

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YYYY) 2/20/2019		2. REPORT TYPE Final Technical		3. DATES COVERED (From - To) 08/15/2015 - 11/30/2017	
4. TITLE AND SUBTITLE Autonomous Seagliders for Extended Missions under Arctic Sea Ice				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER N00014-15-1-2889	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Craig Lee				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Washington – Applied Physics Laboratory 4333 Brooklyn Avenue NE Seattle, WA 98105-6613				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research (Code 322) Ocean Atmosphere & Space Research Division 875 North Randolph Street Arlington, VA 22203-1995				10. SPONSOR/MONITOR'S ACRONYM(S) ONR	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT: Distribution Statement A: Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Rapid Arctic environmental change, exemplified by the recent, dramatic reduction in summertime sea ice extent, highlights the need to improve dynamical understanding of the dominant processes as a step toward developing both tactical and strategic forecast capability. The remote environment, ice cover and extreme operating conditions challenge conventional observing technologies and limit data availability beneath the ice and within the marginal ice zone, particularly during transition seasons (break-up and freeze-up). To provide observational capability in ice-covered environments targeted by upcoming ONR programs, four ice-capable Seagliders were fabricated and tested under this project.					
15. SUBJECT TERMS Gliders, Arctic, autonomous underwater vehicles (AUV), unmanned underwater vehicles (UUV), Seaglider, autonomous platforms.					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 2	19a. NAME OF RESPONSIBLE PERSON Craig Lee
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (include area code) (206) 543-1300

Autonomous Seagliders for Extended Missions under Arctic Sea Ice

Craig M. Lee, Luc Rainville and Jason I. Gobat
Applied Physics Laboratory, University of Washington
1013 NE 40th St.
Seattle, WA 98105-6698

phone: (206) 685-7656 fax: (206) 543-6785 email: craig@apl.washington.edu

Grant Number: N00014-15-1-2889

<http://opd.apl.washington.edu/~craig>

LONG-TERM GOALS

This project supports the fabrication of four ice-capable Seagliders for upcoming ONR Arctic research programs.

OBJECTIVES

Fabricate four ice-capable Seagliders.

APPROACH

Rapid Arctic environmental change, exemplified by the recent, dramatic reduction in summertime sea ice extent, highlights the need to improve dynamical understanding of the dominant processes as a step toward developing both tactical and strategic forecast capability. The remote environment, ice cover and extreme operating conditions challenge conventional observing technologies and limit data availability beneath the ice and within the marginal ice zone, particularly during transition seasons (break-up and freeze-up). The APL-UW team has successfully developed and deployed a Seaglider system capable of extended (multi-month), fully autonomous operation in ice-covered environments. While under ice, these gliders navigate using an array of long-range acoustic beacons and rely on enhanced autonomy to detect overhead ice and make mission-critical decisions. Ice-capable Seagliders have successfully completed multiple science missions under the ice-covered Davis Strait (as part of the NSF Arctic Observing Network) and two shorter deployments in the Antarctic. Most recently, as part of the ONR Marginal Ice Zone (MIZ) Departmental Research Initiative, ice-capable Seagliders successfully completed a three-month, four-glider mission, collecting measurements that spanned from open water, across the MIZ and deep into the pack ice. The MIZ system was augmented to allow navigation from drifting acoustic sources and to employ more advanced real-time navigation algorithms. The acquisition of additional ice-capable gliders will provide the observing capability needed for upcoming ONR Arctic efforts addressing water column processes and their impact on sea ice evolution.

WORK COMPLETED/RESULTS

Four ice-capable Seagliders have been fabricated and tested. They are ready for upcoming deployments.

Final Equipment List

Type of equipment: SEAGLIDERS

Manufacturer of equipment and model number: University of Washington,
Seaglider Fabrication Center
SG221, SG222, SG223, SG224

Cost of equipment: \$112,379 each, Total \$449,516

Quantity: Four

IMPACT/APPLICATION

These gliders will be used for the Stratified Ocean Dynamics of the Arctic Departmental Research Initiative and the Arctic Mobile Observing System Innovative Naval Prototype.

RELATED PROJECTS

Stratified Ocean Dynamics of the Arctic Departmental Research Initiative and the Arctic Mobile Observing System Innovative Naval Prototype.