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Artificial jellyfish, explosives sensor, seabed battery among projects being developed

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Artificial jellyfish, explosives sensor, seabed battery among projects being developed through URI Center of Excellence in Undersea Technology

Research center a partnership with Naval Undersea Warfare Center

KINGSTON, R.I. – December 6, 2007 – When researchers at the Naval Undersea Warfare Center in Newport began to investigate how to create a covert network of widely-distributed underwater sensors, they imagined attaching the sensors to artificial jellyfish that could maintain their place in the water while passing information from one sensor to the next.

So the scientists turned to the Center of Excellence in Undersea Technology at the University of Rhode Island, which was established last January in partnership with NUWC to collaborate on a wide range of innovative research and education initiatives. The Center linked NUWC with two URI oceanographers and a Providence College expert in jellyfish locomotion to explore this novel idea.

"To maximize the utility of these sensor systems and deploy a large number of them, it's important to put them on an inexpensive platform. That's where the jellyfish idea came from," explained Malcolm Spaulding, director of the Center and a URI professor of ocean engineering. "An artificial jellyfish would need to be made of simple materials and be acoustically transparent. The key is understanding how jellyfish move and whether they can stay in one place despite tidal currents and waves."

While still in its early stages, this project is a unique example of the diverse initiatives under way just nine months after the Center of Excellence was established.

"Rhode Island and the rest of southern New England has a wealth of marine and defense companies and an abundance of oceanography and ocean engineering researchers to call upon for assistance on almost any underwater project that could be imagined," Spaulding said. "We're one of the hubs of undersea technology research in the country."

Among the other projects in progress are:

- a chemical sensor that can detect minute quantities of explosives in the water (a mine on the hull of a ship or a diver carrying a bomb, for instance);
- a battery that uses the chemical reactions from bacteria living in the seabed to generate small amounts of electricity to power offshore sensors or other devices;
- an emergency radio beacon powered by a seawater battery that harvests the motion energy of waves to extend the life of the signal; and
- a non-toxic method of preventing organisms from fouling underwater equipment and vehicles.

One of the Center's initial projects, led by the Rhode Island Economic Development Corporation (RIEDC) and involving a number of Rhode Island-based businesses, was the first phase of the development of a prototype of an undersea perimeter defense system that will detect, classify and respond to undersea threats against critical infrastructure like ports and military facilities on shore.

In addition, testing began this fall in Narragansett Bay on an integrated system of undersea sensors and data management tools that are being linked to oceanographic measurement devices and underwater vehicles in a high-tech project called the Ocean Response Coastal Analysis System. Initial demonstrations of the project, led by URI Marine Research Scientist Al Hanson, have shown the capability to monitor dissolved oxygen levels using remotely controlled sensors deployed on bottom-mounted vertical profilers and autonomous underwater vehicles. When completed in five years, it will provide real-time data, analysis and visualizations of a wide range of coastal conditions and observations. Further testing is planned for the spring.

"Few of these projects would have advanced as quickly as they have without the support of the Center of Excellence to coordinate funding, formation of research teams, and associated administrative details," said Spaulding. "The Center has become a vital vehicle for fostering collaboration between academic institutions, industry and the Navy."

Funding for these projects comes mostly from NUWC, with additional support from URI, RIEDC, the U.S. Office of Naval Research and the U.S. Naval Research Laboratory.

The Center doesn't focus exclusively on research and testing, however. It has also launched an on-site graduate degree program in engineering for NUWC employees interested in furthering their education. Classes are offered in the evening in Newport to make it convenient for potential students to participate. Twenty NUWC employees are already enrolled in the program, expanding graduate student enrollment in URI's College of Engineering by 15 percent.

"This program offers our employees the unique opportunity to obtain an advanced degree while continuing to fulfill their work responsibilities," said NUWC Training Officer Jeff Feaster. "In all cases, the students will focus their thesis on an evolving subject area for NUWC Division Newport, Distributed Netted Systems. This tailored course of study is beneficial to both the students and the organization as it facilitates the evolution of the Division and its employees."

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