

# RFID JOURNAL

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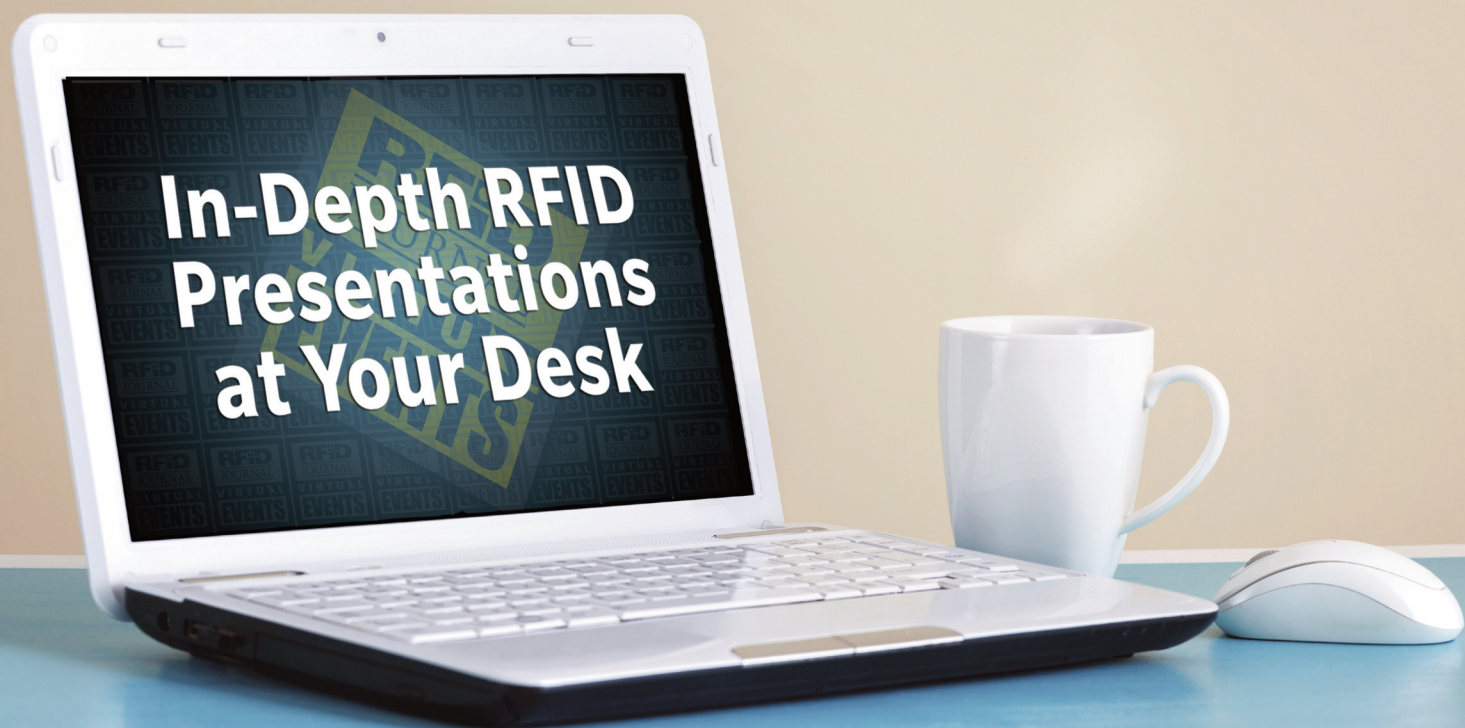
March/April 2016

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Utility Companies Adopt RFID To Reduce Costs,  
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- **PRODUCT DEVELOPMENTS**  
Solutions For Automotive, Health Care And  
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# RFID Risk vs Reward

## Why The Equation Is Changing

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JULY 19 RFID IN HEALTH CARE

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Alan McIntosh: Senior Director of Sales, [amcintosh@rfidjournal.com](mailto:amcintosh@rfidjournal.com) | (212) 584-9400 ext. 4

Matthew Singer: Senior Director of Sales, [msinger@rfidjournal.com](mailto:msinger@rfidjournal.com) | (212) 584-9400 ext. 6



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## EDITORIAL

Mark Roberti, Editor  
mroberti@rfidjournal.com

Andrea Linne, Executive Editor/Magazine  
alinne@rfidjournal.com

Paul Prince, Executive Editor/News  
pprince@rfidjournal.com

John Hull, Creative Director  
jhull@rfidjournal.com

Rich Handley, Managing Editor  
rhandley@rfidjournal.com

Claire Swedberg, Senior Editor  
cswedberg@rfidjournal.com

Sam Greengard, Contributing Writer  
sam@greengard.com

Bob Violino, Contributing Writer  
bviolino@optonline.net

Jennifer Zaino, Contributing Writer  
jennyzaino@optonline.net

Edson Perin, Brasil Editor  
eperin@rfidjournal.com

Beth Bachelder, Senior Editor  
bbachelder@rfidjournal.com

Rhea Wessel, Contributing Writer/Europe  
rwessel@rfidjournal.com

## INTERNET OF THINGS JOURNAL

Mary Catherine O'Connor, Editor  
mc@iotjournal.com

## RFID JOURNAL EVENTS

Kimberly A. Ray, VP of Events  
kray@rfidjournal.com

Cheryl Johnson  
Senior Director of Events Management  
cjohnson@rfidjournal.com

Debbie Hughes  
Senior Editorial Director of Events  
dhughes@rfidjournal.com

Deborah Lambert  
Editorial Coordinator of Events  
dlambert@rfidjournal.com

## SALES

Alan McIntosh, Senior Director of Sales  
amcintosh@rfidjournal.com

Matt Singer, Senior Director of Sales  
msinger@rfidjournal.com

## SUBSCRIPTIONS

subscriptions@rfidjournal.com

## ARTICLE REPRINTS

customerservice@rfidjournal.com

## RFID JOURNAL LLC

Editorial office:  
PO Box 5874  
Hauppauge, NY 11788

Mark Roberti, Chief Executive  
mroberti@rfidjournal.com

Kathleen Knocker, Director of Finance  
kknocker@rfidjournal.com

Sonja Valenta, VP of Marketing  
svalenta@rfidjournal.com

Quedah Locket, Marketing Coordinator  
qlocket@rfidjournal.com

Lydia Sum, Administrative Assistant  
lsum@rfidjournal.com

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The Sensor Tadpole tag helps automobile manufacturers ensure their vehicles are watertight; VueTrack-UDI enables medical device manufacturers to comply with the FDA's identification mandate and achieve internal benefits; Clarity 3.X software lets retailers manage enterprisewide inventory processes more effectively. *By Bob Violino*

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## Fast Followers, It's Time



**R**FID Journal has always been careful not to oversell radio frequency identification and not to scare end users into deploying the technology. Many trade publications push the hype in order to get more subscriptions, sell more ads and make more money. I like to make money, of course, but I began RFID Journal with an eye on the technology's long-term prospects—and with a commitment to serve end users by honestly presenting the benefits RFID can deliver, as well as the deployment challenges.

Is now the time to adopt RFID? I still believe adoption is a decision each business must make on its own. If you are in the middle of upgrading or replacing your enterprise resource planning software, for instance, then maybe not. But I think—and this issue's cover story supports my belief—that the technology has reached a point at which a well-executed deployment can deliver a great deal of value without a lot of risk (see [Listen Up, Laggards!](#)).

In some cases, the risk is in *not* adopting RFID. Bill Hardgrave, dean of Auburn University's Harbert College of Business and founder of the RFID Lab, wrote in a recent column: "I firmly believe retailers must adapt to an omnichannel world or they will not survive." And, he added, you cannot do omnichannel retailing without the visibility RFID provides.

RFID has become a corporate priority for some retailers, such as Macy's and Marks & Spencer, as well as for some aerospace and aviation companies (Airbus, Boeing and Delta Air Lines) and manufacturing firms (American Woodmark). These companies were early adopters of RFID, and they have proved

the business benefits and defined the best practices.

Even utilities, which often have monopolies or limited competition, are learning that RFID can pay off (see [Ground Control](#)). The Orangeburg, S.C., Department of Public Utilities, for example, is using RFID to identify and manage utility poles and all the equipment on them. The village of Thiensville, in Wisconsin, is RFID-tracking sewage pipes, to avoid damage to the system when other entities dig near its assets.

Will your company go bankrupt if you don't adopt RFID within the next 12 months? Of course not. But it takes time to learn how to use RFID to extract the most value for your business. Waiting until your main competitors have begun using it means being several years behind them. And that could lead to big problems. As Geoffrey Moore, an author and leading expert on technology adoption, told RFID Journal: "If you don't transform, you're going to be put out of existence."

The pace of RFID adoption is accelerating. At some point, RFID will reach a tipping point in your sector, and your company will likely need to implement the technology to stay competitive. Acting now gives your firm time to learn the best way to deploy and use RFID, to apply a thoughtful approach that delivers the most value. That seems smarter than waiting and rushing into it later. You follow?

A handwritten signature in blue ink that reads "Mark Roberti". The signature is fluid and cursive, with the first name "Mark" and last name "Roberti" clearly distinguishable.

Mark Roberti, Founder and Editor, RFID Journal



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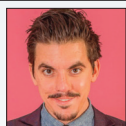
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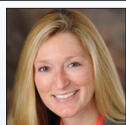


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## Find New Business Opportunities

RFID providers now have a source where they can find companies worldwide that are actively seeking to deploy the technology. [RFID Requests for Proposals](#) is updated regularly, with new RFPs from companies in diverse industries. Each RFP includes detailed information, contacts and submission deadlines.



Harsh Environments, June 2

**RFID Journal Virtual Events** These live interactive programs offer a convenient way to learn why and how companies are using RFID to improve the way they do business. Presenters will answer your questions. If you miss an event, check our archive for on-demand viewing.

[Harsh Environments](#), June 2

[Retail and Apparel](#), June 23

[RFID in Health Care](#), July 19



## RFID Connect

Find products that can help you deploy RFID successfully, such as [Invengo's XC-1003 IoT Phone](#). The compact ultrahigh-frequency RFID reader has an Android 4.4 operating system. Its multiple connectivity options make it suitable for retail, health-care and event-management applications.



