

AGV Navigation: Pros and Cons

Presented by:

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Navigation Considerations

- Accuracy
- Repeatability
- Flexibility
- Environment
 - Block Stacking
 - Temperature
- Floor sub-structure
- Traffic pattern
- Preferences on preserving floor



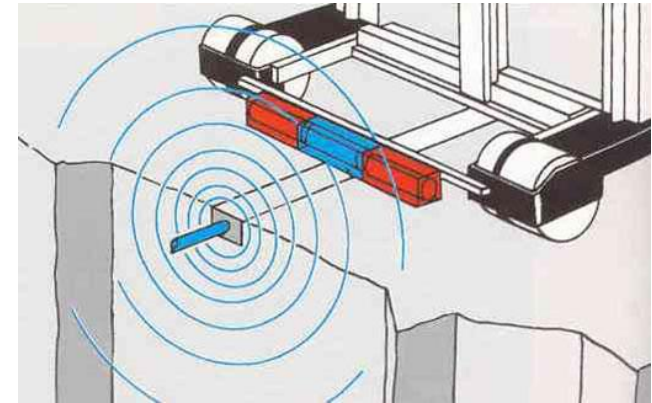
AGV Navigation - History

- 1953 – First AGV is developed with Wire Guidance in Illinois by Barrett Electronics - Arthur “Mac” Barrett
- Mid 1980’s – Inertial Guidance released
- Late 1980’s – Laser & Inertial Navigation were introduced
- Late 1990’s – Natural Feature Guidance was introduced
- Early 2000 – 3D Vision Guidance & SLAM



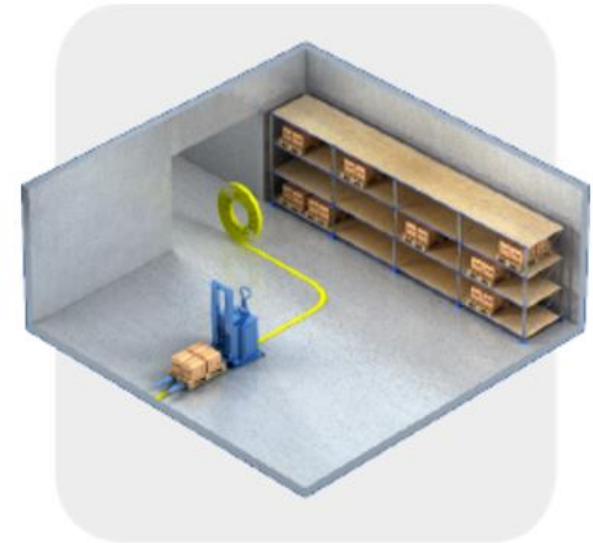
Navigation Types – Wire

- Pros
 - Historically proven
 - Very accurate
 - Mature hardware
 - Negligible effect from snow, ice, dirt
 - Usually limited in speed
- Cons
 - Floor movement affects the wire over time
 - Frequency generators needed for path change. Complicated loops.
 - Inflexible
 - Hard to change
 - Requires antennas at both end for bidirectional travel



Navigation Types – Tape

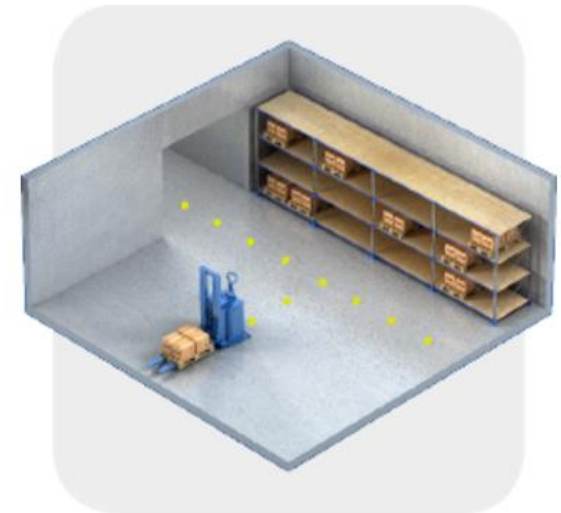
- Pros
 - Low cost
 - Great for Assembly Systems
 - Optionally rubber bar embedded in floor
- Cons
 - Usually limited in speed
 - Needs antennas in each direction
 - Shallow rebar can be problematic
 - Takes time to modify



