DEPLOYMENT GUIDE

Real-time Visibility

Deploying RFID & RTLS in ***Aerospace & Aviation***

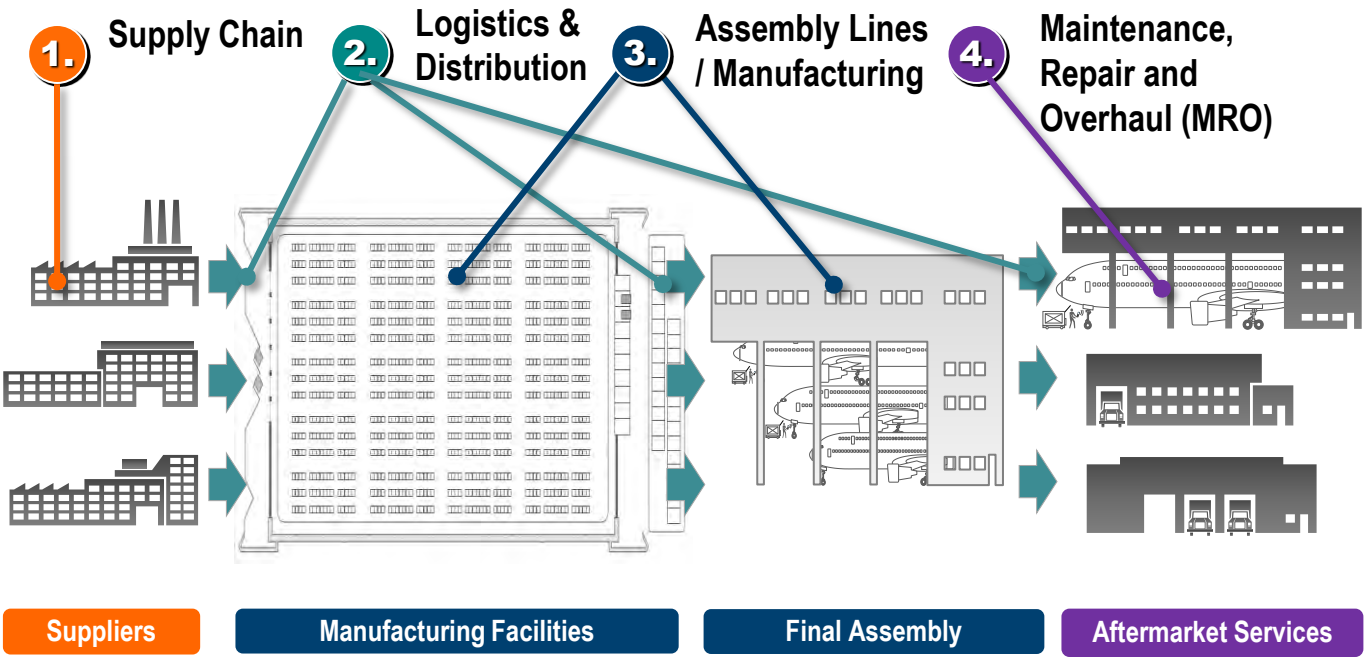
RFID JOURNAL

OAT
A division of Checkpoint

Real-time Visibility: Process Areas

Innovative firms in Aerospace and Aviation continually look for ways to increase efficiency and eliminate waste in day-to-day operations. RFID and RTLS provide the necessary visibility and measurability to drive process improvement and cost savings.

Many have leveraged their existing IT infrastructure and focused on automating specific process areas with RFID and RTLS technology, focusing in one of ***four key areas:***



This guide illustrates specific areas where Aerospace OEMs, Defense Contractors, Suppliers and MRO providers and can quickly and cost-effectively real-time enable their operations, using a complex value chain as an example.

Note: Although RFID and RTLS are referred to specifically within this document, UWB, Wi-Fi, along with other Auto-ID and sensor technologies may be used interchangeably for real-time enabled applications.

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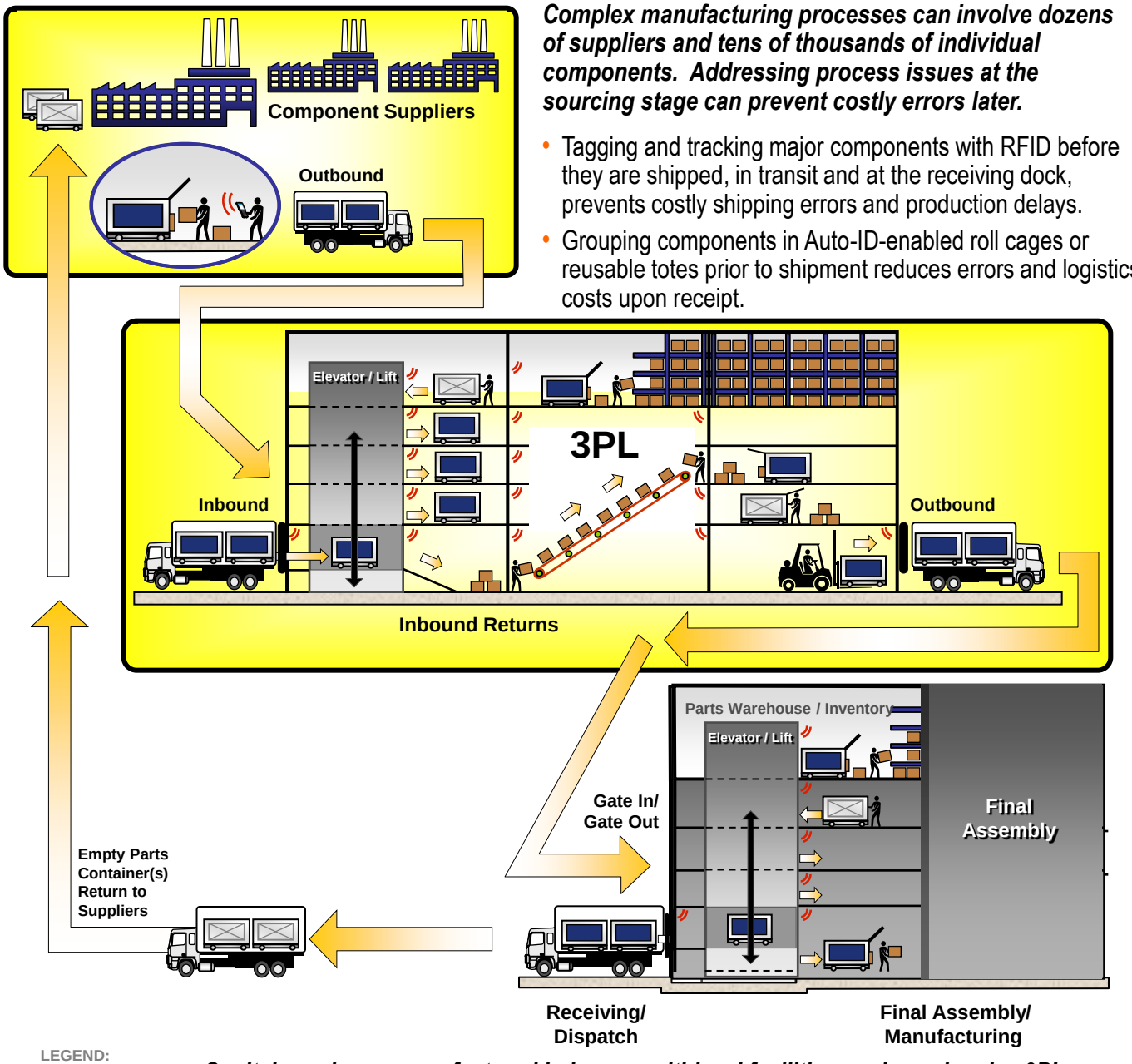
1. RFID & RTLS in the Supply Chain



Complex manufacturing processes can involve dozens of suppliers and tens of thousands of individual components. Addressing process issues at the sourcing stage can prevent costly errors later.

