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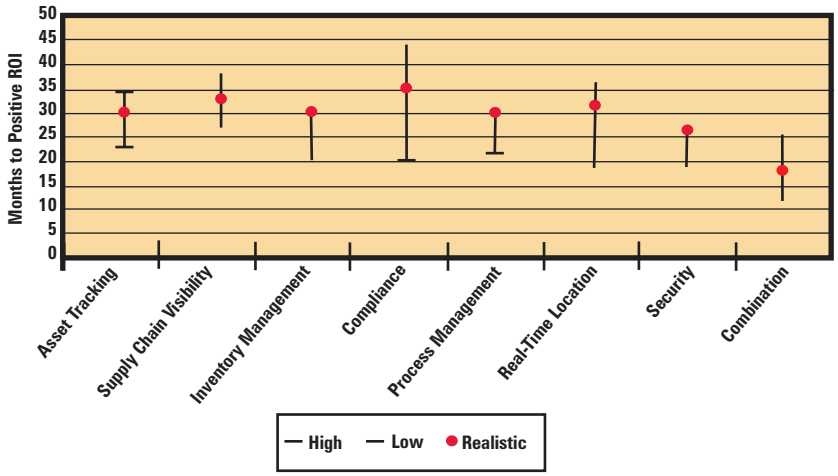
A Zebra Technologies White Paper

Unchaining the Value of RFID for Unmatched Flexibility and Fast ROI

Executive Summary

Businesses in a wide range of industries are realizing significant benefits from radio frequency identification (RFID) technologies. The return on investment (ROI) for RFID comes from reducing the time and labor required to track assets and materials, decreased losses and theft, improved maintenance operations, and streamlined efficiency through better asset availability and utilization. Many of these benefits occur in applications that do not directly require participation from suppliers and customers, and reside outside the external supply chain.

In fact, businesses are more likely to implement RFID and real-time location systems (RTLS) to track assets and improve security than for compliance or supply chain applications. Asset tracking is one of the leading RFID applications. This is because the process improvement delivers some of the clearest benefits and fastest ROI. Businesses can realistically expect full ROI for RFID-based processes in 30 months, and sometimes as low as 18 months, according to an Aberdeen Research study.



Today's RFID technologies enable significant benefits including:

- Process Automation—Businesses from manufacturers to retailers gain unmatched flexibility to adapt RFID to support specific, unique processes.
- Deep Visibility—Management can control project timetables and goals at a finer level of detail.
- Tailored Solutions—The wide variety of tracking tasks means more RFID technology, frequency, standards, and product options.

In the pages that follow, this white paper demonstrates how companies are unlocking the value of RFID by "unchaining" the technology from strictly supply chain-based projects, to improve overall tracking and control throughout the enterprise.

Discover the Value of RFID

Outside the supply chain, RFID systems are created to improve an organization's own processes—not those of a business partner or an upstream or downstream distributer. As ARC Advisory Group wrote in its 2007 RFID Manufacturing Outlook[1]:

"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."

Businesses can match RFID technology and its application to specific requirements. Depending on the project goals, common objectives include saving time, preventing errors, ensuring process integrity, or performing 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?" Businesses answered this question in an Aberdeen Group 2007 benchmark report for manufacturing, which discovered that companies employing RFID-supported processes for at least six months realized the following benefits:

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

In another study, Aberdeen surveyed over 150 companies in the retail industry throughout February and March of 2008 to determine how RFID can deliver increased customer satisfaction and inventory accuracy, among other business improvements. The results showed that customer satisfaction rose by 12 percent from 2007-2008, and 78 percent of the respondents realized an increase in inventory turns by an average of 5.4 percent.[2]

RFID provides many benefits for manufacturers and non-manufacturers alike. Businesses can use RFID to automate most processes for identifying objects, controlling employee access, and recording their location or movements. The technology often creates value by automatically recording these activities, reducing labor costs, and providing more complete and accurate information than manual record keeping. Unattended readers can ensure the recording of all asset movements, and can issue alerts if unauthorized material movement occurs. The following sections describe the functions and key benefits of common RFID applications.

