SBIR

Small Business Innovation Research Program

ABSTRACT OF PHASE II AWARDS FOR FISCAL YEAR 2017

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

INTRODUCTION

The Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), through the Small Business Innovation Research (SBIR) program, awarded 19 Phase I contracts for FY 2017. These awards are up to $120,000 each, and totaling approximately $2,280,000. The awards are for a six-month effort to demonstrate the feasibility of innovative approaches to the research topics identified in the "DOC/NOAA SBIR Program Solicitation for FY 2017 (NOAA 2017-1)." Abstracts of the successful Phase I proposals submitted under this solicitation, and brief comments on their anticipated results are provided in this publication.

The SBIR program is highly competitive. A total of 99 proposals were received by DOC/NOAA in response to its FY 2017 SBIR Phase I solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 19 were selected for an award. Final selection was based upon the results of the reviews, relative importance to DOC/NOAA needs, relationship to on-going research, and potential for commercialization.

In Phase II, funding is provided for projects that are most promising after Phase I is completed from the previous year. These awards can be for up to $400,000 each and for two years. The DOC/NOAA awarded a total of 12 Phase II contracts in FY 2017 for a total of approximately $4.8 million. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

FY2017 NOAA SBIR Phase II Awards

FY 2017 PHASE II
List tof award winners

- 16-2-017 LI-COR Biosciences, Inc.
- 16-2-015 USML LLC (doing business as US Microwave Laboratories)
- 16-2-006 Space Hazards Applications, LLC
- 16-2-064 Remote Sensing Solutions, Inc.
- 16-2-103 Makel Engineering, Inc.
- 16-2-044 Opto-Knowledge Systems, Inc., (OKSI)
- 16-2-068 C.A. Goudey & Associates
- 16-2-025 Kampachi Farms
- 16-2-054 R-3 Digital Sciences, LLC
- 16-2-012 Robo Nautica LLC
- 16-2-114 Toyon Research Corporation
- 16-2-095 Polestar Technologies, Inc.

FY 2017 PHASE II AWARD WINNER

FIRM:	LI-COR Biosciences, Inc. 647 Superior Street Lincoln, NE 68504-1357
AWARD:	$399,774.00
PHONE:	402-467-3576
E-MAIL:	Serguei.Koulikov@lico.com
PRINCIPAL INVESTIGATOR:	Serguei Koulikov

TITLE OF PROJECT: High Stability Atmospheric Carbon Dioxide and Methane Analyzer

SUBTOPIC NUMBER: 8.3.2D

TECHNICAL ABSTRACT:

LI-COR proposes to continue development of a next-generation CO2/CH4/H2O analyzer that will offer an unprecedented combination of high precision and stability, making it the first high-performance gas analyzer suitable for long-term unattended operation. The instrument will be smaller, lighter, and far less expensive than competing technologies. LI-COR's approach exploits a proprietary, revolutionary design that overcomes the limitations of existing techniques and enables a sophisticated spectroscopic analysis strategy that is far more robust than competing approaches. The objective of Phase II is to build, characterize and demonstrate an engineering prototype that meets NOAA's proposed specifications.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated result of Phase II is a mature engineering prototype that will enable subsequent commercialization. The advantages of the commercial product — ultra-high performance, ultra-low drift, suitability for long-term unattended operation, small size, low weight, and low cost — will enable widespread deployment for climate studies and emissions verification in applications that are not currently feasible, such as onboard commercial aircraft.

FY 2017 PHASE II AWARD WINNER

FIRM:	USML LLC 150 Fox Trail Summerfield NC 27358-8280
AWARD:	$399,818.02
PHONE:	336-582-0603
E-MAIL:	cfajardo@usmicrolabs.com
PRINCIPAL INVESTIGATOR:	Claudia P. Fajardo
TITLE OF PROJECT:	Satellite Ground Station Network for Real-Time Space Weather Data
SUBTOPIC NUMBER:	8.4.3W

TECHNICAL ABSTRACT:

The goal of this Phase II effort is to carry out a series of tasks with the purpose of developing a ground station network that can provide less than 15 minute latency in acquiring data from NOAA space weather assets. These tasks include:

