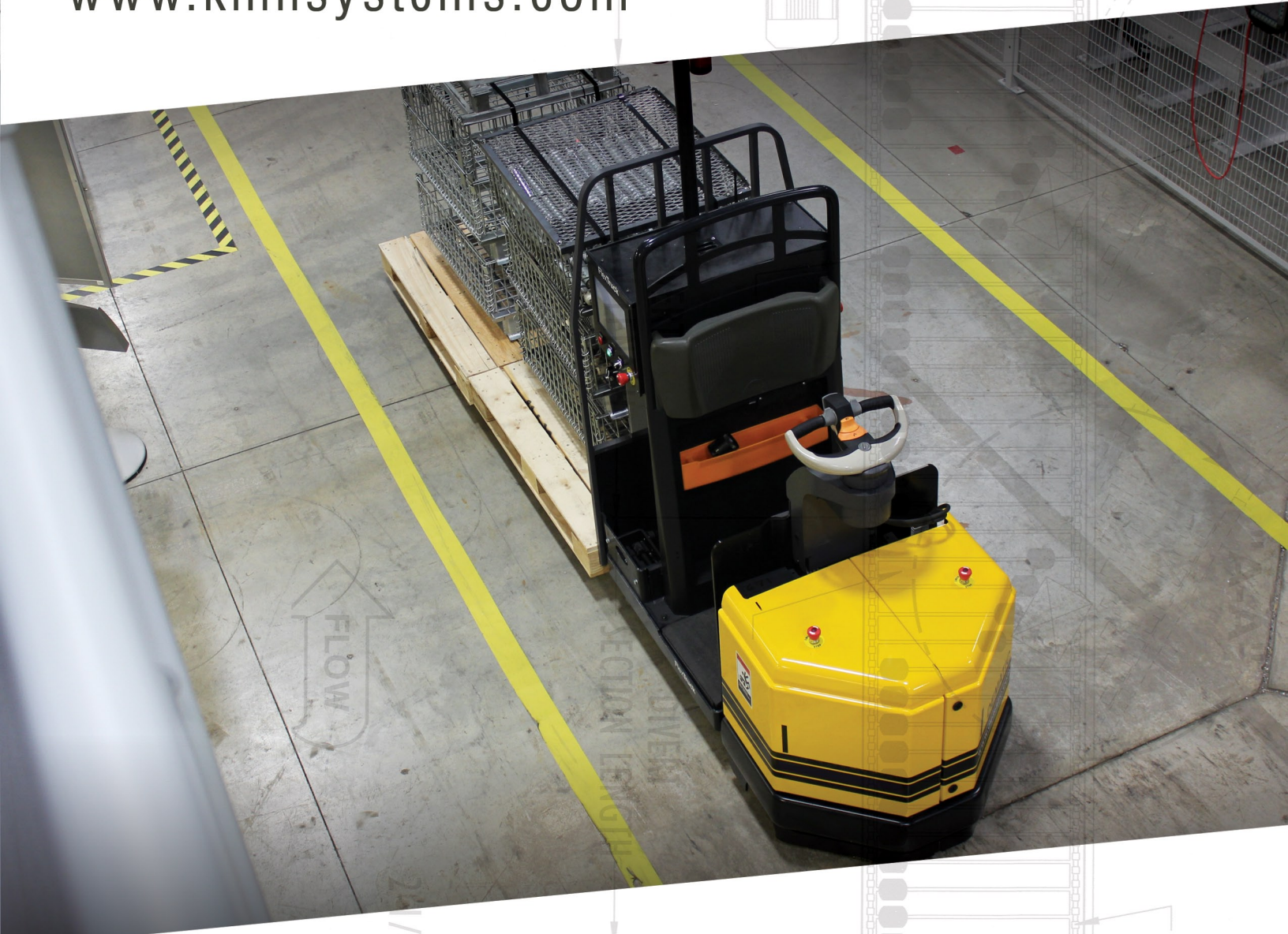


# Trusted Partner In Automatic Guided Vehicle Systems

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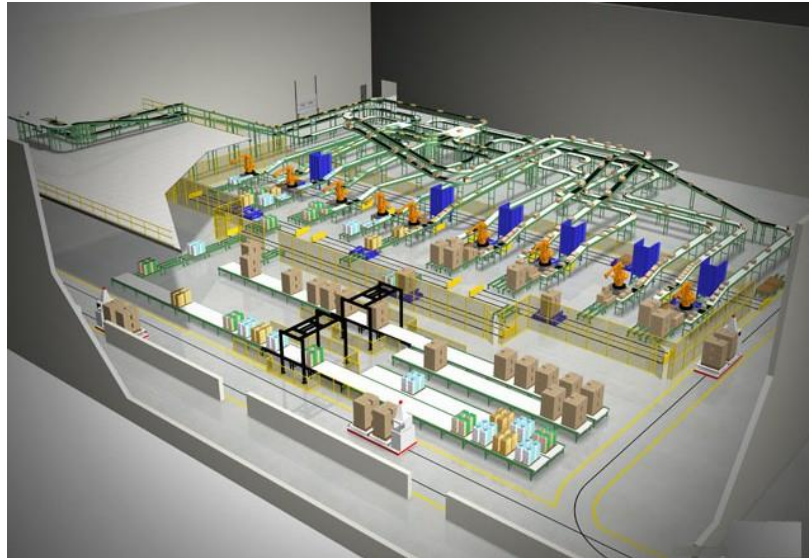


**Material Handling Integration**

# How the AGV System Works

Although every automatic guided vehicle system is unique, typical operation is as follows.

