



# RFID & RTLS in Harsh Environments

## Deployment Guide



*Delivering Real-time  
Visibility to the  
Enterprise*

# RFID & RTLS in Harsh Environments



RFID and RTLS are being widely deployed in multiple industries for asset tracking and process improvement, within manufacturing facilities, distribution centers, and elsewhere across the value chain. With the advent of ruggedized tags and automated process flows, RFID and RTLS benefits can be extended to harsh environments such as remote worksites, autoclaves, clean rooms, in-service aircraft and outdoor maintenance facilities.

But where to start? This guide is designed to help you determine where RFID and RTLS technology can have the most impact on process improvement within your business operation.

Based on the thousands of sites where OAT has deployed RFID and RTLS solutions, we can anticipate some of the questions you may have when evaluating the technology.

These topics are covered in the following pages.

- ▶ *Where are RFID & RTLS used in Harsh Environments?* *Page 3*
  
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- ▶ *What are the most common business processes for RFID?* *Page 5*
  
- ▶ *How exactly do RFID & RTLS enable these business processes?* *Pages 6-8*
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  - ▶ *Materials Management*
  - ▶ *Shipping and Receiving/ Chain of Custody Tracking*
  
- ▶ *What ROI metrics are typically used to justify an RFID/RTLS deployment?* *Page 9*

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.

# Where are RFID and RTLS Deployed in Harsh Environments?

RFID and RTLS are being widely deployed in multiple industries for process automation, within manufacturing facilities, distribution centers, and across the value chain. With the advent of ruggedized tags and automated process flows, the benefits are being extended to remote worksites, clean rooms, in-service aircraft and outdoor maintenance facilities. The table below illustrates the some common applications in Harsh Environments:

## COMMON APPLICATIONS FOR RFID & RTLS IN HARSH ENVIRONMENTS

INDUSTRY	APPLICATION AREAS	ASSETS TRACKED	RFID-ENABLED PROCESSES
 <p><b>OIL &amp; GAS, CHEMICALS</b></p>	<ul style="list-style-type: none"> <li>Remote worksites</li> <li>Processing Plants</li> </ul>	<ul style="list-style-type: none"> <li>Drilling Equipment</li> <li>Inter-facility shipments</li> </ul>	<ul style="list-style-type: none"> <li>Equipment Tracking</li> <li>Downstream Supply Chain</li> </ul>
 <p><b>MINING</b></p>	<ul style="list-style-type: none"> <li>Remote worksites</li> <li>Processing Plants</li> </ul>	<ul style="list-style-type: none"> <li>Mining Equipment</li> <li>Raw Materials</li> </ul>	<ul style="list-style-type: none"> <li>Equipment Tracking</li> <li>Materials Management</li> </ul>
 <p><b>HEAVY EQUIPMENT</b></p>	<ul style="list-style-type: none"> <li>Storage Yards</li> <li>Maintenance Yards</li> </ul>	<ul style="list-style-type: none"> <li>Whole Goods</li> <li>Maintenance Equipment</li> </ul>	<ul style="list-style-type: none"> <li>Whole Goods Tracking</li> <li>Yard Management</li> </ul>
 <p><b>HEALTHCARE</b></p>	<ul style="list-style-type: none"> <li>Central Sterile</li> <li>EMS Vehicles</li> </ul>	<ul style="list-style-type: none"> <li>Surgical Tools</li> <li>Medical Devices</li> <li>Consumables</li> </ul>	<ul style="list-style-type: none"> <li>Sterile Processing</li> <li>Inventory Management</li> </ul>
 <p><b>AEROSPACE &amp; DEFENSE</b></p>	<ul style="list-style-type: none"> <li>Clean Rooms</li> <li>MRO Facilities</li> </ul>	<ul style="list-style-type: none"> <li>Production Equipment</li> <li>Composite Materials</li> <li>Component Spares</li> </ul>	<ul style="list-style-type: none"> <li>Tool/Tooling Tracking</li> <li>Materials Management</li> <li>MRO Tracking</li> </ul>
 <p><b>BIOTECH/ PHARMA</b></p>	<ul style="list-style-type: none"> <li>Clean Rooms</li> <li>Laboratories</li> </ul>	<ul style="list-style-type: none"> <li>Controlled Substances</li> <li>Samples/Specimens</li> <li>Lab Equipment</li> </ul>	<ul style="list-style-type: none"> <li>Controlled Substance Tracking</li> <li>Sample Tracking</li> <li>Equipment Tracking</li> </ul>
 <p><b>ENERGY/ UTILITIES</b></p>	<ul style="list-style-type: none"> <li>Power Plants</li> <li>Remote Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Plant Equipment</li> <li>Utility Poles, Meters, Turbines, Antennas</li> </ul>	<ul style="list-style-type: none"> <li>Service and Maintenance</li> <li>Asset Tracking</li> </ul>
 <p><b>DISTRIBUTION</b></p>	<ul style="list-style-type: none"> <li>Laydown Yards</li> <li>In-Transit</li> </ul>	<ul style="list-style-type: none"> <li>Shipments</li> <li>Intermodal Containers</li> </ul>	<ul style="list-style-type: none"> <li>Chain-of-Custody Tracking</li> </ul>

