



SBIR



Small Business Innovation Research Program

ABSTRACTS OF AWARDS FOR FISCAL YEAR 2018

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, plans to award 31 Phase I contracts for FY 2018. These awards are up to \$120,000 each, and totaling approximately \$3.7 million. 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 2018 (NOAA 2018-1).” 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 122 proposals were received by DOC/NOAA in response to its FY 2018 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 31 were selected for an award. Final selection was based upon the results of the reviews, and the project’s 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 18 Phase II contracts in FY 2018 for a total of approximately \$7.2 million. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication

FY2018 NOAA SBIR Phase I Awards

FY 2018
List of NOAA SBIR Phase I awardees

<u>Proposal #</u>	<u>Company Name</u>
• 18-1-018	Creare, LLC
• 18-1-019	Nikira Labs Inc.
• 18-1-021	SeaTrec Inc.
• 18-1-022	WRSystems
• 18-1-023	Creare LLC
• 18-1-024	Total Quality Systems
• 18-1-026	Riptide Autonomous Solutions
• 18-1-027	HJ Science and Technology
• 18-1-035	Desert Star Systems
• 18-1-039	Arete Associates
• 18-1-040	Barron Associates
• 18-1-041	Autonomous Surface Vehicles (ASV), LLC
• 18-1-044	Creare LLC
• 18-1-045	Tridentis AMV LLC
• 18-1-048	CFD Research Corporation
• 18-1-057	Atmospheric & Space Technology Research Associates, LLC (ASTRA)
• 18-1-058	Night Crew Labs, LLC
• 18-1-067	Access Sensor Technologies
• 18-1-071	Coastal Ocean Vision
• 18-1-072	R3 Digital Sciences
• 18-1-076	Toyon Research
• 18-1-079	Guild Associates, Inc. DBA Guild Biosciences
• 18-1-084	Atmospheric & Space Technology Research Associates, LLC (ASTRA)
• 18-1-086	Brandywine Photonics LLC
• 18-1-087	Triton Systems Inc.
• 18-1-094	Blue Storm Associates, Inc dba PEMDAS Technologies & Innovations
• 18-1-099	Aerodyne Research Inc.
• 18-1-103	Black Swift Technologies LLC
• 18-1-114	InnovaPrep LLC
• 18-1-115	American Benchmark Machine Works
• 18-1-119	Synthetik Applied Technologies LLC

FY 2018 PHASE I AWARD WINNER

FIRM: Creare, LLC
16 Great Hallow Road
Hanover, NH 03755-3116

AWARD: \$119,828.75

PHONE: 603-643-3800

E-MAIL: dbk@creare.com

PRINCIPAL INVESTIGATOR: David B. Kynor

TITLE OF PROJECT: Shallow Water Bathymetric Survey Systems

SUBTOPIC NUMBER: 8.2.9

TECHNICAL ABSTRACT:

Ship groundings can cause sever environmental damage to the delicate ecosystems such as coral reefs, seagrass beds, and beaches. At present, survey work is performed by hand – a method that is inefficient and difficult to perform reliably. Improved bottom survey tools are clearly needed to evaluate the extent and type of damage and assist in determining remediation efforts.

Creare proposals to develop an Autonomous Bathymetric Survey System (ABSS) that allows the operator to obtain highly detailed surveys, determine the extent of damage and understand bottom type. Creare's ABSS uses novel sensor technology to augment traditional bathymetric sounding techniques. Our technology provides improved resolution and detects underwater vegetation to assist in determining whether seagrass beds have been damaged. During Phase I. we will demonstrate the technology through a series for open water surveys.

SUMMARY OF ANTICIPATED RESULTS:

The ABSS is intended for use in near shore survey work to document erosion, monitor erosion mitigation effects and plan coastal and beachfront development efforts. We expect an attractive commercial market for technology, particularly in light of the growth in sales of autonomous platforms for shallow water survey work.

FY 2018 PHASE I AWARD WINNER

FIRM: Nikira Labs Inc.
1931 Old Middlefield Way, Suite 208
Mountain View, CA 94043

AWARD: \$119,517

PHONE: 650-906-0274

E-MAIL: manish.gupta@nikiralabs.com

PRINCIPAL INVESTIGATOR: Manish Gupta

TITLE OF PROJECT: Compact, Lightweight Open-Path Cavity Ringdown Spectrometry System for UAS Deployment

SUBTOPIC NUMBER: 8.4.1

TECHNICAL ABSTRACT:

In this Small Business Innovative Research (SBIR) program, Nikira Labs Inc. proposes to miniaturize the patented, open-path cavity ringdown spectroscopy (CRDS) analyzer developed by the National Oceanic and Atmospheric Administration (NOAA). The resulting instrument will be used to measure the optical properties of aerosols aboard Unmanned Aerial Systems (UASs) in highly humidified area, dust storms, and other poorly characterized regions. This data will be used by researchers in the NOAA Earth System Research Laboratory Chemical Sciences Division (ESRL CSD) to better constrain aerosol radiative forcing estimations, thus improving climate models and the understanding of global climate change.

