FROM PILOT TO DEPLOYMENT

5 Key Strategies

PAGE 14

The RFID Marketer's
HANDBOOK

SMART STRATEGIES FOR FINDING POTENTIAL BUYERS AND CONVERTING THEM INTO CUSTOMERS

Based on a new survey of RFID end users, this guide reveals:

› The state of adoption by industry and region

› Who the RFID buyer is

› How companies make RFID investment decisions

› The applications end users are pursuing

POTENTIAL MARKET SIZE TODAY
Almost 85 percent of companies won't invest until RFID crosses the chasm

		Chasm	34%	34%	16%
Innovators	Early Adopters		Early Majority	Late Majority	Laggards
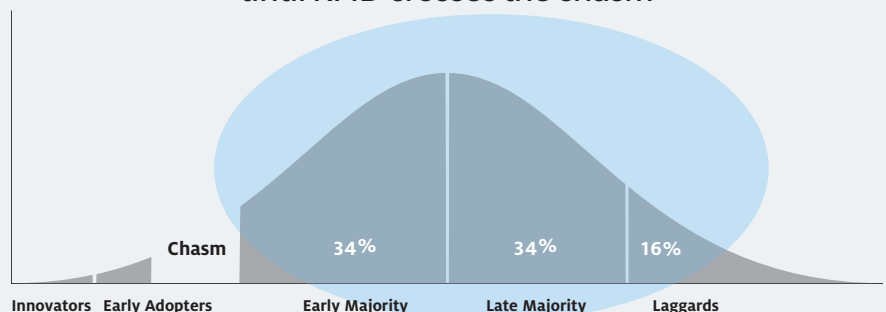
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Find New Business Opportunities

RFID providers now have a new source to 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.

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These live interactive programs offer a convenient way to learn why and how companies are employing RFID to improve the way they do business. Presenters will answer your individual questions.

- **Using NFC to Deliver, Share and Collect Data**
  Learn about the many ways Near-Field Communication technology is being used in consumer and business applications. *Jan. 28, 11 am to 1 pm EST*

Find products that can help you deploy RFID successfully. Here's an example: Times-7's **A1001 Proximity Near-Field Antenna** is designed for enclosed spaces that require a small footprint. The UHF short-range antenna is molded within an ABS housing.

Most-Read Stories in November

- American Apparel Deploys Real-Time, Storewide RFID Inventory-Management Solution
- Proof Obamacare Requires All Americans to Be Chipped
- Motorola Solutions, Smartrac Settle Patent Litigation by Round Rock
- Who Says RFID Tags Pose a Privacy Risk or Are Too Costly?
- Companies Deliver New Apps for Bluetooth Beacons

Top 10 Search Terms On RFIDJournal.com

1	Asset management
2	NFC
3	American Apparel
4	Round Rock
5	RTLS
6	Cost
7	Security
8	Veterans Administration
9	Sensors
10	History

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.

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 being used with electronic medical records?
- Are any Canadian companies using RFID?
- How is NASCAR using RFID?
- Do RFID tags work on a motherboard?
- When should we tag our pallets?

POLL RESULTS

Are you interested in becoming an RFID subject-matter expert?

YES, and I've already registered with the International RFID Institute.

POSSIBLY—I'm still looking into what the RFID Institute has to offer.

YES, but I'm unsure how to go about doing so.

NO, this is not something that really interests me.

DON'T KNOW.

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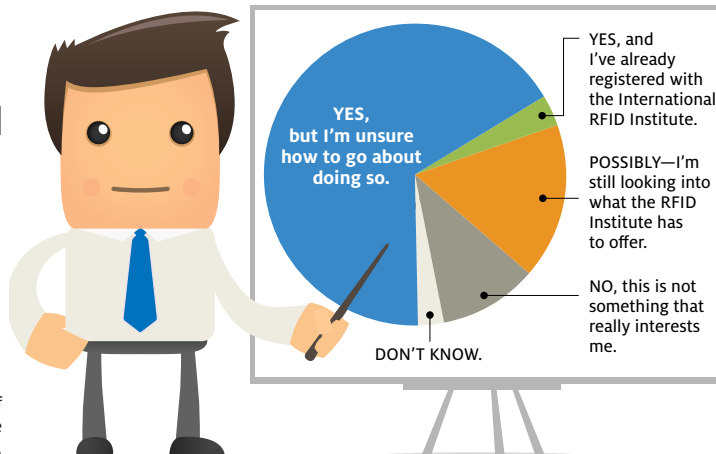
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Using NFC to Deliver, Share and Collect Data

JAN. 28, 2014 • 11:00 AM - 1:00 PM EST

This virtual event will explain how NFC is being used to augment products, in order to improve how consumer devices interact with one another, as well as help people speed up connections, simplify access and make secure payments.

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Steering a Successful Rollout

MOST COMPANIES run pilots of new radio frequency identification applications to be sure the technology works in their environments and the solution delivers the promised benefits. But how do you go from successful pilot to successful deployment?

We asked contributing writer John Edwards to find out. He interviewed end users, system integrators and other experts who have participated in winning rollouts, as well as a few failed attempts. The issues, Edwards writes in our cover story (page 14), vary from company to company, but there are some common strategies that can up the odds of success. The story explains how to execute the strategies, so you can deploy a solution that delivers benefits for the long term.

One of the big lessons is to begin with a clear plan at the pilot stage. Sounds obvious, but many organizations don't identify the problem they are trying to solve and how the pilot solution will address it. They fail to document their current processes, and to set rules and benchmarks to evaluate the pilot. Success defined as having 100 percent visibility of work-in-process all the time, for example, is very different from success defined as a 10 percent increase in production due to greater visibility of WIP.

It's also important to get buy-in from senior management, Edwards writes. Lukewarm support could lead to project cancellation, especially if any glitches occur. And some glitches or unforeseen obstacles usually do appear when a pilot is expanded into a rollout. While you work out any system kinks, be sure management understands the benefits to be gained from rolling out the solution. In addition, don't underestimate the importance of training employees who will be working with the new system.

Several major pharmaceutical manufacturers and distributors conducted successful RFID pilots from 2005 through 2007. California and other states had passed electronic-pedigree laws, and these companies were getting ready to track each unique bottle of pills or vile of serum. Then, California postponed its drug pedigree legislation, and the U.S. Food and Drug Administration stepped in. As Jennifer Zaino explains in this issue's Vertical Focus, technology concerns, cost and a lack of education have derailed the use of RFID for e-pedigree—for now (page 22).

Getting buy-in for an RFID deployment is not always a question of return on investment. Often, ensuring employee health is the primary factor. That's clearly the case when it comes to locating employees during an emergency. Increasingly, energy and mining companies, hospitals, industrial manufacturers and schools are piloting and deploying RFID personnel safety solutions. For a look at the different systems available, see Product Developments (page 30).

Regardless of what RFID application you are deploying, remember to follow best practices each time you go from pilot to rollout. In our January/February issue, we'll examine the key issues to consider when you roll out an RFID solution at other locations.
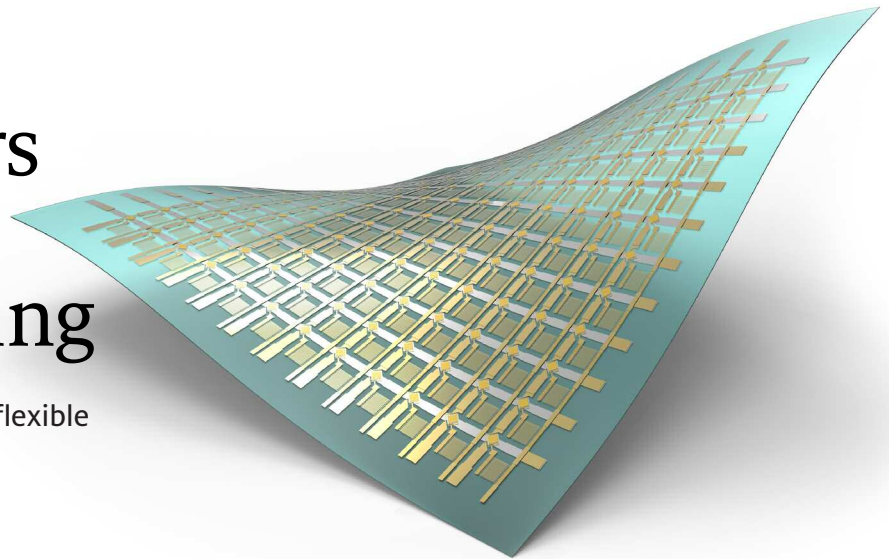
Mark Roberti, Founder and Editor

HEALTH CARE

Wearable Sensors for At-Home Patient Monitoring

Researchers have developed a lightweight, flexible device that conforms to a person's body.

AS THE POPULATION in many industrialized countries ages, researchers worldwide have been developing technologies that would enable doctors to monitor patients at home, remotely and in real time. One challenge has been to develop a device that could be worn for long periods. Researchers at the Someya-Sekitani Organic Transistor Lab at the University of Tokyo, Johannes Kepler University in Austria and the University of Texas at Dallas have taken a step in that direction. Together, they've developed ultrathin, organic sensors that one day could wirelessly communicate a patient's temperature, heart rate and other crucial data.

The researchers' goal was to create lightweight sensors that were thin enough and flexible enough that a patient would not be aware he or she was wearing them. For a device to be worn for long periods, it would have to be soft, compliant and allow for the natural motion of surrounding tissue. They developed sensors that are five times thinner than plastic kitchen wrap and lighter than a feather.

Most state-of-the-art integrated circuits, or "chips," are fabricated on rigid substrates, such as silicon or glass, that can't conform to soft body tissue. Sensors are integrated with these ICs, and in addition to being too rigid to wear, they often require a lot of energy to power them.

The researchers created sensors using a carbon-based semiconductor and an electroplated aluminum oxide dielectric layer on an ultrathin polymer foil that is highly flexible. After fabrication, an ultrathin polymer film is deposited on top of the device, to protect it from fluids, air and other environmental factors. The second polymer layer also alters the bending mechanics of the device, effectively reducing the strain in the sensors so the device can bend or crumple to conform to the movements of human skin.

To minimize the amount of energy consumed, Jonathan Reeder, a University of Texas at Dallas researcher, developed a way to optimize the creation of the dielectric layer, which dictates the voltage at which each transistor activates. This approach opens new doors for applications in biomedical devices that require minimal voltage.

"By making sensors or stimulators that are essentially imperceptible to the body, we hope we can provide a fabrication technique for devices for treating disorders and diseases, and monitoring health in ways that have previously not been possible," Reeder says. "This would be accomplished through the chronic monitoring of body signals, such as blood pressure, body temperature, glucose levels and neural activity, and would provide diagnostic information that could be used for treatments. Treatments could potentially be delivered through a similar type of ultra-thin, ultra-flexible device, such as a neural stimulator."

The prototype sensors require wiring, because the first stage of the research focused on creating high-performance electronics that can interface with delicate tissue. "As flexible biomedical device technology progresses, it will be necessary to create complete devices that bring together multiple technologies—sensors with wireless communication and power delivery—in a robust but flexible package," Reeder says. "Other research groups have shown that it's possible to wirelessly transfer bio-signals from the skin to a computer."

