-picking strategy has proven to be sufficiently agile to accommodate both normal and peak-season order volumes. Furthermore, the cart-based strategy provides ample flexibility in meeting future needs since the number of carts deployed can readily be matched to the order volume.

Jack Peck, President and CEO of FastFetch, attributed the significant increase in picking productivity to three key elements: "First, is the multimodal, batch picking technology—utilizing a combination of voice, barcode scanning, and light-directed placement—to gather items from picking bays into cart locations quickly and accurately. The second is our emphasis upon optimization. We optimize the assignment of orders to carts to minimize travel through the picking area and to maximize cluster picking of common SKU's so that the picker can distribute items into multiple customer orders with a single pick. The third key productivity enhancement is our bulk picking strategy for single-item, baggable orders which enables a picker to retrieve multiple quantities of up to 24 SKU's on a single cart. With our bulk picking strategy, pickers retrieve items for perhaps hundreds of orders on a single trip through the picking area."

The entire system was installed, tested, and placed into production in less than 30 days. As noted by Erik Kirkhofer, BuySeasons' COO, "This was the smoothest installation I have ever experienced."