RFID & GPS Track

† Sponsored by:

[OnAsset Intelligence Logo]
Chairman’s Opening Remarks

↑ John Dowds

↑ Regional Cargo and Freighter Operations Manager, Qatar Airways
RFID for Dummies

John Greaves

RFID expert
RFID what is it?

Applications in the Air Cargo Sector.

John Greaves
Director, RF, Orion Systems
What is RFID?
  • Definition

Brief history of RFID
  • Industry standards: IEEE; ISO/IEC; GS1 / EPC

Types of RFID
  • Passive RFID
  • Active RFID
  • Battery-Assisted Passive
  • Frequencies and their characteristics

Use cases in Aircargo
**What is RFID? It is not Wireless.**

**Radio-Frequency Identification.** The acronym refers to the use of SRD (short range devices) to identify personnel, property or assets in a virtual scenario that is capable of being utilized to track, trace, and protect the personnel, asset or entity.

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

There the similarity ends and the utility increases.
What is RFID? It is not Wireless.

RFID is a regulated industry with a proliferation of standards as some apply to the air interface, the equipment, the use or the regulatory differences in, for instance, a duty cycle, a power emission of signal or a digital or analog methodology.
RFID Technology History Overview

1935 RFID discovered by Scottish physicist Sir Robert Alexander Watson-Watt and used during WW 2 to identify incoming Enemy aircraft

1950-60’s Advances in radar and RF communications systems continue. Electronic article surveillance tags used (1bit)

1973 First U.S. patent for an active RFID tag with rewritable memory and patent for a passive transponder used to unlock a door without a key.
1990’s South African engineers developed and patented an ultra-high frequency (UHF) RFID system. Earlier iterations exist without some of the attributes developed in the CSIR.

1999-2003 ISO Established two air interface protocols (Class 1 and Class 0), EAN / UCC created the Electronic Product Code (EPC) numbering scheme, and a network architecture for looking up data associated on an RFID tag on the Internet. The technology is the basis of an organization created to advance the common use of the data in Passive UHF RFID, EPCglobal.

2004 ISO ratified second-generation standard in December 2004, paving the way for broad adoption.

Class 1 & Class 1
BAP
- Short Range, Passive Backscatter

Class 2
- Class 1 + 512Kb memory

Class 3
- Class 1 + Class 2
  - Battery Assistance for Extended Range
  - Sensor Input
  - Fast Memory R/W

Class 4
- Active RFID
Frequencies:

- LF (125 KHz) – medium & short range RFID (animal ID)
- HF (13.56 MHz) – “proximity” cards (Mifare, legic,..) NFC
- Dash7 Alliance (433 MHz) - Active RFID, Sub 1 GHz interoperability and BSI Active Data Standards Engine.
- UHF (865 -925 MHz) – EPC C1G2, ISO 18000-6C Passive+BAP
- WiFi /Zigbee (2.4 GHz) –
- UWB (5GHz) – ITS
LF, HF, UHF, .. properties

- Less absorption by moisture
- Better omnidirectional capability
- Less impact from presence of metal
- Shorter signal range and slower reading
- Poor bulk reading

- Longer reading range
- Higher Speed
- More interference from metal
<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 11784</td>
<td>Radio frequency identification of animals – Code structure</td>
</tr>
<tr>
<td>ISO 11785</td>
<td>Radio frequency identification of animals – Technical concept</td>
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<tr>
<td>ISO 14223*</td>
<td>Radio frequency identification of animals – Advanced transponders</td>
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<tr>
<td>ISO/IEC 15418</td>
<td>EAN / UCC Application Identifiers and FACT Data Identifiers and Maintenance</td>
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<tr>
<td>ISO/IEC 15434</td>
<td>Transfer Syntax for High Capacity ADC Media</td>
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<tr>
<td>ISO/IEC 15459</td>
<td>Unique Identification of Transport Units</td>
</tr>
<tr>
<td>ISO/IEC 15962*</td>
<td>Radio Frequency Identification for Item Management - Data Syntax</td>
</tr>
<tr>
<td>ISO/IEC 15963*</td>
<td>Unique Identification of RF Tag</td>
</tr>
<tr>
<td>ISO/IEC 18000*</td>
<td>Radio Frequency Identification for Item Management - Air Interface</td>
</tr>
<tr>
<td></td>
<td>(below 135 KHz., 13.56 MHz., 433 MHz., 860-930 MHz., 2.45 GHz., 5.8 GHz.)</td>
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<tr>
<td>ISO/IEC 18001</td>
<td>Radio Frequency Identification for Item Management – Application Requirement Profiles</td>
</tr>
</tbody>
</table>
Frequencies, regions, Power

Power of UHF Passive Readers
4W in US
2W EIRP in EU
AFFECTS READ DISTANCE PER REGION

JAPAN effective 25th July 2012
916.7 – 923.5
A basic RF system consists of a Transmitter, Channel, and Receiver
• RF signals are generated and sent by a “transmitter,” propagate through a “channel,” and are collected and processed by a “receiver”

In “passive backscatter” RFID, there are essentially two RF links
• The reader transmits a very strong signal and the tag “receives” a weak signal
• The tag reflects or “backscatters” a portion of the weak signal to communicate back to the reader’s receive antenna
• The signal had to traverse the “channel” twice incurring propagation loss twice
• The received signal is very low level when the tag is at the maximum distance
Antennas

- Antennas are necessary at every transmit and receive point to convert from electrical signals on wires to wireless RF signals and back.
- Antennas provide “gain” which increases maximum read distance between reader and tags.
  - Higher gain is achieved by making the antenna more directional, i.e. narrow beamwidth, and thus requiring more careful installation of the pointing direction.
- Polarization of an antenna is either linear or circular.
  - Linear antennas can be mounted so the polarization is vertical, horizontal, or in between. This orientation is important for tags with linearly polarized antennas. A vertical reader antenna trying to read a horizontal tag will have significantly reduced range.
  - Circular antennas are “right hand” or “left hand” circularly polarized and is essentially rotation independent. This allows good range with linear tags regardless of tag rotation.
The RF signal level received is affected by several factors