In Phase I, Nikira Labs Inc. will fabricate a prototype, open-path CRDS instrument that includes a miniaturized, high-finesse optical cavity, fiber-coupled laser(s) and detector, and associated electronics for data control, acquisition, analysis, and reporting. The system will be extensively laboratory tested to determine its analytical performance by measuring both Rayleigh and aerosol scattering, before being deployed to measure ambient, outdoor air in an urban environment. Subsequently, the instrument will be deployed aboard a drone to empirically gauge its robustness and ability to perform airborne measurements. Finally, the Phase I results will be used to design a Phase II prototype.

SUMMARY OF ANTICIPATED RESULTS:

If the SBIR program is successful, Nikira Labs Inc. will have developed a very compact, open-path cavity ringdown system capable of measuring aerosol optical extinction and trace gases in unmanned aerial systems (UASs). This instrument will then be used to measure the optical properties of aerosols in highly humidified area (e.g. near clouds), dust storms, and other poorly characterized regions. This data will be used by researchers in the NOAA Earth System Research Laboratory Chemical Sciences Division (ESRL CSD) to better constrain aerosol radiative forcing estimations, thus improving climate models and the understanding of global climate change.

FY 2018 PHASE I AWARD WINNER

FIRM: Seatrec, Inc.
911 S Primrose Ave, Suite J
Monrovia, CA 91016

AWARD: \$119,930.96

PHONE: 626- 386-5988

E-MAIL: dave@seatrec.com

PRINCIPAL INVESTIGATOR: Dr. David Fratantoni

TITLE OF PROJECT: Clean Energy from Air-Sea Temperature Differences

SUBTOPIC NUMBER: 8.2.11

TECHNICAL ABSTRACT:

We will demonstrate the feasibility and commercial applicability of a novel energy harvesting system that converts thermal energy from air-sea temperature differences into electricity. This capability will extend the endurance and capability of NOAA observing platforms, reduce lithium battery waste, increase human and environmental safety, and support efforts to detect and monitor critical trends particularly in remote, high-latitude regions.

Air-sea temperature contrasts can be exploited using an Organic Rankine Cycle, a thermodynamic process commonly used for industrial waste heat recovery. The proposed thermal engine will be optimized for the small temperature differentials encountered in the maritime environment and scaled for the unique needs and constraints of NOAA observational platforms. The system is compact, low-maintenance and capable of long-term deployment on a fixed platform, buoy, or ice floe -- or on a mobile platform such as a drifting buoy or autonomous surface vehicle.

Potential markets include governmental organizations tasked with environmental stewardship (e.g. NOAA, EPA, USGS, NASA), transportation safety and natural resource management (e.g. USCG, FAA, BOEM) and national security (DOD, DHS). Improved observing system capabilities facilitated by this development will also be of interest to the private sector in the oil and gas, defense, and telecommunications industries.

SUMMARY OF ANTICIPATED RESULTS:

This effort will result in proof-of-concept validation of a novel clean energy source that could fundamentally alter the logistics and economics of NOAA observing system operations. We will demonstrate, via numerical simulation and laboratory experimentation, the ability of the proposed system to generate electricity from air-sea temperature differences. We will define leading use cases and evaluate the public- and private-sector market potential.

FY 2018 PHASE I AWARD WINNER

FIRM: W R Systems, Ltd.
2500 Alameda Avenue, Ste. 214
Norfolk, VA 23512

AWARD: \$119,992.14

PHONE: 757-858-6000

E-MAIL: eweaver@wrsystems.com

PRINCIPAL INVESTIGATOR: Dr. Edward Weaver

TITLE OF PROJECT: Under Keel Clearance Management in Support of Precision Navigation

SUBTOPIC NUMBER: 8.2.8

TECHNICAL ABSTRACT:

WR's approach involves design of a modular, S-129 compliant Under Keel Clearance - Risk Management System (UKC-RMS). This will allow for the Electronic Chart Display and Information System (ECDIS), ECS, PPUs, and other situational awareness applications to have S-129 Exchange Sets developed for a planned route.

In WR's design, a system such as an ECDIS generates an S40X Route Plan and transfers this over the network to the UKC-RMS. The UKC-RMS will then use this information, as well as information from other products such as S-98, S-101, S-102, S-104, S-111, and S-412, in an analysis to determine the safest route for the vessel in depth constrained areas. The output of the analysis will be used to generate the S-129 dataset.

The primary innovation is the use of the Lua programming language as the technology in the transformation engine. Lua is a powerful, fast scripting language often used in the gaming sector due to its light weight and high-performance characteristics.