- Finalize a set of specifications for ground stations so they can be used to determine the suitability of existing ground stations for the different missions or recommend upgrades / new construction of other ground stations
- Design a system to receive data from LEO satellites that can be easily deployed in remote locations, which could be offered to NOAA as a turn-key package
- Conduct a feasibility study of commercial ground station options for additional sites
- Update previously conducted ground station access time simulations
- Study satellite-to-satellite links as an alternative to new ground stations, including intra-constellation, inter-constellation and geosynchronous links.
- Explore concepts related to Software Defined Radio as potential solutions for enhancing capability and flexibly in NOAA's current and potential future ground station architecture.
- Provide a final report with a summary of the overall solution, alternatives and recommendations to NOAA's original request of less than 15 minute latency in gathering space weather data.

SUMMARY OF ANTICIPATED RESULTS:

NOAA will receive a comprehensive report with multiple solutions to the request of less than 15 minute latency in gathering space weather data for all space assets in LEO, MEO, GEO and Lagrange orbits. The solutions will include redundancy for risk mitigation and recommendations for cost reduction and future growth. Solutions including new ground stations and inter-satellite links will be provided.

FY 2017 PHASE II AWARD WINNER

FIRM:	Space Hazards Applications, LLC 1909 Arapahoe Street Golden, CO 80401
AWARD:	$399,409.04
PHONE:	720-222-0533
E-MAIL:	jgreen@spacehaz.com
PRINCIPAL INVESTIGATOR:	Dr. Janet Green

TITLE OF PROJECT: SatCAT: The Satellite Charging Assessment Tool

SUBTOPIC NUMBER: 8.4.2W

TECHNICAL ABSTRACT:

The purpose of this project is to develop a Satellite Charging Assessment Tool (SatCAT) that will provide satellite operators/manufacturers with information to quickly and confidently determine whether anomalous satellite behavior observed on orbit results from changes in the space radiation environment. The intense radiation surrounding Earth can damage electronic components causing temporary malfunctions, degraded performance, or a complete system/mission loss. Understanding whether space weather is the cause of such problems expedites investigations and guides successful design improvements resulting in a more robust satellite architecture. Discussions with satellite industry stakeholders held during phase 1, revealed that some space weather related anomalies may go unrecognized and unaddressed, in part, due to a lack of tools for rapid root cause attribution. Real time algorithms addressing this need that calculate how a satellite charges due to the radiation along any orbit for user specified architectures were developed during phase 1. The next phase of the project will expand on that development and advance the usability, reliability, and quality of the system by adding needed enhancements, validation, and testing. The SatCAT application is an innovative solution to satellite industry needs that goes beyond other available information by translating the radiation environment to actual engineering effects

SUMMARY OF ANTICIPATED RESULTS:

The final outcome of the project will be a tool that summarizes space weather impacts to specific assets to quickly and confidently identify the cause of on-orbit issues and the right solution addressing satellite industry needs.

FY 2017 PHASE II AWARD WINNER

FIRM:	Remote Sensing Solutions, Inc. 3179 Main Street, Unit 3, PO Box 1092 Barnstable, MA 02630
AWARD:	$400,000
PHONE:	508-362-9400
E-MAIL:	carswell@remotesensingsolutions.com
PRINCIPAL INVESTIGATOR:	Dr. James R. Carswell
TITLE OF PROJECT:	The Marine Debris and Small Object Mapping (DSOM) Radar System
SUBTOPIC NUMBER:	8.2.4D

TECHNICAL ABSTRACT:

The DSOM system realized in a Phase II effort will provide a modular, compact and reconfigurable system with the ability to provide unique and new information about the scene of interest (e.g. temporal and height information) when compared with traditional SAR sensors. When compared with other imaging technologies, DSOM has the important advantages of being operable through cloud cover and at night. In Phase I, RSS explored the marine debris, and marine object detection applications space. In doing so, we have arrived at a series of radar imaging sensor solutions that are targeted and customized to the individual observational and detection requirements. The primary application considered was marine debris, but we extended our consideration to include ice-berg/bergy-bits detection and characterization, sea-ice freeboard mapping, marine mammal detection, vessel detection, search and rescue, rapid-response and fisheries support. In particular, we propose to employ various sampling and measurement configurations at Ka-band to exploit scattering properties of the targets as distinct from the ambient scene. Ka-band was chosen because; 1) It has a high temporal correlation contrast between water and objects; 2) High precision interferometry (ATI, XTI, etc.) can be achieved with relatively small antenna separations; and 3) This technology is relatively mature. A novel system architecture was devised that will enable XTI/ATI, MSAR and DBF custom configuration of the DSOM for land, sea and airborne platforms. In the long-term, upon the advent of high-altitude long-endurance platforms, the DSOM has the potential to expand our spatio-temporal observational capabilities for marine debris and objects by orders of magnitude.

SUMMARY OF ANTICIPATED RESULTS:

The Phase II effort will yield the finalized baseline requirements, system requirements and critical system design of the DSOM Radar System. The system will be fabricated, integrated and undergo laboratory and field testing. Data measurements leading to positive results from the targeted deployment scenarios presented in the technical proposal will be realized.

FY 2017 PHASE II AWARD WINNER

FIRM:	Makel Engineering, Inc. 1585 Marauder Street Chico, CA 95973
AWARD:	$400,000
PHONE:	530-895-2771
E-MAIL:	dmakel@makelengineering,.com
PRINCIPAL INVESTIGATOR:	Darby B. Makel

TITLE OF PROJECT: High-Sensitivity, Miniaturized CO Sensor for Airborne Use on Small UAVs

SUBTOPIC NUMBER: 8.3.5R

TECHNICAL ABSTRACT:

The team of Makel Engineering, Inc. (MEI), TruWeather Solutions, LLC., and Latitude Engineering, LLC. propose to develop a novel, high sensitivity, fast response, solid state, electrochemical carbon monoxide sensor system for use in small UAVs which is capable of PPB level atmospheric measurements. The sensor is based on a thick film multi-element potentiometric micro sensor approach which has been developed by MEI. Phase I demonstrated a rugged prototype sensor system with a response time under one second and capable of measuring PPB levels of carbon monoxide. In Phase II, the sensor system will be matured into a flight capable CO sensor payload for small UAVs which will include flight packaging, air sampling systems, and control electronics. In Phase II multiple complete units will be fabricated and flight tested.

SUMMARY OF ANTICIPATED RESULTS:

This project will produce a low cost CO sensing system which could be widely deployed on small UAVs. Phase II will mature the technology successfully demonstrated in Phase I and conduct flight testes to validate operation of the system. Successful development of this sensor system will lead to a high marketable commercial product not only for airborne CO sensing but also for automated CO detection for industrial leak detection and safety applications.

FY 2017 PHASE II AWARD WINNER

FIRM:	Opto-Knowledge Systems, Inc. 19805 Hamilton Avenue Torrance, CA 90502
AWARD:	$400,000
PHONE:	310-756-0520
E-MAIL:	jason@oksi.com
PRINCIPAL INVESTIGATOR:	Jason Kriesel

TITLE OF PROJECT:	Capillary Absorption Spectrometer for In-Situ, Underwater Gas Analysis
SUBTOPIC NUMBER:	8.2.6R

TECHNICAL ABSTRACT:

We will produce a prototype Capillary Absorption Spectrometer (CAS) capable of measuring dissolved methane in water. The concept utilizes mid-infrared laser absorption spectroscopy within a hollow fiber optic capillary that both confines a gas sample and acts as an optical waveguide. A tunable laser beam propagates through the hollow fiber to a detector with near unity overlap between the beam and the analyte. The CAS can perform fast (~ 1s) and precise (isotope ratio ~ 1 0/00) measurements within the ultra-small sample volume (V ~ 1 mL) of the hollow fiber, and the concept is amenable to requirements for size, weight, and power necessary for in-situ analysis at depth. In this Phase II project, the proven concept will be developed into a field capable prototype for methane concentration and methane isotope analysis. The system will employee degassing of discrete water sample instead of a membrane, which is possible due to the ultra-small sample volume of the CAS. The concept is versatile and general and can also be applied to a wide range of other molecular species, including higher-C hydrocarbons, CO2, SO2, NOx, and a wide range of VOCs.

