



Five Myths about RFID in the Aerospace Industry and the Reality of How the Technology is Helping Suppliers

Radio frequency identification (RFID) technology use is quickly becoming commonplace in the aerospace industry as airlines, aerospace manufacturers and their suppliers are using tags to track and identify items as part of trading partner programs and internal materials management and MRO programs. There is also a growing body of standards to support these use cases. However, despite growing RFID maturity in the aerospace industry, program guidelines from leading industry organizations like Airbus, Boeing and the ATA, and the availability of RFID tags and software solutions that support internationally recognized standards, there is still considerable confusion about when RFID tags are needed, what types are required and how they can be used.

This white paper debunks the leading myths about using RFID in the aerospace industry and will provide examples of how airlines, aircraft manufacturers and component suppliers have successfully used the technology to improve their operations. The white paper will:

- Address the most common myths about RFID use in the aerospace industry;
- Provide an overview of the requirements of the most common industry, government and manufacturer programs;
- Outline the varying conditions that can influence tag selection and performance, and;
- Provide examples of how RFID can be leveraged within aerospace operations to produce quantifiable business benefits beyond compliance.

RFID technology is poised to become pervasive in the aerospace supply chain thanks to the efforts of major aircraft manufacturers, parts suppliers and airlines. Forward-thinking leaders within the industry have outlined a parts traceability vision that will allow stakeholders to track assets in real time, and provide information on their maintenance history in the field at the push of a button.

However, there are still many misperceptions about RFID within the industry. It can be unclear, for example, just who needs to tag which items. The answer can vary depending on which program or standard is being discussed, and some companies may find themselves having to comply with different requirements from different trading partners. However, significant effort has been put into some degree of rationalization across the aerospace industry to ease the burden on suppliers.

There is also a misperception that the bulk of RFID projects in the industry have been spurred by these standard compliance initiatives. That simply is not the case. While adoption of industry-standard RFID solutions has increased thanks to pressure from large end customers like Airbus, Boeing and the U.S. Department of Defense (DoD), there are numerous examples of aerospace companies leveraging RFID to produce real benefits above and beyond compliance – including improved supply chain visibility, work-in-process (WIP) tracking, asset management and utilization, improved maintenance tracking and more efficient logistics and manufacturing operations.

Some confusion in the market has been caused by the existence of multiple industry and manufacturer standards, in addition to varying data requirements among and within those standards. Often lost in these discussions are the elements of tag suitability; not every tag marketed to the aerospace market can be used in every application. Some tags have to withstand the rigorous environment inside a jet engine; others may never leave the tarmac.

Using standard-compliant RFID tags and software solutions that support standards does not ensure technology performance or project success. Standards should be considered the baseline for measuring the applicability and performance of the tags deployed. Not only does the technology need to meet the requirements of the standard, it also has to perform well in the environment the tagged item will be exposed to. The tags have to be easily readable on the item being tracked, rugged enough to withstand the harsh conditions of the operating environment, and have enough memory to provide sufficient data for the application.

Companies that look at RFID requirements as just another compliance hurdle that has to be met to keep their customers happy are missing a significant opportunity to improve efficiency and visibility, both internally and throughout the value chain.

Myth 1: Aerospace tagging requirements are standard

Standards play a critical role in technology adoption. In the case of RFID in the aerospace industry, standardization will help increase utilization of the technology among the supplier base. But it is a mistake to think that all tagging requirements are standard; in fact, there are multiple industry standards for RFID that must be considered by any company attempting to tag parts or assets.

The primary aviation RFID standard is the Air Transport Association's (ATA) Spec 2000, an e-business framework that outlines requirements for file standards, e-commerce, bar coding, and RFID tagging of aircraft parts.

SAE International also developed the SAE AS5678 requirements specification for the production and testing of passive RFID tags for aerospace application, which spells out requirements regarding a tag's ability to withstand environmental conditions, with

specific variations in temperature, air pressure, vibration, shock and elements.

The Department of Defense also has an identification standard, the Item Unique Identification (IUID) program (which is frequently referred to as UID), requiring a permanent mark on all equipment with an acquisition cost of more than \$5,000. In the context of aviation parts, the standard is compatible with Spec 2000.