- Reader transmit power, cable loss, and antenna gain
- Loss over distance – The farther the distance from the reader to the tag, the higher the path loss in unobstructed free space
- Obstructions – Walls and other materials - esp. metal, concrete, and liquids - in the path directly between the reader and the tag will increase the loss and reduce the power of the signal at the tag
- Multipath – the RF signal can bounce off of flat walls, ground, or metal objects and cause a lot of fluctuation in the level of signal received, worst near to the ground, e.g. 0-2 ft high off the ground

Designing a system to allow for fluctuations in power levels

- A properly designed system must have sufficient “link margin” to tolerate some amount of signal fluctuations
Multipath nulls

PATH LOSS WITH GROUND REFLECTION vs DISTANCE
915 MHz, TX=10', RX=8', Tsg=9'

Chart Area

PATH LOSS, dB
-160, -140, -120, -100, -80, -60, -40, -20

DISTANCE, ft.
0, 50, 100, 150, 200, 250, 300

- Free Space Loss 1Way
- Free Space Loss 2Way
- Forward Path Loss
- Reverse Path Loss
- Combined Path Loss
- Forward link limit
- Reverse link limit
Passive RFID tags do not have a battery and are powered by the RF signal from the reader (forward link)
- Must be close enough to get a strong RF signal
- Very low cost and low power - does not contain a transmitter!
- Limits range to about 40 feet line-of-sight

Passive tags communicate back to the reader (reverse link) via a “backscatter” signal
- Modulates the reflection of the transmitter continuous wave (CW) signal
  - Like signaling with a mirror reflecting sunlight
  - Modulates data onto a subcarrier frequency in the 40 – 640 KHz range
  - The reverse link signal is very low power since it is a reflection of the signal received from the reader
Battery Assisted Passive (BAP) RFID includes a battery to power operation of the tag, but still communicates like a passive tag

- Eliminates the need to be close enough to power the tag through the RF signal and greatly increases range
- Very low power consumption - does not have a transmitter!

**Much farther range - up to 300 feet line of sight at 5 ft high – and ability to penetrate further through objects**

- ISO 18000-6:2010 standard includes new modulation to optimize communication rather than power transfer

**Battery also supports sensors and future functionality**

- Many of these extended functions require batteries
Active RFID uses a transmitter in the tag to get long range

- One way link margin is better than passive backscatter which the signal power must traverse both forward and reverse links

Various approaches:

- Transmit only:
  - “beacons” on a regular interval are transmitted and can be read by reader infrastructure
  - Listens and when reader in range responds
  - Send only when sensor data triggers
  - Combination
The Cold Chain – Significant Variables

- Between 5-13 days of *elapsed* time from field to the grocery cart
  - Need to allow 2 days for selling and 2 days for consumption
- But due to temperature variation, how many days did the berries *actually* age? Without in-transit, pallet-level temperature monitoring, you don’t know
  - Visual inspection cannot provide this information
RFID System Components

- Reader software
- Edge switch
- WiFi AP
- Web Services API
- Windows/C# applications
- Windows .NET DLL
- XML API
- Linux/OSX applications
- WinMobile applications
- WinMobile DLL
- Module firmware
# RFID the Solution?

## Available Options

- **Bar Codes and Passive RFID**: Lacks capabilities
  - Can’t be read at distances or around metal and equipment; requires redesigned workflows
- **Active RFID**: Good capabilities but relatively expensive to deploy
  - Proprietary solution, high cost of active RFID limit adoption
- **Passive UHF RFID**
  - The capabilities of active RFID at a fraction of the price
  - Enables real-world applications and practical benefits
  - Based on ISO/IEC 18000-6:2010 Standards

## REAL WORLD REQUIREMENTS

<table>
<thead>
<tr>
<th>REAL WORLD REQUIREMENTS</th>
<th>XC3 Technology</th>
<th>Passive RFID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Read Range</td>
<td>&gt; 300 ft</td>
<td>~ 40 ft</td>
</tr>
<tr>
<td>Long Write Range</td>
<td>&gt; 300 ft</td>
<td>~ 25 ft</td>
</tr>
<tr>
<td>Large User R/W Memory</td>
<td>60 kbits of on tag storage</td>
<td>~ 1 kbits</td>
</tr>
<tr>
<td>Security</td>
<td>Multi-layer access control</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>Password Protected Memory</td>
<td></td>
</tr>
<tr>
<td>Selectivity</td>
<td>Individual tag or groups of tags</td>
<td>None</td>
</tr>
<tr>
<td>Usage Environments</td>
<td>Metals, liquids, equipment</td>
<td>Very limited</td>
</tr>
</tbody>
</table>
### Passive RFID

**Pros**
- Reader talks first communications
- Low power passive backscatter
- Low overhead, simple communication protocol
- Low cost

**Cons**
- Shorter read range
- Even shorter write range
- Unreliable in RF challenging environments
- No sensor support

### Active RFID

**Pros**
- Long read range (>100m)
- Reliable in RF challenging environments
- Ability to add sensors and store data

**Cons**
- Tag talks first (beacons) communications.
- Higher power requirements
- More complex communications protocol
- Relatively high cost

### BAP (Bipolar Active Passive)

**Combines the best of both Passive and Active to deliver...**
- Long read/write range (>100m only Class 3)
- Reliable in RF challenging environments
- Ability to add sensors and store data
- Reader talks first communications
- Low power passive backscatter
- Low overhead, simple communication protocol
- Lower cost than active tags
The Answer

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Regulatory compliance in the application of RFID

Kumar Mysore

Head, Office of Airworthiness, Cargolux Airlines
Regulatory compliance in the application of RFID as related to Air Cargo operations

IATA - 7th World Cargo Symposium
Doha, 14 March 2013

Kumar MYSORE

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Head, Office of Airworthiness
Cargolux Airlines

www.cargolux.com
This month
We are 43 years old

Number 1 All-Cargo Carrier in Europe
Number 11 Worldwide

Modern & Energy-Efficient Fleet
25th year of Boeing 747F Operation
Last Saturday we received our 7th 747-8F

Forwarder’s Airline With Long Term Relationships
Cargolux Global Presence

- 60 Flight Destinations
- 177 Trucking Destinations
- 55 Countries
- 85 Offices
- 1,564 Employees Worldwide
- 1,187 Employees in Luxembourg
- Multinational staff, originating from over 30 countries
Disclaimer!

Nothing in this presentation should be considered as legal statements.

Current regulations applicable to your operations are binding.
Who?

Stakeholders – Agenda

• Operators
• RFID OEMs
• Freight Forwarders / Shippers
• ULD owners / Pools
• TCH
• Regulators
• ---
What is this session about?

