RFID JOURNAL SURVEY REVEALS

What End Users Want

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RFID JOURNAL LIVE!

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RFID Journal LIVE! is the world's largest and most important event focused on radio frequency identification and related technologies. **During this three-day event, you will gain new insights from industry leaders about how they are benefitting from RFID and related technologies.** The event will feature the world's largest RFID exhibition, with RFID companies from around the world in attendance.

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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.

RFID in the Food Industry, October 26

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. RFID in the Food Industry, Oct.26

RFID Connect

Find products that can help you deploy RFID successfully, such as William Frick's RFID Windshield Vehicle Tracking Tag. The ultrahigh-frequency RFID tag, which can be affixed to glass surfaces, can be used to track vehicles going in and out of parking garages, car washes and other venues, automating access control.

Top 10 Search Terms in September			
1	Decathlon	6	Construction
2	Impinj	7	Library
3	Jewelry	8	Retail
4	Security	9	RTLS
5	Beacon	10	NFC

Most-Read Stories in September

- Indian Aviation MRO Company Expects RFID to Reduce Labor by 50 Percent

- Meggitt Polymers & Composites Uses RFID to Track Aircraft Components, Materials

- Casino Prevents Security Violations Via Beacon Solution

- Impinj Releases xSpan Reader for Tracking Flow of Items, People

- RFID Scores Well at TopGolf's Newest Entertainment Complex

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:

- How is RFID tag testing carried out?
- How should I approach an RFID deployment?
- What is the value of RFID for aviation MROs in terms of dollar savings?
- How can RFID tags be located in warehouses when items are removed from a rack?
- What types of semi-passive logger tags are available?
- Have there been any RFID deployments to track the status of construction projects?

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

What Retailers Should Test for in a Proof-of-Concept
It's not just about the technology. Companies must also consider the business case, change management, the data and other issues.
....

RFID Helps Secure Dignity for Senior Community Residents
McLoughlin Place uses BriefWise to non-intrusively check the incontinent for wetness.
....

NFC Helps Charity With Fundraising Event
Tipping Point received more than $7 million in donations within half an hour.

Readers' Views

We have always tried to make RFID Journal a vehicle for communication among those interested in deploying, selling or studying radio frequency identification technologies. We named our flagship conference and exhibition RFID Journal LIVE!, because we bring the people we write about on our website and in our magazine to a live audience, so attendees can see and hear in person from those who worked on RFID projects, ask them questions, and benefit from their knowledge and insights.

One way to foster communication is to ask you, our readers, what's on your mind when it comes to RFID. To that end, last May, we conducted a survey of end users in our database. We heard from 140 people worldwide who work in a variety of sectors. Our goal was to understand the state of RFID adoption and the factors holding companies back from using the technologies more extensively.

Roughly a third of the survey respondents have deployed RFID in some of their facilities. Another third are researching RFID but have not yet implemented it. The remaining third are in various states of deployment, from conducting a proof of concept to having fully deployed it at all of their facilities.

A key problem limiting adoption is the need to buy tags from one company, readers from another and software from a third, and perhaps hire a fourth to install the system. Nearly half of all respondents said it would be simpler and less risky if they could buy an integrated solution from a single provider.

It's interesting that systems integrators generally got high marks for delivering a system within the quote they'd given, helping to streamline processes and overcoming issues that arose during the deployment. You can read the full results of our survey—and hear from some respondents who answered follow-up questions—in this issue's cover story, End Users Speak Out.

One sector beginning to see concrete benefits from RFID is medical labs, which must process, store and test thousands of specimen samples annually. Most test tubes and other sample containers look alike, and it's labor-intensive to check and recheck bar codes or human-readable characters on small labels on the containers. Labs are using RFID to simplify these processes, reduce error rates and enable their workers to focus on what they do best—testing (see Vertical Focus).

Also in this issue, we highlight some intriguing new products reaching the market: STMicroelectronics' NFC RFID tags, which enable manufacturers and utilities to easily communicate with electric, gas and water meters; and Ubisense's AngleID, a standalone solution that provides a cost-effective way for manufacturers to locate assets in factories and yards (see Product Developments).

Of course, you don't have to wait until our next survey to communicate with us. You can send me an email at editor@rfidjournal, post a question on our Ask the Experts forum, or come to one of our events to engage with speakers, other attendees and the vendor community.

Mark Roberti, Founder and Editor, RFID Journal

TECHNOLOGY

Precisely Monitoring Livestock—and More

The U.S. Department of Agriculture is funding research to track animals, but the work could have broader implications.

On Sept. 7, U.S. Secretary of Agriculture Tom Vilsack announced that grants worth $7.4 million would be given to 76 small businesses to conduct research related to food security, natural resources and agricultural issues. One grant, made through the Small Business Innovation Research (SBIR) program, was awarded to Clairvoyant Technology, which is using the funding to develop software that enables livestock tracking to within 2 inches (5 centimeters) with off-the-shelf ultrahigh-frequency RFID tags, readers and antennas. If successful, the project could have broad implications for the use of passive UHF RFID in retail, logistics and many other industries.

Thomas J. Frederick, president of Clairvoyant Technology, says livestock tracking is a means to an end. "We were looking at the SBIR program as a funding vehicle for research and commercialization of several patented and patent-pending technologies," he says. "Of the 11 federal agencies that participate in the SBIR program, the USDA is among those publishing very broad solicitations. Livestock tracking was a means to fit our technology into research in which the USDA was interested."

Frederick says he has been working on a way to get more precise location data on items with passive UHF RFID tags and to eliminate extraneous reads near distribution-center portals, retail security gates, point-of-sale terminals and so on. "I felt like the position information was there in the signal using standard readers, tags and antennas," he says. "We just weren't effectively extracting it."

Clairvoyant will test its software in field trials involving tracking cattle in the area near feed bunks and water troughs. This could help ranchers monitor the health of their livestock. "The idea is to detect whether an animal is actually at the bunk versus lying sick nearby," Frederick says. "If an animal doesn't visit the feed or water within several hours, an alert can be generated to send a rancher out to check on that calf. There are many other applications, in dairy parlors, auction lots, poultry farms and so on. We are developing a fundamental technology. We anticipate the established industry players will develop new and improved applications and automations using this technology."

Clairvoyant has developed an algorithm that accounts for uncertainty in measuring radio waves from tag to reader, which can be affected by the environment and multipath (the reader receiving waves that bounce off objects). It will conduct field trials early next year at facilities run by Kansas State University, in cooperation with KSU's Animal Identification Knowledge Laboratory. The USDA will consider the project a success if passive UHF readers can reliably discriminate between animals and their motion. Did the calf visit the water trough or is it meandering in the vicinity? Which cattle moved through the loading chute? For Clairvoyant, success will be validating the models and achieving much more precise location accuracy of tagged objects. Frederick hopes to get more funding through phase 2 of the SBIR program, so the technology can be further refined and commercialized.

"This research will have many applications outside agriculture," Frederick says. "Once a viable product is developed and tested, we will work with hardware and software vendors to license the technology. It is important to note that the algorithm does not need to run on the reader. The algorithm requires that the reader produce accurate phase shift and receive signal strength data, as well as identify the antenna that received the signal, frequency of the signal and time it was received. With that, the tracking can be done in middleware or the back-end enterprise system."

This means the algorithm could be used to more precisely locate almost any tagged object in any environment with much greater accuracy than is possible today. —*Mark Roberti*

AGRICULTURE

Tracking Slugs To Reduce Pesticide Use

Shell-less terrestrial gastropod molluscs—commonly known as slugs—are slimy and rather disgusting. They are also harmful to farm crops. The U.K.'s Agriculture and Horticulture Development Board estimates that, left uncontrolled, slugs could cost U.K. potato, wheat and oilseed rape producers nearly £100 million (US$122 million) a year. That's why the AHDB is funding research into how best to control them.

Typically, farmers growing crops susceptible to slug damage spread molluscicides (pellets about the size of a grain of rice) on the soil surface to kill slugs. The molluscicides are applied to the whole crop, but this is economically inefficient, since slugs usually congregate in patches within the field. If farmers were able to apply molluscicides only to the areas infested with patches of slugs, they would save money and reduce potential runoff into streams and lakes.

But how can farmers determine where the slugs are likely to gather in

health or behavior. Since the small LF tags have a short read range, the researchers are using a handheld antenna connected to a reader, which provides a detection range of approximately 20 centimeters (8 inches). "This is ideal, as we can detect slugs that are just below the soil surface, which is a big step forward in this area of research," Pope says. "We will complete regular 'sweeps' of the crop area using the handheld antenna in order to record the position of multiple slugs."

A major advantage of using RFID tags

Researchers can detect slugs identified with LF tags using a handheld antenna connected to a reader.

their fields? The AHDB is funding research into slug behavior. The goal of the work, being led by Prof. Keith Walters at Harper Adams University, is to understand where slug patches are likely to form within the crop, how these patches form and how stable they are.

To track slugs in the field, Harper Adams University researchers Emily Forbes and Tom Pope hit on the idea of using passive low-frequency RFID tags. The researchers inject the slugs with a passive LF tag, which, they report, has not adversely affected the molluscs'

is that researchers don't need to collect the slugs to track them, so it's fast and allows them to study large numbers of slugs at the same time.

"We are at the early stages of this research and we would like to increase the numbers of slugs being tagged and also to investigate further the use of fixed point readers within the field," Pope says. "We hope to be able to advise farmers on how best to apply molluscicides." With any luck, RFID will help control slugs more cost-effectively and in a way that safeguards the environment. —M.R.