Individual companies have also established their own program standards. Since 2004, Boeing has been using passive RFID tags on cases and pallets to track parts shipped to its facilities in Philadelphia and St. Louis. The company has also been developing a solution that will use RFID to trace individual parts on its upcoming Dreamliner 787 passenger planes

In 2011, Boeing announced a program to track component parts of its commercial aircraft, and enable maintenance tracking for its airline customers. Its RFID Integrated Solutions tracking system was tested with Alaska Airlines to determine tag performance in engine parts and other components. The tags will be used to store and transmit maintenance data.

Boeing plans to install the system as a standard part of its 737, 777, and 787 commercial passenger

aircraft, and on all P-8, C17 and KC-46 military aircraft. Boeing's customers could use the system to improve maintenance operations.

Boeing has also worked closely with fellow Aerospace OEM Airbus, to educate their common supplier base about the use of RFID within the parts supply chain. Airbus began asking suppliers to add permanent RFID tags to approximately 3,000 parts for its new A350 XWB aircraft back in 2008. The tags are designed to remain with the parts throughout their entire lifecycle to track maintenance history and enhance automation and visibility in the supply chain. These activities are part of the Airbus Value Chain Visibility (VCV) program, an auto-ID business transformation project aimed at developing state-of-the-art, streamlined business processes via increased visibility and measurability across the entire supply chain (from suppliers to Airbus to customers, and across all industrial processes).

In 2012, Airbus announced it was expanding its RFID activities across its entire fleet. All seats and life vests on new A320, A330, and A380 aircraft will be tagged with permanent RFID tags starting in 2013. By tagging these items will reduce the time required for safety check and inventory activity from hours down to minutes.

Aerospace RFID Tagging Requirements as of December 2012

Standard	Originator	Applies to	Objective
ATA Spec2000, Chapter 9	Air Transport Association (www.airlines.org)	Commercial Aircraft Component Parts	Improved Airline Safety and Traceability
SAE AS5678	Society of Aerospace Engineers (www.sae.org)	RFID tags for Aerospace Applications – shock, vibration, temperature variations	Standardization and cost efficiencies for RFID tags specifically designed for use on aircraft
A350 Part Marking Program A320/A330/A380 Part Marking Program Extension	Airbus (www.airbus.com)	Serialized, Line-Maintainable Components for the Airbus A350 Seats and Life Vests for the Airbus A320, A330 and A380	Value-chain visibility, error-proof identification and efficiency savings in component lifecycle management
Item Unique Identification (IUID)	U.S. Department of Defense (www.acq.osd.mil/dpap/pdi/uid/index.html) (www.iuidtoolkit.com)	Any parts or assets provided to the DoD, including aviation parts, that cost \$5,000 or more, is considered mission critical and meets other criteria.	Improved accountability and maintenance of components and equipment

Myth 2: Standard-compliant tags will meet program requirements

It's also important to recognize that just because you've deployed a standards-compliant tag does not mean that the tag will necessarily meet the requirements of each use case scenario, or that the tag will perform well in the actual environment where it is being used. Standards are a starting point for finding appropriate tags, readers and software, not a guarantee of performance.

Specific programs may have additional requirements, ranging from corrosion resistance and vibration tolerance, to the effects of chemicals and solvents, and even the color of the tags themselves. Read performance requirements may vary based on the application.

Because the tags may be attached to or encapsulated within the component, engineering documents will have to be modified to ensure the tags are mounted securely, that the tag housings will allow the tag life to match the component life, and that the tag is placed in the correct position as not to interfere with normal component operation.

Each standard or program may also have different data requirements. Standards like Spec 2000 and the DoD's UID program lay out basic memory frameworks for the tags, but a manufacturer may require more detailed information for longer-life components that experience more maintenance cycles. There may also be company- or component-specific data that would require the use of tags with higher memory than was initially specified.

Most suppliers will need to meet tagging requirements for multiple components, and those components may require tags in different form factors and made from a variety of materials. RFID

tags may be mounted on to a component with specially designed bolts, attached with specialized adhesives, embedded into a plastic item, attached with a ruggedized tie or lanyard, mounted on a metal fob, or any one of a variety of other options. How the tag is mounted will depend on a number of factors. In aviation applications, tags may be exposed to extreme temperatures, as well as both pressurized and non-pressurized environments, if they are used in flight.

The tag housing has to match the life of the component, which will also impact design. Some components on an aircraft are designed to last for months or years, while others may last for decades. Different components are also subject to different maintenance schedules, which will influence where tags are placed and the memory they require.

Even tags designed specifically for these challenging conditions can vary in their performance. Read-on-metal tags from different manufacturers may provide inconsistent performance depending on the metal, the type of reader used, the antenna configuration and the mounting method.

