# “Introduction to Automatic Guided Vehicles”

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## What is an AGV?

A Computer-Controlled, Non-manned, Electric Powered Vehicle Capable of Handling Material

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## What is a good use for AGVs?

- Repetitive motion
- Distances over 150 feet
- Multi-shift operation
- Desire to save costs and improve efficiency

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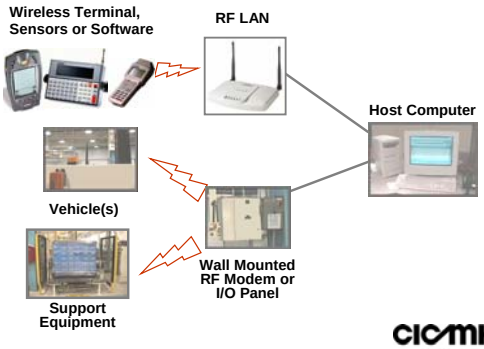
## Why use Guided Vehicles?

- Not a permanent obstacle
- Paths can be changed easily
- System can be expanded easily
- Does not represent a single point of failure - system has built-in redundancy
- Favorable cost/benefit compared to other automated material handling solutions

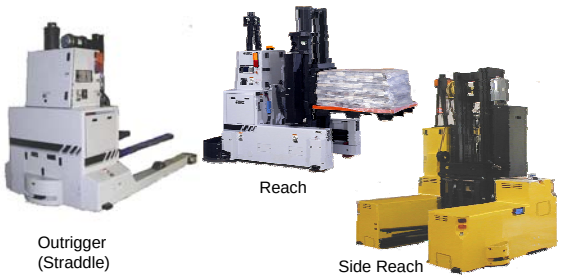
## What is in a system?




## Different Types of AGVs

1. Fork
2. Tow/Tugger
3. Unit Load
4. Custom

## Vehicle Types - Fork

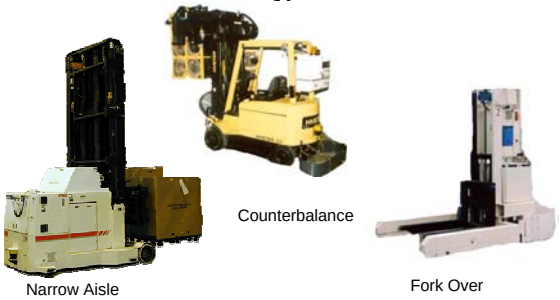


Outrigger
(Straddle)

Reach

Side Reach

## Vehicle Types - Fork



Narrow Aisle

Counterbalance

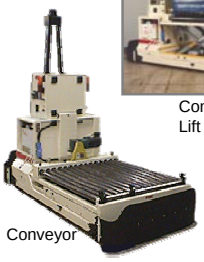
Fork Over

## Vehicle Types – Tow/Tugger

## Vehicle Types – Unit Load

Combination
Lift & Conveyor

Standard



Conveyor

Lift

## Vehicle Types – Custom

## History of AGVs

1st AGV — 1953

1st Tugger — 1959

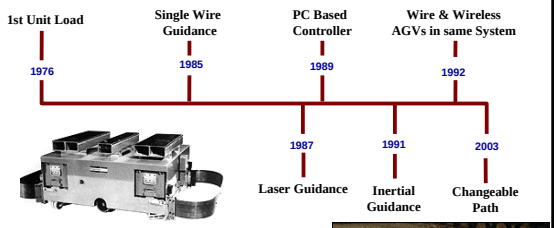
1st Assembly Vehicle — 1973

1976 — 1st Unit Load

**1953** – First AGV created and used. It was used to pull a trailer and follow an overhead wire in a grocery warehouse.

**1973** - Volvo in Kalmar, Sweden utilized 280 computer-controlled AGVs instead of using the typical conveyor assembly line.

## History of AGVs




**1976** – First Unit Load AGV. Now used for many different applications in multiple settings of industry.

**1970's** – Guidance Systems

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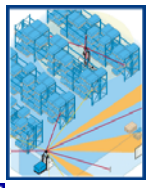
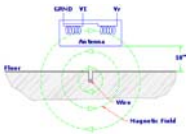
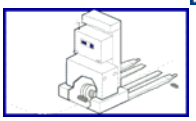
## How do they know where to go? Guidance Methods

- Optical – Tracks contrasting color
- Wire – Embedded in floor
- Inertial – Gyro with magnets in floor
- Laser – Triangulation from reflective targets







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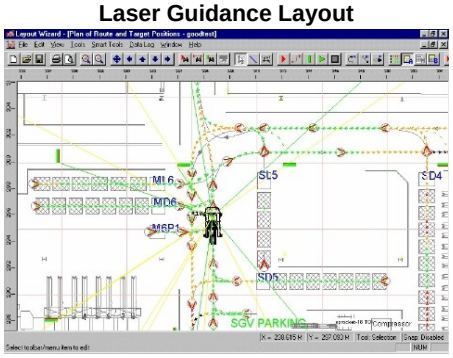
## Laser Guidance Layout

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**How are they powered?**
**Charge it!**

- Standard Charging (battery swap)
- In-Vehicle (opportunity) Charging
- Inductive Charging

## What about Safety?

Most industrial-use AGVs travel at a speed between 100 and 300 feet per minute

**Mechanical Protection Group**

## What about Safety?

**Optional Tower Protection**

**Electronic Protection Group**

## Safety Demonstration
## (click picture to play)

View More Videos

*Video obtained from http://www.agvsystems.com/examples/video.asp.

