



# Supply Chain Technology

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# Key RFID Developments

**American Apparel case study reveals strong ROI.** We evaluated American Apparel's item level RFID pilot and believe the per-store payback to be about 4.5 months given increased sales from fewer out-of-stocks and reduced labor. RFID boosted revenue by providing improved inventory visibility and automation that enabled process changes to ensure a full complement of product offerings were available on the retail floor at all times. This was accomplished with reduced labor for weekly cycle counts and inventory searches. The company expects a full rollout to begin this summer. Please see our June RFID supplement for the entire case study write up and corresponding analysis.

**Coke Leverages RFID to Help Manage New Product.** Coca-Cola has introduced a new fountain dispenser, called Freestyle, which allows significantly more consumer choice at self-service stations, primarily at fast food restaurants and convenience stores. Freestyle leverages RFID to help with several aspects of the unit operations, including shipping accuracy, unit refill, safety and usage. The data generated will help Coke drive incremental revenue by improving consumer marketing, and enable improved inventory management, thus helping key customers.

**Reducing Mis-Shipments a Sizable RFID Opportunity.** Back in September 2008, we wrote about Walgreens new distribution center and its use of RFID to reduce mis-shipments. More recently, we have written about Checkpoint's Merchandise Visibility Solution, which provides automated visibility for apparel at the item level, and enables automated confirmation of shipped contents. This solution is being employed at European retailer Charles Vogele. We believe RFID solutions to reduce mis-shipments, or catch incorrect shipments early in the process represents a sizeable market opportunity given the high cost of the problem, and the large volume of goods shipped through the supply chain.

**Transportation and Federal Stimulus.** As part of the American Recovery and Reinvestment Act of 2009, also known as the "stimulus package," \$1.5B has been appropriated for Grants for Transportation Investment Generating Economic Recovery, or TIGER Grants. We expect both passive and active RFID systems will be used to support tolling, dynamic pricing, rail management, intelligent infrastructure and improving transportation between modes at ports.

To be placed on our [RFID Monthly](#) distribution list, please e-mail us at [rread@rwbaird.com](mailto:rread@rwbaird.com). There is no charge for the publication.

# RFID Hardware News and Comment

## Tags and Readers

Hitachi introduced its  $\mu$ -chip, a passive tag microchip with 128-bit read-only memory which operates at 2.45-GHz frequency. The dimensions are 0.4mm square with a minimum thickness of 60 microns. The product has no anti-collision capabilities, and is targeted towards the document, manufacturing, and distribution markets.

iDTRONIC announced its "UHF Gun", which reads ISO18000-6 B/C based tags and labels at distances up to 2m. The device uses a 3.5" sunlight readable LCD with touch screen, is rated at IP54 for moisture protection, and withstands drops from 1.5m. The device communicates through USB, Bluetooth, and WiFi interfaces.

Brooks Automation announced its HF80 Series reader, which is intended for the solar cell industry. The system operates at 13.56 MHz and uses five antenna terminals. The reader is available with either an Ethernet or serial RS232 interface. While the system is intended for solar cell manufacturing, order picking may be an additional application.

MARK IV IVHS introduced its JANUS technology as a method to implement VMT (Vehicle Miles Traveled) with modifications to the existing E-ZPass infrastructure. The JANUS technology provides additional tolling management options for transportation and infrastructure financing. Like the E-ZPass, JANUS operates at 5.9 GHz, the frequency dedicated to wireless traffic developments.

Savi announced the availability of its ST-694 GlobalTag, a shipment monitoring device that combines GPS with RFID and satellite communications. The system provides defense, public, and commercial customers with continuous monitoring and locating of supply chain assets in locations with no fixed reader infrastructure, such as desert military bases and offshore oil rigs.

## Systems and Solutions

GE and Sandlinks have created an in-transit visibility solution based on GE's Asset Intelligence's VeriWise Asst Tracking Service and Sandlinks UWB offering. GE's current solution is able to discover the location and status of a wide variety of in-transit assets, including trucks, truck trailers and rail cars. This is done using a variety of satellite and cellular technology. GE's software provides routing analysis. Sandlinks UWB product offers increased visibility and status of cargo contents. The Sandlinks offering provides location up to one-foot, has 16K of read write memory, offers tag-to-tag communication and contains a temperature sensor. The tag can be hooked up to other sensors as well. These features enable the overall GE container tracking solution to be enhanced to prevent mis-shipments, provide sensor data for temperature sensitive goods and enable the pallets tagged to have a portable data base, to enhance shipment knowledge. This might include a manifest of associated goods, chain of custody records, exception notes and other valuable information. We understand commercial pilots will begin 3Q09. Sandlinks expects to sell its tags for between \$5 and \$10. The BIRD Foundation, which promotes commercial undertakings between U.S. based and Israeli based companies, contributed \$2M to the development of this solution.

Applied Biosciences announced its new 3500 Series Genetic Analyzer, one of its new capillary electrophoresis sequencing systems, which enable DNA sequencing as a method of identifying genetic variation, will leverage RFID as a method of tracking analyzed samples. The product will be available worldwide in August.

Tangent has introduced the Medix 10T, a 10.4" medical grade touch screen computer tablet for use in electronic medical record and point-of-care applications. As optional features, the tablet can include a barcode scanner and a RFID reader for asset/patient tracking. The reader operates at 13.56 MHz and supports ISO 14443 and ISO 15693.

# RFID Hardware News and Comment

RadarFind introduced a patented RTLS tag for tracking cardiac telemetry devices which monitor patient heart rate. When patient assistance is needed, RadarFind pinpoints the location to a specific room which allows patient care staff to quickly locate the patient. The RadarFind asset tags also help to prevent from misplacing or accidentally discarding the small, expensive telemetry units. The tags operate at 900MHz. RadarFind has worked with WakeMed Health & Hospitals of Raleigh, NC and Mary Washington Hospital in Fredericksburg, VA.

VingCard, maker of hotel guestroom door-locks, introduced the Classic RFID, a new electronic door-locking system. The system operates with ISO 14443A, ISO 14443B, ISO 15693, and is also compatible with NFC cellphones. Vingcard provides an RFID upgrade option for existing magnetic stripe readers, requiring only an update to the card reader and an end cap.

SkyRFID has announced the availability of its new Automated Self Serve Library Management Solution. The solution provides touch screens with search and aisle/shelf locating capabilities for locating items by title, description, etc. Self serve checkout entails passing a patron card past an RFID reader followed by the items to be checked out, with no attendant required. The HF system runs on Microsoft SQL and complies with ISO 14443A, ISO 15693, ISO 18000-3, along with ISO 18092 for contactless payments from NFC cellphones.

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## Industry Commentary

**Reducing Mis-Shipments a Sizable RFID Opportunity.** Back in September 2008, we wrote about Walgreens new distribution center and its use of RFID to reduce mis-shipments. More recently, we have written about Checkpoints Merchandise Visibility Solution, which provides automated visibility for apparel at the item level, and enables automated confirmation of shipped contents. This solution is being employed at European retailer Charles Voegelé. We believe RFID solutions to reduce mis-shipments, or catch incorrect shipments early in the process represents a sizeable market opportunity given the high cost of the problem, and the large volume of goods shipped through the supply chain.

