

AGVs: Bridging the Gap in Automation

**IF YOU SUPPLY THE SUPPLY CHAIN,
YOU BELONG AT MODEX.**

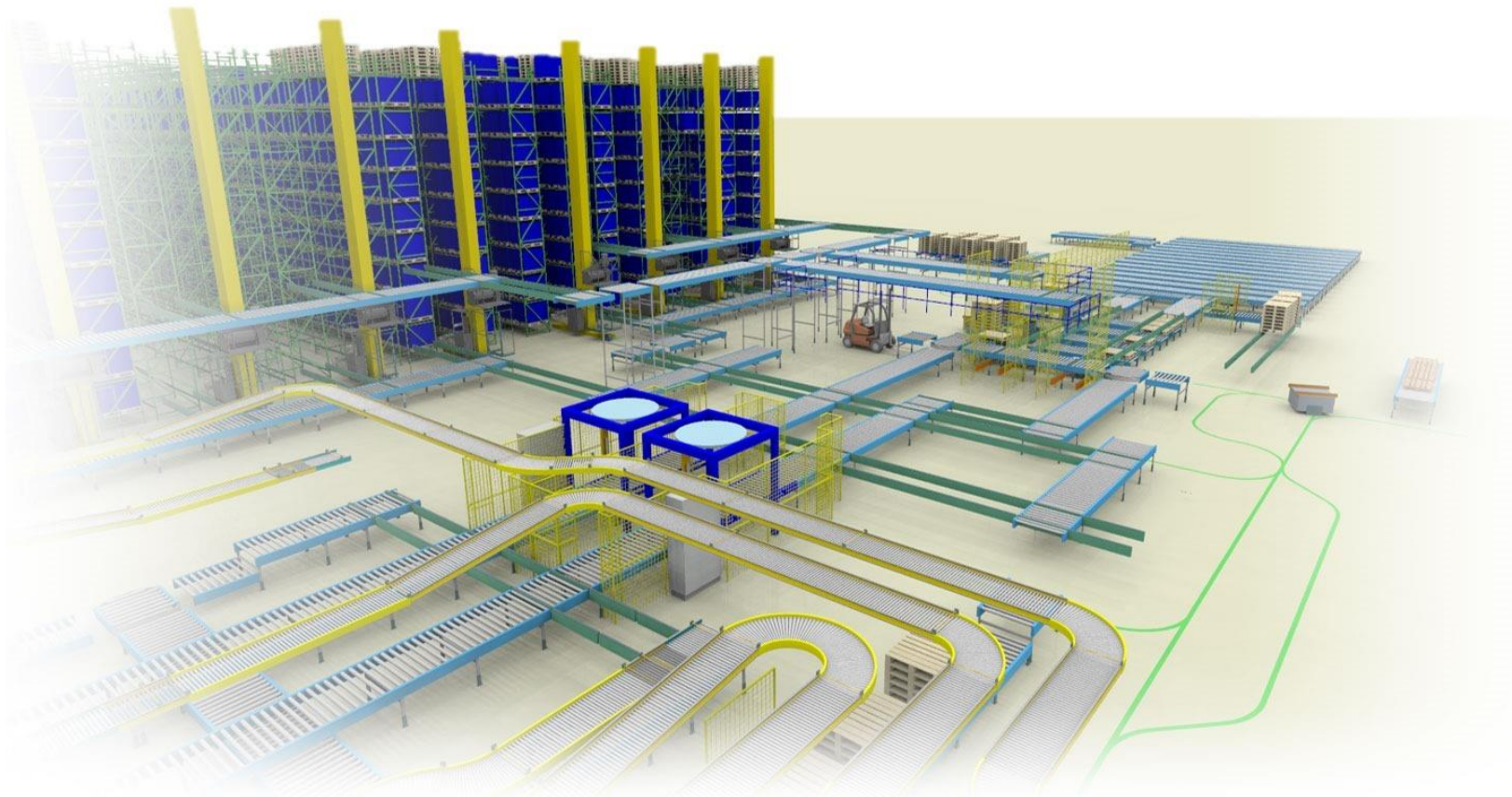
The greatest supply chain show on earth.



