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Plugging In to Energy Savings

MDA-funded information technology lets users get savvy about power consumption.

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Buildings and factories are a lot like living creatures. Their mechanical systems, from elevators to manufacturing equipment, are like muscles. Specialized fluids and life-giving utilities—such as water, natural gas, steam, and electricity—course through their structure. And they respond to their environment. They get hot and cold, and they can feel the effects of humidity.

Increasingly, monitoring the physiology of buildings, factories, and aircraft has relied on networks of sensors that serve as a nervous system—collecting data on conditions and problems and then feeding information to an automated brain center such as a building management system (BMS). Such systems allow human users or rules-based software to monitor conditions and make decisions—whether shutting down a machine that has reached a certain temperature or closing off a gas line that has developed a leak.

But a nervous system for a building or another structure needs computing power not just at the brain center; it also needs computing power at the nodes—at the sensors and data-collection points. Computing power at the nodes controls timely collection, processing, and routing of data.

Software for these nervous-system endpoints must be fast and light, and MDA-funded Embedded Research Solutions, Inc. (ERS; Annapolis, MD), has developed just such a solution. ERS refers to its technology as "miniature software," but the company's product goes well beyond simple software for nodes in a building management system. The company is building a business based on a hosted approach to data collection. Not only is ERS supplying miniature software (loaded on tiny processing devices that can be attached to sensors); it also sells a service that includes real-time collection of data, aggregation of the data, and then delivery of the data back to the customer.

The software for ERS's technology was funded through SBIR Phase I and Phase II contracts from MDA, for a concept

continued on page 2

▲ Big energy users, especially in large cities, increasingly are monitoring their utilities consumption. And new offerings from Embedded Research Solutions are allowing these consumers to curtail their usage and participate in energy incentives programs.

Plugging In to Energy Savings from page 1

known as pervasive computing—in which multiple sensors work together on a network. Company officials envision use of pervasive computing as being applicable throughout missile defense.

The incentives factor

The kind of pervasive data gathering, processing, and delivery that ERS's technology promises is growing in popularity as overseers of real estate realize there are savings to be had in managing their buildings more efficiently. In addition to the obvious savings from conserving energy, having better insight into how energy is being used in a building also allows the manager of the building to participate in government-endorsed energy initiatives.

Such programs can offer monetary incentives or energy credits to companies that curtail their energy usage to take pressure off of the power grid, usually during peak hours for consumption. Some programs allow companies to buy and sell the energy credits like commodities. Sellers curtail their energy and earn energy credits that they can sell into a market. Other big energy consumers then can buy the credits and boost consumption to meet their individual power needs. Ideally, the approach keeps capacity in balance and prevents utility companies from having to activate costly backup power plants to meet high peak demand.

▲ A cooling tower atop a Manhattan office building is just one piece of the power and utilities equation being monitored by ERS's technology.

The interest in managing power consumption has spawned companies such as ConsumerPowerline and Mosto Technologies Companies, two energy-asset-management firms that work with large users that want to tap in to the energy-incentives programs. To help those users, such companies have turned to ERS. Mosto is using the company's technology at sites such as Manhattan's Rockefeller Center. ERS President Drew Sweetak said his company's devices and node software are working to gather data on steam-heat usage at Rockefeller Center buildings.

"What is happening in New York is they are now going to charge usage fees for steam, versus in the past it was simply a flat rate," Sweetak said. "So they need to understand their energy consumption. They need to understand when their peaks are." Sweetak said that, using the technology, customers can avoid peak charges by becoming more aware of their energy usage and making adjustments—such as turning off lower-priority equipment at certain times.

At Rockefeller Center, ERS's devices pass along data wirelessly to an onsite system that transmits the data via the Internet to the company's server farm, where it is then aggregated, processed, validated, and passed back as actionable information that Mosto can use to manage the incentives for Rockefeller Center.

