RFID Applications in Improving Quality, Productivity and Maintainability

Anil Kumar, Phil Coop

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Introductions

• Phil Coop – RFID Integrated Solutions Program Manager
• Anil Kumar – BCA Production RFID Program
• Dave Tilzer – Director of Regulatory Compliance and Quality Assurance
• Takashi Saito – RFID Integrated Solutions Technical Operations Advisor
• Joe Elias – RFID Integrated Solutions Program Engineer
• Thanh Hoang – RFID Integrated Solutions Chief Architect
• Ken Porad – Reliability & Maintainability Engineer
Value Proposition | Aviation Industry

• Tracking and tracing of aircraft parts brings value to all stakeholders in the aviation ecosystem

- Improved accuracy of the “As Built” and “As Delivered” configuration – Aircraft Readiness Log (ARL) parts
- Helps us provide an expanded ARL list to the airlines
- Improving situational awareness due to shared data environment
- Accelerate decision-making capability

- Automated management of parts delivery and distribution
- Optimization of inventory due to improved end-end visibility
- Historical lifecycle data from the operators
- Accurate status of part condition from the field
- Common process across different customers

- Alternative and highly efficient method of ICA compliance
- Fast and reliable configuration management
- Supply chain visibility and inventory reduction
- Maintenance Cost Reduction

“Airplane-Out” data back to the OEM
Quality | Improvement in accuracy

- Data collection with RFID Readers reduces chances of errors in transposing data – applicable to Supply Chain, Airlines, Production – Collected data automatically updated to a centralized database

- On-the-spot verification & validation of the collected data minimizes error propagation

*Little manual data entry – minimizes “fat finger” errors*
Productivity | Flow time reduction

• Ability to collect data from a distance
  – Non-line-of-sight propagation
  – Parts installed behind panels

• One example in production environment:

  Manual process
  Printed ARL

  Automated Inspection
  Hand-held RFID Reader

Significant benefit in flow time reduction for all the stakeholders
Maintainability | Consistent and reliable data

• Performance
  – RFID tags comply with SAE AS 5678 standards to ensure consistent quality of the tags deployed in harsh environment

• Interoperability
  – Data stored on the RFID tags conform to ATA Spec 2000 data encoding standards

• Maintenance
  – Update and maintain parts history during operation
  – Easy access to “back-to-birth” records
  – Minimizes effort in leasing and transfer of ownership process

Reduction in maintenance cost to airlines
Next steps

• Production
  – Boeing continues to carry out extensive studies to ensure consistent performance on all the platforms
  – Working with Suppliers to place the tags on the parts prior to delivery
  – Decision expected in 3Q 2012

• Aftermarket
  – CAS has developed and tested a service offering for operators that helps to further amplify the benefit in the aftermarket

All the key stakeholders of aviation industry need to work together to realize the maximum potential
Forward

- Boeing is offering an RFID-based, centrally managed maintenance program which:
  - Significantly reduces maintenance lead times, configuration defects, redundant tasks and cost
  - Provides stable and reliable component and configuration data supported by a comprehensive technology platform
  - Can be tailored to specific operator requirements
  - Is fleet-agnostic
RFID INTEGRATED SOLUTIONS
PIONEERING SOLUTIONS TO CHANGE THE INDUSTRY

Abstract

A comprehensive solution including:
- Centrally Managed RFID-Based Maintenance Program
  - Maintenance Procedures
  - Training
  - Hardware
  - Software
  - Retrofit Guidance
  - Technical Oversight
  - Continued Support and Post-Retrofit Services
RFID-Based Means of ICA Compliance

- RFID-Based, Centrally Managed Maintenance Program by Boeing
  - Method of compliance with instructions for continued airworthiness – ~150 discrete maintenance procedures integrated into operator’s maintenance program
  - A comprehensive and Boeing-approved hardware solution provided by Fujitsu
  - Centrally managed application software configured to each operator’s requirements
  - Fleet-agnostic
Alaska Airlines Validation

- Developmental partner since the program inception
- Worked together to co-develop, test and validate the first five applications
- Results of operational testing have exceeded expectations
- Alaska will have contributed ~4000 hours of technical evaluation and validation support
Validation of Business & Technical Assumptions

• 10 ASA M&E organizations reviewed and approved all product development documents including;
  • ~5000 pages of document review
    • Business and systems requirements
    • Operational scenarios
    • Technical procedures
  • 167 revisions made
System Performance

• Performed system interference checks

• Confirmed that there will be no EMI / EMC interference between RFID and airplane systems in any ground-based configuration
In-Service Tests

- Fujitsu high-memory RFID and MacSema contact-memory technologies exceeding technical performance expectations
- RFID and CMB exceeded thermal cycle and min/max thermal equilibrium expectations
- Distance and speed of low-memory interior tags exceeded read range and distance expectations
TRAX Integration

• Demonstrated TRAX generic adaptor:
  – Successfully sent RFID transactions to the ASA backend
  – Ran multiple devices simultaneously
  – Demonstrated remote server capability
• Generic adaptor will work with most major ERPs
End User Acceptance

- Demonstrated usability and effectiveness:
  - 440 tags acquired in <3.5 minutes
  - End-user acceptance; AMTs performed all UAT procedures
  - 100% reliability

- Verification of key performance indicators including 99% lead time reduction
737-800 ETOPS System Performance

Oxygen Generator Inspection – 59 tags

Serviceability

Reader Orientation:
Held at mid-torso, no side-to-side sweep

Begin Scan (1st class cabin)

< 1.5 minutes, all generators acquired and statused

End Scan (2/3 length of cabin)

Metrics:
100% first pass yield out of 20 trials
LT reduction of 99%

Before After

~4 hours

Before

After
737-800 ETOPS System Performance

Life Vest Inspection – 330 tags
Presence, Serviceability, Security of Installation

Reader Orientation:
Held at mid-torso, no side-to-side sweep

Begin Scan (1st class cabin)

~1 hour

< 2.5 minutes, all life vests acquired and statused

End Scan Aft Galley

Metrics:
100% first pass yield out of 20 trials
LT reduction of 99%
# High Memory Performance

<table>
<thead>
<tr>
<th>Action</th>
<th>Average Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Part Identification</td>
<td>4.0 seconds</td>
</tr>
<tr>
<td>Create maintenance history record</td>
<td>6.0 seconds</td>
</tr>
<tr>
<td>Create new transaction record</td>
<td>5.0 seconds</td>
</tr>
<tr>
<td>Update scratch pad</td>
<td>4.0 seconds</td>
</tr>
</tbody>
</table>

Rotables Management Application

Includes Fujitsu 64KB, 8KB and MacSema 64KB and 4KB CMB

Boeing transaction requirement metric = 10.0 seconds

Performance improves in enclosed areas within the airframe

All devices have been flight-tested in ultra-harsh environments
Summary – Approach

• Not a technology solution but an alternative maintenance program which is enabled by technology
• A comprehensive solution, centrally managed by Boeing
• An adaptable solution configured to the operator’s requirements
• A fleet-agnostic solution
• A method of compliance with instructions for continued airworthiness
Integrating Aftermarket with Production

Leveraging innovative aftermarket applications to create new standard features
Initial Target Areas for Production Airplanes

Currently working with airplane production to define an as-delivered configuration for Boeing fleets

Focusing on the low-hanging fruit
Contact Information

• Sudhakar Shetty - sudhakar.s.shetty@boeing.com
• Anil Kumar - anil.kumar3@boeing.com
• Phil Coop – william.p.coop@boeing.com
World-class customer support, anywhere, anytime.

Learn more at: boeing.com/boeingedge/

Thank you!