The transformation engine will allow for the system to support the underlining S-100 products required for the generation of an S-129 Exchange Set and provide a secondary functionality that will allow the dataset to be verified to the S-100 specification.

SUMMARY OF ANTICIPATED RESULTS:

In Phase 1, the following will have been achieved:

- A functional S-129 Exchange Set
- An architecture for an Under Keel Clearance Risk Management system consisting of the following:
 - S-129 Transformation Model
 - UKC Analysis Model

- Rendering Model
- External Interface Model

The Phase I efforts will provide the necessary models and standards to design a prototype UKC-RMS application in Phase II. The prototype UKC-RMS service application will be developed to generate and distribute an S-129 Exchange Set upon receipt of an S40X Route Plan.

FY 2018 PHASE I AWARD WINNER

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

AWARD: \$119,940.92

PHONE: 603-643-3800

E-MAIL: bhc@creare.com

PRINCIPAL INVESTIGATOR: Benjamin H. Cameron

TITLE OF PROJECT: Autonomous Meteorological Measurement System

SUBTOPIC NUMBER: 8.2.12

TECHNICAL ABSTRACT:

NOAA and the National Weather Service maintain an immense network of automated maritime, surface, and upper-air observing stations throughout the world and at great expense. These automated stations provide regularly updated data for both short-term weather prediction and long-term climate models. Maritime and surface observations occur as frequently as every 10 to 20 minutes, and upper-air observations often occur only once or twice per day. Despite this vast network, NOAA requires more weather observations to realize significant improvements in weather and climate models, especially in data-sparse regions. To meet this need, Creare proposes the an autonomous meteorological data collection and distribution system, the Drone Sonde System, comprising a lightweight, low-cost unmanned aircraft system (UAS) with vertical takeoff and landing (VTOL) capabilities and a base station for autonomous recovery and recharging of the UAS. The UAS carries an array of sensors and regularly profiles the atmosphere from the surface to 25,000 feet. In Phase I, we will demonstrate the feasibility of our approach through design, analysis, and testing. In Phase II, we will develop, test, and validate a prototype of the system and demonstrate its performance in a field test.

SUMMARY OF ANTICIPATED RESULTS:

Our proposed system will enable distributed deployment of a low-cost VTOL UASs for frequent measurement of atmospheric conditions in data-sparse regions, as well as transmission of the information to NOAA data centers. The proposed VTOL UAS platform will improve the quantity and frequency of data to support improved weather forecasts and climate models in both civilian and Government applications. The end benefits will be improved meteorological information, wider range, reduced deployment and operational costs, and improved weather modeling and prediction.

FY 2018 PHASE I AWARD WINNER

FIRM: Total Quality Systems, Inc.
4066 South 1900 West, Suite A
Roy, Utah 84067-41

AWARD: \$119,785.89

PHONE: 801-731-2150

E-MAIL: bwight@tgsinc.com

PRINCIPAL INVESTIGATOR: Brian Wight

TITLE OF PROJECT: Development of "Permit Wizard" Software for Assisted Permit Application Completion

SUBTOPIC NUMBER: 8.3.3

TECHNICAL ABSTRACT:

The objective of this project is to research the technical feasibility of designing a software tool "Permit Wizard" that will automate the process for aquamarine permit application submittal, review, approval/disapproval and issue (including collection of fees). Aquaculture producers are currently faced with slow, complex, and often confusing permitting processes that must be completed before they can begin operations. The concern over placing significant time and investment into completing and submitting a permit application only to have it rejected is deterring much needed investment in aquaculture. The approach will investigate the use of questions and answers to generate appropriate permit application forms/documents, similar to tax preparation software. The tool will electronically forward completed applications to the appropriate reviewing/approval official who will be able to review, approve or reject, and notify the applicant of the permit decision. If approved, the tool will be able to generate the appropriate permit documents for email distribution to the applicant. The tool will initially focus on a select number of federal permit requirements, but it will be designed to accommodate expansion to additional multi-agency permitting processes. The tool, when fully developed, can be sold to other federal agencies, as well as state or municipal agencies for a wide variety of permit/licensing uses.

SUMMARY OF ANTICIPATED RESULTS:

. The automated "Permit Wizard" tool will streamline the permit process for marine aquaculture. The resulting efficiencies in time for the permitting process will be an incentive for investment in aquaculture. The tool will clarify requirements, generate document templates, and dramatically reduce time and effort for completion of permit documents, all the while, providing a quick, accessible, accurate application history for management. The automated review workflow will enhance visibility of permit applications and allow for expedited permit processing and issue. It will also speed up the disapproval and reapplication cycle by enabling agency officials to document reasons for disapproval. These benefits will result in an increased number of permit

applications being submitted and more permits being issued. With more permits, US Aquaculture production can increase resulting in a reduction of dependence on foreign seafood.