PHOTOS: HARPER ADAMS UNIVERSITY

Organic Growth

Hectares of organic agricultural land under cultivation by region, 2014:

Oceania
17.3 million

Europe
11.6 million

Latin America
6.8 million

Asia
3.6 million

North America
3.1 million

Africa
1.3 million
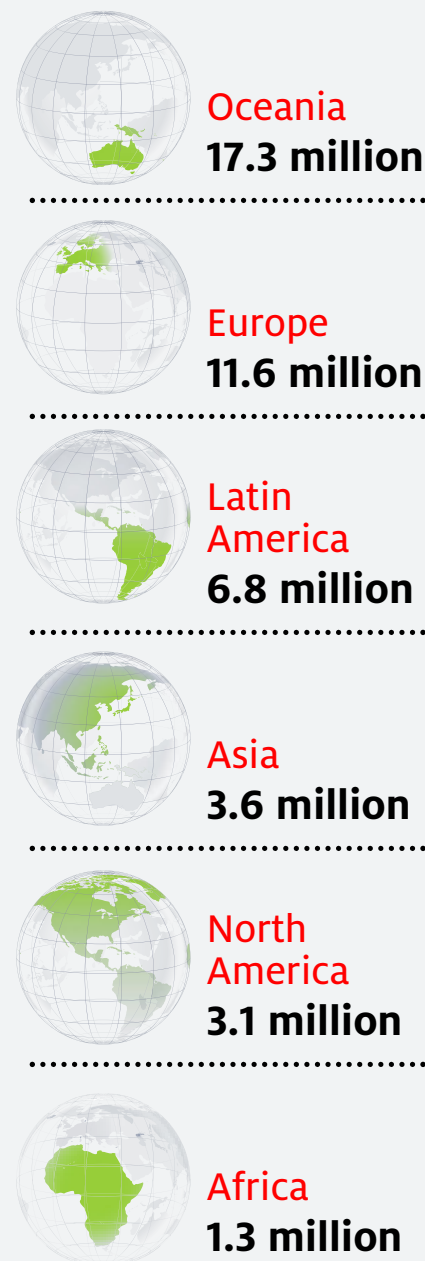
—Rich Handley

Signs RFID Is Nearing A Tipping Point in Apparel Retail

A number of leading indicators suggest the sector is poised to adopt radio frequency technology en masse within the next few years.

For the past few years, RFID Journal has been saying that the first industry to adopt radio frequency identification on a large scale would likely be apparel retail. There are several reasons for this. Clothing is RF-friendly, making it easy to read tags on large numbers of individual items. Clothing inventory is complex, with a wide variety of styles, colors and sizes. The ability to read many tags quickly enables retailers to identify which items are running low or have run out on the store floor and replenish them more effectively. And finally, some big retailers, including Kohl's, Macy's, Marks & Spencer and Zara, have been deploying RFID for inventory tracking.

So how close to mass adoption is apparel retail? In some ways, it seems far off. Fewer than a dozen U.S. retailers are using RFID on most items in all their stores. And some studies estimate that less than 5 percent of all apparel items are tracked with an RFID tag. But there are anecdotal signs that the industry is moving closer to the tipping point, at which time the trickle of new retailers adopting the technology will become a flood. Here are a few signs.

Research conducted by the RFID Lab at Auburn University—based on public reports and the lab's own work with numerous retailers—reveals that U.S. retailers adopting RFID increased 32 percent from June 2015 to June 2016, up from a 23 percent increase the previous year. This suggests adoption among apparel retailers is accelerating. This is supported by RFID Journal's own data. We saw a 25 percent increase in newsletter subscribers from the retail sector from June 2014 to June 2015, and a 37 percent increase from June 2015 to June 2016.

> Research conducted by the RFID Lab at Auburn University reveals that U.S. retailers adopting RFID increased 32 percent from June 2015 to June 2016.

The RFID Lab study also found that many retailers are launching a proof of concept. A PoC typically involves one or two stores and a limited number of merchandise categories. It is designed to demonstrate RFID's effectiveness in the retailer's environment. The study revealed an impressive 42 percent growth in apparel retailers conducting PoCs.

Another positive sign for RFID adoption in apparel retail is that more PoCs are leading to larger pilots. Many of the retailers conducting PoCs last year moved to pilots this year, resulting in a 57 percent increase in the number of pilots, which typically involve more test stores, more tagged categories, and the use of matched control stores to help isolate the effect RFID has on replenishment and sales.

There was a relatively small increase (18 percent) in phased deployments. The most likely reason for the modest increase, according to the study, was that some retailers extended pilots, and it often takes months to convince management to go from a pilot to a phased rollout. In addition, phased rollouts tend to commence at the start of the year, when the holiday selling season is over and new funding becomes available.

The study did find that the number of retailers with full deployments—tracking all items in all stores with RFID—doubled. But, the lab cautions, the base was low, so the

Will Sporting Goods Be Next?

IN HIS BOOKS *Crossing the Chasm* and *Inside the Tornado*, Geoffrey Moore explains that new technologies emerge from the chasm between visionaries and pragmatic early adopters, reach critical mass and then take off in one industry. After that industry enters the "tornado" phase, neighboring industries begin to adopt the technology (this is what Moore calls the "bowling alley" phase of adoption because one industry adopting leads to another and then another, like bowling pins being knocked over).

RFID Journal believes apparel retail will be the first industry to enter the tornado phase of adoption. That raises the question of which related sectors will follow. A number of retail sectors, including auto parts, electronics, jewelry and mass merchandise retail, have been experimenting with RFID. But the sector poised to adopt now appears to be sporting goods.

Many of the items a typical sporting goods store sells are, of course, apparel—sweatpants, sweatshirts, T-shirts, gloves, caps, shorts, socks and so on. If apparel retailers are getting big benefits from RFID-tracking these items, it makes sense for sporting goods retailers to use RFID to manage their apparel inventory.

Moreover, many other items in the store have complex inventory. Baseball mitts, for example, look very similar but come in different sizes. Bicycles, golf clubs, fishing poles and other products have a wide variety of stock-keeping units, making it difficult to keep them in stock. So it is no surprise we are starting to see more sporting goods retailers adopt RFID.

Mammoth Outdoor Sports was one of the first sporting goods retailers to use RFID. It deployed an RFID solution that enabled it to merge its Internet and retail store inventories, and to gain a daily report regarding which products are at its warehouse and stores, or at exhibitions (see California Sporting Goods Retailer Gains Visibility With RFID).

French sporting goods retailer Decathlon has deployed RFID at all of its 1,030 stores worldwide, as well as at 43 warehouses (logistics centers). Decathlon saw an 11 percent increase in sales from July 2014 to July 2015, and the company attributes part of that growth to the RFID deployment. The company also saw a 9 percent reduction in shrinkage after deploying the RFID solution, and the shrinkage continued to decline in 2015 (see Decathlon Scores a Big Win With RFID).

Sport Zone, a sporting goods and sportswear retailer with 120 stores in Spain and Portugal, is expanding its use of RFID technology to eight stores, following a two-store pilot that raised inventory accuracy from roughly 80 percent to 99 percent, thereby boosting sales. At the same time, the retailer achieved a 92 percent reduction in stock-counting efforts, a 90 percent reduction in receiving time and a significant sales lift. The company expects to recoup its investment within a year after deploying an RFID solution that helps it track when merchandise leaves its distribution center, arrives at stores and is put out on the sales floor (see Sport Zone Raises Inventory Accuracy With RFID). —*M.R.*

With such improvements, it's not hard to see why sporting goods will likely follow apparel and enter the tornado phase of RFID adoption. —*M.R.*

100 percent growth is not particularly significant.

Another sign that retail is nearing mass adoption of RFID is that suppliers are more willing to tag items, and retailers are experiencing less pushback. Speaking at RFID Journal's recent RFID in Retail and Apparel event in New York City, Bill Connell, Macy's senior VP of logistics and operations, said there is now a "much greater acceptance and greater understanding of the benefits" among suppliers, and "there is a momentum that suggests to us that we are pretty much at that tipping point."

Suppliers are beginning to discover internal benefits. A few years ago, Elie Tahari, the women's fashion company, was asked to RFID-tag the items it was shipping to Macy's. The company contacted Avery Dennison, which was supplying its apparel hangtags, and asked it to put a passive ultrahigh-frequency RFID transponder in each hangtag on items bound for Macy's. By doing so, it complied with Macy's tagging requirements, but got no benefit from the tags.

Speaking at RFID in Retail and Apparel, Nihad Aytaman, Elie Tahari's VP of information technology, explained the evolution of the company's thinking. "As we began shipping to Macy's more and more, we ended up tagging more lines," he said. "One of our partners, the COO for Tahari ASL said, 'We are spending all of this money tagging [items for Macy's]. Let's tag everything and make use of it internally.'"

Now, Tahari ASL tags items at the point of manufacture. The company decided to use RFID in three areas of its distribution centers: receiving, packing and shipping. Thus far, it has implemented the technology in the receiving area. "The speed is indisputable," Aytaman said.

The packing area is currently undergoing testing. When tagged items are being picked to ship to a Macy's store, they are put in a box and then checked with a handheld reader. The handheld screen displays any anomalies, such as an extra item or an item short. The worker at the picking area can quickly identify and resolve any issues.

Tahari ASL has already reduced the time required to receive goods into inventory at its distribution center. The company believes RFID will reduce picking and shipping errors and deliver a return on investment. Other apparel companies required to ship tagged products are following a similar course.

It is still not clear when RFID will reach the tipping point in apparel retail, but as more retailers begin using the technology, more apparel companies will tag at the source and more, like Elie Tahari, will begin tagging all items they make. As more suppliers do this, there is more reason for laggards to adopt RFID and take advantage of tags already on products they receive. And that is when RFID adoption in this sector will explode. —*Mark Roberti*

Do Tag Costs Matter?

Many retailers that are just learning about RFID ask about the cost of the tag. Some even say they can't adopt the technology until tag prices come down. It's an odd position because tag cost is not a key driver of a retailer's return on investment.

RFID Journal has created an RFID Apparel Retail ROI Calculator to help retailers determine what their potential ROI might be. Of course, the calculator can't cover every benefit of an RFID deployment. For example, it doesn't allot any payback for RFID's help in supporting an omnichannel strategy by ensuring items are in stock when systems say they are in stock, and reducing the amount of time store associates spend locating items purchased online for pickup in store.

The calculator focuses on one key benefit RFID can deliver—higher margins—by ensuring that more items are sold at or near full price. When items sit in the back of the store instead of being displayed on the shelves, customers can't find them and they often have to be marked down later.

The base model in our calculator assumes a 4 percent increase in margin per store due to the improved inventory accuracy RFID delivers. It also assumes a 1 percent increase in

incremental sales from items that are replenished in a more timely way. Is this reasonable? We think it is conservative.

