



SBIR



Small Business Innovation Research Program

ABSTRACTS OF 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 I Awards

FY 2017 PHASE I
List of award winners

- 17-1-016 Pisces Molecular
- 17-1-021 Space Environment Technologies
- 17-1-022 Creare LLC
- 17-1-023 SeaTox Research Inc
- 17-1-032 Forever Oceans Corporation
- 17-1-044 Creare LLC
- 17-1-049 CODAR Ocean Sensors, Ltd.
- 17-1-060 Creare LLC
- 17-1-066 Aerodyne Research Inc.
- 17-1-067 Blue Storm Associates, Inc dba PEMDAS Technologies & Innovations
- 17-1-070 Remote Sensing Solutions, Inc.
- 17-1-071 Metron, Incorporated
- 17-1-072 Swift Engineering, Inc.
- 17-1-083 Actinix
- 17-1-086 Latitude Engineering, LLC
- 17-1-087 High Precision Devices, Inc.
- 17-1-091 Aerodyne Research Inc.
- 17-1-102 Atmospheric & Space Technology Research Associates, LLC (ASTRA)
- 17-1-108 Tridentis LLC.

FY 2017 PHASE I AWARD WINNER

FIRM: Pisces Molecular LLC.
1600 Range Street, Suite 201
Boulder, CO 80301-2739

AWARD: \$112,323.42

PHONE: 303-546-9300

E-MAIL: Info@pisces-molecular.com

PRINCIPAL INVESTIGATOR: John Wood.

TITLE OF PROJECT: Plasmid DNA positive control standards for molecular environmental assays

SUBTOPIC NUMBER: 8.4.3

TECHNICAL ABSTRACT:

The proliferation of sensitive DNA-based assays for detecting the presence of specific harmful, toxic or invasive organisms, as well as the simple reagent and instrumentation requirements for these assays has made widespread and more frequent testing for these different organisms possible. However, a frequent problem with such assays is the lack of available, well-quantified positive control standards for all laboratories running a particular assay. This lack of standardized positive controls greatly hampers both evaluating the correct performance of the assay and comparing results between samples taken at different times, by different individuals, or tested with different assays. Many laboratories carrying out DNA-based assays make their own standards in small batches. These are generally tedious to make, poorly quantified and hard to reproduce, as well as a source of contamination potentially causing false positive results. We propose that plasmid DNA based positive control standards, containing a synthetic DNA sequence, mimicking, but distinguishable from, the natural target sequence of the organism, and quantified using a simple statistical test can be made accurately, economically and in almost unlimited quantities. Such standards would foster the expanded use of DNA-based detection assays, and equally importantly, facilitate comparison of results between different samples, laboratories and assays.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results of this project will be efficient procedures for designing and producing plasmid positive control standard kits, as well as data on the stability of such kits under a variety of environmental conditions. Additional data will include an accurate enumeration of the time, material and labor costs for producing these kits.

FY 2017 PHASE I AWARD WINNER

FIRM: Space Environment Technologies
1676 Palisades Dr.
Pacific Palisades, CA 90272-2111

AWARD: \$119,994

PHONE: 310-573-4185

E-MAIL: ktobiska@spacenvironment.net

PRINCIPAL INVESTIGATOR: Dr. W. Kent Tobiska

TITLE OF PROJECT: Space weather-based position error maps for TEC - On-Line (SpoT-On)

SUBTOPIC NUMBER: 8.3.1

TECHNICAL ABSTRACT:

The Space weather-based position error maps for TEC-On-Line (SpoT-On) project will use GPS=GNSS based TEC data, integrated into the Global Assimilation of Ionospheric Measurements (GAIM) operational system at the Utah State University Space Weather Center to produce improved TEC position correction maps. These will be publicly and globally accessible. A result is that agencies, industry and consumers will enjoy much higher accuracy position information than is currently available from single frequency GPS/GNSS receivers. In Phase I-III, we will demonstrate a prototype capability, construct a development and deployment plan, develop the operational capability, and deploy this system commercially. Validation and design tasks include initially using the existing GAIM Gauss-Markov(GM) model to produce global TEC correction maps and correction coefficients that can replace Klobuchar correction coefficients. Development and verification tasks will then extend the system to use the GAIM Full Physics (FP) model in a operational capability demonstration for even more accurate, reliable correction coefficients for TEC, including at high latitudes,. The deployment of the system will consist of using both smart phone apps and an industrial version of the system to serve updated coefficients to the GPS system as a whole through telecommunications and agency providers.