Installing and using RFID systems on aviation products and equipment are subject to regulatory compliance and airworthiness concerns.

Regulators
- Who are they?
- What are their regulations?

Compliance
- What are the compliance specifications?
- What are acceptable means of compliance?
- Who should comply?

Who approves?

Regulations / Compliance is a dry subject without discussions on its applications.

Your questions, comments during & after the presentation are welcome.
### More Acronyms!

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID</td>
<td>Radio Frequency IDentification</td>
</tr>
<tr>
<td>Passive RFID, Active RFID</td>
<td></td>
</tr>
<tr>
<td>RFID Device</td>
<td>Active RFID, Transmitting RFID, Battery Assisted Passive (BAP) RFID, Semi-Passive RFID devices, Low powered Active RFID</td>
</tr>
<tr>
<td>RFID –Based sensors</td>
<td>Temperature data loggers used for tracking temperature of perishable products. Other parameter: Humidity, Dew point, Barometric pressure, 3-axis shock, Shock energy, Shock duration, Free fall height, Luminosity</td>
</tr>
<tr>
<td>PED</td>
<td>Portable Electronic Devices</td>
</tr>
<tr>
<td>T-PED</td>
<td>Transmitting PED</td>
</tr>
<tr>
<td>C-PED</td>
<td>Controlled PED which are under configuration control by the operator</td>
</tr>
<tr>
<td>M-PED</td>
<td>Medical PED</td>
</tr>
<tr>
<td>Readers</td>
<td>--</td>
</tr>
</tbody>
</table>
Regulators - Who are they?

National Agencies
<table>
<thead>
<tr>
<th>Document Code</th>
<th>Description</th>
<th>Date/Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAA TGL 41</td>
<td>Operational considerations for the use of passive RFID devices (Section 4/Part 3 (JAR-OPS)?)</td>
<td>11 May 2006 (Has this been issued?)</td>
</tr>
<tr>
<td>JAA TGL 29</td>
<td>Guidance concerning the use of portable electronic devices on board the aircraft. (being replaced)</td>
<td>01 October 2001</td>
</tr>
<tr>
<td>CAT.GEN.MPA.140</td>
<td>(Notes: New)</td>
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<tr>
<td>CS 25</td>
<td>Compliance Specifications – Large Airplanes</td>
<td></td>
</tr>
<tr>
<td>RMT.0241 &amp; RMT 242</td>
<td>TGL 41 - Passive RFID Devices</td>
<td>2012-2015</td>
</tr>
<tr>
<td>RMT.0285 &amp; RMT.0286</td>
<td>Active Radio Frequency Identification Devices (RFIDs)</td>
<td>2012-2015</td>
</tr>
</tbody>
</table>
PEDs not accessible during the flight

- Should be switched off, when not accessible for deactivation during flight.
- Applies to PEDs contained in baggage or transported as part of the cargo.
- The operator may allow deviation for PEDs for which tests have demonstrated their safe operation.
- Other precautions, such as transporting in shielded, metal boxes, may also be used to mitigate associated risks.
- In case an automated function is used to deactivate a T-PED, the unit should be qualified for safe operation on board the aircraft.
In particular lithium batteries, and potential resulting fire can be handled properly.
The radio frequency (RF) emissions of PEDs should meet the levels as defined by EUROCAE ED-14E/RTCA DO 160F Section 21 Category M for operation in the passenger compartment and EUROCAE ED-14E/RTCA DO 160F Section 21. Later revisions of those documents may be used for testing.

The assessment of intentional transmissions of T-PEDs is excluded from those test standards and needs to be addressed separately. When the operator intends to allow the operation of T-PEDs, its assessment should follow the principles set out in EUROCAE ED-130.
(a) Definition and categories of PEDs
PEDs are any kind of electronic device, typically but not limited to consumer electronics, brought on board the aircraft by crew members, passengers, or as part of the cargo and that are not included in the approved aircraft configuration. All equipment that is able to consume electrical energy falls under this definition. The electrical energy can be provided from internal sources as batteries (chargeable or non-rechargeable) or the devices may also be connected to specific aircraft power sources.

(b) Definition of the switched-off status
Many PEDs are not completely disconnected from the internal power source when switched off. The switching function may leave some remaining functionality e.g. data storage, timer, clock, etc. These devices can be considered switched off when in the deactivated status. The same applies for devices having no transmit capability and operated by coin cells without further deactivation capability, e.g. wrist watches.
<table>
<thead>
<tr>
<th>Document</th>
<th>Title</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 20-162</td>
<td>Airworthiness approval &amp; Operational allowance of RFID systems</td>
<td>22 September 2008</td>
</tr>
<tr>
<td>AC 91-21.1B</td>
<td>Use of Portable Electronic Devices Aboard Aircraft</td>
<td>25 August 2006</td>
</tr>
<tr>
<td>AC 20-164</td>
<td>Designing and Demonstrating Aircraft Tolerance to Portable Electronic Devices</td>
<td>15 March 2010</td>
</tr>
<tr>
<td>ARC.Charter. 11.8.1207, related to Docket No. FAA-2012-0752</td>
<td>Portable Electronic Device Aviation Rulemaking Committee – Objective – To make recommendation / to further clarify and provide guidance on allowing additional PEDs without compromising the continued safe operation of the aircraft.</td>
<td>07 January 2013</td>
</tr>
<tr>
<td>14 CFR 21, 25</td>
<td>Certification procedures for products &amp; parts; Airworthiness standards – Transport category airplanes</td>
<td></td>
</tr>
</tbody>
</table>
• Installing and using RFID systems on aviation products and equipment.
• Acceptable way to use RFID readers or interrogators installed on aircraft,
• Advice on allowing use of RFID devices on baggage, mail containers, cargo devices and galley/service carts.
• Using portable RFID readers or interrogators carried onboard aircraft.
• Passive /or/ Low-power active RFID devices
• (not RFID devices that communicate using cellular or satellite telephone technology, wireless wide area networks, high power radio transmitters, or other types of tracking devices)
# AC 20-162 Installed RFID Device Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Ancillary part marking</th>
<th>Critical component/life-limited part marking Other functions</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Passive RFID</td>
<td>Active RFID</td>
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<tr>
<td>Safety assessment</td>
<td>Paragraph 8.a</td>
<td>Paragraph 8.a</td>
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<tr>
<td>Major alterations</td>
<td>Paragraph 8.b</td>
<td>Paragraph 8.b</td>
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<tr>
<td>Configuration control</td>
<td>Paragraph 8.c</td>
<td>Paragraph 8.c</td>
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<tr>
<td>EMC demonstration</td>
<td>Not required</td>
<td>Paragraph 8.d</td>
</tr>
<tr>
<td>Software and complex hardware</td>
<td>Not required</td>
<td>Not required</td>
</tr>
<tr>
<td>Environmental qualification</td>
<td>Paragraph 8.f</td>
<td>Paragraph 8.f</td>
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<tr>
<td>Battery safety</td>
<td>Not required</td>
<td>Paragraph 8.g</td>
</tr>
<tr>
<td>Flammability and fire safety</td>
<td>Paragraph 8.h</td>
<td>Paragraph 8.h</td>
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<tr>
<td>Mounting and attachment integrity</td>
<td>Paragraph 8.i</td>
<td>Paragraph 8.i</td>
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<tr>
<td>ICA</td>
<td>Paragraph 8.j</td>
<td>Paragraph 8.j</td>
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</tbody>
</table>
SAE AS 5678