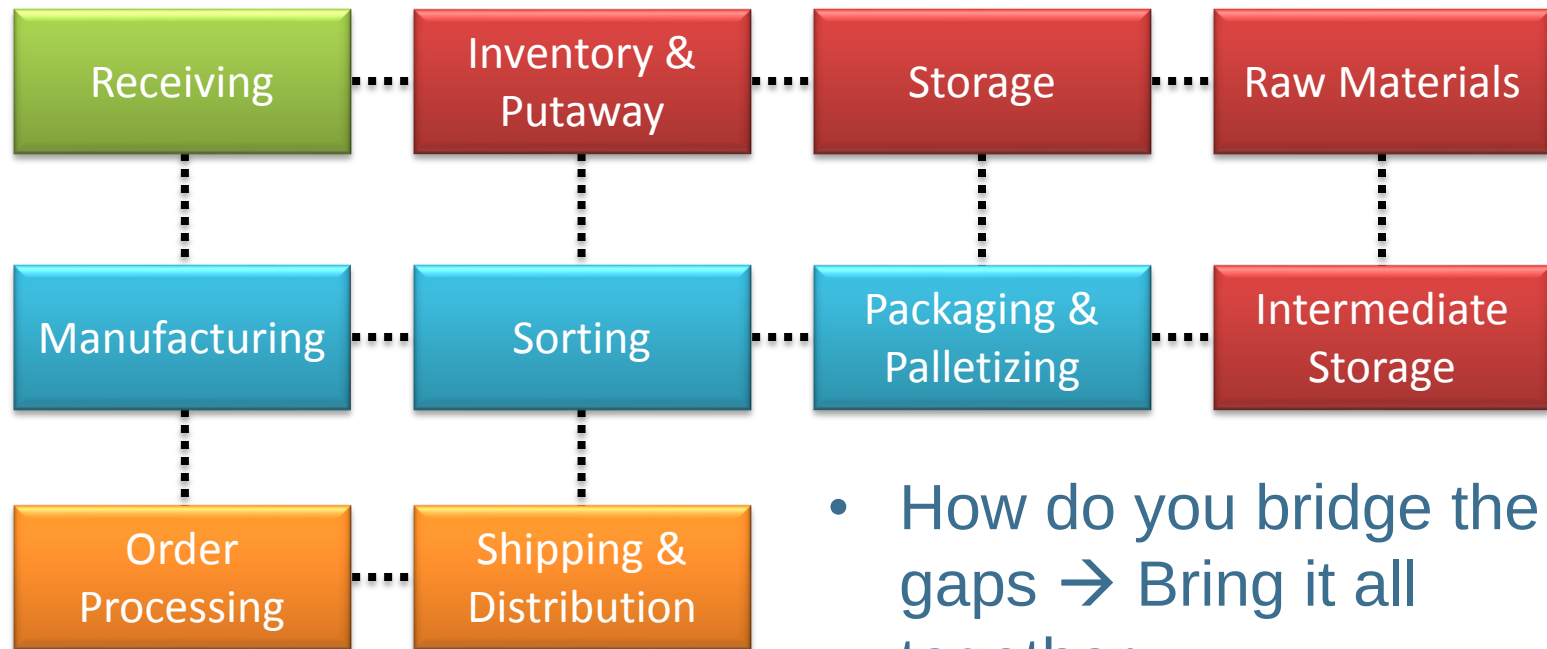
Presented by:

Brian Keiger, CSO

Investing in an Automated Supply Chain



Primary Problem – Islands of Automation



- How do you bridge the gaps → Bring it all together
- Why has so little been done to bridge the gaps?



Constraints of Today's Manufacturer

- Space



- Load



- Capacity



- Costs



- Operating Hours



Today's Manufacturing Requirements

- Faster product turn-around
- Smaller warehouses
- Better safety records
- Better order accuracy
- Reduce costs
- Increase efficiency
- Decrease cycle times
- Improve ROI



Traditional Transport Solutions

- Forklift
- Powered Conveyor
- Monorail
- In-Floor Towline



Overview

- In traditional warehouses, human error has a negative effect on safety, efficiency, quality, and productivity . . . All which have an impact on cost.
- These expenses are reduced with the introduction of an Automated Guided Vehicle (AGV)



