# Increasing Profits and Productivity:

*Accurate Asset Tracking and Management with Bar Coding and RFID*

A ZEBRA **BLACK&WHITE** PAPER

**BarCode ID Systems**

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## Executive Summary

Not being able to find tools and equipment when they are needed costs more than inconvenience. Time spent searching for assets eats into productivity, and hence profitability. Workers lose the equivalent of one full 40-hour workweek per year if they spend only 10 minutes a day searching for and gathering needed items. The inability to track equipment location, usage, service, and maintenance causes companies to lose money on lease and service agreements. Holding too many assets ties up capital, which every business seeks to avoid. To improve competitiveness and profitability, enterprises should manage assets with the same care and innovation they have employed to drive excess inventory and costs out of their operations. A good asset management program will improve return-on-assets (ROA) and other metrics by helping to lower and control the enterprise cost structure.

Automatic identification and data collection (AIDC) technologies and techniques that have proven their value in the supply chain are readily adaptable to help optimize asset levels. Bar code and smart label technology can make it simple and convenient to gather and manage asset information in a timely and efficient manner. These technologies can record asset movements automatically, and provide the data in real time to asset management software applications. Computerized systems provide up-to-date, accurate data that enables an organization to manage its assets with information instead of physical inventory. The result is a lower overall asset base, improved asset utilization, increased productivity and more efficient purchasing and maintenance, which all contribute to bottom line improvement. These outcomes provide a sustainable improvement in profitability without burdening employees with excessive controls or reporting responsibilities.

The key is to make asset tracking convenient and consistent. To show how, this white paper will:

• Describe how bar coding and radio frequency identification (RFID) can facilitate improved asset management procedures;

• Document how these technologies provide a return on investment by saving time and improving accuracy;

• Provide examples of successful systems; and

• Outline technology performance needs and selection criteria.

## Introduction

Effective asset management ensures employees always have equipment, tools and other resources when and where they need them. This can be accomplished either by tightly controlling assets through meticulous record keeping and control procedures, or by purchasing and maintaining spare materials to provide sufficient safety stocks. Of course, it is much more cost effective to ensure asset availability by managing information instead of physical goods, but this approach relies on consistent data collection and is vulnerable to human error or indifference. If information is inaccurate or out of date, assets will unexpectedly be out of service, leading to costly productivity and replacement losses.

Looking for tools, test equipment or supplies may seem like an insignificant part of the work day, but the aggregate effect should get attention. Sixty-four percent of companies reported that their operations personnel perform at least one search for assets or inventory every day, and 27 percent perform more than 10 searches a day, according to a 2003 survey by WhereNet, a wireless asset management systems vendor. Nearly half (47 percent) of the companies in the survey reported their searches take up to one hour. Workers lose the equivalent of one full 40-hour work week per year if they spend only 10 minutes a day searching for and gathering needed items. By using the conservative figure of ten minutes per day of search time, multiply the number of workers who look for items in the course of their work by their average weekly salary to see if ineffective asset management is a mere inconvenience or a drain on profitability.

### Dollar Cost of Asset Searches

| | |
|---|---|
| Minutes/day spent on searches per employee: | 10 |
| Multiplied by 5 days a week for 48 work-weeks per year | 240 days |
| | _____ |
| | 2,400 minutes per year/60 minutes |
| | |
| = Search time spent per year | 40 hours per year |
| | |
| Search time spent per year | 40 hours |
| Multiplied by average hourly pay rate | $25 |
| | _____ |
| = Search time expenses by employee | $1,000 per employee |

Multiply by the number of employees at that salary level engaged in the same activity to determine the overall expense impact.

Lost assets are an even larger drain on profitability, as the following scenario illustrates. A maintenance worker has a week of vacation coming up and plans to do several home improvement projects, Without asking or notifying anyone, he "borrows" a cordless drill valued at $60 at the end of his last day before vacation.

The following week another employee needs to use a drill and can't find one. The employee, who earns $18 per hour, spends 10 minutes thoroughly searching the tool crib, then goes off to look for the drill in other areas around the facility. After a half hour of fruitless searching, the employee notifies a supervisor. The supervisor (who gets $30/hour) makes a cursory 10-minute search of the area, declares the drill lost, and authorizes its replacement. Here is what the "borrowed" tool, whose loss could have been prevented with an automated asset management system, has cost so far:

| | |
|---|---|
| Employee search time: | $9 (0.5 hour @ $18/hour) |
| Supervisor search time: | $5 (0.17 hour @ $30/hour) |
| Item replacement cost: | $60 |
| Total: | $74 |

If the company earns the S&P 500 average after-tax profit margin of 10.72 percent, it needs to bring in $690.30 of new revenue to replace the $60 drill. If the supervisor sends the employee to the hardware store to buy a new drill and the trip takes an hour, the required revenue climbs to $858. In addition, the task the employee originally needed the drill for won't be completed as scheduled. The company will have an extra drill when the first employee returns from vacation, which represents excess capital equipment and lower asset utilization.

