

Solutia's AGV System Operates Continuously Thanks To Automatic Battery Exchange System

Challenge

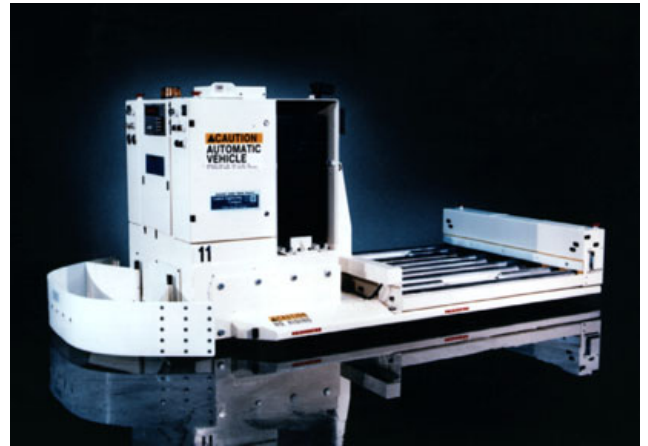
Solutia's work flow required the transport of product through various production processes using wheeled containers (4'x4'x4') weighing approximately 1200 lb.

Two methods of wheeled container transportation were used in the facility, towline conveyor and head pushing, and both involved manual intervention at all transfer locations in the system. The system did not include an inventory management system and container tracking was difficult.

Management set a goal to maintain or exceed existing production levels with a reduced work force and improve material flow control at the same time.

Solutia faced the following challenges associated with the implementation of a new material handling system (MHS):

- Replacement/deactivation of the existing towline system could not disrupt production.
- Existing process equipment was fixed and could not be moved or altered without significant cost.
- Existing wheeled containers would have to be handled and transported through the process during implementation.
- Existing shop floor controls would have to be incorporated into the new MHS to provide inventory management.
- The new MHS would have to be user friendly, safe, reliable, and would need to be designed for future expansion.
- Container tracking was essential to the operation.



Nineteen HV-3 Unit Load Vehicles transport, store, and queue containers weighing up to 1200 lb.

- The new MHS needed to be flexible to handle production variations while maintaining quality levels.

Solutia considered and discarded several material handling methods, including:

- Chain Driven Live Roller conveyor system
- Fork style Automatic Guided Vehicles (AGVs)
- Multiple, smaller loop AGV systems in each process area

These alternate methods were eliminated from consideration because of costs, safety, design and functional operation which had negative impacts on the overall system.

Solution:

Solutia selected Jervis B. Webb Company's proposed system as the best possible solution based on their requirements for the new material handling system.

The material handling system consists of an Automatic Guided Vehicle System (AGVS) and a conveyor system used to transport, store, and queue production containers throughout the facility. The system utilizes multiple levels of control including host and shop floor level interfaces with the Vehicle System Manager (VSM) computer, VSM to vehicle control, and the necessary PLC controls for the conveyor system.

The new system includes a total of 19 (HV-3 model) unit load AGVs capable of carrying product in wheeled containers weighing up to 1200 lb. Automatic container transfer to and from fixed floor conveyors is provided by a low profile chain driven live roller conveyor mounted on each vehicle. Each AGV utilizes an on-board bar code scanner to automatically scan each container during transfers.

Vehicle routing, traffic control, and monitoring is provided by the VSM, which interfaces with the host computer as well as shop floor controls.

The VSM coordinates all the vehicles in the system allowing them to perform the functions necessary to meet critical production schedules. An FM radio link provides real time VSM to vehicle communication throughout the system. The status and location of all vehicles in the system are monitored via the radio link. When containers are to be transported to a specified area, the VSM selects the best available vehicle and directs it to perform the operation. Process feedback is used as well as vehicle proximity in the AGV dispatching algorithm, or rules.

The VSM consists of two identical DEC

MicroVAX 3100 - 40 computers with custom control software. One computer is a hot backup system, which is provided for fault-tolerant computer operation. The core VSM software is proven in over 40 similar installations.