No. 1 search term: supply chain

## Top 10 Search Terms in March

- |                   |             |
|-------------------|-------------|
| 1 Supply chain    | 6 Burberry  |
| 2 Time/attendance | 7 Jewelry   |
| 3 RTLS            | 8 Security  |
| 4 Laundry         | 9 Decathlon |
| 5 Retail          | 10 Beacons  |

## Most-Read Stories in March

- [Airista Acquires Ekahau's RTLS Division](#)
- [CCL Agrees to Buy Checkpoint Systems](#)
- [Retailer Uses RFID, Social Media and Cameras to Track Shopper Behavior](#)
- [Publix Plans to Automate Specialty Drug Management Via RFID](#)
- [American Apparel, Postmates Use RFID Visibility for On-Demand Delivery](#)

## Ideas Exchange

RFID Journal maintains an [Ask the Experts](#) forum, where you can submit questions about RFID technology and its applications. Your questions will be answered by RFID Journal editors or outside experts. Recent questions include:

- What companies manufacture RFID systems for cemeteries?
- Can UHF tags be read in both the near and far fields?
- How do RFID scanners connect with networks?
- What companies have deployed passive RFID technology throughout the supply chain?
- What are wet RFID inlays?

## The Inside Scoop

What are end users saying behind the scenes? Why should the RFID community be optimistic about the industry? Who's spreading misinformation? Get insight and perspective at the [RFID Journal Blog](#).

## DON'T MISS THESE...

### Premium Online Stories

#### How to Conduct a Successful Proof of Concept

This important test will help you determine how best to use RFID to solve your problems.

.....

#### Resin Supplier Uses RFID to Perfect the Curing Process

Reichhold helps a fiberglass pipe manufacturer improve production, saving time and money.

.....

#### French Laundry Company Cleans Up Linen Losses

BIH adopted RFID to save costs and improve customer service.

#### Cruise Ship Fights Fire With RFID

The *Ruby Princess* keeps crew safe with a personnel-tracking system.

## TECHNOLOGY

# Reading Tags in Space

Texas State University engineering students are designing an RFID system that could read multiple tags simultaneously.

**T**he National Aeronautics and Space Administration RFID-tracks all inventory on the International Space Station. Efficiencies are crucial, because sending items up to the station is extremely expensive, and resources, including electricity, are precious. NASA was looking for an RFID system that could read tags simultaneously rather than sequentially, to reduce the time and battery life required to take inventory on the space station.

Jacobs Technology, a subcontractor for NASA's Johnson Space Center, was working on research with the Ingram School of Engineering at Texas State University. In January 2015, senior engineering students Ramsey Doany, Cody Lovejoy and Kyle Jones were assigned a NASA-sponsored project to design an RFID system that could read multiple RFID tags simultaneously.

The students did not have any experience with RFID systems, but their advising professor, Harold Stern, is an expert in wireless communication systems and a regular attendee of RFID Journal LIVE! The team members intended to build an entirely new RFID reader but did not have access to the necessary tools, so they decided to modify existing hardware.

"The RFID companies we contacted

would not grant us access to the privileged information required to modify the existing hardware," Doany says. "So we turned to simulation. After determining the modulation technique of the tags we were using, we built the entire



International Space Station

system in Simulink, a graphical programming environment for modeling, simulating and analyzing multidomain dynamic systems."

Once they had a simulated signal, they transmitted with an RFID reader antenna using an RF arbitrary waveform generator. They received the signal using the HackRF One tool, and demodulated and decoded it using MATLAB software.

The team considered frequency division multiplexing, an RF coding scheme in which numerous signals are combined for transmission on a single

communications line, but quickly found the system's narrow bandwidth would limit the number of RFID tags that could be read. "The clear option was code division multiple access," Doany says. A CDMA-based system would not be better in every application, but it was ideal to meet NASA's needs because it requires less power and works well in noisy environments.

Passive ultrahigh-frequency readers use time division multiplexing, which requires sending signals at specific intervals. "Since a standard passive UHF reader doesn't know how many tags it is going to read, once it signals for all the tags in the area to generate a response delay, it transmits a signal and waits for a tag to

respond at each possible delay time slot, whether there is a tag at that slot or not," Doany says. "If the reader is transmitting without any response, this is a huge waste of information and power. Additionally, if there are collisions, this process may repeat several times. In a CDMA-based system, each beckoning transmission will yield information from the tags within range of the reader, even in the presence of high amounts of noise."

While the researchers test the simulation with larger numbers of tags and improve the design, they are looking for an RFID manufacturer to assist them in obtaining the necessary tools to alter the tags, so they can test CDMA-based RFID in the real world. "There have been discussions about future teams expanding this project to design a versatile RFID system that can switch between current and CDMA protocols, and even work as a tag-locating system," Doany says. "We hope to involve future senior design teams and/or graduate students on the expansion of this project." —Mark Roberti

## ECOLOGY

# RF-Enabling Mussels

Mollusks provide scientists with data about the amount of nitrate in rivers.

**I**n Iowa, more than 2 billion pounds of nitrogen fertilizer are used to grow corn, and roughly 20 percent of the nitrogen, in the form of nitrate, runs off into lakes and rivers. Nitrate is food for the algae and plankton that live in these waterways, leading to excessive growth of these organisms. After they

to the riverbed than the water, Just says, and bacteria convert the ammonia into nitrogen gas that bubbles harmlessly to the surface.

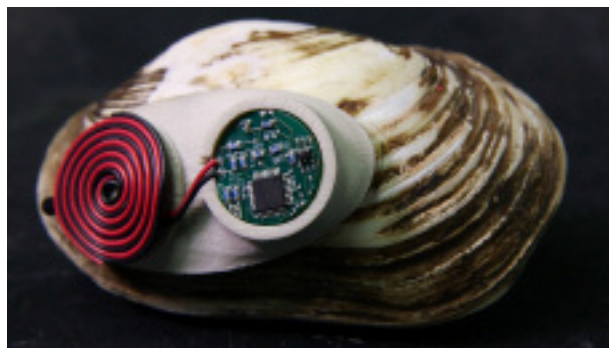
For the study, a team of students attached a magnet to one side of each mussel's shell and a sensor connected to a wireless transmitter to the other side.

The tiny battery-powered sensor can detect changes in the magnetic field each time a mussel opens and closes its valve. If the valve opens and closes more often, it means there is more food in the water, which could mean more nitrate.

The data was sent via a radio transmitter to a base station. The team used ra-

dios that operate in the 400 MHz range, and can transmit 10 feet or so in the river.

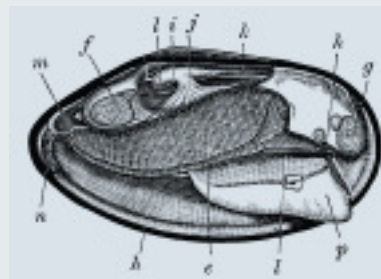
The researchers hope to obtain funding to develop the prototype sensors into ad hoc mesh networks that could communicate with receivers on buoys, so the data could be relayed by a Wi-Fi or cellular network to researchers in the lab. If they can show the mussels improve the water quality, they might be able to convince government agencies and businesses to help restore the freshwater mussel population, which is an endangered species. "The mussels are analogous to the canary in the coal mine," Kruger says. "If they are healthy, the water is healthy. If they are not doing well, then you know there is a problem." —M.R.



Each mollusk wears a sensor connected to a wireless transmitter.

die, the decomposing organisms deplete the water of oxygen, killing fish.

Two University of Iowa colleagues—Anton Kruger, professor of electrical and computer engineering, and Craig Just, assistant professor of civil and environmental engineering—were discussing how to monitor the impact of nitrate in the Iowa River and reduce the amount of nitrate that flows down into the Mississippi Delta. They decided to equip freshwater mussels, which consume algae and phytoplankton, with tiny sensors and radio transmitters and use them to monitor the health of Iowa rivers. They also wanted to show that mussels can help remove nitrate from the water. The mollusks' excrement contains ammonia and urea; the urea more readily deposits



## Mussel Atrophy

Percentage of North American mussel species either extinct or imperiled:

**70**

Percentage of decline among European mussel populations:

**90**

Percentage of industrial waste developing nations dump into waters untreated:

**70**

Percentage of oceanic acidification increase throughout the past two centuries:

**25**

Total number of embankment dams in operation worldwide:

**100,000**

Projected global market for cultured pearls by 2020:

**\$10.7 billion**

—Rich Handley





ILLUSTRATION: ISTOCKPHOTO

# How RFID Will Reach Mass Adoption

Solutions must become simpler to deploy and use, as well as more scalable.

According to Geoffrey Moore, author of *Crossing the Chasm* and other important books on the technology adoption life cycle, new technologies follow a clear and consistent path to mass adoption. First, visionaries see the great potential of a new technology and jump on board, but the vast majority of companies do not follow their lead. Instead, they wait, because the technology seems immature and risky. And the technology falls into the chasm.

Over time, companies with a compelling business problem that no other technology can solve adopt the new technology and solutions begin to mature. At some point, the technology crosses the chasm between visionaries and the “early majority.” Eventually, enough companies in one industry adopt the technology that it hits critical mass and just about everyone in that industry adopts it. From there, it

spreads to other industries and eventually reaches mass adoption.

Radio frequency identification has followed exactly this path. Walmart was an early visionary, along with the U.S. Department of Defense and a few other organizations. But the vast majority of companies did not follow their lead, and in 2007 RFID plunged into the chasm. Since then, we have

Virtually all retailers RFID-tracking clothing, footwear and accessories are using passive UHF technology based on the ISO 18000-6C standard.

seen companies across many industries deploy the technology to solve specific business problems, including lost or misplaced assets, inventory inaccuracies and shipping issues.

Retail is one industry that has embraced RFID more than all others, because virtually all retailers share a common business problem—inaccurate inventory data and resulting out-of-stocks. But only a dozen or so retailers have deployed RFID in all their stores, and the vast majority of retailers have not begun using RFID in any serious way. So what needs to happen for RFID to reach mass adoption in retail and then spread to other industries?