Magnetic tape

Navigation Types – Spot/Inertial

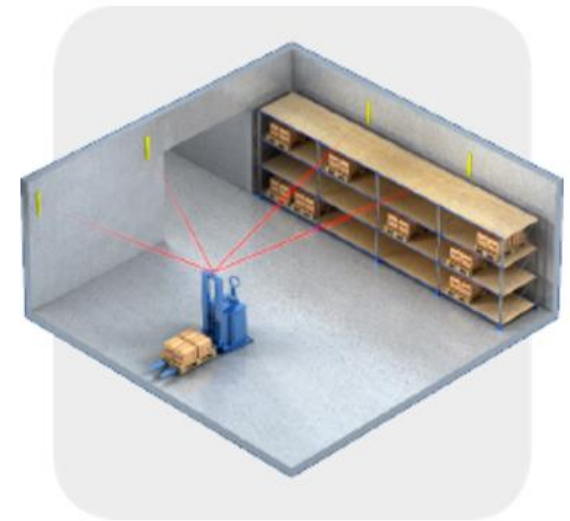
- Pros
 - More durable than tape
 - Spots can be transponders or magnets
 - Gyro improvement has reduced spots
 - Can be used outdoors
 - Good high speed control
- Cons
 - More expensive than tape
 - Can be time consuming to install
 - Potentially time consuming to modify
 - 2 antennas needed
 - Potential issues with metal plate flooring



Spot

Navigation Types – Laser / Targeted Triangulation

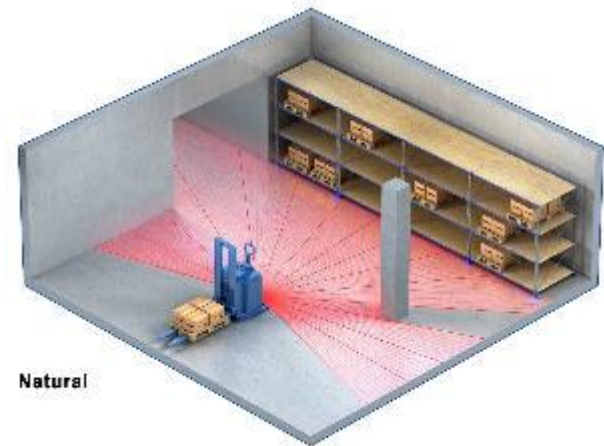
- Pros
 - Very High Accuracy
 - Very easy to modify path
 - Reasonably fast installation
 - No civil installation
 - Can be used outdoors
 - Great high speed control
- Cons
 - Block stacked loads
 - Targets can be removed or damaged
 - Vehicle Cost



Laser

Navigation Types – Laser – 2D Feature/Natural

- Pros
 - Very quick installation time
 - Good high speed control
- Cons
 - Not suitable for all facilities or conditions
 - Not suitable for outdoor use
 - Resolution tied to sensor type and layout typically not as good as targeted laser



Navigation Types – Others

- 3D Vision – stereoscopic camera
- RF Triangulation
- Optical (floor)
- Chemical path
- GPS & Differential GPS (only outdoors)

It's More Than Navigation

- Great systems have:
 - Robust offboard system controls; non custom code
 - Ability to run emulation/simulation
 - [Navigation is not traffic control]
 - Ability handle complicated traffic patterns with numerous vehicles – 50+
 - Reliable mechanical design
 - Reliable navigation

For More Information:

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