- Tagging and tracking major components with RFID before they are shipped, in transit and at the receiving dock, prevents costly shipping errors and production delays.
- Grouping components in Auto-ID-enabled roll cages or reusable totes prior to shipment reduces errors and logistics costs upon receipt.

LEGEND:

- **RFID or RTLS Readers (Identification Checkpoints):** Can be deployed using Auto-ID portals or Mobile Auto-ID Solution
- **Full Parts Container**
- **Empty Parts Container**

Capital goods are manufactured in large, multi-level facilities, and may involve 3PLs or cross-facility assembly processes. Components for a single product are commonly shipped to multiple areas within one location or across dozens of dispersed locations.

- Assigning a specific zone for each major component within the facility before the component is shipped, and verifying receipt with RFID or RTLS reduces material management costs and reduces downtime.
- Tagging, grouping and tracking finished subassemblies by product, customer and final destination prior to shipment reduces production delays downstream.

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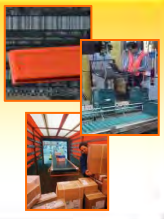
1. Supply Chain RFID & RTLS Applications

Application:	RFID/ RTLS Process Automation:	Enterprise Systems Integration Options:	RFID/ RTLS Value-Add:
ATA 2000 Part Marking	• Automated Tagging, Encoding, Tracking of Aircraft Component Parts • Updating Part History Records Through Final Assembly, Attestation and Time in Service	ERP, MES, Project Mgmt. Systems • Document and update birth record and ongoing product lineage information	• Accurate, reliable tagging and encoding at the point of manufacture • Downstream visibility for Work-in-Process and Maintenance Operations
RTI (Returnable Transport Item) Tracking	• Tracking reusable containers and contents from location to location • Tracking Container Pedigree when hazardous materials are involved	ERP, Project Management, WMS Systems: • Pull parts manifest for each work order to track components • Confirm final destination for each shipment & work order number • Alert staff with a visual or audible alarm when a work order is received in the wrong location	• Automated check-in/check-out processes • Real time status of work orders and components
Inbound Receiving	• Automated Receipt, Verification of Goods • Expediting Rush Orders • Quarantining and Tracking Non-scheduled Shipments	ERP, Project Management, WMS Systems: • Compare Received Goods with Content Manifest or ASN • Flag Rush Orders by Comparing Order Number and Special Instructions	• 100% Automated Tracking & Reliable Identification of Shipments as they are Received • Focusing Staff on Exception Handling vs. Administrative Paperwork

Example

Inbound Receiving:
an Aerospace OEM worked with OAT to automate receipt of shipments from Component Suppliers, resulting in a significant reduction in handling time and labor costs

- **Auto-ID Technology**: RFID, Wi-FI, Barcode
- **Enterprise Systems**: SAP, Baan ERP



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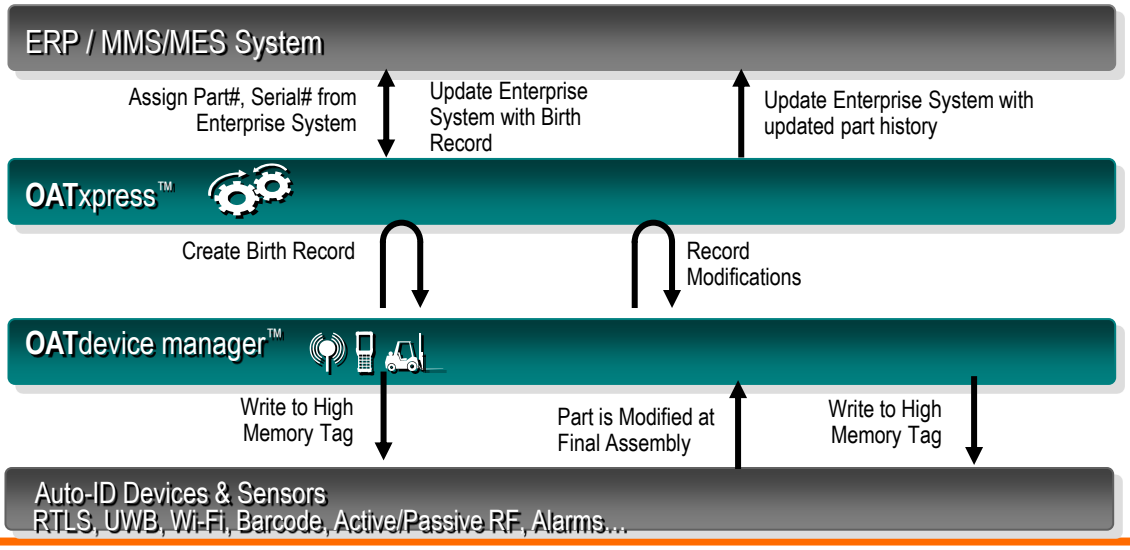
1. Supply Chain: Functional Process Flows

ATA 2000 Part Marking

Sample Process Flow

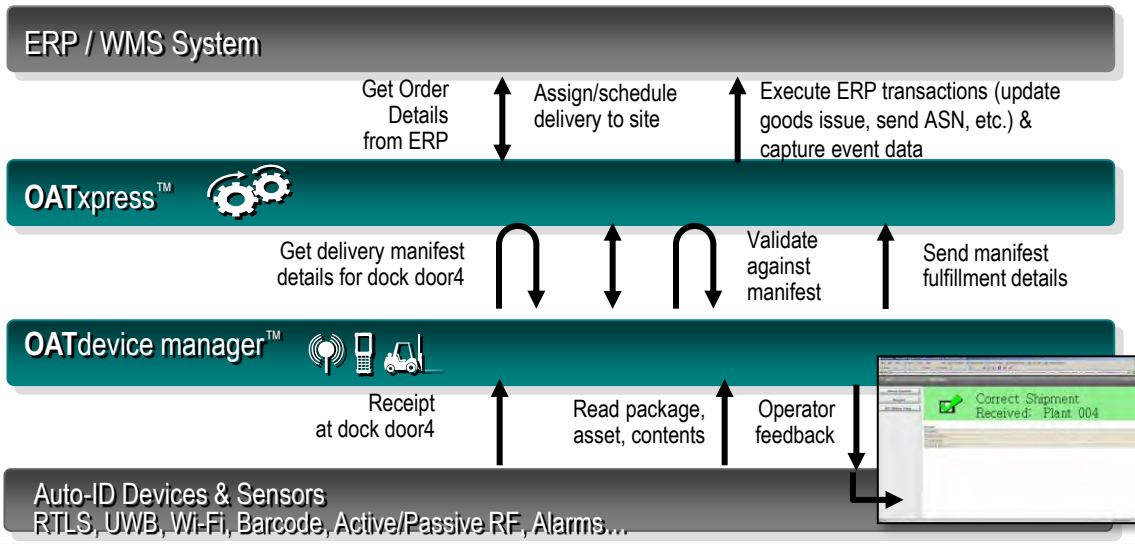
- Automated Birth Record Creation and Product History Update