Asset Tracking Helps Streamline the Enterprise

Every organization needs to manage its assets, which can take many forms including inventory, raw materials, files, product samples, and even people. 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 reduces the cycle time and error rate of the recording process.

Utilizing RFID to ensure accurate record keeping also helps keep assets available and eliminates the hidden costs associated with searching for lost or misplaced items. 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:

1. ARC Advisory Group, "2007 RFID Manufacturing Outlook," 2007.
2. Aberdeen Group, "RFID in Retail: The Truth Behind the Hype," March 2008.

(10 minutes/day x 5 days/week x 50 weeks/year) = 2,500 minutes/year ÷ 60 minutes/hour = 41.67 hours

To find the labor cost impact to a business, multiply this time by the number of employees involved in searches, and then by their average per hour salary. The total impact is actually higher, because employees cannot utilize missing assets, which often then require premature replacement.

There are other costs 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 manual labor, plus the time delays between when workers move or use assets and when the activity is recorded. Download the free white paper *"Increasing Profits and Productivity: Bar Coding and RFID Enables Precise Asset Management"* from www.zebra.com to learn more about automated asset tracking.

Source and Item-Level Tagging Enhances Visibility

Until recently, most RFID applications focused on pallet and case-level tracking. With source and item-level tagging in retail operations, for example, tracking originates farther back in the cycle (with the manufacturer applying item tags) and extends all the way to the consumer. In this scenario, RFID tags are affixed directly to an item's packaging or the actual item itself.

Consider the following retail application. As the retailer receives products, an RFID reader automatically scans each item into the retailer's computer system, which then verifies product type and quantity. Scanners in the store record the item's purchase, or if the item leaves the store without the shopper paying for it. The enhanced visibility allows a store chain to reduce stock-outs, boost the shopper's buying experience, and increase sales. Now, the retailer knows what it's selling, where, and when—powerful metrics that marketing departments can quickly leverage to improve customer loyalty and branding campaigns. In addition, RFID-based Electronic Article Surveillance (EAS) item-level tagging can provide the retailer loss-prevention intelligence regarding what item left the store and when the theft took place.

For manufacturers and food service enterprises, source- and item-level tagging enables compliance with initiatives to protect the food and drug supply and reduce counterfeit drugs. This also creates an opportunity for suppliers and retailers alike to reduce costs by standardizing inventory based on a single technology and simplifying tagging tasks.[3] Businesses gain cost containment, operational efficiency, improved inventory accuracy, and a method to achieve compliance mandates.

Long term, item-level tagging allows consumers to shop without money, sales clerks, or even cash registers. The consumer walks into the retailer, finds their items, and the retailer charges the consumer's bank account automatically. The following list provides a small subset of the applications that source- and item-level tracking enable:

- Reading tags on garments hanging on a mobile metal rack
- Reading tags on items in cases and on pallets going through a dock door portal
- Reading tags on apparel at the point of sale
- Reading tags on DVDs sitting in adjacent shelf slots in a display
- Reading tags on vials and ampoules of liquids in a case

3. EPCglobal, "GS1 EPCglobal RFID-based Electronic Article Surveillance (EAS)," October 14, 2009.

- Reading tags on a mixture of consumer items in a plastic tote
- Writing data to tags on vials on a production line

In 2009, the University of Arkansas Information Technology Research Institute completed a study to determine the business value of RFID item-level tagging for day-to-day operations in a retail environment. The results demonstrated that overall inventory accuracy improved by more than 27 percent, understock decreased by 21 percent, and overstock decreased by 6 percent.[4]

The study also compared how long it took to count items using RFID versus a bar code reader. With RFID, scanning 10,000 items took two hours; scanning with a bar code reader took 53 hours. This translated into an average of 4,767 counted items per hour with RFID and 209 items per hour using a bar code system, a 96 percent reduction in cycle-counting time.[5]

How Returnable Transport Items Help Reduce Operating Expenses

Using automatic identification systems to track pallets, racks, trays, totes and other returnable transport items (RTI) within a facility 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 remain at other facilities for extended periods of time. 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 and tracking returnable containers provides the information businesses need to improve returns and recoveries. To do so, businesses must permanently identify each asset with an RFID tag encoded with a company-specific ID number and/or a standardized Global Returnable Asset Identifier (GRAI) code. Departments can automatically identify and record every instance of a container exiting or entering a facility using unattended RFID portals, forklift-mounted readers, or handhelds. Workers can use mobile readers in the field to record container drop offs and pickups. By leveraging business database systems, departments can associate containers with customer records, providing detailed visibility and billing data.

