Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 2003		**00-00-2003 to 00-00-2003**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Instrumentation in Support of Autonomous Glider Operations	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Physical Oceanography Department,,Woods Hole Oceanographic Institution,,Woods Hole,,MA, 02543**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**3**	

Instrumentation in Support of Autonomous Glider Operations

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Grant #: N00014-03-1-0736
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LONG-TERM GOALS

Our long-term goal is to develop an efficient, relocatable, infrastructure-free ocean observing system composed of high-endurance, low-cost gliding vehicles with near-global range and modular sensor payload. Particular emphasis is placed on the development of adaptive sampling strategies and the automated control of large glider fleets operating within the framework of an autonomous oceanographic sampling network.

OBJECTIVES

This is a DURIP award. Support was requested to purchase acoustic communications equipment, optical sensors, and CTD calibration instrumentation in support of autonomous glider operations. Acquisition of this new instrumentation will support continuing ONR-sponsored research of mesoscale front and eddy dynamics and related biological implications.

APPROACH

The WHOI Glider Lab presently maintains and operates a fleet of 12 autonomous gliders, torpedo-shaped winged autonomous underwater vehicles (AUV) built by Webb Research Corporation (WRC) of East Falmouth, MA. The glider is capable of carrying a range of high-quality scientific payloads including physical, optical, and acoustic sensors on missions exceeding 25 days in length. Through a DURIP solicitation we requested support to enhance the functionality of our fleet through addition of acoustic modems to enable both inter-vehicle communication and application of the glider as an undersea gateway platform. We also requested support to augment each glider's standard sensor suite with a Wet Labs bb2f chlorophyll fluorometer and two-channel backscatter sensor, and for new conductivity and temperature sensors for our shore-based calibration facility to enhance the accuracy of glider-based CTD measurements.

WORK COMPLETED

Twelve WetLabs bb2f fluorometer/backscatter sensors were procured, one for each vehicle in the WHOI glider fleet. Electrical and data connections were designed and installed and control software was modified as required. Preliminary planning for implementation of acoustic communication hardware was completed. New Sea-Bird temperature and conductivity reference sensors were procured and installed in our shore-based calibration tank.

RESULTS

Performance of the new sensors during the summer 2003 AOSN-II / Monterey Bay Predictive Skill Experiment was excellent. A unique dataset consisting of more than 10,000 vertical profiles was collected along nearly 5,000 km of horizontal trackline. Due to rigorous pre-deployment calibration using the new Sea-Bird reference sensors the quality of the CTD data collected during AOSN-II was excellent.

IMPACT/APPLICATIONS

Addition of acoustic modems will expand the utility of the glider fleet as a mobile component of an Autonomous Oceanographic Sampling Network (AOSN). Trials of a glider outfitted with a Benthos Telesonar modem were recently completed in Buzzards Bay by Webb Research Corp. under the guidance of SPAWARSYSCEN San Diego. The tests demonstrated both subsurface communication with a glider and functionality of the acoustically-linked glider as a mobile gateway platform capable of providing over-the-horizon control of subsurface assets.

The Wet Labs bb2f is a miniaturized, low-power chlorophyll fluorometer and two-channel (470nm, 715nm) backscatter sensor developed as part of a collaborative National Oceanographic Partnership Program research effort with scientists at the University of Washington and the University of Maine. Wet Labs has since transitioned the device to a commercial product designed specifically for use in an AUV. This instrument enables the estimation of chlorophyll concentration, and by extension, a measure of primary productivity. Due to its endurance and mobility, the glider is uniquely suited to make distributed observations of biological and physical parameters over extended periods of time. Including this instrument as a standard component of the glider sensor suite will facilitate ongoing efforts to adaptively sample biophysical properties in evolving mesoscale features in both mid-ocean and littoral environments.

RELATED PROJECTS

An Autonomous Glider Network for the Monterey Bay Predictive Skill Experiment / AOSN-II (D.M. Fratantoni, N00014-02-1-0846)

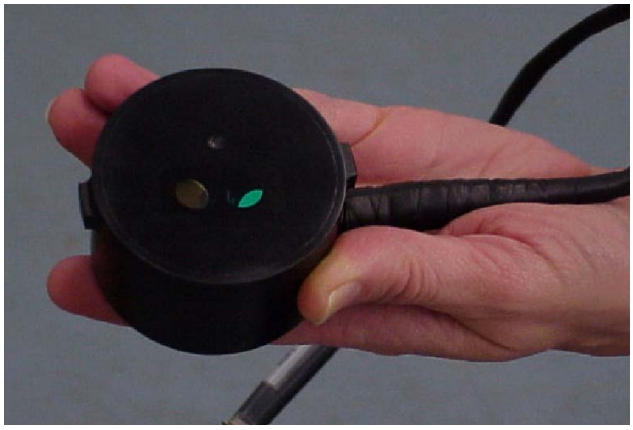

Figure 1: Wet Labs bb2f optical sensor package.