Undersea Gliders: Valuable New Tool in Marine Research

The Pacific Ocean constantly throws challenges in the face of marine scientists: from hypoxia-caused marine "dead zones" to unusual patterns of ocean upwelling that have changed the migratory behavior of Pacific Northwest salmon.

But Oregon State University researchers are making use of a new tool that is better helping them understand the world's vast oceans—undersea gliders that patrol the waters of our coasts and record critical data. These gliders differ from other autonomous underwater vehicles, or AUVs, because they lack propellers or tethers.

In fact, other than their deployment and pickup, they don't even require an accompanying vessel.

"The technology is pretty incredible," said Jack Barth, a professor of oceanography at OSU. "We can literally program them to run underwater for three to five weeks, cruising from the nearshore to over the continental slope and back while taking all kinds of sophisticated measurements.

"And every six hours, the glider will pop up to the surface and call in to a computer at our lab via satellite phone and send home the data," Barth added.

The gliders are about seven feet long, weigh about a hundred pounds, and carry two computers, several oceanographic sensors, communication equipment and batteries for power. But the propulsion system is the key. The gliders are propelled by buoyancy changes, rather than by a propeller, which lessens the overall energy consumption. By displacing seawater, the gliders increase their volume and become more buoyant. Or they can decrease their volume and become heavier, sinking lower in the water.

Small wings on the gliders translate some of that vertical motion into forward motion, Barth pointed out.

"It's much like a sailplane in the atmosphere," he said. "Our gliders can go back and forth over a 90-kilometer transect across the continental shelf in about a week, moving at about half a nautical mile per hour. Their value in research is enormous—and will continue to grow."

Kipp Shearman, an assistant professor in OSU's College of Oceanic and Atmospheric Sciences, says the gliders can dive to a maximum

Assistant Professor R. Kipp Shearman and summer student Alexandra Cwalina prepare a glider for deployment off Newport, Oregon. Phto by Tristan Peery (OSU).

Autonomous underwater glider operated by Oregon State University capable of measuring physical and biological properties of the upper ocean. Changes in buoyancy make the glider move up anad down while the wings allow the vehicle to move forward. Satellite cell phone and GPS antennae are contained in the tail fin. Photo by Susan Holmes (OSU).

depth of about 200 meters, perfect for studying Oregon's near-shore waters. They are typically faster and more maneuverable than their deep-ocean cousins, which can stay at sea for 3 to 6 months and dive to 1,000 meters.

Shearman and Barth are among a small group of researchers worldwide using this new technology.

"Our gliders can also 'dead reckon' their positions while they are underwater—steering to a desired point much like a captain would pilot a boat," Shearman said. "And since the gliders are fixed with a GPS system, we can estimate ocean currents by calculating the difference between the dead-reckoned position and the GPS fix."

These gliders cost about $100,000—primarily because of the sophisticated instrumentation that measures such things as chlorophyll concentrations from phytoplankton, the amount of suspended particles in the water, temperature, salinity, and oxygen concentrations that help monitor hypoxia. Such undertakings used to require a research vessel, complete with researchers and crew at an average cost of about $20,000 a day. "In five weeks, you've saved $600,000," Barth said. "And no one gets seasick."

The OSU researchers recover and deploy the gliders from the university's 54-foot research ship, the R/V *Elakha*, but have used smaller vessels as well, including a jetski and a rowboat! Since April 2006, a glider has been operating nearly continuously off Newport, Ore. New glider projects have been started off both northern and central Chile. As of July 2009, the OSU glider fleet has spent over 1100 days at sea, collected over 100,000 vertical profiles of data, while traveling over 25,000 km, the equivalent of two-thirds of the way around the Earth. Long-term plans include a fleet of gliders patrolling off the Oregon and Washington coasts, silently collecting invaluable oceanographic data.

"This is the future of observing the ocean," Shearman said. "There will always be a need for ships, but there will come a time when gliders are deployed throughout the world's oceans because they are tremendously cost-efficient and they can crank out critical data 24/7 that scientists need to address issues ranging from climate change to dead zones."

OSU researchers recover an underwater glider from the stern of OSU's coastal research vessel the R/V *Elakha*. Photo by Jack Barth, OSU.

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http://gliderfs.coas.oregonstate.edu/gliderweb