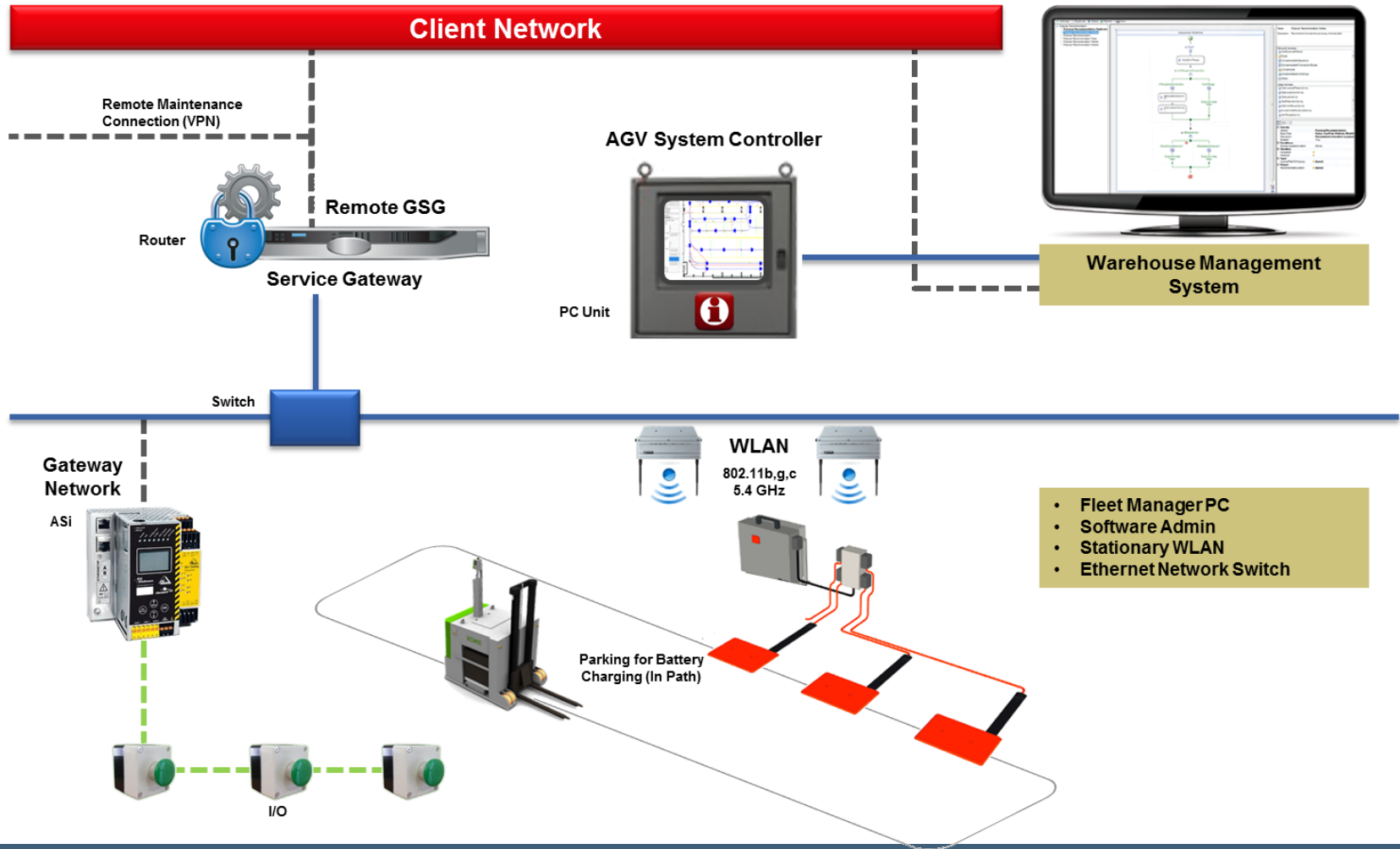
MODEX 2016
powered by  MHI

What is an AGV

- An AGV is an independently operated vehicle that moves material along defined paths between defined delivery points or stations.



What's in an AGV System?



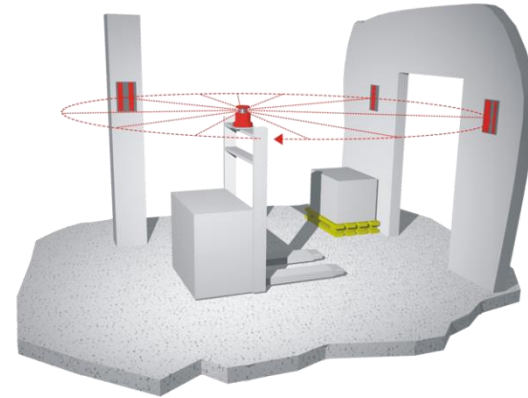
Types of AGVs

- Fork
- Tow/Tugger
- Unit Load
- Custom

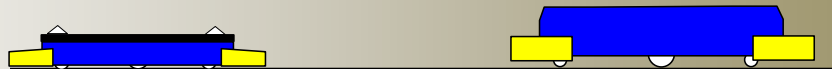
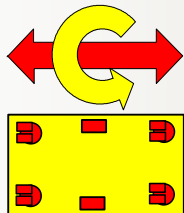
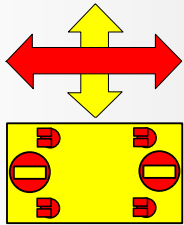
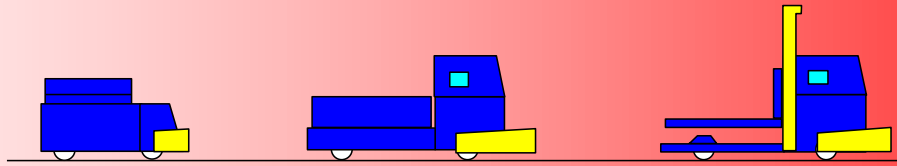
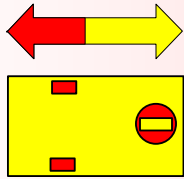


Types of Navigation

- Laser
- Optical (Contrasting Colored Tape)
- Inductive (Embedded in Floor)
- Inertial (Gyro with Magnets in Floor)
- Virtual Navigation



Drive and Steer Types



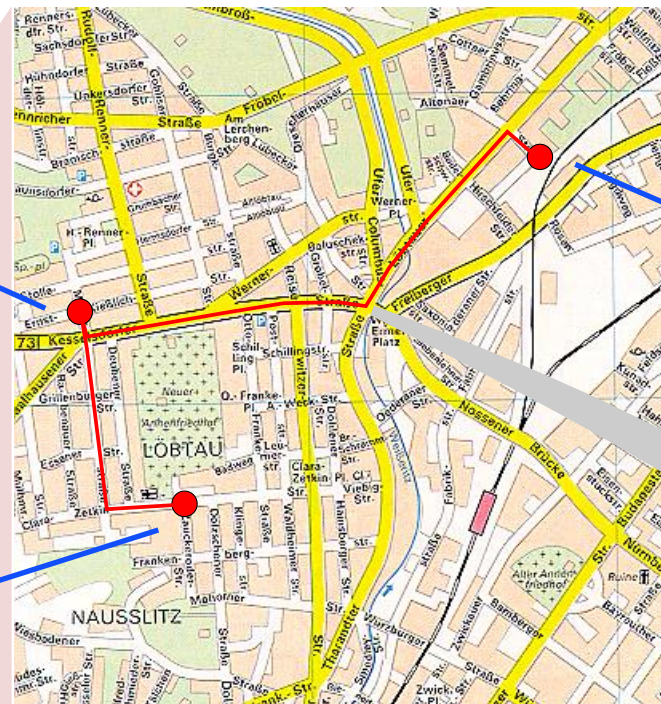
Task Allocation

Collection point
(source)