The researchers have demonstrated temperature, tactile and pressure sensing. They plan to expand the sensing capabilities toward complex body signals, which could include the brain and heart, as well as monitoring pH and chemical levels. "These devices are exciting for applications in medicine for collecting body signals or applying stimulation to biological tissue, which is soft and dynamic," Reeder says. —*Mark Roberti*

ASSISTIVE TECHNOLOGY

A Rose Is (Identified) as a Rose

An RFID-enabled guide lets people who are visually impaired explore on their own.

THE LEWIS GINTER Botanical Garden in Richmond, Va., welcomes visitors who are visually impaired or blind and wish to enjoy the sensory experiences of sound, smell and touch. The garden provides information in Braille, but it's difficult for individuals who are visually impaired to navigate the landscape and locate the signage while on an auditory

An RFID-enabled Android tablet reads passive UHF tags and automatically plays associated audio clips about the tagged flowers.

tour. For her senior project in biomedical engineering at the Virginia Commonwealth University School of Engineering, Christina Walinski developed an RFID-enabled guide that allows people who are visually impaired to explore the gardens on their own.

The concept is not new. Students at the University of Rochester's School of Engineering and Applied Sciences combined RFID readers with CD players to communicate information about tagged items (see Guide for the Visually Impaired). Another RFID guide used passive high-frequency tags (see Swiss Town Rolls Out RFID System for Blind Bus Riders). Both options

were cumbersome and challenging for the user.

What is new is the user-friendliness of Walinski's system. She developed an Android application that runs on a tablet equipped with an ultrahigh-frequency RFID reader. The tablet reads passive UHF tags within three or four feet and automatically plays the associated audio clips about the flowers.

Walinski considered Bluetooth and Wi-Fi for this application, but quickly realized passive UHF technology was the best option because of its ability to read tags within a confined area and communicate the tag data quickly. She scoured the Web for a tablet that could read passive UHF tags from a few feet away and finally found an Android tablet from a Chinese company called Cilico Electronics that has a large UHF antenna, providing several feet of read range.

Walinski worked with garden employees to determine which plants should be tagged and to develop the audio files about each plant. The files also explain how to navigate different pathways within the gardens. A staff member can simply launch the app and give a visitor who is visually impaired a tablet, which fits in a carrying case strapped to the person's waist.

This summer, Walinski, under the supervision of associate professor Dianne Pawluk, tested the system with six individuals who are visually impaired. The system worked well, but not perfectly. Roughly 15 percent of the time, the tags were not picked up immediately, requiring the visitor to back up so the tags could be read. Still, the feedback was positive. "People were really excited to learn about the plants and flowers," Walinski says. "And they were pleased to be able to visit the gardens on their own at any time, rather than having to wait for a guided tour."

Pawluk is talking to organizations about commercializing the system. —M.R.

A Lack of Vision

Number of people afflicted with age-related macular degeneration in selected countries.

United States:
15 million

France:
2 million

Canada:
2 million

Australia:
750,000

Japan:
700,000

United Kingdom:
513,000

—*Rich Handley*
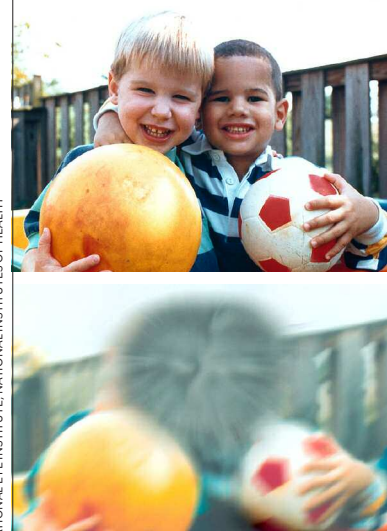
Bottom photo simulates the effect of age-related macular degeneration.

PATENTS

What the Round Rock Settlements Mean

Motorola and Smartrac signed settlement agreements with Round Rock Research, which sued several retailers for patent infringement.

ON NOV. 4, MOTOROLA SOLUTIONS and Smartrac announced they had concurrently signed settlement agreements with Round Rock Research, a patent licensing firm that sued several Motorola customers and other companies adopting passive ultrahigh-frequency radio frequency identification technology for patent infringement. This development could have far-reaching implications for the RFID industry and adoption of RFID technology.

The terms of the deal have not been disclosed, but RFID JOURNAL has learned that retailers who have been sued by Round Rock Research will be given a period of time to comply with the settlement terms. This means retailers will have to use a high percentage—our source would not reveal the number—of readers from Motorola and tags from Smartrac (and other RFID vendors, if more settle). Retailers using RFID for the first time will be exempt from lawsuits by Round Rock if they use the same percentage of licensed RFID technology.

It is unusual for two companies to announce separate agreements together. The reason Motorola and Smartrac each issued a press release stating

ILLUSTRATIONS: ISTOCKPHOTO

both companies had settled concurrently with Round Rock is that under the Round Rock lawsuit, an "RFID system" consists of tags and readers, so Motorola could not settle alone. And retailers would not move forward with deployments if they could use licensed readers but not licensed tags.

The deal is likely to impact RFID adoption—but before we explore that, let's discuss the background. Round Rock Research is a patent-licensing firm with several thousand patents and pending applications. The company does not manufacture, sell or market any products or services. Instead, it operates as a non-practicing entity (NPE), or what is sometimes referred to as a "patent-assertion entity" (PAE) or "patent troll," earning revenue solely by licensing and enforcing its patents.

On Dec. 14, 2011, the Mount Kisco, N.Y., firm filed lawsuits against nine companies using passive UHF RFID products provided by Motorola, Smartrac and other RFID vendors, charging that the solutions infringed on five of Round Rock's RFID patents granted by the U.S. Patent and Trademark Office. Those companies were American Apparel, Dole Food, Fruit of the Loom, Gap, HanesBrands, JC Penney, Macy's Retail Holdings, PepsiCo and VF Corp.

Walmart and Round Rock
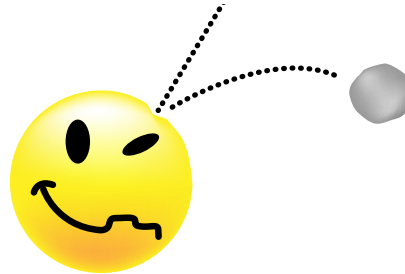
In March 2012, Round Rock Research sued Walmart for patent infringement. A source tells RFID Journal the retailer had some initial discussion with Round Rock regarding agreement to pay a licensing fee. But Round Rock overestimated Walmart's use of RFID and the benefits it was achieving. Round Rock asked for tens of millions of dollars per year. "It was outrageous," the source says, without being more specific.

Walmart apparently had serious concerns about the case, because Round Rock was not asking for a flat royalty fee but a percentage of the benefits from RFID. This was a potential nightmare if it lost the case. It would have to account for the direct benefits of RFID, which might require hiring an army of accountants. The benefits could be in the hundreds of millions of dollars annually, once the solution was fully deployed. And no doubt other technology companies would follow the precedent and ask for a percentage of the benefits of their technology.

In March 2013, Walmart sent a letter to suppliers tagging goods, saying it still believed RFID could deliver value and would defend the lawsuit vigorously, but it was "curtailing its EPC program pending resolution of the existing litigation." Walmart's intention was not entirely clear, and many were shocked that the retailer appeared to be walking away from EPC RFID. The CEO of one RFID company said Walmart kicked the RFID industry in the teeth when it said the return on investment from RFID, when the lawsuit defense cost was factored in, was not good enough to justify expanding the RFID program.

Our interpretation of this move is that Walmart was sending a signal not just to Round Rock but to other technology companies that it would rather not use a promising new technology than pay a percentage of the benefits. The comment related to the ROI could hurt the industry, but it was simply a legal strategy to downplay any potential damages the retailer might have to pay if it lost the suit.

At the time of this writing, Walmart's lawyers are examining the terms of the deal between Round Rock and Motorola and Smartrac to understand what the retailer is required to do to comply with the agreement. But it is highly likely that Walmart will resume its RFID efforts sometime in 2014. —M.R.

The ongoing litigation created some uncertainty—not only for the end users named in the lawsuits but also for potential customers concerned about being pulled into the patent dispute.

> **One retailer expressed disappointment at the settlement, saying: "The patents are not legitimate, and there was no reason to impose this extra burden on us."**

A week later, Round Rock filed a similar lawsuit against Amazon, claiming the online merchant infringed on nine Round Rock U.S. RFID patents. In March 2012, the company added Walmart to its list of defendants, claiming the retailer violated 10 of Round Rock's U.S. RFID patents. In all 11 lawsuits, Round Rock asked that it be awarded damages adequate to compensate for the alleged infringement, that such damages be determined by a jury and be trebled, with interest, and that it be reimbursed for its legal expenses.

In response, some companies being sued demanded defense and indemnification against Round Rock's claims of patent infringement from Motorola, under the indemnification clauses in their contracts with Motorola. In March 2012, Motorola filed a countersuit against Round Rock, challenging its claims. The ongoing litigation created some uncertainty—not only for the end users named in the lawsuits but also for potential customers concerned about being pulled into the patent dispute. Several RFID companies joined Motorola in a joint defense against the patents.

Meanwhile, to settle these claims, Round Rock asked the end users sued to pay a percentage of the benefits RFID delivers to them annually. This is a highly unusual tactic, according to patent lawyers we contacted. Typically, companies are asked to pay a flat licensing fee. The decision to ask for a percentage of the benefits RFID delivers created a problem for other passive UHF companies; potential customers began requesting indemnification. As one systems integrator put it: "If we do a $5 million project for a big retailer, we could wind up indemnifying them for many times that if RFID delivers a lot of benefit. We just can't do that."

The settlement does several things. It ends the suit for Walmart and Macy's if they comply with the agreement (both already use mostly Motorola readers). The framework of the settlement, which calls for Motorola and Smartrac to pay licensing fees, is nonexclusive, so other UHF RFID solution providers could sign similar agreements. In fact, at press time, Alien Technology, Avery Dennison RBIS and Invengo announced they had signed a licensing agreement with Round Rock.

As of this writing, a company that wishes to deploy passive UHF RFID in the United States would need to use mostly tags and readers from the RFID firms that have settled with Round Rock, or buy readers and tags through Checkpoint, which settled with Round Rock in May. To avoid losing out on potential new customers, tag and reader makers are now under pressure to sign similar agreements with Round Rock.

One concern some RFID technology buyers have expressed is that paying royalties to Round Rock will drive up the cost of equipment, particularly tags. Round Rock initially was asking for a licensing fee of 1 cent per tag. For a company such as Marks & Spencer, which expects to use 500 million tags annually, that would have amounted to an additional cost of $5 million per year. But a source who has seen the terms of the settlement says the royalty is nowhere near that high, and if a buyer commits to large purchases over a period of time, it can get an even lower royalty rate.

But the deal does create some issues for retailers. They will need to ensure they purchase mainly passive UHF readers from RFID companies that have settled with Round Rock (at least until 2019, when the most important patents expire). That's not so tough. Harder is ensuring a percentage of tags come from inlay providers that are licensed.

