EXPLORERS OF THE DEEP

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Innovative marine technology developed by UVic engineers will help us all become ocean explorers

by Shannon McCallum

University of Victoria mechanical engineer Colin Bradley barely has time to come up for air these days. But if all goes as planned, the instruments he designs won't be coming up for air for a very long time.

Bradley, who is the Canada Research Chair in Design and Computational Modelling, directs a team of engineers that is developing specialized equipment for use in oceanographic studies. The team's main focus is the design of equipment for underwater cabled observatories—two of which are being built virtually on his doorstep.

UVic is the lead institution in the VENUS (Victoria Experimental Network Under the Sea) project and the Canadian leader of the NEPTUNE (North-East Pacific Time-series Undersea Networked Experiments) project. Both are interactive cabled observatories being installed off the B.C. coast.

The VENUS and NEPTUNE observatories will consist of a network of instruments on the ocean floor. These instruments, connected to shore by cable, will continuously relay measurements, images and sounds in real time to land-based computers, providing researchers with unprecedented amounts of data. The cables will also deliver power and commands to instruments, lights, and remotely operated vehicles.

The deep ocean is an inhospitable place for research. With ocean temperatures just above freezing, crushing pressures and barely a smattering of sunlight, oceanographers depend on engineers like Bradley to build instruments and equipment robust enough to function in these harsh environments.

In one of their latest projects, Bradley and his team have designed an autonomous underwater vehicle (AUV). Research assistant Jeff Kennedy developed the mechanical design and control systems, and graduate student Emmett Gamroth provided the software and electronic components.

These free-swimming, battery-powered vehicles can be customized to carry a variety of oceanographic sensors and instruments. "Underwater vehicles have the potential to advance the kind of science that will be conducted with cabled observatories," says Bradley.

For his next project, Bradley will work with researchers at McGill University to transmit video images from around the VENUS site back to land-based computers. The images will be relayed by a high-definition camera attached to a tethered underwater vehicle.

"Since this transmission will be happening in real time, scientists on land will be able to control the vehicle and see the imagery at the same time," says Bradley.

Before this scenario becomes a reality, however, there are some engineering challenges to overcome. A big hurdle is how to navigate an AUV in a dark environment where ocean currents can steer it off course.

It's a hurdle that Gamroth may have found a way around. He has designed an underwater positioning system, similar in concept to the global positioning systems (GPS) that are now commonplace in today's road vehicles.

"We expect this system will be tested through VENUS within the next year," says Bradley.

With the installation of the first leg of VENUS in Saanich Inlet next month, Bradley is enthusiastic about what the future holds.

"These cabled observatories will change the way ocean sciences are conducted," he says, "and our team of engineers will see the benefits, as well. We're thrilled about exploring the new opportunities in underwater vehicle research that these observatories are giving us."

Bradley's research is funded by CANARIE and the B.C. Innovation Council.

This article was written by Shannon McCallum, a student in the faculty of graduate studies, as a participant in the UVic SPARK program (Students Promoting Awareness of Research Knowledge).

SPARK

DIANA NETHERCOTT

L-r, Bradley, Kennedy and Gamroth with their underwater vehicle.

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The University of Victoria is recognized internationally for its excellence in earth, ocean and climate systems research and education. With its unique location, rich marine environment, and proximity to other key marine research centres, UVic is taking a lead international role in ocean sciences and the development of marine technologies.

EDGEwise

- VENUS is the world's most advanced seafloor observatory. Starting in January, anyone with an Internet connection can view live data, sounds and images from the ocean depths at **www.venus.uvic.ca**.
- The first leg of the VENUS seafloor observatory will be installed next month in Saanich Inlet off the Institute of Ocean Sciences in Patricia Bay. It will support studies of ocean processes and marine ecosytems in a confined body of water.
- The second leg of VENUS will be deployed in late 2006 in the Strait of Georgia, one of Canada's busiest and richest waterways. Initial studies will include the dynamics of water movement, animal migration, and sediments in the Fraser River delta.
- Operating 24 hours a day for approximately 20 years, VENUS will support studies on long-term ocean change; tides, currents and ocean mixing; fish and marine mammal movements; seismic activity; seafloor community ecology; underwater noise pollution; sediment and slope dynamics; and plankton behaviour.