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How to Select a Split Case Picking System

Track 4 Session 6

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Abstract

This omnipotent presentation provides an objective and unbiased comparison of multiple leading split case order picking technologies. Each technology solution will be described with pros and cons, "best fit" applications, labor requirements, price points, and more. Solutions discussed will include voice-directed picking, pick to light, and multiple Goods to person systems including Multishuttle, Autostore, Miniload ASRS, horizontal carousels, and Kiva bot-based systems.

Agenda

Scenario	Concept	Environment	System / Technology
1	Person to Goods	Paper-Based	Paper Pick List
2	Person to Goods	RF	RF Scanning
3	Person to Goods	Pick to Cart	Pick to Light, Voice or RF
4	Person to Goods	Pick to Light	Pick to Light to Conveyor
5	Person to Goods	Voice / RF	Voice with Optional RF
6	Goods to Person	Automated	Horizontal Carousel
7	Goods to Person	Automated	Miniload ASRS
8	Goods to Person	Automated	AutoStore
9	Goods to Person	Automated	Kiva Systems
10	Goods to Person	Automated	Multi-Shuttle

Opening Comments

- **In this presentation we compare different several strategies for split case order picking**
- **It is very difficult to generalize when discussing so many different solutions within a 60 minute presentation and we do not have time to cover all solutions**
- **Our goal is to provide objective fact-based information to help people understand why certain technologies / systems fit in certain environments**