An inlay is the transponder and antenna mounted on a substrate. Label makers buy inlays from a variety of manufacturers and convert them into RFID labels or hangtags for garments. To comply with the settlement terms, retailers must require their suppliers to use tags with inlays from licensed suppliers. One retailer expressed disappointment at the settlement, saying: "The patents are not legitimate, and there was no reason to impose this extra burden on us." —*Mark Roberti*

More Patent Litigation?

ROUND ROCK RESEARCH'S DECISION to sue 11 end user companies for infringing on passive ultrahigh-frequency RFID patents cast a pall over the RFID industry for nearly two years. Some potential users of the technology put their RFID efforts on hold. Others continued their deployments apace, but refused to talk about them publicly for fear of being sued. That problem is being resolved. The settlements by Motorola and Smartrac free many end user companies from the threat of a suit, and other RFID vendors are also likely to settle. But are there any more non-practicing entities (NPEs), or "patent trolls," lurking in the shadows?

Roger Stewart, former CTO of Alien Technology and president of Sourland Mountain Associates, an intellectual property consulting firm, says the U.S. Patent and Trademark Office has issued more than 15,000 RFID patents and continues to issue roughly 500 RFID patents annually. Given these numbers, it's likely the patent issue will not die with the resolution of the Round Rock lawsuit.

Not all patents are equally important, Stewart points out. But some, he says, are seminal to how RFID works, and there is no easy way to engineer a work-around to avoid infringing on the patent. According to a presentation Stewart did at the Massachusetts Institute of Technology in October, Intermec Technologies has seven of these critical patents and Motorola has three, while Alien Technology, Checkpoint, Texas Instruments

and several others each have one.

To date, RFID solution providers have not aggressively asserted their patents. That's because they have a vested interest in seeing the RFID market grow. There might be more suits once the technology achieves widespread adoption.

RFID JOURNAL asked several RFID solution providers whether there are other NPEs that could assert their patents in the next few years. One told us there are many patents, but most are held by technology companies or small RFID companies. "We don't see anyone on the horizon that has the sophistication and resources of Round Rock," he said.

Another vendor agreed, but pointed out that the patent situation can change quickly. "If some struggling RFID company needs to cash in whatever assets it has before closing down, and they sell their patents to an NPE, then you have another Round Rock."

The good news is that the industry is quickly learning how to address patent issues. The bad news is that royalties add to the cost of RFID products. "Based on related industries, such as semiconductors and displays, the RFID industry cannot sustain IP costs of more than 20 percent of profits or 10 percent of sales," Stewart says. "I remain concerned about whether the industry would be able to carry the cumulative burden of 'stacking' 20 or so Round Rock royalty rates, if the Round Rock settlement becomes the template for the other major patent owners." —*M.R.*

> "If some struggling RFID company needs to cash in whatever assets it has before closing down, and they sell their patents to an NPE, then you have another Round Rock."

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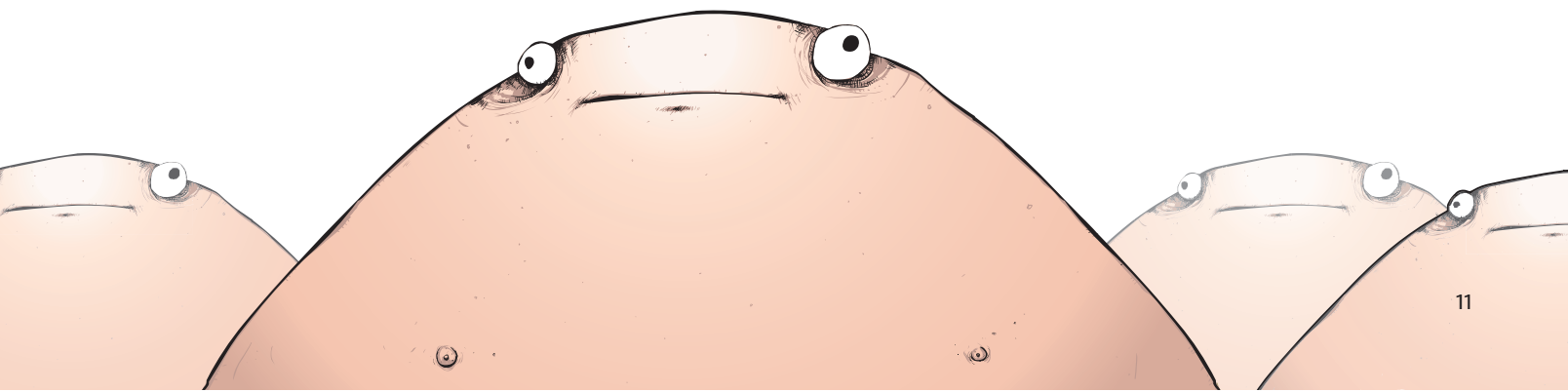
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FROM PILOT TO ROLLOUT:

Reaching the Decisive Moment

Transforming an RFID pilot project into a real-world deployment demands vision, attention to detail and a determination to meet unexpected challenges.

BY JOHN EDWARDS

"THE DECISIVE MOMENT," a term coined by the pioneer photojournalist Henri Cartier-Bresson, refers to the point at which all the fleeting elements necessary to create an awesome image converge in the camera's viewfinder, signaling the photographer that now is the time to press the shutter button.

Organizations that have deployed RFID pilots face their own decisive moment. It occurs weeks or months after the trial winds down, when precise planning, hard-won experience, test data analysis and business insight all merge inside the project leader's head, telling him or her that now is the time to roll out the system.

It all sounds so simple—but decisive moments aren't all that easy to spot. Cartier-Bresson, who shot stunning photographs worldwide for more than half a century, admitted that it took a great deal of experience to know

exactly when to push the shutter button.

RFID project leaders face a greater challenge in determining when to push a pilot into final deployment. "You always wonder, 'Is this a good time? Is this not a good time?'" says Philomena Sousa, oncology systems manager and process specialist at Toronto's Odette Cancer Center, who worked on the team that created an RFID-based patient arrival and tracking module. There's always a feeling, she says, that there's another improvement to be made, another issue to consider.

Rolling out a pilot isn't simple, and specific issues vary among companies. Yet, there are common situations and challenges that nearly every RFID project leader will face as a system is being prepared for full operation. Project
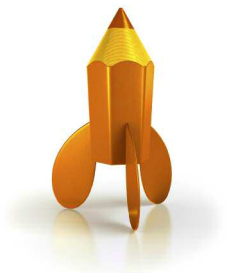
"I also believe that there's a lot of work to be done before the pilot. I know some companies would rather just throw together a pilot and then work on solving the issues that come up when it's time to deploy."

—STEVE HALLIDAY, HIGH TECH AID

leaders who address these issues can feel more confident that they'll have a successful launch and the solution will deliver benefits for the long term.

START WITH A PLAN

The key to a successful rollout begins with meticulous planning at the pilot stage. In RFID Journal's story Eight Common Deployment Mistakes—and How to Avoid Them, RFID experts cite the importance of selecting an experienced systems integrator, choosing the right RFID technology, assigning responsibility to one senior executive, thinking strategically and handling the integration of RFID data with back-end systems.

"I'm a big believer in pilots, but I also believe that there's a lot of work to be done before the pilot," says Steve Halliday, president of High Tech Aid, an RFID consulting firm based in Gibsonia, Pa. "I know some companies would rather just throw together a pilot and then work on solving the issues that come up when it's time to deploy, but that doesn't work for me in my company," he says. "We like to try and identify as many of the issues before we start as we can."

A pilot heading out in the wrong direction will leave a business ill-prepared for a successful rollout, says Grant Richardson, director of the innovative solutions group at CDO Technologies, a Dayton, Ohio-based RFID systems integrator. "First and foremost, you need to understand what problem you're trying to solve," he says. "There definitely needs to be some sort of statement or vision of the problem." Setting goals is the next step, Richardson says. "What is your end state? Where do you want to be when this project is done?"

Steering the pilot in the right direction for deployment also requires establishing specific rules and benchmarks, says Bill Spahr, VP of professional services for Ekahau, an RFID provider based in Reston, Va. Project leaders need to ask themselves several basic questions before launching a pilot, he says, including: "What's the evaluation timeframe? What are the next steps? How do we evaluate success?"

Project leaders should carefully document their current processes before attempting to automate them with RFID, advises Ryan Mabry, a lead software engineer working on the development of an RFID-driven shipboard inventory system at the Naval Surface Warfare Center (NSWC) in Panama City, Fla. (see Naval Surface Warfare Center Demos RFID Tool-Tracking Solution for Combat Ships). This information, he says, is essential for developing a system that will deploy successfully. "A lot of times, people don't have the [current] process actually documented," he explains. "They don't know what they are doing today, or how they actually conduct an inventory, or even what they are actually inventorying." Key details, he says, are often "the hardest things

to nail down" before beginning work on an RFID-based system.

AGREE ON THE RESULTS

As the pilot wraps up, project leaders, systems integrators and stakeholders need to reach a consensus on the trial's results, to determine whether it's time to move on to a full-scale deployment. "It's important to agree on success benchmarks up front," Halliday says. "If you've agreed on the right things, it should be very easy to say whether or not you've done what was needed to move forward." The problem, he explains, is that people sometimes don't know what they really want. "Then," he says, "it becomes much harder to agree up front what the measurement point is."

"Sometimes it's a no-brainer whether to flick that [deployment] switch quickly or slowly, but it's really... measured on a case-by-case basis," says Philip Lassner, CEO of Overheer Systems, a Westmount, Que.-based systems integrator serving retail customers. He recalls one project when a rapid rollout was expected but ultimately deferred. "We thought we were going to do this quickly," he says. Then the client requested a delay, sensing that things just weren't quite right. "It turned out there were some IT issues that needed to be addressed first," he says.

Businesses must examine their current business processes to define pilot acceptance criteria, Spahr says. "Ultimately, what moves the needle is pilot success against acceptance criteria," he observes. "In health care, for example, they would look at things like utilization rates, equipment cycle testing, and equipment being in use versus not in use."

OBTAIN BUY-IN

It's important to ensure that top management remains committed to the project and will fully support—and fund—the system as it moves to the next stage. "Once you get that buy-in, everybody becomes a part of the success," Spahr says. "You want the system to be

something organic that improves processes overall, and you only get that when you have full buy-in."

Buy-in represents management approval and support, not necessarily direct project participation, Halliday notes. "Top-level management doesn't always want to be involved, and there's a lot of work that can go without them being involved," he says. "But I think it's really important to give them an understanding of what's going to happen and what it will mean to them."

Often, buy-in is achieved by demonstrating return on investment—that magic formula that can determine whether a pilot is worth taking to the next stage. "In today's economy, no one's got money to burn," Halliday says.

> "We had to do a business case analysis, and that included return on investment, payback period, reduced workload, and what it would take to actually put all of this into implementation."
>
> —RYAN MABRY, NAVAL SURFACE WARFARE CENTER

"Businesses want to know up front if they will see a three-month, two-year, 10-year ROI."

The NSWC went to great pains to ensure that its RFID system would live up to its ROI goals, Mabry says. "We had to do a business case analysis, and that included return on investment, payback period, reduced workload, and what it would take to actually put all of this into implementation."

