

Sensor Center

With an infusion of federal funding, Boise State has become a hotbed for sensor research. This past fall, the feds awarded a combined \$1.6 million in funding to five researchers for two projects with major implications involving national security.

With \$1 million in federal funding, four researchers at Boise State are working to develop a technology that will detect and analyze hazardous chemicals — including those used in chemical warfare.

In November, Congress approved funds for Boise State scientists to develop multipurpose sensors that will be used to detect harmful chemicals. The research team includes electrical engineering professor Joe Hartman, civil engineering professor Molly Gribb, chemistry professor Dale Russell and Michael Hill, a research professor with the chemistry department.

The researchers hope to produce devices that are small, rugged, and inexpensive; they will be about one thousandth the size and one hundredth the cost of conventional equipment used to test for chemical weapons. Moreover, they will detect a large number of different chemicals and not require a new sensor for each new compound.

The sensors were initially designed to recognize and monitor volatile organic compounds such as benzene or TCE in groundwater. But because chemical weapons agents — such as nerve agents, lung toxicants or mustard gas — can also be detected with these devices, there has been increased interest in their development in the wake of the Sept. 11 terrorist attacks on the United States.

The Boise State researchers proposed the sensors program to Congress through Sen. Larry Craig and the Idaho delegation. Craig, a member of the Senate Appropriations Committee,



included the \$1 million for the project in the Senate appropriations bill that funds the Environmental Protection Agency.

According to Hartman, the project's lead investigator, the combination of inexpensive, multipurpose, miniaturized sensors can be used to provide accurate and timely detection of chemicals at a reasonable cost. The sensors will be manufactured with the techniques used for making semiconductor integrated circuits.

Hartman says the development of the sensors is not breakthrough technology, but an improvement to a technology already used in the computer and electronics industries. A primary objective

Boise State researchers (from left) Dale Russell, Michael Hill, Molly Gribb and Joe Hartman are involved in research projects in sensor technology. Not pictured is Susan Burkett.



MICHAEL HERTZOG, INEEL

of the research, he says, is to mass produce the sensors at a lower cost.

Research and development of the sensors should take one to two years.

Once produced, the devices could play a major role in the detection of minute quantities of environmentally hazardous spills and leaks. They may also be used in aircraft luggage and cargo holds, ship holds and other locations where continuous monitoring for potentially hazardous substances may be necessary to head off possible terrorist threats. In addition, they may be used on an emergency basis in densely occupied places such as subways, theaters and stadiums.

— Bob Evancho

Nuclear compliance focus of DOE grant

Imagine this scenario: An airplane flies over foreign territory and drops a small, rugged instrument into a wastewater holding tank on the ground. The instrument quickly detects whether uranium or other elements used to make nuclear weapons are present. The information is beamed to a satellite and officials on the other side of the globe verify whether the country is violating terms of a nuclear nonproliferation treaty.

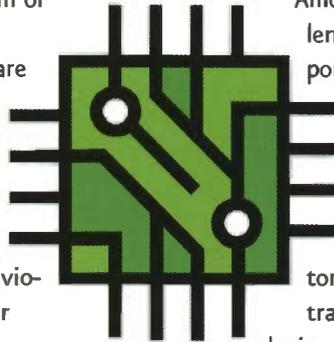
Science fiction? Hardly. A new research project at Boise State is working to develop this instrument with a three-year, \$600,000 grant from the U.S. Department of Energy.

Boise State is one of only three universities in the nation selected by the DOE in a recent round of funding to develop new methods for verifying compliance with nuclear nonproliferation treaties. The project builds on the university's ongoing research efforts to develop miniaturized sensors that can detect subsurface contamination, such as that at the Idaho National Engineering and Environmental Laboratory. The DOE will award \$200,000 this fiscal year for the project, with the grant renewable for two additional years.

"We were up against the very stiffest competition," says Dale Russell, a Boise State chemistry professor and the project's principal investigator. "We're fortunate to have this project here."

Russell and Boise State chemistry research professor Michael Hill, the project's co-principal investigator, will develop a polymer coating that can be used to detect the presence of uranium or other elements used in nuclear weapons. Susan Burkett, a Boise State electrical engineering professor, will then work to integrate the polymer onto silicon-based tran-

sistors to form the device. Russell Hertzog, an INEEL physicist with a background in well-logging technology, will contribute expertise in subsurface applications.



Among the researchers' challenges is to design a portable instrument that is rugged and versatile enough to drop from airplanes or down boreholes, or be used as a hand-held detector. Coupled with radio transmission capability, the device could quickly beam results to a satellite, and it could also be left in place for continuous monitoring.

"The device could be used clandestinely, but the beauty of it is that it works so fast that even if someone sees it being dropped, they won't be able to remove it before the signal has already been transmitted," Russell explains.

The DOE grant builds on earlier research by Russell, who holds one of the world's largest individual patent portfolios on a chemical process that attaches or removes electrical charge to particles suspended in fluid. Russell also developed a "selective mercury electrode" that is a forerunner to the current project; she already holds one patent and has another one pending on this type of analytical device.

While the DOE grant is focused on verification of nuclear nonproliferation treaties, the technology the Boise State researchers are developing has many potential uses, including the detection of chemical warfare agents, heavy metals and other subsurface contaminants.

"This project dovetails with other research we're doing here," says Russell. "It has many potential applications."

— Janelle Brown