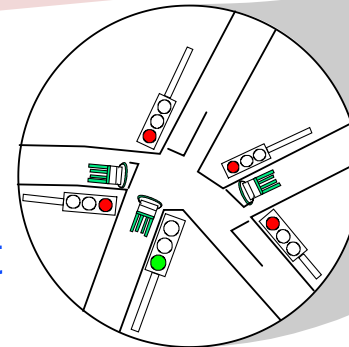
Destination

'from' / 'to' order
Vehicle knows
the street network
(layout)

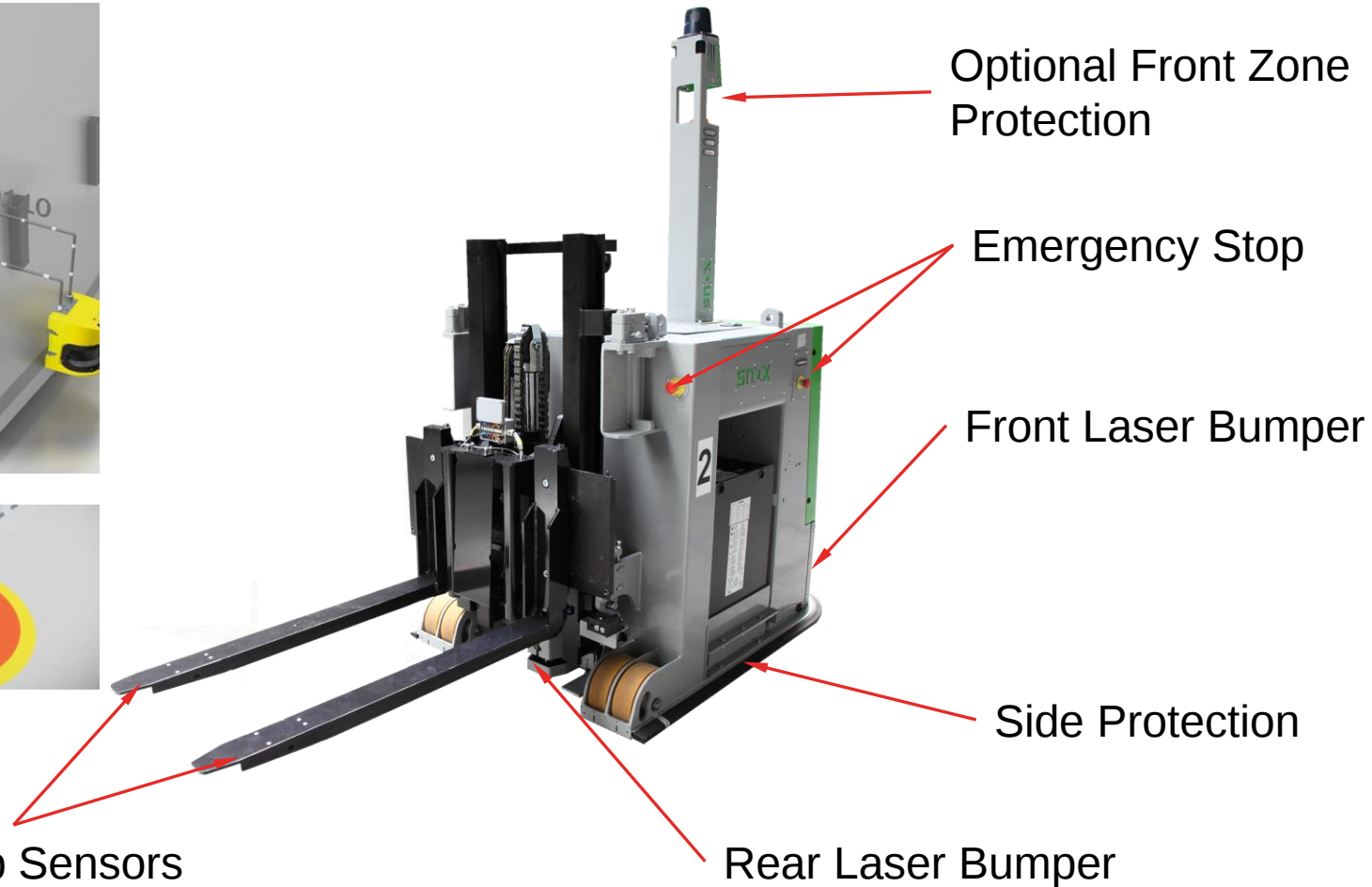
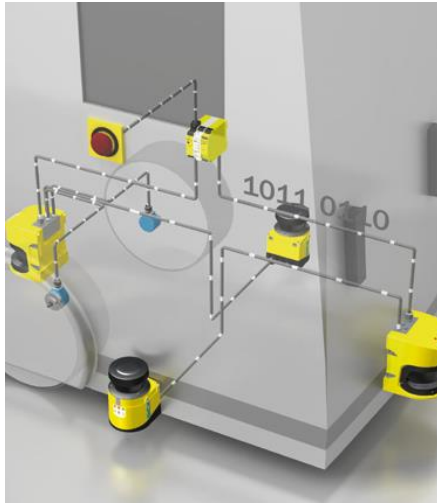
Current
location



Crossing
management



What About Safety?