Many enterprises conduct time and motion studies and other sophisticated process evaluations before and during the pilot. But squeezing meaningful ROI insights out of such data prior to deployment can be tricky. "You can show that by doing things a certain way, you're going to shave three seconds off a step in a process," Halliday says. "Yet, typically, there's no hard and fast way to work it out, nothing

that's going to be the way to compute this sort of thing."

Sousa convinced Odette Cancer Centre management to roll out its patient-management solution by showing various stakeholder committees the concept in operation. "Prior to going live, we had a number of demos," she says. (See Odette Cancer Centre Boosts Throughput via RFID.) "After the pilot, our findings were summarized and the analysis, the business case and the go-live plan were compiled and presented to the senior management for approval. After approval, the implementation team decided that the chemotherapy suite would be the first to be rolled out due to an immediate need."

In some cases, the "go/no-go" decision on a

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>
> —BILL SPAHR, EKAHAU

pilot set to deploy is complicated by the fact that ROI isn't simply a straightforward calculation based on time, dollars and equipment. Mitigating risk, or failing to mitigate risk, can have a significant impact on an RFID deployment's projected ROI. "Ultimately, ROI matters, but there are also a lot of intangibles, like safety," Spahr says. "It's hard to put that into a calculator. A single incident can be absolutely devastating to an organization, particularly in schools or in health care. Those things can be difficult to put a number around, but you certainly can't underestimate the value of them." (Deploying personnel safety solutions to locate employees during emergencies, for example, is typically not determined by ROI; see Product Developments on page 30.)

Employee health is often the biggest factor in determining ROI, Halliday says. "ROI is much more than the direct saving of dollars," he says. "It can be much more indirect, such as not having people out on sick leave." An RFID system can often be engineered—or reengineered after a pilot—to enhance ROI by safeguarding employee health.

A recent project in a consumer industry was adapted to achieve just such a goal, Halliday says. Items shipped in returnable plastic containers must be checked for correctness upon receipt, but the containers are difficult to open, despite the use of special tools, and the repetition was taking its toll on employees' health. The new process uses RFID readers and tags to ensure the contents' accuracy so the majority of containers do not need to be opened and re-closed. The number of containers that must be checked manually has fallen from roughly 1,500 per day to less than 50 per day.

"The change started out because there were three people out on sick leave because of repetitive stress injuries," Halliday explains. "We simply eliminated that stage of their process, so they don't get that repetitive stress injury any more."

In addition to getting buy-in from top management, key stakeholders must always be given the opportunity to voice their support, or objection, before the system is fully deployed. "It's important to have buy-in from all aspects of the organization, so it's not being dumped on anyone," Spahr says. "I can't tell you the number of times I've had an angry IT person on the phone who just had a system dumped on him, and he's trying to figure out what's going on." Failing to consult project stakeholders prior to rollout is inviting trouble, he states. (For tips on getting front-line managers and other end users on your side, see Gaining Project Buy-in From Company Employees.)

FIX THINGS

Pilots are not only designed to show how an RFID system works, but also how it sometimes doesn't work. As deployment preparation begins, project leaders need to turn their attention toward addressing any problems or shortcomings that became apparent during the trial.

Problems can pop up almost anywhere, Lassner says. "There can be shielding issues, there can be tag issues, there can be reader issues... It's really a case-by-case basis," he says. "And, yes, you're only going to notice those things in a pilot."

A need for incremental changes during and after a pilot is to be expected on certain types of projects, says Jignesh Vania, IT head at Adani Port, in Gujarat, India. Since deploying a passive ultrahigh-frequency RFID system to manage cargo, the Hazira Container Terminal has decreased loading and unloading times (see RFID Reduces Traffic Delays at Indian Port).

"We have faced some challenges during the project," Vania says. "As we have moved cranes on which we have to mount the RFID readers and controllers, many modifications were necessary on the standard mounting accessories." Mounting accessories had to be redesigned and customized for each type of crane, but the extra work paid off. "Now, it is almost more than one year, and RFID integration is working fine without any major issues," he says.

RFID project teams handle predeployment system fixes and changes in different ways. NSWC, like most large organizations, takes a committee approach. "We use an engineering change board," Mabry says. The RFID team reviews project results and sends suggestions for upgrades and other alterations to the review panel. "Through this engineering change board, we are able to maintain configu-ration management and make changes," Mabry explains.

Important changes are often made just prior to deployment. The NSWC's project team, for example, thought things over and determined that its shipboard inventory-management system would benefit from the use of smaller tags. "We went with smaller tags because they are less cumbersome and more user-friendly for... systems integration," Mabry says. "And some of the newer tags have a better read range, so therefore you have a higher reliability of your inventory."

Project leaders also must remember that problems that appear trivial in a pilot have the potential to become far more detrimental in a full-scale deployment. "Companies tend to

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>
> —PHILIP LASSNER, OVERHEER SYSTEMS

look at pilots as the least expensive way that they can test their theory, their solution, and determine whether it's going to work," Richardson says. "But what happens when there are 50 tags in proximity to a location, and you haven't considered the fact that your reader sensitivity might have to be dialed down so that you don't start picking up unanticipated reads?"

"Unfortunately, unforeseen issues will always be unforeseen," Lassner says. "It's personnel and people who make the difference. As long as the RFID professionals know what they're doing, and they've got the support of their client, and as long as the resources are strong, it makes all the difference toward minimizing unforeseen issues."

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TACKLE TRAINING

As an RFID pilot heads toward full deployment, it's time to begin training the people who will be operating, managing and maintaining the system, as well as the individuals who will be incorporating the technology into their daily work routines (see How to Develop an RFID Training Program).

IT staff members and other system stakeholders need training to achieve technical ownership of the solution, Spahr says. In addition, training key supervisors and other top staff members is vital "so you can have super-users who can then train regular users," he adds. This way, companies can save time and money by solving routine operational problems in-house rather than turning to outside help.

its staff members but also teach a never-ending stream of new patients how to use its card-based tracking system. "The biggest issue for us was the patients," Sousa says. The first patients to use the system acted as if they were using a bank card. They didn't realize they could register their location simply by waving their device near the reader. Instead, they placed it on the kiosk for a moment, then picked it back up again. "We modified our information pamphlet and the directions to the patient displayed on the screen to scan the card. But if that's the worst [training problem], we're good with that," she jokes.

"Once everything was done and all the privacy and impact issues were signed off, and all the user groups were signed off, then we were ready to go," Sousa says. "We just decided to bite

> "The biggest [training] issue for us was the patients. We modified our information pamphlet and the directions to the patient displayed on the screen to scan the card. But if that's the worst [training problem], we're good with that."
>
> —PHILOMENA SOUSA, ODETTE CANCER CENTER

Halliday agrees. "Once your initial people are trained, they kind of become the onsite experts," he says. "We spend a lot of time training people in the early days, because we find that's the best way to guarantee success."

Good training also helps managers avoid the threat posed by confused and resentful workers. "What ends up happening is that you get 500,000 suggestions telling you why the system doesn't work," Halliday says. "Then it really doesn't work, because that's the attitude people develop when they're forced to do something they either don't want to do or they're not used to doing."

Odette Cancer Center not only had to train

the bullet. We have to go live with this. We know what we're going to be dealing with, and there will be some hardships, but if we keep delaying this, we're never going to get off the ground."

Odette Cancer Center found its decisive moment. Since rolling out its patient-management solution, the center has achieved its goals, increasing patient throughput and shortening the wait time for patients receiving services.

Editor's Note: In our January/February issue, we'll examine best practices for rolling out an RFID system at other locations. And in our March/April issue, we'll look at how to add applications to an RFID infrastructure.
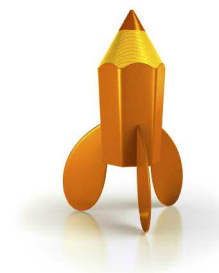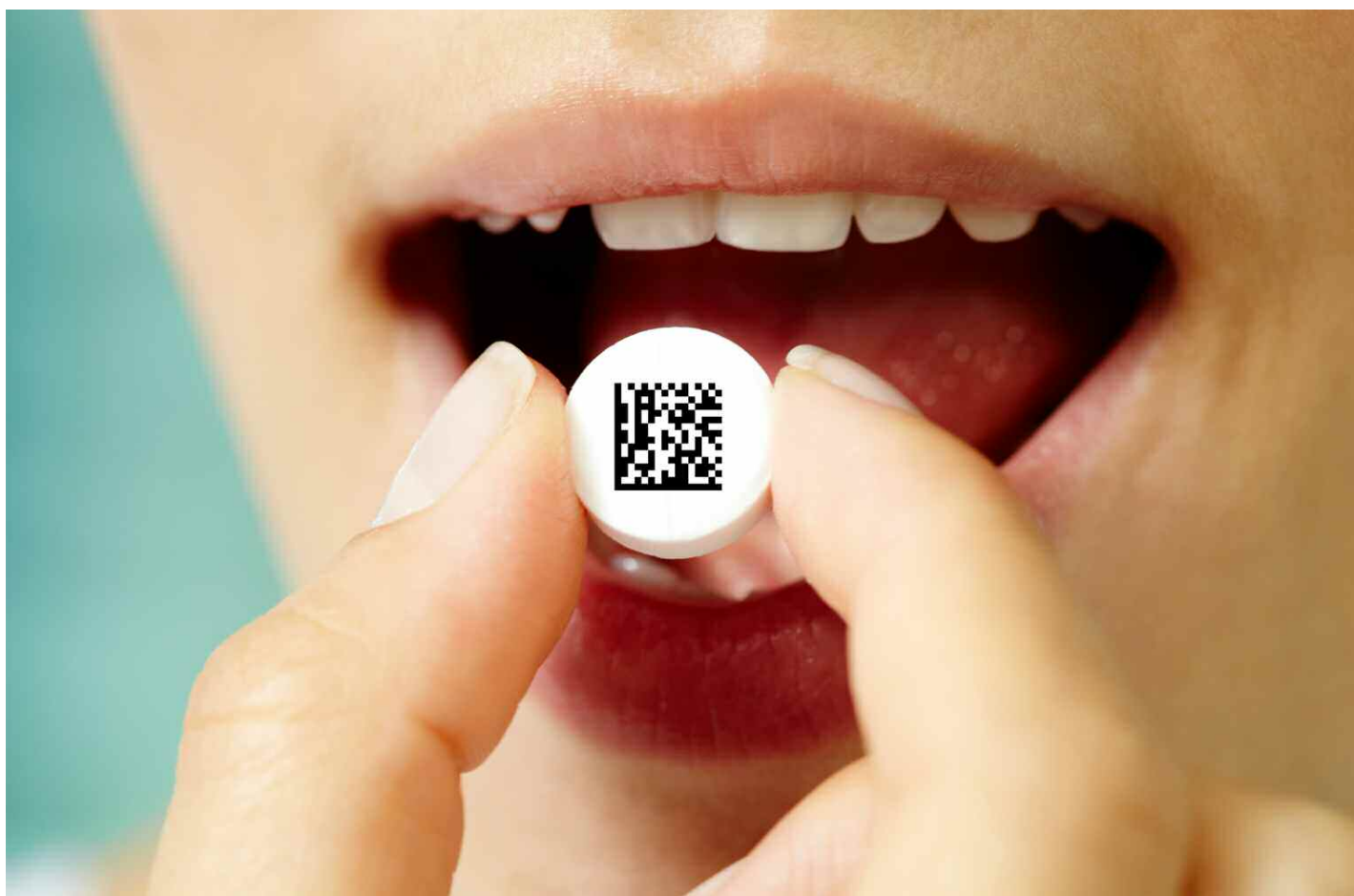
RFID Takes a Back Seat When It Comes to Electronic Pedigrees

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BY JENNIFER ZAINO

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Data Matrix bar codes will be used to identify prescription drugs, to thwart counterfeiting in the pharmaceutical supply chain.