SUMMARY OF ANTICIPATED RESULTS:

Improved GPS TEC correction maps are needed by consumer, agency and industry positional applications to enable lower cost single frequency GPS devices to improve their accuracy. Agency (NOAA NWS) and DoD users would be able to support their customers with this system deployed on their operational servers.

FY 2017 PHASE I AWARD WINNER

FIRM: Create LLC
16 Great Hollow Road
Hanover, New Hampshire 03755-3116

AWARD: \$119,993.83

PHONE: 603-643-3800

E-MAIL: contractsmgr@create.com

PRINCIPAL INVESTIGATOR: David B. Kynor

TITLE OF PROJECT: Open Water - A Citizen Science Monitoring Platform

SUBTOPIC NUMBER: 8.3.3

TECHNICAL ABSTRACT:

Ensuring the health of coastal marine ecosystems has emerged as one of the primary environmental concerns of this century. Frequent monitoring of water quality is required to establish baseline levels, allow identification of anomalies, and enable early detection of problems. Citizen science programs have been shown to be a highly effective method of monitoring water quality.

Create proposes to develop an open source water monitoring system that is both easy to use and inexpensive. In addition, our system incorporates a cloud-based data repository and a number of features that are designed to help ensure the integrity of the collected data. During Phase I we will develop and demonstrate a prototype version of the system to citizen scientists. During Phase II, we will deploy the system and support its use in a citizen-based water quality monitoring project. Hardware and software developed during the project will be placed in the public domain.

SUMMARY OF ANTICIPATED RESULTS:

The project will provide citizen scientists with a cost-effective and reliable framework for monitoring water quality. In addition, the system will provide the scientific community with a set of tools for data assurance, review, and subsequent detailed analysis.

FY 2017 PHASE I AWARD WINNER

FIRM: SeaTox Research Inc.
310 Windemere Road
Wilmington, NC 28405-4028

AWARD: \$119,950.76

PHONE: 910-208-0215

E-MAIL: seatoxresearch@gmail.com

PRINCIPAL INVESTIGATOR: Sam McCall

TITLE OF PROJECT: Development of a sensor for detecting Paralytic Shellfish Poisoning toxins

SUBTOPIC NUMBER: 8.4.2

TECHNICAL ABSTRACT:

Paralytic shellfish poisoning (PSP) due to consumption of contaminated shellfish is an increasing problem in the coastal waters of the United States, particularly in New England and the Pacific Ocean. The symptoms of PSP include vomiting, diarrhea, shortness of breath, confusion, and loss of coordination in both marine animals and humans. In severe cases, PSP toxins can cause respiratory failure and death within hours if care is not provided. PSP is precipitated by neurotoxins produced by marine algae, which accumulate in the flesh and viscera of commercially important shellfish species. Currently, US state agencies monitor for the presence of toxic phytoplankton and when the cell count reaches a set level, shellfish beds are tested for the presence of toxin. However, current methods for detection of PSP toxins have serious drawbacks, including lengthy assay time, cost, and false positive and negative results. The purpose of this project is to develop a fluorescence based receptor binding assay for the detection of PSP neurotoxins. A fluorescent sensor based on a molecule that binds at the PSP toxin receptor site (tetrodotoxin) will allow for low cost rapid assays with high specificity for toxic samples, thus limiting false positive and negative results.

SUMMARY OF ANTICIPATED RESULTS:

A fluorescently-labeled toxin conjugate will be created which binds to the PSP toxin receptor site (primarily voltage-gated sodium channels) on rat brain membrane preparations with sufficient brightness and specificity that it can be used to develop fluorescent receptor binding assays to detect PSP toxins.

FY 2017 PHASE I AWARD WINNER

FIRM: Forever Oceans Corporation
73-4460 Queen Kaahumanu Hwy #104
Kailua Kona, HI 96740-2637

AWARD: \$119,737

PHONE: 646-979-0066

E-MAIL: maththew.goldsborough@foreveroceans.com

PRINCIPAL INVESTIGATOR: Matthew Goldsborough

TITLE OF PROJECT: Camera-based Examination of Risk via Behavioral Evaluation with Remote Underwater Surveillance

SUBTOPIC NUMBER: 8.4.1

TECHNICAL ABSTRACT:

Commercial marine aquaculture operators face many operational hazards including disease, predators, husbandry operations, and environmental changes. Most of these risks are only identified with constant surveillance and physical presence at a farm site. However, human observation of risk factors is expensive, slow, and sometimes ineffective. Sensors are available to monitor individual environmental parameters but comprehensive monitoring of all operational risks is currently infeasible or cost-prohibitive. This project seeks to develop a single, inexpensive tool, CERBERUS (Camera-based Examination of Risk via Behavioral Evaluation with Remote Underwater Surveillance), to detect and alert operators to the presence of multiple types of operational hazards through the use of low-cost hardware and intelligent software processing. CERBERUS will enable fish farmers to remotely and automatically monitor their stock for responses to such hazards, helping them reduce reaction time in rectifying the causal issues, improve outcomes, and decrease overall operational risk.

