

Students create underwater remotely operated vehicle for use in scientific research

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During the past two years, five Port Townsend High School students have invested more than 500 hours working intently with a local entrepreneur to develop, design and construct a highly specialized research vessel capable of diving to the depths of Puget Sound to conduct important marine research.

With a simple goal of giving students an opportunity to apply the disciplines of science, math and English on a real world engineering project, Gary McLuen, a Port Townsend entrepreneur, has contributed his time, his shop and about \$15,000 of his own funds to help five students transform a novel concept into a viable scientific research craft.

The unmanned, underwater remotely operated vehicle, referred to as the ROV, will be demonstrated this Friday, May 20, at 3:00 p.m. at the Pacific Northwest National Laboratory Marine Research Operations facilities in Sequim. At that time, McLuen and the students will give the unique equipment to the U.S. Department of Energy for PNNL to conduct research in the Puget Sound.

The project, conducted entirely independent of their high school curriculum, required the students to apply knowledge learned in the classroom, as well as hands-on skills learned in the field. For instance, the students designed and fabricated components using a computer controlled machining center, learned aluminum welding, and calculated stress and pressure requirements needed for deep water diving. Each task was completed under the careful guidance and supervision of McLuen,

Eric McRae, who assisted with the computer software design, and Port Townsend High School science teacher Tim Behrenfeld.

"Actually, the ROV is quite sophisticated, providing a suite of high-end components and capabilities expected to be extremely useful for scientific research," says McLuen. "The project is more akin to a college or professional endeavor than that of a team of enthused science and engineering high school students."

Instrumentation equipped on the ROV collects and stores real time data such as the levels of dissolved oxygen in water, vehicle depth, water temperature, turbidity and pH levels. Recorded data is stored on a hard drive in an Excel file format, and can be graphically displayed on the computer's monitor.

"The operator can maneuver the ROV by watching a laptop monitor, which offers views from cameras mounted on the front and rear of the underwater vehicle," says Behrenfeld. "A digital compass displayed on the computer screen provides the vehicle's true heading as well as a tilt-and-roll reference to help the operator avoid getting lost or disoriented." Four thrusters powered by an on-board battery can take the vehicle wherever it wants to go, added the science teacher.

While tethered to the computer by a flexible Ethernet cord and maneuvered via a trackball, the ROV can travel to a depth of more than 300 feet thanks to a rugged design calculated by students to withstand the great pressures of exceptionally deep dives.

"Prior to beginning, the students met with PNNL staff as their 'client' to determine our needs and specifications," noted Dick Ecker, director, PNNL Marine Science Laboratory. "We reviewed their draft plans early in the process, and visited their shop periodically to inspect their progress. Interacting directly with the students helped them learn a great

deal about working with a client."

For two years straight, the students gathered each Wednesday afternoon and every other Saturday to design and fabricate the vehicle affectionately referred to as Puma. During that time, McLuen took pleasure in letting the kids struggle a little and occasionally fail, requiring them to use math and engineering like scientists do to solve problems, devise theories and find answers to difficult questions.

Andrew Haines, Cody Blevins, David Kunz, Dan Schulz, and Brahm Lichty, all Port Townsend High School students, are preparing to go to college this fall. Each has chosen areas of interest in the science, engineering and math fields. "These students have exceeded my wildest expectations," says McLuen. "They'll make terrific engineers someday soon."

But first, they'll hand over their project to the PNNL research team, which is anxious to put the ROV through it paces. "We anticipate deploying it right away to help inspect the growth and health of newly planted stands of eelgrass," says Ecker. With its sophisticated capabilities, Ecker says it may also be used in locating, monitoring and mapping out areas on the Hood Canal that lack properly oxygenated water; an important issue ripe for research. "This vehicle will become an important resource for PNNL scientists as we work to examine and sustain our precious Northwest marine ecosystem," Ecker added.

Source: PNNL

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