Managers typically use databases to get a real-time view of RTI availability. As a result, businesses can track overdue containers for each customer, with documentation provided to aid return and recovery. By actively monitoring and managing container usage, businesses can improve cycle times and inventory turns while lowering their fixed asset base.

Consider iGPS, a pallet-pooling company founded in 2006. Every returnable plastic pallet from iGPS contains an RFID tag to enable real-time tracking of the rented asset. Each asset is transparently tracked in real time, allowing the pallet pool to self-reconcile and eliminating errors and potential customer disputes. iGPS also credits its RFID tracking system with preventing lost pallets, streamlining asset and inventory management, and aiding Sarbanes-Oxley (SOX) compliance by providing documentation on asset ownership and location.

The solution at iGPS illustrates that RFID applications are not necessarily limited to tracking objects within a facility or organization. Other organizations that manage circulating assets, such as libraries, equipment rental companies, commercial laundries, uniform and linen providers, laboratories, and records management services, have also created applications to manage materials that travel beyond the facility.

4. University of Arkansas: Information Technology Research Institute, "Item-Level RFID for Apparel: The Bloomingdale's RFID Initiative," August 8, 2009.
5. Ibid.

Optimize Internal Shipping and Receiving Processes

Even though shipping and receiving fall into the supply chain definition, these tasks can also operate within the enterprise to track intra-company transfers and shipments. EPCglobal, the organization that developed the international RFID standards used in most compliance projects, estimated the minimum savings of using RFID in receiving applications to be between $0.01 and $0.03 per case[6]. The primary benefits include a reduction in the time and labor needed to process goods movements, and the elimination of data entry errors. Companies can achieve these benefits by using RFID-enabled processes to manage receiving at their own distribution centers that do not require participation from customers, suppliers, or other supply chain participants.

Internal shipment tracking promises significant value to industries that require distribution regulations, or in food and pharmaceutical markets with strong security and documentation mandates. The EPC RFID tag system encodes each individual item with a product identifier and a unique serial number, making it possible to associate specific products with a lot number and other production information held in central databases quickly and easily. As a result, businesses can automate the receipt of product and electronic proof of delivery (EPOD) processes.

Work-In-Process Tracking Improves Process Throughput

According to Aberdeen Research, best-in-class manufacturers are three times more likely to use RFID for work-in-process tracking, 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[7].

WIP tracking is a highly adaptable and highly beneficial RFID application. Businesses can use and reuse RFID tags in harsh industrial conditions, even when exposed to chemicals, pressure, and temperature extremes. Scanners can still read the encoded data even when tags are covered, stacked, or buried. The versatility RFID provides enables businesses to identify and track materials in processes where bar code and other methods fail. Because RFID tags are re-writable, encoders can update the tags at each step of the production process with a time-stamped job code for the performed operation, operator ID, configuration, quality control grades, and other records.

Simplify Service and Maintenance Operations

Maintenance operations typically use RFID tags on equipment to serve as remote databases that house configuration data and service history information. Re-writable 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 workers accurately identify equipment and components and confirm that the correct items are serviced.

Consider the aerospace giant, Boeing. After testing Zebra® RFID smart label printer/encoders, Boeing committed to using RFID to identify critical parts on its advanced Dreamliner 787 aircraft in order to help airlines improve maintenance operations, save time during pre-flight inspections, improve traceability and safety, and streamline

6. EPCglobal, "Electronic Proof of Delivery (EPOD)," June 2006.
7. Aberdeen Group, "Where's My Stuff! Managing Work-In-Progress with RFID," July 2007.

record keeping. Smart labels logged more than 1,500 flight hours and provided 100 percent read rates and 100 percent data accuracy, providing Boeing with the confidence to move forward with RFID tagging.