The VSM and AGV system controls offer flexible vehicle dispatching algorithms, central system monitoring and control, as well as extensive diagnostic capabilities.

To keep the AGV system in continuous operation, Webb developed an automatic battery exchange system. This new system puts battery swap out and charging procedures for the whole fleet of vehicles under the control of the VSM.

Scheduled automatic battery exchange occurs approximately every 8 to 10 hours depending on system utilization. No operator intervention is required.

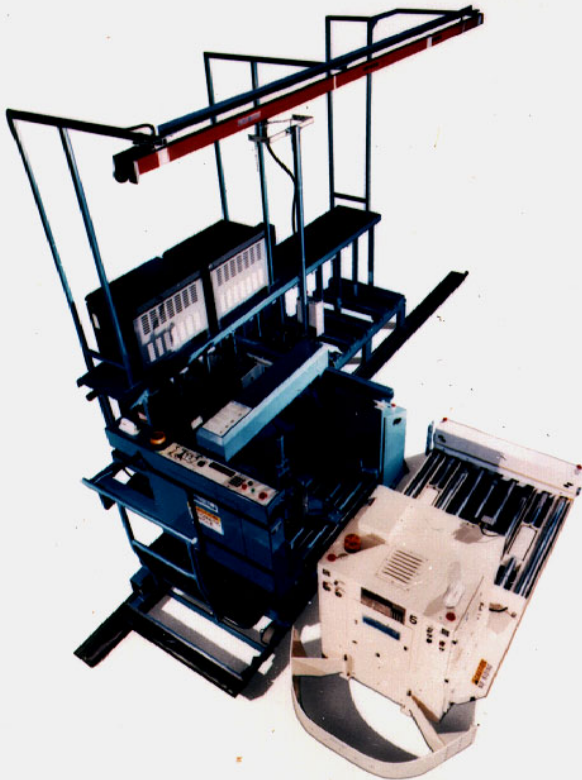
A conveyor system consisting of approximately 160 individual conveyors, including several roller flight conveyors, transfer cars, turntables, pushers, and chain driven live roller conveyor, provides load staging for the input and output side of six process areas. The conveyor systems provide controlled container movement through the manufacturing process.

Individual conveyors were shipped pre-assembled for quick/easy field installation. PLC's, in conjunction with Solutia's shop floor controls, provide controlled container movement on individual conveyors and conveyor status.

Benefits:

- The material handling system replaces labor lost to attrition, providing a significant long term labor cost savings for a fixed investment cost.
- The new conveyor system was capable of handling the original system wheeled container as well as the current "wheels off" flat bottom container.
- The MHS integrates with existing Solutia process equipment and controls.
- Implementation of the MHS was phased to work with Solutia production schedule.
- The MHS meets the production requirements of the manufacturing process.
- The MHS utilizes reliable technology that can meet the uptime requirements of Solutia.
- The MHS is also flexible and is designed to meet the growth requirements of Solutia in critical process areas without major disruption in process operation.
- The equipment provided is designed to meet established safety standards in the material handling industry as well as Solutia's requirements.

Automatic Battery Exchange



Features:

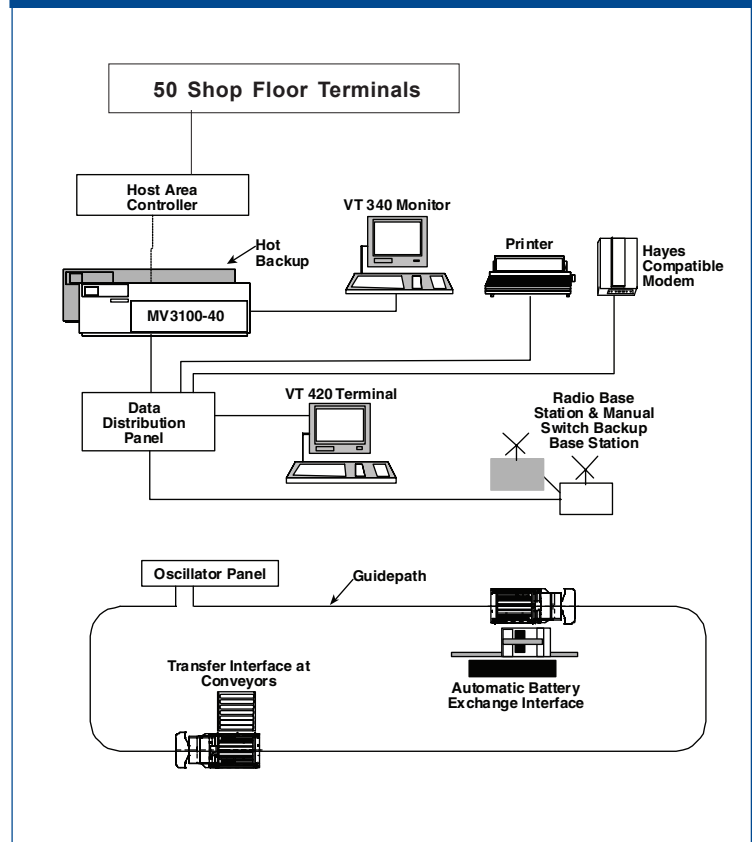
- AGV batteries are automatically exchanged and charged under Vehicle System Manager (VSM) computer direction
- Proven battery cart design
- Proven on-board all-digital microcomputer (VCC-2) controls
- Batteries are automatically "equalize charged"
- Continuous radio communications with VSM
- Front and rear safety bumpers
- Manual override and operation controls
- 10,000 lb battery capacity (Two 5,000 lb batteries)
- Battery use can be optimized with monitoring/reporting from the VSM

AGV System Highlights

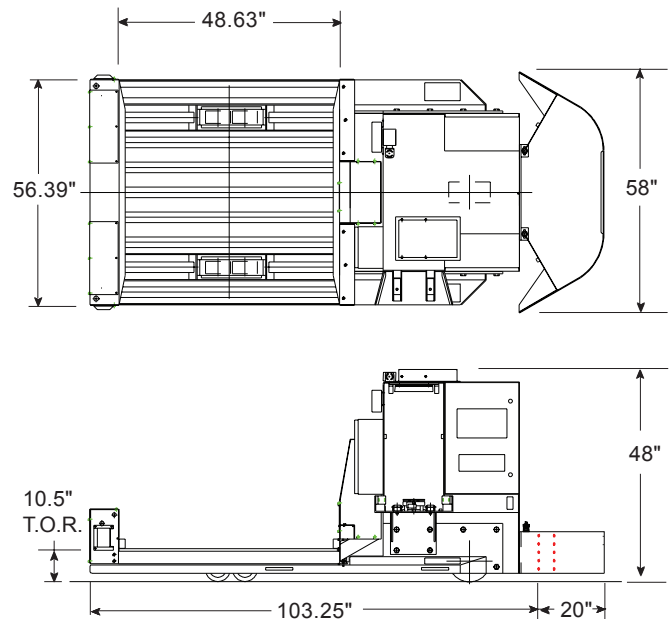
19 HV-3 vehicles that feature:

- Single direction steering vehicle
- Digital steering board and 50 amp motor controller for steering
- Speed control is via 200 amp motor controller controlled by a pulse width modulator (PWM) channel from digital speed/steering board
- Absolute shaft encoder for steering; incremental shaft encoder for speed
- On-board bar code scanner
- Battery discharge indicator
- Hour meter
- Floor coding via transponders
- Manual control pendant
- Automatic battery exchange
- Optic accumulative blocking with zone blocking VSM
- Radio VSM communications
- DEC MV 3100-40 VSM computer
- Hot backup VSM computer
- Redundant radio base station

System Configuration



Vehicle Size



**ISO 9001
Certified**

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