## New Markets/Applications

- Assembly Deck
- Batch Tank Transport
- Battlefield Unmanned Vehicles
- Cleanroom Mobile Robot
- Crabbing
- Dumping
- Extreme Precision
- Flat Bed Truck Side Loading
- Hospital Materials
- Hybrid
- Mars Rover
- Military Shooting Range
- Miniature
- Monster (Humongous)
- Non-System AGV
- Paper Roll/Metal Coil
- People Mover
- Sea Cargo Container
- Very Narrow Aisle (VNA)

## Gillette

**Boston, Massachusetts**

- 1.5-million sq ft facility
- 5-billion razor blades produced per year at one manufacturing center
- 18 AGVs are utilized with 8,000 ft of guide path and over 400 pickup & dropoff points
- Just in Time manufacturing

- The new AGVs combined with an AS/RS has eliminated 14 handling steps associated with storage in an off-site warehouse

*Information obtained from Modern Materials Handling Online.

## Sharp

**Osaka, Japan**

- 485,000 sq ft building, 8 stories tall
- 900,000 air conditioners produced per year
- 17 AGVs are utilized on 2 separate guide paths
- The AGVs serve to deliver raw materials to the assembly line, carrying up to 1 ton at a time
- Just in Time manufacturing

Consumer Products Application

Sharp

The new AGV system along with several miniload systems and a monorail:

- ❖ tripled production capacity with 2/3's less staff
- ❖ cuts WIP by 50%

** Information obtained from MaterialHandlingInfo.com.*

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## Pricing Guides

**(per vehicle)**

| NUMBER OF VEHICLES | UNIT LOAD VEHICLES UP TO 6,000 LBS CAPACITY | | | | | |
|---|---|---|---|---|---|---|
| | COMPLEXITY - $ (thousands) PER VEHICLE | | | | | |
| | 1. | | 2. | | 3. | |
| | Low | High | Low | High | Low | High |
| 1 | 50 | 250 | 100 | 300 | 150 | 350 |
| 2 to 4 | 50 | 200 | 115 | 225 | 130 | 325 |
| 5 and up | 50 | 160 | 100 | 200 | 100 | 300 |

| NUMBER OF VEHICLES | UNIT LOAD VEHICLES 10,000 LBS CAPACITY AND UP | | | | | |
|---|---|---|---|---|---|---|
| | COMPLEXITY - $ (thousands) PER VEHICLE | | | | | |
| | 1. | | 2. | | 3. | |
| | Low | High | Low | High | Low | High |
| 1 | 75 | 360 | 110 | 360 | 190 | 500 |
| 2 to 4 | 90 | 340 | 125 | 340 | 180 | 515 |
| 5 and up | 80 | 320 | 120 | 320 | 150 | 510 |

Total system cost can be estimated by multiplying the projected number of vehicles times the unit costs shown in the following tables.

**Level 1: Simple**
Manual Vehicle Dispatch, Load/Unload, No Central Controller, No Host Interface.

**Level 2: Medium**
Automatic Vehicle Dispatch, Load/Unload, Central Controller, Product Tracking, Multiple Path Options.

**Level 3: More**
Automatic Vehicle Dispatch, Load/Unload, automatic coupling/uncoupling (applies to tuggers only), Central Controller, Complex Host Interface, Ethernet Link, Product Tracking, Multiple Path Options Multiple Transfer Heights, etc.

Information from: http://www.mhia.org/psc/PSC_Products_GuidedVehicle_costEstimating.cfm.

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## Pricing Guides

**(per vehicle)**

| NUMBER OF VEHICLES | TOWING / TUGGER SYSTEMS WITH CAPACITY UP TO 12,000 LBS | | | | | |
|---|---|---|---|---|---|---|
| | COMPLEXITY - $ (thousands) PER VEHICLE | | | | | |
| | 1. | | 2. | | 3. | |
| | Low | High | Low | High | Low | High |
| 1 | 55 | 170 | 90 | 210 | 120 | 250 |
| 2 to 4 | 60 | 115 | 90 | 180 | 110 | 240 |
| 5 and up | 50 | 110 | 70 | 180 | 95 | 235 |

| NUMBER OF VEHICLES | TOWING / TUGGER SYSTEMS WITH CAPACITY OVER 12,000 LBS | | | | | |
|---|---|---|---|---|---|---|
| | COMPLEXITY - $ (thousands) PER VEHICLE | | | | | |
| | 1. | | 2. | | 3. | |
| | Low | High | Low | High | Low | High |
| 1 | 75 | 185 | 110 | 250 | 145 | 500 |
| 2 to 4 | 80 | 155 | 120 | 215 | 135 | 515 |
| 5 and up | 70 | 150 | 100 | 210 | 120 | 510 |

Total system cost can be estimated by multiplying the projected number of vehicles times the unit costs shown in the following tables.

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## Automated Guided Vehicle Systems Product Section of MHIA

www.mhia.org/agvs/

- Member Companies
  - AGV Products, Inc.
  - Cattron-Theimeg International Ltd.
  - Control Engineering Company
  - Egemin Automation Inc.
  - FMC Technologies
  - Frog Navigation Systems
  - HK Systems
  - Mentor AGVS, Formtek Cleveland, Inc.
  - Siemens Dematic Material Handling Automation Division
  - Transbotics Corporation

## Extra Vehicle Slides

## Assembly Deck AGVs

## Battlefield Unmanned Vehicles

## Hospital Materials

## Hybrid AGVs

## Mars Rover

## Military Shooting Range Tugger

- Uses Differential GPS; + - 1 Ft.
- 10 Mile Guide Path
- Tugs Target for Firing Practice

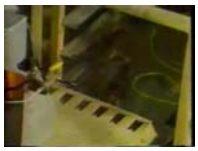
## Monster AGVs

## Paper Roll/Metal Coil

## People Movers

## Video

**Click on the image to play file**



*Videos obtained from
http://w3.centor.ulaval.ca/MHMultimediaBank/general.asp?Pic=108&CategoryID=62&choice=2