DRUG COUNTERFEITING is a global problem that costs pharmaceutical companies billions of dollars and threatens the health of millions of consumers. The National Association of Boards of Pharmacy reports that an estimated 1 percent to 2 percent of drugs in North America are fraudulent. The World Health Organization cites similar statistics for European and other industrialized countries, but says the percentage of counterfeit drugs is much higher in many African countries and in parts of Asia and Latin America.

Countries worldwide have been working to stem the flow of counterfeit drugs in their supply chains. For many years, the pharmaceutical industry has been considering radio frequency identification technology to combat drug diversion and counterfeiting, as well as to improve manufacturing and distribu-

tion efficiencies. Indeed, pharmaceutical providers in South Korea and several other countries have piloted or deployed RFID solutions (see RFID Makes Order Out of Chaotic Distribution Chain, Gador to Track Drugs in Argentina and Nigerian Drug Agency Opts for RFID Anticounterfeiting Technology).

RFID had significant traction in the U.S. pharmaceutical industry, which leads the world in prescription drug manufacturing, accounting for 39 percent of production. "Companies did think, back in 2005-2006, that we were headed toward everyone using RFID," says Dirk Rodgers, an independent consultant focusing on health-care supply chains. In 2005, for example, Pfizer began RFID-tagging each bottle of Viagra sold in the United States. In 2006, drug manufacturer and distributor Cardinal Health completed a successful RFID pilot, which included pallet-, case- and item-level tracking of pharmaceuticals, and noted that it planned to start integrating RFID with its operational processes. And in 2007, Purdue Pharma began rolling out a full-scale RFID implementation, tagging every bottle and case of OxyContin it produced.

So when the California State Board of Pharmacy issued an

electronic-pedigree law, with an initial 2007 deadline, drug manufacturers and wholesalers began considering using RFID to meet the mandate, and RFID providers began offering e-pedigree solutions. The law stated that bar codes or RFID could be used to create an electronic record for tracking the movement of prescription drugs through the supply chain.

Florida, Nevada and several other states also passed e-pedigree laws, each with different requirements. Then, in 2008, the U.S. Food and Drug Administration stepped in, and the push for a drug-authenticating e-pedigree system

on cases, to contain serialization information—the standardized numerical identifiers (SNIs), lot numbers and expiration dates.

WHAT HAPPENED TO RFID?

RFID's momentum began to wane as California moved its e-pedigree deadline from 2007 to 2009, then to 2011 and then to the middle of the decade. While the pharmaceutical industry continued to explore how best to combat counterfeiting, as well as how to facilitate recalls, companies increasingly chose to use bar

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moved from the state to the federal level.

In September, the U.S. House of Representatives passed the Drug Quality and Security Act (H.R. 3204), and in November, the bill passed in the Senate. The legislation creates a uniform national standard for drug supply-chain security that would supersede all state e-pedigree initiatives. H.R. 3204 has many provisions directed at the drug distribution supply chain. These include encoding most prescription drug products at the smallest salable unit and sealed homogenous case level with a unique product identifier. Serialization provisions designed to identify products are combined with product tracing and verification requirements.

The federal regulations, which have the same aim as California's electronic-pedigree mandate, do not use the term e-pedigree. And H.R. 3204 makes no mention of RFID. In fact, the law prescribes the use of Data Matrix (2-D) bar codes on packages, and Data Matrix or linear bar codes

codes rather than RFID in their learning projects, says Shabbir Dahod, president and CEO of TraceLink, which provides global track-and-trace compliance and improved supply network performance for life sciences. There was a perception that RFID was still maturing and the per-unit price was high, he says. At the time, for example, there were concerns about whether ultrahigh-frequency technology worked with liquids or foil, materials that can be found in drugs or drug packaging.

Cost was and remains an issue. Small drug companies handle tens or hundreds of millions of units annually, and large ones can handle billions of units, Dahod says. The cost of RFID tags, and of implementing an RFID infrastructure throughout the supply network, is too high for this kind of volume, he says.

Data Matrix bar-code printing can be easily integrated into the labeling process. "Data Matrix bar codes are a low-cost, effective way to establish and capture unique information at the item

PHOTO: ISTOCKPHOTO

level," says Gary Lerner, founder and managing director of BrandSure, a supply-chain services and solutions provider that has managed more than 30 serialization projects, many of them facilitating California e-pedigree compliance.

The ongoing costs of maintaining a bar-code system, even if its initial design and deployment expenses can be high, also are much lower than the continual cost of RFID tags, Rodgers says. "The ongoing costs are higher for RFID because you have to buy those consumable tags," he says. "People in the RFID industry see it costs $1,000 for a bottle of drugs, so how

much more for an RFID tag compared to the benefits you get. But people in [pharmaceuticals] look at it by what is the cost of packaging today, and what it is tomorrow, and the consumables cost goes there."

In addition, pharmaceutical manufacturers question the value of RFID-enabling their supply chains, says TraceLink's VP of marketing Brian Daleiden. "Much of the primary initial value for the use of RFID tagging comes in downstream receiving, shipping and inventory-management processes," he says. "So companies are always asking, 'How much will

RFID Apps That Are Working for Pharma

While RFID is on hold when it comes to pharmaceutical electronic-pedigree efforts, hospitals are beginning to embrace the technology to manage drug inventories and medication administration. The pharmacy department at the University of Maryland Medical Center, for example, is employing an RFID-based solution to manage medication kits used with patients in emergencies (see Hospital Pharmacy Keeps Emergency Medication Kits in Check). CaroMont Regional Medical Center deployed an RFID solution to track recalled medicines (see North Carolina Hospital Identifies Recalled Drugs via RFID). And Brigham and Women's Hospital, which has used bar codes to manage its medication administration data since 2005, is evaluating a Near-Field Communication system to track the administration of patient medication (see Brigham and Women's Hospital Tests NFC RFID for Patient Bedsides).

Some hospitals and logistics companies are also turning to RFID to track the temperatures of medicines. Memorial Healthcare hospital, for example, installed a real-time location system employing Wi-Fi active RFID tags with temperature sensors to monitor medicines in its pharmacy's coolers. If a temperature is either too warm or too cold, the software sends a text message or e-mail alert to staff members responsible for the units. The system also provides a temperature record that can be provided to The Joint Commission to fulfill reporting requirements (see Michigan's Memorial Healthcare Adopts Ekahau Wi-Fi Tags).

DHL Global Forwarding, the air and ocean freight specialist within Deutsche Post DHL, has commercialized DHL Thermonet, an RFID-based air-freight service allowing customers to track the temperatures of pharmaceuticals or biomedical items throughout the shipping process with an EPC Gen 2 passive ultrahigh-frequency RFID inlay in-

When a crash-cart tray is placed inside the Kit Check scanning station, the built-in RFID reader identifies which medications on the tray are missing or nearing their expiration dates.

tegrated with a battery-powered temperature logger (see DHL Thermonet Tracks Drugs and Life-Sciences Goods With RFID Temperature Tag). Panalpina Group deployed an RFID solution to track the conditions of health-care and pharmaceutical products during transit or storage (see Global Logistics Company Monitors Shipments' Temperatures).

As pharmaceutical manufacturers and distributors begin considering RFID-tagging for inventory control or temperature monitoring, they should factor in the value add it could deliver to customers, suggests Michael Liard, VP of Auto-ID at VDC Research. "You could improve internal operations and enhance customer service," he says. "It can differentiate you from your peers. That's a key role and becoming a bit more attractive to pharmaceutical manufacturers." —*J.Z.*

I have to pay for RFID enablement vs. how much ROI will my company gain from the investment?' This equation is different throughout the supply chain and is something that will have to be worked out before broad RFID adoption takes place."

There's also the issue of education—or, rather, lack of education—among people at the federal level, says Michael Liard, VP of Auto-ID at VDC Research, reflecting on why RFID wasn't included as a way to create electronic records. "It's unfortunate and disappointing," he says. "People don't understand the technol-

that a foundational infrastructure exists around them both broadly and globally. In work with major pharmaceutical companies such as Pfizer (TraceLink serves as its core global track-and-trace provider), all that Dahod sees reflects bar-code serialization at the item and case levels. "Companies that were doing RFID have gone back and removed it, and moved to bar codes for track-and-trace compliance," he says.

At the same time, dozens of other countries are drafting pharmaceutical serialization or e-pedigree regulations that spell out the use of

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>
> MICHAEL LIARD, VDC RESEARCH

ogy still... and how performance has improved miles and miles even from a decade ago, when we first talked about passive UHF and open-loop supply chains. You need lobbying power to force the hand of government to look at RFID, understand its physical limits and the value adds and benefits it can bring to different applications and use cases."

A GLOBAL APPROACH

Data Matrix bar codes are the lowest common denominator that everyone in the industry can conform to for track and trace, Dahod says. "Now, it has gotten to the point that there is enough experience that the entire industry well understands bar codes, particularly 2-D Data Matrix bar codes, for the business processes built around them," he says, adding

Data Matrix bar codes. "These growing global requirements have caused companies to shift away from a country-by-country local solution approach," Daleiden says. "They are now thinking about how to build a global IT, packaging and distribution infrastructure that can efficiently serve multiple countries and diverse supply networks."

European Union members and India are among the countries that require or are about to require unique serial numbers on pharmaceuticals, says Ken Traub, principal at Ken Traub Consulting. They haven't taken the additional e-pedigree step of requiring tracking every change of ownership through the supply chain, from manufacturer on out, he says. But Argentina, China and Turkey are moving ahead with full e-pedigree requirements, including serialization and change-of-owner-

ship reporting to their respective health ministries. "If you are the manufacturer, the biggest part of the e-pedigree job is serialization," he says. "So for manufacturers, they are looking at what to do to meet e-pedigree here and the laws of other countries, and it is pretty much the same problem."

South Korea is unique in that it gives drug manufacturers the option of using RFID or bar codes for serialization purposes. That's because the government has been funding track-and-trace pilots and required that a certain percentage of drugs be RFID-tagged as part of these efforts. "The biggest impetus in

all present and correct," he says.

"The industry calls this approach 'inference,' because they scan the case or pallet and infer the detailed information about which items are contained within it, instead of breaking open each case at each change of custody and scanning every individual item," he continues. "So long as inference is considered suitably robust for use by the intermediate parties in the supply chain, there is no need for them to adopt RFID at item level." RFID offers a significant advantage over Data Matrix bar codes only if there is a need at various stages in the supply chain to scan the items at high

> South Korea is unique in that it gives drug manufacturers the option of using RFID or bar codes for serialization purposes.