Take the example below, in which a retailer buys 100 sweaters for $40 each and sells them for $100. When they don't sell, they are marked down to $70, then $60, then $50 and finally $40. Based on our example, this yields $3,500 in profit on this one item for the retailer.

Number Sold	Selling Price	Revenue	Cost	Profit
40	$100	$4,000	$1,600	$2,400
20	$70	$1,400	$800	$600
20	$60	$1,200	$800	$400
10	$50	$500	$400	$100
10	$40	$400	$400	$0
100	**–**	**$7,500**	**$4,000**	**$3,500**

Now, look at what happens if just three more items are

sold at full price, four more at $70 and two more at $60. The result is an additional $300 in revenue (4 percent), all of which is reflected in the profits.

Number Sold	Selling Price	Revenue	Cost	Profit
43	$100	$4,300	$1,720	$2,580
24	$70	$1,680	$960	$720
22	$60	$1,320	$880	$440
6	$50	$300	$240	$60
5	$40	$200	$200	$0
100		$7,800	$4,000	$3,800

In the fictional example we provide in our calculator, XYZ Apparel has 10,000 items on the floor and 5,000 items in the back of the store, and does three inventory turns annually. Its average unit selling price is $30, with an average margin of 52 percent. The company needs to buy 45,000 tags a year for this store, assuming suppliers aren't tagging at the source. Given a tag cost of 20 cents, the retailer can expect to get a return on investment in 12 months, based on our assumptions.

Now, let's say the tag cost is 30 cents. It would take just one extra month to achieve a payback. If the price is 50 cents, it would take two additional months. If the tag cost is 10 cents (which is roughly what companies are paying today for an inlay), it would take 11 months to get an ROI.

> An even bigger driver is the value of your goods and the margin you make on them.

What drives the ROI? The improvement in the overall profit margin of the store. If the margin improves by 5 percent instead of 4 percent, because more items are sold at or near full price, the ROI drops from 12 months (with a tag cost of 20 cents) to 10 months. If the store's profit margin goes up by 6 percent, the ROI is achieved in eight months.

An even bigger driver is the value of your goods and the margin you make on them. Let's say tags cost 20 cents, the improvement in average margin for the store is 4 percent, but instead of an average selling price of $30 with a 52 percent average margin, your average selling price is $100 with the same margin. You get a payback on your RFID system in just four months.

Download the Apparel Retail ROI Calculator and conduct what-if scenarios to discover for yourself how RFID can deliver a huge benefit to your company. —*M.R.*
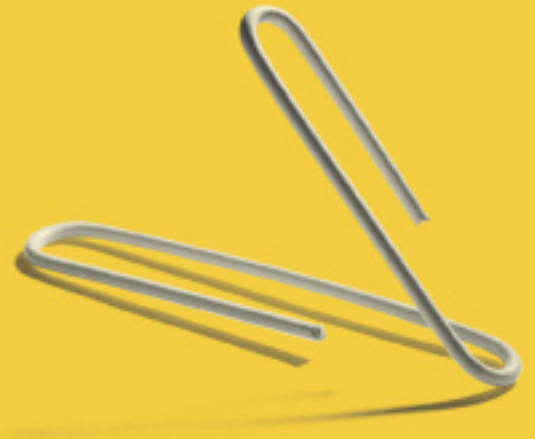
What will it take to make RFID a mainstream technology? We asked the people who are using—or considering using—it in their distribution centers, factories, stores, supply chains and other locations.

End Users
Speak Out

BY SAMUEL GREENGARD

ADVANCEMENTS IN RADIO FREQUENCY IDENTIFICATION during the past few years have resulted in more—and bigger—deployments. Rising RFID adoption rates worldwide and across industries can be attributed in large part to lower costs, more reliable and powerful technologies, best practices for implementation and a better understanding of the business case.

Yet, many organizations continue to grapple with RFID projects. To learn why, RFID Journal asked readers to contribute their thoughts and experiences through a survey, conducted in May. We sent questionnaires to all end users

The survey indicates that many companies are still figuring where and how best to employ RFID.

and potential end users of RFID in our database and received 140 responses. Roughly half the respondents reside in the United States or Canada, 21 percent in Europe, 11 percent in Latin America, 10 percent in the Asia-Pacific region, and 8 percent in the Middle East and Africa.

Auburn University's Harbert College of Business and founder of the RFID Lab, in our Jan./Feb. cover story, Listen Up, Laggards! Many organizations are heeding this advice—50 percent of respondents said they have been reading about, learning about or generally fol-

WHERE ARE YOU BASED?

WHICH OF THE FOLLOWING BEST DESCRIBES THE INDUSTRY YOUR COMPANY IS IN?
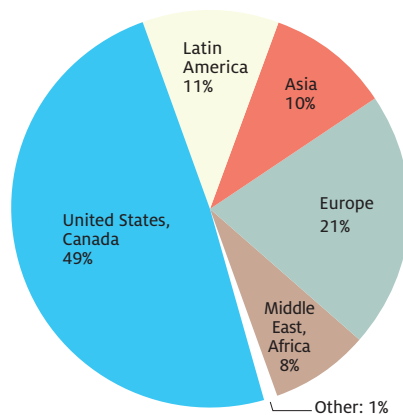
Survey respondents were self-selecting, though they cut across a wide range of industries and include government entities. While the respondents do not necessarily represent the global pool of companies interested in deploying RFID, the survey results provide some interesting insights into the views and practices of organizations researching and using RFID today. In addition, we followed up with some respondents to better understand how their organizations are using RFID, and what challenges and opportunities lie ahead.

The State of Adoption

Before any organization deploys RFID, experts say, it must develop a strategic plan. That includes understanding the conditions in which a business competes and how RFID can change the stakes, advised Bill Hardgrave, dean of

lowing RFID technologies for more than four years, 15 percent for three to four years, and another 15 percent for two to three years. Interest in RFID continues to grow: 9 percent of respondents said they have been researching RFID for one to two years, and nearly 12 percent said they've been researching RFID for less than one year.

The survey indicates that many companies are still figuring where and how best to employ RFID. Only 13 percent of respondents said they have deployed an RFID solution at all their facilities, while just over 30 percent said they have deployed a solution at some of their facilities, and 7 percent said they've completed a pilot and are planning a rollout. Roughly 12 percent said they are either completing an RFID proof of concept or running or planning to run a pilot. At the same time, 32 percent of respondents said they are researching RFID

solutions but have not yet implemented the technology, while 6 percent have no plans for RFID within the next two years.

All this plays out in the real world in different ways. Fashion firm Tahari ASL, for example, is in the process of implementing RFID at

RFID initiative in 2008 to track assets in one of its facilities. This helps technicians and nurses spend less time looking for equipment and more time treating patients, she notes. In 2012, Texas Health Resources undertook a more comprehensive RFID deployment spanning

AT WHAT STAGE OF RFID DEPLOYMENT IS YOUR COMPANY?

We have deployed a solution at some of our facilities. 31%

We have deployed a solution at all of our facilities. 13%

We have completed a pilot and are planning a rollout. 7%

We are running or plan to run an RFID pilot. 6%

We have completed a proof-of-concept. 5%

We are researching RFID solutions, but have not yet implemented. 32%

We have no plans to implement RFID technology within the next two years. 6%
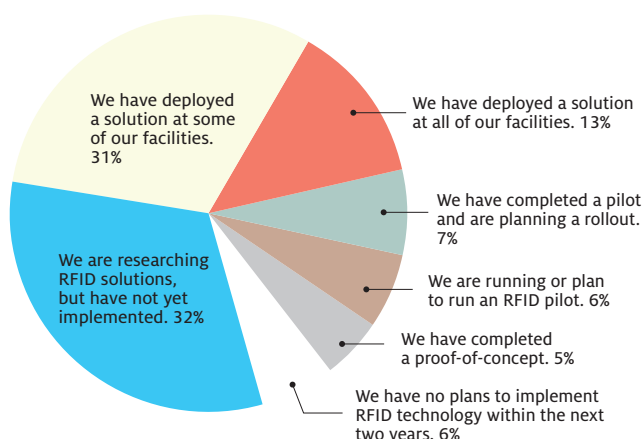
DID THE RFID SOLUTION SOLVE YOUR BUSINESS PROBLEM OR PROVIDE THE RETURN ON INVESTMENT YOU EXPECTED?

Yes, we are very pleased with the solution. 73%

No, we are still struggling to make the system work the way we want it to. 27%

Fashion firm Tahari ASL hopes to reduce if not eliminate human error while merchandise is in transit, by electronically recording shipments to address shortage claims from department stores.
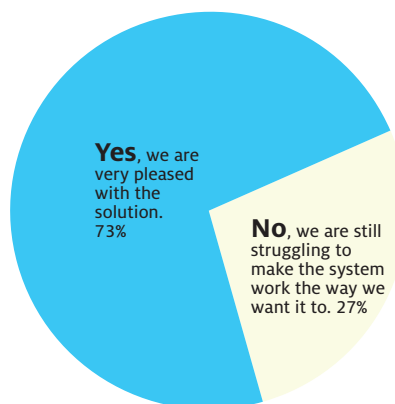
its distribution center. The company sells online and through major clothing retailers, such as Nordstrom and Macy's. "Our goal is to speed up receiving and packing processes," says Nihad Aytaman, VP of information technology for parent company Elie Tahari. Aytaman says 100 percent of its garments are being tagged at the source of manufacture. The company also hopes to reduce if not eliminate human error while merchandise is in transit, by electronically recording shipments to address shortage claims from department stores, he says.

At Texas Health Resources, the largest non-profit faith-based health-care delivery system in North Texas and one of the largest in the United States, the focus is on expanding the use of RFID. "We are already using RFID technology and have been for some years," says Kathi Cox, senior director, system integration & innovation. The organization launched its

assets, patients and staff, and it is just beginning to expand the program to other facilities in its 14-hospital system.

Government, too, is finding value in RFID. The U.S. Department of Energy, for example, is currently tapping the technology to track and monitor the condition of high-value materials, including radioactive shipments. RFID also helps the agency understand how and where it stores materials and their impact on the environment, says James M. Shuler, manager of the DoE Packaging Certification Program. The agency is field-testing RFID systems that can be used with robots to measure radiation at its Argonne National Laboratory and Nevada Nuclear Security Site. These systems could deliver far better environmental monitoring at a lower price point, all while improving safety, Shuler adds.