With respect to incorrect shipments (i.e., the wrong goods shipped), consider the large costs - there is the cost of shipping, the cost of returning the goods, excess labor associated with the return and restocking process, incremental working capital is tied up in excess inventory and delayed payment. One study by A.T. Kearney indicated it cost nearly \$60 to manually correct each invoice error related to incorrect shipments as a result of poor product data. There is also the case of shipping incomplete orders (i.e., missing items in a kit, where the product only works if all the items are included). Here consider that companies incur extra shipping expense, extra labor in acquiring the missing part and incremental customer service expenses. Perhaps the largest hidden cost of all in both cases is customer bad will, which leads to less trust, fewer orders and delayed payments.

In the case of Walgreens, nearly 30M cases are shipped annually from its own distribution center in Anderson, South Carolina to various Walgreen stores. Walgreens found that the cost of mis-shipments in most instances was more than the value of the contents of the case being shipped. As a result, they implemented a combination bar code / RFID system to automatically confirm that each shipping tote was loaded onto the correct truck. Charles Voegelé is also using RFID, among other applications, to verify shipments against orders and then verify distribution center and store receipts against advance ship notices. Apparel, including footwear, sees over 24B items produced

each year. We can extend these applications into electronics, home white goods and grocery. We see home electronics, including cell phones, video games and TV's and DVDs as a large potential market. Consider that a Wii set up includes a game console, a remote, a power cable, a sensor, various cables, an owner's manual and an initial game. If any of these items are missing, the Wii cannot be operated. Therefore, having a reliable verification system is of great value. We see RFID being used by tagging all package components and having an RFID verification process that all of the correct accessories are in the package before it is shipped. About 50M video game units are sold annually between Wii, Xbox and Playstation, and assuming each box contains between 5-8 accessory items, the home video game market potential for inlays is 250M-400M units.

Add TVs, DVDs and White Goods, and the opportunity is an additional 500M units, assuming 4-5 accessories per package. Cell phones represent perhaps the largest opportunity, given that the worldwide annual market for cell phones is roughly 1B and each cell phone has between 3-5 accessories shipped, per unit, suggesting a 3B-5B inlay market opportunity. Recall, in the May edition of RFID Monthly, we highlighted Nokia's interest in evaluating RFID, which we believe is for tracking as part of the manufacturing process, but we could easily see that extended into a shipment verification application. Nokia is the No. 1 handset manufacturer with roughly 36% market share.

We view a verification application as having a strong value proposition on its own. And, because it represents tagging at the source, we believe it will enable other down-stream supply chain applications to be implemented with less incremental cost. We see the real value of RFID coming when it can be leveraged by multiple members of the supply chain and we expect electronics, apparel and Pharma may provide that opportunity.

**Comment on the Apparel Market.** While the overall apparel market remains weak, with many stores continuing to see contraction, there is some evidence of improvement in the last several months. Several of the specialty retailers are seeing stability to gradual improvement in the

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last several months. Of the eight specialty apparel retailers that report results on Business Wire's monthly retail report, seven reported trends were flat to improving over the past three months (American Eagle, Aeropostale, The Children's Place, The Gap, The Limited, Ross Stores, TXJ Cos). This is based on comparing the year-to-date comparable store sales on a monthly basis. Only Saks reported incremental weakness on that basis; however, Saks did show sequential improvement on its monthly store comparable sales to down 26% in May from down 32% in April. We are encouraged that profitability at many of these specialty retailers is beginning to exceed expectations, including Chico's who recently reported a 14% increase in net income; analyst estimates anticipated flat profitability.

We continue to view the apparel market as a strong opportunity for RFID implementations given the complex supply chains, larger asset values and difficulty with out-of-stocks. Our recent American Apparel case study write up and Serge Blanco application profile in this edition provide an overview on value add from RFID. We estimate the apparel market, including footwear produce roughly 24B units annually. Importantly, weak revenues, and the sense of urgency by managements to improve profitability, and what appears to be some signs of relative stability in the end market, may serve as a catalyst for driving more RFID adoption in this area.

**Retail Shrink on the Rise – RFID a Potential Tool.** The downturn is apparently causing retail theft to increase and retailers are considering allocating more resources towards the problem. Recall, we reported in the February edition of RFID Monthly that retail shrink is a \$130B problem worldwide, and that RFID can play a role in helping retailers identify problems associated with in store theft and losses within the supply chain. American Apparel identified shrink reductions with their RFID system. The National Retail Federation (NRF) annual Organized Retail Crime survey of 115 retailers revealed 92% of retailers' report they were subjected to organized retail crime in the past year, up eight points from last year. According to the survey, the amount of organized retail theft was up as 73% of respondents reported an increased level of activity, which was up from 62% last year.

## Standards/Policy/Government

**Transportation and Federal Stimulus.** As part of the American Recovery and Reinvestment Act of 2009, also known as the "stimulus package," \$1.5B has been appropriated for Grants for Transportation Investment Generating Economic Recovery, or TIGER Grants. Detail can be found in the [Federal Register \[Docket No. OST-2009-0115\]](#). We expect some of the associated transportation projects may use RFID. These grants will be awarded by the U.S. Department of Transportation for highway and bridges ([United States Code Title 23](#)), public transportation projects ([USC Title 49, Chapter 53](#)), rail and port improvement projects. Applications to receive grants must be submitted by September 15.

The primary selection criteria for grant applications are based on projects that can create a successful long-term outcome, such as creating economic competitiveness, improving living standards, improving existing infrastructure and improving safety, and on creating jobs and positive economic impact. Secondary criteria for selection are projects that use innovative strategies and projects that demonstrate strong partnership with a group of participants. Innovation specifically includes using technology to promote dynamic pricing, intelligent transportation systems, smart cards, real-time traffic dispatch and RFID. We expect both passive and active RFID systems will be used to support tolling, dynamic pricing, rail management, intelligent infrastructure and improving transportation between modes at ports. Given that the dollars are intended to stimulate the economy, priority is given to projects that can be completed by February 17, 2012.

Grant sizes will be between \$20M-\$300M, with no more than 20% going to any individual state. In addition, \$200M will be available for Transportation Infrastructure Finance Innovation Act of 1998 (TIFIA), where the government provides lines of credit, secure loans and loan guarantees to borrowers for up to one-third of a surface transportation project. To date, the TIFIA program has committed \$4.4B in direct loans for seventeen active or completed highway projects with a total funding requirement exceeding \$20B.

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**Healthcare Test Protocols.** AIM Global announced its RFID Experts Group (REG) will work with Georgia Tech and MET Labs to develop RFID based test protocols in healthcare. Recall, back in December, the REG indicated it would will develop a set of test protocols for RF emitters to determine safe thresholds in a healthcare environment. This was largely in response to findings from a University of Amsterdam Study published last June in the Journal of the American Medical Association (JAMA) that indicated an impact on certain critical care medical equipment from LF RFID at 125kHz and UHF at 868MHz.

The REG workgroup has identified Georgia Tech and MET Labs has having RFID experience and offering third party impartially to develop and validate test protocols. According to AIM Global, the initial effort will be focused on two sets of test protocols, implantable medical devices and clinical instruments.