FY 2018 PHASE I AWARD WINNER

FIRM: Riptide Autonomous Solutions
36 Farmside Drive
Pembroke, MA 02359-1727

AWARD: \$119,687.39

PHONE: 617-820-4586

E-MAIL: jeff@RiptideAS.com

PRINCIPAL INVESTIGATOR: Dr. Dani Goldberg

TITLE OF PROJECT: Riptide Hypoxic Zone AUV

SUBTOPIC NUMBER: 8.2.7

TECHNICAL ABSTRACT:

Buoyancy driven oceanographic gliders, although reasonably cost effective, have challenges operating in the zones due to high gradients in water density.

Under this topic, Riptide will provide a cost-effective autonomous undersea vehicle (AUV) design leveraged from Riptide's family of man-portable AUVs that can more effectively map the hypoxic areas. The stated goals of this topic are to:

- 1) substantially improve the monitoring capabilities currently implemented for the Gulf hypoxic zone, to
- 2) provide a cost- efficient mapping capability that could leverage operational support from interested partners as contribution to the Cooperative Hypoxia Monitoring Program, currently in development, and, if successful, to
- 3) extend this technology to other environments where high density gradients in shallow waters have hampered glider applications to monitoring.

Under this effort, Riptide will provide the AUV design solution that will operate in close bottom proximity in areas of high water density variability to better survey this area of concern.

SUMMARY OF ANTICIPATED RESULTS:

Riptide will demonstrate the increased power density and bouyancy control of the Open Water Power aluminum seawater energy source. Additionally, Riptide will conduct and complete trade studies to select subsystems and provide the final vehicle configuration best able to acheive the hypoxix zone survey.

FY 2018 PHASE I AWARD WINNER

FIRM: HJ Science & Technology, Inc.
820 Heinz Avenue
Berkeley, CA 94710

AWARD: \$119,981.89

PHONE: 408-464-3873

E-MAIL: h.jiao@hjscincetech.com

PRINCIPAL INVESTIGATOR: Erik Jensen

TITLE OF PROJECT: Portable device for simultaneous detections of multiple pathogenic species in marine aquaculture operations

SUBTOPIC NUMBER: 8.3.6

TECHNICAL ABSTRACT:

HJ Science & Technology, Inc. proposes an integrated and portable microfluidic automation technology capable of rapid and simultaneous detections of multiple pathogen species in marine aquaculture operations with a total “end-to-end” analysis time of under one hour. Specifically, we apply our patented microfluidic automation technology as a platform to two well established laboratory-based pathogen separation and detection methods: immunomagnetic separation (IMS) and multiplexing quantitative polymerase chain reaction (qPCR). By integrating IMS and multiplexing qPCR and including automated sample loading and viability assay into a microfluidic format, we can perform rapid and on-site pathogen detections in the marine aquaculture environment with sensitivity and specificity that are currently only achievable with laboratory-based manually performed procedures. As such, our portable detection platform offers several important advantages over existing pathogen detection technologies, including reduction in assay time and reduced costs of equipment and reagents. Critically, this technology provides real-time data for efficient and timely decision-making, thereby greatly benefitting the United State aquaculture industry. In Phase I, we will establish the technical feasibility of the proposed technology by detecting pathogenic *Vibrio* species. In Phase II, we will build a prototype to be delivered to NOAA as a field deployable functional unit.

SUMMARY OF ANTICIPATED RESULTS:

The proposed technology will be useful to a wide range of users including marine resource managers, environmental monitoring entities, aquaculturist, and fisheries. In addition, the proposed technology has significant potential to transition rapidly to the commercial sectors including detection of bacteria and pathogens in food and water supply.

FY 2018 PHASE I AWARD WINNER

FIRM: Desert Star Systems LLC
3261 Imjin Rd
Marina, CA 93933

AWARD: \$119,638.62

PHONE: 831-236-7750

E-MAIL: marco.flagg@desertstar.com

PRINCIPAL INVESTIGATOR: Marco Flagg

TITLE OF PROJECT: SeaTag-SP: A Spawning Detecting and Reporting Pop-Up Satellite Tag

SUBTOPIC NUMBER: 8.1.2

TECHNICAL ABSTRACT:

The application of acoustic sensing in small, affordable, satellite connected ocean devices has broad potential. This proposal focuses at first on the specific topic requirement, designing a pop-up satellite tag (PSAT) incorporating an acoustic receiver to identify and report the timing and location of fish spawning based on signal presence/absence detection for a tiny pinger which is expelled from the ovary. Yet, accelerated by Desert Star's modular approach and extensive database supporting efficient product design, the result of this effort will not be just a specialty spawning tag, but a family of acoustic enabled satellite tags for a broad range of purposes such as the detection, identification and reporting of marine mammals far from shore. The effort yields delivery in phase-1 of a number of acoustic detector 'payload sections' which connects to our SeaTag-MOD modular PSAT to form a first functional spawning detector satellite tag. Early results from tests with these prototypes will inform phase-2, where a miniaturized non-modular spawning detector tag and capabilities beyond spawning detection are implemented and tested. Spawning sites may change over time, thus likely requiring repeated tagging and large tagging sample sizes. Benefiting from the economics of modular design and production, this work will produce acoustic enabled PSAT tags at moderate price points compatible with large scale studies.

