DEDICATED TO RADIO FREQUENCY IDENTIFICATION AND ITS BUSINESS APPLICATIONS



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#### EDITORIAL

Mark Roberti, Editor mroberti@rfidjournal.com

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

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

John Hull, Creative Director jhull@rfidjournal.com

Rich Handley, Managing Editor rhandley@rfidjournal.com

Claire Swedberg, Senior Editor cswedberg@rfidjournal.com

Sam Greengard, Contributing Writer sam@greengard.com

Bob Violino, Contributing Writer bviolino@optonline.net

Jennifer Zaino, Contributing Writer jennyzaino@optonline.net

Edson Perin, Brasil Editor eperin@rfidjournal.com

Beth Bacheldor, Senior Editor bbacheldor@rfidjournal.com

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

#### INTERNET OF THINGS JOURNAL

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

RFID JOURNAL EVENTS

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

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

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

Deborah Lambert Editorial Coordinator of Events dlambert@rfidjournal.com

#### SALES

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

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

SUBSCRIPTIONS subscriptions@rfidjournal.com

ARTICLE REPRINTS customerservice@rfidjournal.com

#### RFID JOURNAL LLC

Editorial office: PO Box 5874 Hauppauge, NY 11788 Mark Roberti, Chief Executive mroberti@rfidjournal.com

Kathleen Knocker, Director of Finance kknocker@rfidjournal.com

Sonja Valenta, VP of Marketing svalenta@rfidjournal.com

Quedah Locket, Marketing Coordinator qlocket@rfidjournal.com

Lydia Sum, Administrative Assistant Isum@rfidjournal.com Contents © 2016 RFID Journal LLC

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# The Awards 10 Years On

R FID Journal introduced the RFID Journal Awards in 2007 to recognize some of the best and most innovative uses of radio frequency identification. Our goal was to highlight how RFID was benefiting some companies so others would take notice and realize the technology might help them, too.

To be frank, I had some concerns that first year. Would we get enough submissions and would they be for projects worth honoring? Would the awards be seen as credible? To ensure fair competition, we instituted a practice, which we continue today, of having independent judges evaluate the entries (see Meet the Judges). From the beginning, the judges' task has been difficult. In 2007, we received nearly 50 entries, many worthy of praise. The winners were Dow AgroSciences for a termite-detection system that cut costs, DHL for a solution that monitors the temperature of pharmaceutical shipments, and Hewlett-Packard Brazil for a system that improves the manufacture and distribution of printers.

Since then, the list of honorees has grown to include Airbus, Boeing, BP International, Cisco, Detroit Diesel, Hy-Vee, Interstate Batteries, Intel, Kuehne + Nagel, Marks & Spencer, NASA and Royal Caribbean Cruises. This year, Decathlon,



TrackCore, Florida Hospital, Golden Environmental Mat Services, CityPoint and Hospital de la Vega join the distinguished group of winners.

As I'd hoped, the RFID Journal Awards are helping companies in myriad industries understand how they can benefit from RFID. Each year, we invite the winners to speak at RFID Journal LIVE!, post their presentations in our video library and profile their projects in our special magazine awards issue. I hope you'll benefit from learning about these impressive deployments—perhaps next year we'll be honoring your project.

Mark Roberti, Founder and Editor

#### From left to right:

Yaojun Sun, Sun International, accepting for Qinshan Nuclear Power Plant Anthony Palermo, RFID Academia, accepting for Evenko lames Casavant, TrackCore Alan Brander, TrackCore Scott Dalgleish, Phase IV Engineering Lauri Hyytinen, Smartrac Mike Klonsinski, Bernstsen Pam Sweeney, Macy's Jean-Marc Lieby, Decathlon Mark Roberti, RFID Journal Rick Lewis, Delta Air Lines Akihiro Ohira, Shimane University Hospital Elena González, Hospital de la Vega Salvador Vera, MySphera Ashley Simmons, Florida Hospital Charles Morris, Florida Hospital Douglas Betts, Reichhold Javier Andrés Polti Figallo, LAMSAC





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#### **RFID Journal Virtual Events**

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

Retail and Apparel, June 23 Health Care, July 19 Internet of Things, Aug. 16



#### **RFID Connect**

Find products that can help you deploy RFID successfully, such as <u>Times-7</u> <u>Research's A6011 Circular Polarized</u> underbelt antenna. The A6011 is wellsuited for conveyor belt ultrahighfrequency RFID applications, such as airport baggage-handling systems.



#### Top 10 Search Terms in May

1 Lululemon	6 Decathlon
2 NFC	7 Zebra
3 Impinj	8 Library
4 Ubisense	9 Security
5 Supply chain	10 History of RFID

#### Most-Read Stories in May

- DoD Sees Tiny RFID Chip as a Way to Verify Electronics
- RFID Journal Announces Winners of Its 10th Annual Awards
- RFID Delivers Benefits to Air Canada Cargo
- RFID Prevents Johnson Controls' Containers From Being Lost
- TSA Installs RFID-enabled Screening System at Atlanta Airport to Cut Wait Times

#### **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:

- Has RFID Journal covered RFID's use in the IT field?
- How can we prevent theft of medical equipment?
- What should a proper sales pitch be when we talk to a fresh prospect?
- How can we prevent RFID tag cloning?
- Are there any types of merchandise that cannot be RFID-tagged?
- Could RFID monitor current variation?

#### The Inside Scoop

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

### DON'T MISS THESE... Premium Online Stories

#### **Toronto Hospital Improves OR Department**

Sunnybrook Health Sciences Centre RFID-tracks surgery patients to reduce bottlenecks and keep family members and friends informed.

#### **Onsite Mechanic Firm Manages Inventory via RFID**

Armored Diesel Repair & Services developed a Smart Trailer that delivers internal benefits and lowers customer downtime and costs.

#### SupplySentry Keeps a Lookout on Inventory for Package Printers

All Printing Resources developed an RFID solution to manage supplies at customer sites, which delivers benefits to clients as well as its own business.

# **OUT IN FRONT**

# TECHNOLOGY **'Invisible' Antennas**

A research student discovers a way to boost the performance of passive UHF RFID tags.

n 2011, Shadi Ebrahimi-Asl, a Ph.D. student at the Missouri University of Science and Technology, in Rolla, Mo., was seeking a thesis project. Her supervisor, Prof. Maciej Zawodniok, suggested she focus on something related to

cannot interpret multiple backscatter signals from multiple tags, so it runs through an anticollision algorithm, dictated by the air-interface protocol standard, to communicate with one tag at a time. But even when tags in the read field









radio frequency identification because he had received some grant money from the National Science Foundation for an RFID project. Ebrahimi-Asl had no background in RFID, but she began delving into how passive ultrahigh-frequency tags and readers communicate. She discovered a potential opportunity to improve system performance by enabling readers to read multiple tags that are in close proximity.

With a passive UHF system, tags reflect a signal from the reader using a technique called backscatter. The reader

Shadi Ebrahimi-Asl

are not responding to commands from the reader, energy from the reader antenna reflects off their antennas, creating interference that makes it harder for the reader to receive a signal from the tag with which it's communicating.

During her research, Ebrahimi-Asl learned that the induced electrical charge on an antenna can be reduced to reach the antenna's minimum backscatter potential (or increased to reach its maximum backscatter potential). When an antenna is in this minimum backscatter state, it is called an "invisible" antenna.

There are currently no RFID chips capable of staying in a minimum scatter state for a sustained interval, but Ebrahimi-Asl built a backscatter antenna in the lab and changed the load on it to make it remain invisible to the reader. She demonstrated that by doing so, she could more easily read a tag close behind it. This capability, if built into passive UHF tags, could make it easier to read tags spaced closely together. It would also increase the read range of passive UHF readers by reducing interference from multiple tags in the read field.

Ebrahimi-Asl has applied for a patent and is doing additional research to see how placing a tag on different materials, such as paper, plastic and corrugated cardboard, affect the ability to change the state of the antenna. She is also looking to collaborate with a passive UHF RFID chip manufacturer to develop a prototype tag that could change the state of the antenna to stay invisible while other tags are being read. The tag would also have to be capable of listening to the reader so it can change its state back to maximum backscatter if interrogated by the reader.

This simple technique, which likely wouldn't add significantly to the cost of the tag, could potentially solve the performance problems caused when readers interrogate multiple tags that are in close proximity—say, on a retail shelf. Not a bad finding for a researcher who stumbled upon RFID. —*Mark Roberti* 

### HEALTH

# Sensors Could Eliminate Second Brain Surgeries

Researchers are developing RF devices that can monitor temperature and pressure in the cranial cavity and then be absorbed into the body.

hen someone experiences head trauma, doctors often need to monitor the temperature and pressure inside the skull, as these are crucial indicators of the patient's status. But current sensors require a second operation for removal, a painful and expensive procedure that involves the risk of infection. To eliminate second surgeries, John A. Rogers, a professor of materials science and engineering at the University of Illinois at Urbana-Champaign (UIUC), and Wilson Ray, a profes-

sor of neurological surgery at the Washington University School of Medicine in St. Louis, are developing RF sensors that can transmit the needed data and then be reabsorbed harmlessly into the body.

Rogers and Ray began working on bioresorbable electronics in 2008, and

in 2012, they published a paper on how to optimize the materials needed for such devices. Since 2014, they have focused on the clinical utility for bioresorbable electronics. Shortly after they began this work, neurosurgeons at Washington University who treat traumatic brain injuries (TBIs) approached them with a specific request for bioresorbable intracranial monitors.

"We can also measure biomarkers of

various types, pH, temperature and flow," Rogers says. "But it's important to monitor pressure and temperature during the recovery phase associated with a TBI event. If either of these parameters falls outside a certain healthy range, then the neurosurgeons must make rapid intervention to protect the patient."

All the intracranial parts of the system are custom-made with bioresorbable electronic materials in UIUC's academic clean-room facilities. The sensors communicate via a passive

> Near-Field Communication transponder, a short-range form of RFID that uses inductive coupling and is not influenced by water in the body. Most of the NFC components can be absorbed into the body without harm.

> A startup company has been created to commercialize

the research. In the meantime, Rogers and Ray and their research teams are working to build sensors with an improved lifetime (a few weeks instead of a few days) and on rendering the NFC transponder out of 100 percent bioresorbable materials. "We're looking at several other applications, including bone and nerve stimulators, drugrelease systems and temporary pacemakers," Rogers adds. -M.R.



# Mind Storms

Number of worldwide traumatic brain injuries (TBIs) reported annually:

# 10 million

Number of worldwide deaths attributed to TBIs annually:

### 4.5 million

Number of hospitalizations for TBIs in the United States annually:

# 1.7 to 2 million

Number of hospitalizations for TBIs in Asia, including India, annually:

### 1.5 to 2 million

Number of hospitalizations for TBIs in the European Union annually:

# 1 million

Estimated annual economic cost of TBIs worldwide:

### \$406 billion

-Rich Handley



Intracranial sensors communicate via a

passive NFC transponder.

# PERSPECTIVE

### THE STORY BEHIND THE NEWS



# LIVE! 2016 and the RFID Market

Demographic data on those who attended our 14th annual event suggests adoption is spreading internationally.



E ach year, after we hold our annual RFID Journal LIVE! conference and exhibition, we clean the attendee list and then examine the demographic data of those who attended to see if we can glean anything about the state of the market for radio frequency identification hardware, software and services. We do this because the event is a microcosm of the industry as a whole, and while the sample size is relatively small, the data does provide insights into the state of adoption.

