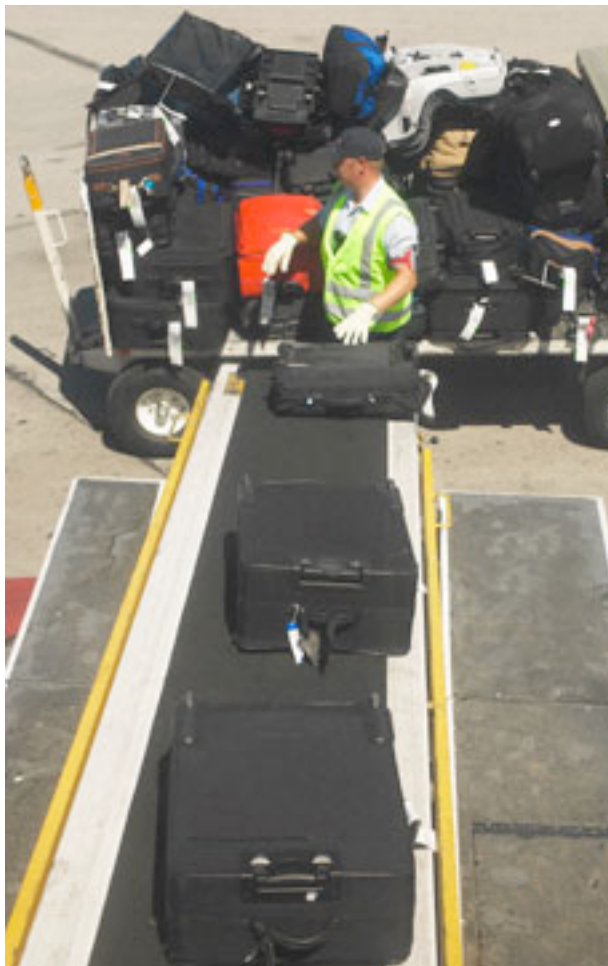


*New thinking—and new tools—clearly are needed to help airports meet conflicting goals of controlling costs and improving efficiency while improving security, complying with mandates and satisfying customers.*



## Introduction

The airline industry faces continued pressure to meet operational challenges while concurrently absorbing costs associated with mandates for increased security. Rising fuel prices and intense pricing among competition, as well as costs incurred through compliance with the November 2001 Aviation and Transportation Security Act, have compelled airports and carriers in the United States to rethink their approach to screening passengers, baggage and cargo.

Internationally, increased passenger and baggage traffic in high-population-growth regions is forcing airports to research new systems capable of handling the higher volumes. And while some countries are less concerned with security issues than is the post-Sept 11. United States, passenger safety is still paramount worldwide.

In compliance with the U.S. Department of Homeland Security mandate calling for every bag to be screened for explosives, many airlines have set up explosive detection and screening (EDS) machines in airport lobbies near check-in stations. Others use inspectors or dogs to manually screen bags. EDS machines may have some downsides; for instance, they take up space otherwise available for passengers or create a crowded environment for Transportation Security Administration (TSA) inspectors who must focus on their job. Unfortunately, manual examination is a tedious process, and can sometimes introduce error.

Customer satisfaction is a global business issue. Competitive advantages for airlines do not rest entirely on price; passengers also choose one airline over another based on overall experience. Crowded check-in areas, long waits in lines and lost baggage encourage passengers to choose carriers who can get customers through check-in quickly and to their destination safely and on time, along with their bags.

The ubiquitous choice for security and baggage handling has been bar code ticketing and tagging. Bar code labels accurately associate passengers with their baggage, but identifying the right bag with the right plane at any point in time can be difficult, with baggage transfers from plane to plane being the most challenging process for airports. Currently, bags with bar code labels are tracked with good, but not 100 percent, accuracy; the cost to airlines for the inefficiency can be damaging, especially when one considers they are operating with slim or negative margins. And when considering the overall cost of ownership, a bar code conveyor reader array requires manual reading and continuous maintenance to ensure optimal performance.

New thinking — and new tools — clearly are needed to help airports meet their conflicting goals of controlling costs and improving efficiency while improving security, complying with mandates and satisfying customers. Many existing business practices and technologies are not up to the challenge. However, RFID technology has recently evolved to become a powerful and cost-effective resource for airport security and facilities management.