Among the respondents whose organiza-

> "RFID is not a system you can set and forget. It's important to validate results against an industry that is constantly being asked to reduce its costs."

KATHI COX,
TEXAS HEALTH RESOURCES

tions have deployed RFID, a whopping 73 percent said they are pleased with their RFID solution. But 27 percent said they're still struggling to make the system work the way they want it to.
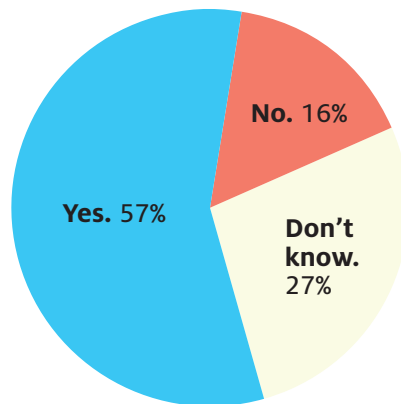
Texas Health Resources' Cox sees RFID as a way to build a more efficient business and IT framework through automation, including de-

DID THE FINAL SYSTEM COST WHAT YOUR RFID PROVIDER ESTIMATED IT WOULD COST?

No. 16%
Don't know. 27%
Yes. 57%

tecting malfunctioning equipment and spotting problems sooner. "Ultimately, the utopia is to have an enterprise solution that allows us to leverage all of our resources—including people and assets—across all facilities," she says. "We want to compare workflows between like-sized facilities, so we can incorporate best practices based on real-time location data rather than inferences." But, she notes, the accumulated costs associated with batteries, tags, hardware upgrades and software can prove formidable. "RFID is not a system you can set and forget," she says. "It's important to validate results against an industry that is constantly being asked to reduce its costs."

The move from paper to electronic systems is nothing short of critical at a French UTC Aerospace Systems site, which manufactures primary flight actuators used in commercial, regional, business and military aircraft, heli-

copters and other platforms. "Using paper documentation and handwritten data increases the risk of lost traceability, which is mandatory," says Antonio Cortes, SOA manufacturing engineering manager. Paper and manual processes also slow access to information of manufactured parts. The company is in the process of implementing an RFID pilot on an assembly line. "Our first goal is to achieve paperless manufacturing processes, with complete electronic data recording," Cortes says. Beyond that, the company hopes to expand RFID to suppliers and customers.

Since 2015, Moods of Norway's clothing suppliers have been RFID-tagging all garments sold by 15 stores the Norwegian retailer operates. The company's retail director, Hans Petter Hübert, says 80 percent of the value has come with 20 percent of the effort. "We have addressed the 'easy' but most important part, which is to secure high-inventory accuracy," he says. But, he adds, evolving toward the future digital store and implementing RFID is complicated because "it's difficult to identify any business case without trial and error. We are dealing with rapid market changes and rapid changes in customer behavior." In the future, he would like to use RFID data to gain more insight into customers' shopping habits.

The expense of RFID and the resources required to operate the system—particularly a fixed or always-on solution—are ongoing factors, Hübert says. But, he adds, in the months and years ahead, RFID will be part of a framework that will allow the company to operate in a more "customer-centric" way.

Tackling the Challenges

For many companies considering or piloting RFID, cost and implementation issues still loom large. Nearly 28 percent of respondents said the cost of tags, readers, software and installation services remains too high. But 29 percent of respondents said costs are not a barrier to the use of RFID technologies.

Of the companies that have deployed RFID systems, 57 percent said the final system cost what their RFID provider estimated it would

RFID End-User Case-Study DVDs

RFID Journal has created a series of DVDs containing presentations by end users, recorded at various live and online events.
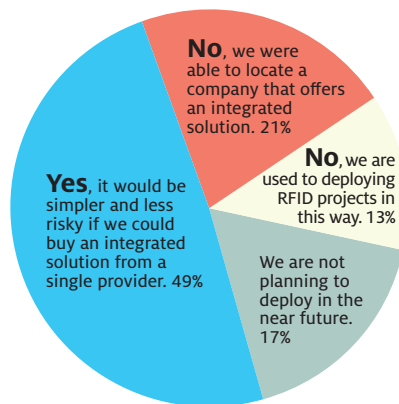
cost, and 43 percent of respondents said the system did not meet estimated costs or they didn't know if it did.

When asked why their company has not deployed an RFID solution, 54 percent of respondents said they are concerned about the

the products available and the companies that offer them, 54 percent said they are familiar with a few companies, and 22 percent said they are unfamiliar with most RFID companies and their offerings.

Another barrier to deployment is the fact

Consolidated Contractors Co. would like to make the use of RFID a standard on all projects, but cost and interference issues remain barriers.

COMPANIES OFTEN HAVE TO BUY TAGS FROM ONE VENDOR, READERS FROM ANOTHER, AND SOFTWARE AND INTEGRATION SERVICES FROM A THIRD. IS THIS A BARRIER TO YOUR COMPANY DEPLOYING RFID?

No, we were able to locate a company that offers an integrated solution. 21%

No, we are used to deploying RFID projects in this way. 13%

Yes, it would be simpler and less risky if we could buy an integrated solution from a single provider. 49%

We are not planning to deploy in the near future. 17%

WAS YOUR SYSTEMS INTEGRATOR ABLE TO ADDRESS PROBLEMS THAT AROSE DURING THE DEPLOYMENT?

Yes, there were several issues that arose, but these were addressed quickly. 78%

No, we had to bring in a third party to address the issues. 8%

No, no significant issues arose. 14%

cost of the system and potential payback.

"Cost is a factor," Elie Tahari's Aytaman says. "Each RFID tag is costing us an additional 10 cents. Tag prices do need to come down for mass acceptance."

Consolidated Contractors Co. (CCC), an Athens, Greece-based construction firm, has been using RFID for 10 years, says Firas Hijazi, manager of information systems for projects automation and controls. "We implemented RFID for spool management, yard management, access control and fuel management," he says. The company would like to make the use of RFID a standard on all projects but, he adds, cost and interference issues remain barriers.

Identifying RFID hardware, software and service providers remains a challenge for many companies. Only 24 percent of respondents said they have a solid understanding of

that companies often have to buy tags from one vendor, readers from another, and software and integration services from a third. Nearly 49 percent of respondents said it would be simpler and less risky to buy an integrated solution from a single provider. In addition, 22 percent of respondents said their company has not deployed an RFID solution because it has not found an off-the-shelf solution that meets their needs.

Still, 67 percent of respondents said they found a provider that could design and install an RFID system for the company fairly quickly. Only 16 percent of respondents said they searched a long time before finding the right provider, and 18 percent said they wound up developing some aspects of the system internally. UTC Aerospace Systems is one of the firms searching for an RFID provider. "We are not specialists of this technology," Cortes says.
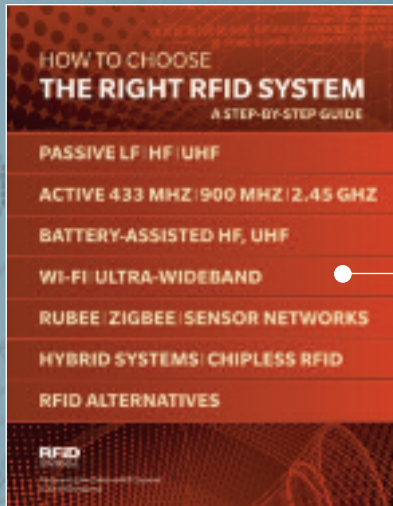
Nestlé has explored using RFID for track and trace, but environmental conditions can be a deterrent and cost is an issue for a consumer products company.

"We are facing issues finding technical and legal support to introduce this technology."

Most respondents, just under 71 percent, said their RFID provider or systems integrator had experience implementing similar systems for other companies in their industry. And 78 percent of respondents said several issues arose during their deployment, but their systems integrator was able to address those concerns quickly. Only 8 percent of respondents said they had to bring in a third party to address issues, and 14 percent said no problems arose. Still 24 percent of respondents were concerned about the ability to deploy a solution that would be 100 percent reliable.

Technical challenges vary depending on the industry. The retail sector, for example, is using passive ultrahigh-frequency EPC Gen 2 RFID tags to track items. At Elie Tahari, the technical challenges involve "calibration and getting the antennae to achieve 100 percent read accuracy as garments flow by at high speed," Aytaman says. "We are currently testing the inbound process and calibrating antennae for optimum capture."

Construction services firm CCC would like to use RFID to assemble components, including fabricated spools, within a warehouse and at other locations, but interference from metal components and pipes remains an issue, Hijazi says.

For food manufacturers, environmental conditions can be a deterrent. Nestlé, for example, has explored using RFID for track and trace, but products with moisture—including liquids and frost on packages—attenuate signals while metal containers block transmissions, explains Thomas A. Doney, expert engineer for the company's packaging competence unit in the Americas. "Materials and finished goods storage areas in the factory are not set up for RFID deployment," he says. Cost, he adds, is also an issue for a consumer products company.

Beyond technical issues, an RFID solution often impacts the way a company conducts business and how employees do their jobs. While 8 percent of respondents said their solution provider or systems integrator did not

DID YOUR SOLUTION PROVIDER OR SYSTEMS INTEGRATOR HELP YOU USE RFID TO STREAMLINE PROCESSES AND/OR IMPROVE WORKFLOW?

Yes, they were very helpful in this regard. 65%

No, we had already done this work before engaging them. 27%

No, they didn't really understand our business. 8%
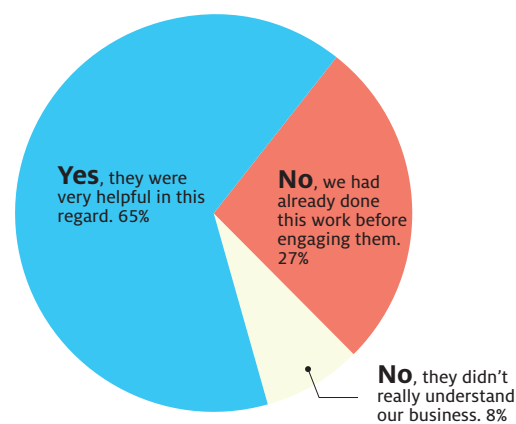
understand their business, 65 percent reported that their provider helped them use RFID to streamline processes and/or improve workflows. Another 27 percent of respondents said they had already done this work before engaging a provider.