SUMMARY OF ANTICIPATED RESULTS:

This project will result in development of a prototype sensor for analysis of dissolved gases in water. The novel, compact concept can be further developed into an in-situ device that will open up new opportunities to perform real-time, measurements for a range of research studies and commercial applications, including the analysis of novel microbial communities, greenhouse gas sources and sinks, potential energy sources, and industrial leaks.

FY 2017 PHASE II AWARD WINNER

FIRM:	C.A. Goudey & Associates 21 Marlboro Street Newburyport, MA 01950
AWARD:	$400,000
PHONE:	978-914-1901
E-MAIL:	cliffgoudey@gmail.com
PRINCIPAL INVESTIGATOR:	Clifford A. Goudey

TITLE OF PROJECT:	Engineering Structures for Offshore Macroalgae Farming
SUBTOPIC NUMBER:	8.1.2F

TECHNICAL ABSTRACT:

This project continues our development of innovative systems for farming macroalgae on the high seas. We will identify suitable sites in Nantucket Sound to demonstrate our system and determine the associated environmental parameters including depths, currents, and waves. By combining that information with load and acceleration data from our Phase I wave-basin tests, we will refine the structural details of a two-transverse-truss array for fabrication and deployment. This 33m x 67m, instrumented, array in will support 36 seeded longlines of sugar kelp, Saccharina latissimi. We will monitor the performance of the system and the growth of the kelp at variable longline spacing from November 2017 to May 2018. We will harvest the kelp and determine optimal longline spacing based on the goal of maximizing production per unit area. A second season of kelp farming will then be used to measure optimized growth per unit area.

Using data collected from these instrumented sea trials, we will design a 100m x 200m array that supports the culture of 2 ha of macroalgae longlines. Based on the projected system cost and the productivity of our test crops, we will refine our profit/loss models for 2 ha array modules and refine our business plan.

SUMMARY OF ANTICIPATED RESULTS:

So far, our findings reveal a significant opportunity for the growth of macroalgae farming in the US and we believe our technology to be game changing in that it scales well and there is little in the way of practical competition. Through the proposed Phase II project we will bring a disruptive system to the macroalgae farming sector that will enable its growth and at the scales necessary to economically produce macroalgaes as a feedstock for biofuels

FY 2017 PHASE II AWARD WINNER

FIRM:	Kampachi Farms P.O. Box 4239 Kailua-Kona, HI 96745
AWARD:	$399,986.31
PHONE:	808-331-1188
E-MAIL:	neil@kampachifarm.com
PRINCIPAL INVESTIGATOR:	Neil Anthony Sims

TITLE OF PROJECT:	Tofu-tolerant mariculture: Genomics-Assisted Breeding of a High-Quality Marine Finfish for Enhanced Performance on Sustainable, Scalable Soy-based Feeds
SUBTOPIC NUMBER:	8.1.1F

TECHNICAL ABSTRACT:

Reliance on fishmeal and fish oil is a significant constraint to aquaculture expansion in America, and globally. As U.S. marine fish farming expands, genetic improvements could increase economic performance and decrease ecological footprint. This is critically important to sustainability, scalability and profitability of the industry, and is key to attracting capital investment. Commercial opportunities and sustainability concerns are probably greatest for high-value marine finfish, such as kampachi (Seriola rivoliana). Phase I research identified genetic markers that were highly-significantly associated with enhanced performance of kampachi on soy-based feeds. This work also initiated early development of high-throughput screening panels for this trait, which could improve sustainability and profitability of kampachi production on U.S. agriculture-based feeds. Primary Phase II objectives are to validate and test heritability of these markers through marker-assisted broodstock selection; and, identify markers associated with other Seriola phenotypes critical for health, survival and yield in commercial culture (fillet yield, fat content, spinal deformities, sex, skin fluke resistance). A flexible marker panel (able to add new markers, as needed) will allow rapid genotyping of potential broodstock for “tofu-tolerance” markers and potentially markers associated with these other commercially critical traits.