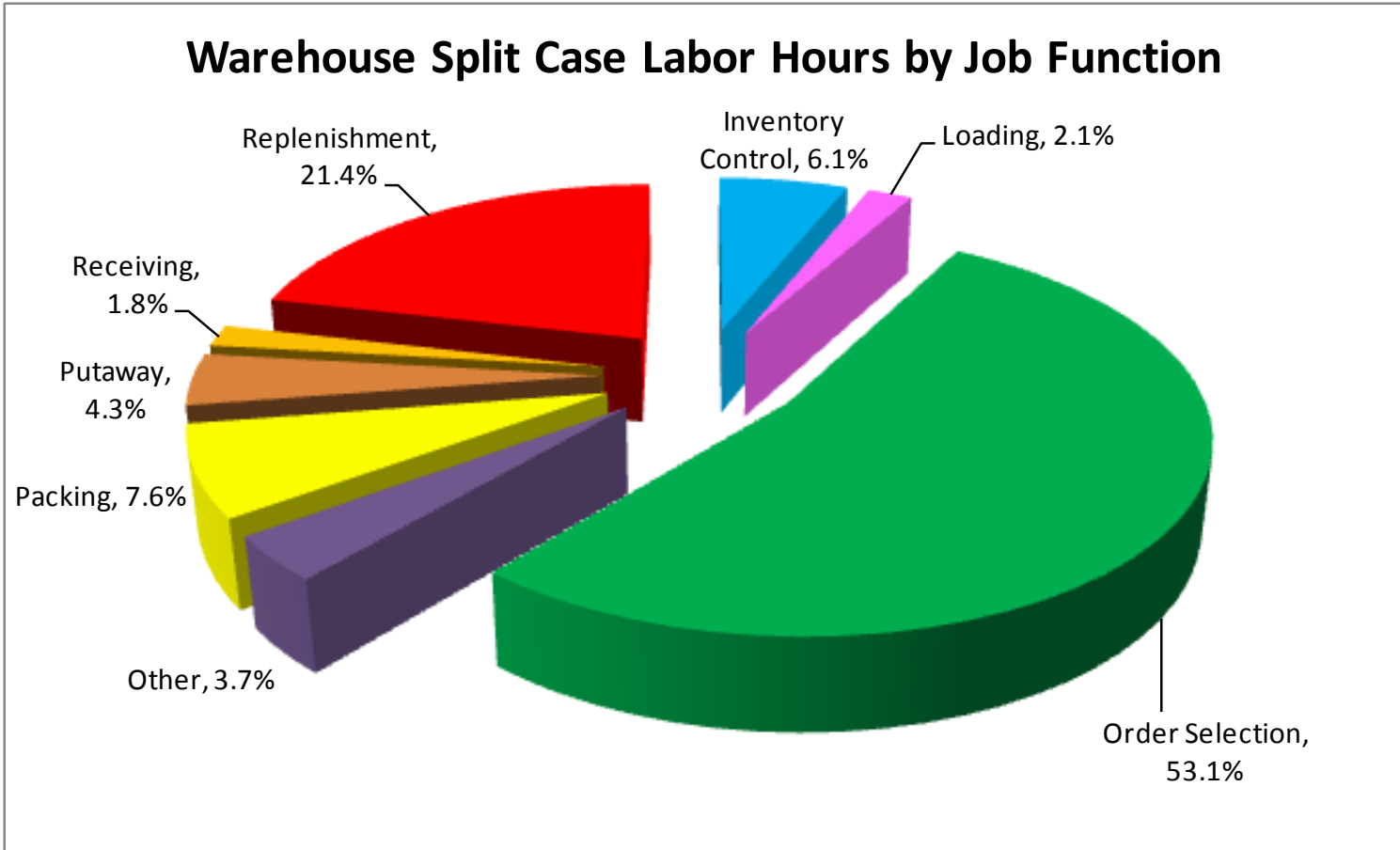
Warehouse Labor Breakdown

Split Case & Full Case Retail Distribution 4.3M Pieces/Wk

High Volume Split Case / Full Case Operation Shipping 4.3 Million Pieces/Week	Job Function	Throughput Rate (Based on Paid Hours)	Metric per Hour	Split Case (Total Hours)	Full Case (Total Hours)	Total Annual Hours (All-Inclusive)
Warehouse Direct Labor Activity						
Receiving	Receiving	46.5	Inbound Lines	10,592	4,162	14,755
Putaway	Putaway	19.4	Inbound Lines	25,412	9,986	35,398
Replenishment / Letdown - Split Case	Replenishment	9.4	Inbound Pallets	52,397	-	52,397
Replenishment / Letdown - Full Case	Replenishment	23.6	Inbound Pallets	-	8,202	8,202
Flow Rack Cutting / Stuffing	Replenishment	180	Inbound Cases/Hour	73,495	-	73,495
Split Case Order Selection	Order Selection	761	Outbound Pieces/Hour	286,590	-	286,590
Full Case Order Selection	Order Selection	92.6	Outbound Cases/Hour	-	55,987	55,987
Leads	Order Selection	9,820	Outbound Pieces/Hour	17,296	5,428	22,724
Wait Chasing - Split Case	Order Selection	23,675	Outbound Pieces/Hour	9,206	-	9,206
Wait Chasing - Full Case	Order Selection	1,794	Outbound Cases/Hour	-	2,890	2,890
Stacking to Pallets	Packing	138.7	Outbound Totes/Hour	44,533	-	44,533
Loading	Loading	15.5	Outbound Pallets/Hour	12,333	8,342	20,675
Inventory Control	Inventory Control	4,758	Outbound Pieces/Hour	35,697	11,202	46,899
Pallet Sortation	Other	140	In&Out Pallets/Hour	4,892	2,309	7,201
Tote Hauling Putaway	Other	515	Outbound Totes/Hour	11,995	-	11,995
Returns/Dammage Processing	Other		Outbound Pieces/Hour	5,023	119	5,142
Cross Dock Labor: Inbound	Cross Dock	20.0	Outbound Pallets/Hour	-	6,448	6,448
Cross Dock Labor : Outbound	Cross Dock	20.0	Outbound Pallets/Hour	-	9,678	9,678
Subtotal Direct Labor		121.0		589,461	124,754	714,215

Distribution Center Labor

Division of Labor by Job Function for Split Case



In split case warehouse operations, order picking is costly and typically accounts for 50-55% of warehouse labor expense. Putaway and Replenishment work typically accounts for 25+% of labor expense.



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Person to Goods Picking Strategies

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Paper Based (Pick to List) Order Picking

- **Person to Goods (PTG) Picking with Paper Lists or labels:**

- Still the solution of choice for a majority of warehouses around the world
- Pick lists are printed and used to guide the picking process
- Pick Lists are also used to confirm order at packing / shipping

- **Benefits:**

- Simplest form of picking technology
- Inexpensive
- Minimal technology requirements



- **Shortcomings:**

- Managing a high volume of manual paper lists is inefficient and error prone
- Low productivity / accuracy
- Can cause throughput capacity constraints within an operation
- Not real-time

Paper Based (Pick to List) Order Picking

- **When to Consider**

- Low volume throughput warehouse operations
- Temporary facilities
- Low value product being shipped in small volumes
- Environments where it is difficult to cost justify investments into technology such as in low wage countries