While we have no data to suggest a direct correlation between RFID adoption and attendance at RFID Journal LIVE!,



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			Attendand by Indust During th Three Yea
			Aerospace/A
	Strange State		Consulting/
			Electronics
Domestic vs	% of	% of	Energy/Cons
International Attendance	attendees from the	attendees from	Entertainme
by Industry	U.S.	outside the U.S.	Financial Se
All	69	31	Food/Agricu
Aerospace/Defense	79	21	Governmen
Retail/Apparel	73	27	Health Care
Manufacturing	76	24	Manufactur
Energy/Construction	70	30	Other
Health Care/Pharmaceutical	83	17	Packaging/L
Information Technology	57	43	Retail
Packaging/Labels	56	44	RFID Hardw
Transportation/Logistics	78	22	Telecommu
RFID	65	35	Transportati
Other	73	27	

	The second	1	2
Attendance by Industry During the Past Three Years	2 0 1 6	2 0 1 5	2 0 1 4
Aerospace/Aviation	6	6	6
Consulting/Business Services/Legal	3	4	4
lectronics	2	3	4
nergy/Construction	2	3	3
intertainment/Hospitality	4	4	3
inancial Services/Venture Capital	1	1	1
ood/Agriculture	3	2	2
Government/Library/Nonprofit	4	4	5
lealth Care/Pharmaceutical	7	6	5
Aanufacturing	13	13	13
Other	4	3	4
Packaging/Labels	5	5	4
Retail	10	9	8
RFID Hardware, Software or Services	31	32	33
elecommunications	1	1	1
ransportation/Logistics	4	4	4
	100	100	100

4. 1 1 1 1

our data does strongly suggest that companies beginning down the road to RFID adoption first read our website and, as they get more serious, then join online events. The most serious about deploying a solution tend to be those attending RFID Journal LIVE! because it is the only event where they can visit more than 200 exhibitors from around the world.

In 2015, the biggest surprise was the jump in the number of countries from which attendees came—60 countries were represented, up from 53 a year earlier and an average of 42 during the previous five years. This year, attendees hailed from 62 countries, suggesting the technology is continuing to make inroads internationally.

Overall, the percentage of attendees from overseas rose to 31 percent, from 30 percent last year. Attendance from Europe was up 3 percent to 12 percent. Attendance from Asia declined

In 2015, the biggest surprise was the jump in the number of countries from which attendees came—60 countries were represented, up from 53 a year earlier and an average of 42 during the previous five years. **This year, attendees hailed from 62 countries**, suggesting the technology is continuing to make inroads internationally.

by a similar amount. This is likely due to the fact that last year's event in San Diego, Calif., was closer to Asia and this year's event in Orlando, Fla., was more convenient for those coming from Europe. (RFID Journal LIVE!, like many events, alternates between East Coast and West Coast cities to attract different audiences each year.)

Attendance from Latin America rose by a point, indicating a growing interest in RFID in that region. Brazil, Colombia, Mexico and Peru were among the countries that saw the biggest increase in attendees. Other countries that saw a jump in the number of attendees are China, Germany, Spain and Taiwan. This year, for the first time, we hosted attendees from Iceland, Iran, Iraq, the Philippines and Turkmenistan.

We also examine international attendance broken down by industry. Companies that produce packaging or labels had the highest percentage of overseas attendees, at 44 percent. This suggests that apparel manufacturers and others are Your Global Automation Partner

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#### **QR24 Rotary Inductive Sensors**

An expanded line of noncontact inductive rotary position sensors with optional stainless steel housing. Wide variety of outputs includes HTL Incremental, SSI, CANopen and analog in voltage and current. expressing interest in buying labels and packaging with RFID transponders already embedded in them. This is not surprising. For early pilots, retailers tagged goods in their distribution centers or asked suppliers to stick an RFID label on the back of a hangtag. But as adoption scales, it makes sense to have the RFID transponder embedded in a standard label so it can be applied to goods without any extra labor involved.

Companies that provide IT services, such as developing applications or hosting servers, were slightly behind packaging and label manufacturers with 43 percent of attendees coming from overseas. This indicates these companies either see an opportunity in developing RFID software or they are being asked to do so by existing customers.

Roughly 35 percent of non-exhibiting RFID companies came from overseas, which is in line with previous years. RFID systems integrators, value-added resellers and distributors attend the event each year to see new products and establish relationships with hardware and software companies.

Health care saw the lowest percentage of attendees from outside the United States. This has historically been the case, probably due to the fact that health care tends not to be an international industry. Few hospital chains, for example, own hospitals outside of their home country because other countries have different sets of regulations.

Overall, attendance by industry changed very little. Manufacturing and health care continued to have a large presence, while the number of attendees from telecommunications and financial services remains low. The percentage of attendees from energy and construction was down slightly, relative to other industries, due to the fact that oil prices remain low and profits are down in that sector.

We expected a bigger increase in attendance by retailers due to all the positive articles about RFID helping companies improve inventory accuracy and boost sales. U.S. retail sales were soft in the first quarter, which might have contributed to some companies holding off on travel and, possibly, on RFID pilots or moving from pilots to the rollout stage. We expect this hiatus to be short as more retailers adopt RFID.

Beyond the statistics, events have different energy levels. This year, enthusiasm seemed to be high. Conference sessions were well attended. Attendees asked a lot of questions during the question-and-answer period after each session, and traffic at booths throughout the exhibit hall was strong from the opening reception until the hall closed on May 5 at 3 pm. It appears the RFID industry continues to gather strength and move toward mass adoption. —*Mark Roberti* 

# **'RETAIL 'RFID IS NOT a Project'** Macy's is educating everyone within its organization about the technology.

R ecently, I hosted a panel at the GS1 Connect conference on omnichannel retailing. I noted that some retailers had deployed a radio frequency identification system to improve inventory accuracy and enable omnichannel retailing, but those efforts had lost steam when a key executive at each company left. I asked Bill Connell, senior VP of logistics and operations at Macy's, who was on the panel, how his firm had been able to remain on track since 2008. "Is it leadership," I asked, "or a culture you've created at Macy's?"

"It's a little of both," Connell said. "For the past few months, we've been saying internally that RFID is not a project. RFID is how we do business. It is part of everything we do. Senior executives are getting training on how it works. Store associates need to understand it. We're educating human resources so they can make it part of hiring and training."

This was the first time I heard a senior executive of any retailer say publicly that RFID is fundamental to the way the company does business. And it marks a big leap from how Macy's saw the technology eight years ago. When Macy's launched its first RFID pilot in 2008, the goal was just to improve replenishment to ensure items were on the shelves when people want to buy them.

In 2011, omnichannel retailing became a priority at Macy's and other brick-and-mortar retailers. They wanted to address changing buying habits—consumers wanted the freedom to shop anytime, whether in a store, on a mobile device, on a home



#### Bill Connell

computer or by phone. Macy's and others also saw omnichannel as a critical strategy to competing with online retailers.

At the time, Connell said, Macy's realized the work it had done to improve replenishment was highly relevant to omnichannel retailing, because having highly accurate inventory data was essential to executing an omnichannel initiative. Dur-

"RFID is essential to omnichannel execution. Therefore, RFID is essential to retailing." —виц соллець, масу's ing the discussion, Connell said omnichannel was critical to success in retail today, and "RFID is essential to omnichannel execution. Therefore, RFID is essential to retailing."

Pam Sweeney, senior VP of logistics systems at Macy's, who was also on the panel, suggested that Macy's is only beginning to tap RFID's potential. Sweeney, who received

this year's RFID Journal Award for Special Achievement (see page 48), said Macy's is beginning to look at how RFID can help improve the customer experience with interactive kiosks and other new tools. Connell added that Macy's is beginning to explore how RFID data can be used to better understand buying patterns and improve supply-chain and other operations. Both executives made it clear RFID will be a big part of the way Macy's does business for years to come. *—M.R.* 

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### 2016 RFID JOURNAL AWARDS BEST RFID IMPLEMENTATION

DECATHLON

# Decathlon Scores a Big Win With RFID

The French sporting goods retailer is tracking most of its products from factories to more than 1,000 stores in 25 countries. By Bob Violino

**IN 2008, DECATHLON** set out to achieve three corporate goals: increase the availability of stock in its stores, boost the efficiency of its teams in retail stores and logistics areas, and improve its control of product shrinkage. The French sporting goods retailer, which opened for business in 1976, had grown from a single store in France to more than 1,000 stores in 25 countries.

The end goal was to improve customer satisfaction by ensuring items were on store shelves when customers wanted to buy them. That meant increasing inventory visibility of a wide range of merchandise. Decathlon sells roughly 35,000 different items—apparel, equipment and accessories for 65 sports, for men, women and children usually in superstores.

In 2013, Decathlon began a global rollout of an RFID solution to track goods throughout its supply chain from factories to warehouses to stores. Today, RFID is improving efficiencies in all Decathlon facilities—1,030 stores and 43 warehouses. The company has tagged 1.4 billion items—90 percent of its products are tagged at the point of manufacture, says Jean-Marc Lieby, who became RFID project coordinator at the beginning of 2015. The RFID solution has increased product availability on store shelves, which, Lieby says, has had a direct impact on the customer experience and sales. "The first source of dissatisfaction of a customer is failing to find a product on the shelf," he explains. Decathlon saw an 11 percent increase in sales from July 2014 to July 2015, and the company attributes part of that growth to the RFID deployment. Decathlon also says the RFID solution has helped the company meet its other goals: improved efficiencies and a decline in product shrinkage.

A behind-the-scenes look at how Decathlon achieved this success reveals a carefully planned and well-executed approach to addressing the retailer's business issues.

# Developing a Strategic Game Plan

In 2008, Decathlon's managers studied possible solutions for improving internal processes and came to the realization that RFID was the only technology that could enable the retailer to meet its objectives, Lieby says. They created a project committee, led by Patrice Ribout, an IT engineer. For the next five years, they met weekly to discuss the move to RFID, with input from consulting firms. The committee examined strategies for improving processes and defined conservative key performance indicators (KPIs). They decided to examine the technology from a cost-benefit standpoint within the context of a 10-year business plan.

In 2010, Decathlon created a "lab" at a store in France, to test and measure the accuracy of various RFID handheld readers and tags. The committee also conducted a pilot at the store to evaluate several use cases.

After researching various RFID providers, Decathlon decided to create an independent company—Embisphere—to design, test and deploy its RFID system, including manufacturing the hardware and developing the software. Embisphere's lab was also used to identify potential tag and reader suppliers. (From the beginning, Decathlon planned to offer Embisphere's services to other retailers. Embisphere now provides RFID solutions for companies in retail, logistics, manufacturing and other sectors worldwide.)

Decathlon created a crossfunctional team, headed by Ribout, to work closely



with the spin-off company. It consisted of representatives from retail, production, logistics, IT and finance. Given that the RFID project would affect processes throughout the company's supply chain—factories, warehouses and stores—management wanted input from all major facets of the business in order to maximize RFID's value.

From 2011 to 2013, Embisphere helped Decathlon create its RFID strategy. During that time, Decathlon conducted pilots at retail stores in 12 countries-first in Belgium, Italy and Spain, and then in China, Eastern Europe and Russia. It was important to test the different hardware and software configurations required in various countries, and to evaluate how people from different cultures would perceive and implement the RFID solution. Every six months, Decathlon's project team met with the CEO and main sponsors of each business unit, to update them on the project's progress.

### RFID Takes the Field

In mid-2013, Decathlon launched a broad rollout of the RFID system, based on Embisphere hardware and Decathlon software. The products were developed with input from Decathlon end users in the retail and logistics departments. The system complies with EPC Gen 2 passive ultrahigh-frequency RFID standards and supports the different RFID frequencies used in North and South America, Europe and China. Embisphere supported several aspects of the project, including some systems integration, compatibility with the Decathlon software, management of encoding and tagging of products, and maintenance.