- To test the impact of RF emissions of medical devices that conforms to AAMI PC69 and “other applicable standards.” [ANSI/AAMI PC69:2007](#) covers electromagnetic compatibility for active implantable medical devices - EMC test protocols for implantable cardiac pacemakers and implantable cardioverter defibrillators.
- To test the impact of RF emissions on clinical instruments that conform to various standards, including IEC 60601-1-2, 60601-2-x (electromagnetic compatibility of equipment and systems), ANSI/IEEE C63.18 (test method for estimating radiated electromagnetic immunity of medical devices to specific radio-frequency transmitters) and [ANSI/AAMI TIR-18](#) (Guidance on Electromagnetic Compatibility of Medical Devices for Clinical/Biomedical Engineers).

The tests will be constructed to determine if negative events occur, and if so, under what environmental conditions. The testing will also seek to identify what types of medical equipment are particularly prone to interference and do determine the possible corrective actions. Further, a key deliverable will be to develop a methodology where manufacturers of RF or medical devices can understand potential problems and provide a process to reduce the potential interference.

The REG test procedure will include nine different sets of RFID equipment, including products conforming to ISO/IEC 18000-2 (Low Frequency-sub 135kHz), ISO/IEC 18000-3 (High Frequency – 13.56MHz), ISO/IEC 18000-4 (2.45GHz), ISO/IEC 18000-5 (5.8GHz), ISO/IEC 18000-6 (Ultra High Frequency – 860MHz-960MHz), ISO/IEC 18000-7 (Active – 433MHz), ISO/IEC 24730-2 (RTLS Asset Management – 2.45GHz), ISO/IEC 243730-5 (RTLS, Chirp Spread Spectrum – 2.45GHz), Ultra Wide Band and WiFi. The test protocols will be submitted to the FDA for validation.

## Passive Applications

**Coke Leverages RFID to Help Manage New Product.** Coca-Cola has introduced a new fountain dispenser, called Freestyle, which allows significantly more consumer choice at self-service stations, with 100 drink combinations versus between 6-12 choices with existing equipment. Freestyle will primarily serve fast food restaurants (consider McDonald's and Burger King, which use Coke products), movie theatres and convenience stores. Combinations could include caffeine-free diet-coke with lime, or PowerAde with Vitamin C (yes, Coke plans to provide options for the health-conscious).

Coke has alpha tested this product with over 10,000 customers, which met with strong success. In addition to stronger customer interaction, Coke sees meaningful operational and marketing benefits. Operationally, the Freestyle design leverages "micro-dosing" of high-concentrate cartridges versus large bags of concentrate. The cartridges are smaller, and thus easier and less costly to transport and store, and are easier to install.

Coke leveraged RFID to help with several aspects of the unit operations, including shipping, unit refill, safety and usage. At manufacture, each cartridge of concentrate is equipped with an RFID tag, which allows automated shipping confirmation, including ensuring that each box contains the correct contents and that each box is moving the correct shipping destination. Potential mis-shipments are detected and halted, thus reducing operational costs (we discuss the cost in a related article in this edition: “Reducing Mis-Shipments a

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Sizable RFID Opportunity”). Once at the store, and staff is notified of a refill need, a new cartridge is acquired from inventory. The RFID tag on the cartridge serves as the unlocking mechanism for the machine door. Each unit contains over 30 cartridges, and a light notes which cartridge needs to be replaced. Once inserted, the cartridge is verified to be authentic (i.e., confirming it is a legitimate Coke product and not counterfeit), and verified to be in the correct slot. If a cartridge is inserted incorrectly, the machine will not work, and a correction must be made. This process ensures quality of delivery to the consumer. Coke also indicated that the RFID system can be used for product recall as necessary, and can even be used to remotely disable a machine with a recalled cartridge.

As product is dispensed, the RFID reader within the unit rewrite to each tag the respective consumption levels. Once per day, the data is re-read from the tags and a summary report is wirelessly sent to Coca-Cola's SAP system to update used quantities. Given Coke understands item level shipping to each location, the specific cartridges inserted into each machine and consumption of those cartridges, it is developing significant business intelligence on customer order patterns. This would include testing consumption during key product times and the ability to test new drink concepts real-time. Coke indicated one alpha test found that Caffeine Free Diet Coke, which is typically not a top 10 product for Coke, and therefore not traditionally offered at this particular test restaurant, was the No. 1 selling drink in the afternoon. This type of information, and the ability to deliver product, is clearly a driver of incremental revenue and in our view represents a huge value proposition for RFID as a tool.

In addition, this system enables Coke to help customers manage their cartridge inventory more effectively and offer information on what products to reorder, thus helping customers reduce working capital and improve inventory management. Customers can access 10 rolling days of demand through a web-based interface into Coke's SAP system.

As a next step for Coke, the Freestyle unit will begin beta pilot in Atlanta and Southern California, with roughly 50-70 units. Coke has indicated that the commercial launch timetable will be driven by these

pilots. Our expectation is that a 60-90 day beta pilot will be conducted with limited rollouts perhaps beginning in the fall. We expect the initial rollout to be limited to North America. We see this as a significant opportunity given Coke has indicated it has over 800,000 dispensers in the field globally today. Coke indicated the specifics of the RFID set up are a proprietary trade secret, and therefore, will not share any information on the technology. We assume one or two readers (module) are likely used per machine, with multiple antennas, we would expect this equipment to be rolled out over a 5-7 year time frame. We initially assumed this was an HF set-up, but given that the system helps with shipping verification for the cartridges, we see a combination far-field/near-field UHF as also a possibility.

Coke's system reminds us of solutions developed by Terso for inventory management with life sciences products and Alliance for inventory management at retail. Terso's solution leverages RFID to tag products contained within a refrigerated storage cabinet that are provided to testing labs on a consigned inventory basis. The RFID system helps to understand who gained access to the cabinet as an RFID enabled employee badge unlocks the door, and each time the door is closed, an internal reader takes inventory of the cabinet. This improves inventory flow and accountability as well as billing accuracy and timeliness.

The Alliance system tags individual DVD's and RFID readers on various displays take sample readings several times per day, allowing insight as to which DVD's have been removed from the display. One key feature is that the updates are sent to a host system on a wireless basis, like the Coke system. This removes a major obstacle to implementing at customer sites as there is no need to interface RFID equipment with the clients' network. This virtually eliminates having the need for a client's IT department to get involved, except for receiving data from a host system, which is a relatively common occurrence. We expect this wireless approach will be a significant trend in implementing RFID based solutions.

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**Apparel – Distribution Center Efficiency.** Serge Blanco, a European apparel retailer with 360 stores, is leveraging RFID to improve its supply chain operating efficiency. The company originally considered increasing its Toulouse distribution center size and adding additional docks, but instead looked at improving efficiency for the 1.5M items that flow through its supply chain each year, and elected to use a Gen 2 based RFID solution. The solution was deployed in early 2009.

Historically, each incoming box from suppliers was opened to confirm contents at receipt; however, now each box is sent through an RFID tunnel scanner. This process enabled reading the contents of a box and comparing it to planned receipts in several seconds versus the previous process of physical inspection which consumed several minutes. We understand it took roughly 1.5 hours to receive on pallet using bar codes, but with RFID, the process time is reduced to three minutes. Receiving accuracy with RFID is reported to be 99.99%. As a result, the historical system required 10 workers to manage the receipt of 25,000 items. With the RFID system, two workers can manage a large shipment of 35,000 items. Tags are created from one of five RFID printer/encoders at Serge Blanco, which are sent to the supplier to be affixed to the existing item labels. The labeling process is largely unchanged as Serge Blanco has historically printed its own bar code labels and sent them to its 20 suppliers.

