

Unchaining the Value of RFID

How closed-loop systems provide flexibility and fast ROI



A ZEBRA BLACK & WHITE PAPER





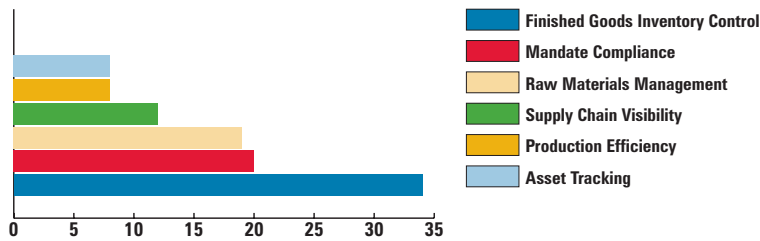
Copyrights

©2007 ZIH Corp. All product names and numbers are Zebra trademarks, and Zebra and the Zebra head graphic are registered trademarks of ZIH Corp. All rights reserved. Wi-Fi is a registered trademark of the Wireless Ethernet Compatibility Alliance, Inc. All other trademarks are the property of their respective owners. Unauthorized reproduction of this document or the software in the label printer may result in imprisonment of up to one year and fines of up to \$10,000 (17 U.S.C.506). Copyright violators may be subject to civil liability.

Executive Summary

For organizations that have assets that are hard to find, the benefits of RFID are easy to see. The return on investment (ROI) for RFID comes from reducing the time and labor required to track assets and materials, reduced losses and theft, potential improvements to maintenance operations, and improved efficiency through better asset availability and utilization. These benefits are typical of closed-loop applications and don't require participation from suppliers and customers. Despite the headlines generated by retail and supply chain projects, RFID is much more widely used for asset management and other closed loop applications, as Figure 1 illustrates.

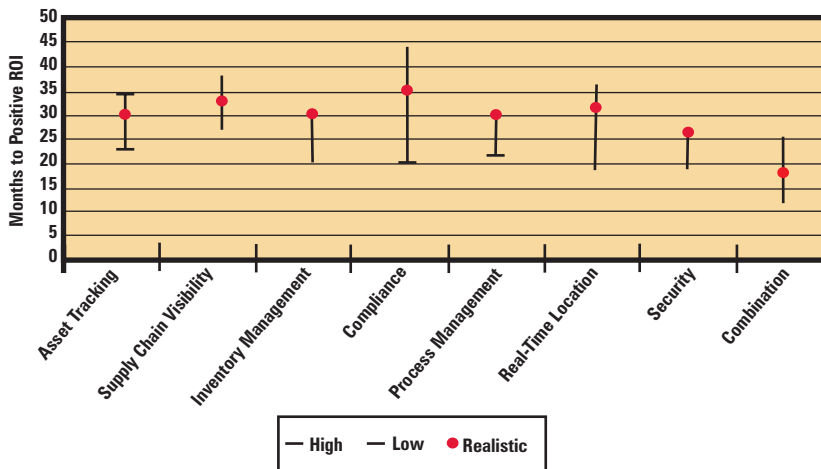
Figure 1: Top Objectives of RFID Initiatives in Manufacturing




Source: Aberdeen Group 2007 Benchmark Report: RFID in Manufacturing

As Figure 1 shows, RFID is implemented more than four times more often to track assets than it is for compliance or supply chain visibility. Asset tracking is a leading RFID application because the resulting process improvements provide some of the clearest business benefits and fastest-documented ROI for RFID investments. For example, full ROI for RFID-based asset tracking systems can realistically be expected in 30 months, and as low as 18 months, which is significantly faster than compliance or supply chain visibility projects, according to an Aberdeen Research study (see Figure 2).

Figure 2: Time to ROI





Closed-loop systems tend to provide more value because they give users more—more flexibility to adapt RFID to support specific, unique processes; more control over project timetables and goals; and more choices of technology, frequencies, standards and products. This white paper will show how companies are unlocking the value of RFID by “unchaining” the technology from strictly supply chain projects to improve tracking and control throughout the organization.