South Korea is that you had a really close private/public partnership in 2006 to 2009," Daleiden says, "and the government's sponsorship of R&D on RFID has kept that moving."

TECHNOLOGY STANDARDS

Pharmaceutical manufacturers or repackagers typically pack items into cases and seal them, and those cases may not be opened until they reach the pharmacy or the last distributor before the pharmacy, says Mark Harrison, director of Auto-ID Labs Cambridge, who works on technical standards development with GS1, which is trying to develop a global open standard for event-based traceability. "In between, there is reliance on visual inspection of tamper-evident security seals and trust that the items that were recorded as being packed in the case are still

speed without opening each case.

GS1 EPCglobal's Electronic Product Code Information Services (EPCIS), which enables trading partners to securely exchange information regarding the location of products in the supply chain, has a role to play in pharmacy e-pedigree initiatives. "EPCIS was originally developed in the context of RFID," says Traub, who was the editor of the EPCIS standard. "Because it operates at a business level, however, it doesn't really take a position on whether the data comes from RFID, bar codes, manual data entry or any other source," he says. "Pharma is moving strongly to the EPCIS data-sharing standard."

Rodgers noted recently in his RxTrace blog, "Over the last five years, the larger companies in the U.S. pharmaceutical supply chain have increasingly aligned around the EPCIS standard for holding and communicating seriali-

zation-based events." While the federal government is not likely to mandate the use of EPCIS, the investments companies have made in EPCIS repositories are safe, he says.

GS1 is working on EPCIS v1.1, which will introduce additional capabilities intended to be applicable to many industry sectors—pharmaceuticals and food, for example—seeking to detect and eliminate counterfeits from legitimate supply chains. These include transformation events for relating input objects (such as specific batches, lots of ingredients or individually identified ingredients) to output objects (products composed of those ingredi-

DOWN THE ROAD

The pharmaceutical industry has been focused on supply-chain visibility to meet track-and-trace compliance, Liard says. But he believes there is potential for drug manufacturers to use RFID technology within their own operations. "It's going to take a little education and awareness building in the pharmaceutical manufacturing community to understand how RFID can have meaningful impact on operations today," he says. There is an opportunity, he adds, for drug manufacturers to use RFID to improve their bottom line and help with efficiencies,

"I think RFID still sets the standard for the vision of where the industry wants to be."
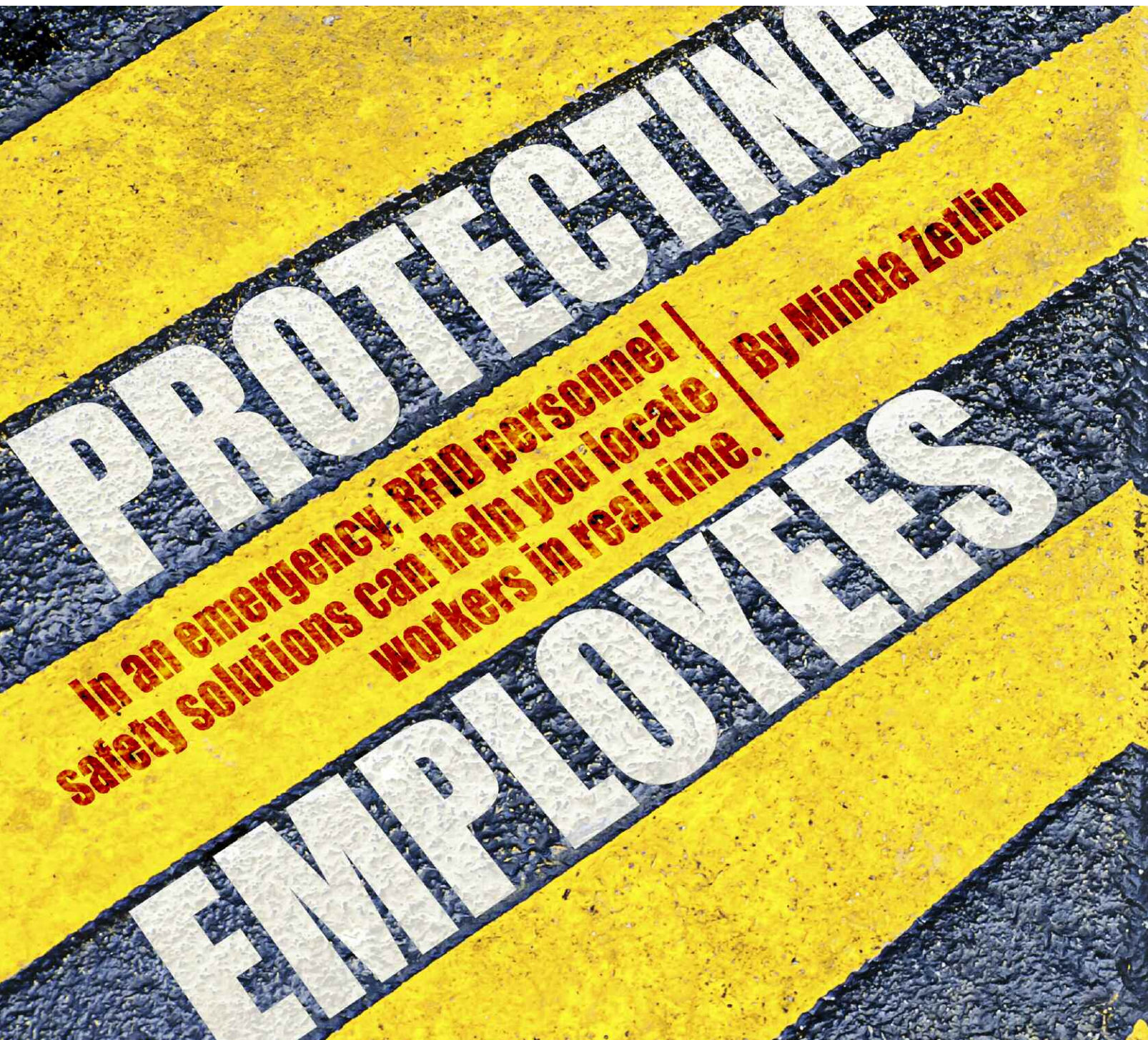
SHABBIR DAHOD, TRACELINK

ents). "EPCIS event data is the foundation for e-pedigree, because you can record every observation at every stage for a time-stamped piece of data of what was seen where, when and its business context (shipped, received and so on)," Harrison says. "EPCIS provides a standardized data model for that, and version 1.1 will additionally provide a number of enhancements, including a way for expressing events relating to the transformation of input objects into output objects."

Checking Services, another GS1 standard under development, is designed to make it cost-efficient for retail pharmacies and distributors to verify serialized data on 2-D bar codes or RFID tags (see Checking Services). "We're considering its role within the overall security framework," Harrison says. "We expect to begin standardization of Checking Services and its interfaces, data model, etc., in 2014."

whether that's inventory visibility, asset management or other business-process improvements.

Someday, radio frequency identification technology may get another shot at the e-pedigree target, Dahod says. "I think RFID still sets the standard for the vision of where the pharmaceutical industry wants to be," he says. "I believe the vision of the optimizations that can be made in inventory management, overall opeational efficiencies and improved safety. It's there, but maybe it's another 10 years out. Our hope and expectation is that RFID matures and becomes more pervasive. Initial learnings from specialty-type scenarios, such as cold-chain management, controlled-substance tracking and medication management, will be very helpful in providing the foundation for RFID to become the next lowest common denominator."

PROTECTING EMPLOYEES

In an emergency, RFID personnel / safety solutions can help you locate workers in real time. | By Minda Zetlin

ROUGHLY 10 YEARS AGO, radio frequency identification providers began offering personnel safety solutions to monitor workers on offshore oil rigs and in other hazardous environments. In the event of an emergency, these solutions allow companies to view workers' locations in real time to see who made it safely to muster stations and who needs to be rescued.

Identec Solutions, for example, launched WatcherOffShore in 2003 to monitor workers on oil rigs in the North Sea (see Active UHF RFID Tags Muster Support for Oil Rigs). Since then, adoption has been growing, and the company predicts that within five years, all North Sea oil rigs will use active RFID tags to track personnel.

Often, personnel safety solutions are deployed in conjunction with real-time location systems (RTLS) designed to track assets. Mexican oil-industry maintenance and transportation company Cotemar, for example, uses an RFID solution from AeroScout to automatically monitor employees, and the services they use, on four offshore platforms that serve as their living quarters while they work on oil rigs in the Gulf (see Cotemar Uses RTLS to Manage Safety, Supplies for Offshore Oil Workers).

Several years ago, RTLS providers developed personnel safety solutions that enable hospitals to monitor caregivers who work on emergency and psychiatric wards, where it's not uncommon for them to be assaulted by patients. Florida's Flagler Hospital, for example, recently deployed Ekahau's Staff Safety & Workflow Optimization within its behavioral-health unit (see Flagler Hospital Improves Caregiver Communications With Ekahau's RFID-Over-Wi-Fi). Many hospitals that employ RFID to track assets add on staff safety applications in their emergency rooms, says Mark Norris, Ekahau's CEO.

In early 2013, Idaho's Skyview High School learned about the staff safety solution deployed at Napa State Hospital (see California State Hospitals Expand Personal-Duress System). The school contacted Ekahau, which modified its health-care solution for the education sector. Now, Skyview teachers and other staff members can press a button on a badge to call for help in an emergency (see Idaho School Installs RTLS to Make Students Safer). Since then, Ekahau has deployed the solution at six other U.S. secondary schools and says many other schools have expressed interest in it. Airista and GuardRFID also offer safety solutions for the education sector.