Passive RFID Tags Intended for Aircraft Use

- No on-tag power source and no active transmission
- Perform a ground operated, non-essential function
- No radio frequency (RF) interference RTCA D0-160, Section 21/FAA Policy Memo of 13 May 2005
- Performance Standard
- Environmental Performance (Table 3 next slide)
- Quality Assurance/Quality Control
- Maintenance and Repair
# Environmental Performance

(AS 5678 - Table 3 Continued)

<table>
<thead>
<tr>
<th>Environmental Requirement</th>
<th>Environmental Test Reference Document</th>
<th>Applicable Category or Guidelines</th>
<th>Applicable Performance Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Interior</td>
<td>Exterior</td>
</tr>
<tr>
<td>Temperature Altitude</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.5.1 - Ground survival low temperature and short time operating temperature test</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>Category A1</td>
<td>Category D2</td>
</tr>
<tr>
<td>4.5.2 - Operating low temperature test (N/A)</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>4.5.3 - Ground survival high temperature and short time operating high temperature</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>Category A1</td>
<td>Category D2</td>
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<tr>
<td>4.5.4 - Operating high temperature test (N/A)</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>4.5.5 - In-flight loss of cooling test (N/A)</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>4.6.1 - Altitude test</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>Category A1</td>
<td>Category D2</td>
</tr>
<tr>
<td>4.6.2 - Decompression test</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>Category A1</td>
<td>Category D2</td>
</tr>
<tr>
<td>4.6.3 - Over pressure test</td>
<td>RTCA DO-160 Rev. E or latest, Section 4</td>
<td>Category A1</td>
<td>Category D2</td>
</tr>
<tr>
<td>Humidity</td>
<td></td>
<td>Category A</td>
<td>Category C</td>
</tr>
</tbody>
</table>

**Operational Shocks and Crash Safety**

<table>
<thead>
<tr>
<th>Environmental Requirement</th>
<th>Environmental Test Reference Document</th>
<th>Applicable Category or Guidelines</th>
<th>Applicable Performance Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Interior</td>
<td>Exterior</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2 - Operational Shocks</td>
<td>RTCA DO-160 Rev. E or latest, Section 7</td>
<td>Category A</td>
<td>Category A</td>
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</table>

**Vibration**

<table>
<thead>
<tr>
<th>Environmental Requirement</th>
<th>Environmental Test Reference Document</th>
<th>Applicable Category or Guidelines</th>
<th>Applicable Performance Standard</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Interior</td>
<td>Exterior</td>
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<tr>
<td></td>
<td></td>
<td>Category S, Curve B</td>
<td>Category S, Curve B</td>
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</table>
Environmental Performance
(AS 5678 - Table 3 Continued)

<table>
<thead>
<tr>
<th>Fluid Susceptibility</th>
<th>RTCA DO-160 Rev. E or latest, Section 11</th>
<th>Category F</th>
<th>Category F</th>
<th>Category F</th>
<th>Data Integrity</th>
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</thead>
<tbody>
<tr>
<td>11.4 - Fluid susceptibility</td>
<td>RTCA DO-160 Rev. E or latest, Section 15</td>
<td>Category Z</td>
<td>Category Z</td>
<td>N/A</td>
<td>&quot; 1.2 No Magnetism, Data Integrity</td>
</tr>
</tbody>
</table>

Magnetic Effect

| Magnetic Effect | RTCA DO-160 Rev. E or latest, Section 15 | Category Z | Category Z | N/A | " 1.2 No Magnetism, Data Integrity |

Flammability

<table>
<thead>
<tr>
<th>14 CFR 25 - Flammability</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 CFR, Section 25.853(a) and Appendix F, Part 1 paragraph (a)(1)(ii)</td>
</tr>
<tr>
<td>14 CFR, Section 25.853(a) and Appendix F, Part 1 paragraph (a)(1)(i)</td>
</tr>
<tr>
<td>14 CFR, Section 25.853(a) and Appendix F, Part 1 paragraph (a)(1)(i)</td>
</tr>
<tr>
<td>14 CFR, Section 25.853(a) and Appendix F, Part 1 paragraph (a)(1)(i)</td>
</tr>
</tbody>
</table>

Flammability per CFR limits:

- All materials used (including adhesive materials) and or the complete RFID tag should be tested in accordance with 14 CFR FAR 25.853(a) Appendix F, Part I.

- RFID tags are not called out expressly in any section of Appendix F, and as such, this document directs the user to test in accordance with Paragraph (a)(1)(ii), the eight inch vertical burn test. This is considered the minimum fire test standard to which an RFID tag should be tested.

- All RFID tag shall be tested in accordance to this standard (interior, exterior and power plant).

- Most RFID tags for use on aircraft will be smaller than the test specimen size called out by the standard. As such, the user will have to construct a representative sample of the RFID tag of sufficient length for fire testing (this should include: all the layers that will be used, including the adhesive layer).

- This requirement is not applicable to small parts (where the greatest dimension is less than 50 mm), that would not contribute significantly to fire propagation.

NOTES to Table 3:

- "Equipment" as referred to in DO-160 is defined as a complete RFID Label, consisting of an integrated circuit "chip" attached to a substrate and integrated antenna, and covered with a human-readable printed film and/or machine-readable bar-code.