Accurate and Fast Check-in/Checkout

Many large libraries around the world rely on RFID to speed material check-in, checkout, shelf inventory, and security applications. Clerks insert low-cost, flexible smart labels in books. Some RFID options include transparent tags, often invisible to patrons. Counter personnel check dozens of tagged books in or out in mere seconds without manually handling and orienting each item. Libraries can use tags 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. Facilities position readers at the checkout, unattended return bins, and doorways to record transactions and detect shoplifted items automatically. Businesses can adapt check-in/checkout applications for tool crib management, evidence tracking, records management, and many other operations.

Implement Precise File Tracking

Imagine having to find a misfiled document in a filing cabinet where hundreds of forms are packed tightly into a compact space. A manual search is like looking for a needle in a haystack—without any guarantee that the needle is actually in the haystack. Designers can build RFID readers into inboxes and filing cabinets to automatically record each folder and document someone files and removes. 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. Departments can also use RFID to automatically associate the files with the person who signed them out by reading RFID employee ID badges as part of the process.

RFID Technology Offers Flexible Options

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

EPC UHF is only one of the wide range of RFID technologies that are available, such as 13.56 MHz HF technology (more widely used than EPC Gen 2), 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 exist for these and other frequencies to help optimize performance in various usage conditions. The following provides an overview of the leading RFID technologies used in enterprise operations:

- High-frequency (HF) RFID systems operate at 13.56 MHz with a typical maximum read range of up to 3 feet (1 meter). Common HF RFID applications include item identification and asset management that require a short read range and high data precision. Other 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, a manufacturer of gas-monitoring devices, embeds 13.56 MHz readers in its sensors and places RFID smart labels on supply cassettes that are loaded into the machines. When a worker inserts the cassette, a scanner reads the tag, and the RFID-enabled sensor auto-calibrates to perform the specific test indicated by the type of supply loaded. The system eliminates the need for manual configuration and the possibility of operator error.

- Ultrahigh-frequency (UHF) 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. The UHF Class-1 Generation-2 air interface protocol V1.2.0 extends the item-level tagging capabilities of UHF Gen 2[8]. In the new protocol, an indicator shows when there is formatted data in user memory. Furthermore, the addition of permalocking on a block level in user memory now protects previously written data from modifications.
- RTLS technology, developed and standardized at different frequencies, includes 433 MHz and 2.45 GHz systems compatible with 802.11-standard wireless networks, and 5.8 GHz Ultra Wide Band (UWB) technology that offers exceptional location accuracy. RTLS is a long-range technology used to track the location of assets in distribution centers and large factory complexes, cargo containers in yards, medical equipment through the various floors and wards in hospitals, and even employees. 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.

Businesses often use multiple RFID technologies in the same system to support different process needs. For example, warehouses can track forklifts with RTLS tags, while the pallets they handle contain UHF Gen 2 smart label tags, and the goods within the pallets contain individual HF item-level tags. For instance, 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. When not constrained by compliance requirements, organizations can choose RFID products with the frequency, range, memory, rewrite capability, security and other features that suit their specific process requirements.

Capitalize on the Value that RFID Delivers

Many RFID applications gain rapid ROI because users have the flexibility to choose technology and tailor process improvement solutions to solve their specific business problems. Processes in which manual data recording creates a bottleneck, is error-prone, or incomplete, are prime candidates for improvement with RFID. Enterprises in both the private and public sector can benefit from RFID technology throughout a wide variety of use-cases and environments, while realizing opportunities for improving efficiency and reducing operational costs.

Zebra Technologies Corporation (NASDAQ: ZBRA) provides the broadest range of innovative technology solutions to identify, track, manage, and optimize the deployment of critical assets for improved business efficiency. Zebra's core technologies include reliable on-demand printer and state-of-the-art software and hardware solutions. By enabling improvements in sourcing, visibility, security and accuracy, Zebra helps its customers to put the right asset in the right place at the right time. Zebra operates in over 100 countries and serves more than 90 percent of Fortune 500 companies worldwide. For more information about Zebra's solutions visit www.zebra.com.

8. EPCglobal, "Class 1 Generation 2 UHF Air Interface Protocol Standard Gen 2," http://www.epcglobalinc.org/standards/uhfc1g2

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