Defining “Closed-Loop” Applications

The term “closed loop” is used loosely in this white paper to mean systems that do not require any RFID tagging, reading or other activity outside of the department or organization that is the primary user of the application. The most common closed-loop RFID application is asset tracking, in which handheld or unattended RFID readers are used to identify, track and locate physical assets. “Asset tracking” is itself a broad term because numerous types of assets can be tracked with RFID, and it is sometimes used as an umbrella to include closely related materials management and inventory control applications. Other leading closed-loop RFID applications include work-in-process tracking, maintenance management, sample tracking and process control.


Finding the Value in Closed-Loop Systems

Closed-loop RFID systems are created to improve an organization's own processes—not those of a business partner. As ARC Advisory Group wrote in its *2007 RFID Manufacturing Outlook*:

“Compared to the challenge of generating ROI from retailer mandate-driven RFID implementations, numerous opportunities exist for internal RFID applications to generate ROI for manufacturers within the typical 12 to 18 month period.”

In closed-loop systems, technology and its application can be closely matched to user needs to save time, prevent errors, ensure process integrity or to perform other specific functions beneficial to the organization. Instead of asking “What do we need to do?” to comply with RFID requirements, users can ask “What can RFID do for us?” Manufacturers answered this question in the Aberdeen Group 2007 benchmark report for manufacturing, titled *Can RFID Deliver the Goods?*, which said companies who had RFID-supported processes in place for at least six months reported the following benefits:

- Average cycle time reductions of 19 percent;
- 27 percent reduction in safety stock;
- 24 percent improvement in change-over time.



RFID can provide many benefits for manufacturers and non-manufacturers alike. Most processes for identifying objects and recording their location or movements can be automated with RFID. The technology often creates value by automatically recording these activities, reducing labor, and getting more complete and accurate information than manual record keeping typically produces. Unattended readers can ensure all asset movements are recorded, and can issue alerts if materials are moved when they shouldn't be. The following sections describe how some typical closed-loop RFID applications work and their advantages.

Asset Tracking

Every organization needs to manage its assets, which can take many forms, including inventory, raw materials, files or samples. Different RFID technologies are well suited for tracking and identifying many types of assets in many environments, so virtually any organization can benefit from RFID asset tracking. Automated—often unattended—RFID reading takes time and errors out of recording processes.

Accurate record keeping also helps keep assets available and avoid time wasting searching for them, which adds hidden costs to business. For example, if employees spend an average of only 10 minutes a day looking for tools, equipment or materials, they spend the equivalent of one full week each year on non-value added searching, as the following calculation illustrates:


$(10 \text{ minutes/day} \times 5 \text{ days/week} \times 50 \text{ weeks/year}) = 2,500 \text{ minutes/year} \div 60 \text{ minutes/hour} = 41.67 \text{ hours.}$

To find the labor cost of searches, multiply this time by the number of employees involved in searches, and by their average hourly salary. Actual costs incurred because of incomplete asset tracking are actually higher, because missing assets aren't fully utilized and often have to be replaced.

There is also cost associated with asset management when manual labor is required to inventory and record assets, track asset movements, and enter the information into information systems. RFID can eliminate the required labor, plus the time delays between when things are moved or used and when the activity is recorded. Zebra's white paper *Increasing Profits and Productivity: Accurate Asset Tracking and Management with Bar Coding and RFID* provides more details, calculations and user examples to show the value of automated asset tracking.

Container Management

Using automatic identification systems to track pallets, racks, trays and other returnable containers can provide a strong return on investment by lowering operating expenses. Many companies do not have accurate information about the quantity and location of their shipping containers because the assets often dwell at customer facilities and aren't returned promptly. As a result, businesses purchase more returnable containers to ensure they have an adequate supply, creating excess capacity and locking capital into fixed assets.