SUMMARY OF ANTICIPATED RESULTS:

This project will result in a line of 'acoustically enabled' satellite tags serving various purposes. Beyond practical spawning detector tags, this will include a micro digital acoustic recorder capability with acoustic signature transmission via satellite. These affordable devices will advance acoustic monitoring in remote regions, while allowing a much greater sampling density for acoustic work than was previously practical.

FY 2018 PHASE I AWARD WINNER

FIRM: Arete Associates
9301 Corbin Avenue, Suite 2000,
Northridge CA 91324

AWARD: \$119,998.80

PHONE: 703-413-0290

E-MAIL: tklein@arete.com

PRINCIPAL INVESTIGATOR: Timothy Klein

TITLE OF PROJECT: FogViewer

SUBTOPIC NUMBER: 8.2.6

TECHNICAL ABSTRACT:

The presence of fog reduces visibility, contributing to unsafe conditions for many maritime tasks. The current system uses active backscatter and has high power requirements, high maintenance and replacement costs. Areté Associates' innovative FogViewer system comprises a passive multi-spectral, multi-polarization sensor suite that leverages available degrees of freedom to best characterize the fog. The envisioned FogViewer system will be innovative, better, easier, simpler, and less costly (initial and recurring) compared to current NOAA visibility sensors. Since fog varies due to different densities, absorption and scattering particles, the processing stream will utilize a combination temporal and spatial methods employed to best isolate the fog and report fog removed imagery. During Phase I new and existing sensors will be used to collect data with and without the presence of obscurants in a variety of environmental conditions. This will provide data to demonstrate and assess performance of the FogViewer system. For Phase II, plans are to optimize the algorithms and produce a demonstration system to be evaluated under realistic maritime fog environments.

SUMMARY OF ANTICIPATED RESULTS:

The innovative FogViewer system uses passive sensors and significantly enhances visibility calculation, in turn aiding navigation, target detection, tracking, and identification tasks during low visibility conditions. Potential customers include port or harbor facilities, the Navy, the Coast Guard and other commercial maritime operators. This technology is directly applicable to general degraded visual environment products for manned and unmanned surface vehicles, manned and autonomous helicopter operation, as well as "port-of-entry" security applications.

FY 2018 PHASE I AWARD WINNER

FIRM: Barron Associates, Inc.
1410 Sachem Place, Suite 202
Charlottesville, VA 22901

AWARD: \$119,962.35

PHONE: 434-973-1215

E-MAIL: neal@bainet.com

PRINCIPAL INVESTIGATOR: David Neal

TITLE OF PROJECT: A Tube-Deployed Expendable UAV for Atmospheric Sensing

SUBTOPIC NUMBER: 8.2.13

TECHNICAL ABSTRACT:

NOAA is pursuing sustained, in-situ sensing technology to support improved atmospheric modeling of the upper ocean boundary environment, including the air-sea interface, during turbulent storms. Improved atmospheric modeling in this critical region will lead to better forecasting and support NOAA's mandate to protect property and save lives.

Small, unmanned aircraft, equipped with atmospheric sensors, can utilize powered, guided flight to perform sustained atmospheric sampling at consistent altitudes in the critical storm region. The goal of this effort is to meld a dropsonde's sensing and expendable deployment attributes with a UAV's guided flight capability. Barron Associates is proposing to develop an atmospheric-sensor UAV that, like a dropsonde, can be tube-deployed from NOAA aircraft into remote regions.

SUMMARY OF ANTICIPATED RESULTS:

Barron Associates' proposed UAV provides the ability to gather atmospheric data across a wide geographic range, and over an extended period of time, while still retaining the dropsondes' ability to be deployed to remote locations. As a powered flight vehicle, it greatly extends a dropsonde's atmospheric mapping capabilities providing increased spatial coverage

FY 2018 PHASE I AWARD WINNER

FIRM: Autonomous Surface Vehicles LLC dba ASV LLC.
209 Cummings Road,
Broussard, LA, 70518-3229, USA

AWARD: \$113,612.46

PHONE: 337-442-4411

E-MAIL: Michael.Kim@ASVglobal.cc

PRINCIPAL INVESTIGATOR: Michael Kim

TITLE OF PROJECT: Adaptive Mapping of the Gulf Dead Zone with Autonomous Surface Vehicles

SUBTOPIC NUMBER: 8.2.7

TECHNICAL ABSTRACT:

