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## Undersea Realm of the Robofish: cutting edge technology explores the depths of Monterey Bay

Howe, Kevin

Monterey, California: Naval Postgraduate School

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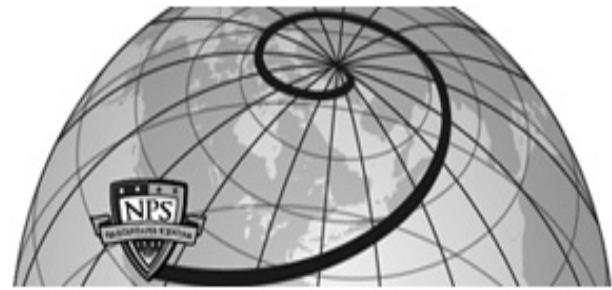
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### Undersea Realm of the Robofish

Thursday, August 24, 2006

#### Cutting-edge technology explores the depths of Monterey Bay

Story by KEVIN HOWE, Monterey Herald Staff Writer

Below the surface of Monterey Bay, schools of robot "fish" swim in circles, foraging for data that will allow scientists to map the ocean in three dimensions and reveal its secrets.

Monterey Bay Field Experiment 2006, which started in July, has drawn teams of scientists and engineers from both coasts to Monterey Bay Aquarium Research Institute in Moss Landing. The project is testing new surveying and measuring equipment that gathers information believed to lay the groundwork for predicting undersea conditions and ocean currents.

Monterey Bay is "the unifying theme" of a range of scientific projects staging out of Moss Landing Harbor that involve a fleet of underwater "gliders," unmanned submarines, diving buoys, aircraft and research ships, said field experiment program manager Thomas Curtin of the Office of Naval Research.

The devices continually measure and record water temperature, salinity, sound, optical changes, oxygen and layered levels of sea life to give scientists a basis for mathematical modeling of the bay and ocean, he said.

All of these factors relate to one another.

"None are independent," Curtin said. "They all affect the other."

Building a scientific "map" of the ocean will allow scientists to eventually predict ecological changes, disasters and even threats to national security, he said.

The latest undersea glider, called the The X-Ray Glider, is a submersible "flying wing" with a 20-foot span that designers hope will function independently for weeks in the ocean. It made its first appearance this week in Monterey Bay.

James Luby, principal electrical engineer and affiliate professor of engineering at the University of Washington in Seattle, showed off the device, which he said can carry a variety of sensors over long periods and dive to 1,000 feet.

It has no outside moving parts, he said. It literally soars through the water, using lead weights and ballast tanks to shift its mass to rise or dive, with no active propeller or jets to drive it.

The X-Ray Glider, developed by Gerald D'Spain and Richard Zimmerman of Scripps Institute of Oceanography's Marine Physical Laboratory, has made 18 dives, all of them shake-down cruises, to see how long it can function, Luby said.

**Other instrument-carrying undersea gliders, shaped like conventional aircraft with wings, fuselage and tail, have been deployed by Princeton University and the Naval Postgraduate School in Monterey, Scripps Institute and Woods Hole, along with MBARI's own Dorado robot submarine.**

Scientists and engineers studied swimming patterns of schools of fish to program the robots to swim in

similar foraging circles and gather data, said Princeton University scientist Naomi Leonard.

**The advantage of the gliders is that they can operate for long periods, surfacing periodically to transmit data. They have performed "remarkably well," said Steve Ramp of NPS. Their disadvantages, he said, are that the gliders are slow and carry a small payload, and their low speeds make them subject to being carried off course by undersea currents.**

**The Dorado is faster, bigger and carries more instruments, he said, but can only operate for 12 hours at a time.**

**The Navy school flies an instrument-equipped twin-engine plane low over the water for wider-ranging surface measurements, he said.**

"The ocean affects us," said Jim Bellingham of MBARI. "It's the memory of our climate. The ocean is the messenger for the consequences of our actions."

The ability to measure conditions below the surface and retrieve data by satellite has changed exponentially since NPS and MBARI began undersea monitoring in 1996, he said.

"It's a very different world from 10 years ago," he said.

Information goes directly to scientists and researchers on both coasts, and to anyone who wants to tune in to the satellite data, Bellingham said.

Most of the ocean's actions take place "down where you can't see," he said, and the undersea robots of Field Experiment 2006 can lift the ocean's veil of secrecy.

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