Identifying returnable containers and tracking them to customers provides the information businesses can use to improve returns and recoveries. The first step is to permanently identify each asset with an RFID tag, which can be encoded with a company-specific ID number and/or a standardized Global Returnable Asset Identifier (GRAI) code. Containers can be automatically identified each time the container exits or enters a facility, with the transaction time stamped, using unattended RFID portals, forklift-mounted readers, or handhelds. Mobile readers can also be used in the field to record container drop offs and pickups. Containers can be associated with customer records in a database to provide visibility and billing data.

Managers use such systems software to get a real-time view of container availability. Outstanding containers can be tracked by customer, with documentation provided to aid return and recovery. By actively monitoring and managing container usage, businesses can improve cycle times and inventory turns, and lower their fixed asset base.

iGPS, a pallet-pooling company founded in 2006, includes RFID tags on all of the returnable plastic pallets it has in circulation. “When you rent a pallet from iGPS, [RFID] technology keeps track of it,” iGPS CEO Bob Moore said in an announcement about the company's RFID pallet tracking system. “Our pool is self-reconciling. RFID technology tracks each asset transparently in real time, so there will be no disputes or surprises at the end of the year.” iGPS also credits its RFID tracking system with preventing lost pallets, streamlining asset and inventory management, and aiding SOX compliance by providing documentation on assets.

The RFID program at iGPS illustrates that closed-loop applications aren't necessarily limited to tracking objects within a facility or organization. Other organizations that manage circulating assets, including libraries, equipment rental companies, commercial laundries, uniform and linen providers, laboratories, and records management services have also created “closed-loop” applications to manage materials that travel beyond the four walls of a facility.

Shipping and Receiving

Shipping and receiving are considered supply chain applications, but can also be done as closed-loop systems to track intra-company transfers and shipments. EPCglobal, the international standards organization that developed the RFID standards used in most compliance projects, measured the savings from using RFID to assist receiving at between \$0.01 and \$0.03 per case¹. The primary benefits are reduced time and labor needed to process goods movements, and the elimination of most data entry errors. These benefits are attainable for companies that use RFID-enabled processes to manage receiving at their own distribution centers and do not require participation from customers, suppliers or other supply chain participants. Internal shipment tracking can be especially valuable in industries where distribution is regulated and that have strong security and documentation requirements, such as food and pharmaceutical. The EPC RFID system creates a unique serial number for each item, making it possible to conveniently associate specific products with lot and other production information held in central databases.

¹“Electronic Proof of Delivery,” EPCglobal, June 2006.



Work-In-Process Tracking

Best-in-class manufacturers are three times more likely than average companies to use RFID for Work-In-Process tracking, according to Aberdeen Research, and most reduced their WIP labor requirements by at least 15 percent. All best-in-class manufacturers Aberdeen surveyed said they improved process throughput by at least 10 percent by using RFID.²

WIP tracking is a highly adaptable and highly beneficial closed-loop RFID application. RFID tags can be used and reused in harsh industrial conditions, even when exposed to chemicals, pressure and temperature extremes, and can be read when they are covered, stacked or buried, so they provide a method of identifying and tracking materials in processes where bar code and other methods can't. Because RFID tags are rewritable, they can be repeatedly time stamped and updated at each step of the production process with a job code for the operation that was performed, operator ID, configuration, quality control grades and other records.

Service and Maintenance

RFID tags are commonly used as remote databases on tagged equipment to store configuration data and service history information to assist maintenance operations. Rewritable memory on RFID tags lets technicians access and update essential information in remote and challenging environments where other database or wireless access is unavailable. Tagging helps ensure equipment and components are identified accurately to ensure the correct item is serviced.

After testing Zebra smart labels and printer/encoders, Boeing committed to using RFID on its advanced Dreamliner 787 to identify critical aircraft parts to help airlines improve maintenance operations, save time during pre-flight inspections, improve traceability and safety, and streamline record keeping. Smart labels logged more than 1,500 flight hours and provided 100 percent read rates and 100 percent data accuracy, which gave Boeing the confidence to move forward with RFID tagging on its highly advanced Dreamliner 787.