SUMMARY OF ANTICIPATED RESULTS:

This Phase I SBIR will result in the generation of a comprehensive dataset containing footage of a cohort of fish being grown in open-ocean netpens. This dataset will be used to train and optimize artificial intelligence algorithms capable of automatically detecting and alerting operators to changes in fish behavior.

FY 2017 PHASE I AWARD WINNER

FIRM: Create LLC
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Hanover, NH 03755-3116

AWARD: \$119,913.54

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E-MAIL: bhc@create.com

PRINCIPAL INVESTIGATOR: Benjamin H. Cameron

TITLE OF PROJECT: A Compact and Agile Fixed-Wing UAS for VTOL
Shipboard Operations

SUBTOPIC NUMBER: 8.3.2

TECHNICAL ABSTRACT:

Commercially available unmanned aircraft systems (UASs) are not well designed to meet requirements for many atmospheric measurement applications, including deployment from ships, long endurance, and low cost. Multi-rotor UASs have recently gained popularity as a low-cost platform use in measurement and monitoring applications, but these systems have limited endurance and payload capabilities. Existing fixed wing systems offer improved endurance and payload capabilities but are expensive and have not been optimized for shipboard deployment and recovery. Existing systems that are deployed from ships require significant support hardware and require high-risk recovery tactics, such as catching the aircraft in a net or by a wingtip-mounted arrestor hook. To meet this need, Create proposes a low cost and compact vertical takeoff and landing (VTOL) UAS named the "Hi-Dive." The Hi-Dive UAS takes off vertically, ascends to a safe altitude for transitions to horizontal flight, and reverses thrust using variable-pitch propellers to fly in a pusher prop configuration. In Phase I, we will demonstrate the feasibility of our proposed approach through design, analysis, and testing of critical system components. In Phase II, we will develop, test, and validate a prototype of the system and demonstrate its performance and value in a field test.

SUMMARY OF ANTICIPATED RESULTS:

Our proposed system will enable shipboard deployment of a low-cost, fixed-wing UAS for measurement of the aerosols in the atmosphere. These measurements will support numerous NOAA programs related to climate and air quality studies. The proposed fixed-wing VTOL UAS platform will also improve adoption of long-endurance sensing platforms useful for collecting data to support weather forecast and climate models in both civilian and DoD applications. The end benefits will be improved meteorological information with reduced deployment time and operational cost.

FY 2017 PHASE I AWARD WINNER

FIRM: CODAR Ocean Sensors, Ltd.
1914 Plymouth Street
Mountain View, CA 94043

AWARD: \$119,283.11

PHONE: 408-773-8240

E-MAIL: chad@codar.com

PRINCIPAL INVESTIGATOR: Chad Whelan

TITLE OF PROJECT: Single-Mast Transmit-Receive Antenna for Long-Range Coastal HF Radars Below 11 MHz

SUBTOPIC NUMBER: 8.2.4

TECHNICAL ABSTRACT:

The U.S. High Frequency Radar (HFR) network contains more than 140 coastal stations that provide hourly two-dimensional coastal surface currents. Approximately one-third of these are Long Range (LR) systems that transmit in the 4 – 5.5 MHz frequency band and have nominal offshore ranges and resolutions of 160-220 km and 3 – 6 km, respectively. The data provided by the network has numerous applications but is most critical to Coast Guard search & rescue and oil spill response [Harlan, et al, 2010]. HFR stations operating below 11 MHz, presently require separate transmit and receive antennas spaced approximately 60 m, which precludes mounting on structures such as buildings or platforms and limits most to ground mounts close to the water. During Hurricanes Irene (2011) and Sandy (2012), HFR was shown to be a key observation tool, along with others, to better predict intensity of approaching hurricanes before they make landfall [Glenn, et al, 2016]. Sandy's storm surge destroyed the stations that were installed in the most vulnerable low-lying coastlines. CODAR proposes to redesign LR HFR antenna(s) to fit on a single mast so that these systems can be installed on platforms such as weather-hardened Sentinel water level monitoring stations, reducing risk of loss.