Investment	Minimal: e.g. \$5,000
Receiving / Putaway Rate	15 – 25 lines per hour
Replenishment Rate	20 – 35 lines per hour
Order Picking Rate (Typical)	35 – 75 lines per hour
Order Picking Rate (High end)	75 – 150 lines per hour
Labor Cost per Pick	\$0.10 - \$0.43 ⁽¹⁾
Accuracy rate	95.0% - 98.0%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Radio Frequency (RF) Directed Picking

- **Person to Goods Picking with an RF Device:**
 - Pick instructions displayed via wireless RF devices
 - Operators may be assigned to pick zones
 - Scan location and/or product barcode to verify pick accuracy
- **Benefits:**
 - Real-time dispatch and balancing of work and productivity tracking
 - Data capture enabled (e.g. lot#)
 - Higher degree of accuracy than paper
 - Relatively low investment cost



- **Shortcomings:**
 - Scanning items and handling an RF scanner can slow down picking function
 - Typically too slow for high volume operations

Radio Frequency (RF) Directed Picking

- **When to Consider**

- Can be used for all warehouse labor functions from receiving to shipping to ensure real-time accuracy for all inventory movement
- RF picking is most suited for slow / medium velocity environments where barcodes are available at the product or inventory container level
- RF picking is also suitable for environments where item-specific data capture is essential such as serial number

Investment	\$3,000 - \$5,000 per RF unit + \$30 – 150,000 for RF network + cost of WMS
Receiving / Putaway Rate	15 – 25 lines per hour
Replenishment Rate	20 – 35 lines per hour
Order Picking Rate (Typical)	50 – 75 lines per hour
Order Picking Rate (High end)	75 – 125 lines per hour
Labor Cost per Pick	\$0.12 - \$0.30 ⁽¹⁾
Accuracy rate	99.0% - 99.90%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Voice or RF Picking to Cart With Lights

- **Person to Goods Voice-or RF Directed Cluster Picking to a Mobile Cart with Pick to Light**

- Typically used for cluster picking environment (e.g. 12 orders picked per trip)
- Each order assigned to a container
- Operator directed through pick line
- RF or Voice or Lights to confirm pick
- Put to Light to confirm put

- **Benefits:**

- Reduce travel time by picking multiple orders in 1 trip
- Flexibility to easily add more item variety over time



- **Shortcomings:**

- Long pick path as per SKU count
- Carts are heavy and bulky to maneuver and need wider aisles
- 'Put' process requires a high degree of discipline to sort child orders/quantities into correct containers

Voice or RF Picking to Cart With Lights

- **When to Consider**

- Best used in slow or medium velocity pick environments where there is a high variety of slow moving SKUs spread across a lengthy pick line at floor level
- Suited for SKUs that can fit inside a tote or container that are not excessively heavy to lift

Investment	\$4,000 - \$10,000 per mobile cart + \$30 – 150,000 for RF network + cost of WMS
Receiving / Putaway Rate	15 – 25 lines per hour
Replenishment Rate	20 – 35 lines per hour
Order Picking Rate (Typical)	75 – 100 lines per hour
Order Picking Rate (High end)	100 – 130 lines per hour
Labor Cost per Pick	\$0.115 - \$0.20 ⁽¹⁾
Accuracy rate	99.0% - 99.75%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Pick to Lights With Conveyors

- **Person to Goods Pick to Light to Conveyor**

- Operators are assigned to specific pick zones alongside conveyor
- Each pick location is equipped with a light and a readout display
- Operator scans tote/carton ID(s) to invoke pick tasks for the order
- Operator presses lighted button to validate pick accuracy

- **Benefits:**

- Enables high speed order picking for high volume throughput operations
- Conveyors reduce travel time
- Highest levels of picking accuracy
- Dynamic workload balancing & Pick & Pass can be supported



- **Shortcomings:**

- System cost is a function of the SKU count – each pick location requires a light
- One picker per zone
- Data capture is challenging
- Requires accurate replenishment

Pick to Lights With Conveyors

- **When to Consider**

- Best used in high velocity pick environments where there is a high volume of order lines associated with a low to medium variety of SKUs
- Suited for SKUs that can fit inside a tote or container that is conveyable
- Also suitable for reverse picking or “put to store” concept widely used in retail apparel

Investment	\$100 - \$130 per location + \$50 – 250,000 for software + cost of WMS
Receiving / Putaway Rate	15 – 25 lines per hour
Replenishment Rate	20 – 35 lines per hour
Order Picking Rate (Typical)	100 – 225 lines per hour
Order Picking Rate (High end)	225 – 325 lines per hour
Labor Cost per Pick	\$0.046 - \$0.15 ⁽¹⁾
Accuracy rate	99.95% - 99.99%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Voice Directed Picking With RF Option