Selecting a tag provider that can provide a range of tag material, sizes and mounting options is key for aviation companies, because their needs cover such a wide range of use cases and environmental conditions. See Xerafy's [Tag Selection Guide](#) for help in specifying the right type of tag for different aerospace applications.

Myth 3: Aerospace RFID tags have standard data and memory requirements

A standards-compliant tag with the correct physical form factor still only gets you so far; the tag also has to be able to hold the required amount of data for the application. Not all RFID tags used in the aerospace industry have the same memory requirements; in

fact, while high memory tags are required for many parts used in commercial aircraft, there are other requirements and options for programs that do not follow commercial aircraft and SPEC 2000 standards.

While there is a substantial demand for high-capacity (with 8K or more of memory) tags, which are required under the Spec 2000 standard to identify flyable parts, approximately half the items covered in the Airbus and Boeing programs do not need high-memory tags.

Tier 1 Supplier Finds Value from Customer-Led Tagging Request

A Tier 1 aerospace component supplier who currently tags parts destined for Airbus and the US Department of Defense has been able to realize internal benefits through improved visibility of its inventory. RFID tags are encoded during the shipping process, and allow the company to automatically update its SAP ERP system when parts are shipped. By automating the entry of each part's shipping information into SAP and directly into each product's individual record, the company has streamlined its information gathering process, and can potentially help create faster advance shipping notices and invoices. The supplier has plans to encode the tags earlier in the process to help track location and status of every unit on the production floor and monitor inventory levels.

The company expects that its own maintenance operations will benefit from RFID tracking. When damaged parts are returned to its facilities, a technician could potentially see their entire calibration and maintenance history, and their MRO activities with customers once the part is returned to service.

Technicians and engineers that design and test products internally could benefit from that enhanced visibility into the maintenance cycle.

Based on the number of maintenance cycles a supplier anticipates for a specific part, there is a range of minimum required memory outlined in the ATA's Spec 2000. There has been significant confusion about tag memory requirements, a problem that has been exacerbated by changes to the standard and conflicting messages from some technology providers.

Within SPEC 2000, there are three separate standards for allowable tag formats. The Multi-Record Tag type is for parts with long lifespans that require extensive record keeping. These high memory tag solutions have to accommodate part identification along with

historical data, particularly for parts that will experience multiple maintenance events over their lifetimes.

The Dual Record Tag type is a low-memory solution with a rewritable lifecycle record. Components with shorter life spans would use this schema. Parts with expiration dates, for instance, could be used with this technology.

Other parts that won't require any data updates during their use can be addressed with Single-Record Tag types that store the birth record only.

Regardless of data requirements, finding a consistent way to use data from enterprise systems (instead of manually entering it or using bar code labels) can save time and minimize data collection errors.

Myth 4: Aerospace RFID is just for OEMs and airlines

If suppliers believe that RFID deployment should be targeted simply at compliance, then it would be easy to mistakenly believe that only large OEMs and airlines will benefit from the presence of the tags. But RFID is not simply a means to compliance with customer demands; the tags can be used by suppliers for process improvements in sourcing, manufacturing and final assembly operations.

There are, in fact, RFID implementations at all levels of the supply chain. Proactive suppliers should take the time to educate internal stakeholders on the tagging program, and brainstorm potential uses for RFID data beyond part marking. Data from enterprise systems can be linked to the component's bill of materials and manufacturing data, including information on subcomponents sourced from other suppliers. From there, the tags can be used to automatically update work order status for customers, verify the bill of materials, and even link testing data to the component.



Figure 1: ATA Spec2000 Birth Record Read from a Components' High Memory Tag

The same RFID infrastructure that makes it possible to provide tagged components to an OEM can also help the supplier manage its inventories by providing real-time tracking of goods as they move in and out of a warehouse. This not only provides tighter inventory control, but also provides enhanced inventory visibility that can potentially be used for forecasting purposes or even shared with other trading partners.

Tags can be placed on tooling, vehicles, and other assets to help improve equipment utilization and

reduce wasted time spent looking for misplaced assets. The tags can also help manage tooling duty cycles and maintenance schedules, in much the same way the aircraft component tags do for the OEMs and airlines.

RFID can guide individual components through assembly processes, and provide real-time work-in-process (WIP) tracking data, which can be used to drive just-in-time inventory replenishment and update customers on jobs status. High-memory tags on returned parts and components could provide service history data that would enable manufacturers to determine if those parts could be placed back into service in an MRO return application.