- 1) Requests to move material can be initiated in one or more of the following ways:
  - Manually directed or requested by facility personnel using pushbuttons, touch screens, etc
  - Automatically via I/O (Input/Output) sensors at pickup points, and/or via customer PLCs. System can support over 1000 different PLC devices through over 130 protocols.
  - Automatically with a direct interface to higher level software (WMS/WCS, ERP, etc.)
- 2) The SGV Manager Server receives the material movement request and assigns the task to the vehicle that can most efficiently complete the work.
- 3) Vehicles receive tasks assigned by SGV Manager Server and travel via the most efficient route defined in Layout Wizard to navigate through the facility to complete the assigned tasks. The vehicles navigate using laser triangulation which allows for precise positional accuracy.
- 4) The SGV Manager Server coordinates operation of external I/O equipment (fire doors, elevators, etc.) to facilitate the most efficient vehicle movement.
- 5) Vehicles regularly report status, location and battery level to SGV Manager. When the battery level is low, SGV Manager commands vehicle to navigate to a battery charging area.
- 6) Vehicles record all pickups, deliveries, movements, and events and report this information to the SGV Manager Server.
- 7) The vehicles communicate to the SGV Manager via a standard wireless network. The SGV Manager Server communicates to I/O, client PCs and devices, and the customer computer system via wireless and/or Wired Networks.
- 8) Various SGV System Clients (PC based, handheld, etc.) can be used to interact with the system to initiate orders, check system status, generate reports, etc. The intuitive graphical user interface, allows simple, user-friendly operation with minimal training.
- 9) Global long term product support is provided with quick response and recovery times using Virtual Private Network (VPN) access.



## Hostless Systems

Simple systems can often operate without the SGV System Server (and SGV Manager Software). These systems are sometimes called "hostless" systems, and typically have one or two vehicles, only a few pick and drop locations, and simple road systems.

With a hostless system, requests to move materials can be made directly on the vehicle display or through I/O, pushbuttons, and sensors. A hostless system can support limited local RF communication between the vehicles and external I/O, such as automatic doors, "call" push buttons, or automatic battery chargers.

## Automatic Guided Vehicle Navigation

Laser guidance has proven to be the premier choice for the majority of applications because of its unmatched flexibility, reliability, and accuracy. A laser scanner mounted on top of the vehicle provides navigation throughout the facility. The eye safe laser scanner strobes the plant, sensing easy to install reflective targets mounted at intervals on the wall. When two or more targets are located, the vehicle is able to identify and update its exact location. Vehicles continue in this manner updating their position several times per second, providing smooth, steady movement. The result is an extremely reliable and accurate navigation tool. It provides...

- **Maximum value** - minimizes installation time, no floor modifications are necessary, less targets are required
- **Maximum flexibility** - guide paths can be changed easily and quickly with no modifications to the plant or floor
- **Maximum performance** extremely reliable with exceptional accuracy

## Main Types Of Vehicles

### Unit Load Vehicles



### Tugger Vehicles



## Fork-Type Vehicles



## Calculating Your Return on Investment

- Savings for both direct (hard) and indirect (soft) cost elements should be considered when preparing a return on investment justification for an automatic guided vehicle system.
- Typically the direct cost savings are easier to quantify. These direct cost savings include labor savings, elimination of the costs related to product and plant damage caused by material handling, and saving the costs associated with fork trucks (e.g. training, OSHA compliance, maintenance, vehicle purchases/leases, etc.).
- The indirect cost savings are more difficult to qualify. These savings include improved safety, increased efficiency, and improved inventory accuracy.

### Direct Cost Elements

- The reduction in labor costs is a relatively straight forward calculation. It is simply the number of operators times the hourly rate times the number of hours worked per year. In using the hourly rate, you should use the fully burdened rate which includes all benefits, holidays, vacations, etc.
- The reduction in damage with guided vehicles vs. manual handling is usually significant. This calculation should include damage to product, racks/containers/totes, plant structure, and plant equipment (conveyors, lifts, etc.).
- The lift truck costs should include the purchase/lease costs, maintenance costs, operator and maintenance training costs, and costs for maintaining the OSHA records for compliance. The calculation should also take into account the fact that the average life for a guided vehicle system is much longer (20 years) than a lift truck.

### Indirect Cost Elements

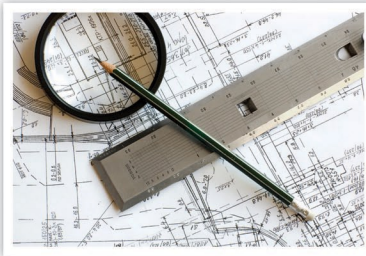
- The increase in inventory accuracy comes from the fact that the guided vehicle system tracks the movement of product. This tracking will reduce material costs, expediting charges and "redo" orders (required to replace lost product).
- Automating the material handling process increases operations efficiency over manual material handling. This increase in efficiency is the result of more timely delivery of material which reduces downtime of the downstream processes (people or machinery waiting for that material). Typically, automating a manual process produces at least a 10% increase in efficiency.
- Finally, the guided vehicle system will increase plant safety. The value placed on this increase in safety can vary widely depending on many factors at the specific installation (e.g. insurance rates, lost days due to accidents, OSHA fines, etc.).



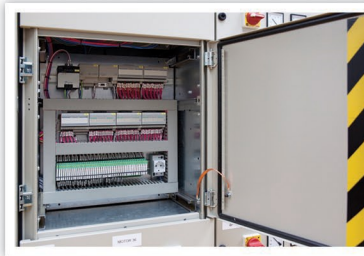
**Material Handling Integration**



**Operational Audit**



**Engineering**



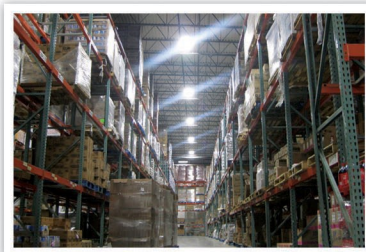
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