Receiving

Sample Process Flow

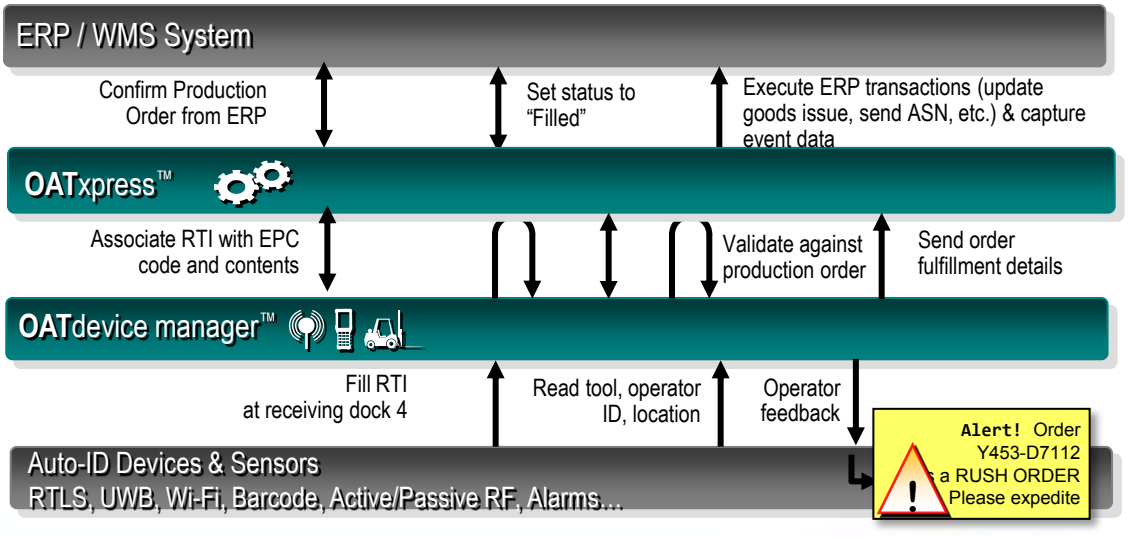
- Validating manifest details, ASN against physical shipments



RTI Tracking

Sample Process Flow

- Validating order & manifest details against physical containers and their contents



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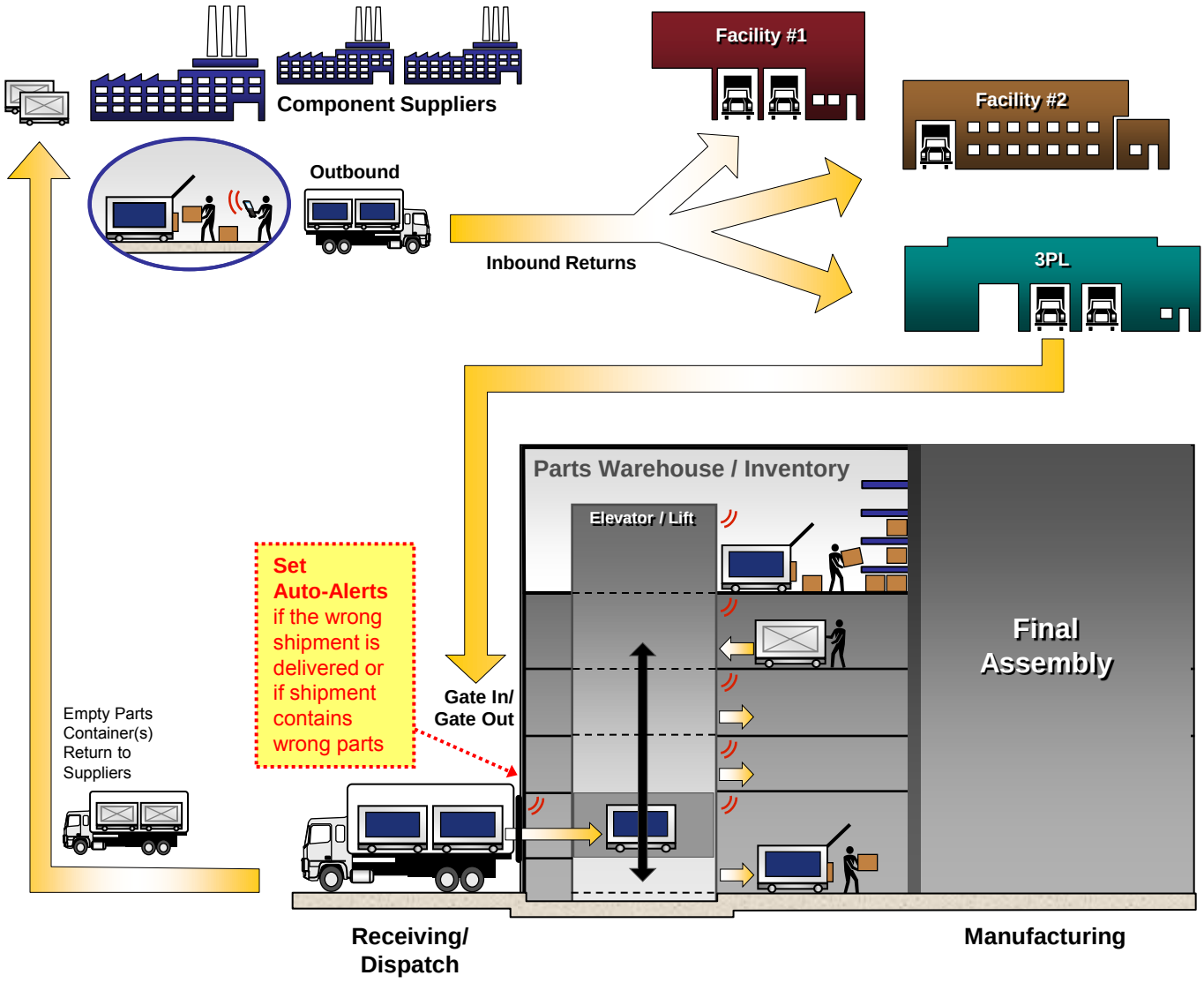
2. RFID & RTLS in Logistics - Distribution



LEGEND:

- **RFID & RTLS Readers (Identification Checkpoints):** Can be deployed using Auto-ID portals or Mobile Auto-ID Solution
- **Full Parts Container**
- **Empty Parts Container**

Many manufacturers manage materials, components and finished goods across multiple facilities. The more complex the logistics process, the more chances for shipping and receiving errors to propagate downstream. RFID & RTLS-enabled processes can automatically track items once they pass through checkpoints within facilities, in transit, or at shipping and receiving points.