SUMMARY OF ANTICIPATED RESULTS:

This project could allow Kampachi Farms to establish a marker-assisted selecting breeding program that would increase our ability to displace wild-sourced marine ingredients in diets for S. rivoliana. This work may improve the economic and ecological viability of U.S. Seriola aquaculture and help expand the market for U.S.-grown soybeans and other agricultural products. Commercial applications include: fee-for-service genomics screening and broodstock program support, and sale of selectively bred broodstock and fingerlings.

FY 2017 PHASE II AWARD WINNER

FIRM:	R3 Digital Sciences, LLC 2200 Kraft Drive, Suite 1350 Blacksburg, VA 24060
AWARD:	$399,978.99
PHONE:	781-449-2284 x1006
E-MAIL:	brent.roeder@r3-ds.com
PRINCIPAL INVESTIGATOR:	Brent Roeder

TITLE OF PROJECT:	Fish Trap Extension Kit for Lionfish Control
SUBTOPIC NUMBER:	8.2.2N

TECHNICAL ABSTRACT:

R3 Digital Sciences (R3-DS) will develop and commercialize the Fish Trap Extension Kit (FTEK), and electromechanical device that will extend the capabilities of existing fish traps, and convert them from indiscriminate traps into “smart traps” capable of targeting specific fish types. To eliminate lionfish bycatch, the FTEK will enable existing commercial spiny lobster traps to autonomously detect, discriminate, and capture lionfish, while preventing other animals from entering the trap. In addition, the FTEK will detect anomalous trap conditions and be able to render a trap inert by permanently closing the trap entrance. This will eliminate the ghost fishing problems associated with conventional fish traps.

SUMMARY OF ANTICIPATED RESULTS:

The result of this project will be a commercial product that will enable the capture of lionfish in large numbers, while eliminating bycatch as well as ghost fishing.

FY 2017 PHASE II AWARD WINNER

FIRM:	Robo Nautica, LLC 225 Butte Drive, C Los Osos, CA 93402
AWARD:	$398,606.92
PHONE:	781-449-2284 x1006
E-MAIL:	ed@robonautica.com
PRINCIPAL INVESTIGATOR:	Eddie H. Williams

TITLE OF PROJECT: BE-ROVER Benthic Environment-ROV Extensible Robot

SUBTOPIC NUMBER: 8.2.1N

TECHNICAL ABSTRACT:

There is currently no low-cost, high performance minimally invasive, bottom-crawling ROV system for monitoring coastal and littoral benthic environments which is also deployable by a single marine researcher. Such a system augmenting divers' observations would greatly expand the quantity and quality of data critical to managing coastal environments and preserving the economic benefits derived by their local communities.

In 2014, Robo Nautica used its innovative system of low-cost high-performance underwater robotics components (US Patent 9315248) to build a working proof-of-concept prototype bottom-crawling robot which exceeded minimum requirements, and successfully demonstrated it at the NOAA Gray's Reef NMS.

In Phase I, that robot was used for empirical testing of improved components and configurations, identified by trade studies, which minimized deployment size and weight while extending the depth and duration of operation, radio range for piloting, and the variety of cameras it supports.

In Phase II, based upon those test results, we will develop an improved bottom-crawling robot, with greater reliability, increased use of COTS components, and industry standard practices. It will be near ready for commercialization. We will make it available for extended testing by NOAA personnel.

SUMMARY OF ANTICIPATED RESULTS:

In Phase I Robo Nautica's proof-of-concept bottom crawling robot was reassembled as a test platform and used to complete the five required trade study and feasibility study tasks.
In Phase II the BE-ROVER bottom-crawler robot will be productized, and multiple copies of the BE-ROVER will be built. One or more BE-ROVERs will be available to NOAA for test and evaluation.