Moore says five conditions must exist for a technology to reach mass adoption:

- A global standard
- A problem no other technology can solve
- The “whole” product (integrated solution)
- Critical mass of end users
- A “gorilla” the market can embrace (a dominant technology provider)

In retail, there is a global standard for RFID. Virtually all retailers RFID-tracking clothing, footwear and accessories are using passive ultrahigh-frequency technology based

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on the ISO 18000-6C standard. There is a problem no other technology can solve (cost-effectively): lack of inventory visibility and accurate inventory data.

But there is no whole product yet. Retailers typically have to buy tags from one company, readers from another and software from a third. It's unlikely one company will ever provide the entire solution. Just as the PC industry had Microsoft, Intel and IBM in the early days, it will likely be three RFID companies coming together to provide a complete solution. Some systems integrators will provide software and source readers and tags for retailers.

Intel has created an overhead reader that is designed to be easy to deploy and use, and is relatively inexpensive. It remains to be seen if that solution will lead to industrywide adoption.

The whole product also must be relatively simple to deploy. For years before Apple created the iPod, a consumer who wanted mobile access to MP3 files had to buy a separate MP3 player, CD ripper and software and copy songs from CDs. Apple developed a whole solution that included the iMac with a built-in CD-ROM drive, software for copying songs to iTunes, and iTunes to create playlists and copy the songs to the iPod. But it wasn't just that Apple created a complete solution. The iPod took off because iTunes and the iPod were easy to use.

Today's retail RFID solutions are not simple to deploy. Companies can use handhelds to take inventory, but most retailers want overhead readers that provide real-time inventory. Intel has created an overhead reader that is designed to be easy to deploy and use, and is relatively inexpensive. It remains to be seen if that solution will lead to industrywide adoption, but Intel appears to be one of the few companies trying to simplify always-on inventory data collection.

When RFID becomes easier to deploy and use, as well as more scalable, more retailers will quickly adopt it and the technology will reach critical mass. All chains will begin using RFID and all clothing will have manufacturer-applied tags. Then, RFID will rapidly spread to sporting goods, jewelry and auto parts retailing (that's already beginning to happen).

### WILL RFID GO BEYOND RETAIL?

It's difficult to say. Apparel is RF-friendly, so deployment can be made relatively simple. Tagging metal parts in a factory will always involve special tags. One day, these tags might be

built into parts, but it's unlikely that will happen unless key players in an industry make it happen. Airbus and Boeing are driving parts tagging in the aerospace sector, and the U.S. Department of Defense is doing the same in the defense sector. It's possible these industries will achieve mass adoption and the technology will then spread to other manufacturing sectors, such as automotive and electronics.

It's likely many industries would adopt RFID if providers made always-on overhead readers that were easy to install and configure and were relatively low-cost. I'm not sure why that's such a big if. Where's RFID's Steve Jobs? —Mark Roberti



ILLUSTRATION: ISTOCKPHOTO



# RFID Adoption in Retail Gains Momentum

Anecdotal evidence suggests that the number of retailers deploying RFID solutions is accelerating.

**T**he retail sector is clearly following the technology adoption life cycle explained by Geoffrey Moore in his book *Crossing the Chasm*. Marks & Spencer, Macy's and other early adopters have proven the benefits of using RFID, and now more retailers are following their lead.

RFID Journal is seeing an increase in the number of retailers subscribing to our retail newsletter. Another noteworthy trend is the increasing number of companies that provide labels for clothing manufacturers signing up for that newsletter. As retailers ask their apparel suppliers to tag clothing, the clothing label suppliers are no doubt being asked to integrate RFID into their labels. This is important, because adoption cannot reach critical mass until apparel is tagged at the source.

Moreover, since the beginning of the year, RFID Journal has published 15 news stories on the use of RFID in retail. That compares with six articles during the same time in 2015. The retailers featured in the 2016 articles are from the United States, Europe, Asia and South America. And while all the solutions are based on solving a common problem—inventory inaccuracy, which results in lost sales—some retailers are also using RFID to improve customer service and achieve other benefits.

## Retail Articles in 2016

[Gieves & Hawkes Installs RFID to Prevent Shrinkage, Track Inventory](#)

The men's clothing retailer has deployed RFID at its store in Birmingham, England, and is implementing the solution at its newest store in Hackney, an East London borough.

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Macy's confidence in its RFID-based inventory data enables the company to list goods for sale online even when there is only one such item available at the store.



### [American Apparel, Postmates Use RFID Visibility for On-Demand Delivery](#)

Postmates is offering one-hour delivery of the clothing company's products in 31 cities, using RFID data that tells shoppers which goods are available within their geographical area.

### [Retailer Uses RFID, Social Media and Cameras to Track Shopper Behavior](#)

ISA Fashion Boutique, a seller of international luxury brands in Hong Kong, China and Macau, has deployed an RFID inventory-management system.

### [Publix Plans to Automate Specialty Drug Management Via RFID](#)

The U.S. supermarket chain, which has 980 pharmacy locations, is implementing a drug-management system that will let pharmacists automatically track high-value, low-volume specialty medications on consignment.

### [Reebok, Music Festival Reach Out to Visitors With iGotcha RFID Solution](#)

Athletic footwear and apparel company Reebok is using an RFID solution to display product information to visitors at its Innovation Showroom.

### [SportLife Tracks Athletic Shoes, Apparel](#)

The Colombian retailer of athletic shoes, apparel and equipment deployed an RFID system at its 38 stores and its distribution center, to reduce labor costs and out-of-stocks.

### [RFID Brings Customer Shipments into Focus for Eyewear Company](#)

Norwegian online eyewear company Extra Optical is piloting an RFID shipping solution to automatically track every pair of glasses it ships to customers, and to trigger a notification to each customer when his or her shipment is about to be delivered to that person's home or office.

### [Singapore Fashion Company Adopts RFID to Be on the Cutting Edge](#)

Decks is RFID-tagging all its merchandise at the source, and is using the technology to expedite inventory counts and sales transactions, with the goal of boosting sales and attracting and retaining employees.

### [C&A Rolls Out RFID to All of Its French Stores](#)

The apparel company is expanding its RFID deployment to 164 sites, to boost sales by improving the availability of items on shelves.

### [Japanese Retailer Aeon Checks Out Checkpoint's RFID-enabled Robot](#)

The general-merchandise chain Aeon Retail is piloting an RFID-enabled robot to track inventory at its flagship store in Chiba, and is rolling out an RFID-based electronic article surveillance system.

### [German Clothing Retailer Adler Gives RFID Robots a Spin](#)

Adler Modemärkte is using an RFID-enabled robot at its store in the city of Erfurt and a store at its corporate headquarters in Haibach, to count inventory and identify the locations of merchandise on store shelves each day.

### [Macy's Launches Pick to the Last Unit Program for Omnichannel Sales](#)

The retailer's confidence in its RFID-based inventory data enables the company to list goods for sale online even when there is only one such item available at the store. In the past, inventory counts were simply not precise enough to ensure that a particular product was actually in stock and available for sale.

### [Rebecca Minkoff Adds RFID to More Stores, Boosts Sales](#)

The high-end fashion retailer is now using RFID at its stores in New York, Los Angeles and San Francisco, to improve customer service.

### [RFID Pops Up in Mobile Interactive Stores](#)

ShopWithMe pop-up stores are visiting cities and selling merchandise via RFID technology that displays product information automatically when a shopper picks up a product and tries it on in a fitting room. It also streamlines the purchase process.

### [G-Star RAW Store Finds Many Uses for RFID](#)

The RFID solution deployed at G-Star's New York store tracks inventory, manages sales transactions and security, and improves customer service. ■

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# *Listen Up,* **Laggards!**

It's time to get up to speed  
on RFID, before your competitors  
leave you in the dust.

---

BY SAMUEL GREENGARD

Several years ago, being an RFID laggard could be considered a safe, even smart move. After all, RFID was an expensive new technology that didn't always work so well. Let other aerospace and energy companies, hospitals, manufacturers, logistics providers and retailers figure out where and how to use it—and whether it was possible to achieve a return on investment.

Well, early adopters in each of those industries did exactly that. They worked with RFID providers and standards organizations and, as a result, the technology has improved, prices have dropped and standards have coalesced. Just as important, companies in each industry have developed solid business



"If you are on the sidelines, I encourage you to consider the reason(s) you have not adopted RFID and address them accordingly."

BILL HARDGRAVE,  
AUBURN UNIVERSITY



cases for employing RFID, and many have shared information documenting the benefits, including cost savings, improved efficiencies, better inventory control, safer operations and more satisfied customers.

To be sure, RFID is still not a plug-and-play technology. Any reliable RFID provider or systems integrator will advise companies considering RFID to first conduct testing to demonstrate proof of concept and then pilot the technology. That's one of the critical best practices early adopters have developed for deploying the technology successfully.

And RFID has not yet reached the tipping point in any industry, though that's likely to occur in apparel retail within the next year or two. The need to compete in an omnichannel world is one of the business cases driving adoption. Retailers now understand that in-store inventory accuracy is key to omnichannel retailing, and RFID is the only efficient way to achieve it. In a recent [Tuned In](#) column, Bill Hardgrave, dean of Auburn University's Harbert College of Business and founder of the RFID Research Center, said: "I firmly believe retailers must adapt to an omnichannel world or they will not survive."

RFID adoption is making steady gains in most other sectors. Recently, David Johnson, American Woodmark's materials technology and projects manager, said custom and office furniture manufacturers "are coming around to RFID" because they understand how the technology can address manufacturing problems by providing visibility into the production process (see [Automating Craftsmanship](#)). American Woodmark adopted the technology enterprisewide to better compete in the remodeling and new-home construction markets.

In fact, there's been a notable shift in this magazine's Vertical Focus articles, which examine RFID adoption in particular sectors. In the past, each story typically highlighted a few early adopters that were benefiting from RFID and explained the challenges the industry faced in using the technology, including identifying the business case, cost and tag readability. Now the benefit-challenge balance has shifted in diverse industries, including steel manufacturers,

mining companies, airports, horticultural firms, and wine and spirits makers. In each sector, the business cases have been identified, and while some deployment challenges still exist, more end users are adopting RFID and seeing a return on their investment.