SUMMARY OF ANTICIPATED RESULTS:

At the conclusion of phase I, based on results from modeling and testing of various strategies to reduce coupling between the loop antennas and the monopole on a single-mast HFR antenna transmitting and receiving in the 4 - 5.5 MHz bands, CODAR will have a strategy for using the most effective ones for building a prototype in phase II. Additionally, CODAR will have a plan for installing such a prototype antenna on a Sentinel platform.

FY 2017 PHASE I AWARD WINNER

FIRM: Create LLC
16 Great Hollow Road
Hanover, NH 03755-3116

AWARD: \$119,910.86

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E-MAIL: iyb@create.com

PRINCIPAL INVESTIGATOR: Jerry Bieszczad

TITLE OF PROJECT: Manual and Automated Marine Weather Observations
Using Smartphones

SUBTOPIC NUMBER: 8.2.6

TECHNICAL ABSTRACT:

Accurate marine weather nowcasts and forecasts are critical requirements for mariners to maintain situational awareness and ensure safe navigation for vessels, passengers, crew, and cargo. To best achieve this, reliable observations of atmospheric and sea conditions must be available at high spatial and temporal coverage. Unfortunately, existing approaches for marine weather observations are inadequate. To address this need, Create proposes to develop the MarineCitizen software for collection and aggregation of marine observations using smartphones. MarineCitizen will enable collection of crowd-sourced marine observations through different modes of operation, including entry of manual observations and automated polling of weather sensors. The observational data will be uploaded to a central MarineCitizen server for dissemination via a web interface, as well as sharing on social media sites.

SUMMARY OF ANTICIPATED RESULTS:

MarineCitizen will provide surface-level marine weather observations at high spatial and temporal coverage. This will provide mariners with improved situational awareness during current and planned navigational routes. These data will also be used for improvement of maps of current and future conditions, data assimilation of numerical weather forecasts, and post-evaluations of forecast accuracy.

FY 2017 PHASE I AWARD WINNER

FIRM: Aerodyne Research Inc.
45 Manning Road
Billerica MA 01821-3976

AWARD: \$119,976.75

PHONE: 978-932-0220

E-MAIL: blerner@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. Brian Lerner

TITLE OF PROJECT: Automated peak fitting and analysis software for advanced gas chromatography and mass spectrometer systems

SUBTOPIC NUMBER: 8.2.7

TECHNICAL ABSTRACT:

Recent advances in gas chromatographic and mass spectrometric techniques for atmospheric measurements have led to highly complex data sets that have overwhelmed the capabilities of current data analysis software. We propose a new method for the automated reduction of chromatographic data using peak-fitting algorithms. By relying upon constrained peak-fit parameterization, accuracy of peak identification can be maintained or improved over standard manual integration methods. The proposed analysis software can take advantage of the fast, multithread processors available in current computer systems to process large multi-dimensional data sets, especially those produced with advanced time-of-flight mass spectrometers. Scientists who use GC-MS instruments will be able to reduce their analysis time to a small fraction of what is currently required. With this automated analysis software, NOAA researchers, and the atmospheric community at large, will be capable of fully and rapidly processing large complex data sets, and will be able to push the boundaries of our understanding of the atmosphere.

SUMMARY OF ANTICIPATED RESULTS:

The fast, automated data analysis software developed in this project will lead to new advances in atmospheric sciences, environmental monitoring, drug discovery and detection, chemical warfare agent detection, food and beverage analysis, medical research, and the petrochemical industry. This software will increase sales of Aerodyne's commercially available advanced research instruments.

FY 2017 PHASE I AWARD WINNER

FIRM: Blue Storm Associates, Inc
dba PEMDAS Technologies & Innovations
5680 King Centre Dr Suite 600
Alexandria, VA 22315

AWARD: \$119,995.32

PHONE: 321-431-6408

E-MAIL: michael.gauthier@pemdastech.com

PRINCIPAL INVESTIGATOR: Michael Gauthier

TITLE OF PROJECT: Development of the Low-Altitude Maritime Survey-Sampling (LAMSS) System

SUBTOPIC NUMBER: 8.2.8

TECHNICAL ABSTRACT:

In this Phase I effort, PEMDAS Technologies and Innovations, in collaboration with Aeroovel, Inc., proposes to assess the feasibility of developing a multi-mission, transdisciplinary manned aerial platform, capable of fulfilling NOAA's requirement to survey, map and collect on our nation's natural ecosystems. Combining Aeroovel's experience in UAS development with PEMDAS' atmospheric sensor expertise, we propose adapting proven UAS technologies with advanced sensor development to design the Low-Altitude Maritime Survey-Sampling (LAMSS) system, an innovative solution intended to deliver the necessary capabilities for Electro-Optical and Infrared and full motion video maritime surveys using Automatic Identification System with simultaneous collection of planetary boundary layer (PBL) observations to enable the government to monitor the planet's air and water resources in remote maritime locations and measure its boundary layer more safely and with greater effectiveness.