Item- and box-level tracking begins at suppliers' factories, where manufacturers use the Embisphere and Decathlon websites to order RFID tags from approved providers, including Avery Dennison, Checkpoint, Paragon Identification, SML and Tageos. Decathlon tags its own EmbiWay, a fixed UHF RFID tunnel reader deployed on conveyor belts at suppliers' factories, monitors boxes as they are shipped out to Decathlon warehouses.

branded merchandise.

Each retail store plans its inventory requirements for a given month roughly four weeks before the products are needed on shelves—based on historical sales, and orders goods from suppliers via an inventory-management system developed by Decathlon.

At suppliers' factories, workers use multiple Embisphere devices to ensure the correct products are selected for shipment. One, called embiScan, is a bar-code/RFID reader connected to a PC via a USB cable, which scans items to be shipped and enters the data into the inventory-management application. EmbiScan also allows suppliers to ensure correct encoding on boxes of products and quantity of products to be shipped. "At any time during the manufacturing process, embiScan can be used for random item or box quality checks," Lieby says.

Two other products—embiStation, a portable metal structure with four antennas, and embiWay, a fixed tunnel deployed on conveyor belts—monitor boxes as they are shipped out to Decathlon warehouses.

When boxes of products arrive at Decathlon's warehouses from factories, At stores, which typically do not have back rooms, inventory is conducted at store shelves with embiVentory, a handheld reader shaped like a badminton racket. The lightweight device has powerful antennas and is resistant to water, dust and impact, so it can read tags that are difficult to access, Lieby says. Users can insert it into a stack of densely packed products on high and low shelves to read items without much effort.

The Bluetooth-enabled reader trans-

so retailers can track returns. Another version of embiPos, called embiBac, enables self-checkout by shoppers.

While most of the technology comes from Embisphere, Decathlon is using RF-enabled electronic article surveillance (EAS) gates from Checkpoint Systems and Nedap Retail at store exits.

Given the scope of Decathlon's RFID deployment, it's no surprise the retailer faced several challenges. From a technical standpoint, Lieby says, by far the most



embiTrolley, a mobile tunnel reader, is used for quality, inventory and shipment control. EmbiTrolley tracks the inventory, even in very densely packed boxes, within a few seconds and without the need to open the boxes. It then feeds the data into the inventory-management application, so Decathlon can track which products have arrived for shipment to the stores that need them. EmbiGates, installed near the docking area, tracks pallets into and out of the warehouses. fers tag data to Android mobile devices, including smartphones and tablets. The devices are equipped with a Decathlondeveloped app that displays the data.

EmbiPos, a stationary RFID reader, tracks product purchases at all point-ofsale locations. It sends this information to the inventory-management application so Decathlon is aware of which stores are running low on certain products. The readers are also used at product-return locations in the stores When boxes of products arrive at Decathlon's warehouses, embiTrolley, a mobile tunnel reader, is used for quality, inventory and shipment control.

difficult issue was the implementation of pallet-level and conveyer tunnel readers, because they must be very fast to support the quick movement of products through warehouses to meet store demand.

In addition, these readers often op-

erate in environments in which product containers are densely stacked in confined areas of warehouses. "We don't require a perfect reading with these tools," Lieby says. "What is important for us is to identify the mistakes of picking. When the products are stacked, we know the level of reading we expect and drive the quality controls on boxes [where the percentage] of reading is under the level expected."

Decathlon also had to certify the

in one hour for each process," Lieby says of the change-management program. "It took only three months to train all users worldwide."

### It's a New Game

Decathlon is now using RFID "all over the supply chain, from factory to stores," Lieby says. "Whether the reader reads a pallet or a box, each item included is 150 stores worldwide, all of which use the RFID system, and all new Decathlon stores going forward will be fully equipped with RFID devices, he says.

In addition to increasing product availability on store shelves, the RFID solution decreased product shrinkage by 9 percent in 2014. The retailer credits the use of the system at security gates. The shrinkage continued to decline in 2015, Lieby adds.

Other benefits include faster and



(Left) Inventory is conducted at store shelves with embiVentory, a handheld reader. (Right) EmbiPos, a stationary reader at PoS locations, tracks purchases.



25,000 readers used in factories, warehouses and stores in 25 countries. Embisphere was in charge of ensuring that happened, Lieby says.

What's more, the company had to prepare thousands of employees for new ways of performing processes, such as sales and inventory management. Decathlon used training videos and e-learning programs produced in local languages. "The goal was to have the right e-learning tools to train staff read and the data in the central system is updated," he says. The company aims to have 100 percent of its products tagged "as soon as possible," he adds.

Decathlon's early decision to test and fine-tune the technology worldwide allowed the company to RFID-enable 800 stores in just a few months, from April through July 2014. Some 60,000 employees are now using RFID on a daily basis, Lieby says. Since the beginning of 2014, Decathlon has opened more than easier transactions at the point of sale for shoppers, inventory cost reductions, and an increase in logistics quality and efficiency, Lieby says.

"This deployment was the biggest RFID deployment in the world," Lieby says. "Value created by RFID has been captured in all areas of the business from manufacturing to warehouses to stores. This deployment is the first step to realize our vision of the digital store of the future."

### 2016 RFID JOURNAL AWARDS BEST USE OF RFID TO ENHANCE A PRODUCT OR SERVICE

TRACKCORE

# A Healthy Partnership Solves Hospital Problems

TrackCore's Operating Room software integrated with Terso's RFID cabinets automates tissue and implant tracking, improving efficiencies, facilitating government compliance and boosting nurse satisfaction. By Barb Freda

FOR 10 YEARS, some hospitals have been using bar codes and TrackCore Operating Room software to monitor biologic tissues and surgical implants, to comply with safety standards established by the U.S. Food and Drug Administration

and the Joint Commission, the not-for-profit organization that accredits hospitals. But the manual process is laborious and often an afterthought for nurses, whose first priority is hands-on patient care, says Alan Brander, TrackCore's VP of national sales and a former chief nursing officer for a regional hospital. "Skipping steps in the interest of time jeopardizes compliance," he says.

The software is designed to integrate with patient electronic health records (EHR) and materials-management systems

(MMS). But when tissues or implants are recalled, it's still cumbersome to locate items that must be removed from inventory and identify patients who have received the recalled items. "When there are issues with the chain of custody and inventory accuracy, there can be compliance issues," Brander says.

Hospital directors of surgery asked TrackCore for an automated, "touchless" workflow for tissue tracking, says Ross MacGregor, TrackCore's director of strategic accounts and new business



West Virginia University Ruby Memorial Hospital

development. So in 2013, the software company began researching technology solutions and storage options.

"We performed various customer workflow studies and realized that TrackCore software without RFID required nurses to record product movement in and out of storage, which still took a considerable amount of time," Brander says. "Using RFID technology would eliminate the need for nurses to log movement and provide real-time inventory visibility, automated temper-

ature monitoring and nursing accountability and further workflow efficiencies to streamline the process for tissue and implant tracking."

TrackCore decided to integrate its software with RFID-enabled storage units. "RFID was a relatively new, yet building, technology in the health-care space," says James Casavant, TrackCore's CTO. "As we saw the technology maturing, its use became more viable for our needs, and at the same time, the cost of the technology began to fall, making it more affordable for

our customers." Terso Solutions, which provides RFID-enabled cabinets, refrigerators and freezers to hospitals, had the technology and storage units TrackCore needed to meet customer demand.

TrackCore and Terso formed a partnership that resulted in the creation of TrackCore Operating Room With Integrated RFID Enclosures, launched in September 2014. To date, more than 30 U.S. hospitals have adopted the RFID solution, with many more existing customers preparing budgeting groundwork for the upgrade, MacGregor says. In addition to meeting the original goal of facilitating an automated workflow, he notes, hospitals that have deployed the solution are saving money, reducing errors and improving patient care.

West Virginia University Ruby Memorial Hospital, a 500-plus-bed facility with a Level I trauma center designation, upgraded to TrackCore RFID in 2015. "In a trauma center, people do not always go through the protocols we have in place," says Kimberly Cheuvront, Ruby Memorial's quality assurance coordinator of perioperative services. "There was a lot of follow-up to ID who the patient was, who received the implant." It was a situation that required

# Developing a Complete Solution

It took approximately one year to integrate TrackCore's web-based software with Terso's RFID-enabled storage units. The two companies established a crossfunctional team that included software developers, RFID experts, integration specialists, clinical nurses, sales personnel and trainers.

The team members defined how the software and storage units would interact to provide a seamless workflow for hospitals. They also collaborated on how to install and operate the solution at hospitals. Then they tested all use

cases at both hospital staff and patient levels to ensure the integrated solution met all compliance and safety requirements.

TrackCore RFID is designed to

ultrahigh-frequency RFID tags made with Impinj Monza 5 and R6 chips. Some items in foil packaging require flag tags, which use the same types of chips.

TrackCore prints the RFID labels and provides them to hospitals. Hospital personnel apply a label to each box of tissue or implants (only some manufacturers RFID-tag these products before shipping), and then scan the label and product bar code to associate the tag's unique identification number with the product in TrackCore's system. The product information includes name, part number, lot and serial number, and expiration date. "We then print a blue label that includes the RFID tag ID number and all the product info,"





receives from TrackCore and the item's bar code, and then prints a blue label that includes the tag ID and product information.

paper chasing and time from nurses.

"We've seen a lot of savings in waste [costs]," Cheuvront says. "We are able to monitor product expiration dates. We can also track trends in usage by the surgeons. There are some items they stop using because they prefer something else." Error rates tracking products that were implanted in patients during procedures dropped from 3 percent to lower than 1 percent, she adds. automatically track tissue and implants from initial receipt at hospitals to final disposition (whether implanted, disposed of during a procedure or shipped back to the manufacturer). Individual boxes of biologic tissues (such as bones, ligaments and skin), nonbiologic implants (medical devices, orthopedics and synthetics), and hardware (plates, rods and screws) are identified with Avery Dennison EPC Gen 2 passive says Jason Merrill, materials and business manager surgical services at St. Dominic Hospital in Jackson, Miss. The 535-bed acute-care facility adopted TrackCore's RFID solution in early 2015.

St. Dominic Hospital scans the RFID label it

The Terso cabinets, refrigerators and freezers, available in a variety of sizes, are equipped with Impinj Speedway Revolution readers. The storage units also have low-frequency proximity readers for access control. Designated hospital personnel are issued access badges.

TrackCore provides the first 500 tags and 50 access badges, which are reusable, with implementations of up to five storage units; larger orders include more tags and badges. Hospitals order additional tags as needed. Each tags costs \$1, but prices continue to fall, MacGregor says. When an authorized user opens an RFID cabinet and removes tagged items for a patient, the system reads the items and transmits the information, including who accessed the cabinet, to the Jetstream servers. Users note in the TrackCore system whether an item was expired, used or disposed of during a to ensure that the units are actually transmitting information—and issuing alerts for open doors or out-of-range temperatures.

TrackCore generates daily reports, including product usage, expiration dates and FDA recalls, which are displayed on dashboards. "At any given



# Automating Workflow

When tagged items are placed in the storage units, the readers capture the tag ID numbers and transmit the data, via a wireless LAN, or cellular or Wi-Fi connection, to Terso's cloud-based Jet-stream platform. The TrackCore RFID system pulls real-time data from the Jetstream servers.

procedure. The software updates the "disposal log," which keeps the information for historical reporting. Unused items are recorded when they are returned to the RFID cabinet. The Track-Core software can be integrated with various EHR and MMS software, to eliminate dual entry and tie implant information to specific patients.