- **Person to Goods Voice Directed Picking**

- Pick instructions relayed to operators via wireless voice devices
- Operator dialogues via headset to validate pick location, item code, UPC or other alias code to verify pick accuracy
- Option to combine with RF scanning for required data capture function (e.g. lot#)

- **Benefits:**

- Hands-free operation highly suited for handling full cases, heavy or bulky items
- More efficient than paper or RF picking by 20% - 30%
- Flexibility due to dynamic workload balancing – operators can work in all zones
- Fast learning curve: Easy to train



- **Shortcomings:**

- Data capture requires use of RF device which will slow down the pick process
- May be too slow for high volume split case picking environments

Voice Directed Picking With RF Option

- **When to Consider**

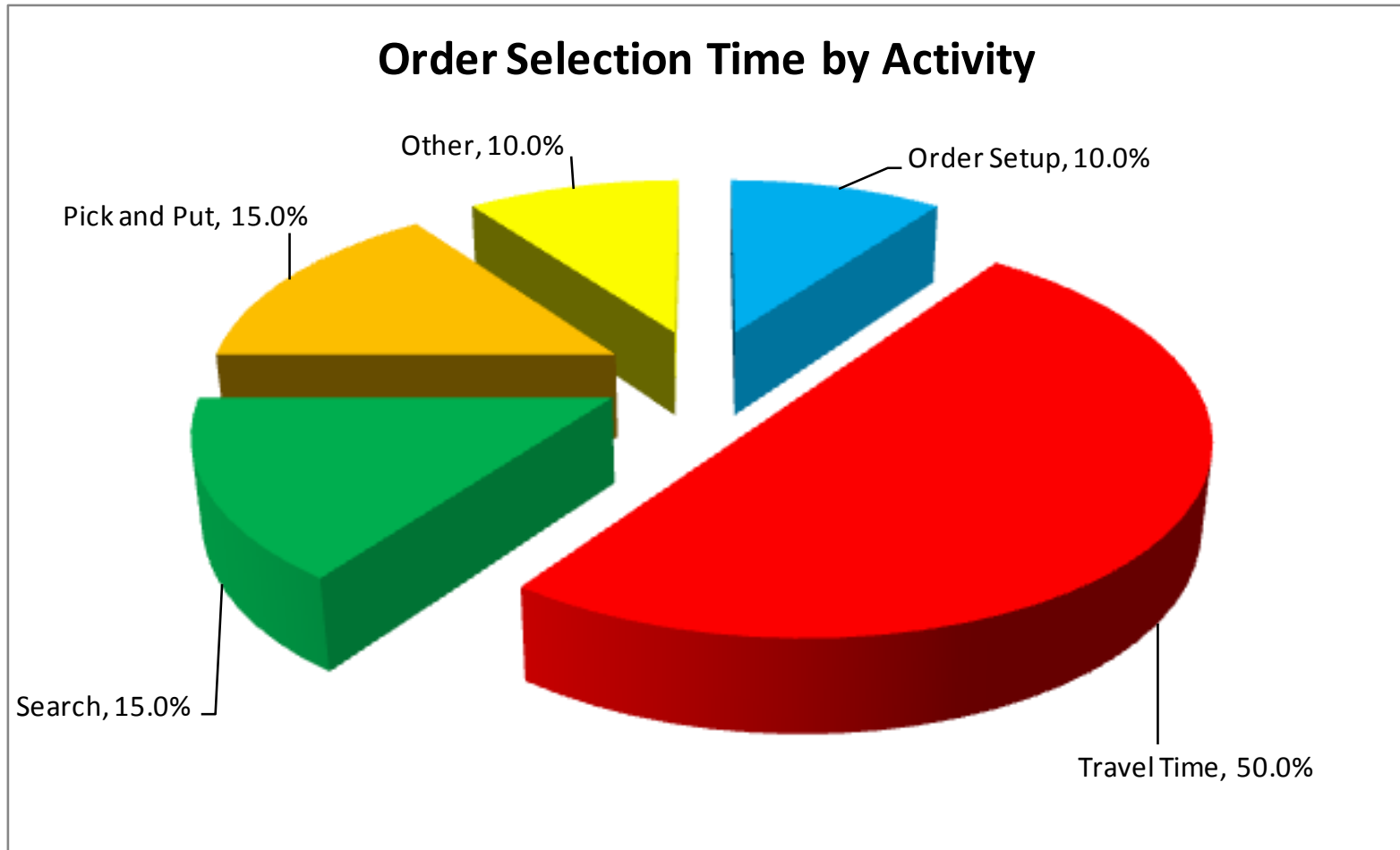
- Best used in high velocity full case pick environments where the benefit of hands free is realized
- Ideal for cold storage environments
- Ideal for split case environments where SKU variety is high and pick to light is too expensive