As outlined in the proposal, the technical challenges primarily surround identification and integration of viable technologies capable of meeting the stringent operational requirements detailed in the subtopic description. An extensive review and evaluation of currently available technologies will be conducted in design of the LAMSS system. A proof-of-concept demonstration flight will be conducted to show the feasibility of integrating a suite of atmospheric sensors onto the candidate platform.

SUMMARY OF ANTICIPATED RESULTS:

The outcome of this Phase I effort is the development of a preliminary design for the LAMSS System based on a comprehensive assessment of available technologies capable of meeting NOAA's operational requirements. During Phase II, we will finalize the design of the complete prototype, evaluate it with respect to the requirements and specifications from Phase I, fabricate a working prototype, and evaluate its performance.

FY 2017 PHASE I AWARD WINNER

FIRM: Remote Sensing Solutions
3179 Main Street, Unit 3
PO Box 1092
Barnstable, MA 02630-1105

AWARD: \$120,000

PHONE: 508-362-9400

E-MAIL: [ychao@remotesensingsolutions.com](mailto:ychoao@remotesensingsolutions.com)

PRINCIPAL INVESTIGATOR: Dr. Yi Chao

TITLE OF PROJECT: Development of a portable 3-dimensional variational (3DVAR) data assimilation module for NOAA operational forecasting systems

SUBTOPIC NUMBER: 8.1.4

TECHNICAL ABSTRACT:

We propose to develop and deliver a generalized 3DVAR data assimilation module, in an open-source and non-proprietary programming language, which is compatible with both ROMS and FVCOM and easily incorporated into the existing NOAA operational forecast system (OFS). Our innovation is to develop a data assimilation roadmap contrasting 3DVAR with other advanced techniques such as multi-scale 3DVAR, 4DVAR or Local Ensemble Transform Kalman Filter (LETKF) in terms of accuracy and computational efficiency. We will leverage our experience and expertise in developing 3DVAR for a ROMS-based real-time forecast system for the California coastal ocean. 3DVAR has an ability to propagate observational information in both the horizontal and vertical directions while still keeping the computational overhead at a manageable level (e.g., 2X the forward model run time as compared to 20X or more for (4DVAR). Working closely with NOAA scientists, we will identify requirements for data assimilation, implement 3DVAR into the model selected by NOAA, and demonstrate the ability of 3DVAR to 1) incorporate various observational data sets into the existing NOAA OFS, 2) run efficiently from the computationally perspective with a user friendly interface, and 3) improve over unassimilated simulations.

SUMMARY OF ANTICIPATED RESULTS:

Successful completion of the proposed work will deliver an advanced 3DVAR data assimilation module, in an open-source and non-proprietary programming language, which is compatible with both ROMS and FVCOM and easily incorporated into the existing NOAA operational forecast system. The developed data assimilation roadmap will guide future improvement of the 3DVAR data assimilation. Through 3DVAR data assimilation, the impact of observational data on the operational forecast system will be quantified. Since this technology fits into our company's mission statement, we will develop a more detailed business plan to expand the sales and marketing strategy for commercialization

FY 2017 PHASE I AWARD WINNER

FIRM: Metron, Incorporated
1818 Library Street, Suite 600
Reston, VA 20190

AWARD: \$119,850.74

PHONE: 703-787-8700

E-MAIL: keller@ca.metsci.com

PRINCIPAL INVESTIGATOR: Colleen Keller

TITLE OF PROJECT: Mariner Report Application (MARApp): Crowdsourcing Maritime Weather Conditions

SUBTOPIC NUMBER: 8.2.6

TECHNICAL ABSTRACT:

Metron proposes a software framework for crowd-sourcing weather observations in a maritime environment leveraging personal mobile devices. Our proposed App, the Mariner's Report App (MARApp), draws data from existing sensors in modern smartphones and tablets, as well as meteorological sensors normally found on small marine vessels. Our architecture is modular, extensible, and readily adaptable to new data sources as they become available. The software is designed to collect the data and send it over the cell network to a web-based repository where it is available for user queries and for NOAA use in modeling. MARApp uses innovative methods to incentivize reporting and to "rate" observations. App users can set filters for notifications of weather changes, and specify geographic areas for displaying data. MARApp will also send updates to other social media sites such as Twitter to allow non-participating users to benefit from the additional data. We will base our architecture around our existing Search and Rescue App SARApp, which has been operational on Android and iOS devices since 2012. Our proof-of-concept demonstration will generate a prototype App designed for devices employing the Android OS.