Diagnostic information from the units also flows through Jetstream to the TrackCore RFID system, monitoring temperatures, communication statustime, I can go into TrackCore and see any piece of tissue and who has touched it," St. Dominic's Merrill says.

# Meeting Customer Needs

TrackCore conducts a prequalification visit with each hospital to discuss its needs and locations for the units. "The initial kick-off call to full implementa-

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tion takes only about three to four months," MacGregor says. "Our goal is to ensure everyone is on board from the start. A seamless implementation requires IT, facilities management, nursing and materials/operations all to be on the same page. It's important for everyone to understand what needs to happen and how it will happen. In the end, implementation will be difficult if the enclosure arrives and there is nowhere to put it." Once everyone is on board and locations for the units are chosen and prepared, the system is "plug and play," he notes.

"When Terso puts these refrigerators and freezers together, they calibrate them and go through the appropriate QA process to ensure the units are working properly prior to delivery," MacGregor says. "Our RFID implementation specialists are onsite to make sure the enclosures are connected to both the internet and the power grid properly. They also register the enclosures and make sure temperatures are correct." RFID readability is doublechecked and every badge issued is tested, he adds.

Budgetary buy-in has not been an issue for most hospitals, MacGregor says. Before St. Dominic Hospital adopted TrackCore RFID, it was storing tissue and implants at an off-site blood bank and tracking items manually, logging each transaction in a three-ring binder. "I knew it would make sense to house these items in the hospital, where they were being used," Merrill says. After meeting with other hospitals that were using tissue-tracking systems, St. Dominic chose TrackCore's solution. "Once the initial decision was made, we wanted to go as quickly as we could cut a check," Merrill says.

St. Dominic needed only one cabinet, which was installed in the operating room. Chad Derry, TrackCore's senior training specialist, spent a week onsite, Merrill says. "He made sure the Jetstream communications were working, helped us troubleshoot any problems and made sure we were comfortable with the system before we went live. We put tissue into the cabinet on a Monday and went live on that Wednesday. Chad stayed through Friday. It was like an open-book test for us—the nurses were using the system, and Derry was making sure they were doing it correctly.

"TrackCore hasn't let me down," Merrill adds. "We love it because it takes a lot of human error out of the equation."

### "We want the nurses to be able to function as nurses and not wandering around trying to find product."

-KIMBERLY CHEUVRONT, RUBY MEMORIAL HOSPITAL

Ruby Memorial Hospital's expenditure to upgrade to TrackCore RFID was less than \$150,000, Cheuvront says, noting the cost was recouped through savings. WVU, which touts itself as one of the most wired hospitals in the country, did not object to the cost. "We waited until all our upgrades to Epic [the electronic medical records system the hospital uses] were in place," she says. "We budgeted for the units through the proper channels. We prepared for the units, gave the finance people the proper documentation, and they were fine with it."

Ruby Memorial installed one refrigerator and two freezers in an inventory room near the OR. The upgrade went smoothly, Cheuvront says—there was little to no learning curve. Waste fell from 10 percent to 8.9 percent over the course of 24 months, with an increase in patient flow. "We can, in some cases, work with vendors, who will change product out for us before expiration dates," Cheuvront adds.

When WVU got a recall notice about implanted pumps, the hospital used TrackCore to find the recalled pumps in inventory and contact patients who had received them. The information was accessed from the system in less than to minutes, Cheuvront says.

TrackCore's real-time inventorymanagement application alerts hospital administrators when it's time to reorder required stock. It also helps hospitals save money on shipping, TrackCore's Brander says. "The ability to reserve items for a specific surgery ensures these items are available for the surgery, removing them from inventory, and alerting that they need to be reordered through the standard process," he says. "Hospitals have seen savings of \$20,000 by eliminating overnight shipping charges."

TrackCore RFID also facilitates government audits, known in the healthcare industry as surveys, which are conducted roughly every 18 months. "When the Joint Commission surveyor came to St. Dominic, I asked what he needed to know, telling him we have TrackCore RFID," Merrill says. "He literally moved on, saying, 'That answers all my questions.' He asked to see the cabinet, and that was the extent of the survey."

Hospitals report that TrackCore RFID delivers another important benefit, Brander says. The solution allows nurses to be nurses. "We want the nurses to be able to function as nurses and not wandering around trying to find product," Cheuvront says. "The level of nursing satisfaction here is great, and you can't put a price on that."





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### 2016 RFID JOURNAL AWARDS MOST INNOVATIVE USE OF RFID

**FLORIDA HOSPITAL** 

# RFID Gets to the Root of Surgical Services Problems

Florida Hospital uses real-time location data to understand why delays and bottlenecks occur, to improve OR performance and patient satisfaction. By Samuel Greengard





(Left) Patients are identified with AeroScout tags attached with wristbands. (Right) The visual dashboards allow staff members to proactively manage patient throughput and staff scheduling.

**FLORIDA HOSPITAL'S** Celebration Health, established in 1997 in the Disneyplanned community of Celebration, Fla., was an early adopter of radio frequency identification technology. Florida Hospital "has used RFID in one form or another since around 2005," says Ashley Simmons, director of innovation development for Florida Hospital, which is part of the Adventist Health System. "In the early years, we relied on it for asset tracking and temperature monitoring, but we are now looking to use it far more extensively. There are huge opportunities to understand the flow of people and equipment—and bring greater insight and visibility to the business."

Celebration Health, which performs nearly 10,000 surgeries annually, turned to RFID to rethink, remap and reinvent the fundamental way it delivers surgical services. "Providing an excellent patient experience has become a priority for hospitals," Simmons says. "Hospital managers needed to know why a procedure was delayed, not just that a problem occurred, in order to take action to improve processes and patient care."

That meant using RFID to get answers to complex questions: What's the root cause of bottlenecks that prevent ontime surgeries? How can we optimize room utilization? What information is required for effective in-the-moment decisions? How can we enhance the patient and family experience? To that end, Florida Hospital partnered with Stanley Healthcare to deploy an RFID real-time location system (RTLS) and build a platform with dashboards for analyzing real-time and historical data.

In 2015, the RFID initiative-now called the OR Patient Flow solutionwas implemented in Celebration Health's pre-op bays, 11 operating-room and two endoscopy suites, the 14-bed post-anesthesia care unit (PACU), 31 patient rooms in the acute-care unit and the surgical waiting room. The hospital has real-time visibility into the location of patients, nurses, equipment and other assets. The data is used to enhance patient flow, improve communications and expedite room turnover. A dashboard in the waiting room displays the status of patients for family members and friends. Moreover, by plugging the data into analytics tools, "we are able to put the data to work to manage space and resources in a very efficient manner," Simmons says.

### Rethinking Care

Florida Hospital launched a broad RFID initiative in 2010. "At that time, we began building a new patient facility on the Celebration Health campus, and we wanted to make it a living laboratory for innovation," Simmons says. Florida Hospital introduced a Center for Innovative Patient Care and formed a crossfunctional team, including representatives from administration, IT, nursing and surgical services, to oversee IT development and identify opportunities to put RFID and other technologies to work.

Once the team members began exploring how to collect, manage and use data to improve workflows, they quickly realized that real-time information generated automatically with an RFID RTLS solution was essential to the project. The hospital brought in Stanley Healthcare, which acquired AeroScout, to serve as the team's implementation partner.

"We didn't want to follow people around and create a Hawthorne effect, in which people know they are being studied and they change their behavior," Simmons says. "We wanted to have an accurate understanding of what they really do. What's more, instead of the data reporting taking days or weeks, the facility wanted to move to a platform that would tap real-time location services." This would allow the facility to optimize scheduling and understand events on a minute-by-minute basis by studying the routes and movements of doctors, nurses and other health-care workers as they go about their daily tasks. "We could see how, by taking a different approach, we could reduce waste and increase collaboration among the teams," Simmons explains.

RFID-tracking health-care workers provided valuable insights into their workflows, so the team decided to use the solution to better understand the dynamics of patient flow and how that, too, might be made more efficient. Most patients on the unit where staff workflows were being studied were recovering from surgery, so the natural progression was to monitor the location of surgical patients from registration through OR, recovery and discharge from the unit. The team members collaborated with hospital workers to identify the specific information required to visualize a patient's full experience. Then, they established key performance indicators (KPIs), including on-time case starts, recovery times and efficiency of room turnover. To assess performance and adjust workflows to meet KPIs, they developed realtime and historical dashboards.

### Remapping Processes

In 2011, Florida Hospital began building the current IT framework, including new servers, storage, and cabling to ensure sufficient Wi-Fi coverage to gather accurate location data. The hospital leveraged the existing Cisco Wi-Fi network and RFID-tagged assets, to track infusion pumps, beds and other mobile equipment. AeroScout tags with temperature probes were installed on pharmaceutical refrigerators and freezers, to continuously monitor the units and ensure they operated properly.

In 2013, the hospital began constructing the updated RTLS platform for managing surgical services. Stanley Healthcare engineers worked closely with Florida Hospital's IT staff to configure and deploy the RFID system. Over an 18-month period, the team perfected the infrastructure to achieve high data accuracy and developed the real-time data visualizations and retrospective analvtics dashboards that are central to the solution. "A real-time clinical application requires high data accuracy," Simmons says, "and we met a realistic goal of 80 percent to 90 percent accuracy, always shooting for 95-plus percent."

To achieve room-level accuracy to support the OR Patient Flow solution, AeroScout ultrasound exciters were added to the patient rooms in the surgical unit. More than 30 AeroScout low-frequency exciters were installed at several locations on the surgical-service department—including key entry and exit points in pre-op and PACU. In addition, 13 exciters were installed above operating tables in the OR and endoscopy suites.

Nurses and some physicians wear AeroScout tags attached to their employee ID badges, and patients wear the same tags attached with wristbands.



When a tag "hears" an exciter, the tag reports the exciter's unique ID number, which identifies a specific room, to an AeroScout MobileView server. The tag transmits data every 30 to 60 seconds (the facility uses a high beacon rate to enable precise tracking, even at the expense of battery life), using Wi-Fi access points on a Cisco wireless network. Data flows into custom-built software and an SQL database. Analysts use Excel spreadsheets, SAS analytics software and Stanley Healthcare's MobileView Analytics, based on the Tableau platform, to examine the data and put it to work.

Because the system captures the location in real time, it is able to accurately time-stamp procedure start times, "wheels-in, wheels-out" events and room-status changes, important metrics to drive process improvement and better patient throughput. The infrastructure also enables other workflow applications, including the ability to automatically display a staff member's identification when he or she enters a patient room, promote safety, and automatically document the amount of time a caregiver spends in a patient room.

"Once you move beyond tracking

The real-time pre-op dashboard includes a list of patients checked in and waiting or in pre-op. It supports the goal of on-time first case start, which can impact the on-time starts of subsequent procedures.

pumps or refrigerators with RFID, it gets a lot more complicated," Simmons says. "There was a need to factor in Wi-Fi, ultrasound and other systems. R&D would test the systems in the lab but then, in the real world of the hospital, things wouldn't always work the same way.

"We had to change the strength of the signal of the exciters and the tags," Simmons adds. "If, for example, they were in power-save mode, some of them would not work correctly. We had to test multiple settings and different combinations to understand how everything worked together. We also had to tweak the Wi-Fi so that only certain exciters could actually trigger an event based on a previous exciter. It was just multiple trial and failure over and over until we figured out the right mix of settings."

