Commercial Aviation Clears RFID for Takeoff

Extended memory passive and battery-assisted passive RFID technology enable tracking solutions in the aviation industry.

The FAA formally approved the use of passive UHF RFID tags on individual airplane parts for commercial aircraft, which opens up a number of potential RFID-based applications for airlines, air-freight carriers, aircraft maintenance and repair centers, and airplane manufacturers. This paper examines four of these applications in more detail:

1. Airline parts maintenance tracking
2. Tool management
3. Cargo container management
4. Mobile asset management

It also explains how extended-memory passive and battery-assisted passive RFID technologies from Intelleflex have proven to be particularly useful for these application areas – through their unique combination of the best features of passive (low cost) and active (high performance) RFID solutions.

Airline Parts Maintenance Tracking

Shortly after the FAA approved the use of passive UHF RFID tags on individual airplane parts, Boeing announced plans in October 2005 to tag 1,750 maintenance-significant parts for its 787 Dreamliner. Boeing plans to incorporate RFID tags on high dollar value items, line replaceable units (LRUs), limited life parts that need to be frequently inspected, repaired and replaced, and on-board emergency equipment.

In addition to storing a unique identification (i.e. part #, serial # and manufacturer's code) on the RFID tag, Boeing also plans to store flight time, maintenance and inspection data. Logging a part's flight hours, maintenance and repair histories directly on the RFID tag will reduce the airlines' costs of tracking and maintaining service history on parts. It will also reduce the cycle time to solve in-service problems by improving the accuracy of information exchanged between customers and suppliers.

Giving mechanics the ability to reference and update a part's maintenance history more quickly and easily will facilitate accurate configuration control and repair history, reduced warranty claim processing costs, accurate and efficient spare parts pooling and easier identification of rogue parts.

Storing electronic maintenance records on the RFID tags will also reduce airlines' reliance on paper records and ease future compliance with FAA documentation requirements.

To support this vision, Boeing requires high-memory capacity tags that can be directly mounted on metal / non-metallic parts and withstand changes in temperature, pressure and humidity. Furthermore, approximately a dozen tag form factors will be necessary to accommodate the unique characteristics (i.e. size, shape and material composition) of the 1,750 parts to be tagged. Boeing also wants tags that comply with the EPCGlobal C1G2 and ISO 18000-6C passive UHF standards.

In April 2006, Boeing announced that it had selected the Intelleflex passive C1G2 high memory chip as the platform upon which a variety of tags and labels will be developed. Boeing chose Intelleflex because they already had a 64 Kb total (60 Kb user configurable) high-memory chip in their Class 3 battery-assisted passive solution. To facilitate global availability of tags in customized form factors, Intelleflex will offer its chips to tag partners who will design and deliver finished tags to Boeing suppliers.

Tool Management

The same Intelleflex RFID tags and readers for tracking spare parts can also be put to good use for managing tool cribs at maintenance and repair depots – providing real-time visibility to what tools are in storage, their maintenance and calibration history, when they were last checked out and checked in (by whom) and ensuring that certified tools are being used for specific operations.

In long-range battery-assisted passive mode, tagged tools can be inventoried in real time. Short range access to tagged tools and employee badges can expedite the process of checking tools in and out of the tool crib and through other choke points. Maintenance and calibration history can be written to the Intelleflex battery-assisted passive tag's memory.

Cargo Container Management

Air freight cargo containers are known as unit load devices or ULDs. These devices come in a variety of shapes and sizes depending on the type of airplane, type of cargo they will contain and where they are actually designed to fit on the airplane (top deck versus belly).

Managing the inventory of ULDs is particularly chaotic with the multiple shapes and sizes, and imbalances frequently occur at airports between air freight facilities (i.e. facilities having an over-abundance of ULDs they don't need and scarcity of types they do need). This leads to frequent "borrowing" between airlines, lost ULDs and unnecessary procurement.