In some industries, government regulations are driving RFID adoption. Farmers worldwide, for example, are using the technology to identify livestock for disease management and prevention. In the United States, medical device manufacturers and food producers are exploring the technology to meet U.S. Food and Drug Administration mandates. The FDA's Unique Device Identification system requires that most medical devices carry a unique device identifier to facilitate quick and efficient recalls. The Food Safety Modernization Act, which takes effect in January 2017, will require growers to monitor environmental conditions. Other companies are adopting RFID to comply with the Sarbanes-Oxley Act or facilitate state audits. In each case, organizations that adopt RFID to meet these regulations also find internal benefits.

In 2016, being an RFID laggard is no longer a smart or safe move. "In today's global business environment, technology innovation is the key to success," states Nandini Bhat-tacharya, a Frost & Sullivan senior research analyst. "Laggard companies are left behind by their peers. RFID is a critical component because it works in tandem with many other technologies."

Hardgrave was addressing retailers when he noted: "If you are on the sidelines, I encourage you to consider the reason(s) you have not adopted RFID and address them accordingly." But clearly, this advice holds true for any laggard company. "It's impossible to constantly be on the leading edge of technology adoption," he says, "but it's also important to stay focused on how it's possible to innovate and use the technology to achieve maximum value."

Addressing your RFID laggard status can be a challenge. If you're still sitting on the sidelines watching your competitors benefit from the technology, here are four strategies to help you get in the game.

## Know the Technology Adoption Cycle

First, to understand why it's no longer smart or safe to be an RFID laggard, it's essential to know how companies adopt new technologies. When author and technology advisor Geoffrey A. Moore penned his landmark book *Crossing the Chasm* in 1991, he ushered in a far deeper understanding of the way organizations approach and use information technology. Although the book focuses on business and IT in a general way, the lessons learned are highly applicable to RFID projects.

New IT technologies, Moore says, pass through several distinct stages before they gain widespread adoption. In the first stage, technology innovators and early adopters sponsor visionary projects intended to gain a dramatic competitive advantage.

In the second stage, called the "chasm," vendors offer these solutions to other end users, but the technology meets with resistance because it isn't complete enough to satisfy all their needs. The technology must cross the chasm for pragmatists (what Everett Rogers, in the original work on technology diffusion, called the "early majority") to invest in it. To do so, Moore says, vendors must solve a painful and otherwise intractable problem and, within the constraints of that specific problem, bring to market a complete solution.

Based on evidence from logistics, livestock management and luxury consumer goods retail, in 2012, Moore observed: "RFID has crossed the 'chasm' period in which early adopters conduct projects while the rest of the world is in a wait-and-see mode. That means RFID is not going away."

The vast majority of enterprise buying decisions, Moore says, are made by pragmatists or conservatives (Rogers' "late majority"). Most organizations, he says, position themselves here, to remain competitive without taking undue risks. Pragmatists go when they see the productivity gains outweigh the change-management demands, whereas conservatives postpone until the world simply will not put up

with their old-fashioned ways anymore.

"Conservatives don't trust their own judgment," Moore says. But, he adds, they can be won over when they see their organization isn't breaking new ground—that others in their industry are benefiting from the technology. At this stage in the RFID adoption life cycle, conservatives are beginning to learn about the technology—reading case studies and white papers, attending RFID events and/or conducting proofs of concept. They understand the risk of falling too far behind the early adopters and pragmatists.

By focusing solely on technology and not process automation, laggards too often underestimate the time and steps required to move an RFID initiative forward, says Su Doyle, Checkpoint Systems' director of RFID applications. While RFID is becoming faster and easier to deploy, it's important to take the time to integrate the data into core business applications. Establishing committees, identifying organizational goals and opportunities, and building out the IT framework and systems can take weeks or months—all while the current RFID environment continues to shift and advance.

Finding the sweet spot on the technology curve is easier said than done. It requires an eye on your industry, another on the technology, and an understanding of how business conditions are changing. "Some businesses that deployed advanced RFID solutions a few years ago may now face the challenge of spending more money to bring them up to date through upgrades or entirely new hardware, software and systems," Bhattacharya points out. Conversely, she notes, some laggards may benefit by entering the space with little or no existing baggage or overhead. They may have the luxury of adopting a state-of-the-art solution while avoiding integration problems.

## Address Cultural Issues

Of course, an organization can lead in one area and lag in another. Or it can establish itself as a leader in a space and later, due to advances in technology or changing business condi-



"RFID has crossed the 'chasm' period in which early adopters conduct projects while the rest of the world is in a wait-and-see mode. That means RFID is not going away."

GEOFFREY A. MOORE,  
AUTHOR





“The No. 1 selling point for business leaders is ROI. You have to establish a use case that is compelling. You have to have a way to sway management to authorize an initiative.”

ED NABROTZKY,  
OMNI-ID



tions, find itself trailing the pack. “Organizations that may have been leaders at some point in the past may now be lagging in terms of RFID adoption and use,” Doyle says.

It’s no secret that an organization’s culture can make or break an initiative. Companies that trail peers often have an entrenched “risk-averse” mentality, Moore says. Either they don’t recognize the need to change or they parrot the axiom “If it ain’t broke, don’t fix it.” But in today’s business environment, standing still can easily translate into moving backward. Fear or indifference can lead to inaction and, ultimately, failure. “Although visionary and early adopting cultures tend to move toward a solution voluntarily, pragmatists, conservatives and laggards often require some type of event to galvanize action,” he explains.

Too often, organizations become stuck on short-term goals and capital expenditures and don’t think about how to build a long-term foundation for success. RFID represents a sizable capital expenditure and it demands considerable IT and other resources, so sliding the dial from resistance to an embrace requires someone who can see the value of RFID, serve as a visionary and communicate the value proposition, Hardgrave says. “Company culture can change—and it’s possible to overcome resistance—but it’s a difficult and sometimes frustrating process.” Most organizations, he says, follow a predictable pattern. If they are innovators overall, they will be innovators with RFID. If not, they will lag behind in RFID adoption, or, at least, not benefit as much as they could because they fail to integrate the technology with other IT systems and tools.

One thing that makes it so difficult to change a culture is the fact that “companies that are laggards or late to the game often wind up rewarded because they suffer no strategic or competitive harm,” Hardgrave says. “The process becomes reinforced over time.” But at a certain point, the entire business landscape changes, the model breaks and the company finds itself floundering—or even fighting for survival. “There is a point at which an organization faces a competitive disadvantage that it cannot overcome,” he explains. “They

are simply too far behind the curve.”

Cultural change is “really difficult” but possible, says Ed Nabrotzky, Omni-ID’s chief solutions officer. The process, he says, begins with a visionary or group that recognizes the benefits of an RFID initiative and communicates this to senior executives, a CIO and other key decision makers. “The No. 1 selling point for business leaders is ROI,” he says. “You have to establish a use case that is compelling. You have to have a way to sway management to authorize an initiative.”

This, Nabrotzky adds, means research. Are others in your industry using RFID? What have their experiences been? It then means building a business case that delivers a clear view of the opportunities and benefits. “It’s ultimately about how you can make money, cut costs or fundamentally change things for the better,” he says. “If you can provide a solid business case and demonstrate value, you can break through the cultural inertia or resistance.”

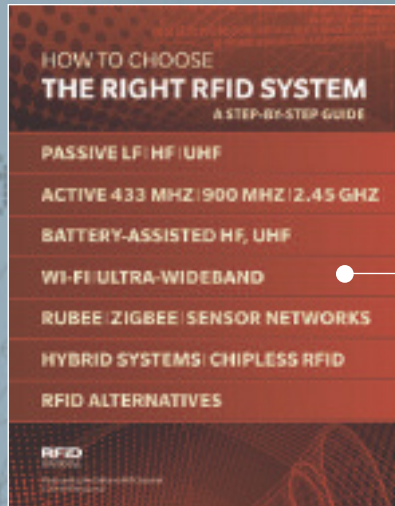
## Develop a Strategic Plan

While many industries have developed business cases for RFID, you have to understand where and how RFID supports your organization’s goals. Some hospitals, for example, are initially using the technology to manage high-value assets while others are deploying it to improve patient flow or increase hand-washing compliance. Similarly, some automotive companies are first adopting RFID to manage returnable transport items, while others are implementing it in factories to manage tools or track work-in-process.

A good starting point for developing a strategy and a plan, Hardgrave says, is to understand the conditions in which a business competes and how RFID can change the stakes. Although every industry and organization is different and there’s no single template for success, the common denominator is a need to understand what RFID can do, where it makes sense and how it leads to real-world dollar gains. A persuasive business case, Hardgrave says, often revolves around a more



See the complete table of contents at  
[www.rfidjournal.com/howtochoose](http://www.rfidjournal.com/howtochoose)



# How to Choose the Right RFID Technology for Your Application

Choosing the proper radio frequency identification system for your application can be a difficult task. The editors of RFID Journal provide a guide to choosing the right system for your needs, and explain the pros and cons of different RFID solutions for different applications.

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“If a company can solve multiple business problems and improve things like financial performance, costs and regulatory compliance, it’s possible to move to adoption without a lot of resistance.”

SU DOYLE,  
CHECKPOINT SYSTEMS



automated real-time business model that lets an enterprise update, change, customize or track products in a way that would have been unimaginable only a few years earlier.

Companies must work from a value proposition to a solution, Doyle says. The questions that need to be asked include: “What is the organization attempting to accomplish? How can we improve functions and processes? How can we monetize this particular technology? If a company can solve multiple business problems and improve things like financial performance, costs and regulatory compliance, it’s possible to move to adoption without a lot of resistance. No longer is RFID viewed as a niche technology or a one-off tool but, rather, a valuable technology that can solve real challenges and help transform the business.”

The strategic plan must also involve building a coalition of support for your RFID initiative. If you’re a department or mid-level manager who understands the benefits of RFID, Nabrotzky says, it’s important to identify an ally who has influence within the organization. “If you have a team that can stand shoulder-to-shoulder and say, ‘This is absolutely the right thing to do and here is why: It saves money, it makes people’s jobs easier, it delivers better customer sales or service’—and you can support this with facts and numbers—it goes a long way toward reducing anxiety and achieving buy-in.”

Information is one of the best ways to build support. Invite potential team members to RFID events, so they can learn from thought leaders and other companies in your industry that have adopted RFID and are willing to share their experiences. This presents an opportunity for your designated ally and others in your organization to ask questions and gain a deeper understanding of business benefits, opportunities and challenges, Nabrotzky says.