At shipment from the distribution center, each item placed into the box is read at one of five fixed “RFID control station” and compared to a shipping list, thus improving shipping accuracy through automated package validation. As a result of the increased automation, we understand the overall logistics process is now 10 times faster with respect to monitoring time for the receipt and shipping processes, and has resulted in a 40%-50% increase in distribution center capacity, which helped avoid a significant capital deployment to enlarge the facility. Serge Blanco expects to roll RFID receiving, inventory and point of sale systems to each of its 360 stores beginning in 2Q10. TAGSYS provided the complete “RFID for Fashion” solution, including tags, readers and its e-connectware platform, which filters data and delivers it to the correct application systems.

**Manufacturing – Automated Goods Transfer.** Artilux produces home lighting products for the European market and is using RFID to reduce warehouse mistakes and improve efficiency. The company produces 6M products annually and uses 25,000 pallets for product shipping. Beginning early this year, the company implemented an initial phase of RFID by tagging each pallet with a Gen 2 tag at the quality control process. Readers were installed between the production process and warehousing, which now automatically enables the transfer to be captured in the company’s Navision ERP System. This reduces manual labor and increases throughput. Further, business logic prevents pallet transfers to incorrect areas. In addition, quality control personnel are able to more rapidly identify pallets through the use of handheld scanners. Artilux has begun a phase two project to install RFID readers on its loading docks. Autepra provided the system integration, and CAEN readers were used.

**Retail – Dairy Queen’s Loyalty Program.** Dairy Queen is leveraging a multi-vendor, RFID based solution to conduct targeted marketing campaigns and track customer loyalty using customer mobile phones. Dairy Queen provides HF RFID tags to customers who sign up for the mobile loyalty program. These tags are placed on the customers’ mobile phone, which provides an easy and reliable form of customer identification during store transactions, and allows targeted customer promotions to be sent via text message. A reporting system, including a summary of all transactions as well as analytics is delivered through a web-based interface. The overall solution was developed by Tetherball, a provider of mobile marketing offerings. ViVOtech provided the equipment, while Mobiquitous provided the reporting and analytics. Dairy Queen is averaging about 900 loyalty members per store for stores implemented. Dairy Queen has over 5,600 stores worldwide.

## Active Applications – Healthcare Focus

University Hospital, part of the State University of New York (SUNY) Upstate Medical University, has implemented an RTLS solution for multiple applications. The 366 bed facility is tracking traditional equipment such as IV infusion pumps, wheel chairs and beds in an effort to improve asset utilization. In addition, the hospital implemented

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RTLS for key assets in its 16 operating rooms (OR). Assets such as specialized beds, bladder scanners and diagnostic equipment are shared among the various Ors, and historically, personnel were required to manually search for this equipment, which could be time consuming as the ORs are on different floors. The hospital reports that the implementation of the system has lead to faster retrieval times. In addition, the hospital also implemented temperature monitoring tags in pharmacy and nursing unit refrigerators to comply with regulatory requirements. Previously this data was collected manually by nurses. Aeroscout supplied the RTLS system, which interfaced with the existing 802.11 network.

The Protestant Konigin Elisabeth Herzeberge (KEH) Hospital and Friedrich von Bodelschwingh Clinic in Berlin have implemented an active system to improve staff safety. Each staff member will be equipped with a badge that provides real-time location of the person in the hospital, and offers a pull cord feature on the badge to signal an emergency. The alerts are sent to both a central security system and to employees that have a text pager equipped on their tags. Ekahau supplied its T301BD tags and location system, which is capable of interfacing with the existing Cisco 802.11 network. Globits provided the system integration.

Ekahau will also provide its RLTS solution to the University of Kentucky Albert B. Chandler Hospital in Lexington, KY to track infusion pumps, wheeled beds and wheel chairs. In total, 2,600 tags will initially be deployed in the 500 bed facility, with expectations for additional deployments with new facilities. The University of Kentucky hospital is part of the University HealthSystems Consortium, which identified Ekahau and Aeroscout as preferred providers of RTLS systems for its 294 member hospitals.

## Partnerships

IBM and FXA Group announced they are working closely with the Vietnam Association of Seafood Exporters and Producers (VASEP) and the Vietnamese State Agency for Technological Innovation (SATI) to develop a system of tracking seafood from origin to its end markets. Selected Vietnamese farms will participate in the test program, tracing

food from farm to processing to through the supply chain to arrival at its international destination in Japan, the U.S. or Europe. IBM's InfoSphere Traceability Server software, which is EPCIS compliant, will provide the means to share data among trading partners, such as current location, location history and sensor data, such as temperature. FXA's OpsSmart is a food traceability application, which can be used in conjunction with several automated data capture technologies, including bar code and RFID. Vietnam sees an opportunity to boost its seafood quality and prestige in world markets as a result of this program. Given the large numbers of food recalls, we continue to expect data trace solutions will gain more traction.

RF Code announced the integration of its Sensor Manager with the Avocent MergePoint Infrastructure Explorer (AMIE). The Sensor Manager collects data from temperature and humidity sensors, and RF Code's *Connector for Infrastructure Manager* module transmits the data. AMIE provides a platform for IT managers to view optimize data center heating, cooling, power, and space requirements. AMIE also provides data center modeling capabilities to view the impacts of layout and change proposals.

Omni-ID and Convergence Systems Limited (CSL) have announced a global distribution agreement. CSL will market Omni-ID passive UHF tags through its system integrators, of which many are in Asia. CSL will also offer a starter solution bundle including its CS101 handheld reader, asset tracking software, and Omni-ID UHF tags.

RFID Global Solution and Ubisense announced a partnership providing RTLS applications. The partnership combines RFID Global Solution's Visi-Trac™ real-time asset visibility with Ubisense locating technology, and applications will be targeted towards the defense and industrial markets.

The Russian Corporation of Nanotechnologies (Rusnano) and Galileo Vacuum Systems have established a joint RFID tag business. The business will be based in Russia and include production facilities in Russia, Italy, and Serbia. Manufacturing will involve selective metallization nanotechnology designed to coat any flexible metallic surface. The total cost of the project is 43M euros.

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Innovision Research and Technology plc and NXP Semiconductors announced a joint near field communication marketing and technology licensing agreement. The deal joins Innovision IP and NXP's firmware, software, and secure elements including SmartMX. The agreement will expand Innovision's market to include NFC capabilities, including payments.

Sirit and *eriginate* announced a partnership to provide cattle traceability to the livestock food industry. *eriginate's eTattoo* system incorporates a Sirit UHF inlay embedded into a livestock ear tag and Sirit's *IDentity* 5100 reader. The two companies have been field testing the tag/reader combination for 18 months, and systems are currently being implemented in the US, Brazil, and Taiwan.

Fleetmind Solutions and Alien announced a partnership to offer real-time solutions for waste and recycling firms. Gen2 Alien circuits will be integrated with FleetMind's operations to provide visibility to customer activity and service accuracy. The tags will also identify carts that have been moved or stolen. Fleetmind expects the integration will reduce service complaints and related disagreements.