In announcing the program, Mike Bair, Boeing's 787 vice president and general manager said: "The use of RFID on the 787 Dreamliner will benefit our customers by reducing maintenance and inventory costs by providing detailed, electronic part tracking information on one small chip." A case study about the RFID trial is available in the Resource Library section of www.zebra.com.

² Aberdeen Group "Where's My Stuff?!" Managing Work-in-Process with RFID" July 2007.



C h e c k - i n / C h e c k o u t

Many large libraries around the world have implemented RFID to speed material check-in, checkout, shelf inventory, and security applications. Low-cost, flexible smart labels are inserted in books and can be made invisible to patrons. Counter personnel check dozens of books in or out in mere seconds without manually handling and orienting each item. The tags can also be used for theft detection, much like anti-shoplifting technology used by retailers. Librarians using portable computers with RFID readers can take inventory and find misfiled materials simply by walking down an aisle of bookshelves. The reader can automatically detect missing materials and alert the operator. Video rental stores use RFID for similar applications. Readers are positioned at the checkout, unattended return bins, and doorways to record transactions and detect shoplifted items automatically. Check-in/checkout applications can be adapted for tool crib management, evidence tracking, records management, file tracking and many other operations.

F i l e T r a c k i n g

Imagine having to find a misfiled document in a filing cabinet where hundreds of forms are packed into a dense space. A manual search is like looking for a needle in a haystack—without any guarantee that the needle is actually in the haystack. RFID readers can be built into inboxes and filing cabinets to automatically record each folder and document that is filed and removed. For records and archive operations, readers can automatically check entire boxes of records in and out in seconds, saving countless time for manual data entry. RFID can also be used to associate the files with the person who signed them out by reading RFID employee ID badges as part of the process.

F l e x i b l e T e c h n o l o g y O p t i o n s

One reason RFID is adaptable to so many processes is because closed-loop applications afford users a broad choice of RFID technologies. EPCglobal Gen 2-standard UHF (858-930 MHz) technology is almost always required for compliance programs. The protocol works very well for many supply chain and other operations, but it is not the best technology for all environments and operations. For example, 13.56 MHz high frequency technology excels at identifying individual items, especially those in crowded and dense conditions.

EPC/UHF is a small subset of the wide range of RFID technologies that are available, which also includes 13.56 MHz high-frequency (HF) technology (which is actually more widely used than EPC Gen 2), real-time locating system (RTLS) tags that can communicate with legacy 802.11-standard networks, and other standard and proprietary systems that operate at other frequencies. Industry and international standards have been set for these and other frequencies to help optimize performance in various usage conditions. Here's a brief overview of the leading RFID technologies used in enterprise operations.

- Low-frequency RFID systems operate at about 125 kHz with a typical maximum read range of up to 20 inches (508 mm). Low-frequency RFID is not supported by on-demand smart label printing/encoding systems and is commonly used for access control applications, including vehicle tagging to activate parking lot gates.



- High-frequency RFID systems operate at 13.56 MHz with a typical maximum read range of up to 3 feet (1 meter). They are commonly used for item identification and asset management at short range where high precision is required. Typical applications include file tracking, shelf management, tool crib check in/checkout and sample identification. 13.56 MHz reader modules are popular for integration into machines used for sorting, dispensing, testing and industrial process control. For example, Zellweger Analytics, which makes gas monitoring devices, embeds 13.56 MHz readers in its sensors and puts RFID smart labels on the supply cassettes that are loaded into the machines. When the cassette is inserted, its tag is read and the sensor calibrates itself to perform the specific test indicated by the type of material that was loaded. The system eliminates the need for manual configuration and the possibility of operator error.
- Ultrahigh-frequency RFID systems operate at multiple frequencies, typically between 860 and 960 MHz. EPCglobal Gen 2 is a leading standardized UHF protocol. UHF tags often produce read ranges of 20 feet (6 meters) or more, which is why they are popular for supply chain processes such as shipping and receiving, container management and warehouse inventory control.
- RTLS technology has been developed and standardized at different frequencies, including 433 MHz and 2.45 GHz systems, which are compatible with 802.11-standard (Wi-Fi®) networks. RTLS is a long-range technology that is used to track the location of forklifts in distribution centers, parts bins in factories, cargo containers in yards, medical equipment through different floors and wards at hospitals, and other high-value assets. RTLS is one of the fastest-growing segments of the RFID industry, in part because there are many well-documented business improvement results for RTLS asset management systems.

