

CAN MOBILE ROBOTS HELP YOUR BOTTOM LINE?

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AGENDA

- What is a Mobile Robot?
- Mobile Robots vs. Traditional AGVs
- Deploying Multiple Mobile Robots
- Case Studies and Examples
- So are they right for you?



What is a MoBot?

(Not necessarily an industry-wide term)





What is a MoBot?

Called several things by the industry **A I V** – Autonomous Intelligent Vehicle **A M R** – Autonomous Mobile Robot **I G V** – Intelligent Guided Vehicle

Central feature of a Mobile Robot:

The ability to detect obstacles and find alternate routes when needed and without intervention



Anatomy of a Mobile Robot





Application Payload Examples

- Carts
- Conveyors
- Secure storage
- [Almost unlimited options]











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Mobile Robots vs AGVs

SIMILAR, BUT DIFFERENT



MoBots and AGVs are Similar...

- Move "stuff" from point A to B
- Can safely operate alongside people
- Can be deployed as part of a fleet







...But Different

	Mobile Robots	Automated Guided Vehicles
Infrastructure	WiFi Overhead lights (optional)	Wire guidance, magnetic tape, reflective markers, RFID, etc.
Navigation	Internal map for autonomous navigation Simultaneous Localization and Mapping Overhead "lights"	Follows fixed routes with physical markers
Obstacle Handling	Finds alternate routes around obstacles	Stops until obstacle is removed
Scalability / Optimization	Remap facility by scanning Reprogram on PC and deploy via WiFi	Possible to add or change tracks, but extensive overhaul may be required
Charging	Autonomously determines best charging schedule	Scheduled or trickle charging at stations
Human/Robot Collaboration	Accomplishes tasks even with dynamic and unpredictable human traffic	Accommodates occasional human traffic through travel path



Moving Material in a Nutshell

Manual Logistics



Push Carts Forklifts

Traditional Automation





AGVs Conveyors

Decentralized Navigation



Mobile Robots



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FLEETING THOUGHTS

Managing Multiple Robots



Multiple Mobile Robots

- Allows simultaneous tasks to be carried out
- Must be coordinated in carrying out multiple tasks
- Individual robots can be tied to specific jobs, but what happens when
 - Facility layout changes?
 - Job queues are not balanced?
 - One robot needs repairs?

The true power of multiple mobile robots can be unlocked with fleet management software



Strength in Numbers

- Mobile robot fleet management provides autonomous, dynamic transport of goods and **on-demand flexibility**
- Fleet manager software centralizes:
 - Job dispatch and management
 - Configuration management
 - Traffic flow optimization
 - Control of up to 100 MoBots
- Similar to a foreman





Key System Features

- Ability to interface with operators
- Integration with WMS and related IT systems
- Queue Management
- Fleet Management







How Big of a Fleet?

- 1. Gather preliminary info
- 2. Spreadsheet it
- 3. Simulate it







MoBots, Mo' Productivity

Use Cases and Examples



"Milk Run"

- Manufacturing:
 - Line-side replenishment
 - Kitting for assembly
- Order Fulfillment:
 - Running
 - Put-away
- Eliminates:
 - Low value-add task
 - Error in selecting carts
 - Error in selecting destinations
 - Late deliveries
 - Employee delays/distractions
- Allows traceability in movement of goods







Kitting Delivery

- Kitting for food trays w/ delivery to final assembly
- Two-shift operation (replaced two people)
- Eliminates:
 - Low-value add human task
 - Human error in cart selection
 - Large number of staged carts in assembly and lineside
 - Batch processing (converts to JIT fulfillment)
- Allows traceability in movement of goods





Bus Route Pickup

- Small Manufacturer assembling Jewelry
- 2-shift operation
- Eliminates :
 - Human Error in selecting carts
 - Human Error in selecting destinations
 - Late deliveries
 - Employee delays/distractions
- Allows traceability and control during movement of valuable WIP components
- Suitable for use in tight corridors near humans





Final Goods Inventory Pickup

- Example of complex Application Paylod
- Transport totes from an ASRS to manual sorting stations.
- Pick up the completed package and deliver to the exit (fixed) conveyor
- Eliminates :
 - Human Error in selecting carts
 - Human Error in selecting destinations
 - Late deliveries
 - Employee delays/distractions





Flexible Production Line

- Not constrained by floor plan
- Augment existing cells with "mobile conveyors"
- Allows much greater flexibility in planning a production line







Are Mobile Robots Right for You?

Mobile Robots and Your Bottom Line

The 8 Deadly Wastes in Material Transport



Defects

Efforts caused by rework, scrap, and incorrect information.