AeroScout announced a wireless healthcare temperature monitoring solution distribution agreement with Comstar. AeroScout's monitoring solution uses Wi-Fi Tags with on-board temperature sensors, and offers healthcare organizations a packaged monitoring solution for improving patient safety and regulatory compliance. The solution integrates Cisco's Unified Wireless Network and Mobility Services Engine with AeroScout's MobileView software. The system leverages clients' existing Wi-Fi networks.

TagStone has formed an alliance partnership with IDENTIC SOLUTIONS, focused on providing active RFID applications in the oil & gas industry. TagStone, a Middle East solution integrator, will use IDENTIC technologies primarily in the Gulf Cooperation Council countries. The two companies have been jointly working on several asset management and people safety projects.

FileTrail announced a partnership with BookFactory to provide a scientific notebook with RFID traceability. FileTrail is introducing its RFID technology and browser-based tracking capability to BookFactory's custom scientific notebooks, allowing users to locate notebooks & track transfer between individuals in a laboratory.

GuardRFID has partnered with Dynamic RFID to provide its active RFID technology. GuardRFID produces infant protection, patient protection, and asset tracking solutions. GuardRFID's *TotGuard* Infant Security System uses small, disposable active infant tags, eliminating the need to clean/disinfect while removing the risk of cross-infection.

TagStone signed an alliance partnership with noFilis, maker of the CrossTalk software platform. The distribution agreement will include solutions in supply chain, asset management, logistics, and retail applications. TagStone, with offices in UAE and Kuwait, primarily provides wireless solutions to the Gulf region.

PingPing and Touchatag™, an Alcatel-Lucent venture, have partnered to develop an open model to encourage new applications for contactless cards and mobile payment technology. With an open model, innovators can develop new applications that will expand the capabilities of the electronic wallet. With a single RFID sticker, consumers will be able to access new services, add loyalty services, pay for services and receive information. Both parties will also support NFC cell phone development.

RF Surgical and Medline have announced a new, non-exclusive distribution agreement following a legal dispute. The RF Surgical Detection Systems scan for and signal an alert if any RFID-tagged sponges, gauze, or towels remain in a patient prior to surgical closing procedures. Under the new agreement, Medline will continue to provide the Detection System to health care providers in the US and Canada, and will expand to include distribution in Australia and New Zealand.

# RFID Briefs

Socket Mobile and Optimus EMR have partnered to combine the Socket SoMo 650Rx handheld computer and Optimus EMR software for a patient care solution. The 650 Rx computer has built-in Bluetooth and Wi-Fi, and can be configured to read barcode and RFID data to enable more accurate patient care tracking and reduce the time required to record data.

## Corporate News

European retailer's Metro AG and Arcandor are looking at possibly combining their Kaufhof and Karstadt department store units, respectively. Arcandor filed for insolvency in early June, which could provide an opportunity for Metro to combine the operations with a low capital commitment. Metro would likely divest the combined unit with improved market conditions. Both Kaufhof and Karstadt have been piloting RFID technology in their operations. Kaufhof, which employs 25,000, has worked with Impinj, while Karstadt, which employs 23,000 is using Sensormatic.

ODIN and XIO Strategies both announced they have been approved under the U.S. General Services Administration (GSA) Schedule 81 IB for Shipping, Packaging and Packaging Supplies. The GSA approval allows both companies to bid on contracts for RFID based products and services into the Federal government. Historically, both companies have had a strong presence within the Department of Defense.

New Belgium Brewing selected Fluensee's Asset Track to help improve the visibility of its beer keg fleet. By leveraging RFID on the fill-line the brewer has gained access to information on specific keg fill rates. In the future, plans to increase the program to enable knowing current keg location, fill-to-fill cycle time and keg return rates by distributor. Today the process is done manually or with bar codes and provides limited visibility. With increased visibility, brewers can increase their asset utilization, decrease distributor losses and gain insight into shipment accuracy.

Zebra Enterprise Solutions announced the full deployment of its Airport Visualizer with Abu Dhabi Airport Services (ADAS). This report follows a pilot that began in 2008 and included 50 ground support equipment (GSE) vehicles. The full deployment will include 472 vehicles and is scheduled to be completed in March 2010. The Airport Visualizer will enable ADAS to improve asset utilization by providing visibility of GSE vehicle location and operating status. The system will also improve utilization by assisting operators to only remove a vehicle from service for refueling when necessary. Additional savings will be enabled through more efficient maintenance scheduling by using engine hours (run time) versus simply time.

The Norfolk, VA airport began accepting MasterCard's PayPass (contactless payment) solution at its parking lots, which encompasses 10 exit lanes and 7,200 total spaces. The implementation was conducted by ACS. According to MasterCard, over 55M PayPass cards have been issued and are now being accepted at over 145,000 locations on a global basis.

Enumclaw, Washington Public Library announced plans to implement Integrated Technology Groups RFID solution in the Fall of 2009 to enhance efficiency and provide security. The solution offers self-checkout, track and trace, and multimedia access, all on an automated basis, freeing the library staff of 12 to spend more time offering services. The library has 50,000 items and annual circulation of 185,000 items.

Savi announced a settlement with AeroScout regarding a lawsuit involving Savi's low frequency active RFID intellectual property. Savi had contended that AeroScout infringed on US Patent Nos. 6,542,114, 6,765,484, and 6,940,392. The patents cover Savi's low frequency wakeup technology, which is a process used to extend battery life, and to act as a choke-point. Terms of the settlement were not disclosed.

B.O.S. Better Online Solutions reported 1Q09 revenue of \$9.0M versus \$12.1M last year. The company reported a first quarter net loss of \$433k, compared to a net income of \$147k in the comparable quarter last year.

# RFID Briefs

AeroScout reported 1Q09 healthcare segment revenue growth of 150% versus 1Q08. During the quarter, the company added over 30 new hospital clients, and 40 existing clients made additional purchases. According to a January note published by research firm KLAS, AeroScout leads the healthcare industry in RTLS market share.

After winning the American Security Challenge, Hi-G-Tek was awarded a \$2M prize from Chart Venture Partners. The event invites small tech companies with products targeting homeland security problems. The event intends to connect these companies with available funding and bring them to market as commercially viable and widely available. The \$2M award is dependent on the Hi-G-Tek and Chart Venture Partners reaching a funding agreement in the upcoming months.

Digital security provider Gemalto acquired O3SIS, which provides Personal Data Management solutions to mobile network operators. The O3SIS platform allows users to move and share data records such as contact information, photos, mail, and other multimedia content on devices such as the iPhone and Blackberry.

RFID Global Solutions announced that it has joined the Dakota Defense Alliance (DDA), which are mainly defense contractors and Boeing suppliers. As part of the program, RFIDGS will provide RFID solutions and services to DDA companies and help establish a community college RFID training program.

NXP announced that the LA County Metropolitan Transportation Authority (LA Metro) will implement NCP's MIFARE plus contactless technology for its automatic fare collection infrastructure. LA Metro will be upgrading from the MIFARE classic-based system, upgrading its Transit Access Pass to include the MIFARE Plus microcontroller smart card ICs.

Data Systems International (DSI) announced the acquisition of Unibar, a provider of barcode and RFID printing software. DSI plans to use Unibar's software to expand its offering of enterprise mobility solutions. Along with traditional software solutions, Unibar also provides software-as-a-service, enabling users to print directly from the web.

