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AOSN MURI: Field Use of SLOCUM a Long Range Clean Glider Propelled by Environmental Thermal Energy

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LONG TERM GOAL

Our goal is to contribute an exploration and monitoring vehicle of very great range and endurance to the AOSN toolbox. The SLOCUM glider, which harvests its propulsion energy from the ocean environment, will operate on ocean basin and 5 year scales complimenting AOSN programs of smaller spatial and temporal focus. A further goal is SLOCUM gliders of sufficient simplicity and low cost that they can be used in quantity, 50-500.

OBJECTIVE

Deploy the first group of SLOCUM gliders able to demonstrate a small fleet operation and quantify the hydrodynamic performance, observational, communication, and costs capabilities, each demonstration embedded within productive ocean experiments.

APPROACH

Demonstrate and quantify step by step the unique SLOCUM capability, starting with the highest risk, least predictable design components. Vehicle design and operation is emphasized, and we will join with other groups to answer many community wide questions – for example, sensor biofouling and communications.

WORK COMPLETED

Our contract started February 25, 1998. Already in hand were trials of vehicle gliding and hydrodynamics (reference 1), and of thermal propulsion (reference 2), so we moved quickly to combine the glider and engine, and were able to deploy it in a series of trials in Seneca Lake starting 25 August, 8 months after contract receipt.

The trials were intended to show a first integration of vehicle and thermal propulsion, and recover flight and engineering data to guide the design of an ocean going glider.

RESULTS

Over a 5 day trial at Seneca Lake, we completed 16 glider dives or excursions, after 2 initial trials, dives were to 120m (lake bottom approximately 180m). Nine dives in “hands off” sequence, using an

internal flight recorder, were successfully executed with all of the propulsion energy for a dive being harvested from the thermocline heat flow during the preceding dive.

An ocean glider is now in preparation, intended for a "station keeping" deployment near the Bermuda long-term hydrographic station. It is planned to dive to 1200m, 6 times per day, collecting CTP data, and using GPS reception, it will circle the station nominal position.

A second experiment to observe the fine scale structure of salinity steps near Barbados is being discussed with Ray Schmitt and Phil Richardson at WHOI is being evaluated. In this plan the vehicle trajectory, both horizontal and vertical will adaptively sample the layers of a strong gradient. If successful, a follow on experiment would use a small number of gliders operating in concert.

RELATED PROJECTS

This project is part of the Multidisciplinary University Research Initiative: "Real-Time Oceanography with Autonomous Ocean Sampling Networks: A Center for Excellence".

REFERENCES

1. Webb, D. C. and P. J. Simonetti, A Simplified Approach to the Prediction and Optimization of Performance of Underwater Gliders. Proceedings of the 10th International Symposium on Unmanned Untethered Submersible Technology, Sept. 1997.
- 2: Simonetti, P. J., SLOCUM: A Long Endurance Ocean Profiler Powered by Thermocline Driven Engine. Sea Technology, pp. 17-21, February, 1998