Investment	\$3,000 - \$7,500 per voice unit + \$50 – 100,000 for software + cost of WMS
Receiving / Putaway Rate	15 – 25 lines per hour
Replenishment Rate	20 – 35 lines per hour
Order Picking Rate (Typical)	100 – 175 lines per hour
Order Picking Rate (High end)	175 – 225 lines per hour ⁽²⁾
Labor Cost per Pick	\$0.067 - \$0.15 ⁽¹⁾
Accuracy rate	99.95% - 99.99%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

(2) Rates can be higher if batch picking of full cases to conveyor belt picking is used

Order Selection Time Breakdown



Travel time typically accounts for 50+% of the order selection job function which is why goods to person systems can significantly improve productivity.



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Goods to Person Picking Strategies

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Horizontal Carousels

- **Goods to Person to Horizontal Carousels**

- Products stored in bin locations within horizontal rotating carousels which are typically setup as a set of 2 – 3 pods per operator / pick station
- Carousels rotate to bring required product to operator
- Operator picks one or more orders at a time and confirms via RF scanner or voice terminal
- Remaining carousels rotate to prepare for next pick to minimize dwell time

- **Benefits:**

- No travel time therefore higher pick rates
- No operating aisles – high density storage
- Can accommodate a high SKU variety in small warehouse footprint



- **Shortcomings:**

- Replenishment of carousel requires quiet time with no picking; or a slow down in the overall throughput of machine
- Throughput capacity of carousel is limited by maximum operator pick rate

Horizontal Carousels

- **When to Consider**

- If the entire system is intelligently designed with put to light to batch pick multiple orders concurrently, carousels can be used to support high-speed high-throughput split case environments
- However, more typical application is for slow moving parts storage where throughput is relatively low
- Most suitable for small cube SKUs that have high order lines

Investment	\$75,000 - \$125,000 per carousel + \$100,000 cost of WCS & WMS
Receiving / Putaway Rate	40 – 115 lines per hour
Replenishment Rate	Can potentially be eliminated ⁽²⁾
Order Picking Rate (Typical)	150 – 350 lines per hour
Order Picking Rate (High end)	350 – 600 lines per hour
Labor Cost per Pick	\$0.025 - \$0.010 ⁽¹⁾
Accuracy rate	99.85% - 99.95%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

(2) Carousels are now available combined with automated ASRS miniload machines that perform concurrent extraction and replenishment functions such that shut down is not required during picking operations

ASRS Miniload

- **Goods to Person to Miniload ASRS**

- At receiving, products are placed into standardized entities (containers or pans) that get conveyed to induction points for the miniload ASRS system
- ASRS automatically stores and retrieves containers into a storage buffer
- ASRS extracts and deposits containers either to dynamic floor-level pick locations; or to conveyors for transfer to picking workstations
- Operator picks required SKU/Quantity and container with residual inventory is conveyed back to ASRS miniload to be returned to storage



ASRS Miniload

- **Benefits:**

- No travel time therefore higher pick rates
- Eliminates putaway and replenishment labor
- Product can be stored in original cartons
- Very narrow aisles (e.g. 36") for ASRS machine therefore high density storage
- Can accommodate a high SKU variety in small warehouse footprint
- Can be deployed up to 60' high

- **Shortcomings:**

- Medium to slow throughput capability
- Throughput capacity of Miniload ASRS is limited to the machine's vertical and horizontal speed therefore only a limited number of cycles (70 – 150) available per aisle



ASRS Miniload

- **When to Consider**

- High variety of slow moving parts that require high density storage to minimize warehouse space requirements
- Ideal for environments where high speed order turnaround time is a need or presents a competitive advantage
- Ideal for products that require a secure storage environment or for kitting operations