Incidents like this go on undetected every day in business and rob companies of productivity and profitability. Shareholders and executive management don't pay attention to cordless drills, but they pay close attention to the return on assets (ROA) the company earns. With competition and the economy making it difficult to acquire new revenues, companies have renewed their focus on ROA and have aggressively sought to improve it through increased outsourcing, equipment leasing and supply chain management activity. A good asset management program improves return on assets and other metrics by helping to lower and control the enterprise cost structure.

## Using Bar Code & RFID for Asset Management

The first step to any asset management program is to identify and record (inventory) all assets. This initial step may be very time consuming, but must be done thoroughly to provide an accurate foundation that enables future improvements. Identifying and recording all assets provides a snapshot that gives the organization an accurate view of its assets for a brief period of time. For asset management to be effective, organizations need to create and use consistent processes to record changes in asset location, condition and availability. Bar code and RFID simplify the recording process and help ensure that information is entered accurately.

Kitsap County, Washington, operates an automated system for tracking road signs that is an excellent example of the time savings and accuracy benefits that bar coding provides. After changing data recording procedures from clipboard-based manual processes to bar code scanning, the county reduced data entry time by 92 percent and improved the accuracy of information in its database.

The county records the location, condition, age and other data for each of its 18,000 road and street signs in a database. Each sign is labeled with an 11-digit serial number that is printed in text and a bar code. The serial number uses a schema that uniquely identifies the sign and describes its location. Whenever there is action performed on the sign, such as new placement, removal for repair, application of new coating or other maintenance, the serial number and activity is recorded in the field and re-entered into the county's database application.

Road crews previously recorded serial numbers and activity in the field with pencil and clipboard and submitted the paperwork to a traffic engineer at the end of the day to be typed into the database. The redundant manual data recording procedures provided two opportunities to incorrectly log or transcribe the serial number. Studies on data input accuracy conducted in the bar code industry found that an experienced typist makes one error approximately every 300 keystrokes. Using this standard benchmark, Kitsap County would make approximately one error per every 27 database entries - which does not include errors resulting from incorrect serial number recording in the field, where weather conditions and other distractions would likely lead to more errors.

Kitsap County now records data in the field by scanning the bar code with a hand-held computer and key entering a 2-character activity code. At the end of the day, the computers are placed in docking cradles at the office and all the work activity records are automatically uploaded to the county's software system. Traffic engineers previously spent at least three hours a week entering handwritten report data; the process now takes about three minutes a night. Bar code scanning also saves considerable data entry time in the field, enabling road crews to service more signs each day, and has improved data entry accuracy at both ends of the process.

Kitsap County's success is a classic example of the benefits automatic identification and data capture can provide for asset management. AIDC technologies can be used to identify all types of assets in many environments including large, immobile highway signs, expensive test equipment and tools, computers,

peripherals and digital cameras, even replacement toner cartridges and other supplies. The following sections describe how to take advantage of bar code and RFID technology to meet different asset management needs.

## Fixed Assets

Kitsap County operates a traditional bar code asset management program that is notable because the assets are always outdoors. Durable bar code labels and rugged scanners make the system possible. Bar codes-and increasingly RFID-are often used for in-premise asset management programs to identify all sorts of fixed assets and capital goods, from PCs to office furniture to material handling equipment.

Asset management programs vary by the frequency that materials are identified and the amount of information that is recorded. For example, a conference room table might be checked every few years with a simple location audit. The same company might monitor the usage, maintenance and performance issues of important production equipment every shift. Regardless of the audit frequency or data content, automated data entry is beneficial because it collects information much more quickly and accurately than manual methods.

Beyond scanning fixed assets annually for inventory, audit or insurance purposes, organizations can expand their asset management programs to collect additional information. Monitoring assets regularly, which can be done efficiently with automatic identification, can improve asset utilization and the total cost of ownership by providing the information needed to optimize capacity planning and preventive maintenance.