Freight carriers are looking at RFID as a means to more effectively track the arrival and departure of these containers, and to monitor their location while on site. Moreover, RFID's ability to store an electronic manifest of the containers' contents can provide the carrier with real-time information on which ULDs require special handling and which need to be forwarded immediately for onward shipment.

Armed with real-time information as to the availability, location and condition of ULDs, air freight carriers and passenger airlines can more efficiently load and unload aircraft, minimize lost and misplaced ULDs, and reduce the need to order additional ULDs to meet anticipated peak requirements.

With a maximum read range of 3 meters, susceptibility to electromagnetic interference and limited tag memory, currently available EPCGlobal C1G2 passive UHF RFID does not support the level of performance required for this application. On the other hand, Class 4 active RFID systems that can support this application cost considerably more than Class 1 and require a totally separate and incompatible reading infrastructure.

Intelleflex Class 3 battery-assisted passive systems offer the best of both worlds for tracking ULDs. They provide the performance advantages of Class 4 at a fraction of the cost. Furthermore, they use the same communications protocol between tags and readers as the Class 1 systems, and can operate in either pure-passive or battery-assist mode. This compatibility affords carriers the flexibility to combine Class 1 and Class 3 tags and readers within a single, interoperable infrastructure.

For example, Intelleflex readers can read the passive UHF C1G2 tags on individual shipments as they are being loaded into a ULD. Upon sealing the container, the same reader can write the individual shipment information (i.e. the contents of the container) to an Intelleflex Class 3 battery-assisted passive tag on the ULD. This information now serves as an electronic manifest that can be read at the receiving location, thus enabling verification of ULD contents without breaking the seal. This is made possible by the Class 3 battery-assisted passive tag's 60 Kb rewritable memory which can be accessed in passive C1G2 mode. Data written to Intelleflex tag memory can be password protected to prevent unauthorized personnel in the supply chain overwriting it.

In battery-assist mode, Intelleflex readers can read the Class 3 battery-assisted passive tags at long range to facilitate routing and repositioning of ULDs during the loading/unloading process. This capability can help carriers meet the tight sort connection and cross-load turnaround times that are typical in the airline industry.

Using the Intelleflex Class 3 battery-assisted passive tags allows the user both functionalities in one tag and one reader infrastructure.

Mobile Asset Management

Airlines rely on mobile assets such as tugs, trailers and forklifts to move containers during the loading and unloading process. Knowing how many of these assets are available in the staging area, and where they are located is critical to their effective deployment. Furthermore, providing service personnel access to maintenance records on the asset itself can be critical for expediting maintenance and repair activities.

Zonal Locating

Intelleflex readers placed throughout large areas can define zonal grids and track tagged assets (bearing Intelleflex battery-assisted passive tags) from distances of up to 50 meters. This generates real-time

information on asset movement and current zonal locations. Armed with graphical displays of this information, facilities managers can quickly identify and deploy assets to the operations that need them. This improves asset utilization and operational throughput at the facility.

Event Logging

The Intelleflex battery-assisted passive tags contain 60 Kb of rewritable memory. This capability can be used to log chain of custody events for shared and leased assets, making it easier to reconcile billing and liability disputes. It can also be used to ensure only certified personnel are operating the equipment.

When subsequently servicing the equipment in the field, the asset's service history can be read directly from the tag without relying on network connectivity to a central database. This increases the service technician's ability to more quickly diagnose and repair the problem and get the equipment back into service.

The Best of Both Worlds

By combining Class 4 capabilities (at a fraction of the cost) with Class 1 compatibility, Intelleflex offers breakthrough performance at a breakthrough price – all within a standards-compliant framework. This unique combination provides cost effective parts tracking and asset management applications within the aviation industry. To learn more about Intelleflex RFID solutions, visit www.intelleflex.com.

Salient Features of Intelleflex Technology

- 64 Kb total, 60 Kb user rewritable memory
- Multi-protocol readers that can read C1G2, C2 and C3 tags
- Up to 50 meter range
- Fraction of the cost of active tags

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