## The business case for RFID

With the baggage-tracking systems in use today, there are only two times when most airports or airlines are best able to pinpoint the location of a passenger's bag: when it is checked in and tagged for departure, and when the passenger retrieves it from the luggage carousel at arrival. The rest of the time, it is difficult to find or conveniently access a passenger's bag.

Odds are, people who travel often will eventually have to deal with a customer service representative because their bag is lost — what the industry refers to as a “mishandled bag.” The top 10 airlines in the United States handle approximately 500,000 passengers each day. Current data for the entire industry show the average occurrence of mishandled bags is four out of every 1,000 passengers. For the top 10 airlines, the figure jumps to almost eight bags per 1,000 passengers.<sup>1</sup> Every missing or mishandled bag costs the responsible airline approximately \$80 to \$120, or an average of \$100 per bag.<sup>2</sup> This figure includes labor and transportation costs (such as for taxis and trains) for redirecting the bag and delivering it to the owner, or replacement costs to reimburse the owner for the lost luggage and contents.

*Every missing or mishandled bag costs the responsible airline approximately \$80 to \$120, or an average of \$100 per bag.*

Calculating the impact, we find:

500,000 bags X 0.008 bags lost = 4,000  
4,000 X \$100.00 = \$400,000/day  
\$400,000/day X 365 days = \$146 million lost per year!

The airline responsible for losing the bag takes a hit to its bottom line in more than one way. The frustrated passenger whose bags are lost leaves the baggage carousel considering other carriers for the next flight, and he or she may also tell friends about the negative experience, eroding brand preference.

Reconciling baggage is not only important for lowering operating overhead, it's required for safety reasons. The December 1988 Pan Am 103 Lockerbie, Scotland tragedy was a lesson well learned. The perpetrators of the bombing boarded the plane in Frankfurt and deplaned in London — their bags stayed on the plane and later exploded. In response, Section 109 of the Aviation and Transportation Security Act requires airlines to institute “a bag-match program that ensures that no checked baggage is placed aboard an aircraft unless the passenger who checked the baggage is aboard the aircraft.” Because RFID enables increased visibility of bags, if for any reason a passenger decides not to get on the plane, airport personnel are able to quickly read tags, map data to passenger lists and if appropriate, locate and remove that passenger's bag. RFID makes it easier to locate a bag since the bag does not have to be in line of sight, and tags can be read through different materials.

Quick location and removal of bags helps keep planes on schedule, which can save airlines thousands of dollars. Delaying an airplane costs the airport approximately \$10,000 or more for every five minutes a plane is stalled at a gate.<sup>3</sup> Like any traffic jam, the problem quickly compounds. Other planes might need to be routed to another gate. A backup builds from the gate to the runway, and may even cause delays for landing planes. Passengers in the terminal might need to move to another gate, and passengers on the plane grow impatient, especially if they're already on a tight schedule. Meanwhile, the support crew is idle.

Using RFID for baggage tracking is not a new idea. Systems employing RFID at 13.56 MHz (LF), 433 MHz (HF) and 2.45 GHz (microwave or SHF) for baggage and cargo tracking have been tested for more than a decade. However, because of short read ranges or lack of infrastructure, and high costs of these technologies, systems fell short of required accuracy and didn't integrate with other RFID baggage tracking systems.

1. IATA Passenger Forecast 2004 – 2008.

2. World Air Transport Statistics; see also “Simplifying the Business Industry Revolution Kicks Off,” *IATA News*, Nov. 16, 2004.

3. International Air Transport Association Business Intelligence Services 2004, Montreal – Geneva.

Compounding the problem, high implementation costs yielded poor return on investment (ROI), making deployment virtually impossible to justify.

RFID is now entering an era of global network standardization and vast economies of scale. Printed RFID tags with an embedded chip and antenna look identical to the bar code baggage tags currently in service, but are read without line of sight by handheld or mounted readers at distances of more than 20 feet—read ranges previously available only from larger form factors.

The value and potential uses of RFID grow whenever chip size becomes smaller. As usage grows, production volumes will increase, leading to economies of scale that can reduce tag prices and further stimulate demand. In 2004, a new size threshold was crossed with the introduction of long-range UHF chips measuring only 0.36 mm. The new chips are produced with a CMOS (complementary metal-oxide semiconductor) manufacturing process, and the small size enables a higher chip yield from each silicon wafer. Instead of paying a premium, users get more price/performance value for their money.

The other components comprising an RFID implementation are also evolving in terms of functionality and value. Readers, antennas, printers and software are becoming more capable. And technical advances— together with increasing competition among vendors — spur the availability of more and more cost-effective solutions.