In addition, reach out to your business partners that have deployed RFID successfully. They can provide a valuable outside-in perspective along with ideas about how to move forward. “In many cases, business partners are willing to share expertise because an integrated supply chain and more comprehensive tagging earlier in the product life cycle bene-

fits everyone,” Doyle says. In fact, discussing projects that have the potential to yield mutual gains could provide the impetus to put a project into motion.

## Lay the Groundwork

“Businesses need to understand that in today’s environment, disruption is the new normal and innovation is critical,” Moore says. “If you don’t transform, you’re going to be put out of existence.”

While your organization may not be ready to fully embrace RFID, the end goal is to move from a risk-averse culture to one that has room for innovation. Organizations frequently benefit from creating incubation zones for testing and experimentation, Moore says. It’s also wise to zone off portions of the business for traditional activities and understand where and how to apply new and innovative technologies. Laggard companies that engage in pilots and test projects learn from initiatives—both successes and failures—and, ultimately, begin to view risk and disruption as opportunity.

The price of RFID technology has dropped to the point at which the risk-reward model has flipped to a far more favorable position for most businesses, Nabrotzky says. “We now have ultralow-cost microtransmitters that operate on tiny power or no power at all that can be embedded into all sorts of devices or put into applications,” he says. “We also have RFID standards firmly in place. So the technology has arrived. It’s now a matter of figuring out how to use it and make it work within an overall framework of information technology.”

As RFID adoption ramps up in most industries, organizations that may have been rewarded for standing on the sidelines can no longer remain spectators. “As long as a market has not been disrupted, it’s not a bad strategy to be a conservative or a laggard,” Moore says. “But when conditions shift, it’s important to be equipped to move forward. Having your head in the sand and avoiding innovation is a sure way to get killed.” ■

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# Ground Control

Gas, electric and water companies slowly adopt RFID to reduce costs and improve services.

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BY JENNIFER ZAINO

Cities and towns worldwide are populated with a wide variety of cables, pipes and poles that supply us with electricity, gas and water. These assets, made of concrete, metal, plastic or wood, reside above and below ground. Every day, workers spend hours in the field inspecting the integrity of these items, doing essential maintenance and repairs, and ensuring other utility or construction firms working in the vicinity don't accidentally damage them. Much of that time is spent locating the assets and manually updating records.

RFID, often in combination with other technologies, can help utility companies save time and money by speeding their ability to locate and identify assets, thereby facilitating inspections and services. The solutions also provide a more cost-effective way to comply with government regulations.

In addition, the ability to quickly locate critical assets during an emergency can reduce infrastructure damage and enable utilities to restore services to customers within hours rather than days. Responding to the natural gas explosion that took place in Seattle in March was delayed, in part, because workers had to find and then drill down to underground gas shutoff valves, says Mike Klonsinski, international business development director for Berntsen, which makes the InfraMarker RFID system.

A public works group responsible for water utility maintenance is considering using RFID to help it speed repairs when a water main blows, preventing thousands of gallons of water from becoming waste, says Robert Zielinski, CDO Technologies' director of commercial marketing. Multiple valves sit at street-level intersections, and each valve controls a different water line and has a different set of tooling and on/off configuration procedures. "If they had a passive UHF RFID tag next to each valve, repair crews could read them [even through inches of water] to find out which valve controls which line and what tooling is needed for it," he says.

Clearly, several strong business cases exist for using RFID in the utilities sector. RFID providers say utility companies now under-

stand what the technology is and how it can address their problems, and interest in their solutions is picking up. But while some utility companies have deployed RFID systems (see "Where in the World Is RFID Helping Utilities?" on page 31), many are not in a rush to embrace the technology.

Cost, especially for small, local utility firms, remains a barrier to adoption, as does the industry's culture. "The utilities industry is very conservative," says Jim Anspach, director at Cardno, which coordinates and conducts worldwide research of utility issues, and founding governor of the American Society of Civil Engineers' Utility Engineering and Surveying Institute. "It has been resisting, to a degree, some of the new technology."

One concern utilities have is that they'll become too efficient using technologies like RFID, Anspach says. "They can't put themselves in danger of not being able to, say, carry enough manpower on a regular basis to handle those emergencies that crop up," he says.

#### ABOVE GROUND

RFID really shines when it comes to delivering field data to workers that identifies an asset and its history, CDO's Zielinski says. Workers can know when activities, such as inspections, were conducted, and who performed those operations. They can also see which tools are required for repair services. Moreover, companies that tag poles at the point of manufacture can use RFID for asset tracking at storage yards (see "A Lifetime of Benefits" on page 29).

A few years ago, for example, the Orange-

"The utilities industry is very conservative. It has been resisting, to a degree, some of the new technology."

JIM ANSPACH, CARDNO



Assets that are RFID-tagged at the manufacturing plant can be tracked from construction through maintenance and operational inspections for quality control.

burg Department of Public Utilities (DPU), in Orangeburg, S.C., began rolling out an RFID system from Sustainable Management Systems, to improve maintenance and repair operations on roughly 30,000 poles that supply electricity to some 25,000 customers. The poles are identified with passive RFID tags, and each tag's identification number is associated with DPU's geographic information system (GIS), to provide a visual understanding of every pole's location via GPS coordinates, says SMS CEO Barry Breede.

SMS' Pole Information Management System (PIMS) software is also integrated with the DPU's GIS database. Office personnel use PIMS to assign inspection and maintenance work. Field workers read the tags with RFID handhelds or RFID-equipped iOS or Android smartphones or tablets. "PIMS self-populates all assets on that pole from transformers to lights to wiring [from the GIS], and then the inspector makes an assessment of the condition of those items," Breede says. An inspector can photograph problems and transmit those

images, along with an updated maintenance record for the RFID-identified asset, to the GIS, to streamline communications and speed repairs.

Before-and-after studies of the Orangeburg utility's inspection process "showed time and labor rates improved along with dollar savings," Breede says. "In this case, it paid back within a year of implementation, so that's a pretty quick return." But, he notes, RFID for such use cases makes more sense for utilities that have a certain scale to them—larger cooperatives or investor-owned utilities, for instance.

## BELOW GROUND

RFID in passive and even most active forms doesn't provide X-ray vision to an asset buried more than a foot in moist, metal-filled dirt, CDO's Zielinski says. While it can help detect the zone an asset is in, it can't pinpoint the asset's location for absolute assurance that a gas or fiber line, for instance, won't be hit



when utility crews start digging, he says. For better location accuracy, underground solutions may equip an asset with RFID and other capabilities, such as GPS receivers or cellular connections and services. But that, he says, represents a more significant investment than for a passive tag, which could limit the type of utility assets on which the technology can be deployed.

The one-square-mile village of Thiensville, in Wisconsin, implemented Berntsen's Infra-Marker RFID system, to ensure any digging taking place there wouldn't damage its main sewer line, which intersects with other utilities. The solution, designed to find subsurface assets, combines RFID with GPS and magnetic locating technologies, and includes handheld readers and mobile application software. The UHF tags don't sit on the iron pipe, but rather reside above it or slightly off to its side. This eliminated the need for Thiensville to dig dozens of feet down or through asphalt or con-

crete. RFID identifies the pipe, and the magnet that sits atop the tag is used in conjunction with GPS data to locate it.

While Thiensville never experienced a problem with its sewage line before implementing the RFID system, the process of dispatching surveyors and trucks to confirm pipe locations and determine whether it was safe to dig somewhere was arduous. Andy LaFond, the village's director of public works, believes the locating system helped to avoid potential problems when the WE Energies electrical utility undertook a conversion project that required a lot of boring near the pipe. "Any contracting work that could hit or damage the main sewer line would be a financial and environmental disaster," he says. "On average, we pump probably 600,000 to 700,000 gallons of sewage a day. If we were just to shut that off [if an incident occurred], that would back up basements with sewage."

Riviera Utilities, which serves South Bald-

**"Any contracting work that could hit or damage the main sewer line would be a financial and environmental disaster."**

ANDY LAFOND,  
THIENSVILLE PUBLIC  
WORKS



## A Lifetime of Benefits



MOST RFID UTILITY projects are designed to identify cables, pipes and poles once they're in the field. But Texas Electric Cooperatives (TEC), which represents dozens of electric cooperatives statewide, wants to cash in on RFID's benefits early on. TEC is deploying Sustainable Management Systems'

YardTrack solution to automate the time-consuming, error-prone manual processes used to inventory the many thousands of assets at its Jasper manufacturing facility and yard and at roughly 20 member-operated storerooms.

TEC will print the ultrahigh-frequency RFID tags onsite and affix them to the newly manufactured poles. The RR Donnelley tags are encapsulated in weatherproof material and tracked with Motorola Solutions handheld readers. The YardTrack solution includes software, from SMS partner Stratum Global, for identifying

the location of assets in real time. "We showed them we can take a three-, four- or five-day process and winnow that down to less than a day in terms of inventory management, and with a higher degree of accuracy" at the manufacturing yard, says Barry Breede, SMS' CEO.

The individual co-ops will use fixed readers at the entry and exit points of their facilities, to confirm receipt of new poles and identify poles taken from inventory. "We chose fixed read zones because of the need to have 24/7 read capability," Breede says. "Often, the utilities must access inventory during nonworking hours, particularly during storm response. With inventory visibility, they will quickly know how many poles they can deliver after a big storm."

TEC is now considering using SMS's Pole Information Management System (PIMS) for inspection and maintenance in the field. "Doing so would allow TEC and its members the ability to leverage their investment in RFID, because we can associate PIMS-driven field data with the original data captured in YardTrack," Breede says. "Effectively, this will give TEC full life-cycle visibility of its poles, from manufacturing through final disposal. —J.Z.

win County in Alabama, participated in a research project conducted by the Geospatial Research and Applications Center (GRAC) at Auburn University, to determine whether underground assets could be found more quickly with GPS alone or with GPS and the RFID InfraMarkers. "The research we have done with Riviera and with other projects clearly proves GPS alone is not sufficient to mark infrastructure elements," says Chetan S. Sankar, GRAC's director. "You need other technologies in addition to GPS," he adds, noting that RFID can play a very strong role in identifying those elements.