Bar code and RFID can play an important role in these applications. For example, consider a cutting machine that requires oiling and other periodic maintenance based on hours of use or the nature of the jobs processed. Traditional asset management would probably require the machine's location and condition to be verified once a year, a requirement that could be met with a simple bar code scan. By creating procedures to require workers and maintenance personnel to record the amount of time they used the machine and any maintenance performed, the company could build a service record to support its asset record. Collecting the additional data could be accomplished by scanning the asset label and scanning or key entering a job code, similar to the Kitsap County system. Collecting data regularly provides information that is invaluable for risk management and defending against liability claims.

Supplies such as oil and blades could also be bar coded and scanned when they are loaded into the machine. Scanning would automatically associate specific materials and quantities with specific machines. Database and maintenance management software applications could use the information to monitor asset efficiency, schedule preventive maintenance, or send alert messages if the machine is using an inordinate amount of supplies that may indicate a performance problem. The documentation would also support service agreement and warranty claims.

For maintenance operations, an RFID tag could be used to identify the equipment, date of installation, and then updated whenever service or inspections were performed. Workers who service the machine could read the tag to learn the most recent work performed or service history, which is extremely advantageous for remote asset management where personnel may not have access to enterprise databases and service records.

Service documentation and record keeping can have a direct effect on profitability. Businesses who show leadership in automating their service operations are 25 percent more profitable than average companies in the same industry, according to a study by AMR Research. Manufacturers who provide equipment service to

their customers fail to capture between 50 and 70 percent of service revenues because of poor record keeping and management, the same study found. Using automatic identification to quickly capture information to build service records, and using mobile printers to create service reminder labels and other materials, can help improve service efficiency, lower costs and position the company to gain additional service revenue.

## Authentication

Materials authentication is another complementary asset management application. It provides a way to detect counterfeit products and can ensure that only authorized parts and supplies are used with equipment.

Now companies can take advantage of their existing labeling systems to further protect their products against counterfeiting and enable easy authentication in the field. Product nameplates, UL and CSA marks, and many other types of asset and product labels, can be produced on secure media that appears normal to the naked eye but contains authentication materials that can only be detected with specialized readers. The materials may contain a simple pattern that is verified for authenticity, or may carry variable data such as a serial number or expiration date. Various types of overt and covert secure media have existed for a long time, but only very recently became available for use with demand label printers that are commonly used in business. Zebra's white paper *Brand Protection in the Supply Chain: Securing Products and Profits with Secure Media Solutions* provides more information about how authentication media can be integrated with existing labeling operations.

RFID smart labels, which embed a chip and antenna for wireless data communication within an adhesive label, can also provide authentication and protection. Zellweger Analytics manufactures gas detection systems that draw air samples through chemically treated monitoring tape, which changes color if the gas being tested for is present. The specialized tape comes in disposable cassettes that are loaded into the analyzer. Each specific gas to be tested for requires its own cassette, which lasts up to three months. Cassettes must be matched to the gas the analyzer is configured to detect or no results will be recorded.

To ensure the proper use of materials and improve operator convenience, Zellweger applies smart labels to its cassettes and has built RFID readers into some models of its test equipment. The cassette type, serial number and expiration date are encoded in the smart label, by the smart label printer/encoder at the point of application. The information required by operators is printed in text on the label face. When cassettes are loaded, the instrument captures the product type, serial number and expiration date from the cassette label. The system first verifies the cassette has not expired, then verifies the correct cassette has been loaded to detect the desired gas.

After confirmation, the test machine uses information read from the RFID label to automatically calibrate the analyzer. Once gas detection operations are underway, the encoder inside the test machine records the amount of time the cassette is in use and electronically "writes" the data onto the smart label. The system alerts operators when cassettes have limited time remaining before they expire. This advance warning enables users to plan for continuous coverage and is a tremendous safety improvement.

The automated data capture and calibration ensures 100 percent accuracy in the processes and saves between two and five minutes of operator set-up and recording time each instance a cassette is used. The process also ensures that only genuine, valid Zellweger cassettes are used and improves asset efficiency for its customers by ensuring that unsafe expired or recycled materials cannot be used.

## Moveable Assets

Many variations of Zellweger's authentication application have been used to track tools, equipment and other moveable assets. Asset movements can be automatically recorded with mobile data collection equipment or automated dispensing machines.

