DATALOGIC™

Case study

Intier Seating has solved the sequenced part delivery (SPD) problem with the **EMS RFID systems**

Sequenced Part Delivery (SPD) allows automotive manufacturers to outsource whole sections of their assembly process essentially creating a 'factory without borders'. Key to this method of outsourcing is absolute synchronization of the delivery of the outsourced part to the automotive assembly line.
Intier Seating has solved this problem of highly reliable process synchronization using industrial RFID. The ability of industrial RFID to reduce identification errors on automated lines to nearly zero as well as record test and assembly data in process is key to Inlier's solution to their SPD supporting Ford's assembly line for Ford's new Edge models.

Problem Statement

Automotive manufacturers that outsource some of their car and truck components to third parties require a precise mixture of component products to be delivered at the main assembly plant according to a Sequenced Part Delivery (SPD) plan, just in time for the parts to be added into the final car or truck assembly. Suppliers must be able to precisely and reliably track their product flow during manufacturing through shipping, so that the order that goods are built and the shipment loading exactly matches the main assembly plant's delivery requirements.
SPD works great providing one thing: the outsource supplier execution must be FLAWLESS. Heavy penalties may be levied on the supplier any time the automotive production line is held up due to late or incorrect deliveries.
Intier Seating, of Mississauga, Ontario, engaged Escort Memory Systems to help them develop a solution for Ford's Sequenced Part Delivery requirements. Says Jeff Fuller, assistant general manager of Intier Seating, 'Today's automotive climate demands our plants to have the capability to run many vehicle types on the same line. The EMS RFID system provides Mississauga

.Production pallets that carry seats down the production line.

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Seating Systems (a division of Magna-Intier Seating) with a smart pallets containing the product type and giving the MES the ability to load the respective torques, scans, oven heat %, tact times, and test requirements. Our system drives our operators to produce quality products with complete parts traceability. The EMS RFID system is the core of our flexibility and competitiveness.

Sequenced Part Delivery at Intier Seating

The automotive industry uses Sequenced Part Delivery (SPD) to create a 'factory without borders'. This advanced JIT parts delivery technique was developed to enable outsourcing of some operations within the auto assembly process. When done correctly, Ford can back a trailer into the assembly area with the correct finished components ready to build into a particular car as it moves down the line.
Ford is beginning to manufacture two new models: the Ford Edge and the Mercury MKX. Intier Seating of Mississauga, Ontario, is building the seats for these cars as an SPD outsourced part that must arrive at the Ford assembly plant at exactly the right time and exactly the right sequence. Traditionally, this scheduling has been done within the walls of the main assembly plant with coordination of parts handled by the internal scheduling programs.
The SPD schedule is sent to Intier Seating from Ford one week in advance of delivery. This information broadcast includes the VIN number of the final installed vehicle and the required sequence of delivery.
Intier Seatings' Sequenced Part Delivery Solution Escort Memory Systems worked with the Quality Team at Intier to develop a product tracking system for process automation based on RFID (Radio Frequency Identification) technology. The RFID systems have been in use for several months now for both the seat assembly process and for the shipment preparation process.

.Escort Memory Systems COBALT™ RFID Controller/Antenna in a conveyor section

.Shipping Pallet with an Escort Memory Systems durable RFID tag

Building Seats Correctly with RFID

When a seat build order is started down the line at Intier, the job number is transmitted by the RFID system to an RFID transponder, or "tag", which has been embedded in the seat assembly pallet. Once embedded, these durable tags will remain as a permanent element of the re-usable pallets. The job number is then read from the tag at each manufacturing workstation to initiate the correct processing as the seat travels from station to station on the production line.
The seat assembly remains with its pallet throughout the build process. After a seat is finished, the pallet is removed to be re-used to carry another seat through the assembly line, and the tag is re-written with a new job number. The pallets with their

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tags can be used over and over again.
The Escort Memory Systems tags chosen for this application require no batteries; instead they receive electrical power from the energy of the RF field when passing an RFID system antenna. These “passive” RFID tags contain digital memory that can typically store from 1000 to 2000 bytes of data.
Escort Memory Systems Cobalt™ integrated RFID controller/ antennas are installed into the conveyor system at each work station to automatically read the job identification data from the tag embedded in the bottom of the seat pallets. Any incorrect (skipped steps, out-of-sequence steps) are flagged and corrective action taken.

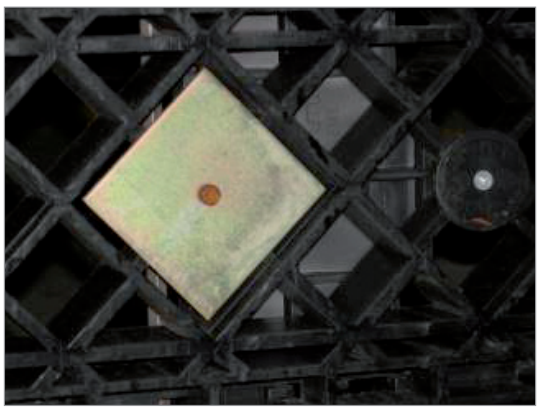
Shipping the Right Seats

The seats are transferred from manufacturing pallets to shipping pallets when manufacturing is complete. These shipping pallets have durable RFID tags embedded in them as well, so the finished seat assemblies may also be identified for correct staging in the warehouse and preparation of shipping loads.
Key to Intier Seatings’ operation is the use of EMS’ durable tag solutions that last hundreds of manufacturing cycles. Here we see the EMS RFID tag embedded in the seat shipping pallet.