Tracking shipping containers, customer orders and delivery vehicles with an RFID or RTLS-enabled ERP or WMS system:

- Prevents mis-shipments and make-goods, so less on-hand inventory is required at each location
- Increases product velocity, leading to higher cash flow
- Improves customer satisfaction

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2. Logistics/Distribution RFID & RTLS Applications

Application:	RFID/ RTLS Process Automation:	Enterprise Systems Integration Options:	RFID/ RTLS Value-Add:
Order Tracking	• Track orders and their individual items from location to location	ERP, WMS, Project Mgmt. Systems • Pull ASN for each order to track supplier, end customer, final destination and item numbers • Alert staff with a visual or audible alarm when an order is received in the wrong location, or needs to be expedited	• Real time order status • Reduce manual labor in confirmation, verification and search activities
Shipping	• Automate Advanced Shipping Notices (ASNs) • Verify outgoing orders • Automate tracking of delivery vehicles and associated orders	ERP, Project Management, WMS Systems: • Expedite rush orders • Verify individual items with customer orders • Verify final destination, carrier and dock door • Flag rush orders by comparing order number & special instructions	• 100% automated tracking & reliable confirmation of orders as they are shipped • Significantly reduce error rates and costly correction processes • Focus staff on exception handling vs. administrative paperwork
Component Tracking & Kitting	• Automate Component Manifest, Shipping Manifest • Verifying outgoing orders • Expediting rush orders • Automating customs documentation for international shipments	ERP, Project Management, WMS Systems: • Compare outgoing goods with Component Manifest/Shipping Manifest • Compile customs documentation based on component part history records, work orders, customer requirements	• Error-proofing kitting and shipping process • Focusing staff on fulfilling orders vs. managing paperwork

Example

Component Tracking & Kitting:
a Specialized Aircraft Manufacturer worked with OAT to track subassemblies and whole goods being shipped directly to customers, resulting in reduced costs for outbound shipping and reduced labor costs for preparing customs paperwork

- **Auto-ID Technology**: RFID, Barcode
- **Enterprise Systems**: SAP ERP

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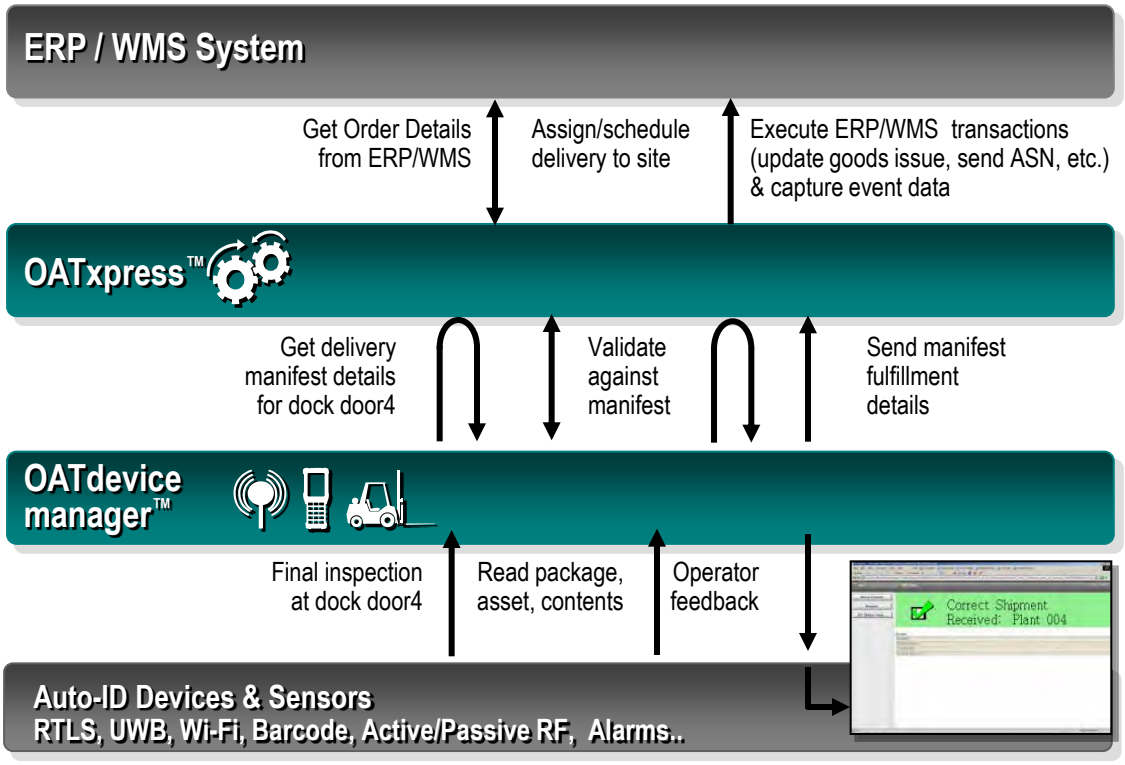
2. Logistics - Distribution: Functional Process Flows

Shipping

Sample Process Flow

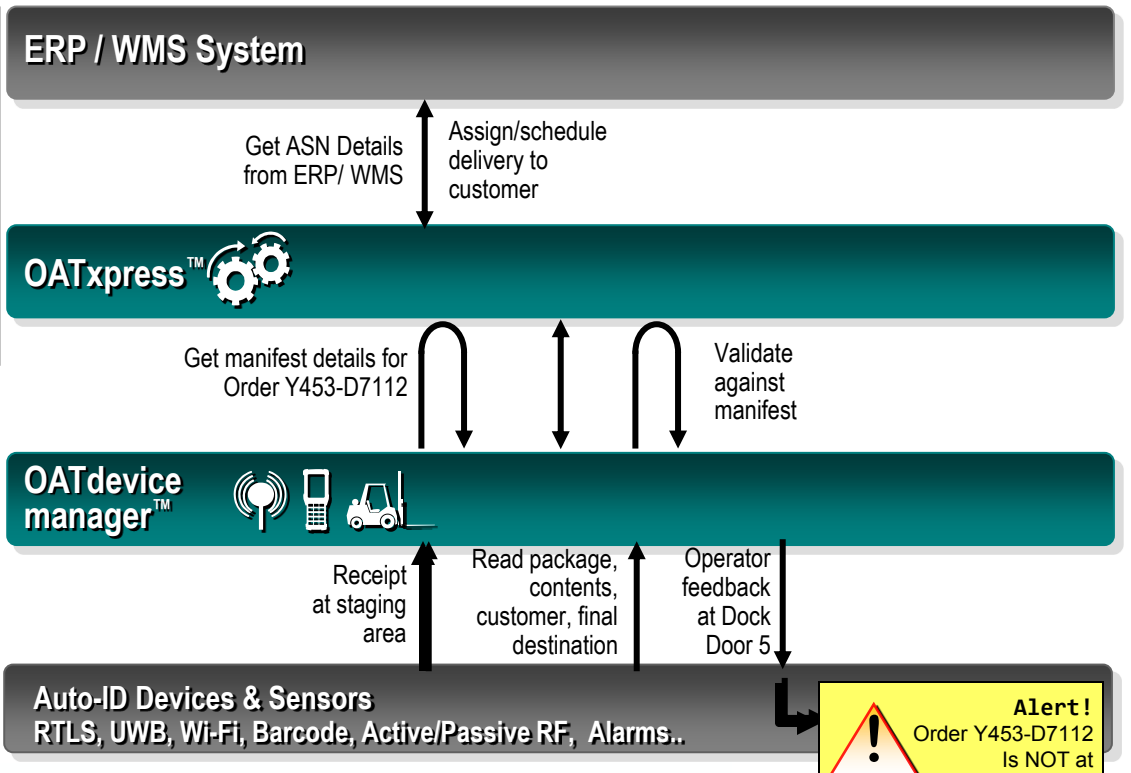
- Verifying outgoing orders, validating Packages against ASN