Investment	\$500 – 750,000 per ASRS Miniload Aisle + WCS & WMS + \$100 – 250K services
Receiving / Putaway Rate	40 – 160 lines per hour
Replenishment Rate	Eliminated
Order Picking Rate (Typical)	150 – 175 lines per hour
Order Picking Rate (High end)	175 – 200 lines per hour
Labor Cost per Pick	\$0.075 - \$0.10 ⁽¹⁾
Accuracy rate	99.95% - 99.99%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Click&Pick™ Powered by AutoStore

- **Goods to Person**
Click&Pick™ System

- At receiving, products are placed into standardized totes that get conveyed to induction points for the AutoStore system
- Robotic mobile vehicles move on an XY axis atop a 17' high storage buffer consisting of vertical stacks of totes
- Robots automatically retrieve totes from the vertical stacks for presentation at picking work stations
- Operator picks required SKU/Quantity and tote with residual inventory is returned back to the top of the cube to be stored in a vertical stack



Autostore robots are equipped with a hoist that uses 4 rollup steel bands that reach into a stack to pull out the tote.

Click&Pick™ Powered by AutoStore

- **Benefits:**

- No travel time therefore higher pick rates
- Operators can pick one or many orders concurrently
- Eliminates putaway and replenishment labor
- Top of Grid is at 17'-3" in height – no operating aisles or lost space. Preferred height is 22' CSH
- Can accommodate a very high SKU variety in small warehouse footprint
- Self-optimizing slotting system - faster movers always at the top of the cube
- Highly secure storage environment
- Flexibility to easily expand system

- **Shortcomings:**

- Constrained to 16' of product height usage (but it can be put on a mezzanine)
- Robots run on batteries and are available for 22 hours/day



Click&Pick™ Powered by AutoStore

- **When to Consider**

- High variety of slow moving parts that require high density storage to minimize warehouse space requirements
- Ideal for environments where products can fit inside the standard dimensional (15.75" wide x 23.6" long x 12.2" or 7.9" high) and weight (65 LBs) constraints of the tote
- Ideal for products that require a secure storage environment
- Also being used for high volume retail (e.g. Walmart ASDA UK)

Investment	\$1 Million for 10 robots with 1 station for picking + 1 station for replenishment for up to 5,000 SKUs
Receiving / Putaway Rate	40 – 160 lines per hour
Replenishment Rate	Eliminated
Order Picking Rate (Typical)	250 – 300 lines per hour
Order Picking Rate (High end)	300 – 600 lines per hour
Labor Cost per Pick	\$0.025 - \$0.06 ⁽¹⁾
Accuracy rate	99.95% - 99.99%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

KIVA Systems

- **Goods to Person to KIVA System**
 - At receiving, products are replenished to shelving pods that are retrieved and transported by KIVA robots
 - At picking, KIVA robots fetch the shelving pods (or pallets) and transport them to work picking station(s) where operators perform continuous picking
 - Operator typically picks multiple orders concurrently with the aid of a laser pointer and put to light to ensure accuracy
 - Robot returns shelf pod back to storage area



KIVA robots optimally transport shelf pods or pallets to picking work stations to minimize operator dwell time

KIVA Systems

- **Benefits:**

- No travel time therefore higher pick rates
- Operators typically pick 1 to 6 orders concurrently
- Eliminates putaway and replenishment labor
- Sophisticated software used to optimize all robot activity to minimize investment requirement and labor efficiency
- Highest flexibility to expand or relocate system to a new building

- **Shortcomings:**

- Acquired by Amazon has caused concerns and uncertainty in the market place
- System makes poor use of height unless extensive infrastructural mezzanines / elevators / conveyors are used
- Pick station ergonomics not optimal



KIVA Systems

- **When to Consider**

- No competitive relationship to Amazon
- Highly dynamic and unpredictable growth rates (internet order fulfillment) whereby a there is a high need for flexibility, adaptability and scalability with minimal infrastructural ties to the floor
- Low ceiling height buildings
- Companies seeking a high “wow” factor as part of their marketing efforts

Investment	DC with 50 -100 robots costs between \$2 to 4 Million
Receiving / Putaway Rate	40 – 160 lines per hour
Replenishment Rate	Eliminated
Order Picking Rate (Typical)	300 – 500 lines per hour
Order Picking Rate (High end)	500 – 800 lines per hour
Labor Cost per Pick	\$0.019 - \$0.05 ⁽¹⁾
Accuracy rate	99.95% - 99.99%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Multi-Shuttle System