RFID Users Share Their Wish Lists

Lower costs and plug-and-play systems top many RFID end users' wish lists. We asked some executives what product developments they'd like to see. Here's what they told us.

"For all software and hardware to come together and work in harmony for simpler implementation," says Elie Tahari's Aytaman. "All RFID tags and readers must work as accurately and flawlessly as bar codes. Right now, we still see differences in tag quality and readability." If RFID worked seamlessly, he says, the retailer could use it to achieve a number of benefits: "First, speeding up the receipt process by eliminating manual processes. Second, maintaining better inventory accuracy with fast cycle counts using handheld RFID guns. Third, speeding packing processes by eliminating

scanning (RFID readers under the packing tables would detect what goes into the carton). This would also eliminate double scanning and short shipping at the packing station, since each RFID tag is, in effect, a serial number. Fourth, an electronic record of what is loaded into the truck, to fight short shipment claims."

Texas Health Resources' Cox would like to see "more champions who understand all the benefits," she says. "Assets are easy, low-hanging fruit and how you justify the initial costs. The real value of RFID is all the things you can do with it that don't necessarily generate a hard ROI. Without champions who truly understand the technology and what its capabilities are, it is hard to move things forward."

On the technology side, Cox would like "one-use active tags for patients built into their armbands, which would ping to show changes in location. This could help us with infection control, patient flow, association between patient and asset, or even association between patient and staff member," she says. "Today's tag is a larger footprint that has to be attached to the patient via a wristband or clip. It takes resources to ensure the tags are cleaned before use on each patient. Sometimes we lose them because staff members forget them and/or they are underneath a coat and don't set off an alarm when a patient is discharged. The expense of the lost tags is significant in an industry in which we are constantly trying to reduce costs and reimbursements are declining."

The DoE's Shuler says he would welcome "low-cost, miniature gas-composition sensors for various gases. A package of certain types of radioactive materials, for example, may give off hydrogen gas as radioactive decay occurs," he explains. "With an H2 sensor, we could monitor the pressure buildup and take action before the pressure could harm the package seals. Also, if we could detect different gases—for example, explosive sewer gases in sewers, H2S gases for the oil and gas industry, sarin gas for military arms inspectors in certain countries, combustion gases for smoke jumpers and firefighters—we could monitor for almost everything using either our SAV-EM, ARG-US, RAMM, ACTS or InPac RFID solution, and transmit that information anywhere in the world instantaneously via 3G, 4G, Wi-Fi or various satellite systems to the appropriate individuals' computers or cell phones for action."

"Lower-cost tags that have a longer reading range and less interference with metal," says CCC's Hijazi when asked what tops his RFID wish list. "We have used RFID tags for two major types of implementations: pipe yard management for fabricated spools and employees' access control to the site. In the fabricated spools implementation, the read range was less than the theoretical lab reading range, since there is interference from the metal—especially if the spools are stacked or too close to each other.

"For access control, there were two major sources of interference," he says. "Since tag reading takes place while the employees are on board a bus, in their seats, there is interference from the metal on the sides of the buses and from the water inside the employees' bodies, since they sit next to each other and have their tags in their pockets or hanging from their neck.

"In the case of the fabricated spools yard management, you can have the reader installed on a drone that can fly over the yard and collect readings from the tags," he adds. "This is faster than the handheld or the car-mounted readers. Similarly, you can read the tags of the employees and track their locations simply by flying the drone above the construction site."

Moods of Norway's Hübert says he would like "a robust, always-on solution that would require little or no manual interaction from store personnel."

"The information flow must become more fluid," says UTC's Cortes. "That includes the ability to comprehensively view physical movement, identify differences between flows and understand details, such as who has completed an operation or task or where are parts that are urgently needed." This, he adds, may require further advances in software and more advanced integration across various systems and data repositories. ◼

Lower costs and plug-and-play systems top many RFID end users' wish lists.

VERTICAL FOCUS: LABS

Health-Care Labs Get Healthier

Targeted solutions for monitoring specimens and tracking assets, and innovative research, promise to make RFID a standard tool in laboratories. BY JENNIFER ZAINO

THE QUALITY OF any health-care laboratory—whether it's servicing the biomedical, clinical trial and research, diagnostic or pharmaceutical community—depends on its ability to provide accurate, precise and timely results. In recent years, some labs have begun using RFID to automate manual processes to track human specimens and other samples, preventing loss and misidentification, assuring chain of custody, enabling quick retrieval when needed and facilitating compliance with govement regulations.

In 2011, for example, the Mayo Clinic's department of laboratory medicine and pathology worked with software provider ODIN (now Quake Global) to develop EasySpecimen, a passive RFID system to track patient tissue samples. In 2013, the Legacy Health Good Samaritan Medical Center in Portland, Ore., collaborated with Cerner to deploy an RFID solution to track patient tissue specimens from the point of collection in the endoscopy department to receipt at the pathology lab. Prior to using RFID, endoscopy nurses had to manually create and double-label specimen containers, and pathology lab workers had to verify the containers against paperwork before entering their receipts into the Cerner Laboratory Information System (LIS). The RFID solution integrates Quake Global's pad readers, ceiling readers and Tag Acquisition Processor (TAP) server with the Cerner LIS.

"Now, nurses provide specimen source information to the hospital's electronic medical records system, submit the order to the EMR and print an RFID label," says Dani Sensenig, pathology supervisor for Legacy Laboratory Services. Zebra Technologies' tags and printers are used in the process. It's best practice to print the label at the point of blood collection or specimen removal, says Chris Sullivan, Zebra's global

(Top) MSM Solutions PortralTrack software provides real-time views of where samples are flowing throughout a facility. (Above) Legacy Health's RFID solution integrates Quake Global's pad readers, ceiling readers and server with the Cerner Laboratory Information System. Zebra Technologies' tags and printers are used in the process.

health-care practice leader. "If you have the label applied instantaneously to the blood collection or specimen, you significantly reduce the risk of errors versus doing that as a separate work stream."

Then, nurses place the specimen container on an RFID pad in the endoscopy suite, and the reader sends a signal to the LIS that the speci-

men is ready for pickup. Antennas in the hallway outside the suite and outside the pathology department track the movement of the sample, which is read on another RFID pad when it arrives at the lab. "In health care, this workflow is a game changer," says Sam Bhatia, Cerner's director of laboratory automation.

"It's absolutely beneficial to the lab because

RFID Is Instrumental in Managing Lab Assets

LABORATORIES DEPEND ON A VARIETY of instruments and devices to analyze, measure and process chemical compounds, drugs, tissue samples, specimens and so on. "Lab environments can be very unstructured," says Scott Thull, Agilent Technologies' senior product manager for life sciences. "They have small and large devices, things that go into freezers or hot environments, things that move around and things that are stored in drawers—and there's no traceability," he says. "So they can't answer questions about what they have, whether they are using it and where it is."

Answers to those questions could help labs control inventory and labor costs and adhere to audit guidelines. Pharmaceutical labs, for example, are often under pressure to begin new drug trial projects fast, Thull says, so they buy new instruments when they have the appropriate device sitting idle elsewhere in the same building. They also have to ensure quality control of instruments that are used in testing production drug samples, he explains. In many cases, instruments have multiple parts, all of which must be compliant with regulatory requirements. This means labs have to make sure they don't replace broken parts with working but noncompliant ones, which could lead to a drug batch recall.

To help labs track their assets efficiently and cost-effectively, Agilent developed the RFID-based CrossLab Inventory Management Service. The solution involves a four-phase process that begins with getting a list of the lab's assets and then matching that to the Agilent database of more than 30,000 devices—it's the equivalent

of retail UPC codes, Thull says. "We map their list to our file, which we know has consistent names, manufacturers and equipment model numbers, so we don't have the same instrument called something different in three different locations on the customer site," he says. "We clean up their lists."

Next, Agilent sorts through the "the jungle" of instruments and devices the client has to find out what's really there, Thull says. Then the vendor chooses the best passive Omni-ID RFID tag for identifying each item, such as stainless steel and plastic assets and those that must withstand repeated exposure to chemical washings.

Finally, each tag's unique identification number is associated with the item in the cleaned-up inventory database. The Agilent database is integrated with Omni-ID's ProView software, which allows each customer site or location to have its own view of its data, and each corporate customer to have an aggregated view of all of its locations, inventory and maintenance records.

Labs that use the Agilent solution can conduct inventory with an RFID handheld reader. CrossLab is an all-inclusive service, Thull explains, so Agilent will provide field teams to conduct inventory, freeing customers to work on other important lab operation tasks. "With RFID, we can do this quickly, scanning the lab and knowing we're in pretty good shape," Thull says. "The real win is the ability to do more frequent inventories and do them accurately." —*J.Z.*

Agilent Technologies' CrossLab Inventory Management Service uses passive RFID tags and handheld readers to track a variety of instruments and devices.

PHOTOS: AGILENT TECHNOLOGIES

specimens are the bread and butter of what we do," Sensenig says. "The quality of specimen identification, the labeling of containers and tracking transportation is all part of the process," says Andrea Stacy, Legacy Health's manager of system pathology and cytology labs. "If pathology expects to receive a specimen that doesn't show up, we can actually track if it left the endoscopy department or if it came into our lab." Today, Stacy notes, the pathology lab RFID-tracks between 1,200 and 1,500 endoscopy specimens annually, with a 100 percent read rate.

The Cerner RFID Anatomical Pathology tracking solution is generating a lot of interest at Good Samaritan Medical Center. "Other departments that produce pathology specimens have reached out to learn more about the work," Stacy says. "And there's potential to leverage RFID to track the samples through the lab's internal processes," adds Bryan Desimone, a Legacy Health senior system analyst who supports the pathology lab. "We're starting small and hoping to grow."

RFID providers have addressed many hardware and software issues, so the technology can now be used in labs to monitor samples. They also have developed inventory-management solutions to help labs better manage their equipment and supplies (see "RFID Is Instrumental in Managing Lab Assets" on page 26 and Hospital Lab Benefits From RFID Inventory-Management Solution). Targeted solutions, and innovations on the horizon, promise to make RFID a standard tool in labs. Still, the initial cost of implementing an RFID solution remains a challenge to adoption.