It was critical to not only deploy RFID to capture the data but also build logic into the platform, Simmons explains. "In many cases, multiple process flows can take place," she says. "A patient, for example, may arrive at the hospital for a procedure, spend a few hours in recovery but then have another procedure scheduled later the same day." Similarly, a nurse might take a patient to a specific room via a different route from one day to the next. "We had to have flexibility to identify when a change takes place-such as a canceled procedure or when a patient goes home," Simmons says. "Otherwise, it could throw off the entire sequence of events and impact utilization of the dashboards due to decreased accuracy of information."

The Florida Hospital-Stanley Healthcare team built the OR real-time map, list and dashboard views from scratch, to monitor all surgical services areas. The dashboard transforms the data into visual information so hospital staff members can see movements in real time, to better understand and adjust workflows for optimal efficiency and productivity. The visual dashboards allow staff members to look "upstream and downstream" to proactively manage patient throughput and staff scheduling, rather than simply react to events. It also enables staff members to see and respond immediately to potential delays or when the facility is approaching a high-risk level.

"At a high level, processes in an OR seem highly standardized," Simmons says. "Once you gain finer-grained visibility into movements, randomness begins to emerge. Even within a strict protocol, there is still room for considerable variation in human behavior."

# **Reinventing Services**

The OR Patient Flow solution is helping Florida Hospital to meet its goals to improve surgical services performance



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and, thus, the patient experience. The historical dashboards enable managers to review a day's performance, see failure points and drive continuous improvement.

The real-time pre-op dashboard includes a list of patients checked in and waiting or in pre-op. "The staff can actually see that a patient has checked in-that he or she is in the waiting room or in pre-op, so the surgical team can start preparing," Simmons says. "They can see whether the necessary equipment and staff are available. If there's a delay in case start due to patient arrival or other variable, for example, the team can proactively manage the schedule to continue progress of other patients through the process. All of this keeps the day moving and helps the staff be efficient with our resources and timely for all of our patients." This visibility supports the goal of on-time first case start, which can impact the on-time starts of subsequent procedures throughout the day.

"Overall, the hospital has achieved a 10- to 24-minute reduction in total time in recovery for OR patients," Simmons says. The sooner patients are The sooner patients are released (once they have met care criteria), the faster they are reunited with their families, whether they are discharged to go home or transferred to the acute-care unit.

released (once they have met care criteria), the faster they are reunited with their families, whether they are discharged to go home or transferred to the acute-care unit. What's more, she notes, "total recovery times are far more predictable, with an average of 20 percent less variation."

The real-time PACU dashboard includes a list of patients in surgery or recovery, so caregivers know when to expect them. Staff members can also see the status of rooms in the acute-care unit, so they can understand any delays in moving patients there. The PACU has achieved a reduction of six minutes to 16 minutes in hold times. Similarly, the real-time acute-care dashboard lets caregivers know when to expect patients from the PACU. The dashboards have led to a 75 percent reduction in phone calls and person-to-person communications between staff members to confirm basic information.

The OR Patient Flow solution has also improved the room-turnover process. When a surgical patient leaves an OR or endoscopy suite, the system automatically changes the room status to "soiled" and the icon for the room on the map changes color to brown. When environmental services is finished cleaning the suite, a worker pushes a button on an RTLS tag at the exit to change the room status to "available," indicated by green. The event information is time-stamped and logged into the system. This data can be analyzed with the room-utilization dashboards to identify bottlenecks and investigate why rooms are sitting idle.

The dashboard in the surgical waiting room "provides families and friends with the current status of patients," Simmons says. "People know immediately what is taking place and where their loved one is located at any given moment."

Celebration Health plans to expand the RFID solution to the emergency department. As Florida Hospital perfects the RFID systems, they're made available to other hospitals in the Adventist Health System.

"The current solution represents the early stages of technology innovation and transformation," Simmons says. Florida Hospital is continuing to develop and perfect dashboards and analytics tools. "For a number of years, RFID was used in a very basic way," she says. "We have gotten to the point at which the technology works extremely well. We are seeing huge value in building out a platform based on RFID and RTLS and seeding the technology to the entire company.

"This project has opened our eyes to a whole new level of data, information and knowledge," Simmons adds. "There are new use cases emerging and they will continue to shape the future of health care."



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# 2016 RFID JOURNAL AWARDS

**GOLDEN ENVIRONMENTAL MAT SERVICES** 

# A Gem of a Solution

Golden Environmental Mat Services tracks one-ton mats, so they don't get lost in the mud on job sites or harm environmentally fragile terrain. By Minda Zetlin

WHEN BUILDING PIPELINES or digging oil wells in harsh climates and environmentally sensitive areas, construction crews need temporary roads that will allow them to operate their equipment safely and efficiently, without sinking into the mud. This means they need mats-lots of mats, which are typically made of wood or, sometimes, plastic composite. The mats each measure roughly 8 feet wide, 14 feet long and 6 inches thick, and weigh approximately a ton. They can be assembled to create a road strong enough to keep heavy construction equipment from bogging down, and prevent the ground and plants from being torn up.

"Mats protect things above and below," says Steve Fisher, CEO of Golden Environmental Mat (GEM) Services in Calgary, Alberta, Canada. The 16-person mat-rental company provides a littleknown but vital service to the energy industry.

A typical job uses 2,000 to 5,000 mats, and "the big complaint was that nobody could actually keep track of them," Fisher says. "You'd have guys in machinery counting them, writing the numbers down and then submitting bunches of pieces of paper at the end of the day." Inaccuracies were unavoidable. And some mats would inevitably sink into the mud and disappear from



sight, resulting in what the industry calls "mat abandonment."

Before Fisher and his business partner, George Otcenasek, founded GEM Services in 2011, they conducted a market survey and the results confirmed the matting industry faced many problems. "We wanted to enter a business that needed a major improvement," Fisher says, "and we felt certain modern technology could alleviate the problems." Once their company was open for business, they began researching RFID options for tracking their wood mats.

In 2013, Fisher discovered an even

Every piece of heavy equipment GEM Services uses to move mats, whether rented or owned, is equipped with an RFID reader and antennas.

bigger problem than miscounted or sunk-in-the-mud mats—misidentified mats. GEM had delivered mats to a job site, which was also using mats from both the client company and another rental service. At the end of the project, GEM was missing CAN\$100,000 (US\$78,100) worth of mats. Each mat is worth roughly CAN\$750 (US\$586).

Both the client company and the other mat supplier denied taking any GEM mats, Fisher says. "They said, 'How can you prove this happened?' and we couldn't," he recalls. "All mats look the same once they're covered with mud." GEM had no choice but to write off those mats. "That was a major, major loss," he says. "So that motivated us, as pain does, and got us going on finding a solution."

In 2015, GEM introduced SmartMat, an RFID solution that tracks tagged mats with readers installed in the heavy equipment the company uses to move them. GEM's primary motivation in introducing RFID was to better manage its inventory, and indeed using RFID eliminated both mat abandonment and any conflicts over mat ownership.

But the move has also brought welcome benefits to the environment in one of the world's wildest areas. These include a reduction in burning fossil fuels, a major contributor to global warming, and a new system that helps heavy equipment operators comply with environmental best practices, protecting delicate areas and reducing the spread of plant diseases such as clubroot. "There are a few big wins for the environment," Fisher says.

### Getting Unstuck

Fisher knew developing an RFID mattracking solution wasn't going to be easy. "Always, the big problem was readability, because mats go down in mud and water," he says. "Sometimes they're fully submerged." GEM needed a solution that would allow mats to be identified when sunk in mud and completely waterlogged, and in harsh weather that could see a hot summer day followed by a snowy night. The company also wanted to compete in the



much larger U.S. market, which meant GEM needed a solution that could track mats whether they were face up or down. Canadian mats have a right side and wrong side up.

There was no off-the-shelf solution

Mats are used at construction sites to create temporary roads that can support heavy equipment, but they can be difficult to locate when submerged in mud and water. to meet these requirements, so GEM turned to the Southern Alberta Institute of Technology in Calgary for design help. "Mats tend to soak up a lot of moisture, so trying to find a place where we could put RFID tags and still give them a 10-foot read range was our No. I priority," says Glen Kathler, a research associate in charge of SAIT's RFID Application Development Lab.

GEM presented SAIT with two other challenges, Kathler adds. The company wanted to RFID-tag the 10,000 mats it already had and, in the future, work with suppliers to RFID-tag mats during manufacture. So SAIT devised a solution for inserting EPC Gen 2 passive ultrahigh-frequency tags in mats.

With tag design solved, the next hurdle was coming up with a way to read the tagged mats. In addition to SAIT, the project team included Steve Reid, an inhouse technology lead, executives from Tesera Systems, a Canadian software solutions provider, which developed the mobile software, and representatives from SensorUp, which helped connect GEM's mobile software to hardware in remote environments. They began experimenting with handheld readers, which turned out to be highly impractical for use at sprawling job sites. Then, they mounted an RFID reader and antenna in the company's pickup truck and drove to job sites to read mats. But this approach wasn't efficient, either, because mats are transported by large trucks and set in place and removed by heavy equipment. Pickup trucks are not part of the process. "It dawned on us," Fisher recalls, "that we needed to use our own heavy equipment."

GEM worked with SAIT to RFID-enable the vehicles the company uses to move mats, including wheel loaders, excavators and a giant arm, similar to the robotic Canadarm on the International Space Station, which can pick up a mat in its "fingers." They installed Impinj Speedway Revolution R420 readers in the cabs. For read accuracy, they determined the optimal placements for MTI Wireless Edge linear antennas and Laird circular polarized antennas, including on the cab, within the vehicle's wheels or tread and on the mechanical arm, which can extend as far as 15 feet.

GEM also installed Trimble Yuma 2 tablets inside the cabs, which work well with the Impinj readers and Laird antennas, Fisher says. The tablets provide a dashboard for the equipment operators and use GPS to record the exact

"Mats tend to soak up a lot of moisture, so trying to find a place where we could put RFID tags and still give them a 10-foot read range was our No. 1 priority."

-GLEN KATHLER, SAIT

location of each mat every time its tags are read.

"We offer clients a log-in to our dashboard to view project maps, trucking information, mat types and grades, contamination information, mat inventories in use and available, and of course mat locations," Fisher says. The software will also provide reports on any or all of this data so clients can track trends over time or see how a particular project is performing.

GEM field-tested the solution for three months, during which time it corrected hardware and software issues. Every piece of heavy equipment GEM uses, whether rented or owned, is now RFID-enabled and has GPS capabilities. The tagged mats are installed on a project while needed, then either returned to a GEM storage location or moved to the next project.

### A Clean View

Since 2015, GEM has used the SmartMat solution to monitor mats on several projects in remote areas of Alberta. On those projects, there has been no incidence of mat abandonment. Operators used combined RFID and GPS data to identify a mat's location before it disappeared from view, so they could use equipment to feel around in the mud for the missing mat and retrieve it. The company now has a clear and accurate view of its inventory. And—in case the question ever arises again—it also has a foolproof way to prove ownership of its mats on every job site.

GEM is also seeing unexpected efficiency gains and lower costs. "We thought we were just keeping track of inventory, but we found the bigger value is keeping track of the overall project," Fisher says. GEM software keeps a record of exactly what time and where each mat is read. "We can see for, say, a particular excavator, how much time it touches each mat and where there are gaps," Fisher explains. "If it's not touching a mat for a long period, that's down time. Either that machinery is moving somewhere, which is fine, or it's sitting around waiting for mats to arrive, which is not fine. We can tell we have an access problem, or we may not have enough trucks out there, which is a big problem."

