Extreme RFID:
Tracking Machinery & Tooling in Rugged Environments
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Tracking Machinery & Tooling in Rugged Environments

Eric Heineman
Director, Business Development
Xerafy

Chris Forgione
Director, Asset Tracking
OATSystems
Today’s Presenters

Chris Forgione
Director of Asset Tracking

- Leads OATSystems’ Asset Tracking initiatives in North America.
- RFID Project Development for enterprise process automation at Fortune 100 Chemical, Heavy Equipment, Aerospace and Defense Manufacturers.
- Enterprise software and business intelligence background from IBI (Information Builders, Inc.)

Eric Heineman
Director of Business Development

- 20-plus years in marketing, business development, and product line management. Formerly Motorola product line manager for RFID tags
- RFID solution development for various Manufacturers and Transportation companies (CN Railroad, Montreal Transit Authority, BHP Billiton, Dow Chemical)
- Industrial automation background from Rockwell Automation, ABB Instrumentation, Genicom Corporation.
Welcome

Dialing in to the Conference Line

Asking Questions

Full Screen View
Agenda

- Introduction
  - Extending RFID to Extreme Environments

- Asset Tracking 2.0
  - Why Now?

- Extreme RFID Use Cases
  - Aerospace Manufacturing – Work in Progress
  - Aerospace Manufacturing – Tool and Jig Tracking
  - Defense Manufacturing – Tooling Tracking
  - Industrial Equipment – Container Tracking and WIP Tracking

- Getting Started
  - Tag Selection
  - Process Automation
About OAT Systems and Xerafy

Auto-ID Pioneer & Solutions Leader

- Most Widely Deployed Auto-ID Software Platform: over 100 industrial manufacturers, retailers and consumer products companies deploy OAT software to streamline operations

- Enterprise Scale: Powers the world’s largest RFID-enabled Manufacturing deployment: Airbus A380 Value Chain

- Global Reach: division of Checkpoint Systems (NYSE: CKP) $1B RF technology innovator and services provider

Xerafy

World’s smallest and most extreme EPC UHF RFID-on-metal tags

- Award winning Innovative Packaging Technology: unique product portfolio of ruggedized metal-mount and metal-embedded RFID tag products for the most challenging environmental durability requirements.

- Worldwide presence: XERAFY Ltd. is headquartered in Hong Kong, with offices in Shanghai, UK, Dallas, and Washington DC and worldwide network of partners.

- Industrial Grade Solutions: asset tracking for automotive, aerospace, energy, IT, and construction market
Asset Tracking 2.0
Asset Tracking Systems Have Blind Spots

- ERP, Program Management and Field Service Systems lack real-time reality on asset movements
- Quality and schedule issues result when
  - Tools are missing
  - Equipment is improperly calibrated
  - Machinery is not maintained
- Automating data collection with Auto-ID and ruggedized RFID technology is the answer
- Extreme RFID Extends the Benefits to the Shop Floor and the Maintenance Bay
  - Challenging Environments
  - Tooling, Machinery
  - Hazardous Materials
Extending RFID to Rugged Environments

RFID Projects 2001 - Present

Supply Chain Logistics Retail

RFID Projects 2010 -

Lower Risk Shorter Asset Life No Hazardous Conditions

Many Critical Assets are Still Hidden

RFID Projects

2001 - Present

Supply Chain Logistics Retail
Extending RFID to Rugged Environments

Lower Risk
Shorter Asset Life
No Hazardous Conditions

Many Critical Assets are Still Hidden

Higher Risk
Longer Asset Life
Hazardous Conditions

RFID Asset Tracking 1.0
Supply Chain
Logistics
Retail

Aerospace Manufacturing
Defense Manufacturing
Chemical Transport
Oil & Gas Operations
MRO
Energy Plant Maintenance

Aerospace / Aviation
Military / Defence
Manufacturing
Oil & Gas / Petrochemical
Power Generation / Public Utilities