The InfraMarker system provides other benefits, Sankar says. Every time a tag is interrogated, that information is captured and date-stamped for a true audit trail, key for life-cycle management. "With small companies, the utility people have been there for a long time and often know the history" of their assets, he says. "While it's helpful there, too, it can be very helpful in big city utilities, where there may be large turnovers of staff,"

and with them asset knowledge.

Corley Lauderdale, Riviera's utilities engineering and field operations superintendent for gas, water and wastewater, participated in the research project and is a fan of the InfraMarker system. But cost played a role in Riviera's decision not to "take things beyond the experiment stage at this point," he says. "Each of the InfraMarker units is about \$25 to \$30, and that's rather expensive if you need a few thousand of them." Plus, he says, you have to equip workers with handheld readers.

Still, "The potential for RFID adoption by utilities is very high," Sankar says. He notes that Auburn students who participated in the research projects calculated as much as a 20 percent cost savings using RFID to tag the assets of 10-mile-long gas pipelines. The savings, he says, comes from how quickly one can identify an asset to fix it.

LaFond notes that Thiensville was fortunate not to have cost issues around its deployment. The village, he says, is 100 percent debt-free and at the time of its implementation, Berntsen was

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just developing the technology and provided it at reduced cost in exchange for the utility's feedback and efforts in helping it move the technology to the next stage.

Klonsinski says it's important to consider how the system can help utilities save money. By finding critical underground assets faster, he says, the customer spends less money on labor, suffers less damage to the infrastructure, and minimizes time wasted from projects put on hold while assets are located. The solution, he adds, "works best for new construction or in places where you already are uncovering assets for inspection or maintenance, or new placement or repairs. It's very costly just to go ahead and choose to find all your infrastructure, dig it up and put a tag on it. But if you're uncovering assets on a regular

basis, you can mark all your infrastructure over time." That said, Berntsen now offers aboveground markers, so customers can mark underground assets without having to wait for them to be uncovered.

#### COMPLIANCE COULD DRIVE ADOPTION

Some utilities may turn to RFID location solutions to solve another issue—the need to better manage and assure the integrity of underground assets, to support compliance with state or federal safety regulations. Metallic lines that utilities laid 50 to 100 years ago are deteriorating, says Tony Radoszewski, president of the Plastics Pipe Institute (PPI). The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administra-

"If you're uncovering assets on a regular basis, you can mark all your infrastructure over time."

MIKE KLONSINSKI,  
BERNTSEN



## Where in the World Is RFID Helping Utilities?

Companies worldwide are adopting RFID location solutions, to reign in costs, maintain services and improve safety. Here are some examples.

#### [California Water Utility Uses RFID to Reduce Terrorism Risk](#)

Alco is utilizing active tags to control access to its pump stations, as well as track assets, enabling it to locate equipment quickly in the event of an emergency.

#### [GDF Suez Tries RFID Underground](#)

The multinational energy firm is testing a system that employs passive RFID tags to enable the detection of subterranean polyethylene utility pipes.

#### [Heathrow Airport to Use RFID to Map Underground Utilities](#)

BAA Airports, an owner and operator of seven airports in the United Kingdom, plans to use RFID markers to help workers locate underground pipes and cables before they begin to dig.

#### [RFID Keeps City Sewers Running Smoothly](#)

In Warendorf, Germany, workers use RFID to track the maintenance of the city's 127-mile network of sewage canals and pipes.

#### [RFID Locates Pipes and Secures Meter Collection for Utilities](#)

A South American water company is piloting IDMetrics' passive UHF solution designed to locate pipes above or below ground.

#### [RFID Marks the Underground Spot](#)

London's City of Westminster launches a pilot project to use RFID-enabled markers and GPS to identify and manage underground municipal water pipes and electrical cables.

#### [RFID Tracks Wooden Utility Poles at the Factory and in the Field](#)

Cox Industries is using EPC Gen 2 tags to manage the storage and shipment of poles it makes, while a South Carolina city is employing similar tags to manage its poles' inspection and maintenance.

#### [Westar Energy Tracks Power Poles, Transformers With RFID](#)

The Kansas utility company uses the technology to automatically identify when each pole and transformer is removed from storage yards, by whom, and when unused items are returned.



“We can search our database for any piece of information on any component tied into the RFID tag and find it within seconds and print it.”

LAYNE TUCKER, ECHORFID

tion (PHMSA) regulations are beginning to require that utilities determine pipeline viability.

“There are increasing regulatory requirements coming out all the time to improve the inspection and tracking of the nation’s infrastructure,” Klonsinski says. “PHMSA is just one agency that is becoming more aggressive about utility managers tracking the performance and maintenance of the gas transmission infrastructure.”

Thiensville, LaFond says, uses the data it writes back to the RFID tags on its assets with the InfraMarker system about maintenance and other actions to help in its reporting to regulating bodies. “Wisconsin has a Capacity Maintenance Overflow and Management program for sewer systems, so every year it has benchmarks and definable goals,” he says. “Having a way to locate and identify our force’s main assets was a benchmark we achieved.”

Riviera’s Lauderdale also sees the benefits of using RFID to comply with government safety regulations. “We do have regulations pretty specific to the gas industry about doing quarterly and yearly leak surveys of gas systems, an area at a time, and reporting the survey results to the Federal Highway Administration,” he says. RFID, he adds, could be used to document gas distribution system leak repairs.

Ideally, assets should be RFID-tagged at birth at the manufacturing plant, says Layne Tucker, CEO and founder of EchoRFID, which makes the PipeTalker asset and integrity data management system, designed to help reduce a utility’s liabilities by proving it has done its due diligence. “We can locate all material installed in a project and recall its georeferenced location,” he says. The solution uses GPS and RFID to track assets and their attributes, from construction through maintenance and operational inspections for quality control. The PipeTalker software runs on handheld devices, such as smartphones and tablets, and uses open architecture to integrate with existing GIS systems.

“You want to follow that component, whether it’s a pipe, valve or fitting that goes

into a line during manufacture, and whether it’s joining plastic pipe together or welding steel pipe or fusing something else,” Tucker says. “You want to have historical construction information from the manufacturing level on, to trace it at the warehouse, and merge it with the materials management information.” Utility companies buy and sell assets all the time, he explains, and having good, up-to-date data on every asset adds to its value.

Should an incident occur, the utility would be able to provide regulatory bodies or government inspectors with information documenting that it had done its due diligence—and it could comply in a more timely manner than if it had to dig through piles of paper stored in file cabinets or cartons. “Our system gets that information electronically in eforms that are stored in the cloud very securely,” he says. “We can search our database for any piece of information on any component tied into the RFID tag and find it within seconds and print it.”

PPI’s Radoszewski says industry organizations see value in the concept of improving traceability. “The whole idea is to take advantage of technology that tells you everything about the pipe and anything else near it, so if anything goes wrong you can go back and investigate,” he says.

Pipeline integrity management, as demonstrated by solutions like EchoRFID’s, “is right in line with what we need in this country,” Cardno’s Anspach says. “We really need to do a better job of determining how we are going to document the utilities we put in the ground today, because we didn’t do a very good job of documenting that in the past,” he says.

In the near future, RFID field markers will become more even more valuable when they are embedded with sensors that detect what is going on in the environment around that tag, Klonsinski says. “Knowing that land in which the pipe is located has shifted or that increased gas levels are detected over a weldpoint can give infrastructure managers an early warning that these assets are at risk,” he says. “This technology has the potential to help stop a disaster before it happens.” ■



# RETAIL APPAREL ROI CALCULATOR

ESTIMATE WHAT RFID CAN DO FOR YOUR BOTTOM LINE

Learn how to assess your potential return on investment (ROI) from employing RFID to track apparel, footwear and accessories in stores. This interactive spreadsheet comes with supporting notes that explain the assumptions in the calculator.

#### THE CALCULATOR ENABLES RETAIL FIRMS TO:

- › Enter their average number of units on the sales floor and in the back room, as well as their average unit cost, inventory turns and retail margins
- › Enter the number of hours that staff members spend receiving goods, conducting cycle counts and replenishing product inventory
- › Estimate the reduction in labor costs

#### THE CALCULATOR ALSO:

- › Allows a user to estimate the potential increase in sales
- › Enables companies to estimate hardware, software and integration costs, based on their store layout and operations
- › Provides a sample case for a fictional company

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Making RFID deployments faster, cheaper and more reliable—and solutions more powerful.

BY BOB VIOLINO

IN THIS ISSUE: HEALTH CARE • RETAIL • AUTOMOTIVE

## A Turnkey Solution for Medical Device Manufacturers

Vue-Med enables companies to comply with the FDA's identification mandate and achieve internal and supply-chain benefits.

**VueTrack-UDI** includes software-as-a-service to enable cost savings for companies.

WHEN THE U.S. FOOD AND DRUG ADMINISTRATION established its Unique Device Identification (UDI) System to improve patient safety, it did not specify whether device manufacturers should use bar codes or RFID technology to identify medical implants, surgical instruments and life-support/life-sustaining machines. The regulation specifies that each medical device must carry a unique identifier to facilitate recalls, improve reports about adverse events and thwart counterfeiting. The system leverages human- and machine-readable UDI labeling for identifying medical devices, and requires device labelers to submit information about each device to the FDA's Global UDI Database. The data includes lot, serial number and expiration date.

While some device manufacturers are opting

to use bar codes to comply with the FDA mandate, other companies see this as an opportunity to adopt RFID because it also allows them to improve their internal processes. And while bar codes may be the easier route to compliance, VueTrack-UDI—which features VueMed's software and Zebra Technologies' hardware—is a complete solution that facilitates UDI compliance and provides supply-chain visibility.

Boston Scientific, Cook Medical, Gore, Medtronic, St. Jude Medical and other large device manufacturers have adopted VueTrack-UDI and are encoding UDI information onto RFID tags at their distribution facilities. They are leveraging the technology for inventory management and chain-of-custody tracking and tracing of products, says Lana Makhnik, VueMed's COO. "Other companies are opting to



use bar codes, because to shift to RFID involves a significant retooling of manufacturing and labeling operations,” she says. “In terms of executing this, it’s going to take time.”