A lot of the work transporting GEM mats from one location to another is subcontracted to trucking companies. Here, too, RFID provides valuable insight into operations. If, for example, two trucks are dispatched to a job site RFID End-User Case-Study DVDs

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20 minutes apart—but the RFID data indicates one truck moved its mats several hours after the other truck —GEM's owners know to ask why the second truck was delayed. Those conversations have led to efficiency improvements on the part of the trucking companies, Fisher says.

SmartMat also shows that sustainability and profit go hand in hand. Having an accurate record of every mat's location has cut down dramatically on the need to transport the mats long distances, which, in turn, reduces fuel costs and harmful fuel emissions. "It's knowing you have mats stored 100 miles away from a project rather than fetching them from another location 200 miles away," Fisher explains.

Knowing the mats' locations also improves customer service. "There will be mats out on a project not being used," Fisher says. "It's as far out in the middle of nowhere as you can imagine and these are very large sites, so quite often they get forgotten. So customers will be phoning us asking for mats when they have mats already there that are available." With the RFID record, GEM executives can reply, "We have some in the back corner of your site," he says.

SmartMat delivers other green benefits. The tablet dashboards alert operators when they are entering environmentally sensitive areas and should either leave or take extra precautions. Previously, this information was contained in paper documents several hundred pages long. Operators might not remember all the necessary precautions or know the exact locations of protected areas.

The RFID solution also facilitates compliance with Alberta's Agricultural Pests Act, which includes controlling clubroot by practicing good sanitation. Mats that have been in infected areas must be washed and decontaminated before they are moved to another location. Because SmartMat gives GEM a verifiable record of exactly where each mat has been, the company has been able to cut back on the labor and expense of washing mats on a long-distance project such as a pipeline. "We've gone from washing 100 percent of our mats to about 75 percent," Fisher says.

The company is partnering with a mat-washing facility that will incorporate RFID to track mats when they enter and exit the wash. "As mats roll through the mat-washing machine, we will scan

SmartMat enables GEM Services to better manage transportation, reducing fuel costs and harmful fuel emissions. It also alerts operators when they are entering environmentally sensitive areas and should either leave or take extra precautions.

them before they enter the conveyer," he says. "They go through a multistep process that uses steam and bleach to decontaminate the mat, then we scan them again as they roll out afterward. This way we can monitor which mat was decontaminated at exactly what time, which really helps with client liabilities." It also adds redundancy when capturing this critically important data, he says.

In the near future, GEM's mats may have a second life as an energy source. Mats have a lifespan of roughly four years, after which they are destroyed, Fisher says, usually by piling them up at a job site and setting fire to them. With more than 4 million mats in use in North America, that's an awful lot of waste. "Matting has the potential to eclipse the forestry industry for wood waste," he notes.

GEM is in talks with Decentralised Energy Canada (DEC), a national technology accelerator, about building a "waste-to-energy" plant capable of turning nearly any flammable object into electric power and/or heat. Wasteto-energy technology is gaining popularity in Europe. Although burning waste in such plants creates CO2 emissions, those emissions are less harmful to the environment than the methane gases that would be emitted if that waste were buried in landfills, according to the International Solid Waste Association. And, of course, turning waste into energy reduces the need to burn fossil fuels such as coal and natural gas to produce power. This is why the European Union has called for phasing out landfills in favor of waste-to-energy plants. But before building such a plant, DEC must know it would have a dependable and predictable source of burnable material for several years.

GEM can be a reliable source, but bringing mats to be burned at a plant only makes economic sense if they don't need to be transported any more than 100 miles, Fisher says. RFID makes this possible because it lets GEM track individual mats throughout their life cycle. "So part of our plan is brand-new mats go to more remote locations," he says. "In years two, three and four, we can start using them closer in and work them toward an area with a facility close by where they can be turned into power."

If all this sounds unusually forward thinking and ambitious, it is. It's also pure GEM, a small company that saw a problem and harnessed the power of RFID to solve it.



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### 2016 RFID JOURNAL AWARDS BEST NFC DEPLOYMENT

### CITYPOINT

# London's CityPoint Modernizes Building Security

An NFC solution automates access control for contractors, facilitates guard patrol and gives property managers insight into operations. By Jill Gambon

**AT CITYPOINT, AN ICONIC** 34-story glass and steel tower in London's financial district, providing state-of-the-art amenities and secure, well-managed services is crucial for business. The building's tenants, many of them international law firms, demand nothing less.

To meet the expectations of its high-end clients, CityPoint's propertymanagement team is always looking for ways to up the ante when it comes to amenities and services, says Lee Murray, CityPoint's building manager. Last year, Murray and his team identified three areas within building operations for improvement: management of keys, record-keeping related to onsite contractors and security-patrol operations. The goal was to replace outdated processes with a highly secure, automated system.

Every day, property managers relied on a paper-based process to issue hundreds of keys to contractors, including mechanical and maintenance crews, IT workers and window washers. The process was time-consuming and riddled with inefficiencies. Once keys were signed out, it was impossible to keep track of them, and many were lost or stolen. In addition, manually tracking attendance and billable hours for all those workers resulted in inaccurate records.

CityPoint's security officers patrol the interior and the grounds of the 706,000-square-foot building, which

### "We were looking for a product that would allow us to work smarter."

-LEE MURRAY, CITYPOINT

includes an underground parking garage and retail shops and restaurants on the ground floor, 24 hours a day. The guards' duties include making sure doors are locked and checking for water leaks. The patrol routes are lengthy, each equivalent to several miles, and officers couldn't report incidents in real time—they used a handheld wand to collect a digital time stamp at each of the 300 checkpoints, and the timestamped data was downloaded to a computer at the end of their rounds. Incident reports were handwritten. "We were looking for a product that would allow us to work smarter," Murray says. In January, CityPoint implemented a Near-Field Communication solution that combined securitymanagement software from MyTag.io, HID Global's Trusted Tag Services platform for authentication and proof of presence, and hundreds of NFC tags, including key fobs, inlays and transponders, from HID Global.

The NFC solution has fulfilled all of CityPoint's goals, according to Murray. "My team is really impressed with this," he says.

# A Smart Solution

As CityPoint's managers explored their options, they identified two priorities: a common platform that could address the three areas targeted for improvement and technology that would leverage the building's existing Wi-Fi infrastructure. The building's security manager suggested the cloud-based NFC solution because it would work with CityPoint's infrastructure and with standard NFC-enabled smartphones, tablets and USB readers. The "tap and go" solution also promised to be easy to



introduce, because most people in the United Kingdom had experience using contactless smart cards for payments.

An implementation team, which included representatives from facilities, security and information technology, evaluated the solution. In December 2015, the team launched a small, month-long pilot project. The pilot went smoothly and the project was green-lighted. Rollout took two weeks, including installation of tags at all security checkpoints and attachment of the tags to hundreds of keys.

All building keys were identified with an HID Global Epoxy Tag Keyfob transponder, a thin, durable tag with a unique chip that optimizes security when deployed with HID Trusted Tag Services, a cloud-based authentication platform that adds a nonreplicable identity to each interaction. When an individual requests a key, a CityPoint employee taps the key on an NFC tablet, which launches a check-out interface. Information about the identity of the person checking out the key is recorded on the tablet. When the individual returns the key, a tap on the tablet checks it back in.

Contractor record-keeping was simplified by giving preprinted NFC cards to the contractors when they enter the building. The contractors check in by CityPoint chose an NFC platform because it addressed the three areas targeted for improvement and leveraged the building's existing Wi-Fi infrastructure.

tapping their cards on an NFC tablet; they tap their cards on the tablet to check out. This creates an auditable record of the hours they worked at the building. After checkout, contractors hand in the cards to property-management staff so the cards can be reused.

The checkpoints were also identified with NFC tags—HID Global labels custom-printed with the CityPoint logo for the inside checkpoints and HID Global



outside checkpoints. When guards tap their phones to NFC tags, the phones receive a URL with an encrypted code attached. The tag generates the code at the point of contact. All of the guards' interactions between their phones and the NFC tags are collected and reported through the MyTag.io platform.

A simple web service call integrates HID Trusted Tag Services with MyTag.io's cloud security-management application. The MyTag.io interface is customized with the necessary data about the property, employees and contractors. The MyTag.io software validates that a URL was accessed by someone physically tapping an NFC tag, identifies each checkpoint and uploads time-stamp information. HID Global's



Trusted Tag Services validates the proof of presence, which prevents the URL from being used multiple times without a physical tap. It also prevents cloning of the URL.

The NFC tags are provisioned to the MyTag.io database so CityPoint staff can input and manage the tags. The platform's web-based interface allows the Security guards tap their phones to NFC tags at checkpoints, which gives management a real-time view of their locations.

facilities staff to access it onsite or remotely with a browser.

Training, Murray says, was minimal and included a hands-on demonstration of the new system and an instructional video. The building's facilities staff embraced it, he says. "My team is quite used to using new technology," he adds.

One of the few problems that cropped up early on was poor performance of the initial Android phones that were being used to interact with the NFC tags. CityPoint resolved the issue by switching to a different manufacturer's phones.

### Working Smarter

Now, with the system in place, the data from key management, contractor record-keeping and security patrols can be viewed from a single interface, providing insight into operations to enable informed decisions. Management of building keys has been streamlined, since the facilities staff no longer has to comb through paper lists. The MyTag.io software generates a dashboard displaying all keys that are checked out at any given time, who checked them out and when they are due back. This leads to a better understanding of which keys are in highest demand, when they are used and who is using them-information that was never before readily available, Murray says.

The automated contractor recordkeeping has reduced billing errors, Murray says. Invoices can be itemized based on the information gathered from the check-in, check-out process.

The data from the tags provides a real-time view of the security guards'

### "It's made life easier for our security officers." Overall, there is "an ease of accounting."

-LEE MURRAY, CITYPOINT

locations, which is also information property managers never could access previously. MyTag.io can track the time it takes a guard to travel from one checkpoint to the next and, if there is an unexplained delay, can send an alert to the guard's phone or a message to the facilities staff to follow up. If guards discover a problem, they can use their smartphones to generate a report on the spot and take a photo or shoot video to document it, instead of waiting until completing their patrol to report it.

While analytics are still being gathered to calculate the precise return on investment for the project, Murray says the impact became quickly evident. "It's made life easier for our security officers," he says. Overall, there is "an ease of accounting."

CityPoint is considering expanding the NFC solution to asset management, including heating, lights and other equipment, and linking it to the building's access-control system. The technology has the potential to lower costs while improving services, Murray says. "We must provide the best possible facilities to our clients," he adds.



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### 2016 RFID JOURNAL AWARDS BEST INTERNET OF THINGS DEPLOYMENT

**HOSPITAL DE LA VEGA** 

# Spain's Hospital de la Vega Gets Connected

An IoT platform gathers data from multiple sources, puts it in context and disperses critical information in real time, improving patient care and internal processes. By Jennifer Zaino

**SYNERGY IS THE BYWORD** at Hospital de la Vega, a private hospital in Murcia, Spain, that provides basic medical services and specialized procedures such as extracorporeal cardiac surgery.

In 2015, Hospital de la Vega conducted a pilot of the MySphera Internet of Things (IoT) platform that integrates data from various sources, including electronic health records (EHR), health information systems (HIS), lab and Xray systems, and a real-time location system (RTLS) that tracks patients and assets. The IoT platform puts all the data in context and makes the information easily accessible, whenever and wherever it's needed. Physicians, nurses, clinicians and hospital administrators can use the information to make smart decisions in real time, to improve processes and patient care, lower costs and deliver better communications to patients' families during medical procedures, says Hospital de la Vega's CEO Carlos Arenas.