Gliders alone are incapable of monitoring the shallower regions of the hypoxic zone under conditions when the density gradient is strong, therefore surface vehicles are required to autonomously collect a suite of oceanographic observations from surface waters and profile this portion of the hypoxic zone. Autonomous Surface Vehicles, LLC (ASV, LLC) is partnering with Integral Consulting Inc. to research and develop adaptive profiling capabilities. The development will enable adaptive profiles to be conducted in water depths ranging from shallower than 5 m to greater than 120 m. An autonomous surface vehicle (e.g., ASV C-Worker 5), equipped with a profiling conductivity-temperature-depth (CTD) system, will be capable of performing autonomous, adaptive, water quality profiles to provide real-time CTD, dissolved oxygen (DO), turbidity, pH, and chlorophyll concentration data between the water's surface and to within 1 m of the seabed using altimeter feedback. This high spatial resolution water quality data will be telemetered in real-time to the GCOOS repository.

SUMMARY OF ANTICIPATED RESULTS:

This development will enhance autonomous hypoxia mapping capabilities for surface, subsurface, and near-bottom waters of the Northern Gulf of Mexico (NGOMEX) by expanding our spatial and temporal monitoring at lower costs. It directly benefits our efforts in mapping the mid-summer hypoxic zone to generate the metric used by the Hypoxia Task Force to assess progress toward their Coastal Goal to reduce the zone to 5000 km² and will advance hypoxia forecast models that are currently data starved.

FY 2018 PHASE I AWARD WINNER

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

AWARD: \$119,975.49

PHONE: 603-643-3800

E-MAIL: contractsmgr@create.com

PRINCIPAL INVESTIGATOR: Jeffrey J. Breedlove

TITLE OF PROJECT: Clean Energy Source to Power NOAA Long-term
Observation and Monitoring Networks

SUBTOPIC NUMBER: 8.2.11

TECHNICAL ABSTRACT:

Create proposes to develop a self-sustained small-scale power conversion system to power NOAA's weather monitoring network stations located in harsh uninhabited locations. Our miniature heat engine will take advantage of the existing year-round thermal gradients found between water and air in Arctic regions. Our baseline approach is the development of a compact Turbo-Rankine energy conversion system using a natural working fluid with advanced turbo-alternator and heat exchanger technology. The system will leverage decades of advances at Create in the performance and miniaturization of turbomachines, heat exchangers, and low-power thermodynamic systems such as turbo-Rankine and turbo-Brayton, generators and cryocoolers. In Phase I, we will validate our performance models with laboratory testing of a small turbine utilizing the selected working fluid at prototypical heat source and heat sink temperatures. During Phase II, we will fabricate and demonstrate a complete prototype system in an environmentally controlled low-temperature research facility.

SUMMARY OF ANTICIPATED RESULTS:

Create's compact Turbo Rankine Energy Conversion system will enable a new paradigm for compact thermally-driven power systems. Due to the unlimited supply of heat sources and heat sinks, provided by the ocean and ambient air, our system will provide unlimited and unattended clean energy to NOAA's sensors and monitoring networks. These capabilities are critically needed for scientific, commercial and military operations. The core technology is also broadly applicable for power generation from a wide range of alternative heat sources.

FY 2018 PHASE I AWARD WINNER

FIRM: Tridentis AMV LLC.
73-4460 Queen Kaahumanu Hwy., #138,
Kailua Kona, Hawaii 96740

AWARD: \$119,933.21

PHONE: 540-903-5544

E-MAIL: william.latham@tridentis.com

PRINCIPAL INVESTIGATOR: William Latham, Sr.

TITLE OF PROJECT: Bottom Feeder - A Highly Maneuverable Autonomous Underwater Vehicle

SUBTOPIC NUMBER: 8.2.2

TECHNICAL ABSTRACT:

Bottom Feeder will be a highly maneuverable Autonomous Underwater Vehicle (AUV), with a tethered operations option and modular sensor bay, to support benthic optical surveys, coral reef mapping and health assessment, and be expandable for future survey operations. It will integrate a low drag hullform, a minimum of four degrees of independent motion control, a highly efficient propulsion system, autonomous obstacle avoidance, a modular sensor bay that can accommodate multiple sensors at a time, and capable of supporting multiple survey methods. Bottom Feeder will operate in two configuration modes and be able to dynamically change between modes while submerged. The first configuration is AUV Mode using in-line propulsors where pitch and yaw of the platform is used to control direction and depth like torpedo shaped AUVs. The second configuration is ROV Mode using six vectored thrusters to control orientation, propulsion, and depth of the platform and provide at least four degrees of freedom. AUV Mode focuses on straight line efficiency with good transect or path following, while ROV Mode is geared towards high maneuverability; especially at low or no forward speed. Both modes will have the capability of running autonomously or tethered to the surface, and changing while submerged.