RFID Asset Tracking 2.0
<table>
<thead>
<tr>
<th>Asset Tracking Challenges</th>
<th>RFID 1.0</th>
<th>Extreme RFID</th>
<th>Extreme Benefits</th>
<th>Applications</th>
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</thead>
</table>
| **Asset Type:** Metal Tooling, Machinery, Subassemblies | ❌ | ✓ | - Metal Friendly Tags  
- Embedded Tags | Tool Tracking and Equipment Tracking for Manufacturing and Maintenance Processes  
WIP Tracking for Metal Subassemblies |
| **Maintenance Requirements:** Precise Calibration Duty Cycles | ❌ | ✓ | - Point-of-use data storage can be accessed by all parties | Tooling Tracking for Industrial Manufacturing, Aerospace, Process Manufacturing |
| **Documentation Requirements:** Multiple manufacturing / maintenance partners | ❌ | ✓ | - Tag memory can last decades to provide birth to death audit trail or pedigree | Plant Maintenance Aircraft MRO  
Life Cycle Tracking  
(Aircraft, Heavy Equipment, Pipelines) |
| **Environment**  
- Extreme Temperatures,  
- Harsh Chemical Agents  
- Radiation | ❌ | ✓ | - Survives radiation, harsh chemicals and autoclaves. Keeps data secure | Plant Maintenance Aircraft MRO  
Life Cycle Tracking  
(Aircraft, Heavy Equipment, Pipelines) |
| **Asset Life**  
Multiple years, decades in service (Plant equipment, aircraft, transport vehicles, vehicles, armaments) | ❌ | ✓ | - Long life without requiring an independent power source | Plant Maintenance Aircraft MRO  
Life Cycle Tracking  
(Aircraft, Heavy Equipment, Pipelines) |
Extreme RFID:
Case Studies
Asset Tracking is More Challenging Than Ever, Particularly in Manufacturing and Maintenance

- **Increase in Custom Tooling, Machinery**
  - Complex, Custom-Made Tooling – difficult to source, replace, track & store – degradation over time with curing processes
  - Currently managed manually or with barcode

- **Increased Cost Pressure/Contract Pressure**
  - Need to track work-in-process, indirect materials more closely
  - Need to manage sourcing/expedite costs with single-source tooling

- **Risk of Foreign Object Debris**
  - Serious incidents associated with manufacturing & equipment maintenance
  - Currently controlled through processes, signs
<table>
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<tr>
<th>Equipment Tracking</th>
<th>Component Tracking &amp; Kitting</th>
<th>Clean Room Tracking</th>
<th>Controlled Asset Tracking</th>
<th>ATA 2000 Part Marking</th>
<th>WIP Tracking</th>
<th>Tooling Tracking</th>
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</thead>
<tbody>
<tr>
<td>Specialized equipment, yard trailers across multiple locations</td>
<td>Component parts, subassemblies for customized packing kits</td>
<td>Indirect materials used in process mfg</td>
<td>Finished goods (aircraft) through audit &amp; attestation</td>
<td>Serialized components for Airbus A350</td>
<td>Specialized tools across 20+ buildings in mfg campus</td>
<td>Molds and jigs associated with Work Orders</td>
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<tr>
<td>RFID, Wi-Fi, Barcode, GPS</td>
<td>RFID, Wi-Fi, Barcode</td>
<td>RFID, Barcode</td>
<td>RFID, UWB, Barcode</td>
<td>RFID High Memory Tags, integrated with 2D barcode</td>
<td>RFID, Barcode</td>
<td>RFID, RTLS</td>
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<tr>
<td>SAP ERP</td>
<td>SAP, Baan ERP</td>
<td></td>
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<td>SAP ERP</td>
<td>Deltek Cost Point</td>
<td>SAP</td>
</tr>
<tr>
<td>Reduction in asset shrinkage</td>
<td>Reduced labor costs for inbound receiving, warehousing</td>
<td>Reduced indirect material inventory/costs</td>
<td>Reduction in labor cost for documenting final BOM, product lineage, testing results</td>
<td>Automated part marking for ATA 2000 compliance</td>
<td>Improved utilization of specialized tools, equipment</td>
<td>Reduction in tooling costs</td>
</tr>
<tr>
<td>Reduced labor costs for tracking down missing assets</td>
<td>Improved customer satisfaction</td>
<td></td>
<td>Reduced number of audits, fines</td>
<td>Planned WIP tracking aligned with Lean Manufacturing, Six Sigma initiatives</td>
<td>Increased uptime</td>
<td></td>
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<tr>
<td>Reduced expedite &amp; inventory costs</td>
<td></td>
<td></td>
<td></td>
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<td>Reduced tool inventory</td>
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</table>
Aerospace & Defense Manufacturing Case Study
– WIP Tracking, Materials Management

Process Areas:
Production: Inventory management, process control for composite materials

Why Extreme RFID?:
Extreme temperatures in freezers and autoclaves.
- Tracking movement of bulk/processed composite material through freezers and processing areas
- Managing cure cycles and expiration dates of prepreg material
- Excess inventory used as a buffer

Solution: RFID-enabled tracking of temperature-sensitive composite material as it moves in and out of storage freezers and processing areas (e.g. pattern cutting), integrated with the company’s existing Materials Management and ERP systems (Impresa and Solumina)

Metrics:
- Auditable time-stamped records of check-out/check-in times and assigned personal responsibility
- Reduction in scrap material due to missed expiration dates, inadvertent curing
- Improved utilization of high value materials and equipment
Multiple Aerospace and Defense Manufacturers – Jig and Tooling Tracking

**Process Areas:**
- Logistics: managing transport jigs
- Production: maintenance and calibration of tooling
- Final Assembly: foreign object detection

**Why Extreme RFID?:** Metal tooling, rough handling during shipment.
- Missing jigs impacting production schedule.
- Duplicate tool inventory used as a buffer. Custom tools, jigs costly to source, replace.