The TSA is supporting efforts to endorse UHF frequencies (ranging from 860 to 960 MHz) as the worldwide standard. Symbol Technologies is working with the TSA on pilot programs in airports around the world to support using UHF passive RFID for airline passenger travel, and for tracking baggage and other cargo. With the support of the TSA and Federal Aviation Administration, the International Air Transport Association (IATA) recently approved UHF as an acceptable frequency for baggage handling and other applications at airports. IATA currently encourages using RFID for baggage handling. The benefits and value of standards have been demonstrated in other industries, and surely the effect will be the same for airlines.

The business case for RFID is being explored and defined in pilot programs at airports around the world. More significant, Symbol Technologies is currently deploying complete integrated, passive, UHF RFID solutions at both Hong Kong International Airport and McCarran International Airport in Las Vegas, providing dramatic improvements in operational efficiencies, enhanced security and customer satisfaction.

## Enterprise-wide solution for the aviation industry

Symbol has real-world experience bringing RFID solutions to global suppliers who are now responding to major retail and U.S. Department of Defense RFID mandates, as well as to forward-thinking companies applying RFID to improve supply chain management and operational processes— knowledge that is directly applicable to the airline industry. Just as pallets of RFID-labeled product will be instantly read by the retailer's inventory system as they pass beneath a reading portal on the distribution center's receiving dock, so will hundreds of tagged bags on a baggage conveyor be instantly and accurately identified as they pass through airport security.

In addition to better security, RFID promises higher efficiencies for inbound and outbound cargo shipments. And the increased visibility enabled by RFID not only reduces the manual labor associated with locating cargo in holding areas and during pallet-building, it also improves accuracy.

To date, Symbol is the only company to prove it's able to deliver a real, practical, cost-effective and fully integrated solution for tracking baggage and cargo in the aviation world. That experience minimizes risk, and speeds planning and implementation of an RFID solution.

An end-to-end RFID implementation must address such things as:

- Printers at the ticket counter
- Data encoding schemes
- Design and placement of readers/antennas on conveyor systems, luggage carousels and transfer points
- Installation of RFID readers at EDS machine entry or exit points
- Integration with programmable logic controllers (PLCs)
- Baggage handling systems (BHS) and baggage reconciliation systems (BRS)

- Managing transfers to unit load devices (ULDs)
- Handling bags in the bag rooms and airplane bellies
- Using RFID equipment on ground-support equipment airside

In addition, the data collected by the RFID solution is relayed to the airport operations database (AODB), which includes the software designed for the BHS and BRS. RFID tags themselves can serve as a "distributed database" holding passenger, flight and security information as well as other details; the data would be locally available, and changeable, on the tag itself.

RFID technology and products are developing rapidly, driven by demand and the promise of superior efficiencies. Decision-makers are able to rest assured, knowing Symbol's solutions are designed to scale with those changes. Symbol's dual-mode fixed and handheld readers capture and move data from both bar code and RFID tags. Built with an open architecture, the multi-protocol Symbol readers are ready to be enhanced for next-generation tag constructs, so they will read both Generation 1 and Generation 2 tags, protecting investment and lowering the total cost. The same is true for the other elements in the system. From the antennas to software and services, Symbol's approach is based on a long-term vision for success.

*Symbol's solution at McCarran has elevated the accuracy of tag reading to over 99 percent.*

Every application is unique and calls for the right mix of products and expertise. Symbol's technology and experience, combined with specialized partner-provided products and services, enables an enterprise-wide RFID implementation. The resulting visibility and cost-effective tracking of baggage and other cargo improves security and increases customer satisfaction.

Symbol is at the forefront of RFID development for various applications across all of aviation, collaborating with U.S. and international organizations—such as IATA, ATA, American Association of Airport Executives, Airport Consultants Council, Airports Council International, the TSA and others—to establish standards and cooperative funding for airports wishing to implement RFID.

The implementation at McCarran International Airport is of interest to the TSA not only because they helped fund the project, but also because it may provide validation of RFID as a solution for improving security and reducing operational costs. However, Samuel Ingalls, McCarran's Information Services Manager, stresses that the TSA's help wasn't the primary motivation for bringing RFID into the airport. "Although the TSA helped fund the solution, the decision to use RFID technology was made on its own merits," Ingalls says. "We determined that using RFID was a critical element for improving our overall system effectiveness, and was the most cost-effective way to integrate EDS equipment into the baggage-handling conveyor lines."