ERS also is seeing significant business through its relationship with ConsumerPowerline. In early 2008, ERS's technology already was deployed at seven ConsumerPowerline customer sites, and Sweetak said ConsumerPowerline would be using ERS's technology or services for 300 customer sites by the end of this summer. While an energy customer could pay a few thousand dollars per month for this type of granular data monitoring, the return in incentives could amount to hundreds of thousands of dollars annually, according to ERS officials.

Sweetak said nodes at a customer site could be set up to pass along data in several ways. A node could transmit the data wirelessly. It could transmit the data via cellular or analog modem. Or it could transmit the data via a hardwired network connection. The last method is useful for environments such as aircraft, another application area where ERS's technology is taking off. Sweetak said the company is working with aircraft companies Lockheed Martin, BAE, and Gulfstream to deploy ERS software and hardware for sensors used on military and surveillance aircraft—for applications such as monitoring the performance of cooling systems.

The Lockheed-BAE work involves a project known as CATB, which is a Boeing 737-300 modified to perform mission systems testing for the F-35 Joint Strike Fighter program. The Gulfstream work involves systems on electronic-warfare aircraft for foreign forces. Specifically, Gulfstream has provided Israel with aircraft for its Conformal Airborne Early Warning program and its Special Electronic Mission Aircraft program.

continued on page 3

Plugging In to Energy Savings from page 2

ERS's tiny technology—about the size of a matchbook—is perfect for aircraft, where space is at a premium. "It's cheaper. It's smaller," Sweetak said. "We can do it with off-the-shelf components."

Commercial transformation

ERS's success at commercializing its MDA-funded technology is somewhat surprising, given the company's direction five years ago. (See *MDA TechUpdate*, Winter 2003, "Tiny Wireless Computers Create Sprawling Networks.") At that time, ERS was positioning its technology largely as a tool for the R&D community. "What we found ourselves doing was becoming a research organization," Sweetak said. "You know, 'Hey look, here's a platform piece of code. Come, masses, to us and we will adapt it to your needs.' That really didn't have a lot of legs."

So ERS repackaged its technology—from a simple plug-and-play wireless device, suited to researchers who wanted to collect data such as river temperature or rainfall levels at various points in the field, to a product optimized for commercial and industrial users.

The improved device—which ERS has branded a Monitoring & Control Server (MCS)—still acts as the gateway for data from field sensors and actuators. But the connectivity is more versatile these days. MCS can work on a wired or wireless network, and stored data within the MCS can be retrieved via a network connection (Ethernet or cellular), via dial-up, or by simply plugging in a USB memory device. Inside the repackaged device, the core miniature software remains essentially the same, however.

After enhancing its device, ERS went out and found distributors, including Optima Energy, LLC, in Pennsylvania. "So with that kind of impetus, that's when it started to catch fire. People started to notice," Sweetak said. "Certainly there was a market force at play here, and that's energy." Through Optima, ERS is working with New York-based textile maker Louis Hornick Company. The work with Hornick involves eight ERS devices collecting data at about 40 points, gathering information on use of steam, natural gas, and electricity. In addition to its business with ConsumerPowerline, Mosto, and Optima, ERS also works with Energy Curtailment Specialists, a New York company that helps clients manage utilities consumption.

▲ The Monitoring & Control Server manages the collection and flow of data gathered from sensors in a building's utilities infrastructure.

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–Drew Sweetak, President of ERS

"Our R&D five years ago probably accounted for 95 percent of our income," Sweetak said. "That would be grants and research projects. Today, that has flipped to 95 percent commercial contracts. And that was hard."

In addition to MDA funding, the company has received financial help from partners that include the State of Maryland's Technology Development Corporation (TEDCO) and the Maryland-based LaMotte Company, which makes testing equipment for several industries. The involvement of TEDCO and LaMotte helped ERS get matching MDA SBIR funds through the FastTrack program. Several years ago, wireless giant Nokia also funded ERS with a convertible note that allowed the Annapolis company to conduct essential market research.

Sweetak said his company would continue to seek partnerships that allow the company to boost its commercial exposure. "It's important for us to tie up with larger companies at this point—whether that's an investment vehicle or a product strategy," he said. "So I would be very much interested in trying to solicit collaborative requests."

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