SUMMARY OF ANTICIPATED RESULTS:

We anticipate direct applications of our GUI design and software framework into the maritime sector, along with obvious utility to NOAA for real-time maritime weather reporting. The direct benefit from this increased accurate weather information is a reduction in US Coast Guard Search and Rescue missions, increased safety, improvements to ship routing planning, and improved climatological modeling. By engaging users in the collection of environmental data, we hope to improve their awareness of conditions and how they are changing. MARApp will increase point reporting of conditions, improving models and predictions with real-time data in more precise geographical locations. MARApp will be easily extensible to other activities in which real-time weather is critical, such as aviation - Pilot Reports (PIREPS) to Flight Service Stations can be made using an App on a mobile device. The MARApp concept can also be extended to crowdsourcing conditions during disaster situations such as earthquakes, fires,

flooding etc. Connecting each of these functions to social networking sites will ensure widespread sharing of information critical to public safety.

FY 2017 PHASE I AWARD WINNER

FIRM: Swift Engineering, Inc.
1141-A Via Callejon
San Clemente, CA 92673-6230

AWARD: \$119,170.56

PHONE: 949-492-6606

E-MAIL: jschloss@swiftengineering.com

PRINCIPAL INVESTIGATOR: Jacob Schloss

TITLE OF PROJECT: Crowdsourcing Coastal Data with Low Cost IOT CTD / Hydrophone

SUBTOPIC NUMBER: 8.3.3

TECHNICAL ABSTRACT:

This paper proposes development of a low cost combined hydrophone and CTD sensor, with wireless communication and software support to upload data to National Geographic's FieldKit. This will enable citizen scientists to collect conductivity, temperature, depth, and ocean noise measurements on an adhoc basis while contributing to a single large data repository which will allow for deep analysis of data over a larger area than would be otherwise possible. There does not currently exist an online open platform for exchange of scientific and GIS data between citizen scientists and professional researches. The development of FieldKit into an open platform with both commercial and public support will benefit researchers and sensor providers by reducing re-implementation of frameworks and reducing data lost because there is not a good central platform for archival.

SUMMARY OF ANTICIPATED RESULTS:

A prototype hydrophone and CTD sensor with wireless connectivity will be developed, as well as a phone application that will allow for data sharing via an open on-line platform that is being developed by National Geographic.

FY 2017 PHASE I AWARD WINNER

FIRM: Actinix
1800 Green Hills Rd, Ste 105
Scotts Valley, CA 95066-4985

AWARD: \$120,000

PHONE: 831-440-9388

E-MAIL: jimjacob@actinix.com

PRINCIPAL INVESTIGATOR: James Jacob

TITLE OF PROJECT: Flow cytometry for aquatic single-particle optical properties

SUBTOPIC NUMBER: 8.2.2

TECHNICAL ABSTRACT:

A flow micro-photometer is proposed that can measure absorption and backscatter from single aquatic particles including phytoplankton, detritus and minerals. This instrument will make use of a novel adaptive diaphragm to define an analysis region of interest that exactly matches the size, shape and orientation of each particle being analyzed. A micro-fluidic chip will be used to convey the particles in a sequential fashion through the analysis region of the system.

The proposed instrument will be designed to be capable of measuring the transmitted and back-reflected light of particles from 0.5 microns to 100 microns in diameter. Initially the tool will measure the optical properties at three wavelengths in the visible, 440 nm, 520 nm and 670 nm. The instrument will also provide images of each particle, from which the identification of the type of particle being analyzed is possible, as well as provide morphology information.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results of this research are sets of imagery and photometric data from a variety of ocean particles that demonstrate the technical feasibility of the tool and a plan to go forward with a further Phase 2 development effort.