There are also numerous examples of companies using RFID on returnable containers and conveyances to track goods through the supply chain, as well as provide asset-tracking data on those expensive logistics assets.

With planning and forethought, a compliance-driven RFID project can easily expand into a more holistic program that provides internal benefits to the supplier, while ensuring that customer requirements are met.

Common RFID Applications in Aerospace

RFID Application	Functional Area/s	RFID Process Automation	RFID Benefits
Work-In-Process Tracking	Manufacturing	Real-time tracking of manufacturing work orders, component parts & subassemblies through multiple processes	Real-time WIP tracking in extreme conditions (e.g., freezer to autoclave); complete visibility in production processes
Materials Management	Manufacturing	Proactive inventory management & automatic replenishment of composite materials and molds	Automatic replenishment for perishable materials or materials which need special handling and transport
Tool / Tooling Tracking	Manufacturing MRO	Real-time tracking of tools and specialized equipment, jigs, and conveyances	Improved labor productivity from less time spent searching for tools; tool inventory can be reduced/optimized; improved asset utilization

Kitting and Shipping	Manufacturing Logistics	Automate component & shipping manifests Verify outgoing orders, expedite rush orders Automate customs documentation	Error-proofing kitting and shipping process for metal parts, subassemblies
Container / Conveyance Tracking	Manufacturing Logistics	Track reusable containers, conveyances and contents from location to location Track container pedigree when hazardous materials are involved	Automate tracking of cargo subject to rough handling, extreme temperatures
Inbound Receiving	Manufacturing Logistics	Automated receipt, verification of goods Expediting rush orders, quarantining and tracking non-scheduled shipments	100% automated tracking & reliable identification of complex asset shipments as they are received
Line-Side Maintenance	MRO	Automate parts replenishment and service documentation for line-side maintenance	Tracking metal parts and tooling in hazardous conditions
Equipment Tracking	Manufacturing MRO	Real-time tracking of specialized equipment, high-value assets	Automate service, calibration and inspection history of industrial equipment subject to extreme temperatures, chemicals, radiation
ATA 2000 Component Maintenance	MRO	Automated tracking of aircraft component parts and maintenance history	Tracking parts with decades-long asset life, through extreme conditions

Myth 5: Aerospace RFID will not provide ROI for many years

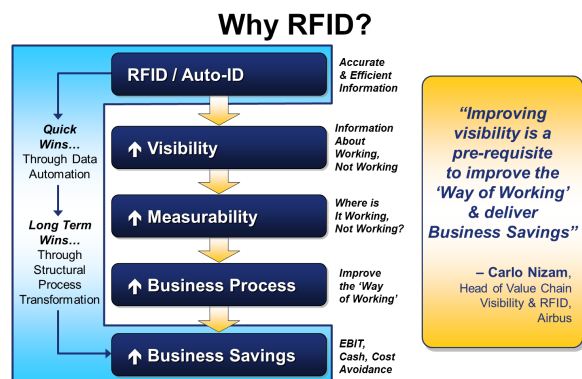
But will these investments in RFID pay off? As detailed in the previous section, there are numerous opportunities for suppliers, OEMs, airlines, and other organizations to leverage RFID for a variety of applications. There is still concern, however, about exactly how long it will take for those deployments to provide any tangible benefits or return on investment.

These concerns are largely unfounded. The cost of RFID tags and infrastructure has fallen significantly over the past decade, while the performance of the technology (particularly in the types of environments encountered in the aerospace industry) has improved dramatically. Those converging trends have greatly reduced the ROI timeline for RFID deployments across the board.

And many suppliers and OEMs are already using the technology to improve their operations. RFID can improve inter-facility WIP tracking by allowing companies to track and manage large airframes manufactured across multiple facilities, as well as tool and equipment tracking, where the tags can help ensure the right use of tools, instant asset location, and calibration/maintenance tracking.

Cessna, for example, is using passive RFID to track more than a thousand tools at its 50,000-square-foot metal shop in Wichita. When a technician needs a tool, they type the tool number into a computer, and readers mounted in each workspace can locate the

Airbus' Business Case for RFID, As Presented at RFID Journal LIVE!



tool's last known location within 20 feet. That allows staff to find tools within seconds, rather than searching the entire shop. The system also alerts Cessna when calibration or maintenance is required for each tool. (See [Cessna Looks to RFID for Unlimited Visibility](#) for more details.)