Avery Dennison named R. Shawn Neville as Group Vice President, Retail Information Systems. Neville was most recently CEO and Director of Boathouse Sports, a custom team apparel manufacturer. Prior to that, he was CEO and President of Footstar's Athletic retail division and GM of Reebok's North American division.

M/A-COM has appointed Joseph Thomas to CEO. Thomas was been with the company for 35 years, and was most recently president of the firm. In April, California-based private equity firm GaAs Labs acquired MA-COM from UK-based Cobham PLC.

MARK IV IVHS has appointed Jim Currie as CFO. Currie was most recently Vice President of Finance with MDS Analytical Technologies. He had previously served as Controller, then Director of Finance with the company. Before joining MDS, he served as Controller at GEAC Computer Corporation.

RFIDJobing.com announced the introduction of its website to match RFID-skilled individuals with projects and positions requiring RFID expertise. They are focused on the RFID-specific requirements of system integrators, manufacturers, consultants and business users.

## Events

RFID Journal Live is hosting its Middle East event June 15-17 at the InterContinental Hotel Festival City in Dubai, United Arab Emirates. The event will provide Middle Eastern companies with an increased understanding of RFID, including solutions can be used in their operations. They will also have the opportunity to meet hardware, software and service vendors that can help them deploy a successful solution. The conference program will focus on how all types of RFID technologies—active, Wi-Fi, passive UHF, passive HF and more—can be used to improve operations in construction, oil and gas, and logistics. To learn more, please visit <http://www.rfidjournalevents.com/middleeast/>.

# Table of Key RFID Providers

| Company Name               | Ticker  | Semir-Conductors | Inlays/Tags | Readers | Printers / Encoders | Networking | Software | Integration/ Services |
|----------------------------|---------|------------------|-------------|---------|---------------------|------------|----------|-----------------------|
| 3M Company                 | MMM     |                  | X           | X       |                     |            | X        | X                     |
| AbeTech                    | Private |                  |             |         |                     |            |          | X                     |
| Accenture                  | ACN     |                  |             |         |                     |            |          | X                     |
| Acsis                      | Private |                  |             |         |                     | X          | X        |                       |
| Aeroscout                  | Private |                  | X           | X       |                     | X          | X        |                       |
| Alien                      | Private | X                | X           | X       |                     |            |          | X                     |
| Ambient ID                 | Private |                  |             |         |                     |            |          | X                     |
| AssetPulse                 | Private |                  |             |         |                     | X          | X        |                       |
| Atmel                      | ATML    | X                |             |         |                     |            |          |                       |
| austriamicrosystems        | Private | X                |             |         |                     |            |          |                       |
| Avery Dennison             | AVY     |                  | X           |         | X                   |            |          |                       |
| AWID                       | Private |                  |             | X       |                     |            |          |                       |
| Access                     | AXSI    |                  | X           | X       |                     | X          |          |                       |
| Bentonville Int'l Group    | Private |                  |             |         |                     | X          | X        |                       |
| BlueStar                   | Private |                  |             |         |                     |            |          | X                     |
| Blue Vector                | Private |                  |             |         | X                   | X          | X        |                       |
| BOS                        | BOSC    |                  |             |         |                     |            |          | X                     |
| BT Global Services         | BT      |                  |             |         |                     | X          | X        |                       |
| Checkpoint Systems         | CKP     |                  | X           | X       |                     | X          |          |                       |
| CIM Bar Code               | Private |                  |             |         |                     |            |          | X                     |
| Cisco                      | CSCO    |                  |             |         | X                   |            |          |                       |
| Computer Sciences Corp.    | CSC     |                  |             |         |                     |            |          | X                     |
| Confidex                   | Private |                  | X           |         |                     |            |          |                       |
| Danaher (Accu-Sort)        | DHR     |                  |             |         |                     |            |          | X                     |
| Datalogic                  | DAL     |                  | X           | X       |                     |            |          |                       |
| Dover (Datamax)            | DOV     |                  |             |         | X                   |            |          |                       |
| Digital Angel              | DOC     |                  | X           | X       |                     |            |          |                       |
| Domino-ISG                 | Private |                  |             |         |                     |            |          | X                     |
| Ekahau                     | Private |                  | X           | X       |                     | X          | X        |                       |
| EM Microelectronic Marin   | UHR.DE  | X                |             |         |                     |            |          |                       |
| Entigral Systems*          | Private |                  |             |         |                     | X          | X        |                       |
| Feig Electronic            | Private |                  | X           | X       |                     |            |          |                       |
| Fluensee                   | Private |                  |             |         |                     | X          | X        |                       |
| General Electric (Agility) | GE      |                  |             |         |                     | X          | X        |                       |
| George Schmitt & Co.       | Private |                  | X           |         | X                   |            |          |                       |
| Globe Ranger               | Private |                  |             |         |                     | X          | X        |                       |
| Goliath Solutions          | Private |                  | X           | X       |                     |            |          |                       |
| Hewlett-Packard            | HPQ     |                  |             |         |                     |            |          | X                     |
| ASSA-ABLOY (HID)           | ASSA    |                  | X           | X       |                     |            |          |                       |
| HK Systems                 | Private |                  |             |         |                     |            |          | X                     |
| IBM                        | IBM     |                  |             |         |                     | X          | X        |                       |
| ID Systems                 | IDSY    |                  | X           | X       |                     | X          |          |                       |
| Identec Solutions          | Private |                  | X           | X       |                     | X          | X        |                       |
| Impinj Inc.                | Private | X                |             | X       |                     |            |          |                       |
| Infineon                   | IFX     | X                |             |         |                     |            |          |                       |
| Intelleflex                | Private | X                | X           | X       |                     |            |          |                       |
| Intermec                   | IN      |                  | X           | X       | X                   |            |          | X                     |
| IPICO                      | RFD.TSX | X                | X           | X       |                     |            |          |                       |
| Lexmark                    | LXK     |                  |             |         | X                   |            |          |                       |
| Lowry Computer             | Private |                  | X           |         | X                   |            | X        | X                     |
| Kennedy Group              | Private |                  | X           |         | X                   |            | X        | X                     |
| Magellan Technology        | Private |                  | X           | X       |                     | X          |          |                       |
| MARKEM                     | Private |                  | X           |         |                     |            |          | X                     |
| MIKOH                      | MIK.ASX |                  | X           |         |                     |            |          | X                     |
| Miles Technologies         | Private |                  |             |         |                     |            |          | X                     |