SUMMARY OF ANTICIPATED RESULTS:

At the end of Phase I we anticipate having a complete preliminary design of the prototype vehicle to move into Phase II with. Additionally, we will have physically proven many of the performance aspects of the vehicle by building and testing a proof of concept demonstrator. This demonstrator will have reduced the risk on the most challenging aspects of the design while being able to collect scientific data from multiple sensors.

FY 2018 PHASE I AWARD WINNER

FIRM: CFD Research Corporation
701 McMillian Way NW
Huntsville, AL 35806

AWARD: \$119,919.96

PHONE: 256-726-4800

E-MAIL: mariana.scott@cfdrc.com

PRINCIPAL INVESTIGATOR: Mariana Scott

TITLE OF PROJECT: A Location-based Weather Threat Tracking and Notification System

SUBTOPIC NUMBER: 8.3.4

TECHNICAL ABSTRACT:

CFDRC proposes the creation of an innovative location-based threat tracking and notification system to allow users to receive hazardous weather messages from the NWS with their call to action, allow users to receive custom-tailored messages about threats, and visualize relevant weather information within their area. The focus is on a tool that allows this information to be communicated in a manner that the general public can understand, while having minimal impact on the forecast and warning duties.

This system will consist of both a mobile application and a web-based tool. At first, the system will work with the current message delivery system provided by the NWS in an intelligent fashion to display threat information, where it is with relation to the user, action messages, and associated weather data. Innovative features, such as the ability to incorporate NWS forecaster-provided hazard tracks and pathcasts based on motion vectors, will also be implemented. It is our aim to develop a solution that will be ready to ingest emerging NWS messaging through APIs and relevant data streams and quickly transition current and future forecaster-enhanced and warning information to the public.

SUMMARY OF ANTICIPATED RESULTS:

Our focus is on the creation of high quality prototype system that can be demonstrated at the end of the Phase I and expanded to a fully featured capability during the Phase II. The Phase II deliverable is a fully tested version 1 release to the public.

FY 2018 PHASE I AWARD WINNER

FIRM: Atmospheric & Space Technology Research Associates,
LLC (ASTRA)
5777 Central Avenue, Ste 221
Boulder, CO 80301-2870

AWARD: \$119,757.08

PHONE: 303-993-8039

E-MAIL: cfish@astraspace.net

PRINCIPAL INVESTIGATOR: Chad Fish

TITLE OF PROJECT: ALOFT: GPS RO from Balloons

SUBTOPIC NUMBER: 8.1.1

TECHNICAL ABSTRACT:

The NOAA Integrated Earth System Process and Predictions 2018 Subtopic 8.1.1 “Radio Occultation from Recoverable Air Balloons for Weather Applications” solicitation has the goal of demonstrating the feasibility of a hardware/software system for a balloon platform that has sufficient quality for measuring global navigation satellite system (GNSS) signals to enable retrieval of atmospheric profiles such as temperature, moisture, and pressure through radio occultation. With the availability of low cost GPS receivers and maturing technology, there appear to be opportunities for measuring atmospheric profiles from recoverable air balloons, or even in conjunction with the radiosondes currently being launched. Therefore, this solicited project provides an opportunity for researchers to leverage previous GPS RO demonstrations from balloons to further demonstrate feasibility and pave the way for enhanced measurement capability and extensive commercialization of RO from air balloons. ASTRA will develop a compact GPS RO payload, ALOFT, that is compatible with high-altitude balloon platforms. We will also investigate ALOFT compatibility with radiosonde platforms. At development and launch costs an order of magnitude less than CubeSats, and with the ability for payload recovery, high altitude balloons have become a very economical means of making regional measurements from the upper atmosphere and space.

SUMMARY OF ANTICIPATED RESULTS:

The proposed Phase I effort will result in the development of a preliminary design of an ALOFT sensor system that meets the requirements of the solicitation. In Phase I, our team will conduct analysis to determine an optimal design sensing strategy that is compatible with high altitude balloon platforms. We will include a goal of ALOFT compatibility with a radiosonde as well. We will identify and complete trades on the critical engineering challenges. During Phase I we will establish a full set of design defining requirements against which performance is measured throughout the program lifecycle, and create system performance error budgets. Technical resource budgets will be used to identify and track size, mass, power, and telemetry

capabilities. As part of our deliverable, we will provide a PDR package that includes detailed design and analysis of all ALOFT subsystems. Phase I will include data collection from a Colorado (near Boulder) high mountain top using a prototype system. Additionally, during Phase I, we will develop an economical and technically viable, manufacturable solution for ALOFT. This state of maturity at the end of Phase I will then enable us to transition quickly into Phase II where we will complete a Critical Design Review (CDR), and then fabricate, calibrate, and demonstrate a fully functional proto-flight ALOFT sensor system in a realistic environment, resulting in a TRL of 6 at the end of Phase II.