Before implementing the IoT platform, Hospital de la Vega suffered from low synergy across information sources, Arenas says. Health-care workers would have to go to workstations and log into separate systems to get patient information, such as blood type, medications or status of test results, and to locate medical devices in an asset database. They didn't always know where particular patients were at any given moment, or how long they had been in particular parts of the hospital. It was difficult to find the closest portable X-ray or other life-saving equipment. Without information synergy, they weren't able to fully understand all the facets of a particular case or issue when decisions had to be made to treat patients who required immediate care.

Hospital de la Vega was selected as a pilot site to use MySphera because the hospital's management team embraced the IoT concept. MySphera is part of the Future Internet Challenge eHealth (FICHe) project, which encourages European health organizations to develop innovative applications using FI–Ware open-platform technology. The project was funded by the European Union.

"MySphera would be able to validate the system in several hospital processes—including hospitalization, emergency, surgery, equipment with the chief of services' support and commitment," says Elena González, chief of emergency nursing, who led the MySphera implementation for the hospital's emergency department.

Today, Hospital de la Vega caregivers and administrators use dashboard applications on tablets, large-screen TVs or PCs to securely identify and control the flow of patients and assets. MySphera also provides business intelligence tools that hospital managers use to visualize workflows and analyze data. The solution has led to cost reductions from shorter patient stays and revenue increases from improved patient throughput. Surveys conducted by the hospital to measure the impact of the IoT project reveal high levels of staff, patient and family satisfaction, Arenas says. Staff members have a greater sense of control over processes and equipment, he adds, and more trust in the information provided for improving processes.

# The IoT Infrastructure

The FI-Ware platform—an enhanced OpenStack cloud environment plus a set of standard application program interfaces (APIs)—underlies the cloudbased MySphera RTLS. It functions as a horizontal hospital process-information system for merging data from different sources. "The MySphera IoT system proposes a completely new technical design, so it can be easily and cheaply deployed in any environment without high up-front investment using technologies that can be useful for many applications," Arenas says. with patient information in the solution's MyHospital software and the hospital's HIS and EHR system.

MySphera's BLE beacons were installed in the ceilings in the emergency department, surgical, internal medicine and social wards, and in the major ambulatory surgery center. The 130 beacons identify the tags, which function as emitters and receivers, from several meters. Unlike some BLE systems, MySphera example, Apple's iBeacon specification—therefore, you need a specific application in the mobile device in order to scan the tag." Additionally, he says, the tag only sends information about itself, such as its ID, never any personal data about the patient.

The central information hub is the FI-Ware Orion Context Broker (CB), an API that correlates information from different sources, including MyHospi-





Bluetooth Low Energy tags are attached to patients' bracelets. The BLE beacons, which were installed in the ceilings throughout the hospital, identify the tags.

But before the IoT platform could correlate personal and process information, Hospital de la Vega had to be able to track patients and assets. The hospital deployed MySphera's RTLS, which uses Bluetooth Low Energy (BLE) tags on patient bracelets and mobile assets. MySphera's USB tag desktop reader for workstations links the assigned patient or asset tag identification number does not incorporate Wi-Fi technology. The beacons were connected via Ethernet cable to the SpheraOne location server, which includes an algorithm that calculates the position of a tag with respect to predefined location areas using the data received from the beacons.

Any mobile device that supports BLE standards is a potential mobile beacon, too, since it can receive a tag signal and identify the assigned person or object. Although the solution uses standard Bluetooth, "access to the information is secure," says MySphera's CEO, Salvador Vera. "The solution uses a proprietary frame sent by tags—we don't use, for tal, SpheraOne and workflow engines monitoring lab tests and other processes. The EHR provides healthcare data for medical and nursing services, triage and procedures, and the HIS provides administrative data such as name and bed. FI-Ware's Geo-fencing API is used with MyHospital for indoor location tracking information and for publishing those events to CB. Multiple devices can access the unified information via queries or subscriptions to information changes to get push updates.

MySphera is designed to operate independently, so it doesn't interfere with a hospital's communication networks or Wi-Fi infrastructure. There is no need for modifications to previously integrated software components, which Vera says is a distinguishing feature of the system. The installation at Hospital de la Vega took eight weeks, he says. The battery-powered tags on patient bracelets last roughly 1.5 years; those on mobile assets last approximately 4 years. The system, including activating firmware on all devices, is remotely monitored and maintained, he says.

MySphera was an optimal solution for the hospital because the vendor is "involved in the use of the open-source technology FI-Ware," Arenas says. "My-Sphera is the company that has more experience and development in this field in Spain." MySphera is a cloud service, so Hospital de la Vega gains the benefits of high scalability in a pay-per-use software-as-a-service model, he adds.

# Anytime, Anywhere Information

During the pilot, conducted from April through December, incoming patients received bracelets with BLE ID tags. Each day, approximately 100 patients were treated in the emergency department; 80 patients on surgical, internal medicine and social wards; and 10 in the major ambulatory surgery center. Roughly 100 assets, including IV pumps, monitors and beds, were tagged. More than 250 staff members and patients' families participated in the pilot.

Health-care workers used smartphones, tablets and Bluetooth-enabled devices on nursing trolleys to quickly scan the BLE ID tags on patients' bracelets to confirm patients' identity, verify they were at the right place at the right time, and ensure they received the correct medications. The tags were also used to check patients into operating rooms and identify their physicians.

Dashboard apps were designed to be viewed on large-screen TVs, PCs or tablets. Three large-screen TVs were installed at nursing stations on the wards, two in operating-room staff areas and two in emergency unit staff areas.

The dashboards were configured to display patient information for each unit, including emergency (pediatrics, X-ray or had completed the X-ray and was ready to return to the emergency unit.

During the pilot, for example, a physician sent an emergency-room patient to the X-ray facility for a test, González recalls. "After some time, he looked at the big dashboard to know where the patient was," she says. "The physician saw the patient was waiting at the right place, so he called the X-ray



adults and X-ray), surgery (ambulatory, programmed and emergency) and hospitalization (patients and bed map). The information included name, triage/procedure/bed, location, state in the process, time in the process and key performance indicators (KPIs) by color. If, for instance, a patient was flagged as being in the most critical state, the business process called for the patient to be seen for the first time within five minutes; if that became 10 or 15 minutes, the dashboard status turned from green to yellow and then red.

Doctors, nurses and hospital porters viewed the dashboards to see, for example, if a patient was waiting for a first visit from a doctor or if the patient was in the X-ray room awaiting or taking an Now that all mobile devices are tagged, the hospital's financial director calculates a 7 percent savings in capital expenditures per year from reducing equipment losses and improving usage rates.

department to accelerate the test."

ER nurses also relied on the realtime dashboards to learn where patients were when doctors neglected to tell them they'd sent the patients to observation wards. That saved nurses from having to look for patients, so they could devote their time to caring for the patients still on their watch.

A large dashboard was deployed in the ER and OR waiting rooms, too; it identified patients by code rather than



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name to maintain their privacy. "Relatives in the waiting rooms of emergency and surgery units talked about the tranquility it provided them to know where the patient was and in which moment of the process," González says. Approved family members and friends could download a MySphera app from Google Play to a BLE mobile device to check a patient's status.

Hospital managers used business

The data analysis enabled managers to gain insights into clinical and operational processes to more effectively assign hospital workers to specific tasks, reducing bottlenecks, mistakes and stress that result from staff shortages and high workloads. The emergency department, for example, reduced wait times by 12 percent. In comparing previous manual data entries with My-Sphera's automatic real-time data, the profiles, levels of studies and ages," González says. "They were used to working in a certain way, and it was difficult to change it." While the system requires hospital workers only to assign and remove tags, that process can add to work challenges in units where the flow of patients is very high. Sometimes, for example, ER workers would forget to remove tags from discharged patients' bracelets. It was important,



Health-care workers use mobile devices and dashboards on large-screen TVs to get real-time information, which enables them to make informed decisions that improve patient care.

intelligence dashboards on mobile and fixed computers to analyze workflows, based on patient and asset location data as well as patient status within testing processes and patient administrative and health information. Managers could view, for example, average surgery and recuperation times per procedure, and average hospital stays per procedure, and have the system merge and measure the data against KPIs established by the hospital. hospital's OR coordinator found a 15 percent deviation in surgery planning. Hospital administrators also used the data to improve bed management.

The project, which is ongoing, has been extended throughout Hospital de la Vega. Now that all mobile assets have been tagged, quantitative measurements include a 20 percent reduction in time searching for equipment. The hospital's financial director calculates a 7 percent savings in capital expenditures per year from reducing equipment losses and improving usage rates, Arenas says.

Both Arenas and González believe the main challenge to getting the My-Sphera IoT solution up and running was related to change management. "The staff in the hospital has very different Arenas says, that the hospital board fully supported the project, communicated the benefits to staff members and enacted a thorough training plan to foster adherence.

"The MySphera IoT platform has proven to be a leapfrog in our internal health IT systems by connecting smart sensors with our hospital applications to improve the quality of care for our patients, our staff effectiveness and our operational costs management easily and decisively," Arenas says. "In addition, the growth possibilities are manifold, with impacts beyond the better care for our patients, such as highly impacting our health-care organization operational KPIs, at a lower total cost of ownership overall."

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### 2016 RFID JOURNAL AWARDS BEST NEW PRODUCTS

### PHASE IV ENGINEERING AND SMARTRAC



# Sensing New Opportunities

Phase IV Engineering's RFID Sensor Reader and Smartrac's Sensor Tadpole tag address end users' needs. By Paul Prince

**It's one thing** to develop a cool new RFID product. It's another to make it useful, easy to deploy and inexpensive enough to adopt. Both Phase IV Engineering and Smartrac sensed a need and did just that.

Phase IV's RFID Sensor Reader ad-

dresses a challenge manufacturers have faced: how to integrate an RFID reader into an assembly plant's machinery, a conveyor system, or an industrial computer known as a programmable logic controller (PLC) that a factory typically This is the first time two companies were honored with the Best New Product Award: Scott Dalgleish (left), CEO of Phase IV Engineering, and Lauri Hyytinen, head of Smartrac's automotive segment. uses to automate processes on an assembly line.

"I had about six projects last year where we had a client that wanted to use RFID in a control system, and every one of them walked away because of the problems of implementing an RFID reader," says Phase IV's CEO Scott Dalgleish. The trouble, he explains, is that RFID readers aren't designed to communicate with the PLC input modules that accept signals from sensors or other devices and convert them into a measurement and, based on the temperature reading, convert that measurement into voltage of o to 5. The reader must then route that voltage signal to the PLC input module terminal assigned to that particular sensor.

"And there are user-configuration issues," Dalgleish says. "How often do you want the reader to read the temperature sensor and feed it to the PLC? Is it once a second? Is it once an hour? What happens in an error condition? So those are all problems that need to be solved metal passive ultrahigh-frequency RFID tag that can detect the presence of moisture, also solves an intractable problem: how to easily and cost-effectively identify water leaks in hidden places, such as within weatherproof electrical boxes, sealed packages and cabinets, behind walls, or inside a car's electronics bays, cabin and trunk (see Water Leaks in Cars Can't Hide From RFID). The Sensor Tadpole communicates with off-the-shelf EPC Gen 2 readers and requires no custom commands.



form that can be used by the PLC's CPU.