Order Tracking

Sample Process Flow

- Validate physical items against ASN & customer order to track supplier, end customer, final destination and item numbers



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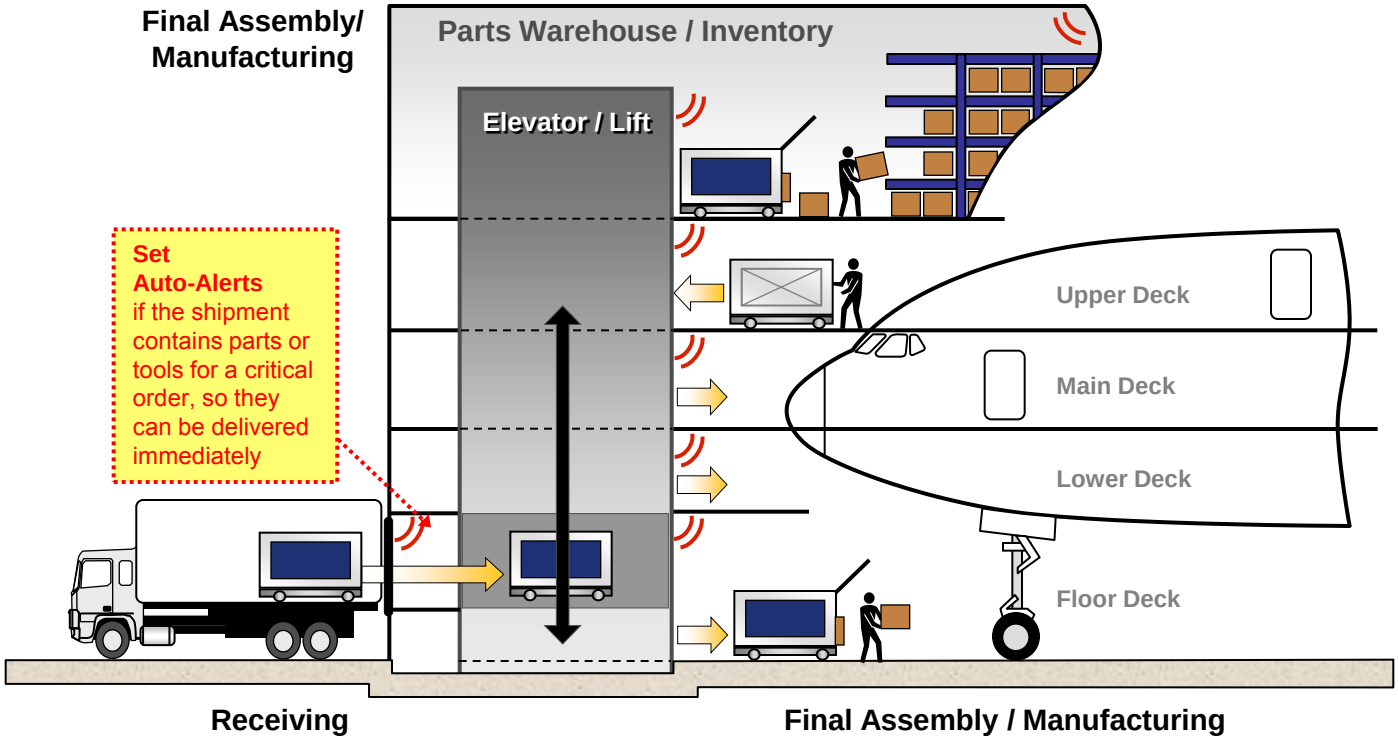
3. RFID & RTLS in Manufacturing

It's a common practice for commercial aircraft to be physically assembled at one location and to have custom interiors installed at a second location.

At each assembly facility, a single aircraft receives parts (chairs, lighting, carpeting, catering equipment) at its own loading dock. The parts are then delivered to different floors within the assembly area. One aerospace OEM reports that the parts to assemble a single aircraft can fill over 700 rolling containers. RFID & RTLS ensures that the right parts are at the right place at the right time. This reduces or eliminates the need for excess safety stock.



LEGEND:

- **RFID & RTLS Readers (Identification Checkpoints):** Can be deployed using Auto-ID portals or Mobile Auto-ID Solution
- **Full Parts Container**
- **Empty Parts Container**

- RFID & RTLS-enabling ERP and MES systems provides real-time visibility into work-in process by:
  - Verifying that the correct components are delivered and installed by comparing each part against the bill of materials
  - Confirming progress of each work order as assembly progresses from one stage to the next
  - Tracking tools and equipment across the facility, eliminating manual check-in & check-out processes and production delays due to lost equipment
- Setting audible and visual alerts prevents a parts container as well as the parts themselves from being delivered to the wrong location.

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3. Manufacturing RFID & RTLS Applications

Application:	RFID/ RTLS Process Automation:	Enterprise Systems Integration Options:	RFID/ RTLS Value-Add:
Work-in-Process Tracking	Real-time Tracking of Manufacturing Work Orders , Component Parts & Subassemblies	ERP, MES, Project Mgmt. Systems • Update Inventory Levels and Component Parts are Assigned to New Work Orders. • Alert Operator or Replenish Part Stores when Inventory Levels fall below a Pre-Defined Threshold	• 100% Automated Tracking & Reliable Identification of Work Orders through the Manufacturing Process • Reduction in Safety Stock and Reusable Containers • Help Prevent Missing Orders and Rework, Increasing Manufacturing • Audit Trail of Components, Batch Numbers for Finished Products
Kanban Management **Cycle Counting**	Proactive Inventory Management & Automatic Replenishment	ERP, Project Management, WMS Systems: • Compare Expected Inventory with Actual Inventory • Alert Operator or Replenish when Inventory Levels are Low	• Automated Stock Taking and Replenishment • Reduction in Safety Stock, Labor Costs
Composite Material Tracking	Tracking Freezer Out-Time for Perishable Materials	ERP, Material Management Systems (MMS) • Monitor Out-time while Material is in Cutting, Layup stages • Alert Staff When Out-Time Threshold is Imminent	• Reduction in Scrap Material • Reduction in Quality Risk
Tool Tracking	• Real-time Tracking of Tools and Specialized Equipment	ERP, Project Management, WMS Systems: • Verify and Update Tool Location and Maintenance Records when Tools are checked in and out	• Automated Inventory Management • Reduction in Tool Spares • Fewer Lost Tools, Increasing Manufacturing Uptime • Audit Trail of Tool Usage and Maintenance Simplifies Compliance

Example

Tool Tracking:
a Fortune 500 Defense Contractor worked with OAT to track specialized Tools and Tooling across a 20+ building manufacturing campus to improve asset utilization and reduce tool inventory

- **Auto-ID Technology**: RFID, Barcode
- **Enterprise Systems**: Deltek CostPoint