Unlike other RFID applications, deciding whether to deploy a personnel safety solution is typically not determined by return on investment. In all

Employees who work in hazardous environments will never go to a job without their hard hats. GuardRFID's tags can be affixed to helmets.
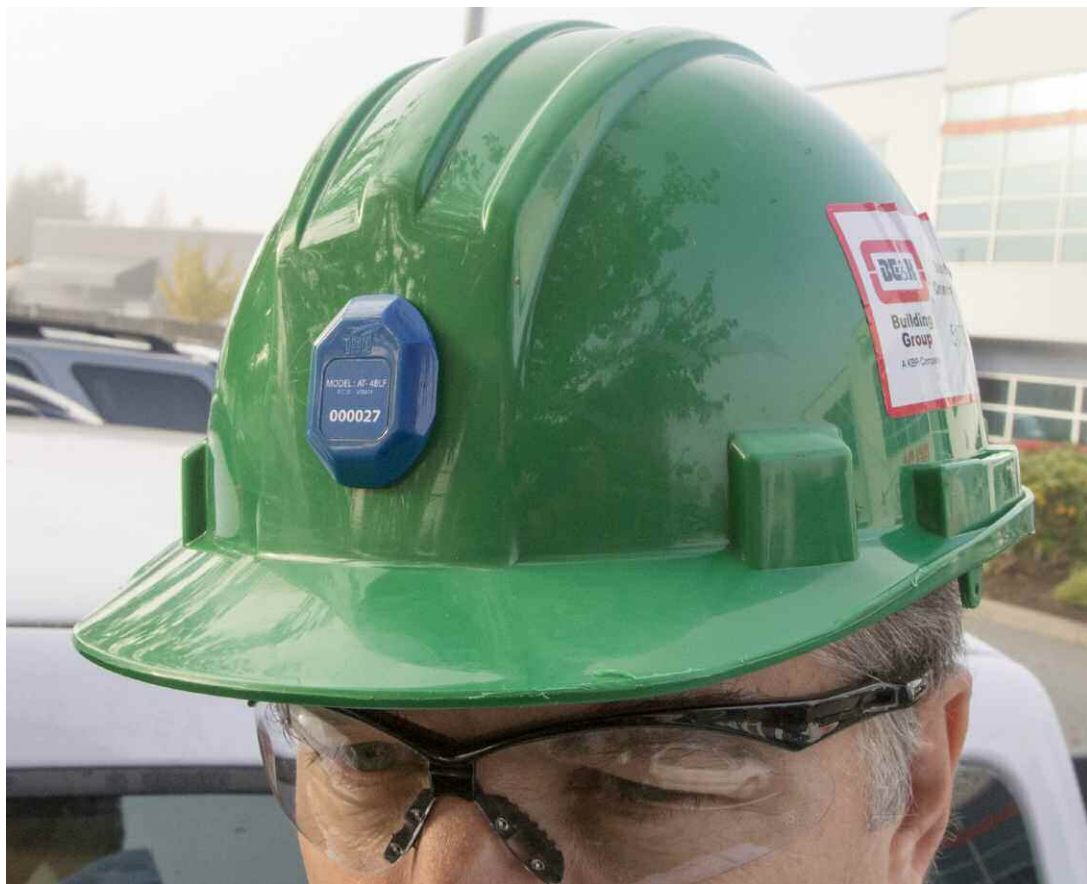
these settings, using RFID to track personnel can make the difference between life and death. Still, employing these solutions in industrial and other sectors can help companies comply with the U.S. Occupational Safety & Health Administration requirements for emergency evacuation plans, says Zahir Abji, CEO of GuardRFID.

Most personnel safety solutions are designed to protect workers' privacy. They typically track workers by zone, and focus on specific locations only when necessary. But the solutions vary by type of RFID technology used and features offered. Here are some issues to consider to help you choose the right solution for your environment. For more details, see the vendor table on opposite page.

TECHNOLOGY OPTIONS
Several personnel safety solutions leverage the 802.11 Wi-Fi networks organizations have installed at their facilities. The active RFID tags communicate with Wi-Fi access points, so companies can save the time and cost involved in installing fixed readers.

"Wi-Fi is widely seen as the most broadly established and most attractive technology to use," says John Devlin, practice director, security and ID at ABI Research. "That's partly because of lower cost in terms of infrastructure and readers and the access points that are already in place. It seems to be the way most people are going."

But there are other technology options. "It comes down to the particular requirements of the end user," Devlin says. Ultrawide-band, for example provides greater accuracy but smaller read ranges, he says. Agip Kazakhstan North Caspian Operating Co. deployed a UWB personnel safety solution from S3 ID (see Agip North Caspian Oil Platform Adopts RTLS Technology).

GuardRFID uses 433 MHz active RFID technology, which Abji says travels better through

PHOTO: GUARDRFID

objects and liquids than Wi-Fi does. Its solution can locate people within a range of 6 to 10 feet, which he says is more accurate than most Wi-Fi solutions. The tags work by emitting a beacon at an adjustable regular interval, such as once every two minutes. "We pick up those messages at various readers and use an algorithm to determine location," he says.

Ekahau says with its Wi-Fi tags and an 802.11 network, it typically achieves 8 to 10 feet accuracy. By adding its infrared (wire-free) location beacons, it can achieve 3-foot accuracy.

Identec Solutions employs ultrahigh-fre-

quency active tags, which can be deployed inexpensively to give widespread coverage over a large area such as an oil rig, according to James Pentreath, global head of oil and gas and mining and tunnel sales. "We tested different options, and 868 MHz in Europe and 920 MHz in the United States are the most reliable for oil rigs and mining situations," he says. "A lot of it comes down to range, reliability and robust transmissions, which are very important criteria when operating in these challenging environments."

The batteries in most active tags have a life

Some Leading Providers of
RFID Personnel Safety Solutions

COMPANY	PRODUCT	TAGS	READERS	SOFTWARE	INDUSTRIES SERVED	FEATURES
AeroScout aeroscout.com	Staff Safety, Worker Safety, Staff Safety & Assistance	Active Wi-Fi tags	Wi-Fi access points; location receivers and exciters	Location Engine, MobileView	Health care, hospitality, mining, oil and gas	Gas and motion sensors; users can send multiple types of signals to convey nature of situation
Airista airista.com	Personnel Safety	Active Wi-Fi tags	Wi-Fi access points; locators for sub-room level detection	Xpert Console	Education, health care, manufacturing, oil and gas	Panic button; two-way communication; can determine if employee has fallen
Ekahau ekahau.com	Life Safety and Security, Staff Safety & Workflow Optimization	Active Wi-Fi tags	Wi-Fi access points; infrared location beacons	Vision	Education and health care	Panic button; text messaging; can determine if employee has fallen
GuardRFID guardrfid.com	SafeGuard Staff Duress, All Guard Evacuation Monitoring and Personnel Accountability	433 MHz active tags	Fixed readers; room-level exciters; zonal portals	SafeGuard	Education, health care, industrial environments	Panic button; two-way communication; can determine if employee has fallen
Identec Solutions identecsolutions.com	WatcherOffShore, WatcherMine	433 MHz, 868 MHz and 920 MHz UHF active tags	Fixed readers	TrailBlazer middleware	Mining, oil and gas	Durable hypoallergenic tags that can withstand steam cleaning
S3 ID s3-id.com	eLocator, eMuster	Active ultrawideband tags	Fixed readers	eLocator, eMuster	Chemical, oil and gas	Two-way communication; designed for harsh environments

Ekahau's B4 Badge tag has an LED screen that can be used to send a brief message to the wearer.

span of roughly four to five years. Ekahau's B4 Badge tag has rechargeable batteries that typically last a shift or a few days, depending on use.

SAFETY FEATURES

Many personnel safety RFID tags incorporate a panic button that allows a user to signal for help in an emergency. Some tags are bidirectional, allowing whoever responds to the panic call to send a signal back to the user that the message was received and help is on the way.

Ekahau's B4 Badge tag has an LED screen that can be used to send a brief message to the wearer. "It can communicate, 'Yes, we've received your call for assistance and here are some things we want you to do in the meantime,'" Norris says. "The software-programmable tags enable multi-use scenarios," he adds. For the company's new school-targeted product, the red button signals a disciplinary event that requires a security response, and the blue button indicates a medical emergency.

Some tags can make an educated guess as to when a user might need help, even when that user can't press a panic button on his or her own. Ekahau, for example, equips some tags with accelerometers to detect the tag's orientation, which could indicate that an employee has fallen. "We've done some studies on what are the most common angles," Norris says. "If it's at a 90-degree angle to horizontal, that usually indicates standing or sitting." A 45-degree angle could signal trouble and trigger an alarm. RFID providers typically call this the "man down" feature.

"All our tags have motion sensors," says Mark Gallant, VP of industrial marketing at AeroScout. "Our application can track dwell times, so if a person is in a location longer than expected or doesn't move for more than two minutes, we can send a vibrating signal." A worker who's simply taking a break can press a responding button to say that all is well; a lack of response may mean that something is wrong. AeroScout tags also include gas sensors that can detect odorless toxic gases in mines, tunnels and other environments. The tags send an alert if dangerous gas is detected.

PHOTO: AEROSCOUT

In the chemical, energy and industrial sectors, most companies have evacuation plans that include muster points, where employees gather in an emergency. Knowing as quickly as possible who has reported in and who remains unaccounted for can help responders save lives. GuardRFID supplements its tags with exciters just inside and outside the doors at muster locations, giving responders a quick and easy way to determine who's still missing. "That gives us automatic role-call capability," Abji says.

"We've added evacuation monitoring," Gallant says. "Many industries need to evacuate workers in a controlled manner, so they need to know where those workers are. Our system will give you in real time how many people are still in the hazard area and how many have reached a muster point. For those who haven't, you can click on them from the dashboard to find out where they are and dispatch first responders."

This feature is popular with many types of companies including cruise lines, he adds. "If you have an engine fire and can guarantee you've gotten everyone out of the engine room, you can flood the area with CO_2 and put out the fire quickly," he says.

Identec's WatcherOffShore solution helps with mustering in emergencies that require workers to use lifeboats to evacuate the rig, Pentreath reports. "In muster zones, the operator is able to see how many people have boarded the lifeboat," he says. Some lifeboats hold as many as 75 people, so having an automated way to know who is and isn't on board makes a big difference when time is short. "As you walk through, your name appears on a screen and you're registered," he says. If someone gets on a lifeboat where he or she wasn't expected, the system automatically alerts the operator at the person's assigned lifeboat as well.

INTEGRATED SAFETY APPLICATIONS

In addition to personnel tracking, RFID safety solutions can be integrated with other applications to further protect employees. Access con-

Personell on board **728** Rescued Personell **117** Personell Without a Tag **0**

Ekofisk Center

- Inactive/ In error
- Partially active
- Active and OK
- Bridge muster zone
- Platform muster starter

trol, for example, can ensure that only authorized workers enter restricted zones. GuardRFID's personnel tags can also be used to lock or unlock a gate or door. An exciter emits a low-frequency signal to activate a response from the tag; otherwise, the wearer would have to wait for the tag to emit a beacon on its usual cycle. "We can deploy two capture zones, one on each side of a door," Abji says. That way, rather than just identifying that a tag wearer went through a doorway, you can easily determine whether the user was entering or exiting.

Identec offers a collision avoidance system to help prevent workers from being run over in tunnels and mines. "The system warns drivers if someone is 150 meters, 100 meters or 25 meters away," Pentreath says. "At 25 meters, which is a critical distance, alarms go off and it's possible to bring the vehicle to a halt."

North Sea oil rigs commonly use a system called DaWinci to schedule helicopter transport for employees on and off rigs and keep track of who's on board, Pentreath says. DaWinci contains detailed information on

each employee, and the Watcher solution has been designed to integrate with it and access that information as well. "Imagine you're an offshore worker, you arrive at the airport and you check in with DaWinci," he says. "We're integrated with the system, so as you arrive it tells us your next of kin, whether you're emergency personnel, and which your primary and secondary muster stations are. This is all crucial information in an emergency situation."

Pentreath believes the energy and mining industries are just starting to discover the many ways active RFID solutions can help keep workers safe in hazardous environments. "When mobile phones first came out, you could only use them for calling," he says. "Then came SMS, and now look what you can do. We know the same is true in other markets, such as retail." He believes we'll continue to see technology innovations, which will help fuel greater adoption. As in other markets, he says, companies will ask, "Now that I've got this technology, what else can I do with it?"

How to Deploy EPCIS

Design the data, then set up your software.

By Ken Traub
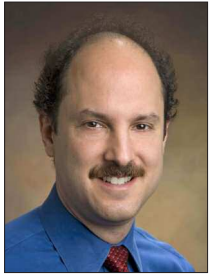
IN MY PREVIOUS column, EPCIS for Internal Projects, I discussed how GS1's Electronic Product Code Information Services standard allows different business units within a company to share RFID data. Now, let's explore how to do it.