A common type of PLC input module, Dalgleish says, is an Allen Bradley analog input card that accepts a signal in a format that varies from o to 5 volts. Say, for example, a factory wants to install a passive RFID temperature sensor tag at four different locations on its assembly line. The analog input card has multiple terminals for accepting signals, and the data from each of the four sensor tags must be routed to its own dedicated terminal on the card. So an RFID reader first needs to read each tag to capture the sensor's temperature to bring RFID sensing into the industrial environment."

To achieve this goal, Phase IV developed the RFID Sensor Reader, an EPC Gen 2 RFID reader with eight terminals for analog output. "Inside the black box is a computer with every I/O you can think of—4 to 20 milliamps, o to 5 volts, USB, Ethernet, a cellular modem," Dalgleish says. "There are a lot of problems that only RFID sensors can solve once you get the data to the control system in an efficient manner. And that's what we've done here."

Smartrac's Sensor Tadpole, an on-

(Left) Phase IV Engineering's RFID Sensor Reader is an EPC Gen 2 RFID reader with eight terminals for analog output. (Right) Smartrac's Sensor Tadpole is an on-metal passive UHF RFID tag that can detect the presence of moisture.

"Sensor Tadpole has really opened a whole new application for RFID," says Lauri Hyytinen, head of Smartrac's automotive segment. "For the first time, we have reliable water detection at a really reasonable cost for automotive and similar applications."

# 2016 RFID JOURNAL AWARDS

**PAM SWEENEY** 

# Setting an Example

Pam Sweeney is a leader on Macy's RFID team, which is using the technology to become the world's first omnichannel retailer. By Mark Roberti



I've always been highly skeptical of buzzwords. When I was an editor at InformationWeek, there was a lot of talk about the "real-time company"—organizations that were capturing real-time data and acting on it. Except almost no companies were doing this. It was mostly talk. In retail, one of the biggest buzzwords today is "omnichannel," which means selling to the customer in-store, on a mobile device, on a home computer or by phone—and delivering the correct product or having it ready for pickup in a store.

Lots of retailers are talking about omnichannel. Macy's, which has \$27

Pam Sweeney accepts her award from Mark Roberti at RFID Journal LIVE! in May.

billion in annual sales, is doing it. And Pam Sweeney is a leader on the executive team that is employing RFID to enable omnichannel shopping.



The cover of a Macy's corporate publications illustrates the company's commitment to the omnichannel retail concept.

Why RFID? Because Macy's gets that omnichannel requires a high degree of inventory accuracy—ideally, visibility down to the last unit—and only RFID can provide that.

Sweeney joined Macy's in 1986 and has held various positions within distribution and warehousing. Today, as senior VP of logistics systems, she is responsible for optimizing logistics information systems, which includes identifying new technologies and applications necessary to enhance existing business processes.

When Sweeney attended our RFID in Fashion event in 2006, she was not an immediate convert to the technology. But she saw its potential and kept investigating it and watching it mature. In 2008, Macy's began testing RFID in its Bloomingdale's stores, and three years later, the board had enough confidence in the technology to approve funding for an RFID rollout to all 850 Bloomingdale's and Macy's stores.

At first, the retailer used RFID to replenish out-of-stock items, to improve on-shelf availability. But around 2011, Macy's began pursuing an omnichannel strategy to better serve its customers and compete with online retailers. Sweeney helped bring together teams from various departments, including shipping, online fulfillment centers and stores, to execute this strategy. And she oversaw several major pilots, including one focused on picking to the last unit, which delivered impressive results.

"At first, some people within Macy's were tired of hearing me talk about RFID," Sweeney confesses. "But now, everyone is talking about it." Her commitment to and enthusiasm for the technology has helped improve Macy's operations and deliver the item-level visibility required to give customers a successful omnichannel shopping experience. She credits RFID for sales increases from high single digits to double digits in various categories.

Sweeney has also been a relentless champion of RFID outside the organization, promoting adoption within the broader U.S. retail industry. She has spoken at RFID Journal events, the National Retail Federation's Big Show and GSI Connect, and she has participated in peer-to-peer meetings hosted by GSI.

RFID Journal bestows its 2016 Special Achievement Award on Sweeney for her commitment to driving RFID adoption throughout Macy's operations and for her work in enabling the company to become the world's first omnichannel retailer. Her efforts, along with those of her colleagues, have set an example for all retailers that aim to pursue an omnichannel strategy. She has been instrumental in making "omnichannel" more than just a buzzword.



# TUNED IN By Bill Hardgrave

# Excuses, Excuses!

Retailers that claim RFID is "too difficult" are misinformed, reluctant to acknowledge inefficiencies in their stores or adverse to change.

When I meet with retailers that haven't adopted RFID to improve inventory accuracy, the first question I ask is: "Why are you *not* using RFID?" Some

retailers are prepared with a ready excuse: "RFID is just too difficult." It is unclear whether they are hearing this from outside their organizations or it has become an internal way to justify not using RFID. I suspect it is a bit of both. Either way, the "just too difficult" excuse is just lame.

Adopting an RFID inventorymanagement solution is not rocket science. There are wellestablished technology standards and best practices for deploying RFID in the retail sector. True, the technology is not yet plug-andplay. I always advise retailers that it's essential to conduct a proofof-concept (PoC) and then a pilot

to ensure a successful deployment. Depending on the retail environment, there may be issues to overcome, such as antenna placement or power settings that require tweaking to achieve optimal read rates. But there are many RFID providers and systems integrators that have experience deploying RFID solutions for retailers and know how to address these challenges effectively.

Retailers that buy into the scary sto-

ries from those outside their organizations are making business decisions based on misinformation. The retailers that claim they had "issues" with RFID



likely made mistakes during their PoCs or pilots (see <u>The Truth About High In-</u> ventory Accuracy).

As more major retailers announce storewide RFID deployments, CEOs have begun to ask their internal leadership why their companies aren't using RFID. The "too difficult" answer they receive often stems from two sources. One is a reluctance to acknowledge to the boss that there are problems that need fixing. But it's getting harder to hide behind that excuse. Studies show the industry average for in-store inventory accuracy among U.S. retailers is roughly 60 percent. And stores that have deployed RFID to address inventory inaccuracy have reduced out-of-stocks and improved sales.

The other source is an aversion to change. When retailers get together, they often discuss how RFID "shines a light" on store processes. Underlying that discussion is the awareness that those in charge will have to make tough decisions to improve processes and then execute them to meet expectations. One retailer,

> for example, learned employees weren't following prescribed store processes. When products were delivered to the store, they were supposed to transfer them directly from the truck to the sales floor—only items that didn't fit on the sales floor were to be taken to the back room. But the employees were storing all the merchandise in the back room, which was having a negative impact on sales.

> Shining a light on a problem is a good thing, but tackling the problem can be hard. Creating change often impacts the work of hundreds or thousands of employees. And change always brings resistance. But the retail

industry is changing, and retailers must change with it. If they continue to make excuses for not adopting RFID, their businesses will suffer.

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



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# **HEALTH-CARE BEAT** By Ygal Bendavid and Harold Boeck

# **Curing Human Bottlenecks**

Before hospitals deploy an RFID solution to improve bed management, they must revise their patient-workflow process.

Beds are scarce resources in hospitals. Often patients wait for hours in the emergency department or in post-op rooms for a bed, because hospital personnel don't know when other patients have been discharged. There are a

variety of RFID solutions designed to improve bed management by tracking patients and beds in real time. They can issue alerts when a patient is moved, a bed is free, and a room has been cleaned and readied for a new patient.

But these solutions are only as effective as a hospital's patient-workflow process. People in several departments have to be available to respond to the system's alerts and act in real time. Hospitals must address the following bottlenecks that impede patient workflow before they deploy an RFID bed-management solution.

Bottleneck 1: Doctors are

responsible for discharging patients. But doctors are busy, so they typically schedule patient visits at fixed times. If patients aren't ready to be released, they may end up staying longer than necessary, as they wait for the doctor's next visit.

**Bottleneck 2:** When doctors discharge patients, nurses have to update patient-status reports so housekeeping teams can begin their work. But nurses are busy caring for patients, so the reports are left for later and patients are discharged by batch.

**Bottleneck 3:** An RFID bed-management solution can send an automatic alert to housekeepers and orderlies that



a room is ready to be cleaned and prepared. This should accelerate room turnover. But in most hospitals, housekeeping works on shifts, and there's not always someone available to clean the room and make the bed.

**Bottleneck 4:** Some patients can't be moved within the hospital until mobile assets, such as a wheelchair or lifesustaining equipment, are available. Often, the people in charge of moving patients can't locate these assets, and when they can, there aren't necessarily workers available to deliver them. The availability of personnel and vehicles to transport patients to external locations,

such as rehabilitation centers, is also a concern.

RFID providers have the technology and know-how to deploy an RFID-based real-time location system to track patients and beds. Converting actionable data into immediate intervention is more complex. Hospitals need to build flexibility into their patientdischarge workflow processes, by adjusting their organizational structure and reassigning roles and responsibilities. Doctors, for example, could visit patients based on discharge readiness rather than a fixed time. The housekeeping and transportation departments could establish teams that are available to react on the fly. Some hospitals have created discharge rooms to free up beds.

Hospitals that addressed workflow issues and then implemented a bed-management solution report improved patient care, and less stress and more satisfaction among hospital personnel.

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

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# SOFTWARE SAVVY By Ken Traub

# Middleware Finds a Home

### It's becoming easier to run middleware on fixed and handheld readers.

Middleware is an essential component of any RFID system. The software manages readers, printer-encoders, sensors and other hardware, filters and aggregates the data, and passes it along to business applications. But a perennial challenge has been to find the best place to run middleware. While middleware can reside on a data center server, it's more efficient if it's close to the hard-

ware components, so it can keep those devices running smoothly and respond instantly to the data. But housing a dedicated computer at each facility isn't easy—factories and warehouses are often hostile places for equipment designed for a data center, and it requires someone who can maintain a computer in that setting.

Another option is to embed middleware directly in the reader. But most middleware packages require customization, and sometimes middleware is developed for a particular project. In either case, programming is

involved, and most fixed and handheld readers don't provide a welcoming platform for software engineers. Middleware developed to run on a Windows PC, for example, won't run inside a reader, which has a different CPU and operating system, and significant constraints on memory and storage. Custom jobs require a specialized programmer who can write code in an unfamiliar environment. Software developers also must contend with many restrictions that limit the ability of their middleware to coexist with reader firmware. Even fixing a bug can be challenging.

Companies looking to hire software engineers for their RFID project will find very few who have the necessary experience. But new options for deploying middleware may soon address these issues.

This year at RFID Journal LIVE!, I saw



many RFID handheld readers that feature a "sled" into which you slide an iOS or Android smartphone. While originally developed to save on costs, they have the necessary processor power and memory to support middleware applications and provide a rich and familiar user interface. It's also easy to find programmers skilled in writing software for smartphones. And the same smartphone features that let consumers install apps with a single touch make it easy to deploy and upgrade middleware on a sled reader.

For most fixed readers, embedding software remains a challenge. But at least one vendor, Harting Technology Group, makes a fixed reader with a programming environment suited to developers. Harting's RF-R300 reader runs the standard Linux operating system, and uses Linux "container" technology to

> host user applications. Linux containers essentially create a walledoff virtual computer within the reader's hardware, so the reader can host any Linux application without fear that it will interfere with the reader's firmware. A hosted application communicates with the reader through a virtual network channel, so programming in this environment is as easy as it is for an outboard PC. With I gigabyte of memory, there is room to host full-scale middleware data-capture applications. And Harting's application-management software makes deployment and maintenance easy.

Reader vendors that address the needs of software developers will make it easier and less costly for end users to deploy RFID.

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



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