- This test must be performed in the following modes, if specified:
  1. Tag holds data, but is in an inert environment, i.e., it is neither energized nor transmitting.
  2. Tag has accepted "handshake" from reader, and data is being transmitted back to reader.

- "Data integrity" - applicant should fill chip’s memory and then check to ensure that all information has not changed due to elapsing of time or environmental exposure.
Passive RFID on ULD

Installing passive RFID devices on approved articles and appliances, including equipment, components and component parts thereof, cabin furnishings including galley/service carts and cargo devices like ULDs is a minor alteration.

Minor alteration does not invalidate the existing approval of the articles and appliances. No change in part number.

Interrogation restricted on ground - i.e., aircraft not-in-motion, and while aircraft is clear of active taxiways or runways.
Other National Agency

What are your encounters?
Compliance Specifications / Approvals

- EASA CS 25
- FAA 14 CFR 25
- EASA Design Organization approvals
- FAA ACO certificate / approval
- FAA DER approvals?
Who should Comply?

Operators.

- Makes it easy if OEM provide required test reports.
- Makes it easy if OEM obtains ETSO/ TSO/STC/PMA or other Agency certifications for their equipment.
Example of approval
FAA – Parts Manufacturer Approval

• In accordance with 14 CFR, part 21, Certification Procedures for Products, Articles, and Parts, Subpart K—Parts Manufacturer Approvals, the FAA has found that the design data of product.......... meets the airworthiness requirements of 14 CFR applicable to the product(s) on which the article(s) is to be installed.
• Additionally, the FAA has determined that the Manufacturer has established the quality system required by § 21.307.
• PMA is hereby granted to the manufacturer to produce the replacement articles (or modification articles, as applicable)
• Subsequent changes to these design data must be approved in a manner acceptable to the FAA.
‘ABC’ Regulatory authority has reviewed the Product and its test reports.

Product has been found to:

- Have appropriate operational characteristics,
- Results of D0-160F section 21 category M radiated emissions testing are acceptable
- Design, production and testing controls are satisfactory.

Airline operators may allow the use of this Product throughout the flight without further electromagnetic compatibility testing on the aircraft provided that their use is limited to the cargo compartment.

The documentation provides aircraft operators with sufficient data to determine if the Product is acceptable for use as required by their Operating Rules.

The use of any portable device is the responsibility of the operator.

The intent of this Letter is to provide operators with the regulators position to help them determine if additional testing of the Product is required.
1. Approval requirements and procedures: airlines, RFID manufacturers, CAAs, roles and responsibilities? (In general, it's believed that the manufacturers should apply for approval from the CAAs)

2. Which department of the CAA should be the governing authority, airworthiness certification, flight safety, or other department? 
   Mention questions to EASA, etc.

3. How to prevent shipper's undeclared active RFID devices from being loaded onto an aircraft? (some airlines would ask the shipper to declare them on the AWB) 
   Explain procedures used at Cargolux

4. The active RFID device should be de-activated during take-off and activated after landing, however, there are no clear definitions of 'during take-off' (some said during taxiing) and 'after landing'.
   A cell phone will not be authorized for use while the aircraft is being taxied for departure after leaving the gate (FAA AC 91-21.1B)
   Cell phones installed in or carried aboard airplanes must not be operated while airplanes are airborne (not touching the ground (FCC & CFR 47, Part 22, Subpart H "Cellular Radiotelephone Service," section 22.925

5. Data security. (some airlines concerned the active devices on board would be able to regularly scan and capture the information of on board).
   At cargolux, we refer to our legal & compliance department – Collection of flight sensitive data (temp/g-shock – aircraft parameters, shipment location, etc.)
Secure Installation
Airport Infrastructure - compatibility

RF network at Cargo center / Routers / Gateway – Internet portal
Instructions for continued Airworthiness

- Calibration
- Maintenance – Battery replacements
- Overhaul/Repair procedures
- Precautions / warnings
Recent / Future efforts

- Questions to EASA through AEA


- IATA RP for ULD identification – Zhi YONG

- IATA - Guidance on Introducing RFID Into Airline Maintenance Operations - Irena KHOMENKO

- IATA – possibly is looking next to work on producing RP for Temperature sensitive cargo RFID?
Regulations / Compliance - Challenges

- Product life time, Product Maintenance, Spares
- Complexity
  - Interference with Aircraft & Airport infrastructure,
  - Numerous Stakeholders,
  - Multiple IT/Software Platforms
- Logistics, Fierce Environmental Conditions
Approval/Compliance/Certification lags behind Technology

Product life cycles in the IT industry are fast-paced.…

From the initial research work to its decommissioning, an aircraft’s entire service life can amount to up to 90 years.…

We need to close the innovation gap between aerospace and IT…

➔ Tom ENDERS, CEO EADS in his opening speech at CeBIT 2013

Acknowledgements

Cargolux
IATA / Zhi YONG & others
AEA
EASA
OEMs, Sentry, 7P, and many others.
Summary

- Brief review of EASA & FAA regulations,
- Available guidance - SAE, RTCA/EUROCAE, SAE
- ATA, IATA, EPC Global, UL etc
- Current industry practices
- Recent / Future industry efforts
Thanks to you all!

Now, your questions please!
EUROCAE - European Organization for Civil Aviation Equipment
Non profit making organization which provides a European forum for resolving technical problems with electronic equipment for air transport. EUROCAE deals exclusively with aviation standardization for use in the regulation of aviation equipment and systems.

RTCA, Inc - Radio Technical Commission for Aeronautics
Not-for-profit corporation
Develops consensus-based recommendations avionics equipment
Functions as a Federal Advisory Committee.
Recommendations are used by the FAA as the basis for policy, program, and regulatory decisions.