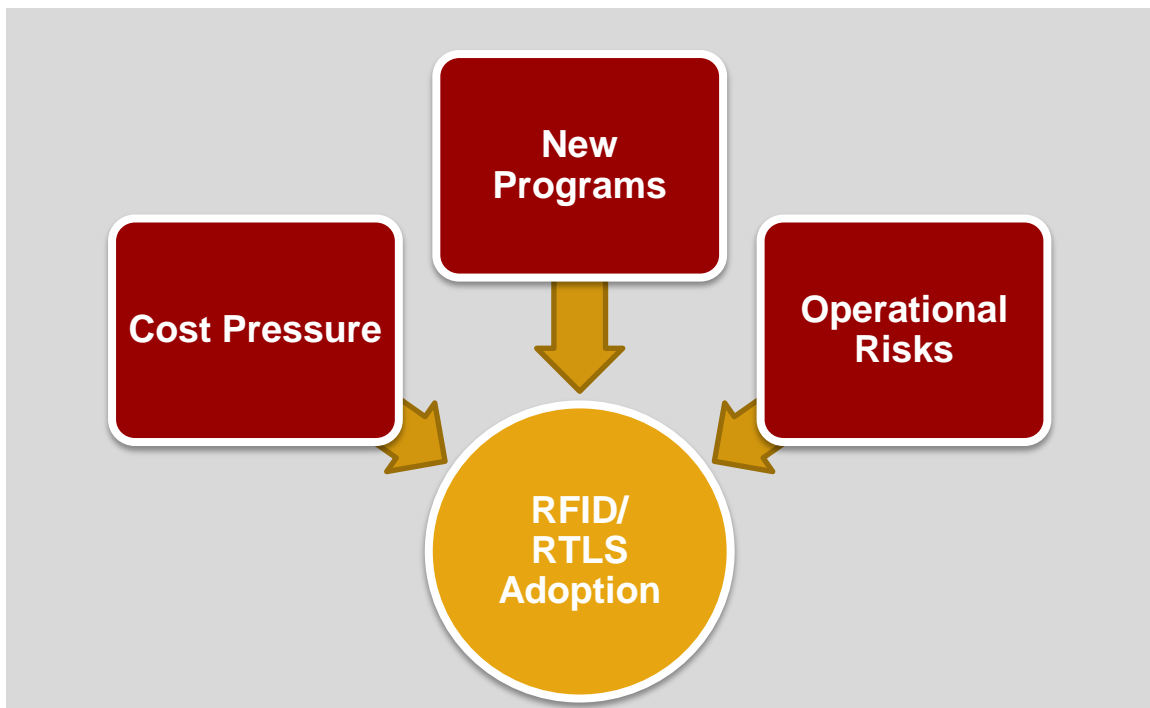
# What's Driving RFID & RTLS Adoption in Harsh Environments?