What About Energy?

Charging in full drive



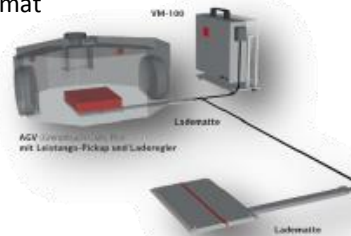
Contact-free charging of the battery while driving on an inductive power transfer loop



Charging on parking place



Contact-free charging of the battery on a parking place with charging mat



Changing batteries



Manual or automatic swap out of batteries



Quick inbetween charging

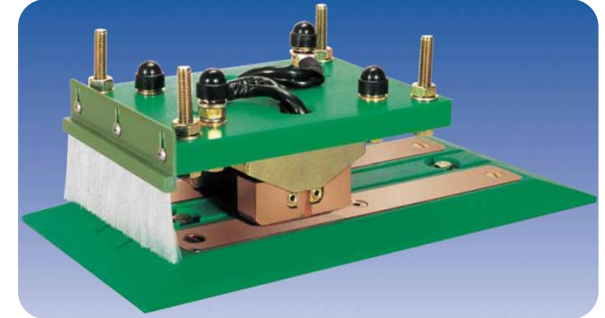
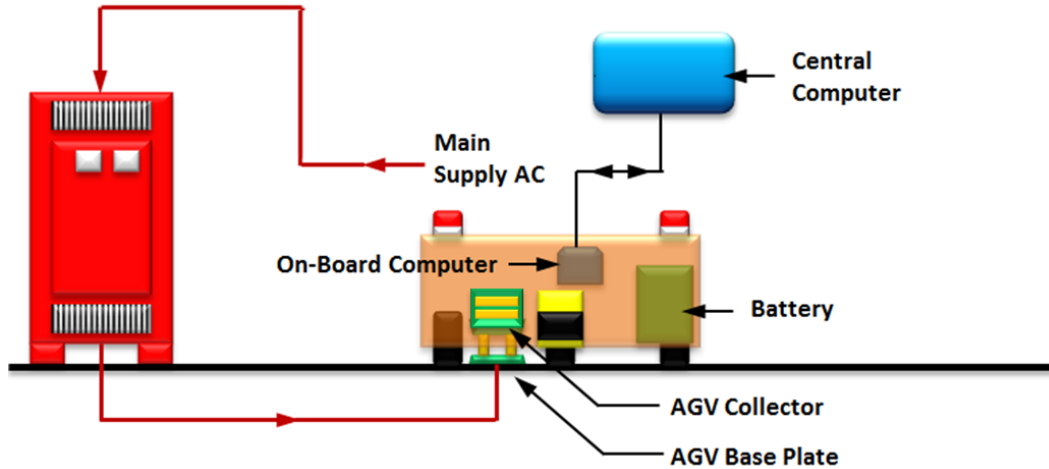
Contact to copper contacts at stationary charging station



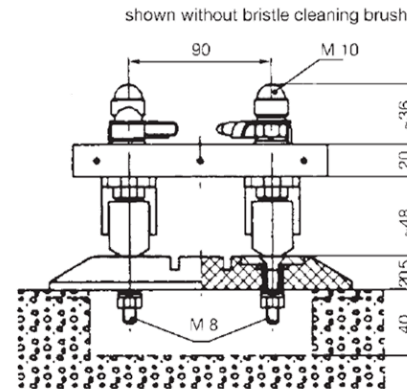
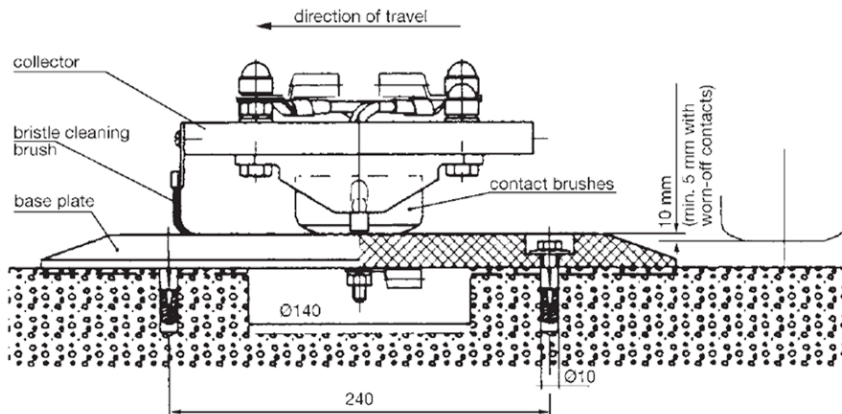
Energy supply 24 hours/ 7 days a week



What About Energy? (Cont'd)