First, you must design your data methodically. Remember, the EPCIS data standard describes events in the physical world using four dimensions: "what," "when," "where" and "why." An EPCIS event, for example, can record receiving an order at a warehouse equipped with an RFID portal. The "what" are the unique identifiers of the goods received; "when" is the date and time they were received; "where" is a location identifier for the building or specific loading dock door; and "why" includes a standard identifier for "receiving" and, perhaps, links to other business data, such as a purchase order for the shipment.

To design your data, each business unit must break down its processes into a series of steps. Then, for each step, you must decide which "what," "when," "where" and "why" elements your business applications need. A typical approach is to create a spreadsheet in which the columns are the steps and the rows are the "what," "when," "where" and "why" data fields. To fill in the "why" dimension, you'll need to consult the GS1 Core Business Vocabulary, which defines standard identifiers for business concepts, such as shipping and receiving.

Once you've designed the data, it's time to set up your software. RFID readers and associated middleware or embedded software capture the "what," "when," "where" and "why" data for each business operation and output the data in EPCIS format. Your spreadsheet tells you exactly what information should be generated at each step, and the EPCIS standard provides an XML schema to give the data a standard format. If you already have readers or middleware that can generate EPCIS data, all you have to do is configure it; otherwise, add middleware software to handle this.

Next, deploy an EPCIS repository at the enterprise level to collect the data to be used by your business applications. An EPCIS repository is just a database that understands the EPCIS data format and supports a standardized "capture" interface for receiving EPCIS data sent by your readers or middleware and a "query" interface for your business applications to retrieve that data. Finally, configure your business applications to query your repository. With a solid understanding of the EPCIS data model, you should be able to deploy EPCIS. If you need help, local GS1 organizations can likely provide referrals to solution providers with EPCIS expertise.

Because EPCIS is a standard, many commercial software products—readers/middleware, EPCIS repositories and business applications—are EPCIS-compliant, so you can choose the best products for your application knowing they will interoperate. As you add more readers and applications, your architecture will stay the same, and all your software will work together. ◼

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.

Retail's Trilogy

A single RFID infrastructure can—and should—enable inventory, asset and identity management.

By Bill Hardgrave

I LOVE THE AT&T commercials that feature a guy asking a group of kindergartners a series of "which is better?" questions. In that vein, let me pose a question to you: Which is better, using an RFID infrastructure to achieve benefits from one application or from three?

Most retailers have been adopting passive, ultrahigh-frequency RFID solutions to improve inventory management. This makes sense. After all, inventory is the stuff retailers sell, and as I've discussed often in this column, improving inventory accuracy can solve many problems and enable retailers to be more competitive.

But retailers should not stop there. They should take advantage of their RFID infrastructure to improve efficiencies in two other major categories—asset management and identity management—both of which can impact their bottom line.

In a retail store, assets are generally fixtures (shelves and racks, for example) and equipment (pallet jacks and rolling clothes racks). These assets can be moved, damaged, destroyed or misplaced. As in other industries, being able to track and locate these assets in a store can improve usage rates and reduce replacement costs. (RFID JOURNAL has published many news stories and case studies detailing how hospitals and manufacturers have deployed RFID asset-tracking solutions that delivered a return on investment within a year.) In stores, RFID could be used to answer questions such as, "Where is the pallet jack when I need it?" or "How many times did the rolling clothes rack go in and out the transition door from the back room to the sales floor?" Use your imagination—what else would you like to know about your assets?

Identity management involves knowing the location and/or identity of people. Many retailers issue low-frequency RFID identification cards to store associates for entry into facilities or rooms, or for clocking in and out. But the ID cards are limited to these applications. If store associates wore or carried ID badges embedded with UHF tags, retailers could also know, for example, who stocked which shelves. In addition, retailers could use UHF tags in customer loyalty cards to gain insight into customer traffic flow and dwell times. This information could be used to optimize store displays and product placements, making it easier for shoppers to find popular items. What else could you do to improve sales and the customer experience?

A company can gain a competitive advantage by doing something no one else is doing, or doing something better than others are doing it. I'm not aware of any retailer using RFID for inventory, asset and identity management. Thus I ask: Which is better, three benefits or one? As any kindergartner will tell you, more is better. ◉

Bill Hardgrave is the dean of Auburn University's Harbert College of Business and the founder of University of Arkansas' RFID Research Center. He will address other RFID adoption and business case issues in this column. Send your questions to hardgrave@auburn.edu.

ILLUSTRATION: ISTOCKPHOTO

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.

RFID Journal holds several face-to-face conferences every year, as well as a number of online virtual events and webinars. These events feature end users speaking objectively about the business reasons that they deployed an RFID system, the technical hurdles they overcame in doing so and the benefits they now achieve as a result, as well as presentations by academics, vendors and other experts. Many of the sessions were recorded, and we have compiled these recordings into seven DVDs that are **available for purchase for only $99 or free with a one-year premium membership to** *RFID Journal*.

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Monitoring the Fresh Food Supply Chain

RFID-tracking pallets and cases of perishable goods can enable retailers to reduce costs and improve customer satisfaction.

By Antonio Rizzi

DURING THE PAST FEW years, researchers at the University of Parma's RFID Lab, in Italy, have been examining the impact of pallet- and case-level RFID deployments in the fresh food supply chain, with a focus on retail stores. We have studied the benefits retailers could achieve from receiving goods identified with EPC Gen 2 passive RFID tags, including more accurate inventory counts and order reconciliations, and out-of-stock reduction from improved replenishment.

As part of our research, we have tracked the flow of highly perishable fresh foods from different manufacturers through the distribution channel to three supercenters of a major retailer. We have realized that out-of-stocks is an element of a wider issue—a store's overall stock-management policy. Some store managers keep low stocks on store shelves and in the back room, while others maintain high inventory levels. Neither policy is optimal: Lower stocks means you have fresher products on store shelves and a reduction in handling costs and shrinkage—the waste that occurs when cases of fresh goods reach their expiration date and can no longer be sold. But this policy increases the likelihood of out-of-stocks. Maintaining higher quantities on shelves and in the back room reduces out-of-stocks but increases holding costs, handling errors and shrinkage. It also leads to shorter shelf life due to poor rotation. As a result, customers often find a quantity of perishable foods but not necessarily the quality—or freshness—they would like.

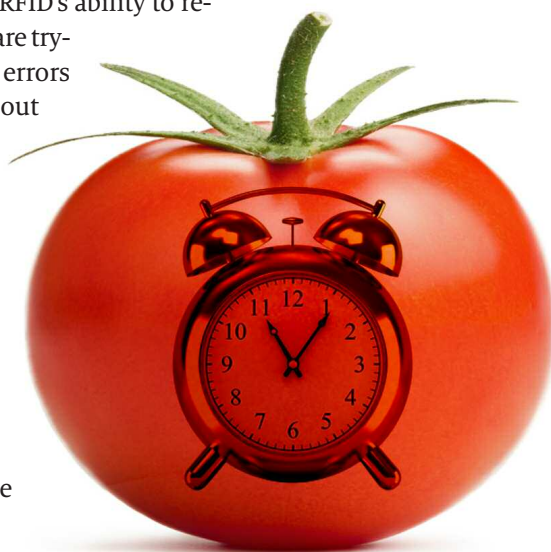Our research indicates that RFID visibility could help retailers address these issues. First, we factored in the number of out-of-stocks that could be eliminated thanks to punctual information about which shelves require replenishment from cases in the back room. We added the holding cost that could be avoided by optimizing safety stocks—cutting out unnecessary stocks that are never touched. Maintaining just the number of goods that is actually needed results in higher product quality and freshness.

Now, we are focusing on RFID's ability to reduce product shrinkage. We are trying to correlate shrinkage to errors in the first-expiring first-out (FEFO) management policy, to determine what part of the shrinkage quota can be statistically correlated to FEFO handling errors.

Typically, store associates replenish shelves with goods from any case they find in the back room. RFID could improve FEFO handling. If cases are identified with a unique serial number, store associates could be instructed to replenish shelves with specific cases.

We expect to complete our research early next year, and then begin a pilot project to RFID-track pallets and cases of perishable goods in the fresh food supply chain. We'll be working with three major fresh food manufacturers (Danone, Mondelez and Nestlé), a third-party logistics provider (Italtrans) and a consortium of retailers (Auchan, Conad and Coop). ◘

Antonio Rizzi is the founder and head of the University of Parma's RFID Lab, in Italy, and a professor of industrial logistics and supply-chain management.

ILLUSTRATION: ISTOCKPHOTO

Street Smarts

Cities that don't embrace the Internet of Things will be left behind.

By Kevin Ashton

IN 1680, the City of London installed oil lamps on its streets. The lamps were left burning each night until midnight. The reduction in crime and the increase in nightlife were so great that after 1736, the lamps were kept lit until sunrise. As the city grew, refilling, lighting and extinguishing the lamps became expensive and laborious. In 1807, London introduced a disruptive fuel: gas produced from coal. Gas drove the growth of Victorian London, and with it the British Empire. In 1878, the technology changed again: The Holborn Viaduct and the Thames Embankment were the first streets in the world to be lit with electric lights.

Today, we take electric streetlights for granted, along with their consequence—cities that are as alive at night as they are during the day.

Now, another big change is coming to our cities: the Internet of Things. Increasingly, people are moving back from suburbs to cities, which face scaling problems including overcrowding, traffic, crime and disease. City governments have identified, and in some cases deployed, applications for RFID and wireless sensor networks that manage, for example, transportation and precious maintenance resources.

In November, 9,000 people attended the Smart City Expo World Congress, in Barcelona, Spain. Keping Zhang, director of information technology for Wuxi, a city of seven million people, talked about how he is leading China's Internet of Things revolution. Brenna Berman, Chicago's CIO, discussed the challenges of modernizing that city's information architecture. Pedro Paulo Carvalho, chief of staff in Rio de Janeiro, explained how sensors are improving the city's security.

But—and it's a big but—there are thousands of cities worldwide, and only 400 were represented in Barcelona. Many cities are missing the Internet of Things revolution, and some of them will die as a result. In 1840, St. Louis, Missouri, had nearly four times the population of Chicago, roughly three hundred miles to the north. By 1890, Chicago was twice as big as St. Louis. Today, Chicago is nine times bigger. One of the main reasons is technology: Chicago was quick to embrace the railroad while St. Louis was slow to let go of the steamboat. This was a deliberate policy on Chicago's part. The city's leaders believed railroads would draw people and industry, and, thus, Chicago would become an important transportation and commercial center. The leaders of St. Louis had no comparable vision.

Just as the railroad transformed Chicago and diminished St. Louis, so the Internet of Things will better many of the world's great cities, while others that ignore it will become smaller and less significant. In cities that embrace the technology, the pattern of growth will be a lot like that of the lamps of London—a few relatively simple applications at first, then a blossoming of complexity and deployment everywhere. Cities that never sleep will become cities that always think. ◼

Kevin Ashton was cofounder and executive director of the Auto-ID Center. He is currently a general manager at electronics maker Belkin.