Most business operations in harsh environments have these common characteristics:

1. Significant investment in capital assets
2. Core processes are either customer-facing or contract-driven
3. High operational and regulatory risk

These three realities, combined with the increasing complexity of business operations in harsh environments, are driving the adoption of RFID and RTLS.

## PRIMARY DRIVERS OF RFID & RTLS ADOPTION



**Cost Pressure** CFOs are putting capital asset inventory under scrutiny since working capital allocation is a prime component of operating profit – enterprises need additional visibility to proactively manage these assets across diverse, geographically distributed operations.

**New Programs** Large scale projects require more resources and more tightly managed processes, as stakeholders demand transparency throughout the program, not just at program completion.

**Operational Risks** With increased focus on quality, safety, FOD (foreign object debris) and program compliance, flagging errors and exceptions at the process level is more important than ever.



# High-Impact Business Processes in Harsh Environments

A high-impact business case is a clearly-defined operational process that is directly related to the bottom line. Automating a high impact business process (especially one that is manual, costly and inefficient) with RFID or RTLS increases not just asset visibility, but the visibility of the project itself – which can lead to more corporate resources and support for your deployment. So while it may be appealing to “experiment” with RFID technology in an isolated area of your operation, this may not be the best approach.

The following table lists some of the most common cross-industry business processes for RFID and RTLS in Harsh Environments.