FY 2017 PHASE I AWARD WINNER

FIRM: Latitude Engineering
744 South Euclid Avenue
Tucson, Arizona (AZ) 85719-6626

AWARD: \$120,000

PHONE: 520-792-2006

E-MAIL: aaron.farber@latitudeengineering.com

PRINCIPAL INVESTIGATOR: Aaron M.Farber

TITLE OF PROJECT: HQ-55 VTOL UAS for Ship Based Operation

SUBTOPIC NUMBER: 8.3.2

TECHNICAL ABSTRACT:

The Hybrid Quadrotor concept, developed by Latitude Engineering, combines the high power density of electric motors and propellers with the high energy density of a piston engine and liquid fuel. Together, each technology enables maximum performance in HQ's two regimes of flight: the electric system is responsible for lift while hovering (high power, short endurance), and the gas engine gives long endurance in fixed wing flight (low power, long endurance). Latitude proposes to address NOAA's requirement for a ship based UAS capable of carrying a 15lb payload and operating from ships, or confined land areas, by combining the lessons learned from the development of the HQ-40 and HQ-90 aircraft. The resulting HQ-55 aircraft will have a higher useful load fraction than any previous HQ aircraft design, while staying under the 55lb limit to allow operations under the new Part 107 regulations. Phase I will prove the feasibility of the HQ-55 for this mission by creating an initial design and a prototype airframe, and conducting an initial test flight.

SUMMARY OF ANTICIPATED RESULTS:

The outcome of the proposed project will be a high performance VTOL UAS capable of carrying a specified 15lb aerosol sampling payload while operating from a ship. The goal is to provide 10 hours of endurance and maintain flexibility for additional payload integrations. During Phase I, an initial design will be made and prototype airframe will be constructed and test flown. In Phase II, full integration of fuel injected engine, transponder, comms systems, will be made, and flight testing throughout the performance envelope will be conducted.

FY 2017 PHASE I AWARD WINNER

FIRM: High Precision Devices, Inc.
1668 Valtec Ln, Ste. C
Boulder, CO 80301

AWARD: \$119,976

PHONE: 303-447-2558

E-MAIL: kmliller@hpd-online.com

PRINCIPAL INVESTIGATOR: Kevin Miller

TITLE OF PROJECT: Development of a Commercial, Reproducible NO(y) CRDS
for Precise Atmospheric Research

SUBTOPIC NUMBER: 8.5.1

TECHNICAL ABSTRACT:

HPD, a small business focused on development and commercialization of advanced instruments, sensors and research equipment, proposes to partner with NOAA on technology transfer and commercialization of the NO(y) Cavity Ring-Down Spectrometer for atmospheric research. Since our founding in 1993, HPD has collaborated with researchers at NOAA and other government, commercial and academic institutions to translate instrument concepts and prototypes into robust, cost-effective commercially available products. We believe that the NO(y) CRDS offers outstanding potential for commercialization based on its excellent performance and robustness and stability of the optical cavities and cage system. Our team provides over a century of collective experience in design and collaborative development of high performance instrument and atmospheric research. HPD offers the design and development expertise and processes as well as systems engineering and business acumen to achieve NOAA's objective to make the CRDS accessible to the research community.

SUMMARY OF ANTICIPATED RESULTS:

The Phase I efforts will capture the critical requirements, characteristics and lessons learned of NOAA's prototype sensor, produce a commercialization plan including detailed input regarding needs and priorities from prospective customers and users in the research community, and a design that reflects these inputs, optimized for performance and manufacturability to ensure reliable research results and effective commercialization of NOAA's design.

FY 2017 PHASE I AWARD WINNER

FIRM: Aerodyne Research Inc.
45 Manning Road
Billerica MA 01821-3976

AWARD: \$119,995.58

PHONE: 978-932-0266

E-MAIL: herndon@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. Scott Herndon

TITLE OF PROJECT: Automated HCl laser monitor for long term and flight deployments

SUBTOPIC NUMBER: 8.1.3

TECHNICAL ABSTRACT:

Tropospheric oxidation capacity is dominated by HOx photochemistry, however halogen atoms and oxides significantly affect these chemical cycles. A sensitive and robust measurement of gaseous HCl is critically important to improve our understanding of halogen chemistry and its impacts on the spatial and temporal oxidation capacity of the atmosphere. This is vital to evaluating the life time of short lived radiative forcers and understanding air quality in continental and coastal cities. We will combine two innovations to create a novel trace gas monitor that can sensitively (15 ppt noise at 1 Hz) and continuously monitor HCl at remote field sites and from flight platforms with little or no user intervention. First, we will use a recently commercialized ICL laser to probe one of the strongest HCl rovibrational transitions. Second, we will extend our patented active passivation technique from HNO₃ to HCl, enabling HCl sampling with minimal surface interactions despite its stickiness. HCl can be detected with chemical ionization mass spectrometry but our approach will require far less user intervention and almost no calibration. During Phase I we will build a prototype instrument, an HCl source and an actively passivated inlet to demonstrate the feasibility of this technique.