One emerging area of potential ROI: tracking composite materials that have to be transported and stored at sub-zero temperatures. The perishable composite materials (e.g., prepreg) materials used in aerospace range from \$1,000 to \$5,000 per roll; a 10-week supply of 500 rolls may be on hand at any given time. Companies that handle these materials need to be able to track how long the material has been out of the freezer (freezer time-out) in order to prevent spoilage and waste. On-hand inventory for a typical manufacturer could be as high as a million dollars, so waste is costly.

One aerospace manufacturer worked with OAT Systems and Xerafy to develop a way to track composite prepreg as it moves in and out of freezers and processing areas. RFID readers at dock doors track incoming shipments, and each roll of prepreg is tagged as it placed in storage freezers. Time out of the freezer is automatically tracked, and alerts are sent if material approaches its time-out threshold. This has resulted in reduced scrap and improved utilization.

The solution also illustrates why standard-compliant tags alone are not enough to ensure success. For this application, specialty tag material was needed to get reliable performance. A tag made from common

material would not hold up in the environment. Perishable composite materials (e.g., prepreg) must be stored and transported at sub-zero temperatures. Tooling may be exposed to the high temperatures of an autoclave. RFID can be used in both cases to track autoclave cycles or to help reduce waste by tracking freezer time-out. Many RFID tags cannot perform when exposed to such extreme temperature ranges. In addition, metal tools and equipment require on-metal tags that do not interfere with their function. In the past, metal presented a significant challenge when it came to RFID tagging. Now, on-metal tags exist that not only provide high accuracy and reliability, but also extended read ranges.