## HIGH IMPACT BUSINESS PROCESSES - HARSH ENVIRONMENTS

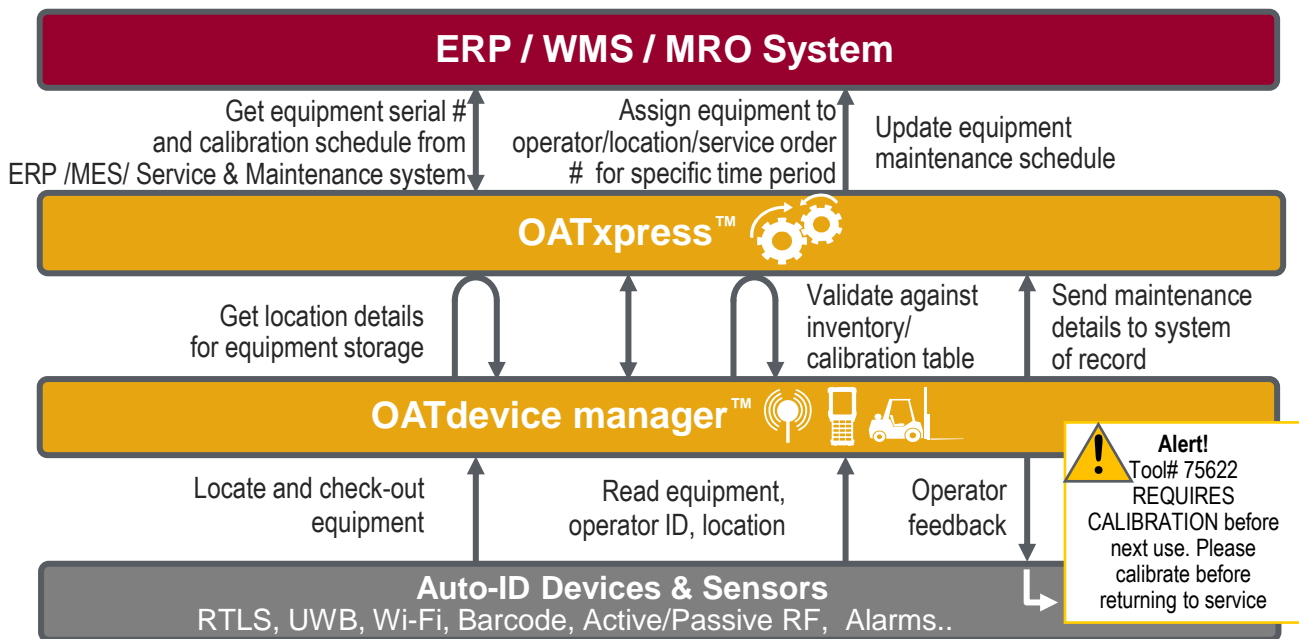
Business Process:	Functional Area(s):	Related Business Drivers	Operational Challenges	High-Impact Performance Metrics:
<b>EQUIPMENT/ TOOL TRACKING/ TRACKING/</b>	<ul style="list-style-type: none"> <li>▪ E&amp;P</li> <li>▪ Manufacturing</li> <li>▪ Aftermarket Service</li> <li>▪ Field Operations</li> <li>▪ Research &amp; Development</li> <li>▪ Medical Labs</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Cost Pressure</li> <li><input checked="" type="checkbox"/> New Programs</li> <li><input checked="" type="checkbox"/> Operational Risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ High value assets, high cost of capital</li> <li>▪ Specialized assets are difficult to source/replace</li> <li>▪ Out-of-Spec tools can compromise quality and safety</li> <li>▪ High cost/potential risk of tracking right-to-use tools</li> <li>▪ Risk of FOD (Foreign Object Debris)</li> <li>▪ High penalties for inefficiency, non-compliance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Significant reduction in duplicate inventory &amp; spares</li> <li>▪ Less rework, fewer quality issues due to out-of-spec tools</li> <li>▪ Reduction in regulatory fines for missing right-to-use tools</li> <li>▪ Reduced labor costs for locating tools, FOD prevention</li> </ul>
<b>HAZARDOUS/ PERISHABLE MATERIAL TRACKING</b>	<ul style="list-style-type: none"> <li>▪ Manufacturing</li> <li>▪ Research &amp; Development</li> <li>▪ Medical Labs</li> <li>▪ Transportation</li> <li>▪ Hospital Operations</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Cost Pressure</li> <li><input checked="" type="checkbox"/> New Programs</li> <li><input checked="" type="checkbox"/> Operational Risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ High level of working capital allocated to “in-process” manufacturing</li> <li>▪ Quality initiatives require higher visibility into each manufacturing step</li> <li>▪ High level of rework, make-goods impacting profitability</li> <li>▪ Labor costs for locating missing orders, expediting shipments</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduction in non-performing inventory and assets</li> <li>▪ Reduction in scrap material, due to closer tracking of batches/expiration dates</li> <li>▪ Reduction in rework, make-goods</li> <li>▪ Reduction in labor costs for exception handling, transportation costs for expedited shipments</li> </ul>
<b>SHIPPING &amp; RECEIVING/ CHAIN-OF- CUSTODY TRACKING</b>	<ul style="list-style-type: none"> <li>▪ Logistics</li> <li>▪ Transportation</li> <li>▪ Supply Chain Operations</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Cost Pressure</li> <li><input checked="" type="checkbox"/> Operational Risk</li> </ul>	<ul style="list-style-type: none"> <li>▪ Labor-intensive transport &amp; customs paperwork, confirmation processes</li> <li>▪ Multiple logistics providers</li> <li>▪ Risk of material breach, mishandling</li> <li>▪ Risk of regulatory fines</li> </ul>	<ul style="list-style-type: none"> <li>▪ Faster revenue recognition, fewer disputes</li> <li>▪ Streamlined customs clearance,</li> <li>▪ Lower documentation costs</li> <li>▪ Improved customer satisfaction</li> </ul>

# RFID/RTLS-enabled Equipment Tracking

RFID and RTLS can automate the tracking of capital equipment used across facilities and remote worksites, informing the system of record (ERP, MRO, Service & Maintenance system) when equipment moves to a new location, completes a process step, is in need of calibration or maintenance or if the equipment is reserved for a specific project (e.g. right to use tooling which is restricted to a single contract).

In the following example, equipment is used to perform a service order, checked out to the equipment operator a specific location the work will be performed, and to the service order. The equipment status is verified in the system and the operator receives an alert that the equipment will need to be calibrated before returning to service.

