FIND YOURS.

Collaborative Robots & the Supply Chain of the Future

Presented by:

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We’re Playing in a Big Market

The US e-commerce market is growing at a 10% compound annual growth rate. Total domestic e-commerce revenue will top $650 billion by 2021.

Of the $504,000,000,000 (that’s billions) in e-commerce sales last year, Amazon sales accounted for about 1/3.

Warehouse workers have seen their hourly wage increase by more than 30% since 2001.

While you’ve been reading this slide, 39,642 items have been picked from warehouse shelves in the USA.
Today’s Warehouse Challenge

Piece ("each") Picking
The Amazon Effect

Forecast E-Commerce Revenue Growth (10% CAGR)

E-Commerce Labor

Consumer Expectations

VIP Service

Express Delivery

Gift wrap

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FIND YOUR WOW
The Amazon Effect

Forecast E-Commerce Revenue Growth (10% CAGR)

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VIP Service
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Consumer Expectations
Demand for Labor is Highly Seasonal

- Typical E-Commerce Warehouse Pick Volume

Peak Season:
- Peak: Low = 13X
- Peak: Average = 4X

Low Season

- Layoff 80% of workforce here
- Hire here: 5X workforce
- Train workers @ $1,000 each

Average Volume

- Train workers @ $1,000 each

Month: January, February, March, April, May, June, July, August, September, October, November, December
Solving the Piece-Picking Puzzle

- Productivity
- Flexibility
- Innovation
- Insights
Typical E-Commerce Scenarios

- **Back to School**
  - Gym shorts
  - Spiral notebooks
  - Backpack
  - Penny loafers

- **Office Supplies**
  - Paper clips
  - Post-it notes
  - USB drives
  - File folders

- **Personal Care Purchases**
  - Multivitamins
  - Razor blades
  - Cosmetics

- **Holiday Shopping**
  - Katie: camera drone
  - Roberto: video games
  - Ahmed: Building blocks
  - Simone: 3D puzzle
  - Caroline: perfume

- **Household Purchases**
  - Batteries
  - Paper towels
  - Dog treats
  - Cleaning wipes
Typical E-Commerce Scenarios

Giftwrap

Giftwrap
Traditional Cart Picking

- Worker walks 10 – 15 miles per day, including...
  - Non-productive walks between picks
  - Non-productive time between aisles and pack stations
- Worker must push cart
- Worker must carry RF device
G2P Robotics: High Productivity / High CapEx

- Expensive and time-consuming to set up (requires green-field warehouse)
- Poor capital utilization
  - Workers are productive, but robots are inefficient
- Inflexible
  - Fixed capacity; cannot expand or contract on demand
AMRs: Productivity + Capital Efficiency

- Workers remain in the aisles to minimize unproductive walking
- Upon completion of picks, robots transport orders to pack stations
- Robots move autonomously and efficiently to pick locations
- Workers pick closest robot
- Orders may be picked by one or many workers, based on proximity to pick
Does the worker follow the robot, or does the robot follow the worker?

Neither
Lead, Follow, or Get Out of the Way

Whether the worker follows the robot or the robot follows the worker, the result is the same: the worker is always “attached” to one robot.

For as long as the robot is in the aisles, the worker is occupied with that robot.

How to avoid forcing the worker to do all this unnecessary walking? Disconnect the worker and the robot.

The worker travels as much as the robot until the robot exits the pick aisles to go to packing.

"FollowBot"
How it Works
5 Easy Steps to Significant Productivity Gains

1. **Locus Retrieves Order From the WMS**

2. **Tote is Inducted**

3. **Bot Travels to Pick Location**
   - Associate locates item, scans & drops into tote

4. **Bot Travels to Pick Location**
   - Bot directs associate to next robot & moves to its next pick location

5. **Completed orders are transported to pack area**

**Key Differentiator:**
Multiple bots work with multiple associates

**Increase in Productivity:**
2-3X
Why it Works:
A Whole New Paradigm
Workers and robots operate as independent agents, allowing parallel processing, as each robot is shared by many workers.

Orders are assigned to robots to “flood the zone”. I.e., orders are selected for their close proximity to one another, as well as proximity to a worker.

Workers pick to the nearest robot, without worrying about which order they’re picking, or whether a particular order is close to completion.

Robot order assignments are designed to “sweep” across the warehouse, continuously delivering work as associates are directed through the aisles.
Multi-Bot Pick “Sweeping” in the Real World
## Locus Reduces Both Pick Time & Walk Time

<table>
<thead>
<tr>
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<th>RF Cart Picking</th>
<th>FollowBot</th>
<th>Locus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pick Time</strong></td>
<td>Pick</td>
<td>Pick</td>
<td>Pick</td>
</tr>
<tr>
<td><strong>Walk Time</strong></td>
<td>Walk</td>
<td>Walk</td>
<td>Walk</td>
</tr>
<tr>
<td><strong>Pick:Walk %</strong></td>
<td>20%</td>
<td>25%</td>
<td>40% - 60%</td>
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Locus’s hands-free operation and directed work logic substantially reduce pick time.

FollowBot saves only about 15% of walk time.

Locus saves 55 - 60% of walk time.

2-3X Increase in Productivity
Powerful Results

Same number of picks in less than half the time
User Experience is Key
UX Drives Productivity AND Accuracy

Robot automatically detects associate
Screen language automatically changes based on worker’s profile
Accuracy as Well as Speed

- Large, clear type identifies pick location and SKU
- Product photo helps worker identify correct SKU
- One tap confirms and dismisses robot
Before rolling away, robot directs worker to next nearest robot.
Intelligent Tote Direction

At induction, robot indicates number of remaining orders and units

Robot directs worker to induct tote type optimized for work density.
On-screen color-coding directs pick into correct tote compartment.
Actionable Insights
Reports, Recommendations, Best Practices

LocusView

Daily
Monthly
Daily Performance
Robot Map
Pick Map
Loop

FIND YOUR WOW
Reports, Recommendations, Best Practices
Historical pick data mapped to physical locations provides guidance into better inventory storage to further enhance pick optimization.
Real World … Real Customer Data

Following post-deployment optimization, pick rates > 100% improvement over baseline

RF baseline of 72 UPH
Scale to Meet Seasonal Demands
Questions?
Thank You!
For more information

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