**Solution:** RFID and barcode-enabled check-in and check out and calibration of production tooling, maintenance equipment, integrated with ERP, Service & Asset Management systems

**Metrics:**
- Reduction in jig, tooling inventory, expedite costs
- Increased on-time program completion
- Improved asset utilization
Defense Contractor Case Study – Tool Tracking

**Process Areas:**
Production: tool and tooling inventory management

**Why Extreme RFID?:** **Metal tooling.**
Manual processes inadequate for inventorying and locating specialized tools across 25+ building manufacturing campus. Duplicate tool inventory used as a buffer. Right to use tools subject to audit

**Solution:** RFID and barcode-enabled check-in and check out and calibration of production tooling, maintenance equipment, integrated with Program Management systems

**Metrics:**
- Improved utilization of specialized tools, equipment
- Reduced tool inventory, reduced risk of missing project timelines, reduced risk of fines for non-compliance
Industrial Manufacturing Case Study – Container Tracking, WIP Tracking

**Process Areas:**
Production: Tracking RTIs (Reusable Transport Items) containing component parts, subassemblies and work-in-process

**Why Extreme RFID?:**
Rough Handling Conditions – Transporting containers within and between multiple manufacturing facilities.

Manual WIP/RTI tracking process and barcode-based Kanban replenishment resulting missing parts, work orders and containers.

Increased rework, expedite and labor costs for exception handling.

**Solution:** RFID-enabled SAP ERP system provides instant status of 1000s of Reusable Transport Items associated with work orders, component parts and subassemblies

**Metrics:**
- Reduction in container and parts inventory, while reducing transportation costs and “fire drills”
- Increase in saleable goods (complete vs. “95% done” orders)
- Improved build-to-order process with higher efficiency and quality
Extreme RFID:
How it Works
Collecting and Managing Real-Time Sensor Data

Auto-ID/RFID Data

• High Volume
• Time-Sensitive
• Real-Time
• Operational Info

Auto-ID/RFID Software Platform

• Multi-Modal Device Management
• Data Management, Context
• Customizable Scenarios
• Rules Engine
• Workflow & Triggers
• Event Management
• Visualization & Reporting
• Enterprise Device & Data Administration
• API & Integration Tools
• Decision Support

Enterprise Applications

WMS
ERP
MRO
MES
Project Mgmt.
How Sensor Data Informs a Tool Tracking Process

Sample: Process Flow

- Validate order & manifesting details against physical containers & their contents
Extreme RFID:
Getting Started
Anatomy of an RFID Deployment

1. Identify Process Areas
   - Work-in-Process
   - Tooling
   - Logistics
   - Aftermarket Service

2. Quantify Value
   - Manual vs. Automated Process
   - Map Use Cases to Business Scenario
   - Cost Reduction
   - Process Improvement
   - Quality/Safety

3. Define Solution
   - Tags
   - Software
   - Hardware
   - Integration
   - Data Management

4. Deploy Solution
   - Define Project Timeline
   - By Process
   - By Facility
   - By Enterprise Solution

5. Measure Result
   - Gather Metrics
   - Evaluate Process Parameters

CONTINUOUS IMPROVEMENT
## Extreme RFID Applications by Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Extreme RFID Applications</th>
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</table>
| Aerospace                       | - Tool/Tooling Tracking  
                                  | - ATA 2000 Part Marking  
                                  | - Audit and Attestation       |
| Automotive                      | - Warranty/Recall Tracking  
                                  | - Kanban Management          
                                  | - Line-Side Replenishment     |
| Chemicals                       | - Hazardous Material Tracking  
                                  | - Container Pedigree          
                                  | - Batch Tracking              |
| Consumer Products               | - Warranty/Recall Tracking  
                                  | - Batch Tracking              
                                  | - Anti-Counterfeit /Diversion |
| Defense                         | - Tool/Tooling Tracking  
                                  | - Kitting and Shipping        
                                  | - Weapons Tracking            |
| Energy                          | - Plant Maintenance  
                                  | - Hazardous Material Tracking |
                                  | - FME/FOD Control             |
| Industrial Machinery            | - WIP, Whole Goods Tracking  
                                  | - Kitting and Shipping        
                                  | - Tooling Tracking            |
| Medical Devices/Biotech         | - Clean Room Tracking  
                                  | - Indirect Material Tracking  
                                  | - Clean Manufacturing WIP      |
| Oil & Gas                       | - Equipment Tracking  
                                  | - Indirect Material Tracking  
                                  | - Personnel Tracking          |
| Pharmaceuticals                 | - Batch Tracking  
                                  | - e-Pedigree                  
                                  | - Controlled Substance Tracking |
Basic Tag Selection Questions