Automated dispensing machines function like vending machines for tools and supplies. Employees present their ID cards (usually sporting a bar code or RFID tag for automated processing) to the machine, which reads the badge automatically to identify employees and verify their authorization to receive the requested equipment. When the equipment is released, the machine records the item serial number (often by a bar code scan) and stores it in a record with the date and time of release and the employee it was dispensed to. Every item disbursement is tracked objectively with no human data entry required. Materials can be logged back into the system with a bar code scan that automatically applies a time and date stamp to the transaction to document their return.

Tool crib, depot, storehouse, library and other operations can be managed in a similar manner by having employees scan out their own items, or by using a material clerk in place of the dispensing machine. Creating supermarket-style equipment checkout operations enables organizations to manage more assets than dispensing machines, which can hold items of limited sizes and quantities. However, self-checkout and clerk-checkout operations are not as accurate because they rely on users to scan both their ID and each item every time.

Moveable assets, which include files and samples in addition to tools and equipment, are more commonly tracked with mobile data collection equipment. The asset database and other desired data or usage rules are loaded into a mobile computer, which may be a handheld, laptop, tablet, or vehicle-mounted model. A bar code or RFID reader can be added as a peripheral device or integrated into the computer to automatically identify items in the field.

For example, many casinos use handheld computers with bar code readers to automatically identify collection boxes as they are removed from slot machines. Slot machines are highly regulated and casinos must be able to provide specific collection and payout information for each machine or risk losing their license. Managing cash boxes and machines requires total data entry accuracy and can be very labor intensive and time consuming without bar coding.

Systems integration firm Mpact developed a casino asset identification system featuring handheld computers, bar code scanners and Zebra® label printers that significantly streamlines slot machine cash management. Collection employees use a handheld computer with bar code reader to scan both the slot machine asset ID label and the separate cash box label when boxes are removed for collection. Application software uses the scan data to build a database record associating the box with the machine. Because boxes are automatically associated with the correct slot machine, they can be unloaded and processed in any order in the count room.

Boxes are scanned again prior to cash counting, which triggers the automatic generation of a label that has the box ID printed in text and bar code. The label is scanned when the cash from the boxes is processed in counting machines. System software links the scanned ID with the cash machine count to automatically create the collection record for each slot. Empty boxes can then be recirculated and do not have to be matched to specific slot machines. The system has cut container tracking time in half at some casinos in addition to improving accuracy and compliance and saving time in counting operations.

Clean rooms and medical labs look and sound nothing like casinos, but have very similar tracking and chain-of-custody requirements. Bar code or RFID smart labels can be applied to slides and test tubes to track individual samples, and also to test equipment for traditional fixed asset management or to facilitate scanning to automatically associate samples with the specific equipment used to process them. Scanned data can satisfy U.S. Food & Drug Administration (FDA) CFR 21 Part 11 requirements for electronic signatures without labor-intensive record keeping. A leading pharmaceutical company reduced data recording time from two to three minutes per test to five to 10 seconds by integrating mobile bar code label printers, RFID employee ID badges and bar coded sample slides to facilitate scan data entry. Between one and three hours of transcription time per shift was also eliminated, which has improved productivity and shortened the drug discovery and approval cycle. Scanning can also help preserve clean room environments by eliminating the need for paper.

## Identification Options

Regardless of the environment, asset management begins with uniquely identifying each asset. This concept is easy to understand but is often challenging to execute. Kitsap County conducted testing for more than six months before it was satisfied that it found a label material that would remain affixed to signs and ensure bar code readability during a lifetime of outdoor use. Lab applications often involve exposure to temperature extremes and harsh chemicals. Industrial equipment is frequently covered in dirt and grease that can make bar codes unreadable.

Finding the optimal way to identify assets is a three-step process. First you must determine how much information the asset identifier must contain. The identifier is usually a serial number, but it could also contain configuration or service data. The choice of data content will dictate the second decision, which is to choose a data carrier. Data carrier refers to the method the data will be expressed. It may be in text, a traditional bar code, two-dimensional (2-D) bar code, or an RFID tag. After the data carrier is determined you can choose which label material will perform best in your usage environment.

### Determining Content

Asset tags do not need to carry actual data, but must at least clearly and uniquely identify each asset. The most common situation is to use the asset tag as a serial number that corresponds to a record in a database, where the actual asset information is stored. The license plate on your car is a good example. Vanity plates notwithstanding, no one, including law enforcement officers, can determine your identity simply by reading your license plate. Patrolmen use the plates to learn your identity and relevant driving history from a database they access by radioing to the station or using a wireless computer in the field. In industry, users may conduct database lookups through a wireless or wired LAN connection, or by accessing files stored on a mobile computer. Because databases can hold more information than license plates or other common identifiers, lookup architectures are favored for most asset management applications.