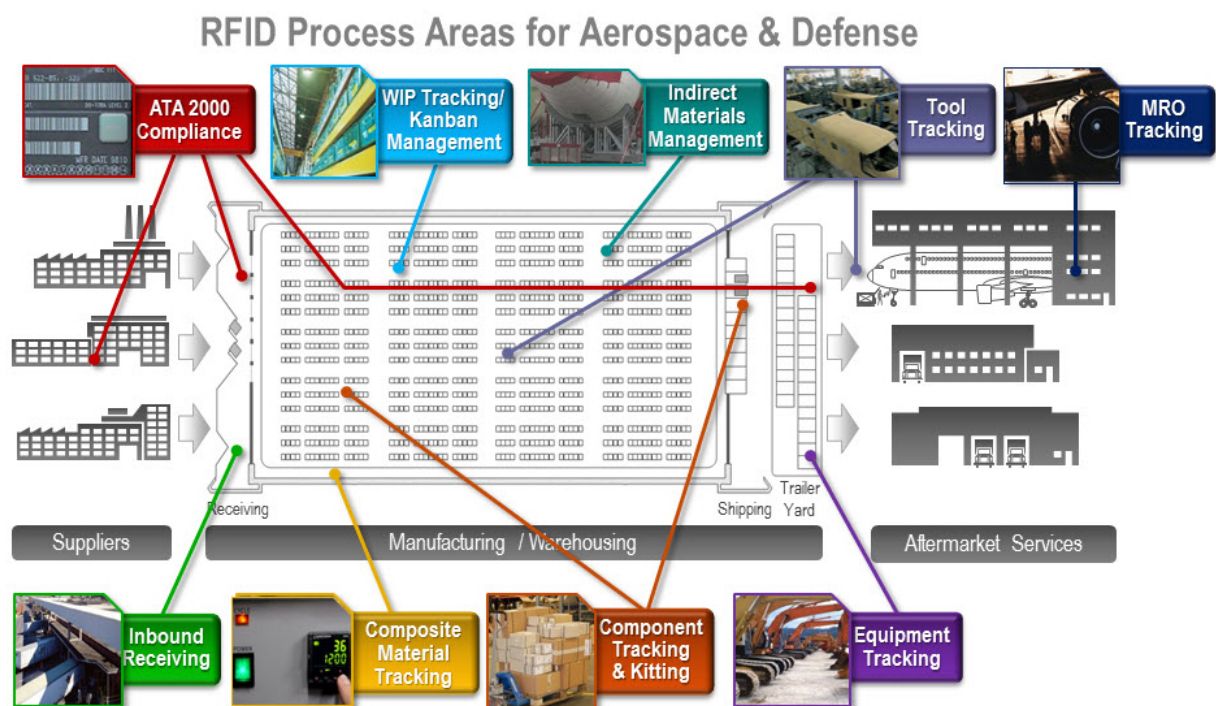


Figure 2: Application Areas for RFID

Likewise, composite tooling and large composite molds have a limited duty cycle; after being exposed to autoclave conditions multiple times, they must be discarded. One aircraft manufacturer is using RFID to track composite tooling across multiple sites on a manufacturing campus. RFID readers in each zone or building track tooling movement and report status. Another aerospace company is using extreme temperature RFID tags to track the location and duty cycle of molds, as well as tracking fabricated parts through the autoclave and curing process. (See [RFID Takes Wing at Composite Aircraft Components Plant](#) for more details). In other WIP scenarios, RFID can

help reduce the level of capital assets (and working capital) in play by reducing asset inventory and "near-finished" inventory, which needs "just one more part" before being delivered to the customer.

There are also real-world examples of RFID paying off in maintenance and repair operations (MRO) that go above and beyond the types of applications envisioned for the ATA Spec 2000 standard. One regional airline in Europe expects to save more than €3 million per year by tracking engine overhaul processes with RFID.

Conclusion

RFID technology is being deployed across the aerospace industry for applications that run the gamut from maintenance tracking to inventory management, and from asset management to materials monitoring. These varied applications have different RFID requirements based on applicable standards, operating environment, application requirements, the material being tagged, and the processes to which the tags will be exposed.

But starting an RFID deployment by evaluating tags, or simply targeting customer compliance requirements, would be a mistake. For end users to successfully manage an RFID installation, and to reap the potentially valuable benefits, companies should start by evaluating the affected business process and the desired outcome. Successful projects require an understanding of all of these variables.

There are tremendous benefits available if these deployments are handled correctly, and they go well beyond OEM part marking programs and MRO automation. Today, companies are already realizing benefits such as improved material and tooling utilization, reductions in scrap material, improved inventory turns, real-time WIP visibility, and more efficient supply chain performance. While there are few easy decisions about whether or not to use RFID for a given process, how to use the resultant data, and which tags to deploy under which conditions, by carefully evaluating the potential application of that data aerospace companies can position themselves to reap large rewards.

There are numerous examples of successful aerospace and defense deployments of RFID technology that serve as excellent models of the type of ROI that can be realized. But few companies can get there on their own. Aerospace companies that want to both meet industry requirements and achieve efficiency and cost improvements should partner with an experienced solution provider that understands the intricacies of these admittedly complex deployments.

About the Sponsors

OATSystems has helped over 100 companies take advantage of RFID to streamline operations, enhance customer satisfaction and increase bottom line results. OAT is the recognized RFID solution leader with software that empowers businesses to achieve a competitive advantage and ROI from RFID. As a pioneer in the development of RFID technology, OAT has been setting the standard in RFID for over a decade and has provided RFID-enabled solutions to leading companies such as Airbus, Bell Helicopter, Cessna, Rockwell Collins, Eurocopter, Parker Hannifin, Monsanto, Chevron, Kimberly-Clark, Cephalon, and others. More information on OAT Aerospace Applications may be found at www.oatsystems.com/industries/aerospace.php and on Twitter at @OATSystems.

Xerafy's innovations have changed the price-performance ratio for RFID tags and made it possible for customers to track assets in a wide range of harsh environments. Xerafy provides read-on-metal tags that can be embedded directly into assets to meet a full range of needs for RFID asset tracking in the aerospace, industrial, data center, healthcare, energy and other industries. Xerafy is headquartered in Hong Kong and maintains U.S. sales and support offices in San Jose, Dallas and Minneapolis, and additional offices in the U.K. and China. Learn more about Xerafy's Aerospace expertise by visiting www.xerafy.com/en/application/aerospace and on Twitter at @Xerafy.

Aerospace RFID Resources

Air Transport Association

- [ATA spec 2000 Guides](#)
- [General information](#)
- [eBiz Forum](#)

RFID Journal

- [Article: RFID Finally Cleared for Takeoff](#)
- [Article: Cessna Looks to RFID for Unlimited Visibility](#)
- [Aerospace section](#)
- [Defense section](#)
- [RFID in Aerospace and Aviation On-Demand Webinar](#)

Department of Defense IUID

[IUID Directives](#)

SAE AS5678

[Standards Document](#)

Airbus A350 Program

[General Information](#)

Boeing

[RFID Integrated Solutions](#)