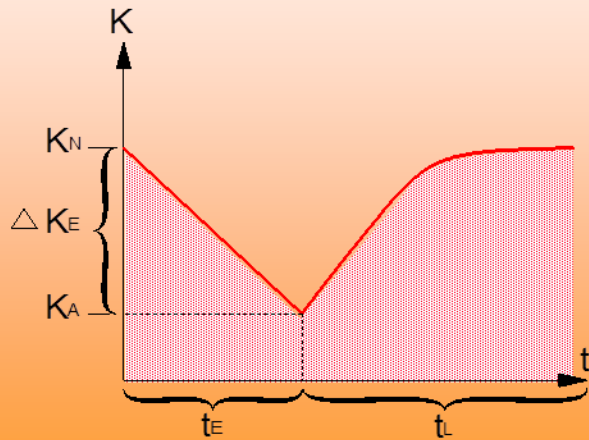


Example of installation: BLS 200-2-01 with BLK 200-2-01

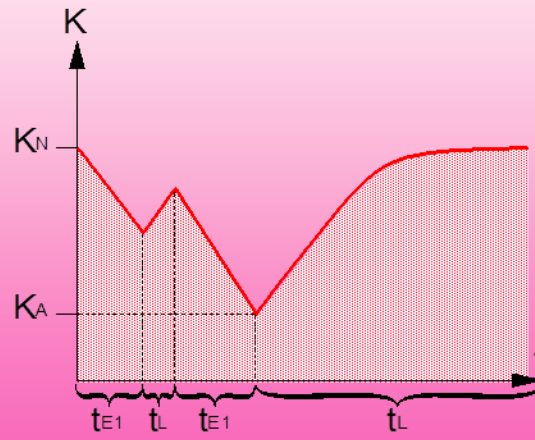


What About Energy? (Cont'd)

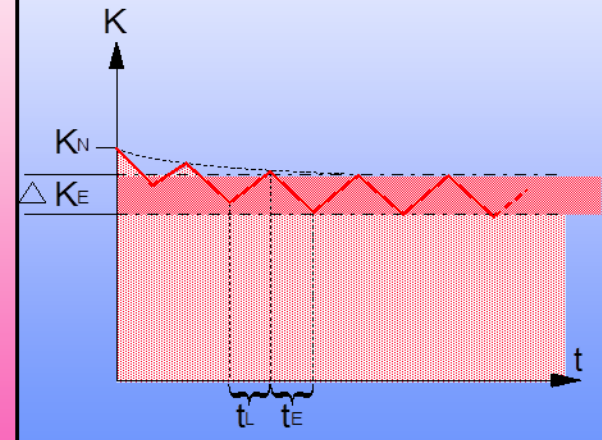
Operation from reserves
(for 8-14 hours)



Operation from reserves
(with interim recharging
(for 8-16 hours operation))



Cyclic operation
(for 24 hours operation)



AGV Applications

- Automated Guided Vehicles can be used in a wide variety of applications to transport many different types of material including pallets, rolls, racks, carts, and containers. AGVs excel in applications with the following characteristics:
 - *Repetitive movement of materials over a distance*
 - *Regular delivery of stable loads*
 - *Medium throughput/volume*
 - *When on-time delivery is critical and late deliveries are causing inefficiency*
 - *Operations with at least two shifts*
 - *Processes where tracking material is important*



AGV Applications

- Raw Materials Handling

- *AGVs are commonly used to transport raw materials such as paper, steel, rubber, metal, and plastic. This includes transporting materials from receiving to the warehouse, and delivering materials directly to production lines.*



- Work-In-Progress (WIP) Movement

- *Work-in-Process movement is one of the first applications where automated guided vehicles were used, and includes the repetitive movement of materials throughout the manufacturing process. AGVs can be used to move material from the warehouse to production/processing lines or from one process to another.*



- Pallet Handling

- *Pallet handling is an extremely popular application for AGVs as repetitive movement of pallets is very common in manufacturing and distribution facilities. AGVs can move pallets from the palletizer to stretch wrapping to the warehouse/storage or to the outbound shipping docks.*



AGV Applications

- Finished Product Handling

- *Moving finished goods from manufacturing to storage or shipping is the final movement of materials before they are delivered to customers. These movements often require the gentlest material handling because the products are complete and subject to damage from rough handling. Because AGVs operate with precisely controlled navigation and acceleration and deceleration this minimizes the potential for damage making them an excellent choice for this type of application.*



- Roll Handling

- *AGVs are used to transport rolls in many types of plant including paper mills, converters, printers, newspapers, steel producers, and plastics manufacturers. AGVs can store and stack rolls on the floor, in racking, and can even automatically load printing presses with rolls of paper.*



- Trailer Loading

- *Automatic loading of trailers is a relatively new application for AGVs and becoming increasingly popular. AGVs are used to transport and load pallets of finished goods directly into standard, over-the-road trailers without any special dock equipment.*