Because items must be uniquely identified, the U.P.C./EAN bar codes that are applied to most consumer products cannot be used as identifiers in asset management programs. U.P.C./EAN numbers identify the product and its manufacturer, but do not uniquely identify each individual item. For example, every can in a case of cola has the exact same U.P.C./EAN number; in fact, every can of that size and brand ever produced should have been marked with the same number. This is not a problem for inventory operations, where quantity is the chief concern, but is problematic for permanent asset management when service, maintenance and warranty history must be tracked for each item.

Asset identification systems can be designed to include some intelligence to streamline operations or enable work to continue if database access is unavailable. For example, Kitsap County's 11-digit serial numbering system for signs includes a five-digit road identification code, a four-digit mile code that describes where the sign is located on the road, a digit to indicate which side of the road the sign belongs on, and a sequence number that differentiates each sign if multiples are posted at the same location. A database on the handheld computer carried into the field contains the road identification codes, so crews only need to scan the sign codes to get all the information they need to locate and place road signs.

### Data Carrier Selection

Most industrial, lab and office asset management programs have sufficient database access to use simple serial numbers for bar code identification. Database records can be accessed through a wired or wireless connection to a host computer, or stored in a mobile device. If database records are too large or access is unavailable, additional information must be included in the asset label. The primary options are to encode a 2-D bar code or an RFID smart label.

Two-dimensional symbologies encode data both horizontally and vertically (hence the name 2-D) and can hold much more data than traditional linear symbols of the same size. One symbology enables the entire Gettysburg Address to be encoded in a space slightly larger than a standard linear U.P.C./EAN symbol. Other symbologies enable a serial number, lot code and production date to be printed small enough to fit on tiny parts and electronic components.

Data from smart labels is gathered wirelessly using RFID. In addition to being able to hold more data than linear bar codes (currently up to 2K, smart labels can be read if they are covered in dirt, grease or other contaminants and do not require a direct line of site between the label and reader. Read/write RFID tags are available, which could be updated with usage, inspection, service or other data in the field using a mobile read/write device. For more information about smart labels, download the Zebra white paper *Zebra's RFID Readiness Guide: Ensuring A Successful RFID Implementation* at www.rfid.zebra.com.

## Technology Selection

The desired data carrier and the conditions it will be exposed to (temperature extremes, sunlight, dirt, chemicals and moisture are among the factors that must be considered) will dictate the range of acceptable label materials. The label must identify the item from the time it is put into service until the time it is retired, so durable materials and permanent adhesives are required.

Many document printers require an entire sheet of label material to produce each label, and can't apply different information to multiple labels on the same sheet. These printers add unnecessary cost to labeling operations because so much material is wasted. Thermal transfer printers can accept the widest variety of label materials of any on-demand print technology and are purpose-built to provide the best bar code print quality. Thermal transfer printers also produce labels with sequential serial numbers or other variable data on demand, with no wasted label material.

Thermal transfer printers can produce long-lasting bar codes and smart labels on paper, polyester, polypropylene and other synthetic materials that resist temperature extremes, condensation and moisture, blood, oils and chemicals and other contaminants. Zebra Technologies offers multiple media and ribbon combinations that have been certified to meet UL and CSA marking requirements. Thermal is the only technology that currently enables smart labels to be printed and encoded on demand.

Media efficiency is one of several total cost of ownership (TCO) advantages thermal provides over other print technologies. For more information about the benefits of thermal printing, see Zebra's white paper *Best in Class Bar Coding: The Business Case for a Dedicated Thermal Label Printer*.

## Conclusion

Effective asset management requires timely, accurate information. Gathering the information must be convenient, otherwise operators will tend to skip the step and hence data integrity will be compromised. As we have seen, even the temporary unavailability of low-value items can have a surprising impact on a company's productivity and profitability. Therefore once an asset management program is established, organizations should seek to include as many assets as possible in the program to maximize their return on investment.

On-demand thermal bar code printers and smart label printers/encoders make it convenient and cost effective to label all types of assets for automatic identification at the point of consumption or application. They produce durable labels that will help provide the accurate information foundation that successful asset management programs require. Zebra Technologies offers a wide range of thermal bar code and smart label printers plus many different durable and secure label materials for asset identification. Contact Zebra today to learn more about how our products and expertise can help enhance your asset management program.
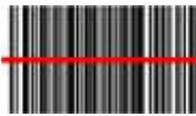
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