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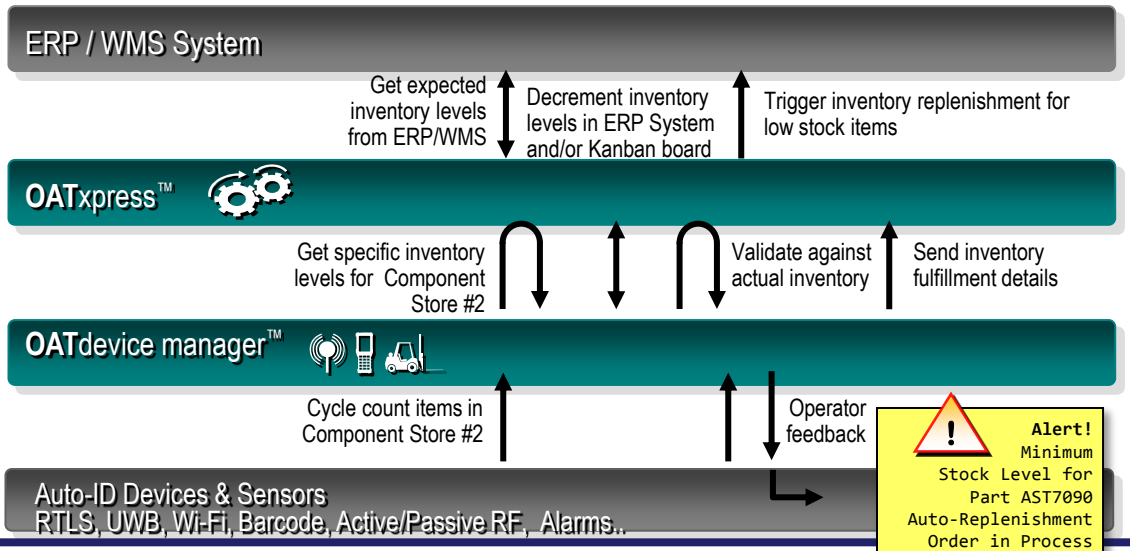
3. Manufacturing: Functional Process Flows

Kanban/ Cycle Counting

Sample Process Flow

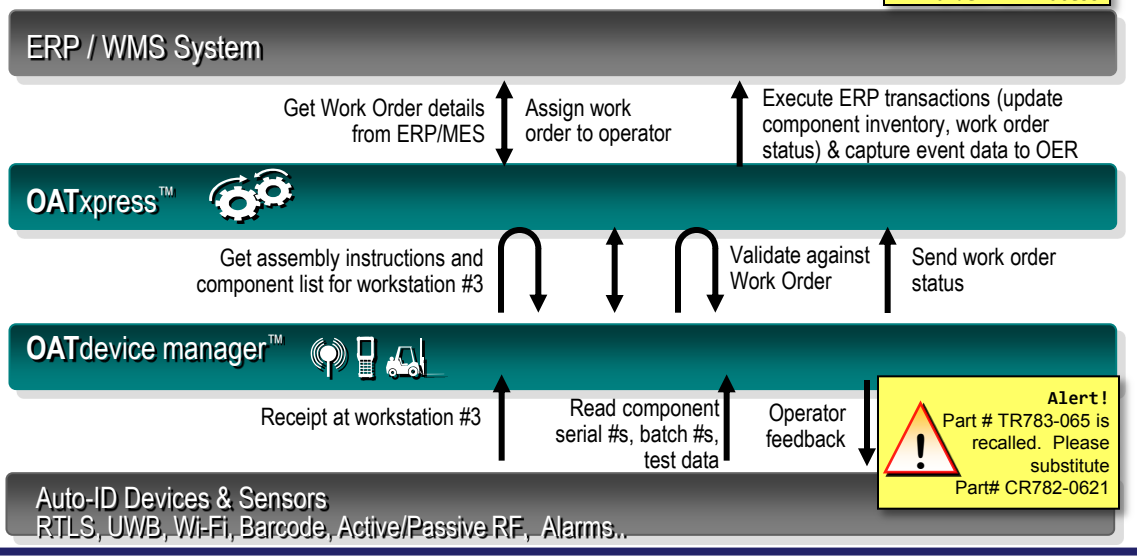
- Inventory Verification and Auto-Replenishment



Work-in-Process Tracking

Sample Process Flow

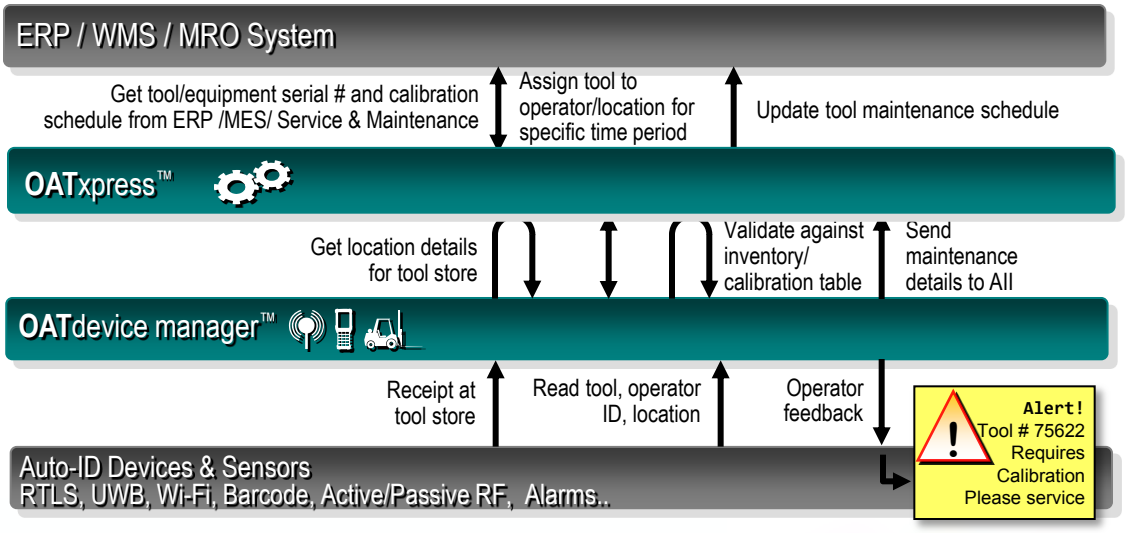
- Verifying Components as they are Assigned to Work Orders