EUROCAE or RTCA
Not official agencies of any European or US government.
Recommendations may not be regarded as statements of official government policy unless so enunciated so by appropriate government organization.
Some of the OEMs

- http://www.sentrysafe.com/
- http://www.intelleflex.com/
- http://www.sensitech.com/products/TempTaleRF
- http://www.cartasense.com/technology_main.html
- http://www.maximintegrated.com/
- http://www.logtagrecorders.com/
Related References

(Notes: For battery carried as cargo shipment)

- EASA SIB No.: 2010-30R1, Issued: 31 March 2011 Risks in Transporting Lithium Batteries in Cargo by Aircraft
- FAA Safety Alert for Operators (SAFO) 10017, dated 08 October 2010.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIA</td>
<td>Aerospace Industries Association of America</td>
</tr>
<tr>
<td>EMC</td>
<td>Electro Magnetic Compatibility</td>
</tr>
<tr>
<td>EUROCAE</td>
<td>European Organization for Civil Aviation Equipment</td>
</tr>
<tr>
<td>PED</td>
<td>Portable Electronic Device (per FAA AC 91-21-1B)</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment manufacturer</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification Device.</td>
</tr>
<tr>
<td>TCH</td>
<td>Type certificate Holder</td>
</tr>
<tr>
<td>TGL</td>
<td>Temporary Guidance Letter, EASA/JAA.</td>
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</tbody>
</table>
7th WORLD CARGO SYMPOSIUM
DOHA 12-14 MARCH 2013

Coffee Break Sponsored by
Why RFID and Wireless Technologies are Again on Top of the Air Cargo Agenda and How to Ensure Alignment and Compatibility?
M2M, Location, and Environmental Tracking &
Time / Temperature / Humidity / Shock Monitoring

† Nikki Cuban
    † Vice President of Sales and Marketing, OnAsset Intelligence
M2M, Location, and Environmental Tracking

AIR CARGO
Approved by Operators Across the Globe

SENTRY FlightSafe® Network – GSM / GPRS
OnAsset Intelligence: “M2M” Service Provider

OnAsset is an M2M* manufacturer and system designer of GPS, sensor-based tracking devices and applications that serve transportation providers, shippers of high value cargo, and consumers who move important valuables through the global supply chain.

**Machine-to-Machine Communications** is the automated data transmission of electronic devices over a wireless network, where communication takes place without human intervention. The term was coined by Nokia in 2002, now also often called:

- “Internet of Things” / “Connected World” / “Smarter Planet (IBM)”

**MACHINE-TO-MACHINE**
M2M Predictions are Strong

- 33.3 Million total M2M connections in the U.S. in 2012
- Growth is forecasted at 114.7 million connections by 2016

36% Growth by 2016

- The largest B2B vertical market is the transportation vertical, with over 40% market share.
- Growth will come from areas where there is a demonstrable ROI, cloud computing and hosted applications will drive M2M adoption.

Source: Compass Intelligence, 2012
**ROI Benefits of Real-Time Information**

- Improved Operations
- Reduced Risk & Exposure
- Call Volume Reduction
- Service Differentiation
- Proactive Response
- Compliance Validation
- Accountability
- Improved Workflow Management
- Scalability
- Confidence to Carry New Cargo
All Major Wireless Carriers are M2M Focused
AT&T Machine to Machine

Increase productivity through the deployment of fully integrated mobile solutions.

Connected Assets → Cellular Network → Service Delivery → M2M Application Platform → Applications → Hosting/Cloud

- Rugged Devices
- Modem
- Module
- Smart Meter

- Enterprise On Demand
- AT&T Control Center

- AT&T M2M Application Platform
- Powered by Axeda

- Fleet Management
- Field Services Automation
- Sales Force Automation
- Pre-packaged Apps
In OTHER WORDS…. 

- No costly reader infrastructure 
- Very few visibility gaps 
- No time delays or human effort involved in data collection 
- No read rate issues 
- **Track Now vs. Later** 
  - *Very low market entry and start up costs*
## RFID vs. M2M in Medical Facilities – Helpful Tips

### Guideline for Choosing Asset Tracking Technology

<table>
<thead>
<tr>
<th>Visibility Frequency</th>
<th>Environment</th>
<th>Asset Value</th>
<th>$300</th>
<th>$3,000</th>
<th>$10,000</th>
<th>$20,000</th>
<th>$150,000</th>
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<tbody>
<tr>
<td>Daily</td>
<td>Patient Room</td>
<td>UHF RFID</td>
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<tr>
<td>Weekly</td>
<td>ICU</td>
<td>UHF RFID</td>
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<td></td>
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<td>Weekly</td>
<td>Recovery</td>
<td>UHF RFID</td>
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<td>Weekly</td>
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<td>UHF RFID</td>
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<td>Monthly</td>
<td>ER</td>
<td>UHF RFID</td>
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<td></td>
<td></td>
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<tr>
<td>In/Out</td>
<td>Central Supply</td>
<td>UHF RFID</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>In/Out</td>
<td>Warehouse</td>
<td>UHF RFID</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Legend:**
- Bar codes =
- UHF RFID =
- RTLS =

**Source:** Intelligent Hospital Today: [http://intelligenthospitaltoday.com/rfid-tracking-vs-barcode-scanning-how-to-determine-which-is-essential-for-your-healthcare-environment/](http://intelligenthospitaltoday.com/rfid-tracking-vs-barcode-scanning-how-to-determine-which-is-essential-for-your-healthcare-environment/)
RFID vs. M2M in Air Cargo

- Asset Value = HIGH
- Replacement Costs = HIGH
- Supply Chain Disruption = HIGH
- Supply Chain Process = COMPLEX
- Deployment Footprint = GLOBAL

High Value, Fast & Frequent = M2M
M2M Partners
Delivering data fast to achieve faster response time.

_Raising Asset Tracking to New Heights_
- Vision Platform powered by AT&T Cloud
- Exclusive partnership for low-cost international data services
- AT&T Financing services for high volume device deployment
- Next Generation FlightSafe

_Joining Forces to Propel Data Forward, Fast_
- Integrating FlightSafe with RKN e1 and RAP e2 Active Containers
- Telemetry data management and reporting services
- Proactive response procedures, maintenance awareness, and improved return
Key Drivers of M2M Technology

**BUSINESS DRIVERS**
- Compliance Management
- Claims Costs
- Chain of Custody
- Cargo Security
- Service Differentiation

**SENSOR DATA**
- Temperature & Humidity
- Verification & Trending
- Location
- Light Detection
- All of the above
SENTRY FlightSafe Tracking Device

- GSM / GPRS Global Communications
- Long battery life range: 4 to 7 days
- Active Sensor Suite
  - Temperature
  - Humidity
  - Intrusion Detection (Light / Dark)
  - Shock
  - Vibration
  - Motion
  - GPS & AGPS Location
- Adaptive to all types of cargo
  - Oil & Gas
  - Machine Parts
  - High Value
  - Precious Metals & Documents
  - Pharmaceutical and Life Sciences
  - Perishables