- **Goods to Person to Multi-Shuttle System**
 - At receiving, split case products are placed into standard entities (containers or trays). Full cases can be stored as is.
 - Goods conveyed to induction points at a storage buffer. Vertical lifts transport containers to storage levels. Shuttle robots powered by busbars store and retrieve goods up to 2-deep.
 - Operator typically picks 1,6,24 or more orders at work station
 - Residual inventory in container is moved by robotic shuttle back into the storage buffer



Multi-shuttle robots automatically store and retrieve cases, totes or trays in a 2-deep storage buffer for presentation to pick work stations

Multi-Shuttle System

- **Benefits:**

- Incoming containers are presented within 1 second of outgoing container being taken away which yields the highest levels of picking productivity
- Ergonomic workstations can be designed for operators to pick 1, 6, or 24+ orders concurrently
- Eliminates putaway and replenishment labor
- Extremely high throughput and storage capacity up to 40' high
- Robotic shuttles can roam across vertical levels or to other aisles in the storage buffer

- **Shortcomings:**

- Capital investment requirement requires high throughput volume to be justified
- Certain size and weight restrictions apply for the shuttle to be able to handle the product



Pick work stations are typically configured to pick 1, 6, 24 or more orders at a time. Pick rates slow down as this number increases.

Multi-Shuttle System

- **When to Consider**

- Extremely high split case throughput environments where high productivity is critical to success
- High speed order turnaround time enables competitive advantage
- High security / high availability requirement
- Storage buffer needed for sequencing of containers in between the picking and palletizing process (e..g. ensure heaviest totes are place at bottom of pallet)

Investment	\$650,000 - \$1.2 Million per operating aisle depending on the number of shuttle robots needed
Receiving / Putaway Rate	40 – 160 lines per hour
Replenishment Rate	Eliminated
Order Picking Rate (Typical)	300 – 500 lines per hour
Order Picking Rate (High end)	500 – 800 lines per hour
Labor Cost per Pick	\$0.019 - \$0.05 ⁽¹⁾
Accuracy rate	99.95% - 99.99%

(1) Based on fully loaded direct labor wage rate of \$US 15.00 per hour

Other Systems Not Reviewed

- **Due to time constraints, we cannot discuss all systems. The ones we omitted from this presentation include:**
 - Vertical lift modules / carousels
 - Carousels with ASRS Miniload extractors
 - Automated dispensing systems
 - Tilt Tray Sorters
 - A-Frames
 - Case sequencers

Executive Summary of Options – Part 1

Scenario	Concept (1)	Environment	System / Technology	Capital Investment Overview
1	PTG	Paper-Based	Paper Pick List	Minimal: \$5 - \$10K
2	PTG	RF	RF Scanning	\$3-5K / User + \$30 - 150K for infrastructure
3	PTG	Pick to Cart	Pick to Light, Voice or RF	\$4-10K / Cart + \$30 - 150K for infrastructure
4	PTG	Pick to Light	Pick to Light to Conveyor	\$100 - \$130 per location + \$50 – 250K for infrastructure
5	PTG	Voice / RF	Voice with Optional RF	\$3 - \$7.5K per voice unit + \$50 – 100K for infrastructure
6	GTP	Automated	Horizontal Carousel	\$75 - \$125K per carousel + \$100K cost of infrastructure
7	GTP	Automated	Miniload ASRS	\$500 – 750K per ASRS Miniload Aisle + \$100-250K services
8	GTP	Automated	AutoStore Click&Pick™	\$1 Million for 10 robots with 1 station for picking + 1 station for replenishment for up to 5,000 SKUs.
9	GTP	Automated	Kiva Systems	DC with 50 -100 robots costs between \$2 to 4 Million
10	GTP	Automated	Multi-Shuttle	\$650,000 - \$1.2 Million per operating aisle depending on the number of shuttle robots needed.