FY 2017 PHASE II AWARD WINNER

FIRM:	Toyon Research Corporation 6800 Cortona Drive Goleta, CA 93117
AWARD:	$399,999.97
PHONE:	781-449-2284 x1006
E-MAIL:	esandoz@toyon.com
PRINCIPAL INVESTIGATOR:	Eric E. Sandoz

TITLE OF PROJECT:	Small UAS Platform for NWS Missions
SUBTOPIC NUMBER:	8.4.1W

TECHNICAL ABSTRACT:

NOAA and in particular, the National Weather Service (NWS), have an unmet need of a cost feasible small Unmanned Aerial Systems (UAS) which can support multiple sensing missions which will either directly save lives or indirectly save lives through improved weather forecasts, warnings and public alerts. NOAA has enumerated two dozen valuable applications of small UAS for itself and partners. Toyon proposes to demonstrate and continue the development of its Waptor small UAS for these NWS missions. Waptor was originally developed for environmental sensing in difficult to reach locations, and in difficult conditions. The Waptor UAV, with its unique hybrid Vertical Take-Off and Landing (VTOL)/fixed-wing configuration combines the maneuverability aspects of a multi-rotor drone with nearly the flight endurance of a traditional fixed wing sailplane. Waptor goes further with a waterproof platform and rugged composite construction which allow it to operate in difficult conditions. The high thrust to weight ratio required for a VTOL craft allows Waptor to battle stronger winds. Waptor is designed to be low cost and easy to integrate custom sensor packages with a modular payload bay, featuring connectivity integrated by open-source software, minimizing cost of ownership.

SUMMARY OF ANTICIPATED RESULTS:

The Waptor UAV's VTOL capability enables it to launch and land vertically in tight areas without bulky and costly launch/catch equipment. The waterproof airframe enables unique missions like landing sensors on the water as well as the ability to fly in heavy precipitation. The focus on open-source software based systems reduces platform cost and cost of ownership. This effort will produce a production ready prototype system ready for commercialization. The objective of the Phase II effort is to have a production ready Beta 2.0 Prototype platform at the conclusion. The supporting navigation and control software will be optimized for Waptor's unique actuation strategy and flight capability. These capabilities will have been demonstrated through extensive flight testing. The credibility gained by successful flight testing and Waptor's unique capabilities will be the foundation for commercialization of the small UAS.

FY 2017 PHASE II AWARD WINNER

FIRM:	Polestar Technologies, Inc. 220 Reservoir Street, Suite 3 Needham Heights, MA 02494
AWARD:	$399,910.36
PHONE:	781-449-2284 x1006
E-MAIL:	yufeng@polestartech.com
PRINCIPAL INVESTIGATOR:	Dr. Yufeng Ma

TITLE OF PROJECT:	Carbon Nanotube Array-based Nanosensor for Autonomous and Direct Measurement of Carbonate
SUBTOPIC NUMBER:	8.2.5R

TECHNICAL ABSTRACT:

This program is aimed at the development of a deployable sensor for direct measurement of carbonate ions in saline waters with a sensitivity of 5 µM. The sensor combines the selectivity of carbonate ionophore with the unique structure of a carbon nanotube array to achieve a large dynamic range, high specificity and sensitivity. Phase I was focused on demonstrating the proof-of-principle concept for selective and sensitive detection of carbonate ions with a sensitivity of 5 µM in saline waters. The specific objectives of the Phase I SBIR program were: a) Demonstration of direct measurement of carbonate ion with a sensitivity of 5 µ, b) Establishing the specificity for carbonate ion detection in sea water, c) Fast response time, d) Dynamic range of 0 – 500 µM for carbonate detection and e) Initiation of the circuitry and mechanical design for autonomous detection. Except for the complete dynamic range, all the other objectives of Phase I have been achieved. Phase II work will involve increasing the dynamic range in addition to design, develop and testing of a prototype sensor in conditions of relevance to NOAA applications. Also, the system will be3 designed to enable integration with existing infrastructure and communications protocols of NOAA.

SUMMARY OF ANTICIPATED RESULTS:

The prototype developed in Phase II will have direct implications for NOAA's mission needs to monitor ocean acidification. In order to fully evaluate and address this problem, a precise, sensitive and direct method for determining the state of the carbonate system in seawater is needed. As mentioned in the topic announcement, none of the existing methods for measuring carbonate ion concentration are suitable and cannot meet the key NOAA requirements. For instance, one of the commonly used methods to determine carbonate ion relies on measurements of two of the four primary parameters: the total alkalinity (TA), total dissolved inorganic carbon (DIC), pH and the partial pressure of carbon dioxide (pCO2). The system developed under the Phase II program will enable a direct measurement of the carbonate to a precision required by NOAA