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating: -20°C to 60°C</td>
<td>Standard Battery: 3.75 in W x 1.06 in H x 5.13 in L, 10 oz</td>
</tr>
<tr>
<td>Charging: 0°C to 34°C</td>
<td>Extended Battery: 3.75 in W x 1.88 in H x 5.13 in L, 1 lb 5 oz</td>
</tr>
<tr>
<td>Storage: -40°C to 85°C</td>
<td></td>
</tr>
</tbody>
</table>
New SENTRY FlightSafe® - July 2013

- New smaller size, only 85mm x 48mm x 23mm
- Weighs less than 4 ounces
- Global AT&T 3G connectivity
- Accessories for attachment to pet collars
- Compact form factor works easily with cold chain packaging
- Patented FlightSafe® technology
- Complete sensor suite
- Plug-in extended battery modules
- Gang-style charger racks for high volume users
## Multi-Sensor Platform

Horizontal Monitoring Platform for All Varieties of Cargo

<table>
<thead>
<tr>
<th>Wireless</th>
<th>GPS</th>
<th>Temp.</th>
<th>Humidity</th>
<th>Pressure</th>
<th>Shock</th>
<th>Light</th>
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</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Global</td>
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<tr>
<td>Arrival Time Dwell Status</td>
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<tr>
<td>Condition</td>
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<td>Condition</td>
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<tr>
<td>Intrusion Detection</td>
<td></td>
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</tr>
</tbody>
</table>

- **AOG Parts**
  - Wireless: X
  - GPS: X
  - Temp.: X
  - Humidity: X
  - Pressure: X
  - Shock: X
  - Light: X

- **Life Science**
  - Wireless: X
  - GPS: X
  - Temp.: X
  - Humidity: X
  - Pressure: X
  - Shock: X
  - Light: X

- **Medical Devices**
  - Wireless: X
  - GPS: X
  - Temp.: X
  - Humidity: X
  - Pressure: X
  - Shock: X
  - Light: X

- **Electronics**
  - Wireless: X
  - GPS: X
  - Temp.: X
  - Humidity: X
  - Pressure: X
  - Shock: X
  - Light: X

- **Entertainment**
  - Wireless: X
  - GPS: X
  - Temp.: X
  - Humidity: X
  - Pressure: X
  - Shock: X
  - Light: X

- **Perishables**
  - Wireless: X
  - GPS: X
  - Temp.: X
  - Humidity: X
  - Pressure: X
  - Shock: X
  - Light: X
Scenario 2: SHOCK

- **TRANSIT**: Chicago to Europe
- **CARGO**: Painting purchased from art auction house
- **SITUATION**:
  - Painting did not make the connection flight
  - Excessive shock reported at cargo facility
  - Airline personnel dispatched to find damaged packaging
  - Airline initiates immediate response plan with customer
- **COST to REPLACE** painting: **HIGH**
Scenario 4: SHOCK / MOTION / ANALYSIS

Embedded Cargo
With ShockBox and Pre-labeling for Reverse Logistics

Additional Sensors:
- GPS
- Temperature
- Pressure
- Speed
- Motion
- Vibration

Return Pre-Label
Shock Pad
Light

Placed on top of pallet 1 or pallet 2 in the nose of the trailer
Detects trailer impact and vibration
**Scenario 3: LIGHT AND REAL-TIME RECEIPT OF GOODS**

**SENTRY device placed in shipment**

**SENTRY exits origin geofence and sends notification that shipping has started.**

**GPS, Shock, and Light / Dark conditions monitored during transit with real-time alerts for breakage, out-of-route locations, and unauthorized package “open” events.**

**Package arrives at destination geofence, in good condition and customer opens the box.**

**SENTRY recognizes geofence location and light sensor triggers a “box opened” event to the Vision Platform.**

**Customer receives invoice immediately upon opening the box of goods from manufacturer’s SAP system as an EDI transaction.**

**OnAsset Platform notifies Electronic Manufacturer’s SAP system to initiate the invoice.**

**Speed up Cash Flow Achieved.**
Scenario 5: Temperature & Location

- **TRANSIT**: U.S. Domestic
- **CARGO**: Human Blood
- **EMERGENCY**:
  - Misplaced in cargo facility
  - Close to expiration
- **ACTIONS**:
  - Freight Forwarder receives dwell time warning
  - 1 hour later, increase in temperature occurs
  - Flight No. shows departed while cargo remains at the airport
  - Freight Forwarder emails alert data and tracking page data to airline and cargo is located in under 30 minutes. Temperature is mitigated and cargo makes next flight out. Arrives on time and in good condition.
- **COST to PATIENT CARE**: HIGH
Alerting & Response

- **Condition alerts**
  - Temperature: + or – 2 to 8 degrees C

- **Dwell time**
  - Too long at a single location

- **High Theft Areas – Entry & Exit**
  - Automatic frequent reporting

- **Focused Messaging**
  - Customer Notifications
  - Control Center Notifications

- **Performance Metrics**
  - Alert trends
OnAsset Contact Information

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  - +44 7917 649325
  - prodwell@onasset.com

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  - Nikki Cuban
  - Based in the U.S.
  - ncuban@onasset.com
  - 972-659-1619 x 138
Piece Level Tracking

Barb Johnston
- General Manager, Regulatory and Industry Affairs, Air Canada Cargo

Jeff Wells
- CEO/President, Franwell
RFID Piece Level Tracking

Agenda

- Executive Summary
- RFID Pilot Scope / Objectives
- Benefits to Piece Level Tracking
- Video Demo
- Air Canada's Next steps
RFID Piece Level Tracking

Executive Summary

• With partners Franwell and the University of Florida, the RFID Team at Air Canada Cargo began investigating RFID technology in 2005.