Transportation

Unnecessary movements of products & materials.



Overproduction

Production that is more than needed or before it is needed.



Inventory

Excess products and materials not being processed.



- Waiting
- Wasted time waiting for the next step in a process.



Motion

Unnecessary movements by people (e.g., walking). **H**

Non-Utilized Talent

Underutilizing people's talents, skills, & knowledge.



Extra-Processing

More work or higher quality than is required by the customer.



Mobile Robots Can Address or Eliminate 5 of them:

- 1. Computer-driven task list with traceable actions
- 2. Automated material flow optimizes movement of WIP from cell to cell
- 3. Labor Redeployment to higher value tasks
- Reduces non-value-add touches movement performed by robot
- 5. Reduces walking and manual material handling



...and Combine that with High Turnover

- Today's job market is booming for seekers
- For employers, this has led to **high turnover**, especially in less skilled positions
- In skilled and semi-skilled jobs cost of replacing a worker typically 1.5 - 2.5x their annual salary
- This *really* hurts when the worker's job involves a lot of **non-value-add material handling**



Automating your material handling can be a buffer against high turnover in semi-skilled material handling positions



What Are Your Needs?

If this is you:	Mobile Robots:
Cannot alter floor, high possibility that work areas will change	Uses environment to navigate – no need for magnets, buried wires, or tape for pathfinding
Unpredictable and/or continuous human traffic	Avoids people, can maneuver thorough a crowd of people walking down a corridor
Pathways routinely subject to complete or partial blockage by people, material, pallets, or equipment	The vehicle is able to find an alternative route to reach its goal if one route is blocked.
The scale of operation does not permit waiting on one automated material mover	Multiple vehicles can operate together to find the most efficient method of executing multiple tasks



Return on Investment

		Pus	h Cart FTE	Pus	h Cart TEMP	Tugger
Labor cost per hour		\$	16	\$	10	\$ 12.00
Labor Cost per hour with Fringe		\$	21.39	\$	10.00	\$ 14.76
Annual wage		\$	44,491	\$	20,800	\$ 30,701
Labor Churn factor		\$	4,449	\$	2,080	\$ 6,140
Cost of Cart		\$	500.00	\$	500.00	\$ 15,000
Total Annual Cost per shift		\$	48,940	\$	22,880	\$ 36,841
Assume Lynx does 50% of person's job (transport time)	50%	\$	24,470	\$	11,440	\$ 18,420
Increase in Person's non-transport task capacity/efficiency	15%	\$	6,674	\$	3,120	\$ 4,605
		•				
Damage to infrastructure		\$	-	\$	-	\$ 1,000
Damage to goods transported						
Errors in goods transported (time)	5%	\$	2,447.02	\$	1,144.00	\$ 1,842.05
Personal (unscheduled) down-time during work shift (minutes) - annual impact	30	\$	2,781	\$	1,300	\$ 1,919
Personal Sick leave						
Work injuries (manuf. & WH) one person (typ.8 days per incident)	4%	\$	60	\$	28	\$ 45
Insurance premium						
Time spent "searching" in a WH (up to 8%)	3%	\$	1,468	\$	686	\$ 1,105
Traceability (material loss)						
Adept Vehicle Selling Price		\$	60,000	\$	60,000	\$ 60,000
Breakeven Months @ 60k ASP 1 shift			19		41	25
Breakeven Months @ 60k ASP 2 shifts			9		20	12
Breakeven Months @ 60k ASP 3 shifts			6		14	8

For "push cart" jobs, a single Mobile Robot doing half of the human job can break even in less than one year



Mobile Robots Comparison

	<250kg	1500kg	Safety Compliant	LIDAR Navigation	Fleet Mgmt.	Industrial Experience
ClearPath	\checkmark	\checkmark	×	\checkmark	×	<2 years
MIR	\checkmark	×	\checkmark	\checkmark	\checkmark	<2 years
Aethon	\checkmark	×	\checkmark	×	\bigcirc	>12 years
MT Robot	\checkmark	×	\checkmark	\checkmark	×	<2 years
IncubedIT	\checkmark	×	\checkmark	\checkmark	?	<2 years
Seegrid	×	\checkmark	\checkmark	×	\checkmark	>10 years
Savant	×	\checkmark	\checkmark	×	\checkmark	>10 years
Fetch	\checkmark	\checkmark	×	\checkmark	\bigcirc	<2 years
Omron Adept	~	×	\checkmark	\checkmark	✓	>17 years



THANK YOU www.crossrobotics.com

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