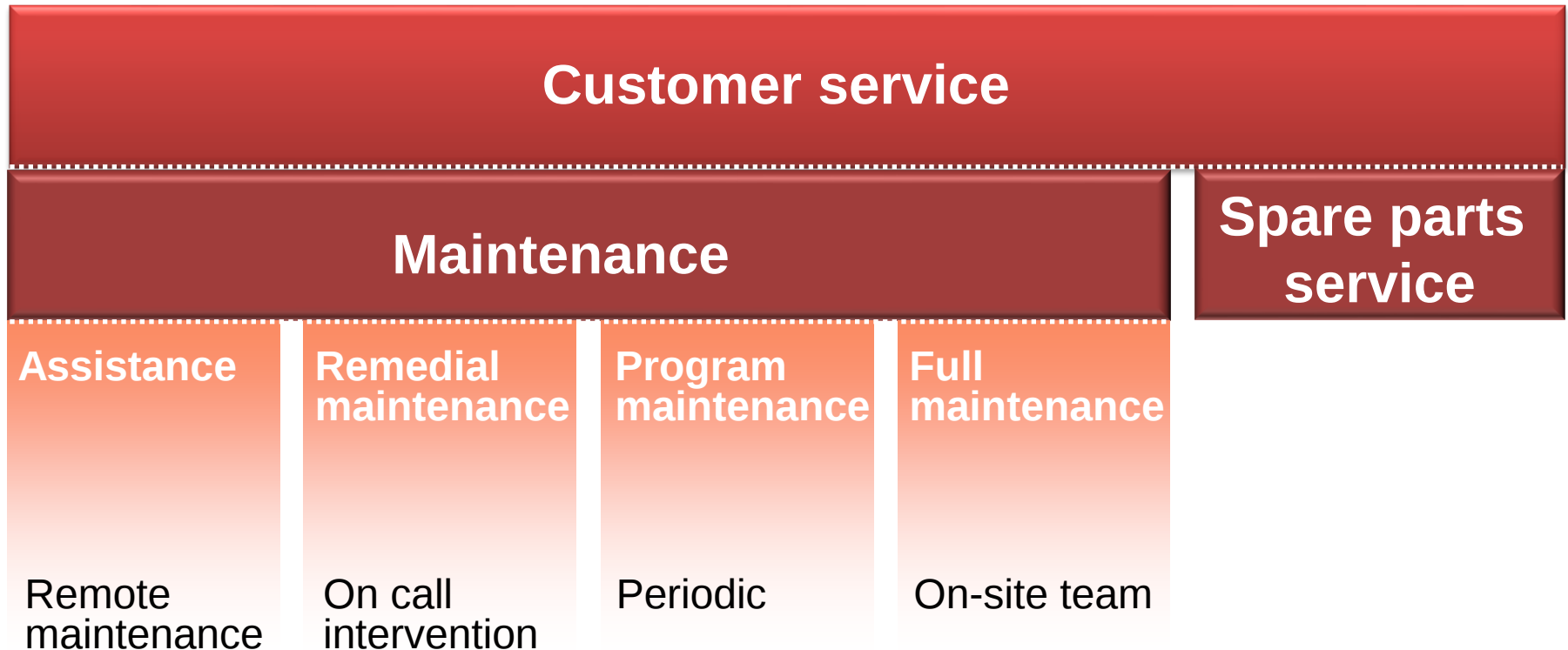


Why AGVs?

- Clear floor space
- Reduces labor costs
- Flexible
- Intelligent
- Creates discipline in your operations
- Reduces production & warehouse costs



Service and Support



AGV Costs

- Costs vary as widely as the applications
- \$50K - \$500K per vehicle
- AGV manufacturers all claim their products/solutions pay for themselves



AGV Value

- AGVs reduce labor costs
- Increase efficiency
- Reduce long-term costs
- AGVs remove many “human errors” , and other concerns inherent of using humans in production or material handling:
 - *AGVs avoid/ prevent Injuries that normally occur during material handling due to a human driver’s lack of attention.*
 - *AGVs have visual and pressure sensors integrated within them in order to safely avoid/ prevent Injuries that normally occur during material handling due to other personal not paying attention. (An AGV will stop before running over an idiot)*
 - *AGVs don’t get impatient and drive too fast, causing injuries to the drivers, those around them, or possibly losing / damaging their load*
 - *AGVs don’t require Medicare*
 - *If an AGV gets damaged / broken down while on the job, it won’t try to sue the company*
 - *AGVs don’t go on strike*



AGV Additional Value

- Improved Response Time



- AGVs can improve the material delivery response time required to a manufacturing cell or shipping dock. AGVs remove and supply loads precisely upon demand [fork trucks are undesirable for precise timing].

- Safe Vehicle Movement



- AGVs move slower than manually operated industrial vehicles, operate on a fixed path, and have safety features built in for pedestrian interaction. In applications where "fork truck madness" and pedestrian safety are problems, an Automated Guided Vehicle System can be a good solution. AGVs efficiently share aisles with people and fork truck traffic.



AGV Additional Value (Cont'd)

- Reduction in Labor



- Once set up and configured AGVs can deliver material automatically, 24 / 7, with minimal operator involvement. Therefore, material handling labor costs can be drastically reduced.

- Elimination of Conveyor Walls



- AGV Systems allow open aisle ways. Since AGVs are operator less industrial vehicles, no fixed obstructions are required. AGVs are a good solution in contrast to a conveyor when a fixed obstruction is in the proposed material path.

- Service From Palletizers



- AGVs are adaptable to an interface with palletizers. Since palletizers generate consistent unitized loads at a steady rate, AGVs are well suited. AGVs make an excellent bridge between the out feed conveyor of a palletizer and a storage system or shipping dock.