• The work progressed and resulted in the completion of several successful pilots concluding with providing proof of concept of reading shipments at the piece level associated to a ULD on live flights.
RFID Piece Level Tracking

Pilot Objectives

✈ Implement the infrastructure and applications necessary to perform real-time tracking of shipments at piece level with minimal human intervention

✈ Maintain integrity of the current processes

✈ Design a solution for large scale deployment that will support e-commerce using RFID, and one that could expand beyond cargo: mail, asset management, baggage…

✈ Build a business case to justify automation of cargo activities resulting in improved service, enhanced billing integrity and total visibility
RFID Piece Level Tracking

Benefits

→ Improved track and trace
  - Increased precision / Improved data collection
  - Seamlessly aggregate piece data capture to ULDs
  - Provide real time visibility and performance down to the piece level

→ Supports e-commerce initiatives
  - e-AWB
  - e-CSD
RFID Piece Level Tracking

Benefits

→ Ability to timestamp locations throughout the handling process

→ Elimination of blind or electronically triggered events
  - Real events at actual times are captured, improving visibility, track and trace and billing integrity

→ Reduced requirement of human intervention
  - Improves data quality and speed of data received
  - Manpower allocation and resources may be reduced or redeployed
RFID Piece Level Tracking

RFID was successfully utilized to obtain real-time, hands free status updates for the following cargo events:

- Acceptance
- Buildup
- Export
- Import
- Delivery
RFID Piece Level Tracking

✈ Video
RFID Piece Level Tracking

Next Steps

- The results of the pilot convinced the RFID Team that the technology is ready and capable of providing significant value to Air Canada and to the cargo industry.
- The RFID Team is looking at ways to introduce paperless customs and security reporting using RFID.
- Air Canada and Franwell are working closely with IATA to ensure global standards are developed and deployed.
- Air Canada is now launching RFID capabilities fully operational and integrated in YUL and FRA with other stations to follow.
RFID Piece Level Tracking

Thank you!
Automatic Identification of ULDs

Zhi Yong Liao 廖志勇
Manager, Business Process and Standards, IATA
RFID Benefits

- reduce human errors and ensure reliability/accuracy
- eliminate paper handling and processing costs
- achieve higher speed throughput
- enable efficient tracking and locating the ULDs
- facilitate the association of shipment information with the ULD ID Code

It seems to be the next generation technology but why it does not take off despite the standard available since the ’90s?
RFID Challenges

- Lack of strong expertise in RFID technology
- Insufficient/outdated industry standards
- Lack of coordination across various wireless applications
- Unclear regulatory approval requirements for active RFID devices on board an aircraft
- Various RFID tag data formats available but unclear which one would be appropriate
Cargo RFID Working Group
Terms of Reference

Provide recommendations to the CBPP on:

- CSC Recommended Practice 1640 (Use of RF Technology for the Automatic Identification of ULDs)

Industry participants:

- Airlines
- RFID manufacturers
- Aircraft manufacturers
- Freight forwarders
- ULD OEMs
- Invited industry observers (ISO/IEC/ATA/GS1)

---

**RECOMMENDED PRACTICE 1640**

**USE OF RADIO FREQUENCY TECHNOLOGY FOR THE AUTOMATIC IDENTIFICATION OF UNIT LOAD DEVICES**

CSC(18)1640  Expiry: indefinite  Type: A

RECOMMENDED that:

1. Where Members wish to use radio frequency technology for the automatic identification of unit load devices (ULDs), the provisions of Attachment ‘A’ hereto shall apply.

2. This Recommended Practice provides for the automatic identification of ULDs by use of a radio frequency tag, and the electronic transfer of the information contained in such a tag to data processing systems.

3. Such a tag must be capable of further possible applications which may be identified in the cargo services area.

4. The standard embodied in this Recommended Practice is not restricted. It is intended that one manufacturer’s tags may be read by other manufacturer’s sensing or reading equipment and vice versa.

---

**RECOMMENDED PRACTICE 1640**

**Attachment ‘A’**

1. **INTRODUCTION**

This Recommended Practice describes the airlines’ requirements for a system of automatic identification of aircraft unit load devices (ULDs) and ground service equipment (GSE). These requirements are based on the electronic transfer of information using radio frequency (RF) tags, fitted to the equipment.

This radio frequency automatic identification (RFID) system supplements visual markings. Installation of such a system and equipping ULDs for automatic identification is optional.

2. **REFERENCES**

In this Recommended Practice:

ULD terminology is in accordance with the provisions of Resolution 986, General Rules for the use of Unit Load Devices.

ULD identification codes are in accordance with the provisions of Resolution 986, IATA Identification Code for Unit Load Devices.

3. **DEFINITIONS**

3.1 Unit Load Device
Key Discussions (1 of 5)

Visibility across supply chain?
Key Discussions (2 of 5)

- Passive/battery-assisted-passive/semi-active/active or GPS?
Key Discussions (3 of 5)

Where to attach the ULD tags, adjacent/opposite/all sides?

Tag Positioning

- 2~4 tags attached to the sides of ULD
  - Pallet: located inside the seat track of the edge rail
  - Container: located at least 51 cm above the base
**Key Discussions (4 of 5)**

What data to be contained in the RFID tag?

<table>
<thead>
<tr>
<th>Object</th>
<th>Mandatory</th>
<th>Decoded data characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULD ID Code</td>
<td>Y</td>
<td>15 Alpha Numeric</td>
</tr>
<tr>
<td>ULD OEM Name</td>
<td>N</td>
<td>5 Alpha Numeric (CAGE Code)</td>
</tr>
<tr>
<td>ULD Serial Number</td>
<td>N</td>
<td>1-15 Alpha Numeric</td>
</tr>
<tr>
<td>ULD Part Number</td>
<td>N</td>
<td>1-15 Alpha Numeric</td>
</tr>
<tr>
<td>Date of Manufacture</td>
<td>N</td>
<td>6 Numeric (YYYYYMM)</td>
</tr>
</tbody>
</table>
Which external standards documents to refer to?

Fully aligned with PSC RP 1740c and relevant ISO/IEC standards
Next Steps

- Submit the updated CSC RP 1640 for CBPP approval
- Identify potential airlines to drive the application of RP 1640
- Start the assigned task on time & temperature monitoring devices
- Maintain internal coordination with departments working on RFID for baggage handling, aircraft part tracking, in-flight catering trolley management
- Maintain external liaison with ISO/IEC/GS1/ATA
IATA’s Goal

- Take the lead in establishing standards for the application of wireless technologies:
  - Applicable across the air cargo supply chain
  - Maximize efficiency
  - Ensure compatibility and interoperability
Thank You!

Any suggestions and comments, please contact LIAO, Zhi Yong (liaozy@iata.org).
Panel Discussion

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