

Whether it's tracking warehouse inventory, factory-floor product assembly, or timing marathon runners, inexpensive, disposable and reliable RFID tags are quickly displacing barcodes and electronic transponders.

## Lexmark RFID encoder and laser printer combination goes the distance

### The Organization

Based in Southfield, Michigan, SAI Timing & Tracking is a world leader in the specialized industry of clocking athletes in marathons, triathlons and other events.

### The Challenge

The first Boston Marathon, in 1897, featured 15 runners. In 2008, 130 marathons are scheduled – in the United States alone. The largest, the New York City Marathon, had more than 93,000 registrants in 2007. Keeping track of each runner, including registration, distribution of numbered bibs and recording actual realtime race progress to the fraction of a second, with multiple split times recorded at several points and at the finish line, is its own world-class challenge. It is an undertaking with profound parallels to other industries.

Before the electronic age, race timing was obtained by tearing a small perforated numbered tag from the runner's bib and placing it on a string as each runner crossed the finish line. A long manual process ensued, and split times often were not available. The mid-1990s ushered in total electronic timing. The technology uses a batteryless transponder that uniquely identifies each runner. Housed in a small plastic case, it is tied onto the runner's shoelaces or worn on an ankle bracelet. Specialized stationary equipment installed at the start line, designated split locations, and the finish line emanates a magnetic field that energizes each passing transponder. The energized transponder broadcasts its unique identifying code, which the equipment records to log runners' progress and report results instantaneously. The underlying technology is similar to the highway toll transponders now mounted on millions of automobile windshields.

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—David Simms  
Cofounder  
SAI Timing & Tracking

Though a huge advancement, transponder technology suffers from significant shortcomings. The devices are anything but disposable. With a retail value of up to \$35 apiece, retrieving each runner's transponder after a race is an enormous – and expensive – undertaking. Keeping each one matched with the correct numbered bib poses operational challenges. And though an individual transponder is smaller than a fifty-cent coin, shipping 50,000 or more to a race presents its own logistical problems.

SAI Timing & Tracking believed a better method could be found.



### The Solution

Advances in RFID (radio frequency identification) technology led SAI to conclude the time was right for a new approach. Gaining popularity for inventory-tracking applications, RFID tags are both inexpensive and accurate. SAI leveraged this technology and developed a world-class, cost-effective disposable RFID solution for participatory sports. Barely a half inch in width, their flat, paper-thin shape allows tags to be adhered to each runner's bib, saving space, reducing shipping costs and guaranteeing accurate results.

For this new approach to work, the large numerals and other identifying information printed on the bib and the encoding of the tag with that same data needed to be accomplished in a single step. To assure that the printing could stand up to rain, perspiration and other environmental factors, thermal and inkjet printers were ruled out. "We knew the only answer was laser printing," said David Simms, a Cofounder of SAI.

Through the service bureau that SAI uses to manage the printing and distribution of runners' bibs, Simms was introduced to Lexmark's RFID marketing and development team. After studying SAI's one-of-a-kind requirements, the Lexmark team proposed testing the T640rn, the world's only laser printer containing a built-in RFID encoder, along with custom designed weather-resistant polyethylene media. "The Lexmark T640rn was the perfect solution," said Simms. "It let us print thousands of runner's bibs and encode RFID tags in a single operation."

The heart of the T640rn is Lexmark's enterprise-class T640 monochrome laser printer rated at 35 pages per minute on 8.5" x 11" paper. Equipped with an embedded RFID encoder and antenna, the T640rn prints full-size pages and simultaneously programs the RFID tag in a single pass, unlike thermal printers, which typically are limited to smaller roll-fed label-size media. SAI Timing & Tracking uses only genuine Lexmark toner. As a result, when printing in all sorts of weather and outside environmental conditions, the company can be assured that the toner will adhere to the specialty media.

Combination RFID encoding and document-printing technology from Lexmark reaches far beyond the starting line of any marathon. For warehouse, order fulfillment, manufacturing or other industrial applications, the RFID tag need not be on the surface of the object, protecting it from abrasion. With a read time of typically less than 100 milliseconds and no line of site required, large numbers of tags can be

read at once rather than item by item, a requirement of optical barcode scanning systems. There are document handling benefits with this solution as well. If an RFID-enabled document is reported missing, a complete history of all its users can be recalled along with dates and all the locations where the document has been. Other applications include hospital patient identification wristbands and inventory management.

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To assure acceptance by the hundreds of organizations that manage races worldwide, design of the system included both RFID industry researchers and race directors and timers from around the world.

### The Results

The first test of this new solution took place in Nov. 2007 at the Las Vegas Marathon. With nearly 17,000 registrants, the system worked flawlessly. Runners peeled the RFID tag from their bib and attached it to their running shoes, an essential step since the magnetic fields that energize the tags are generated at ground level. Runners no longer need to return expensive transponders and race organizers are freed from the task of transponder recovery or assessing fees for those not returned.

"Lexmark believes in what we are doing and continually asked how they could help," said Simms. "Even though this is a niche market, they knew that any solution they built for us could be adapted for use in dozens of other industries." SAI is already thinking ahead and is working with Lexmark to incorporate RFID encoding technology into new products. Skeptics said simultaneous printing of full-size pages and RFID tag encoding could not be done. Lexmark proved otherwise and is the first — and so far only — printer manufacturer to cross the finish line with a combination laser printer and tag encoder that can be put to work today.