Multiple RFID technologies are also used together in some systems to support different process needs. For example, forklifts in a warehouse may be tracked with RTLS tags, while the pallets they handle are tagged with Gen 2 smart labels, and the goods within the pallets may be individually tagged with standardized 13.56 MHz technology. Hospitals use 13.56 MHz RFID to monitor supplies on shelves and to signal replenishment, plus RTLS technology to automatically locate defibrillators, monitors and other critical equipment throughout the facility—even to find assets that were moved to different floors. When not constrained by compliance requirements, organizations can choose RFID products with the frequency, range, memory, rewriteability, security and other features that work best in their specific processes.

Conclusion

Many closed-loop RFID applications are proven to provide full and fast ROI because users have the flexibility to choose technology and tailor processes to solve their specific business problems. Many operations where data recording creates a bottleneck, or is often erroneous or incomplete, are candidates for improvement with RFID. The technology can be used in a wide variety of processes and environments, and consistently provides efficiency and accuracy benefits.

Visit Zebra Technologies' Web site, www.zebra.com, for more information, white papers and case studies about RFID applications and technology and RFID smart labeling systems. Zebra offers the industry's broadest range of RFID smart label printer/encoders, including products that support UHF and 13.56 MHz, and is also a leading RTLS provider. Zebra is thus positioned to recommend the products and technology that best meet each customer's specific requirements.





Zebra Technologies Corporation (NASDAQ: ZBRA) delivers innovative and reliable on-demand printing solutions for business improvement and security applications in 100 countries around the world. More than 90 percent of Fortune 500 companies use Zebra-brand printers. A broad range of applications benefit from Zebra-brand thermal bar code, “smart” label, receipt, and card printers, resulting in enhanced security, increased productivity, improved quality, lower costs, and better customer service. The company has sold more than 6 million printers, including RFID and wireless mobile solutions, as well as ZebraDesigner™ label formatting software, ZebraLink™ connectivity solutions, genuine Zebra™ supplies and ZebraCare™ services and support. Information about Zebra bar code, card and RFID products can be found at <http://www.zebra.com>.

Notes



GLOBAL/AMERICAS

HEADQUARTERS

Zebra Technologies Corporation
333 Corporate Woods Parkway
Vernon Hills, IL 60061-3109 U.S.A.

T: +1 847 793 2600 or
+1 800 423 0442
F: +1 847 913 8766

EMEA HEADQUARTERS

Zebra Technologies Europe Limited
Zebra House, Unit 14,
The Valley Centre
Gordon Road, High Wycombe
Buckinghamshire HP13 6EQ, UK

T: +44 (0)1494 472872
F: +44 (0)1494 768251

ASIA-PACIFIC HEADQUARTERS

Zebra Technologies Asia Pacific, LLC
16 New Industrial Road
#05-03 Hudson TechnoCentre
Singapore 536204

T: +65 6858 0722
F: +65 6885 0838

OTHER LOCATIONS

USA

California, Rhode Island, Texas,
Wisconsin

EUROPE

France, Germany, Italy, Netherlands,
Poland, Spain, Sweden

ASIA-PACIFIC

Australia, China, Japan, South Korea

LATIN AMERICA

Florida (USA), Mexico

AFRICA/MIDDLE EAST

India, Russia, South Africa,
United Arab Emirates