TARGETED SOLUTIONS

RFID providers are helping labs find the tags and antennas that work best for tracking specimens in what are often cramped environments. Very small high-frequency RFID tags work well for item-level tracking of liquid-filled containers, and small ultrahigh-frequency tags can be paired with vials that contain mostly solid substances, such as human tissue, says Frank Gao, CEO at GAO RFID, which offers the Specimen

Very small high-frequency RFID tags work well for item-level tracking of liquid-filled containers, and small ultrahigh-frequency tags can be paired with vials that contain mostly solid substances, such as human tissue.

Tracking System—a complete hardware and software solution for monitoring samples from collection through delivery to the lab in real time and throughout the diagnostic and testing processes.

The Specimen Tracking System can be deployed alone or as part of the company's Smart Labs Pro cloud solution, designed to "strengthen communications between workers at one lab organization with multiple locations or across multiple lab companies, and to use this kind of information to help their daily work become more efficient," Gao says. "Each individual user of the system can log in from anywhere and, in the same timeframe, share the information of specimen type and location." Authorized personnel can access the company's online database to monitor items throughout the diagnostic and testing process—and track samples that are transferred to a central lab facility. The solution can incorporate GPS coordinate information during scans, and cool transport boxes can be monitored to provide a temperature history.

To read samples that are being processed at the same time in close proximity, low-profile near-field antennas can be mounted under lab workstation countertops, says Brett Wilkerson, RFID business development director for systems integrator MSM Solutions. "You have to be able to cut down read ranges and read zones," he says, "so you show things where they actually are, and not 20 feet away, with the right power levels and settings." To RFID-enable a lab, MSM uses the hardware best suited for each environment, including Impinj Speedway readers, Zebra fixed and mobile readers and Times-7 antennas, and its own PortralTrack software for monitoring and managing the hardware and providing users with real-time views of where samples are flowing throughout the facility.

MSM recently implemented an RFID solution for forensic toxicology and health-care sciences lab Aegis Sciences, to monitor the status of the blood and urine samples as they move from one instrument to another or from one section of the lab to another. "A side benefit of

RFID, especially with blood and urine labs, is they can gain a lot of metrics by knowing how long things sit at a particular station because they're always reading the sample," Wilkerson says. They can get visibility from that data into things such as which stations are not in use and which samples are waiting to be processed, he adds, to improve workflows and productivity, thereby gaining a competitive edge.

COLD STORAGE

Labs routinely use biologics, reagents and other products that must be stored at cool temperatures. Labs have several choices when it comes to RFID-tracking samples that need to be refrigerated. And now, RFID can address what providers say has been the holy grail: the ability to track lab products inside freezers.

One solution is Ruro's FreezerPro, designed for tracking the collection and then management of frozen samples in scientific or pharmaceutical labs. Its cryosafe RFID labels are designed to survive 10 or more years in liquid nitrogen freezer environments, says COO Tom Dolan. Labs can use FreezerPro to check samples into and out of freezers by briefly holding boxes of individually RFID-tagged samples over an RFID antenna. Its software, which is available as a cloud-hosted service, stores all samples' information, including date and time specimens were checked in or out.

Labs can also use FreezerPro's software to create virtual freezers that reproduce the exact configuration of the real freezers, including doors, racks and samples' storage locations, to quickly locate items. But if someone puts a sample on the wrong shelf or in the wrong rack or the wrong freezer, the software would not be able to detect it, because the tags aren't read in the freezer.

SpaceCode and Terso Solutions offer RFID-enabled refrigerators and freezers that monitor access and who took out what items and when. They can also monitor temperature, manage product inventory in real time and streamline the reordering process. And these smart solutions can monitor samples and specimens in cold storage in real time.

With SpaceCode's cold storage devices, for example, once tagged samples and specimens are entered into its software system, they can be stored in a fridge or freezer in any position, says CEO Pavlo Protopapa. A lab technician can use the device's built-in screen to view each item's location and more easily find needed items, including those that may inadvertently have been moved to the wrong storage device. The device's interior LED lighting indicates the storage slot where the sample is being held. The company's SmartBoard, an RFID work-surface reader, can be used to track samples and specimens as they are passed between individuals and processes, to reduce manual errors.

On another front, BioTillion has a grant from the National Institutes of Health for a project to create a smart freezer that can track sample boxes even when the freezer door is closed, says CEO Hanan Davidowitz. In the next few months, the company plans to launch a ColdSight beta test site at a biobank.

All the system's movable parts—the boxes and the racks that hold the boxes are powered and accessed wirelessly, Davidowitz says, and all the system's components must operate from room temperature down to minus 80 degrees Celsius (minus 112 degrees Fahrenheit). "You have to get the electronics to work in ultralow temperatures and to be rock solid," he says.

ColdSight can leverage BioTillion's BoxMapper technology, which can map the contents of a standard freezer box of RFID-tagged samples in vials within seconds; the vials are associated with the box before they are stored in the freezer. As with other freezer solutions, the RFID-tagged boxes can be taken out of cold storage and read immediately. "If samples are optically bar-coded, the tubes need to be manually defrosted," Davidowitz says. "That takes additional time during which the samples' temperatures rise—this is to be avoided at all costs."

The ability to quickly identify required vials also addresses another common problem, Davidowitz says: In most labs, technicians usually have some idea which samples are in which freezers, but to get to those samples when needed, they often start pulling out other boxes and items. That can cause temper-

Now, RFID can address what providers say has been the holy grail: the ability to track lab products inside freezers.

Slowly

but steadily, RFID-tracking specimens from collection into labs and across workstations is gaining a foothold.

ature fluctuations in the products and in the freezer overall. Temperature fluctuations can also occur when inventory is conducted manually. "A freezer warms up every minute you open the freezer door," he says. "It can take a couple of hours for it to cool down if you open the door even for two minutes."

ColdSight also features temperature sensors, to monitor a freezer's performance. "No one had this information before, so we don't even know what people are going do with it," Davidowitz says. But, for example, he says labs could ensure that samples particularly sensitive to temperature variances within freezers are placed in optimal locations.

BioTillion will offer ColdSight in its first implementation as an option users can order with new Stirling Ultracold lab freezers or as retrofits to existing Stirling freezers. BioTillion designed the system to be flexible in respect to freezer organization, Davidowitz says. One freezer model, for example, might store many small sample boxes and another might store fewer but larger boxes, in racks that vary significantly in size. The company has built enough flexibility into the system that it will be able to work with other manufacturers' freezers, either as built-in or bolt-on options, the CEO notes.

Cold storage also plays a role in SmartLab, a EuroCPS-funded project that aims to reduce bottlenecks during sample processing in clinical studies. A biolab, for example, could house a few thousand test tubes, so searching for individual test tubes from storage racks is time consuming and error prone. The project was developed by molecular diagnostics product developer Neumann, which chose the Budapest University of Technology and Economics' (BME) department of electron devices as its design partner. The effort targets tracking cervical samples for lab tests and processes related to the field of infectious diseases, but can be employed for any specimen tracking requirements.

The project includes a cloud-based data-and-quality management system and RFID tags that can withstand temperatures of 0 degrees Celsius to minus 20 degrees Celsius (32 degrees Fahrenheit to minus 4 degrees Fahren-

heit), so the tags are readable as soon as they are removed from storage freezers. The tubes are tracked continuously for quality assurance—they are transported in intelligent holder racks equipped with temperature or other environmental sensors, and the racks are placed in RFID-enabled docking stations at lab technicians' workstations.

When technicians need to retrieve certain types of samples—say, specimens taken from women under age 25 infected by the human papillomavirus—they can remove racks from the freezer and query the cloud database. "There is a light indicator in each sample for the rack, which calls up the samples in question," says Ferenc Ender, an assistant professor at BME who is managing the project on the design side. "So that's a help for an operator to select some specific samples from over a few thousand samples and, therefore, speed up the sample process time."

Slowly but steadily, RFID-tracking specimens from collection into labs and across workstations is gaining a foothold. GAO RFID, for instance, says 10 customers are using its solution, and the company sees fast growth in the market thanks to the visibility, traceability and loss prevention it offers. Of course, CEO Gao says, there is the typically initial resistance due to RFID's costs. But, he says, "they become happy once they see the ROI."

FreezerPro's Dolan believes the value of RFID in inventorying high-sensitivity or even dangerous cold samples—vials of anthrax in government labs, for instance—or in dealing with ongoing manual check-in and check-out of such samples will drive adoption. Instead of having to take boxes out of freezers and visually confirm the presence of individual vials, he says, end users increasingly appreciate the ability to use RFID to put a box on an antenna "and read everything inside it without opening it, no line of sight required. That's where a lot of our customers get value."

SpaceCode's Protopapa also predicts widescale adoption of comprehensive RFID-enabled cold storage solutions: "It no longer makes sense to have no security and manual inventory management and no business intelligence." ◼

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

To download this **free calculator**, simply visit:

www.rfidjournal.com/store/fashion-retail-roi-calculator

PRODUCT DEVELOPMENTS

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

BY BOB VIOLINO

Utility Meters Get Connected

STMicroelectronics' NFC RFID tags enable manufacturers and utilities to easily communicate with electric, gas and water meters.

The Dynamic Tags provide embedded electrically erasable programmable read-only memory, which meter manufacturers can use to store authentication keys and other data.

SMART GRID IS MORE than a buzz term, as countries worldwide aim to update their energy delivery systems to improve efficiencies. Smart meters, which can gather usage data in real time and report back to the utility, are a fundamental building block for the development of a smart grid, says Gianmarco Ferrari, STMicroelectronics' nonvolatile memory and NFC marketing manager for the Americas. But smart meters must be customized for each utility in order to do their jobs.

Now, some meter manufacturers are integrating STMicroelectronics' Dynamic NFC RFID Tags in their devices and using an NFC RFID reader or Android smartphone to quickly and reliably transmit setup information to the meters after they've been prepared for shipping and the manufacturer knows which utilities will be receiving the meters. The tags feature a wired connection (industry-standard I2C) to the device's microcontroller.

