

# **AUV-Based Measurements of Turbulence in the Oregon Coastal Ocean**

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## **LONG-TERM GOALS**

Our long-term goals are to understand the mechanisms of turbulence and mixing in the coastal ocean environment sufficiently well to be able to incorporate mixing processes in coastal circulation models as sub-grid scale parameterizations. We plan to achieve our long-range objectives by collecting concurrent data sets of microscale, finescale, and mesoscale variables from sensors mounted on an autonomous underwater vehicle.

## **SPECIFIC OBJECTIVES**

The main objective of this study is to demonstrate the feasibility of simultaneously collecting microstructure, hydrographic, and velocity data from an autonomous underwater vehicle (AUV) platform and ancillary data from a small boat in Oregon coastal waters.

## **APPROACH**

The approach is to collect data off the coast of Newport, Oregon using an AUV acquired from Bluefin Robotics in combination with a sensor payload section developed at OSU. Our field program has been delayed until November, 2002, due to delays in the delivery of the AUV from Bluefin Robotics.

## **WORK COMPLETED**

Work this year has focused on several activities: (1) interacting with Bluefin Robotics to assure delivery of a platform from which we can obtain high-quality oceanographic data, (2) development of our own sensor-payload section, (3) integration of our sensor payloads with the Bluefin platform, and (4) developing and testing strategies for successful deployment of the platform from a small vessel in our local waters.

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Working with the shell of a mid-body parallel section, provided by Bluefin, we designed and assembled instrument mounts and buoyancy elements to produce a neutrally buoyant payload section (Figures 1 and 2). Instrumentation in this section includes: an upward-looking 1200 kHz ADCP, an ac-9 optical spectrometer, a downward-looking backscattering sensor, an upward-looking irradiance sensor, and a downward-looking video camera system, as well as a data logger, battery packs, and a junction box for power and data transmission to/from the AUV's main electronic housing. Some of the payload section sensors use AUV power but record data internally (e.g. the 1200 kHz ADCP), while data from other sensors (e.g. ac-9) are recorded by the AUV main vehicle computer for convenience in merging with the vehicle CTD data.

The microstructure sensing package, MicroSoar, was updated and configured for mounting at the forward end of the AUV nose cone (Figure 2). This included removing a dc-dc power converter, replacing data storage devices to minimize power usage and making a new pressure case. In order to avoid possible flow distortion by the AUV, the MicroSoar sensors are located about one foot in front of the main body of the AUV (Figure 2).

OSU and Bluefin engineering efforts were coordinated in order to satisfy the requirement of high-quality CTD data. In order to minimize the effects of conductivity cell thermal inertia, a CTD sensor mount was designed which incorporates a pumped flow-collar around the conductivity cell. This CTD sensor mounting was designed at OSU and implemented at Bluefin using common CAD software.

We developed and successfully practiced AUV deployment and retrieval methods, using a dummy AUV (with approximate AUV dimensions and weight) aboard OSU's 54-foot vessel R/V Elakha. These tests were conducted off the coast of Newport, OR in July 2002.

## **RESULTS**

We have developed a sensor payload section for use with a Bluefin Robotics Odyssey III Autonomous Underwater Vehicle (AUV).

## **IMPACT/APPLICATIONS**

None

## **TRANSITIONS**

None

## **RELATED PROJECTS**

None

## **REFERENCES**

None

## **PUBLICATIONS**

Wijesekera, H. W., J. S. Allen, and P. A. Newberger, 2002: Modeling study of turbulent mixing over the continental shelf: Comparison of turbulent closure schemes. J. Geophys. Res. (recommended for publication).

Wijesekera, H. and T. J. Boyd, Upper Ocean Heat and Freshwater Budgets, in Encyclopedia of Ocean Sciences, J. H. Steele, S. A. Thorpe, and K. K. Turekian, eds., Academic Press, 2001.

## **PATENTS**

None



*Figure 1. Payload mid-section of AUV*



*[Exploded view of payload mid-section of AUV, showing sensor layout]*