Executive Summary of Options – Part 2

Scenario	System / Technology	Receiving -Putaway Rate (LPH)	Replenishment Rate (LPH)	Order Picking Rate Typical (LPH)	Order Picking Rate High (LPH)	Labor Cost per Pick	Accuracy Rate
1	Paper Pick List	15 - 25	20 - 35	35 - 75	75 - 150	\$0.10 - \$0.43	95.0% - 98.00%
2	RF Scanning	15 - 25	20 - 35	50 - 75	75 - 125	\$0.12 - \$0.30	99.0% - 99.90%
3	Pick to Cart	15 - 25	20 - 35	75 - 100	100 - 130	\$0.115 - \$0.20	99.0% - 99.75%
4	Pick to Light to Conveyor	15 - 25	20 - 35	100 - 225	225 - 325	\$0.046 - \$0.15	99.95% - 99.99%
5	Voice with Optional RF	15 - 25	20 - 35	100 - 175	175 - 225	\$0.067 - \$0.15	99.95% - 99.99%
6	Horizontal Carousel	40 - 115	0	150 - 350	350 - 600	\$0.025 - \$0.010	99.85% - 99.95%
7	Miniload ASRS	40 - 160	0	150 - 175	175 - 200	\$0.075 - \$0.10	99.95% - 99.99%
8	AutoStore Click&Pick™	40 - 160	0	250 - 300	300 - 600	\$0.025 - \$0.06	99.95% - 99.99%
9	Kiva Systems	40 - 160	0	300 - 500	500 - 800	\$0.019 - \$0.05	99.95% - 99.99%
10	Multi-Shuttle	40 - 160	0	300 - 500	500 - 800	\$0.019 - \$0.05	99.95% - 99.99%

Executive Summary of Options – Part 3

Scenario	System / Technology	Benefits	Shortcomings
1	Paper Pick List	Simple and Inexpensive	Low productivity and accuracy Not real time
2	RF Scanning	Real time data capture at a low investment	Too slow for high volume picking due to handling device/scanning
3	Pick to Cart	Less travel time due to cluster picking	Carts are heavy and slow to maneuver and put errors can easily be made
4	Pick to Light to Conveyor	High speed picking with high accuracy and dynamic balancing	High cost solution when SKU count is high, limited data capture
5	Voice with Optional RF	Hands free, fast learning curve, Flexible to use across entire DC	May be too slow for some high volume operations
6	Horizontal Carousel	No travel time, high density storage therefore low footprint	Carousel replenishment requires quiet time; constrained throughput capacity
7	Miniload ASRS	No travel time, high density storage therefore low footprint up to 60'	Slow to Medium throughput capability
8	AutoStore Click&Pick™	High pick rates, high accuracy, high storage density for large SKU count	Constrained to 16' of height and robots run on batteries
9	Kiva Systems	High pick rates and flexible system to relocate	Amazon acquisition causing market uncertainty; weak use of height
10	Multi-Shuttle	High pick rates, high accuracy, highest throughput, flexibility	Higher capital investment requirement

Executive Summary of Options – Part 3

Order Lines Throughput per Day

Scenario	System / Technology	Order Lines Throughput per Day									
		0 to 1,000	1,000 to 5,000	5,000 to 10,000	10,000 to 15,000	15,000 to 20,000	20,000 to 25,000	25,000 to 50,000	50,000 to 100,000	100,000 to 150,000	150,000 to 250,000+
1	Paper Pick List	Strong Fit	Moderate Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit
2	RF Scanning	Strong Fit	Strong Fit	Strong Fit	Moderate Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit
3	Pick to Cart	Strong Fit	Strong Fit	Moderate Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit
4	Pick to Light to Conveyor	Moderate Fit	Moderate Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit
5	Voice with Optional RF	Moderate Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Moderate Fit
6	Horizontal Carousel	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Moderate Fit	Moderate Fit	Weak Fit	Weak Fit	Weak Fit
7	Miniload ASRS	Weak Fit	Strong Fit	Strong Fit	Strong Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit	Weak Fit
8	AutoStore Click&Pick™	Weak Fit	Weak Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Moderate Fit	Moderate Fit
9	Kiva Systems	Weak Fit	Weak Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Moderate Fit	Moderate Fit
10	Multi-Shuttle	Weak Fit	Weak Fit	Weak Fit	Moderate Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit	Strong Fit

Strong Fit
Moderate Fit
Weak Fit

Key Takeaways

- **We have looked at 10 different split case picking systems at a high level ; there are also others that we did not have time for.**
- **There is no such thing as a “best technology” because the business requirements vary by type of operation**
- **Choosing a split case picking system with a good fit requires an understanding of the distribution center operational profile, shapes and sizes of products, flexibility requirements, overall throughput volumes, etc.**
- **As volumes increase above 10,000 order lines/day , the fit for automation solutions starts to provides more shareholder value**

Session Smarts

Additional Resources



The following white papers are available with much further detail:

- http://www.mwpvl.com/html/swisslog_autostore_review.html
- http://www.mwpvl.com/html/kiva_systems.html
- http://www.mwpvl.com/html/dematic_multishuttle_review.html
- http://www.mwpvl.com/html/order_pick_technologies.html



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Questions