The Dynamic Tags provide embedded electrically erasable programmable read-only memory (EEPROM) ranging from 2 kilobits to 64 kilobits. That ensures meter manufacturers have plenty of storage for their authentication keys, provisioning parameters, geolocation-specific settings and customer tariff, display calibration and data-logging capabilities, Ferrari says.

"At the customer premises, utilities can use a smartphone to register the meter to the network with a simple tap, reducing time and cost for commissioning," Ferrari says. "In the past, that required a back-office operation between the installer and the utility company. The manual operation is costly and time-consuming and could also introduce errors." Utilities also can use a smartphone in the field to activate the meters and receive information from the meters for maintenance and other operations.
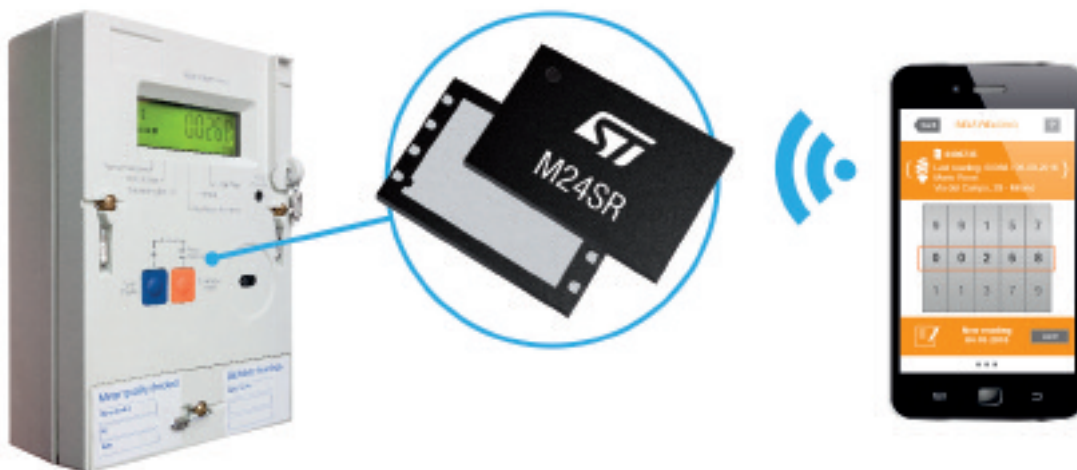
"We have several customers in Europe, Asia and the Americas in the electric-, water- and gas-meter markets that are using these NFC tags to realize greater operational efficiencies in manufacturing and in the field and to improve the customer experience," Ferrari says. A large European meter manufacturer, for example, is using the tags to load meter node profiles during manufacturing. Then, he explains, its utility customers use a smartphone to read the node profile and transfer the network key to the tags. When the meter is installed, a field worker uses a smartphone to connect the meter to the utility's infrastructure.

In other cases, Ferrari says, the NFC tags could speed the meter customization necessary to account for the state or country in which they will be used and the tariffs the utility would apply. "In still other cases," he adds, "the tags can be used as a low-power wireless link for meters that don't have a power connection." A field worker could read usage and billing data from a meter's tag memory when the power line is dropped.

"All of these use cases improve how these customers work," Ferrari says, "and have, alone or together, made our tags extremely attractive and cost-efficient."

A large European meter manufacturer uses the tags to load meter node profiles. Its utility customers use a smartphone to read the node profile and transfer the network key to the tags.

No Job Too Small For This RTLS

Ubisense's AngleID is a standalone solution that provides a cost-effective way for manufacturers to locate assets in factories and yards.


A U.S. AGRICULTURAL MACHINERY manufacturer had a problem. Within one of its plants, it has a metal shelving unit with six shelves, each a foot apart. Forklifts load pallets of varying types of sheet metal on the unit roughly every two hours. But when the forklift drivers went to get a particular type of sheet metal, they sometimes picked and delivered the wrong type to a machine. This held up production until the correct sheets were delivered.

Earlier this year, the agricultural machinery company deployed Ubisense's AngleID, de-

The AngleID sensor (reader) can identify active ultrawide-band RFID tags in a highly metallic environment.
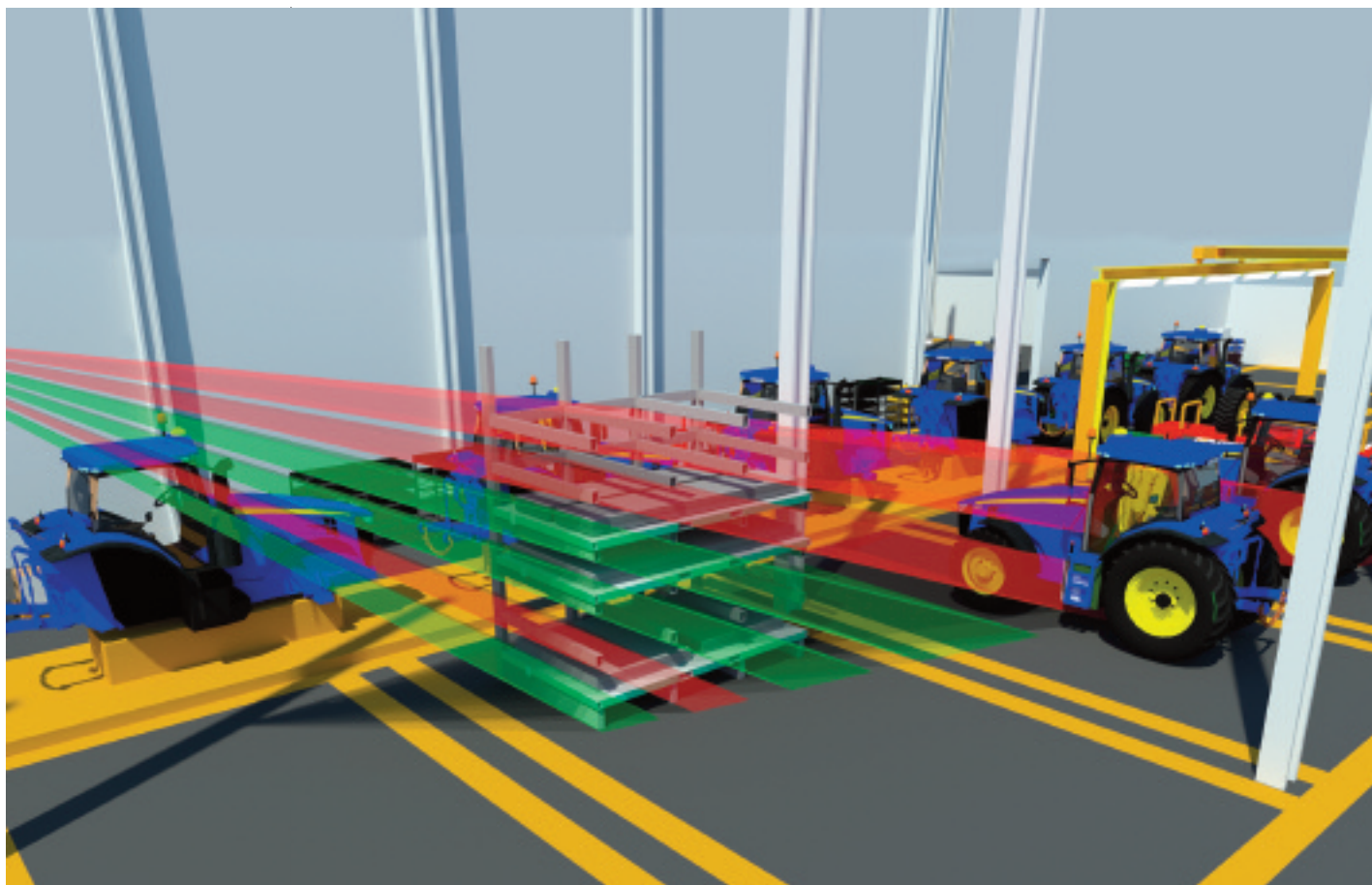
The reader software was used to create seven zones—one for the rack and one for each of the six shelves. The reader detects the tagged pallets as they enter and exit the zones.

signed for manufacturers that need a simple yet accurate real-time location system (RTLS)—and, in this case, one that works in a highly metallic environment. Each pallet was identified with an active ultrawide-band RFID tag, and an AngleID sensor (reader) that Ubisense says is smaller than a passive reader. The sensor was attached via a metal clamp to a nearby pole, roughly 10 feet off the ground and connected directly to the company's local area network.

The reader software was used to create seven zones—one for the rack and one for each of the six shelves. The reader detects the tagged pallets as they enter and exit the zones, so the machinery manufacturer knows the exact location of each pallet and type of metal at all times. The system is integrated with the manufacturer's existing Ubisense Smart Factory software, which monitors work-in-progress, providing a unified view of parts through critical stages of the process.

It took less than 30 minutes to set up the

simple, single-reader solution, says Adrian Jennings, Ubisense's VP of industry strategy for manufacturing. Many RTLS solutions can take months to install and require IT integration, a cabled reader infrastructure and careful calibration, Jennings explains. AngleID achieved the same result in a much more cost-effective package, he adds.

A U.S. maker of chassis for the recreational vehicle market also deployed AngleID to solve its problem: Incorrect frames were occasionally being shipped to customers. At the end of production, each chassis' status changes to "assembly complete." Then, at the end of the inspection process, the status shifts to "inspection complete," at which time the chassis was identified with a sticker on the front bumper and parked in an outdoor area to await shipping.

But if an assembly-complete chassis needs a repair or the inspection lines are full, an unfinished chassis may be parked outdoors with

the inspected frames. "The problem occurred when an assembly-complete chassis was mistakenly loaded and shipped, resulting in either a failed or uninspected chassis being delivered to the customer," Jennings says. "Since all chassis are visually identical, the only identifier that a unit was ready to ship was the inspection complete sticker, which was sometimes overlooked."

Now, the company places Ubisense Industrial Tags on all chassis during assembly, and removes them when the inspection is complete. Two AngleID readers are situated on a light pole in the shipping area over the loading ramps. If a tagged assembly-complete chassis accidentally enters one of the designated zones around a loading ramp, the reader issues an alert. "In this way, any chassis off the assembly line with a tag mounted is 'assembly complete,' and no tagged chassis should be shipped," Jennings says.