## EXAMPLE: AN EQUIPMENT TRACKING PROCESS



### CASE STUDY: ENGINE OVERHAUL TRACKING

An International Airline worked with OAT to track equipment, components and service orders 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

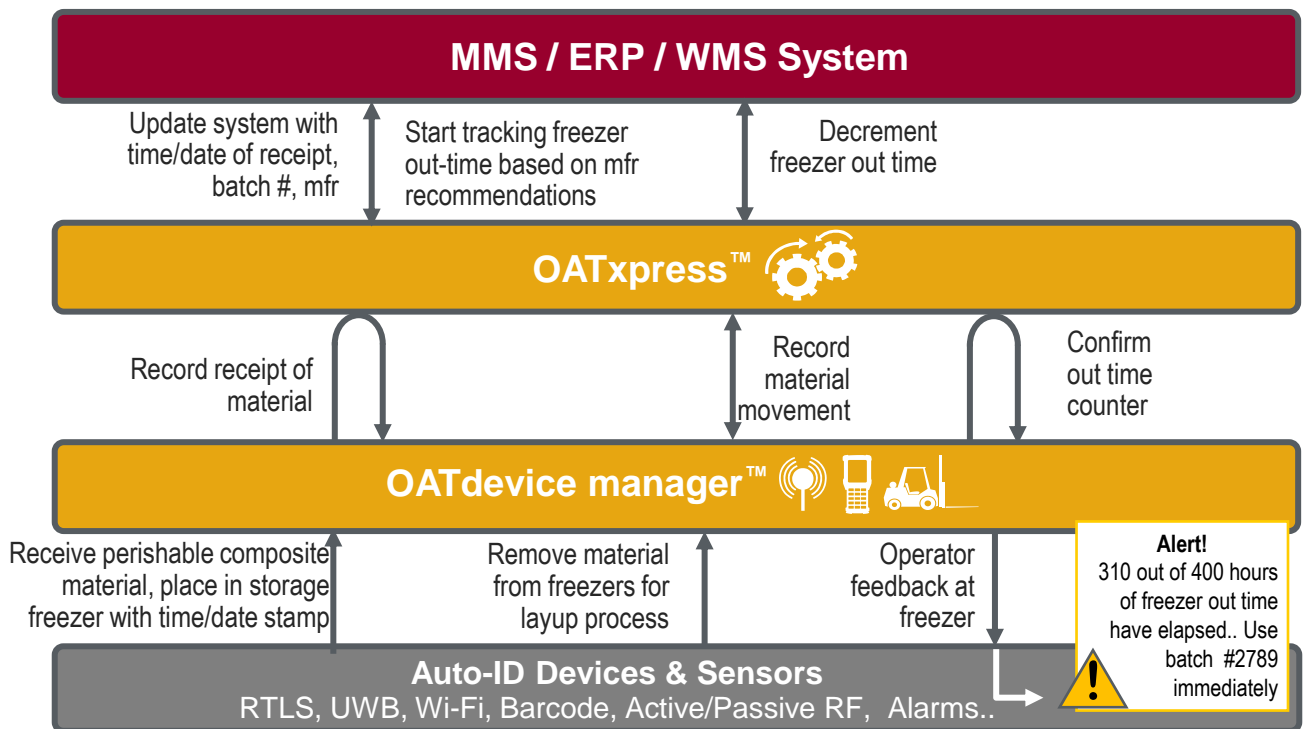


# RFID/RTLS-enabled Materials Management

RFID and RTLS can automate the tracking of perishable, hazardous or regulated materials (e.g. controlled substances) by automatically documenting state changes (temperature, location, elapsed time) in the system of record (ERP, MMS, Program Management, MRO system) and providing alerts when material is misplaced, mishandled or about to expire. Tracking tissue samples, radioactive isotopes, composite materials or Schedule II pharmaceuticals is labor intensive and risk prone, leaving non-compliant operations subject to audit fines, lawsuits and recalls. If the condition of the material is in doubt, it needs to be disposed of, which incurs additional costs and often, additional disposal and containment fees.

