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# Wireless sensor test bed to provide guidelines for industrial systems

*By Ryan Weeks, INL Communications and Governmental Affairs*

For many companies, installing wireless technology inside factories, power plants and nuclear facilities can be risky. Although wireless is cheaper than cable connections, the flow of information is not as reliable.

That may not be a big deal when you're surfing the Net at home, but at a factory or power plant with automated control systems, even a five-second disruption could have serious consequences.

"A malfunction could cause a water tower to overflow," said John Buttles, a senior engineer at Idaho National Laboratory. "Or you could end up with the wrong colored pill in a bottle instead of aspirin."

Buttles is devising and testing wireless sensor networks (WSNs) to help ensure the transition to wireless is safer for power plants, factories and other facilities with automated control systems. He is using INL's Center for Advanced Energy Studies (CAES) to design a wireless sensor test bed where he can investigate vulnerabilities and weaknesses of these networks. CAES' wireless system, along with its laboratories and office space, provides an environment that is similar to an industrial setting.

"We want to make sure these devices are put in correctly, and the CAES environment best resembles a real-world installation," Buttles said.

WSNs are designed to help measure and manage the operation of an industrial control system. They are composed of a number of sensors or nodes that monitor environmental conditions such as temperature, pressure and volume. The nodes relay readings, known as sensory data, to a central point that connects to the control system, which then makes decisions based on the information.

Transmitting and receiving sensory data in a timely and consistent manner is key to keeping a control system running smoothly.

Buttles' hypothesis is that radio frequencies and cyber interferences can interrupt the flow of sensory data. Interferences that slow down, corrupt or even stop sensory data from reaching its destination can cause an entire control system to fail.

"And that is enough to ruin your day," he said.

At CAES, Buttles will monitor the effect that existing frequencies and interferences have on the networks he has installed. He also will operate multiple types of radio systems and generate interferences.

In addition, Buttles will collect data on different models and styles of wireless hardware. Multiple vendors design instruments with unique characteristics and protocols, and each design may have different rules that govern how messages are exchanged between devices. Buttles' research will mesh the different types of devices and determine the compatibility of each instrument.

Student researchers at CAES will then use software to simulate various settings and industrial environments. Researchers will create computer models of WSN behavior and predict their operation in different scenarios and conditions.

Buttles expects the research to establish design guidelines and standards — something the industry currently lacks — which will benefit both vendors and customers. He also hopes his research will improve the resilience of WSNs and, more importantly, move industry one step closer to ensuring the safety of our Nation's critical infrastructure control systems.

"That's what we do here — we figure out those tough problems that industries can not or do not want to," he said.

# CAES student selected as World Nuclear fellow

*By Ryan Weeks, INL Communications & Governmental Affairs*

University of Idaho Professor Akira Tokuhiro leaped from his seat and rushed down the hall at Center for Advanced Energy Studies (CAES) to see Olumuyiwa Omotowa, one of his doctoral students.

He had just heard the news — Omotowa had been selected to attend the 2010 World Nuclear University Summer Institute at Oxford University in England.

Chances of attending the institute are slim, especially for U.S. university students. The six-week program accepts mainly young professionals who are working in the nuclear industry and U.S. national laboratories. Only a few university students are invited to attend.

"Olu had less than a 1 percent chance of being accepted," said Tokuhiro, Omotowa's thesis advisor. "This is a pretty prestigious event."

Omotowa, a native of Nigeria, was equally shocked. He was one of 100 fellows asked to participate in this year's event.

"I was really excited," he said. "Surprised, but excited."

Omotowa is the first institute fellow from CAES and the University of Idaho.

At Oxford, he will be immersed in the nuclear energy and technology fields for six weeks, learning and networking with the some of the world's foremost leaders in science, engineering and the global environment.

Fellows also will tour various nuclear facilities in the United Kingdom and France, including a fast breeder reactor, an enrichment facility and fuel manufacturing and reprocessing plants.

"For me, this is a big deal," Omotowa said. "Attending the summer institute will further give me a drive towards some of the key things I'd like to achieve."

One of his goals is to bring nuclear power to Africa.

The continent has only two power reactors (South Africa's Koeberg units 1 and 2) and Omotowa believes more are needed to reduce its reliance on fossil fuels. Nigeria, he said, relies so heavily on fossil fuels that everyone graduates from school and thinks only of securing jobs in the oil industry.

At INL, Omotowa is working on two of Tokuhiro's projects that are funded by the U.S. Department of Energy's Nuclear Energy University Programs (NEUP). His research is focused on optimizing the safety of next-generation nuclear reactor designs. He hopes his work will someday help Africa embrace nuclear power.

"It will be very difficult to make that shift," he said. "Africa has no plans after the oil reserves are depleted."

Originally from Abuja, Nigeria's capital city, Omotowa completed his Master's degree in Environmental & Energy Engineering at the University of Sheffield in England. Once he completes his PhD at the University of Idaho, he will have a Pan-African-European-American perspective on nuclear energy.

And while the Summer Institute seeks a "synergistic and internationally diverse" mix of top young professionals, Tokuhiro believes that Omotowa's multi-continental experience was a contributing factor to his selection as a fellow.

"The institute is really focused on building future leaders for the global nuclear community, and Olu's experience puts him in a pretty unique position," he said.

## Did you know?

Idaho National Laboratory has strong ties to the World Nuclear University Summer Institute.

The first summer institute in 2005 was held in Idaho Falls. INL helped host the summer event, which included tours of several laboratories and research buildings.