AngleID was the ideal solution, based on range, zone discrimination and ease of setup, Jennings says. The manufacturer's loading ramps are spread over a large area, requiring long-range operation. Precise zone discrimination is required to avoid setting off false alarms, and the ramps are moved from time to time, so the RTLS had to be easy to reconfigure.

Ubisense says AngleID fills a gap in the market between passive RFID and a full-blown RTLS. The agricultural machinery manufacturer, for example, did not need a complex system, but it did need to accurately discriminate the metal shelves. Passive RFID cannot provide that level of performance from that distance, Jennings says. While originally developed for use in manufacturing environments, he adds, AngleID also opens up opportunities for health-care, logistics and retail companies. ◼

RFID Adoption Headwinds

Retailers that understand three basic issues can sail through their RFID pilots.

My previous column, Awareness➝Acceptance➝Accelerated Adoption, examined recent metrics in the U.S retail sector, which showed that, overall, RFID adoption is up this year compared with last year, and the adoption rate is accelerating. But three headwinds could prove to be a drag on adoption in the short term. The good news is that retailers can steer clear of these challenges by adhering to the following guidelines.

Don't treat RFID as "just another project." Some retailers view adopting RFID as a project to be undertaken alongside other projects, such as omnichannel enablement—in particular, buy-online-pickup-in-store (BOPIS) and ship-from-store. One retailer, for example, decided to postpone its RFID initiative so it could focus on BOPIS. The irony, of course, is that a retailer must have high inventory accuracy to ensure a successful BOPIS program, and the best way to achieve high inventory accuracy is with item-level RFID tracking. RFID is the foundation that enables many of the projects retailers must undertake to adequately satisfy today's consumers.

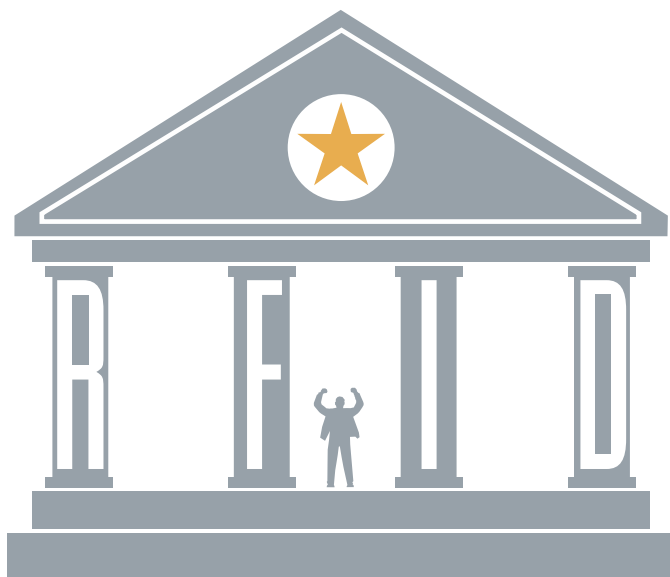**Do plan ahead.** Before beginning a pilot, it is important to take good pre-RFID measures of the key indicators, such as inventory accuracy and out-of-stocks, and choose control (non-RFID) stores to compare with the test stores. The RFID Lab recommends taking a matched-pair approach: choose one control store for each test store using a set of matching criteria, such as geographic location, store traffic, sales, size and turnover. If conducted properly, a pre-vs.-post and test-vs.-control approach will provide insight into RFID's value.

Some retailers have used post-selected or one-to-many control matching, which may not yield valid results for transformational initiatives such as an RFID implementation. They chose higher-performance control stores to match the improved test stores, for instance, rather than comparing a control store with a pre-RFID test store. This approach can provide inaccurate conclusions—for example, there may appear to be no difference between the test and control stores.

Do act on the RFID data. I hear this all too often from retailers: "We installed RFID and now have high inventory accuracy, but our shrink has not decreased and sales have not improved. Why isn't the system working?" The answer is simple: A retailer must do something—high inventory accuracy and visibility alone will not solve these problems. A retailer must use the RFID data to improve processes, such as replenishment. The information can also be used to expose more inventory to consumers and implement a loss-prevention system.

After many years of retail initiatives, the industry has established best practices for conducting RFID store pilots. All the issues retailers complain about can be avoided with proper planning and attention. But left unchecked, they can swamp an RFID pilot. ◼

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. Follow him on twitter at @bhardgrave.

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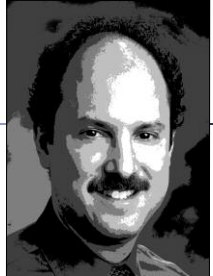
EPC Memory vs. User Memory

One bank identifies a tagged object and the other describes it.

An ultrahigh-frequency Gen 2 RFID tag carries business data in two memory banks: the EPC memory bank (also called the UII memory bank) and the user memory bank. (Two other memory banks hold control information and are not discussed here.)

Most tags have at least 96 bits of EPC memory, many have 128 bits and a few have as much as 496 bits. Some tags have no user memory, while others have 128 bits, 512 bits or even thousands of bits. How should application data be divided between these two memory banks?

The EPC memory bank should be used only to store a unique number that identifies the object to which the tag is affixed. This unique number, which typically requires at least 96 bits of memory, is like a car's license plate. The license plate doesn't tell you much about the car—just what state issued it—but because the number is different for every car, it serves well to identify the car and distinguish it from other vehicles.

A unique EPC number is crucial for correct operation of an RFID system. This is because RFID readers are blind—they don't know what tags are out there except by broadcasting a signal and listening for tags to respond with the contents of their EPC memory banks. The only reliable way a reader can tell the difference between reading two different tags and reading the same tag twice is if every tag carries a unique EPC—two different EPCs means two different tags.

The user memory bank is best used to describe the object to which the tag is affixed. It's akin to a car's registration, which says who owns the car and what color it is. The information varies according to the business application—user memory for a perishable item might include its expiration date, for an aircraft part it would likely identify the manufacturer and for a luggage tag it could identify the owner. Unlike EPC memory, user memory can change over time. Data, for example, might be added to the user memory of an aircraft part tag each time a maintenance operation is performed.

In principle, user memory is never required. Instead, a database can hold a record for every tag containing the descriptive information. An application can use the unique EPC number to look up the information in the database. There are several benefits to this approach. A database is not limited by the size and the data isn't lost if the tag fails. In addition, reading user memory makes reading tags slower and less reliable. But user memory may be needed in settings in which it's difficult to connect to a database.

And as I've discussed in previous columns, it's essential to use the correct data standard for each memory bank; see Managing User Memory and What's in a Name?

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.

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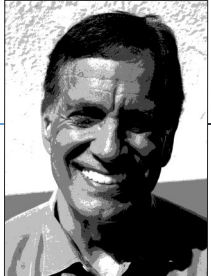
EXPERT VIEW | By Michael McCartney

Complying With the Food Safety Modernization Act

RFID can help U.S. produce farmers cost-effectively meet the FDA's mandate.

Sept. 19 marked the first implementation date of the U.S. Food and Drug Administration's Food Safety Modernization Act (FSMA), designed to regulate national and international foods to prevent or minimize food-borne illnesses. Now, large U.S. produce farmers are required to document the location and condition of perishables, and all steps from harvesting to processing and transporting.

While U.S. farmers have been aware of FSMA for several years, most have not begun to automate processes to make compliance easier. Many still rely on manual paper-driven processes, which are labor-intensive and error-prone and don't provide visibility into product movement. Instead, growers have hired more people to comply with the mandate. This is an outdated and costly approach. With minimum wage expected to increase during the next three years to $15 an hour, growers will need to automate to control labor costs. That's particularly true in California, where beginning in January 2017 farm laborers will be paid overtime after 40 hours.

The FDA is focused on food safety and not how companies comply with the FSMA rules. I believe a passive RFID track-and-trace solutio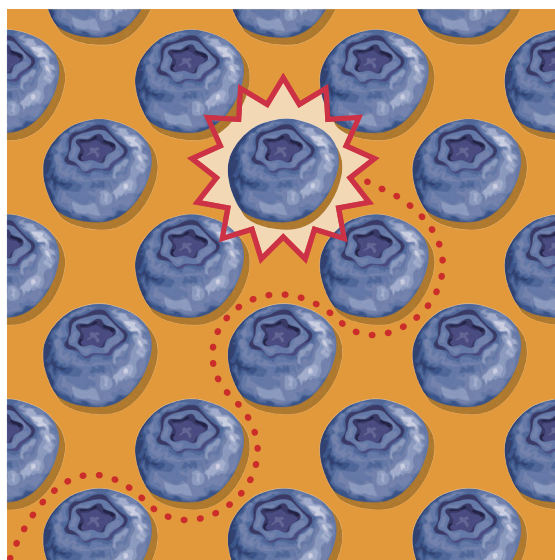n could help farmers meet FSMA compliance and address their business issues. A passive RFID tag could be placed on field bins at the first point in the harvest process and read with a handheld device to document date, time and location of products. The tag could then be used to track

and document movement of perishables until they are passed on to the next participant in the supply chain.

RFID read distances and accuracy are no longer challenges and what remains is the cost issue. An RFID label costs five cents while a bar code or QR label is typically less than two cents each when purchased in comparable quantities. But if farmers do an economic analysis that takes all costs into consideration—

including labor, training, cost of errors and time to correct those errors, recall expenses and brand tarnishing—they will find that it's cost-effective to invest in an RFID solution.

In addition, a farmer could use the RFID solution to achieve internal benefits. Recently, for example, Jim Gross, an account manager at Cool Pak, implemented an RFID solution for a tree fruit grower to track field bins in and out of a processing plant. The grower's IT department, he says, began using it to monitor product quality. The solution, he adds, improved inventory accuracy, saved labor and will provide valuable data to identify specific times to add labor and new equipment.

If a food-safety incident were to occur, the ability of all participants in the supply chain to track the perishables' history immediately could minimize health issues. And rather than recall a hundred thousand boxes from a 10-acre parcel, for example, the farmer could isolate the affected consumer unit. That could save a grower's company and its brand reputation. ◑

Michael McCartney is managing principal at QLM Consulting, which specializes in automated food safety and traceability systems.

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