In the following example, perishable composite material (used in building equipment, airframes and other capital goods) is tracked from storage freezers to clean rooms for layup (fabrication) processes. The elapsed time is automatically recorded and the operator is alerted when material is about to expire and must be used immediately.

## EXAMPLE: A COMPOSITE MATERIAL TRACKING PROCESS



### CASE STUDY: COMPOSITE MATERIALS MANAGEMENT

After winning a large contract to produce composite parts for a new aircraft program, an Industrial Manufacturer worked with OAT to track composite materials through a multi-step manufacturing process. The resulting system provides automated tracking and replenishment of raw materials and work-in-process, improving program performance while reducing excess inventory and scrap material.

- **Auto-ID Technology:** RFID, Barcode
- **Enterprise Systems:** Solumina MMS, Impresa ERP

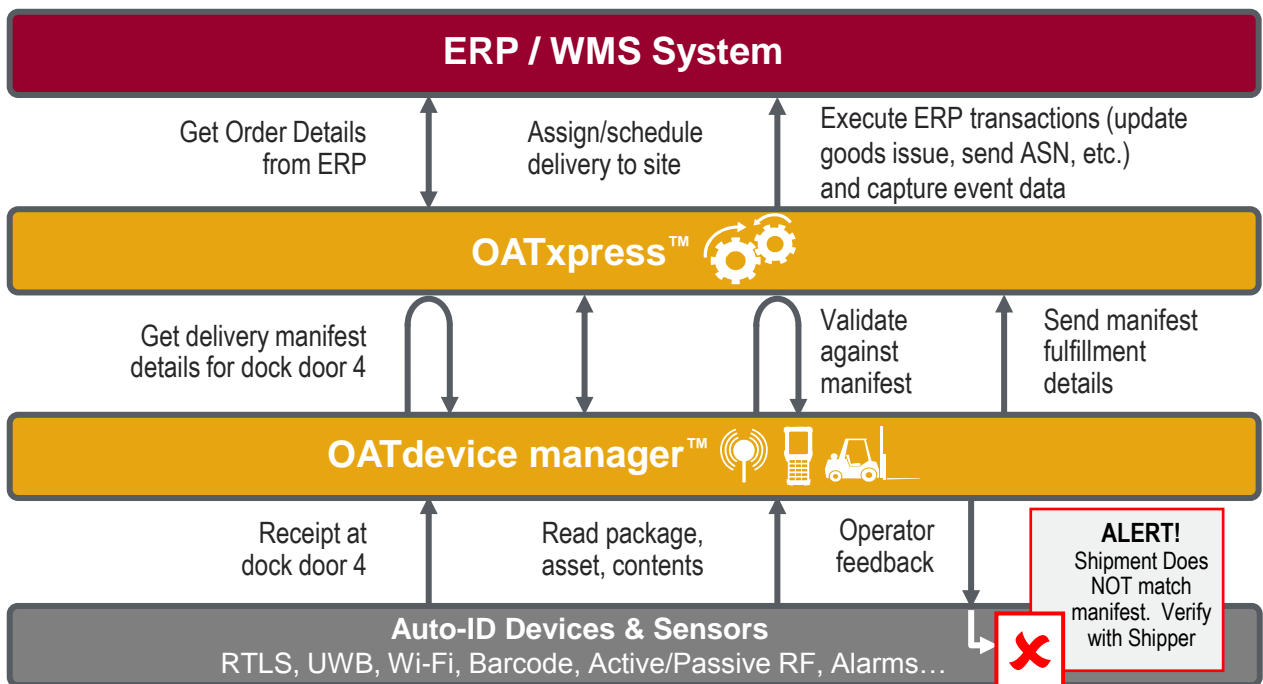


# RFID/RTLS-enabled Shipping and Receiving

RFID and RTLS can automate the tracking of shipments and deliveries, confirming contents of shipping manifests, documenting customs and regulatory paperwork and providing alerts when shipments are incomplete, incorrect or delivered to the wrong location. By providing an automated, accurate record of exactly when outbound shipments were sent and when inbound deliveries were received (and in some cases, tracking delivery vehicles via GPS), chain of custody disputes are virtually eliminated. Automated tracking also prevents duplicate asset inventory created by “quarantined” shipments which do not match the manifest and are set aside for weeks, even months before they can be reconciled.