SUMMARY OF ANTICIPATED RESULTS:

The proposed instrument will be invaluable to the research market, governments agencies and academic institutions that research halogen cycling. Additional commercial opportunities exist in industrial fence line monitoring. The effort invested to make the instrument extremely autonomous will improve all of our trace gas monitors and will increase sales; almost all users would prefer an instrument that requires little or no user intervention and training.

FY 2017 PHASE I AWARD WINNER

FIRM: Atmospheric & Space Technology Research Associates,
LLC (ASTRA)
5777 Central Ave., Suite 221
Boulder, CO 80301

AWARD: \$119,994.33

PHONE: 303-993-8039

E-MAIL: gcrowley@astraspace.net

PRINCIPAL INVESTIGATOR: Geoffrey Crowley

TITLE OF PROJECT: Position Error Maps for GPS/GNSS

SUBTOPIC NUMBER: 8.3.1

TECHNICAL ABSTRACT:

As our nation's dependence on reliable satellite navigation systems for precise Position, Navigation and Timing (PNT) applications increases, any errors/uncertainties or degradation of service will have significant life, safety, and economic impacts. Ionospheric 'space weather' is one of the largest sources of error in PNT applications that use the Global Navigation Satellite System (GNSS) satellite constellations, including the US government's Global Positioning Satellite (GPS) system. NOAA currently has no operational products or services to provide GPS users accurate information on the magnitude of the ionosphere-induced positioning errors, or to help them recognize conditions where degradation due to GPS scintillation may be a problem. Thus, specification and forecast products are needed to support the broad GPS user community. We propose to develop a software solution to process the existing publicly available GPS data at NOAA/SWPC to generate PPP error maps for single- and dual-frequency GNSS receivers. The proposed Phase I research effort will investigate the feasibility of integrating ASTRA's various existing software tools to provide a now-casting and forecasting framework for GPS error mapping. Furthermore, the proposed Phase I research will develop and validate algorithms for providing ionospheric scintillation maps over the Continental US (CONUS) using GPS TEC data.

SUMMARY OF ANTICIPATED RESULTS:

At the end of Phase I, we will have demonstrated the feasibility of augmenting ASTRA's existing software to create maps of PPP uncertainties. We will demonstrate that these maps can potentially be produced in real-time at NOAA, with the full complement of data currently used in generating NOAA NA-TEC maps. We will demonstrate the feasibility of producing these maps in both now-casting and forecasting mode.

FY 2017 PHASE I AWARD WINNER

FIRM: Tridentis LLC.
433 S. Lee Street
Alexandria, VA 22314

AWARD: \$119,671.89

PHONE: 571-243-0870

E-MAIL: william.latham@tridentis.com

PRINCIPAL INVESTIGATOR: William Latham

TITLE OF PROJECT: Design of an Autonomous, Green Powered, Mobile Coastal Monitor

SUBTOPIC NUMBER: 8.2.1

TECHNICAL ABSTRACT:

The mobile coastal monitor project is designed to research the state-of-the-art green power supplies and apply them as the propulsion and sensor power source for a highly efficient surface platform. The platform will be equipped with a modular sensor bay that is capable of housing a wide variety of atmospheric, air/sea interface, and sub-surface sensors suitable for a wide range of sensing operations from benthic and flora/fauna surveying, to pollutant mapping, to calibration and validation of space borne optical sensors. The platform will incorporate the latest unmanned vessel controls that conform to current Collision Regulations (COLREGS) and obstacle (surface and sub-surface) avoidance technology. This will be a clean sheet design as current autonomous surface vehicles either do not run on green power, or smaller battery, sail, or wave powered vehicles do not have the appropriate COLREGS / collision avoidance capability.

SUMMARY OF ANTICIPATED RESULTS:

Our anticipated results will include the preliminary design of the mobile coastal monitor including the design and interface description of the modular sensor bay. The platform will be autonomous and powered by a green power supply(ies). This design will be suitable to take into contract and detail design cycles to prototype in Phase II.

FY2017 NOAA SBIR Phase II Awards

FY 2017 PHASE II
List of 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 flexibility 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 (~ 1 s) and precise (isotope ratio ~ 1 0/00) measurements within the ultra-small sample volume ($V \sim 1$ 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 employ 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, NO_x, 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 macroalgae 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 μM , 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 be 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 ($p\text{CO}_2$). The system developed under the Phase II program will enable a direct measurement of the carbonate to a precision required by NOAA.