  

| Company Name            | Ticker   | Semir-Conductors | Straps / Inlays / Tags | Readers | Printers / Encoders | Networking | Software | Integrat |
|-------------------------|----------|------------------|------------------------|---------|---------------------|------------|----------|----------|
| Mojix                   | Private  |                  |                        |         |                     |            |          | X        |
| Moore Wallace           | RHD      |                  | X                      |         |                     |            |          |          |
| Motorola (Symbol)       | MOT      |                  |                        | X       |                     |            |          | X        |
| Nashua                  | NSHA     |                  | X                      |         |                     |            |          |          |
| noFilis                 | Private  |                  |                        |         | X                   | X          |          |          |
| NXP                     | NXP      | X                |                        |         |                     |            |          |          |
| Odin                    | Private  |                  |                        |         |                     |            |          | X        |
| Omni - ID               | Private  |                  | X                      |         |                     |            |          | X        |
| Omnitrol                | Private  |                  |                        |         | X                   | X          |          |          |
| Omron Corporation       | OMRNF.PK |                  | X                      | X       |                     |            |          |          |
| Oracle                  | ORCL     |                  |                        |         | X                   | X          | X        | X        |
| PINC                    | Private  |                  | X                      | X       |                     |            | X        | X        |
| Power ID                | Private  | X                | X                      |         |                     |            |          | X        |
| Precision Dynamics      | Private  |                  | X                      | X       |                     |            |          |          |
| Printronic              | Private  |                  |                        |         | X                   |            |          |          |
| Red Prairie             | Private  |                  |                        |         |                     | X          | X        | X        |
| Reva Systems            | Private  |                  |                        |         | X                   |            |          |          |
| RF Code                 | Private  |                  | X                      | X       |                     |            | X        |          |
| RF Technologies         | Private  |                  | X                      | X       |                     |            | X        |          |
| RFID Global Solution    | Private  |                  |                        |         |                     |            | X        | X        |
| Rush Tracking Systems   | Private  |                  |                        |         |                     |            |          | X        |
| S3 Edge                 | Private  |                  |                        |         |                     |            | X        |          |
| SAP                     | SAP      |                  |                        |         |                     |            | X        | X        |
| Sato                    | Japan    |                  | X                      |         | X                   |            |          |          |
| SAVR Communications     | Private  |                  | X                      |         |                     |            |          |          |
| Lockheed (Savi)         | LMT      |                  | X                      | X       |                     | X          | X        | X        |
| ScanSource Inc.         | SCSC     |                  |                        |         |                     |            |          | X        |
| Sealed Air              | SEE      |                  | X                      | X       |                     |            | X        | X        |
| Seeonic                 | Private  |                  |                        |         | X                   | X          | X        | X        |
| Siemens                 | SI       |                  | X                      | X       |                     | X          |          | X        |
| Sirit                   | SI.TSX   |                  | X                      | X       |                     |            | X        | X        |
| SkyeTek                 | Private  |                  |                        | X       |                     |            |          |          |
| Sovereign Tracking Sys. | Private  |                  | X                      | X       |                     |            | X        | X        |
| STMicroelectronics      | STM      | X                | X                      |         |                     |            |          |          |
| Stratum Global          | Private  |                  |                        |         |                     |            | X        | X        |
| Tagsys                  | Private  |                  | X                      | X       |                     |            | X        | X        |
| Texas Instruments       | TXN      | X                | X                      |         |                     |            |          |          |
| ThingMagic              | Private  |                  |                        | X       |                     |            |          |          |
| Toppan Printing         | 7911     |                  | X                      | X       | X                   |            |          |          |
| Toshiba TEC             | Japan    |                  | X                      |         | X                   |            |          |          |
| Roper (TransCore)       | ROP      |                  | X                      | X       |                     |            |          | X        |
| TrenStar Inc.           | Private  |                  |                        |         |                     |            |          | X        |
| Tyco (Sensomatic/Vue)   | TYC      |                  | X                      | X       |                     |            | X        | X        |
| Unitech                 | Private  |                  |                        | X       |                     |            |          |          |
| UPM Raflatac            | UPM      |                  | X                      |         |                     |            |          |          |
| Venture Research, Inc   | Private  |                  |                        |         | X                   |            | X        | X        |
| Verichip                | CHIP     | X                | X                      |         |                     |            |          |          |
| Verisign                | VRSN     |                  |                        |         | X                   | X          | X        | X        |
| Vuance LTD              | VUNC     |                  | X                      | X       |                     |            | X        | X        |
| Vue Technology          | TYC      |                  |                        |         |                     |            | X        | X        |
| Wavetrend               | Private  |                  | X                      | X       |                     |            | X        | X        |
| WJ Communications       | WJCI     |                  |                        | X       |                     |            |          |          |
| Xterprise               | Private  |                  |                        |         |                     |            | X        | X        |
| Zebra Technologies      | ZBRA     |                  | X                      | X       | X                   |            | X        | X        |

Source: Company Information and Robert W. Baird & Co.

# Glossary of RFID Terms

**Active RFID Tag** – The tag has an internal power source (i.e., a battery), which allows for significantly longer read ranges. Primarily used to track large, high-value assets such as intermodal shipping containers. Active tags are significantly larger and more expensive (\$25-\$250 per unit) than passive tags.

**Air Interface** – The communication protocol between the tag and reader. Passive tags at UHF are standardized around the Generation 2 protocol; HF is seeking a similar standard. Some active tags are increasingly communicating with standardized Wi-Fi networks (IEEE 802.11x), however, active continues to see several proprietary air interface protocols.

**Antenna** – Attached to chips on tags and an integral part of a reader; antennas are devices that send and receive radio frequency (electromagnetic) energy.

**Anti-Collision** – A component of the air-interface protocol that prevents tag data from multiple tags in the read area from interfering (colliding) with each other. Also prevents multiple readers in close proximity from interfering with each other. This is a key component to the Generation 2 standard.

**Battery Assisted Passive (also semi-passive)** – Passive tags that offer a small battery to boost signal strength, or improve tag sensor capability. The battery generally goes into sleep mode until required. Referred to as Class 3 products; a standard is expected in early 2008.

**Class 0** – Class 0 refers to a proprietary air interface protocol for passive UHF tags. Class 0 is read only, while a subsequent protocol, Class 0 Plus, offers read/write capability. This protocol is largely obsolete with Gen 2.

**Class 1** – Class 1 refers to a proprietary air interface protocol for passive UHF tags. Class 1 offers read/write capability. Class This protocol is largely obsolete with Gen 2.

**Closed Loop Solution** – Set of readers and tags intended for a particular application having specific, well defined start and end point. Generally seen in tracking work in process or reverse logistics operations.

**DoD Mandate** – A mandate to all 43,000+ DoD suppliers, announced in June of 2003, to employ RFID. The DoD issued a timetable specifying when RFID will be required (by products into specified DoD depots). The timetable has been somewhat fluid given DoD budget dollars are focused on existing operations in Iraq and Afghanistan.

**Dual Di-Pole** – A tag that essentially has two antennas, reducing the sensitivity to orientation and increasing read capability.

**Electronic Product Codes (EPC)** – The code that resides on an RFID tag that is unique to each product. The code contains manufacturer and product information as well as an individualized serial number. EPCs are maintained by EPCglobal.

**Encode and Apply** – A step up from “Slap and Ship,” where labels are encoded and applied on a more automated basis. Slightly more capital intensive, but more operationally efficient than slap and ship.

**Encoder** – Device that transmits and writes data on to an RFID tag. Used extensively in printers and label applicators for product shipments. Encoders are generally RFID reader modules developed for a printing or other encoding application.

**Environmental Factors** – Typically discussed with respect to UHF products, which can be affected by many factors including the presence of metal, liquids, significant reader activity, other RF “noise,” etc. These factors require process controls in terms of tag and reader placement. Readers also need proper adjustment for a given environment.

**EPC Global** – The body responsible for RFID standards creation; formed originally as a joint venture between the Uniform Code Council (UCC) and the Electronic Article Numbering Association (EAN). EPC Global is responsible for RFID standards development and for promoting vertical RFID solution development.