In the following example, a shipment is received at a dock door enabled by an RFID reader. The contents of the shipment are automatically compared to the Advance Shipping Notice (ASN) and the operator is alerted if the contents do not match the expected manifest.

## EXAMPLE: AN INBOUND RECEIVING PROCESS



## CASE STUDY: 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. The company was also able to reduce working capital allocation by eliminating redundant asset inventory sitting idle in quarantined or incomplete shipments.

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





# ROI Metrics for RFID & RTLS



Although every business operation runs differently, there are common value drivers across industries and business functions. OAT has developed calculators to measure RFID/RTLS payback for a wide range of use cases. A summary of common ROI metrics for Equipment Tracking:

## MEASURING RFID/RTLS ROI FOR EQUIPMENT TRACKING

Business Process	Common ROI Drivers	How They are Calculated
<b>EQUIPMENT/ TOOL TRACKING/</b>	Reduction in Equipment/Tooling/ Indirect Material Inventory	<ul style="list-style-type: none"> <li>▪ Buffer inventory of tooling, equipment to compensate for missing or out-of-spec tools, as a percentage of overall inventory</li> </ul>
	Reduction in FOD (Foreign Object Debris)	<ul style="list-style-type: none"> <li>▪ Operational risk reduction/capital allocation reduction by finance</li> <li>▪ Reduction in fines,</li> <li>▪ Operational KPIs (incl. time in service)</li> </ul>
	Increase in Labor Utilization	<ul style="list-style-type: none"> <li>▪ Average labor rate and # of employees involved with equipment tracking, - multiplied by % of non-value added activities - locating tools, locating service history and specific work instructions</li> </ul>
	Improved Asset Utilization	<ul style="list-style-type: none"> <li>▪ Redundant inventory of capital assets, assets that have not been used in &gt;6 months or duplicate inventory</li> <li>▪ Percentage of capital assets not being utilized - missing or under repair</li> </ul>
	Improved On-Time Performance Reduced Schedule Risk	<ul style="list-style-type: none"> <li>▪ Reduction in days outstanding for accounts receivable</li> <li>▪ Reduction in revenue recognition delays</li> <li>▪ Customer make-goods, discounting to make up for late orders</li> <li>▪ Fines for breach of contract</li> </ul>
	Improved Process Tracking Reduced Quality Risk	<ul style="list-style-type: none"> <li>▪ Reduction in rework costs</li> <li>▪ Customer make-goods, discounting to make up for quality issues</li> <li>▪ Reduction in out-of-spec equipment and tooling</li> <li>▪ Fines for non-compliance based on quality errors</li> </ul>

### CASE STUDY: CONTROLLED SUBSTANCE TRACKING

a Pharmaceutical Firm worked with OAT to track Schedule II Pharmaceuticals through manufacturing, and distribution processes. By monitoring the movement of pain relief medication through secured zones within their facility, the company reduced risk and liability while improving efficiency.

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



# About OATSystems.

OATSystems solutions are used across 2000 facilities worldwide, helping companies take advantage of RFID and 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 RFID & RTLS. As a pioneer in the development of Auto-ID technology, OAT has been setting the standard in RFID over the last decade and has provided RFID & RTLS-enabled solutions to leading companies such as Airbus, Monsanto, Bell Helicopter, VA Health System, ATK, Cessna, Parker Hannifin, Chevron, Kimberly-Clark, Teva, Shell and others. A division of Checkpoint Systems (NYSE:CKP), OATSystems is located in Waltham, MA, and has a development office in Bangalore, India and various direct sales offices and resellers around the globe.

Contact OATSystems today at [www.oatsystems.com](http://www.oatsystems.com) or 781-907-6100 and get ready to take control of your operations.

For specific information on Asset Tracking applications visit [www.oatsystems.com/asset\\_tracking/index.php](http://www.oatsystems.com/asset_tracking/index.php)

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