AGV Additional Value (Cont'd)

- Eliminate Single Point Failures



- AGVS are continuous flow devices. However, AGVs are almost immune to single point failures, which could occur on conveyors or monorail systems. One AGV may malfunction but other vehicles will continue to deliver material during its repair. If a vehicle fails on a main guide path, it can be easily moved, allowing for material flow to continue unabated.

- Adaptable to Manual Backup Methods



- An AGV system allows open aisles and open accessibility to pickup and delivery points. If the AGV system is inoperative, loads can still be delivered by a manual method, such as forklift truck.



AGV Additional Value (Cont'd)

- Reusable Asset



- An AGV System is a reusable asset to any facility. An entire AGV System can be moved to another location or another plant with minimal downtime. Vehicles, Batteries, Chargers, and Fixed Controls can also be moved easily. The only system elements that cannot be reused are any in-floor guide wires.

- Reduced Product Damage



- AGVs move slower and are in general more careful than manually operated fork trucks. Therefore, AGVs allow little or no product damage in comparison to fork trucks.



AGV Additional Value (Cont'd)

- Better Tracking of Materials



- AGV control systems allow tracking of materials while loads are in the AGV system. Each pallet can be uniquely identified and tracked throughout the material transport process. In addition, load pickup and drop off times can be monitored.

- Improved Logistics



- Production machinery has already reached a high level of productivity. Further increases in overall manufacturing efficiency must come from logistics. For example, in many manufacturing facilities, about 75% of each work piece cycle time consists of transportation and waiting. An AGV System can link information about material flow and supply the workstation as demand arises. In general, AGV Systems improve the organization and execution of materials transportation.



AGV Additional Value (Cont'd)

- Improved Image / Better Housekeeping



- An AGV System improves plant organization by maintaining clear aisles and organized workstations. Since pickup and drop off stations are fixed and dedicated, operators are able to keep their workstations more organized. This improves the workplace environment for employees and creates a positive image for plant visitors and prospective customers.

- Better Discipline



- An AGV System forces discipline in plant operations. Material flow in and out are scheduled by the AGV System controls. Unnecessary raw, finished or packing materials do not clog aisles and workstations.



AGV Additional Value (Cont'd)

- Reduced HR costs



- AGVs eliminate the need to rehire people along with the costs associated with hiring them and training them. These costs can add up across multiple people, multiple shifts when employees constantly leave due to repetitive, hazardous, difficult, or undesirable work environments that may exist.



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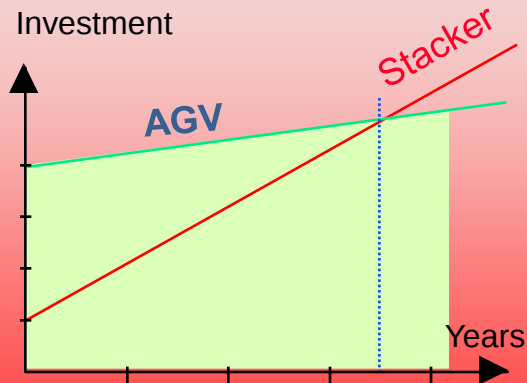
Cost-Effectiveness Considerations

**Manned
forklift**

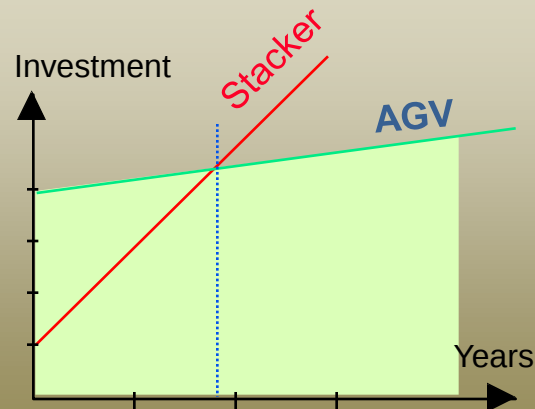
**Automated
Transport (typical)**

Investment cost	100%	400%
Manning costs	100%	5%
Maintenance	100%	200%
Transport damage	100%	5%

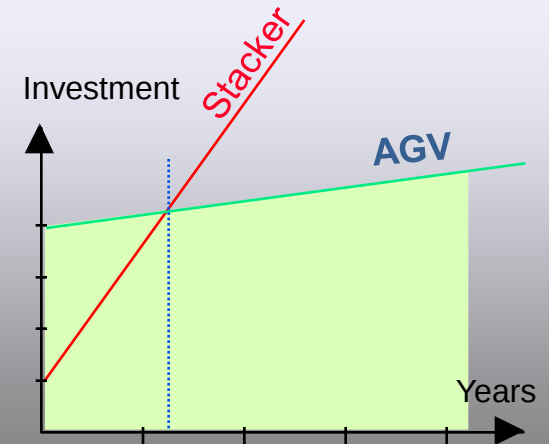
Single-shift



Two-shift



Three-shift



AGV Key Takeaways

- Reduces costs by decreasing labor, product damage and lower installation costs
 - Resolves turnover and training of employees
- Eliminates conveyors
- Improves response times
- Increases work safety
- Eliminates single points of failure
- Provides a reusable asset
- Improves logistics
- Provides better tracking and inventory management
- Improves image and housekeeping
- Forces discipline in the work area





Q&A



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