Tool Tracking

Sample Process Flow

- Verifying Tool Location and Maintenance during Check-In – Check-Out Process



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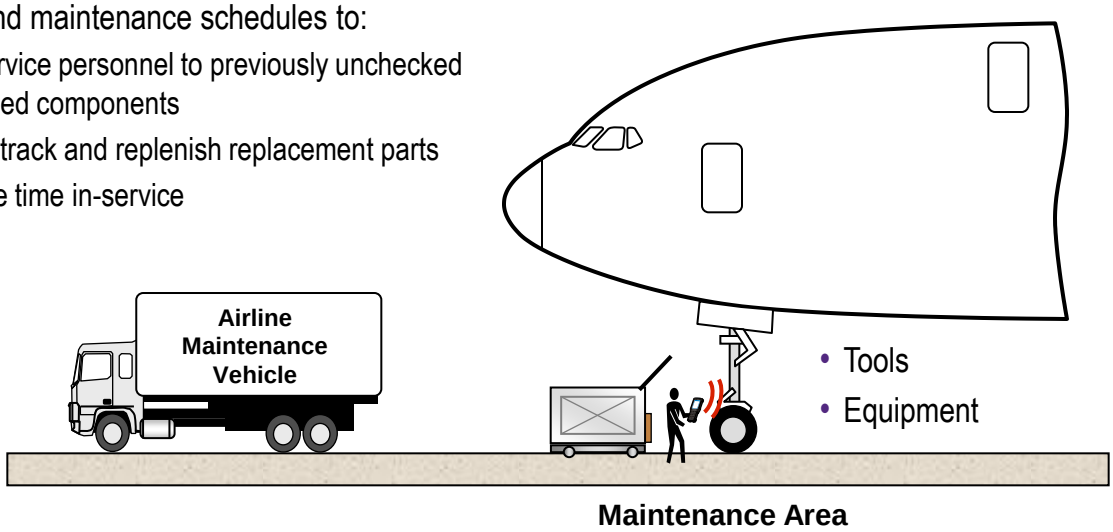
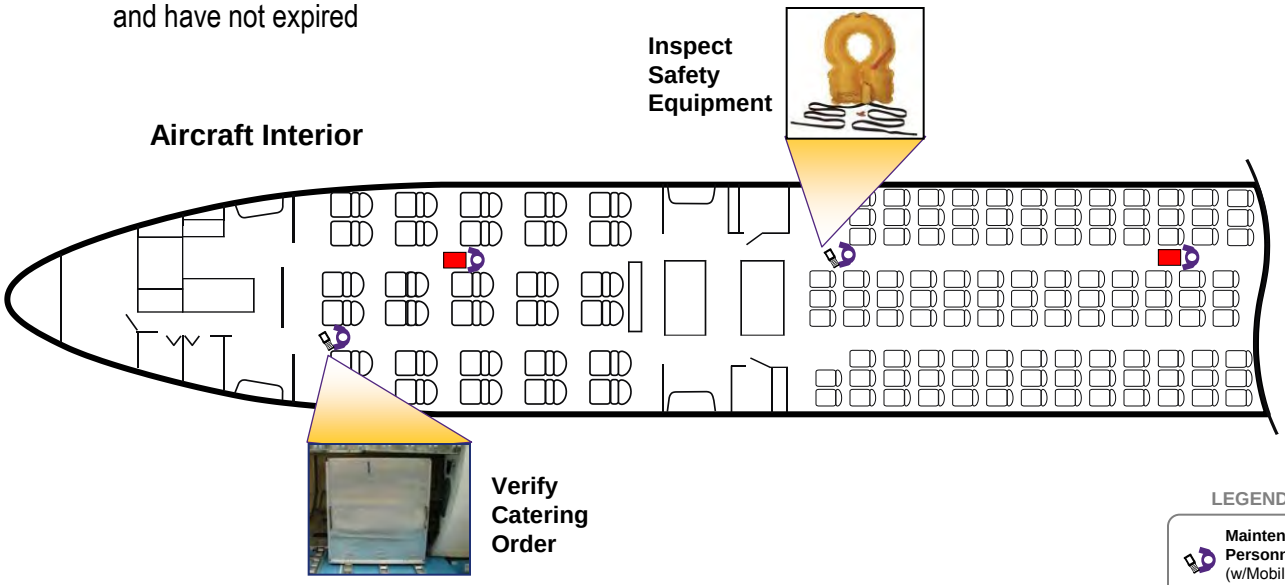
4. RFID & RTLS in MRO Operations

A commercial aircraft is checked and maintained before and after each flight, on the ground and inside the cabin…

- RFID & RTLS-enabled MRO systems track tools, equipment and maintenance schedules to:
  - Alert service personnel to previously unchecked or recalled components
  - Closely track and replenish replacement parts
  - Increase time in-service



- Inside the cabin, safety equipment can be quickly scanned with hand-held RFID readers to ensure that:
  - The catering order is complete and correct
  - The passenger cabin and each seating area have the required safety equipment
  - The correct number of life jackets, masks, oxygen containers and other critical items are on-board and have not expired



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4. MRO RFID & RTLS Applications

Application:	RFID/ RTLS Process Automation:	Enterprise Systems Integration Options:	RFID/ RTLS Value-Add:
Line-Side Maintenance	• Automated parts replenishment and service documentation for line-side maintenance	ERP, MRO, Service & Asset Mgmt. Systems • Compare maintenance schedule and service parts against current service history, update history as service is performed • Alert operator to components which need to be checked and replaced • Compare and update physical parts and tool inventory, place replenishment orders when stock runs low	• Increased time in service • Reduced labor costs for managing administrative paperwork, reduced regulatory fines • More efficient labor and parts allocation, reducing overall maintenance and repair costs
Audit & Inspection	• Real-time Tracking of MRO Activities and Maintenance Schedules • Automated Stock Taking and Replenishment Reconciliation	ERP, Project Management, WMS Systems: • Pull parts manifest for each work Verify and Update Maintenance Records when Aircraft is Serviced • Confirm Required Components (Oxygen Canisters, Life Vests) are On Board • Alert Staff if a specific component is missing, near or past expiration date, or requires maintenance	• Faster Turnaround Time at Maintenance and at the Gate • Fewer Spare Components Required • Audit Trail of Maintenance & Inspection Activities Simplifies Compliance
Overhaul Operations	Real-time Tracking of M&E Operations such as engine overhaul	ERP, MRO, M&E Systems: • Update Work Order Status as Service is Performed • Update Inventory Levels and Component Parts are Assigned to New Work Orders. • Alert Operator or Replenish Part Stores when Inventory Levels fall below a Pre-Defined Threshold:	• 100% Automated Tracking & Reliable Identification of Work Orders through the Overhaul Process • Reduce Rework, Labor and Inventory Costs

Example

Engine Overhaul Tracking:
an International Airline worked with OAT to track components and work-in-process for engine overhaul operations, resulting in increased efficiency, on-time delivery and significant labor savings

- **Auto-ID Technology**: RFID, Barcode
- **Enterprise Systems**: In-house M&E Application

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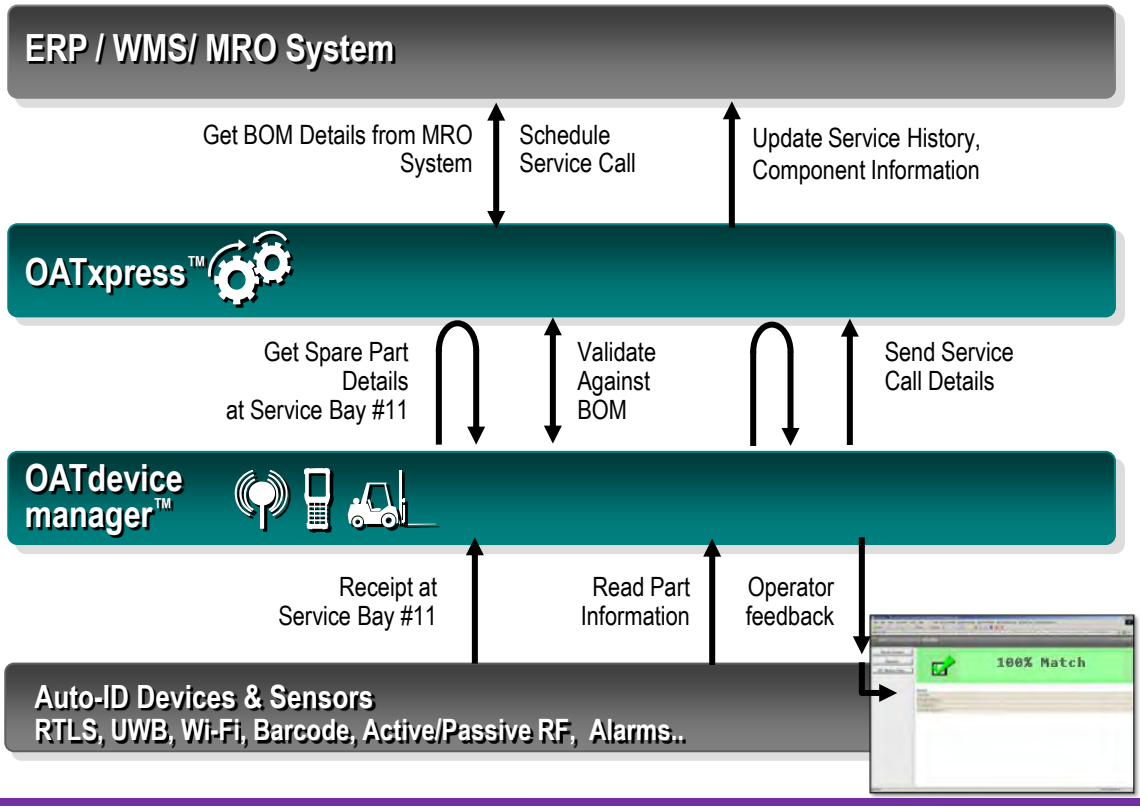
4. MRO: Functional Process Areas

