“Introduction to Automatic Guided Vehicles”

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

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?
- Wireless Terminal, Sensors or Software
- RF LAN
- Host Computer
- Vehicle(s)
- Wall Mounted RF Modem or I/O Panel
- Support Equipment

Different Types of AGVs
1. Fork
2. Tow/Tugger
3. Unit Load
4. Custom
Vehicle Types - Fork

- Outrigger (Straddle)
- Reach
- Side Reach
- Narrow Aisle
- Counterbalance
- Fork Over

Vehicle Types – Tow/Tugger

- Combination Lift & Conveyor
- Standard Lift
- Conveyor Lift

Vehicle Types – Custom

History of AGVs

- 1st AGV: 1953
- 1st Tugger: 1959
- 1st Assembly Vehicle: 1973
- 1st Unit Load: 1976

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

1985 1989

1991

1992

2003

Wire & Wireless AGVs in same System

Wire Guidance

Inertial Guidance

Changeable Path

Laser Guidance

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

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

Laser Guidance Layout

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

Front & Rear Bumpers

Side Optical Bumper

Optional Tower Protection

Electronic Protection Group

Front Warning Zone

Front Stop Zone

Side Protection

Rear Warning & Stop Zones

What about Safety?
Safety Demonstration
(click picture to play)


New Markets/Applications

- Assembly Deck
- Batch Tank Transport
- Battlefield Unmanned Vehicles
- Cleanroom Mobile Robot
- Cracking
- 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
- 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.

Pricing Guides
(per vehicle)

<table>
<thead>
<tr>
<th>NUMBER OF VEHICLES</th>
<th>UNIT LOAD CAPACITY UPH TO 6,000 LB.</th>
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<tr>
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Level 1: Simple

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.

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

Automated Guided Vehicle Systems
Product Section of MHIA

- 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