The event moved to Stockholm, Sweden, in 2006, to South Korea in 2007 and to Ottawa, Canada in 2008.

England's Oxford University became the permanent home for the institute in 2009.

Michael Pope, an INL nuclear engineer, was selected as a World Nuclear University Summer Institute fellow in 2007.

## Publicly-funded Research

The ATR National Scientific User Facility and the Center for Advanced Energy Studies recently hosted a panel of technology transfer experts and entrepreneurs. The forum focused on publicly-funded research and how it increases the country's ability to compete globally.

Panel members: Todd Stevens of RenewableTech Ventures, Mike Altree of Convergent-Digital Corp, Cory Steffek of The Altira Group and Jason Stolworthy of INL Technology Deployment.

## My Amazing Future

More than 70 female eighth-grade students from Twin Falls- and Idaho Falls-area schools conducted experiments and learned about science and technology careers during the "My Amazing Future" event at CAES on February 2, 2010. To view a video of the event, go to www.inl.gov/.

# Energy training pays off for recent graduates

*By Ryan Weeks, INL Communications and Governmental Affairs*

In this tough economy, many college graduates are struggling to find full-time jobs that pay top wages. Graduates from the Energy Systems Technology and Education Center (ESTEC), an energy-technician education and training program started by Idaho State University's College of Technology in partnership with the Idaho National Laboratory and Partners for Prosperity, are bucking that trend.

ESTEC students are not only landing jobs – the program had a 92 percent placement rate as of November – but well-paying ones. Their average starting salary ranges from $50,000 to $75,000.

"ESTEC is an initiative that has exceeded our wildest expectations," said Richard Holman, deputy director of ESTEC and INL manager of Energy Workforce Initiatives.

With significant support from Idaho National Laboratory, the center was created to address the growing need for technicians within the U.S. energy sector. With help from the nonprofit group Partners for Prosperity, the program is finding recruits in the likes of displaced workers, homemakers, single parents, unemployed or underemployed individuals, under-represented populations and workers from declining industries.

"We especially wanted to change the face of the energy market sector by increasing the diversity of candidates going into energy careers and the involvement of Partners for Prosperity has been instrumental to our success in that regard." said Holman.

Many ESTEC students have worked in fields that have suffered significant layoffs or that offer limited advancement opportunity. The average ESTEC student is returning for a two-year Associate of Applied Science degree after at least a five-year absence from school.

Such was the case with Rana Jones.

Jones enrolled at ESTEC in the spring of 2008. She had earned a bachelor's degree in communications and worked in television and radio for several years. Her career was a "one- man show" that required early mornings and late nights without the benefits of a good paycheck.

Jones eventually left the radio and television industry and dabbled in a family business and in real estate, but was ready to find an interesting career with a good salary.

That opportunity came while she was helping her parents paint their house.

One of the neighbors, who happened to be an energy systems instructor at ISU,

***Graduates from the Energy Systems Technology and Education Center (ESTEC), an energy-technician education and training program, have the tools they need to land jobs in a tough economy.***

told her about the program. It piqued her interest enough that she toured the ESTEC facility in Pocatello and was impressed by the state-of-the-art equipment.

Jones registered for ESTEC and started on a path to a new career.

"This was completely different from any education I'd had before," she said.

Jones graduated in December with a degree in Energy Systems Instrumentation and Controls. She is now interviewing for a position within the energy sector and hopes her new training will guarantee her the life – and security - communications could not offer.

"Career-wise the energy industry offers a lot of rewarding benefits," she said.

The ESTEC program is a heavily hands-on, laboratory approach to instruction. Students graduating from the ESTEC programs have actually worked on the equipment in the classroom that they will be responsible for in industry.

To date, ESTEC has graduated 33 students with Associate of Applied Science degrees.

The ESTEC program is expected to expand again next fall, which is good news for the six people already on its waiting list.

The U.S. Department of Energy, through a Nuclear Energy University Programs grant, has provided funding to start a new Nuclear Operations Technician program. The nuclear program may be accepting enrollees as early as Fall of 2010.

ESTEC has also recently received $1.5 million through a federal green jobs grant program sponsored by the U.S. Department of Labor to develop a nine-month renewable energy technician program.

Students can begin enrolling in the new renewable energy program in fall 2011. Those who complete the program will be certified as renewable energy technicians and with additional classes, they can receive a degree in wind engineering or mechanical engineering technology.

## ESTEC by the numbers

**92% –** ESTEC's placement rate from August 2007 to November 2009

**33 –** Number of students who have graduated to date with an associate's degree in energy systems instrumentation and control engineering technology

**9 –** Number of students who graduated from ESTEC in December 2009

**$27 –** Average per-hour starting salary for ESTEC graduates

**4 –** The number of degrees ESTEC currently offers: energy systems mechanical engineering technology, energy systems wind engineering technology, energy systems electrical engineering technology, energy systems instrumentation and control engineering technology.

***Instrumentation and Controls Engineering Technology student Bonnie Fields works on wiring a Programmable Logic Controller during her final semester.***

They also have the option to pursue a Bachelor of Applied Science degree.

The new degrees will make it possible for even more students to earn the two-year Applied Science degrees and qualify for jobs in an expanding energy industry.

"These jobs are in demand and it takes half the time and half the expenses," said Jones.

To submit story ideas, calendar items or other information for upcoming CAES newsletters, please send an e-mail to Kortny.Rolston@inl.gov.