## Here to stay, or passing through?

Hong Kong International Airport and McCarran chose RFID baggage tracking for different reasons, but viewed together, they show how reduced costs, improved security and enhanced customer experiences resulted.

The Hong Kong International Airport (HKIA) is one of the busiest in the world as the gateway to China. Annually, the airport caters to approximately 38 million passengers and handles 3 million tons of air cargo. The airport manages 50 takeoffs and landings per hour at its peak. Forty percent of the passengers passing through the airport are transferring from one flight to another. After an extensive qualification and testing process in which vendors had to go through real-life deployment and performance testing at the airport's facilities, HKIA chose Symbol and its business partner, Marubeni Corporation, for the job.

Reader systems will be installed to read and write to RFID tags across HKIA's extensive baggage-handling facilities. HKIA is a major hub for transfer baggage going "tail to tail," or from one plane to a connecting flight elsewhere in the airport. At various nodes within the airport—including baggage carousels, ULDs and

conveyors—reader systems will be installed to read and write to RFID tags, which are then applied on passenger bags. RFID-enabled handheld readers also will be used for mobile baggage operations. With its high, long-range and accurate read rates, RFID has the potential to further increase efficiency by reducing the minimum connecting time at an airport.

The Hong Kong implementation demonstrates how RFID delivers a cost-effective, practical and efficient means of tracking baggage making its journey to one plane from another, ensuring fast turnaround times for flights, with delivery of the right bag to the right plane at the right time.

More often than not, Las Vegas is the final destination for travelers flying into McCarran International Airport, so security and improved operations are more important than baggage transfer. McCarran's RFID implementation ensures every bag is tracked and processed through an EDS machine. According to Ingalls, the project is all-encompassing, ultimately covering all six screening nodes and 100 percent of checked baggage — almost 70,000 bags daily. "One of our significant focal points at McCarran is providing stellar customer service," says Ingalls. "We want to make sure that what's packed in Vegas leaves Vegas and arrives at its destination along with the passenger. The RFID system helps us ensure that bags move accurately and efficiently through the system to accomplish that goal." Symbol's solution at McCarran has elevated the accuracy of tag reading to over 99 percent. And the accurate data capture McCarran realizes eases reporting, which in turn helps the airport meet U.S. Homeland Security Act requirements.

The McCarran implementation also proves RFID dramatically increases efficiency and lowers operational costs. While concrete data are not yet available, comparing the nearly 100 percent reading and tracking success rate of McCarran's RFID implementation with the avoided cost of lost bags and delayed planes clearly points to a positive ROI for McCarran.

## Summary

With intense pressure to function profitably and heighten security, the aviation industry must turn to new technology that can complement existing bar code technology to find the improved operational processes it needs to continue operations in a more competitive environment. Implementations by Symbol and pilot programs currently underway demonstrate how RFID will satisfy those needs and provide a foundation for further advances at airports.

Baggage and passengers are just the start. RFID technology is already used thousands of times each day at airports around the world to identify employees, unlock doors and open parking gates. Symbol is looking to extend this platform so it provides not just tracking of bags and cargo, but also will serve as the platform for launching other applications, such as traveler identification, express screening and passage of travelers at security checkpoints, tracking carry-on luggage, vehicle parking and access control and other applications deployed airport-wide.

Symbol is ready now to deliver enterprise mobility applications that will fulfill the promises of RFID, while minimizing risk through proven technology and processes.

For more information about Symbol Technologies, The Enterprise Mobility Company, visit [www.symbol.com](http://www.symbol.com)

## About Symbol Technologies

Symbol Technologies, Inc., The Enterprise Mobility Company™, is a recognized worldwide leader in enterprise mobility, delivering products and solutions that capture, move and manage information in real time to and from the point of business activity. Symbol enterprise mobility solutions integrate advanced data capture products, radio frequency identification technology, mobile computing platforms, wireless infrastructure, mobility software and world-class services programs under the Symbol Enterprise Mobility Services brand. Symbol enterprise mobility products and solutions are proven to increase workforce productivity, reduce operating costs, drive operational efficiencies and realize competitive advantages for the world's leading companies. More information is available at [www.symbol.com](http://www.symbol.com)



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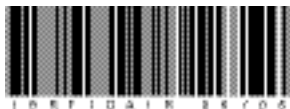
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