Device manufacturers use a Zebra RFID printer (R110Xi4, ZD500R or ZT400) to encode UDI data onto RFID tags and print the required labels. VueTrack-UDI can work with any EPC Gen 2 passive ultrahigh-frequency RFID tag that has the extended user memory required for UDI on-tag data (512 bytes).

VueTrack-UDI includes software-as-a-service to enable cost savings for companies, because VueMed handles all software maintenance and upgrades. The cost of the software varies based on the size of the implementation, number of locations and so on, Makhanik says. “It takes just a few seconds to encode, print, validate and register the RFID tag for each item, creating its unique identification



and providing the ability to track it throughout its life cycle using the VueMed cloud,” she says.

Manufacturers can view Web-based reports to track medical devices throughout the supply chain, from their facility to a hospital’s procedure room. The UDI tag data allows users to locate expiring and recalled products immediately.

Hospitals that have a fixed or mobile UHF RFID infrastructure can leverage the UDI data for their own inventory management and supplies documentation, including expiration and recall tracking. “Both the manufacturer and the customer, usually a hospital, can know when the device showed up at the customer site,” Makhanik says. The data can be integrated with hospital clinical-documentation and electronic health record systems. VueMed is working with a number of hospitals to deploy such infrastruc-

ture and services during the next few months, she says.

Hospitals must document the supplies they use for patient care, as well as those they purchase, Makhanik says. “The specifics and degree of supply-documentation requirements may vary from one hospital to another, but as a general rule all must document any devices implanted in patients, along with the lot and serial number and expiration date for each,” she says. “Most hospitals are also interested in capturing this information, either before or at the time of receipt into the facility.”

Manufacturers and hospitals don’t need to use the same software, as long as they’re able to refer to the same item or same instance of an item, Makhanik says. VueMed’s software and cloud data management enable this visibility and data cross-references between hospitals and manufacturers, as well as between



various systems within a hospital, she says. Because VueTrack-UDI encodes the UDI data directly onto the tag, the data can be read by any UHF RFID-compliant technology.

The medical device industry has long suffered from a lack of supply-chain visibility and the ability to do any meaningful supply-chain forecasting, Makhanik says, including knowing what items are in the field, when they’re due to expire, where recalled items are, and which devices have been used for patient care. This has resulted in billions of dollars of waste for manufacturers and hospitals, as well as shortages and inefficiencies in the supply chain and clinical and patient safety risks, she says.

“The current state is that each trading partner—manufacturer, distributor and hospital—typically uses its own way to identify the products it is selling, distributing or purchas-



**Device manufacturers** use a Zebra RFID printer to encode UDI data onto RFID tags and print the required labels.



ing, creating numerous disparities in the data, which takes a lot of time and resources to reconcile and manage,” Makhanik says.

Although the FDA regulation is aimed at device makers to ensure product safety, the UDI System has broad implications for the health-care supply chain. In addition to patient safety, Makhanik says, “UDI adoption

holds numerous potential benefits in gaining substantial improvements in supply-chain and workflow efficiencies, data accuracy and management, complete inventory visibility, and significant enhancements in trading-partner relationships across the industry as a whole. VueTrack-UDI was designed to help achieve these goals for all trading partners.”

## Retail Software Grows Up

SML takes Clarity to the cloud, to help Tesco and other retailers manage enterprisewide inventory processes more effectively.

**Clarity 3.X** software can manage inventory data collected from fixed and handheld RFID readers, as well as from ceiling readers and robots.



WHEN XTERPRISE INTRODUCED Clarity’s Advanced Retail System (ARS) in 2008, the software was designed specifically to enable retailers to use item-level RFID data to improve inventory accuracy in stores. American Apparel, one of the first retailers to adopt the solution, rolled it out to more than 250 stores worldwide. The ARS software platform featured five modules for in-store retail applications and in-store servers to collect and manage the RFID-generated data. The solution helped American Apparel reduce overall

inventory by 15 percent and boost sales by 3 percent. Two unexpected benefits were a reduction in shrinkage and a decrease in employee turnover.

Many developments have occurred since then. SML Group bought Xterprise in 2013, and changed its name to SML Intelligent Inventory Solutions in 2015, to better reflect its strategy to provide RFID-enabled inventory-management solutions to the apparel market. More apparel retailers began deploying item-level tracking at hundreds of their stores—often within

PHOTO: SML

months—and at distribution centers. And now, retailers also want to provide their customers with an omnichannel shopping experience.

Retailers moving toward chainwide adoption of RFID for inventory management began asking for software that could support a broad spectrum of business processes without the need for costly in-store servers, says Dean Frew, SML's chief technology officer and senior VP of RFID solutions.

To address this demand, in 2013, SML began working with U.K. retailer Tesco to develop Clarity 3.X software. Tesco wanted to adopt RFID to boost customer service at its more than 500 F&F brand stores, by reducing out-of-stocks and freeing up sales associates from performing manual stock counts, so they could spend more time assisting shoppers.

Retailers today require highly scalable solutions that support hundreds of stores—simultaneously performing stock counts and replenishment processes, and tracking deliveries, Frew says. That meant a fundamental shift from Clarity's pipeline architecture to a cloud-based software suite that enables hori-

zontal scalability to support retailers of all sizes. Clarity 3.X does not require any servers running at a retailer's site. That means a much lighter technology footprint in stores, he says, which simplifies deployment and support.

Retailers can also implement Clarity 3.X with point-of-sale readers. This enables the retailer to have item-level inventory accuracy at the last transaction point in the chain, with the customer, Frew says.

Clarity 3.X features a Web dashboard and a user interface for handheld readers or tablets. "These three user terminals support initiation of transactions, finalization of transactions, or basic or advanced business intelligence reporting," Frew says. The applications enable sales associates or managers to monitor the status of a stock count, view a variance of that stock count, direct replenishment or spot a trend in out-of-stocks on the store floor for the week, he says.

Today, Tesco is using Clarity 3.X to manage more than 95 percent of its F&F brand apparel line. SML also provides Tesco with most of the EPC Gen 2 passive ultrahigh-frequency RFID tags it's using to identify more than 200 mil-



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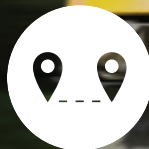


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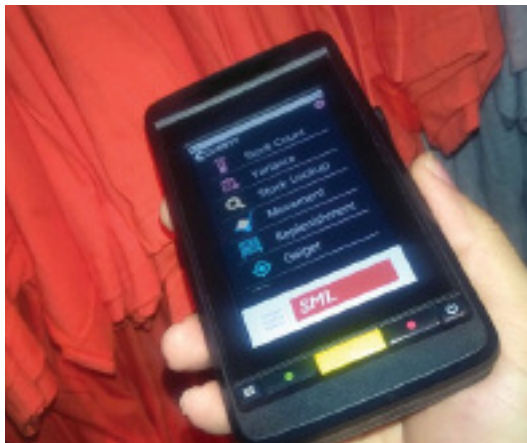
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### Clarity 3.X

does not require any servers running at a retailer's site, which simplifies deployment and support.



lion items annually. The retailer is using fixed and handheld readers from Zebra Technologies, and Nedap pedestal readers. "We also have built Clarity to support future

technologies, such as ceiling readers and robots," Frew says (see [Tesco Deploys Tag-Reading Robot at Five Stores to Track F&F Clothing](#)).

Tesco has reduced out-of-stocks by more than 95 percent, and stock counts take one-twentieth of the time they used to take, so sales associates can spend more time servicing customers. The retailer also has real-time visibility of stock levels and the locations of specific items, Frew says, so it can provide an omnichannel shopping experience for customers, such as buy online pickup in store. Based on the benefits seen with the F&F apparel brand, Tesco is now rolling out RFID at the mobile phone shops in its superstores.

As for American Apparel, the retailer is now evaluating whether to upgrade its RFID item-level tracking software.

## Water Leaks in Cars Can't Hide From RFID

Smarterac's Sensor Tadpole tag helps automobile manufacturers ensure their vehicles are watertight.



### Sensor Tadpole

is a passive UHF on-metal RFID tag with RFMicron's Magnus S2 Sensor IC, which can sense moisture or pressure.

WATER LEAKS CAN CAUSE significant damage to a vehicle's electronics, cabin and trunk, during and after assembly. Automobile manufacturers rely on time-consuming manual processes to check for water leaks in vehicles before they leave the factory. But leakage, which usually comes from window seals, weather stripping and body seams, can be hard to detect, ultimately leading to consumer distress and dissatisfaction.

Now, a German manufacturer of high-end cars is piloting an RFID solution, with industrial automation specialist Turck, to ensure vehicles leaving its factory are completely watertight. The solution uses Smarterac's Sensor Tadpole, a new passive ultrahigh-frequency on-metal RFID tag with RFMicron's Magnus S2 Sensor IC, which can sense moisture or pressure. The Sensor Tadpole, which can be delivered pre-encoded, has an Electronic Product Code and a unique sensor code.

Six to 16 tags are attached via adhesives to a car's body during assembly. Standard UHF handheld readers or gate readers interrogate the tags as they pass through the automaker's quality-check areas, which include a high-pressure shower tunnel to ensure the sensors are placed and working correctly.

The sensors are read before and after a vehicle moves through the shower tunnel. The before-and-after data values are compared, using software provided by Turck that runs on the fixed or handheld readers. If there's a value difference, which would indicate a leak, the tag's EPC identifies the specific location of the leak.

The tags can detect water under carpets, insulators and seats and from high-voltage areas, says Lauri Hyytinen, head of Smarterac's segment automotive business division. "You don't need probes or swabs anymore to identify water from different locations," he says.

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**The sensor tags,** attached via adhesives to a car's body during assembly, can detect water under carpets, insulators and seats and from high-voltage areas.



Automakers can use Smartrac's Smart Cosmos cloud-based services platform to collate and analyze the data received from the sensor tags. They can, for example, track the performance of vehicle components and potentially improve the quality of those components.

"There have been several tests and proofs of concept [with the auto company] to establish an error-free solution," says Walter Hein, Turck's business-development manager. "We began our tests reading the tags via handhelds. The next step was a gate test to simulate real production conditions. The first gate test has been finished and others are just in progress." Turck is also running tests with other automakers and still more are interested in testing the product, he says.