**EPC Network** – Developed by the Auto-ID center, this Internet-based system allows supply chain participants to retrieve data associated with an EPC through the Internet. The network remains in an emerging phase, and is administered by EPC Global.

**Fluidic Self Assembly (FSA)** – A proprietary process developed to rapidly attach chips to straps. The process uses a fluid bath to place small chips on a substrate for strap attachment. This process continues to be developed.

**Generation 2** – The RFID air interface standard for supply chain shipments using UHF. The Gen 2 standard was approved in December 2004 by EPC Global, and has since received international approval by ISO as 18000-6C. EPCglobal is working to create a similar standard for HF.

**High Frequency (HF) RFID** – RFID products that use the 13.56MHz band, which is not regulated by any government. This frequency generally allows read ranges of 4-8 feet, and is not affected by environmental factors such as liquid due to magnetic coupling. The existing ISO 15963 standard is different from the Gen 2 protocol. We expect a new EPC-based standard by the end of 2007. HF has historically been used in contactless payment and item level tracking applications.

**Hybrid (semi-active) RFID Tag** – Tag that incorporates a smaller internal power supply, which is triggered by reader action. After interrogation, the tag resumes a passive stance.

# Glossary of RFID Terms

**ISO** – International Organization for Standardization is a network of the national standards institutes of 148 countries, on the basis of one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. ISO is not government affiliated. EPC Global is an ISO member and has received ISO approval for the Generation 2 standard.

**Kill Command** – A code within the RFID tag that once activated will permanently disable the tag. Intended to limit consumer tracking after purchase for privacy protection.

**Low Frequency (LF) RFID** – RFID products that use the 125Kz band. Products that use this frequency are generally smaller and cheaper as read ranges are short, typically less than 12 inches. Security access and control and contactless payment are typical applications.

**Mandate Requirements** – Primarily refers to an edict put in place by retailers, most notably Metro, Wal-Mart and the DoD, requiring that certain types of shipments (mostly deliveries at the case and pallet level) use RFID for tracking purposes. The Metro mandate is the only one that imposes a charge for non-compliance.

**Metro Mandate** – German based retailer that is piloting Gen 2 based RFID at 229 German based stores. Suppliers are required to tag all pallets by October 1, 2007 or face a charge of approximately 2 euros per pallet. Case level tagging is expected in 2008. Metro, the worlds 5<sup>th</sup> largest retailer, operates roughly 2,400 stores in Europe and Asia.

**Middleware** – A specific class of software that offers several levels of functionality. Middleware acts as a data filter, eliminating duplicate reads so that the host system maintains accurate records and is not inundated with excessive data. Middleware also ensures that the RFID data formatting “maps up” with the host system data structure.

**Optional User Memory** – Additional bits memory available on a tag that can be used by any member of the supply chain as they see fit (i.e., routing information). Intended to allow for increased tracking efficiency.

**Parallel Integrated Chip Assembly (PICA)** – A proprietary process developed by Symbol (Motorola) to rapidly assemble chips to tags. The process uses small punches to extract a chip from the wafer and attach the chip to the tag antenna using a single motion. The process remains in test stages, and Motorola no longer produces tags.

**Passive RFID Tag** – A tag that receives its power supply from the reader upon interrogation. Used primarily in supply chain applications, these tags tend to be small in size and relatively inexpensive compared to active tags.

**Pilots** – Testing done by companies seeking RFID solutions, primarily for supply chain applications. Consumer product companies under mandate requirements are seeking ways to increase the value add to themselves in addition to meeting mandate compliance, which requires evaluation of equipment and internal business processes.

**Portal** – A door or other point in a facility surrounded by fixed RFID readers to identify and track the flow of product. Dock doors are a typical example.

**Reader** – Also known as an interrogator. Typically a network-based device and antenna configuration, which reads the information contained on an RFID tag. In passive operations, the reader supplies the tag with power. Readers can be fixed position for dock door or other portal applications, or embedded into mobile computing devices for in store or exception reporting requirements.

**Rollout** – When pilots provide sufficient evidence of a strong return on investment, companies are expected to deploy (rollout) the technology into greater parts of their internal operations or external supply chain partners. This process is expected to result in significant growth for the RFID industry.

**Slap and Ship** – Refers to placing an RFID tagged bar code label on products immediately before shipment. The process is typically done on an exception basis for products requiring compliance labeling. Slap and Ship is not labor efficient and allows virtually no incremental value add to the supplier; however, the up-front capital investment is small.

**Strap** – Component of a tag or inlay that connects the microchip to the antenna. The purpose of the strap is largely to make the manufacturing process of antenna attachment easier and faster.

**Tag** – Also referred to as transponder or transponder tag, which is typically affixed to an item for tracking purposes. Composed of a semi-conductor chip and antenna held together in a substrate. Each tag has a manufacturer installed unique identification number as well as additional few bits to many kilobits of incremental memory. Passive tags receive energy from the reader, while active tags have an internal power supply.

**UID** – Unique Identification is a DoD based numbering scheme to identify a broad range of high-value assets. RFID is not necessarily required, but is preferred in many UID applications. UID applications typically require more than 256 bits of memory.

# Glossary of RFID Terms

**Ultra High Frequency (UHF) RFID** – RFID products that use the 868MHz to 950MHz frequency band, which is regulated by governments. This frequency allows read ranges of 8-30 feet (2x-4x of HF), but can be heavily affected by environmental factors, including liquids and metals.

**Wal-Mart Mandate** – Wal-Mart mandated that its top 600 suppliers ship products with Gen 2 RFID tags identifying each pallet and case to up to 1,400 stores by the end of 2007. As part of this program, Wal-Mart continues to conduct pilots to determine ROI.

**Write Once Read Many (WORM)** – Used to describe an RFID tag that allows only one set of data to be written on to it. Typically used in applications where security is a concern.

## Appendix – Important Disclosures and Analyst Certification

Robert W. Baird & Co. and/or its affiliates expect to receive or intend to seek investment-banking related compensation from the company or companies mentioned in this report within the next three months.

**Investment Ratings: Outperform (O)** - Expected to outperform on a total return, risk-adjusted basis the broader U.S. equity market over the next 12 months. **Neutral (N)** - Expected to perform in line with the broader U.S. equity market over the next 12 months. **Underperform (U)** - Expected to underperform on a total return, risk-adjusted basis the broader U.S. equity market over the next 12 months.

**Risk Ratings: L - Lower Risk** - Higher-quality companies for investors seeking capital appreciation or income with an emphasis on safety. Company characteristics may include: stable earnings, conservative balance sheets, and an established history of revenue and earnings. **A - Average Risk** - Growth situations for investors seeking capital appreciation with an emphasis on safety. Company characteristics may include: moderate volatility, modest balance-sheet leverage, and stable patterns of revenue and earnings. **H - Higher Risk** - Higher-growth situations appropriate for investors seeking capital appreciation with the acceptance of risk. Company characteristics may include: higher balance-sheet leverage, dynamic business environments, and higher levels of earnings and price volatility. **S - Speculative Risk** - High-growth situations appropriate only for investors willing to accept a high degree of volatility and risk. Company characteristics may include: unpredictable earnings, small capitalization, aggressive growth strategies, rapidly changing market dynamics, high leverage, extreme price volatility and unknown competitive challenges.

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