Why Not Barcode?

At this point let’s stop for a moment and consider why barcode labels weren’t chosen to identify the seats as they move down the line. After all, the barcode is a unique identifier associated with the job and the individual barcode labels cost less than RFID tags.

The reasons are simple but key to the success of this application: reliability – cost – function.
First, EMS’s readers and tags provide much higher reliability of data in manufacturing environments than can be achieved by barcode techniques. The EMS readers and tags achieve as many as a million read cycles with only a few failures. This means that Intier Seating has a bullet-proof method of identifying each seat pallet. This level of reliability is not possible for barcode reader systems in the manufacturing environment.



.Close-up of RFID Tag in Shipping Pallet

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Optical systems are subject to failure in manufacturing environments due to optics degradation, condensation and barcode damage.
Barcode data cannot be changed once created.

RFID readers and tags are environmentally sealed.
Tags support multiple read/write operations for continued use.

Second, EMS' RFID tags can be used thousands of times meaning the cost of a durable tag can be spread over thousands of cycles. This makes them cheaper to use than a barcode label that must be re-applied after every production cycle (i.e. new job number). This is a typical example of re-useable production line carriers or shipping containers such as the pallets used to ship seats from Intier Seating to Ford.
And finally, the RFID tags can be written to during the process. For Intier Seating, this was critical as they needed to test each seat during safety compliance testing and record those results on the shipping tag for every order. This tag and the data on it are then transferred along with the seat to Ford.

Reliability – Getting specific

There are many ways to measure and predict reliability of complex systems, tools, etc. including mean time to fail, mean time to repair and other 'mean times', Another way of analyzing reliability is to analyze error rates. It is this method that underlies the '6-sigma' approach to continuous process improvement. The '6-sigma' approach to improving processes uses statistical process control (or SPC) methods outlined below. In essence, statistical process control says that each process step has a certain failure rate. If you string these process steps (manufacturing steps, if you will) into in a complete process flow to create a product then the error rate of the whole process is predicted from the combined error rate of the process steps;

Combined error rate (%) = Number of process steps ^ (1-error rate at each step)

	Number of process steps	Normal RFID read failure rate	Normal barcode fread failure rate	Normal case: Routine human errors
		1 in 10000	1 in 1000	1 in 100
	25	1.00	0.98	0.78
Intier Seat building steps	100	0.99	0.90	0.37
	200	0.98	0.82	0.13
	300	0.97	0.74	0.05
	400	0.96	0.67	0.02
	500	0.95	0.61	0.01
	600	0.94	0.55	0.00
	700	0.93	0.50	0.00
semiconductor process	800	0.92	0.45	0.00

Identification Errors as a function of process complexity

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A concrete example of this phenomena is observed at Intier Seating. Each day, Intier ships roughly 1000 seats to Ford;

Using human identification – 1000 seats x 100 steps x 1/100 = 1000 identification errors per day

Using barcode identification – 1000 seats x 100 steps x 1/1000 = 100 identification errors per day

Using RFID identification - 1000 seats x 100 steps x 1/10000 = 10 identification errors per day

The effect of identification errors range from interrupted processing and manual intervention to incorrect parts being delivered to the customer; both, costly errors in an automated environment. The bottom line here is that RFID systems offer the most reliable form of auto-identification compared to other systems available.

Sequenced Part Delivery to Ford

Once the seats are on the shipping pallet, weight sensors in the seats are tested according to Federal safety requirements (OCS occupant child safety) to insure correct functioning of the airbag control systems. This test result is then saved to the RFID tag on the shipping pallet. The seat/shipping pallet assemblies are then automatically stored in the ASRS (automated seat retrieval system) to await loading on to trailers bound for the Ford assembly plant.
On the morning of order shipment the ASRS system pulls the seats based upon the confirmed order. At each staging position for upper and lower seat loading the RFID tag on the shipping pallet is read to confirm the sequence in which that the pallets are placed onto the trailer. A rotation number is written to the RFID tag before the seat is loaded onto the trailer. When the trailer is received at the Ford plant, the rotation number is read from the RFID tag to verify sequencing into the Assembly production line.
With only four hours of inventory in the ASRS facility, every portion of the production system must work flawlessly. The key to success for Intier Seatings' SPD line lies in the reliability of the Escort Memory Systems RFID solution, and the ability of these systems to communicate with the standard industrial control equipment in use today.
On the seat production line, RFID controls communicate to Rockwell Automation's Contrologix PLC's via Industrial Ethernet IP. The RFID antennas on the shipping system communicate via Allen-Bradley Remote I/O to a PLC5 controller and directly through the backplane on an SLC500 interface module. The antennas are multi-dropped into the interface modules via MUX32.

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Problem Solved

Industrial RFID solutions from Escort Memory Systems were chosen for a mission critical application by Intier Seating, a SPD supplier to Ford's Edge and MKX assembly plant. The RFID automation scheme chosen by Intier gave them all of the elements required:

• Bullet-proof auto-identification for production line support with Cobalt HF family readers

• Lowest possible cost with durable RFID tags

• Finished goods test and production data delivered to the end user by RFID tags.

RFID's unique robustness in harsh environments, low cost in manufacturing environments and ability to change data by simply writing new data to the tag's memory make it the ideal solution to difficult automation problems.

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