Smartrac designed the Sensor Tadpole tag as a low-cost solution to the challenge of water-sensing applications in high-volume deployments. Water sensors using active tags are too costly for wide-scale use, Smartrac's Hyytinen says. They require batteries that must be replaced on a regular basis, which drives up the cost. "So," Turck's Hein adds, "obviously there is a huge demand for a turnkey solution like this."

The auto company is now deciding whether to move forward with a full-scale implementation, Hein says. "We are very confident to see such solutions running this year," he says. The customer can benefit in a number of ways, he adds, such as the elimination of errors resulting from manual operations.

"With the current test methods for leakage, some of the faulty vehicles are not detected and are delivered to the customers," Hein says. With the automated system, faulty vehicles are immediately detected and removed from the line. "The 100 percent detection ensures that each vehicle is leak-proof when it leaves the production hall," he says. "Any costly rework is no longer required."

In addition, Hein says, because only checked vehicles that have been verified as leak-proof are delivered to consumers, complaints about leaks "are becoming a thing of the past. Thus, both the customer and the brand can benefit from the increased level of quality."

The Sensor Tadpole has the potential to deliver benefits to other industries, such as aviation and shipbuilding, that also must monitor products for water leakage, Smartrac says. ■





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# Retailers Must Reframe Their Thinking

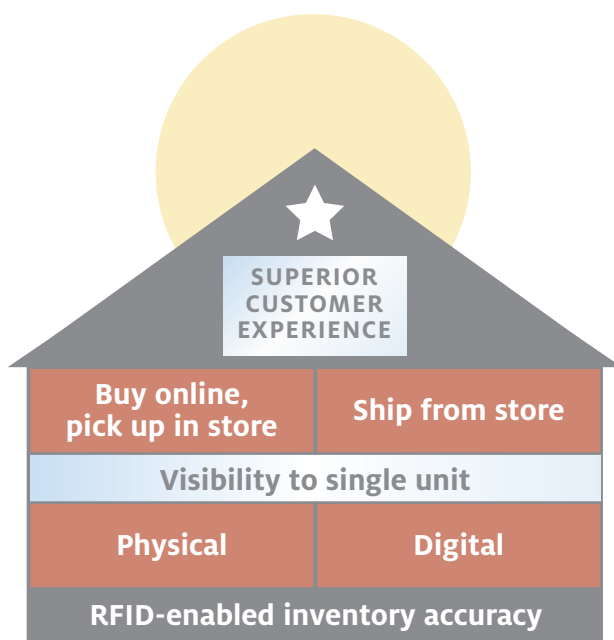
If you build an omnichannel house without an RFID foundation, it will crumble.

On a recent conference call with a leading RFID integrator discussing RFID adoption, the conversation turned to competing retail projects. During the previous holiday season, the vast majority of retailers failed in their efforts to provide an omnichannel shopping experience for customers. As a result, retailers were setting aside RFID inventory-management projects and escalating their omnichannel efforts. A few days later, I visited the VP of operations for a major retailer. He told me that while the company was interested in RFID, it had other priorities and had decided to focus on enabling customers to buy online pickup in stores (BOPIS).

On my drive home later that day, I passed by a new house being built on my street. The builders had spent the past month preparing the ground and laying the foundation, and now they were beginning to frame the house. Why, I wondered, would retailers try to build an omnichannel house without the proper foundation? I can only surmise that retailers still don't understand that RFID is the only reliable and cost-efficient way to obtain high inventory accuracy—and having high

inventory accuracy is the only foundation on which an omnichannel house can be built.

The first floor of an omnichannel



house is represented by the two commerce channels—digital and physical. The digital channel represents online efforts, and the physical one, stores or collection points. Since the inception of the Internet, the general trend has been for brick-and-mortar retailers to add the digital channel. Recently, the reverse is happening as digital retailers

are adding physical channels.

The second floor of an omnichannel house is composed of two key omnichannel capabilities—BOPIS and ship from store (SfS). BOPIS blends the digital and physical channels from the customer's perspective, providing an anytime, anywhere shopping experience. SfS blends the channels from the operations perspective, as digital purchases become sourced from the physical stores.

There's a critical subfloor between the first and second floors: visibility to the single unit. For BOPIS and SfS to blend the channels, retailers must know what merchandise they have and where they have each item. Finally, and most importantly, the entire house is supported by a firm foundation, based on high inventory accuracy.

The ultimate outcome of a well-built omnichannel house is a superior customer experience. Retailers are frantically trying to build the first and second floors in an effort to get the roof put on the house very soon. But if they build the house without a firm RFID foundation, they will fail.

RFID should not be viewed as an independent initiative or a competing priority to any omnichannel initiative. Without high inventory accuracy, an omnichannel house cannot be built, or, if it is built, it will not stand. ■

Bill Hardgrave is dean of Auburn University's Harbert College of Business and founder of the RFID Lab. He will address other RFID adoption and business case issues in this column. Send your questions to [hardgrave@auburn.edu](mailto:hardgrave@auburn.edu). Follow him on twitter at @bhardgrave.

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## HEALTH-CARE BEAT

By Ygal Bendavid and Harold Boeck

# Managing Surgical Instruments

RFID can improve patient safety and deliver cost savings to hospitals.

In 2011, Shimane University Hospital, in Japan, deployed a high-frequency RFID solution to track surgical instruments used on patients through cleaning, sterilization and storage. The Rigshospitalet hospital, in Copenhagen, recently completed an 18-month trial in which it used ultrahigh-frequency RFID technology to track surgical instruments. While they took different approaches, both hospitals found that item-level monitoring improved patient safety and reduced costs and labor.

To help determine whether an RFID surgical-instrument tracking solution will deliver a return on investment for your hospital, consider the hard and soft benefits to be gained throughout the process: the preoperative stage, during the assembly of instrument trays at the central sterile department (CSD); intraoperative stage, for verifications before surgical interventions in the operating room; and postoperative stage, when hospital personnel collect all soiled instruments and send them back to the CSD for reprocessing (decontamination, assembly and sterilization).

As we discussed in our recent column [Hard vs. Soft Benefits](#), hard benefits are those that will be converted into cash savings or additional revenues. Soft ben-

efits will improve efficiencies, but they won't necessarily impact your bottom line. Still, when it comes to managing surgical instruments, the soft benefits may drive your business case, because



patient safety comes first. Automatically tracking instruments can greatly reduce or eliminate infections, and it ensures no instruments are inadvertently left in the patient. Item-level tracking also facilitates traceability for compliance with sanitization and record-keeping requirements. Moreover, Shimane reports its solution reduces nurses' mental stress and enables them to spend more time caring for patients.

But to be sure, the soft benefits are bolstered by recurrent hard benefits. Rigshospitalet, for example, which conducts approximately 75,000 surgeries annually, found automating manual

processes could save the hospital 31,000 hours a year in operating-room procedures. Similarly, Shimane, which performs roughly 6,000 surgeries annually, found the entire process of managing instruments per operation was shortened from 150 minutes to 50 minutes, with expected annual savings in hundreds of thousands of dollars. More efficient use of instruments also enabled the hospital to reduce its inventory by 20 percent, with anticipated savings related to further procurements. In addition, the RFID data can be used for quality control, maintenance and

repair. The hard benefits your hospital could achieve will depend, in part, on how many surgeries are performed annually and how many tools you tag and track.

Using RFID to manage surgical instruments is a relatively new application that involves a number of challenges. When developing your business case, assess your workflow and all the areas in which you will need to establish read points. Also,

consider the up-front cost of tagging tens of thousands of instruments (which requires specific competencies and equipment), as well as trays and carts.

If your business case indicates your hospital could achieve a ROI, put out a call for tenders. Then, as the Shimane and Rigshospitalet examples demonstrate, you'll have to evaluate the HF and UHF RFID options and decide which is best for your hospital. ■

Ygal Bendavid and Harold Boeck are professors in the school of management at the Université du Québec à Montréal, and members of RFID Academia's research board.





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## The Four Questions

What you must know *before* you begin an RFID project.

Many of my consulting clients come to me when they run into trouble in the middle of an RFID project. Often, their software problems could have been avoided, and much time and money saved, if those involved understood the answers to the following questions before they bought a single tag or reader.

*Is this a point solution or an enterprise project?* A point solution automates a single process, and the RFID data doesn't interact with other business applications. With an enterprise project, RFID data has value to many business processes and, possibly, to trading partners. At first, tracking tools in a plant might seem like a point solution that will be confined to helping factory workers improve productivity. But the RFID data also could help with job scheduling, capital equipment accounting and workflow analysis. If your RFID project has the potential for broader use, plan for that (see [Document Your Software Deployment Design](#)).

*Should I invent my own encoding scheme for the tag data?* The answer is *no*! Whether you're tracking items within your company or through the supply chain, it's best to use a global industry standard. I've addressed this issue in previous columns (see [What's In a](#)

[Name? The Right Way to Encode RFID Tags for Consumer Products and A New EPC on the Block](#)).

*What data should I put on the tag?* A passive EPC Gen 2 ultrahigh-frequency RFID tag has user memory that can function as a miniature database. This



is useful for some applications, such as tracking airplane parts for maintenance and repair operations. But for most other applications, it's best to encode only a unique identification number onto the tag, and put all the other information into a database, which you can look up using the tag's UID number. That way, you can easily update the information even if you don't have

physical access to the tag, and you won't lose any data if the tag fails. There is a little more up-front work to deploy the database and make sure it's always accessible, but the long-term benefits more than outweigh that.

*Should I design my own data format for sending RFID reads to my business applications?* Again, the answer is *no*. Use the industry standard Electronic Product Code Information Services (EPCIS), which provides context to tag reads. It not only tells you *what* tags were read and *when*, but also *where* and *why*. EPCIS is flexible to accommodate your project's information needs, while helping make your data resilient to changing business requirements (see [EPCIS for Internal Projects and Supply Chain Visibility](#)).

Understanding these software issues will ensure your RFID implementation can scale and deliver all the benefits possible.

Otherwise, you'll be locked into a rigid system in which you can't adapt data to new purposes or upgrade to more advanced hardware down the road. ■

Ken Traub is the founder of Ken Traub Consulting, a Mass.-based firm providing services to companies that rely on advanced software technology to run their businesses. Send your software questions to [swsavvy@kentraub.com](mailto:swsavvy@kentraub.com).

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