Line-Side Maintenance

Sample Process Flow

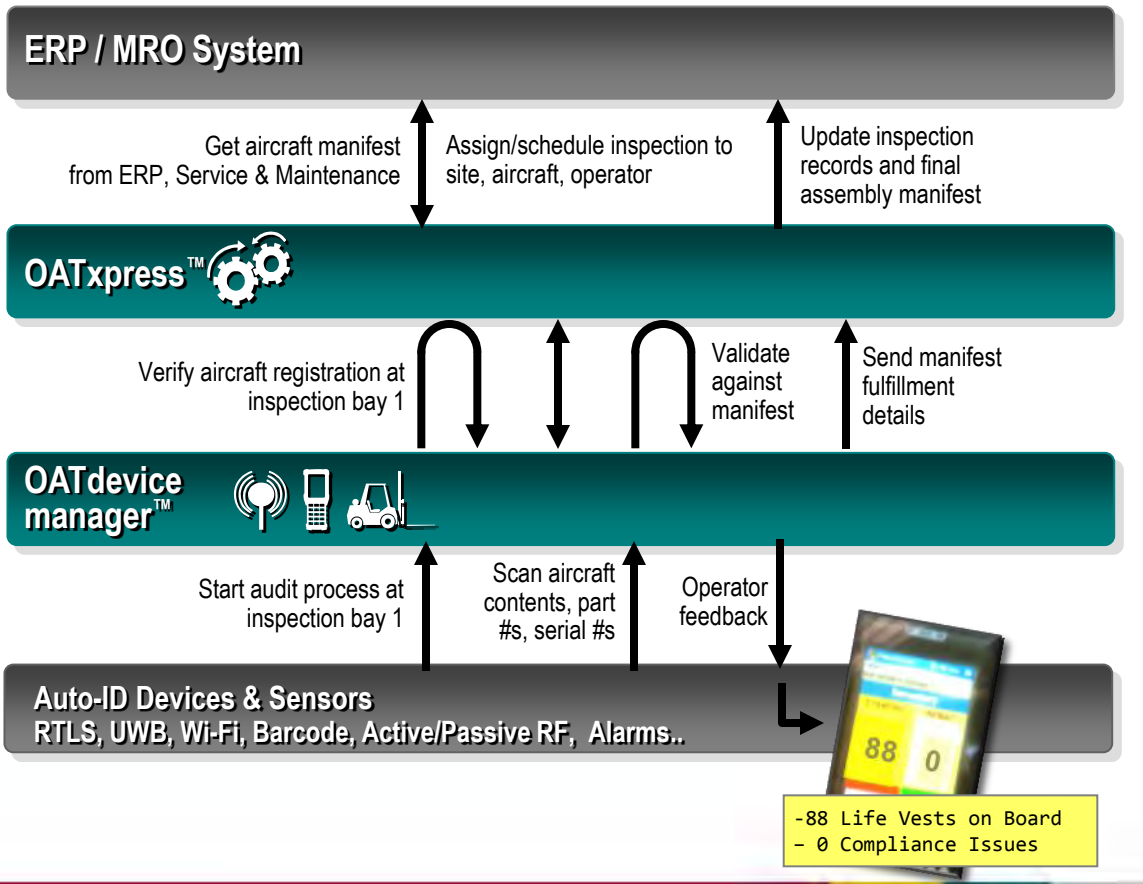
- Verifying service orders and spare part availability during maintenance process



Audit & Regulation

Sample Process Flow

- Confirm required components are on board aircraft



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RFID & RTLS-enabling Key Process Areas

	1. Supply Chain	2. Logistics & Distribution	3. Manufacturing/ Assembly Lines	4. Maintenance & Repair
Items to Track:	• Component Parts • Supplier • Batch Number • Due Date	• Carrier • Order Number • Order Contents • Final Destination • Due Date	• Work-in-Process • Tools and Equipment • Test Results • Custom Order Details	• Service History • Replacement Parts • Part Expiration Date • Service Due Date
Processes to Enable:	Sourcing Shipping/Receiving	Shipping/Receiving Reverse Logistics	Shipping/Receiving Line-side Replenishment Assembly Asset Tracking Tool Tracking	Line-side Maintenance Engine Maintenance Component Maintenance Heavy Maintenance Audit & Inspection
Enterprise Systems to Enable	ERP MMS WMS	ERP WMS	ERP MMS MES WMS	MRO Field Service Enterprise Asset Management
Infrastructure to Enable	Barcode, RFID, Contact Memory Buttons, Wi-Fi	Barcode, RFID, Wi-Fi, RTLS, GPS	Barcode, RFID, CMBs, Wi-Fi, PLCs, Stack Lights & other sensors	Barcode, RFID, CMBs, Wi-Fi, RTLS, GPS
Quantifying Value:	Increased Forecast Accuracy Reduced Safety Stock Reduced Expedite Costs	Streamlined Shipping Costs Increased Order Accuracy & Customer Satisfaction	Improved Product Quality, Fewer Returns Reduced Downtime Reduced Scrap & Rework Reduced Expedite Costs	Increased Time in Service Fewer Audits & Regulatory Fines Reduced Maintenance and Repair Costs

While every manufacturing and services operation is unique, there are common operational challenges that can be addressed with real-time visibility. By automating and error-proofing critical processes, RFID & RTLS-enabling existing applications and implementing Auto-ID packaged solutions, Aerospace Manufacturers and Defense Contractors can reduce deployment time and accelerate the return on their technology investment.

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About OATSystems

OATSystems has helped more than 100 companies take advantage of RFID & RTLS to streamline operations, enhance customer satisfaction and increase bottom line results. OAT is the recognized Auto-ID solution leader with software that empowers businesses to achieve a competitive advantage and ROI from real-time visibility. As a pioneer in the development of Auto-ID technology, OAT has been setting the standard in RFID for over half a decade and has provided RFID & RTLS-enabled solutions to leading Aerospace and Industrial companies such as Airbus, Parker Hannifin, Rockwell Collins, Bell Helicopter, Monsanto, Chevron, TAP Air Portugal, Cephalon, Shell and others.

Contact OATSystems today at www.oatsystems.com or 781-907-6100 and get ready to take control of your operations.

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