• What surface material will the tag be attached to?
• What is the required read distance?
• What type of attachment methods are possible?
• How much surface area is available on the asset?
• From what perspective will the tag(s) be read? Straight-on, edge?
• What temperature range does the tag need to survive and operate within?
• Do you need multi-directional performance?
  • Hang tag required?
• How much data do you want to reside on the tag?
Advanced Specsmanship ...

- **Ingress Protection (IP rating) Requirements**
  - Defines the level of sealing effectiveness of tag’s enclosure
  - IP"XX": 1\textsuperscript{st} digit (dust, particulates), 2\textsuperscript{nd} digit (moisture, submersion)
  - Durable tags typically range from IP54 [$] to IP68 [$$] (best)

- **Application Temperature vs. Operating Temperature**
  - Application Temp.: The environment that the tag will be exposed to in its intended application. “Possible”: -40C to +250C (-40F to +482F)
  - Operating Temp.: The environment the tag will be interrogated in by the RFID reader. “Typical”: -30C to +85C (-22F to +185F)

- **Attachment Method**
  - Adhesive attachment or intrusive (fasteners): Pressurized container? Sheer impact? Pressure wash? Solvent or chemical exposure? Shock & vibration?

- **Tag Enclosure Material (PET, ABS, FR-4, Nylon polymer?)**
  - Resistance to industry pervasive chemicals. Example: Skydrol\textsuperscript{®} (aerospace industry) harmful to plastic.
# Xerafy Tag Selection Guide

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<th>X 9 Series</th>
<th>8 Series</th>
<th>Track Series</th>
<th>XL Series</th>
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<td>High Temp. Rugged Line</td>
<td>Embeddable Line for Rough Tapping and Extreme Conditions</td>
<td>Versatile Ox and Off Metal Line</td>
<td>High Memory Line</td>
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</tbody>
</table>

### High Temperature and Rugged Line
- **X 9 Series**:
  - X9-2000 Series (UHF)
  - X9-3000 Series (UHF)
  - X9-4000 Series (UHF)

- **8 Series**:
  - 82-2000 Series (UHF)
  - 82-3000 Series (UHF)
  - 82-4000 Series (UHF)

### Embeddable Line for Rough Tapping and Extreme Conditions
- **X 9 Series**:
  - X9-2000 Series (UHF)
  - X9-3000 Series (UHF)
  - X9-4000 Series (UHF)

- **8 Series**:
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### Versatile Ox and Off Metal Line
- **X 9 Series**:
  - X9-2000 Series (UHF)
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- **8 Series**:
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### High Memory Line
- **X 9 Series**:
  - X9-2000 Series (UHF)
  - X9-3000 Series (UHF)
  - X9-4000 Series (UHF)

- **8 Series**:
  - 82-2000 Series (UHF)
  - 82-3000 Series (UHF)
  - 82-4000 Series (UHF)

### Features
- **Temperature Range**:
  - X 9 Series: -40°C to 125°C
  - 8 Series: -40°C to 125°C

- **Material**:
  - X 9 Series: Polycarbonate
  - 8 Series: Polycarbonate

- **Read Range**:
  - X 9 Series: 3-5 m (9 ft)
  - 8 Series: 3-5 m (9 ft)

### Additional Features
- **Read Rate**:
  - X 9 Series: 300 tags per second
  - 8 Series: 300 tags per second

- **Memory Size**:
  - X 9 Series: 16 KB
  - 8 Series: 16 KB

- **Power Source**:
  - X 9 Series: Battery
  - 8 Series: Battery

### Conclusion
- Xerafy offers a comprehensive range of RFID tags suitable for various applications, from high-temperature environments to rough tapping and extreme conditions, ensuring reliable performance across diverse industries and environments.
How Can I Learn More?

- Precedents / Case Studies
  - Similar assets
  - Similar functions
  - Similar industries

- Articulating Value
  - Labor savings
  - Risk mitigation
  - Reduced handling and transportation costs
  - Improved quality
Extreme RFID:
Question and Answer Session

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