FY 2018 PHASE I AWARD WINNER

FIRM: Night Crew Labs, LLC
140 Skylonda Dr
Woodside, CA 94062

AWARD: \$119.949

PHONE: 314-630-0191

E-MAIL: bryan@nightcrewlabs.com

PRINCIPAL INVESTIGATOR: Bryan Chan

TITLE OF PROJECT: Feasibility of a Recoverable, Balloon-Based, GNSS-RO Platform

SUBTOPIC NUMBER: 8.1.1

TECHNICAL ABSTRACT:

The SBIR Phase I proposal outlines the approach of Night Crew Labs (NCL) in assessing the feasibility of performing GNSS radio occultations (GNSS-ROs) from a balloon platform.

In Phase I, NCL will perform appropriate trade studies and sensitivity studies to identify key design requirements for the balloon-based GNSS-RO payload and the balloon platform. A low-cost, proof-of-concept GNSS-RO payload will then be designed and developed based around these requirements. Once developed, the payload will collect GNSS-RO sounding measurements from two balloon flights, and then the data will be analyzed for quality.

The first, more environmentally benign demonstration flight will use a crewed hot air balloon to lift the payload to a target altitude of 5 km on a stabilized platform. The second, more ambitious demonstration flight will use an unmanned weather balloon to lift the payload to a target altitude of 30 km.

After collecting GNSS-RO sounding measurements on these test flights, the measurements will be converted to bending angles and refractivity values. The data will be analyzed for quality and sensitivities to balloon parameters such as vertical altitude, balloon platform stability, and velocity. In addition, a study on using higher performance GNSS receivers and state estimation equipment will be performed.

SUMMARY OF ANTICIPATED RESULTS

Ground-based and in-flight GNSS measurements will be recorded and combined to achieve estimates of balloon position and velocity during the flight. In turn, these estimates will be used with raw GNSS measurements to produce bending angle and refractivity profiles from the top of the planetary boundary layer (PBL: ~ 2.0 km) up to the balloon altitude. Because the PBL is one of the most difficult atmospheric layers to be sensed by spacebased RO missions due to

increased multipath, low signal-to-noise ratio occultations and atmospheric ducting, we will also analyze the raw GNSS-RO data within the PBL to investigate potential use.

FY 2018 PHASE I AWARD WINNER

FIRM: Access Sensor Technologies, LLC
430 N College Ave Suite 420
Fort Collins, CO 80524-2674

AWARD: \$119,999.99

PHONE: 303-810-3390

E-MAIL: jhofstetter@accsensors.com

PRINCIPAL INVESTIGATOR: Josephine Hofstetter

TITLE OF PROJECT: Development of a Solar Powered Aerosol Reference Calibrator

SUBTOPIC NUMBER: 8.1.3

TECHNICAL ABSTRACT:

This project will develop and demonstrate an inexpensive and portable calibration system for low-cost aerosol sensors. Current calibration methods are cost prohibitive and impractical for widespread field deployment. Access Sensor Technologies (AST) proposes to produce a solar powered aerosol reference calibrator (SPARC) that builds upon an established (patent pending) technology developed at Colorado State University and licensed to AST; the ultrasonic personal aerosol sampler (UPAS). Phase I of this project includes prototype construction, field demonstration in a low-cost sensor network, and subsequent data analyses to evaluate the utility of the SPARC sampler as an in-field calibration tool. There are no commercial technologies that currently meet SPARC's specifications- especially not integrating size-selective inlets, an easily-exchangeable filter cartridge, a pump, and accompanying sensors into one miniaturized, solar-powered housing. Successful completion of this project will yield a novel air sampling technology that will help improve the reliability and data quality obtained from low-cost air monitoring networks; these networks are valuable for regulatory monitoring networks, fence-line emissions monitoring (e.g., wildland fire, industrial operations, energy production), academic and community-based research on air quality, climate and health, military, and citizen science.

SUMMARY OF ANTICIPATED RESULTS:

In Phase I we propose to advance and test a novel, lightweight, outdoor air sampling system (named the SPARC sampler) for use as a solution for lower cost, field-based calibration. Data generated during Phase I will be used to validate the performance of the SPARC technology and to evaluate the efficacy of several sensor calibration techniques. To accomplish this work we will produce 25 field-ready prototypes, deploy a network of SPARC devices co-located with commercially-available standard reference monitors and low-cost PM sensors, and evaluate the utility of the SPARC sampler as a node-calibration system for a low-cost sensor network and against existing calibration approaches.

FY 2018 PHASE I AWARD WINNER

FIRM: CoastalOceanVision, Inc
10 Edgerton Drive
North Falmouth, Ma 02556

AWARD: \$ 119,337

PHONE: 508 472 5520

E-MAIL: sgallager@coastalocoeanvision.com

PRINCIPAL INVESTIGATOR: Scott M. Gallager

TITLE OF PROJECT: Harmful Algal Bloom Species, Toxin and Total
Phytoplankton Identification System (HABStats) for Hand-
Held, Remotely Networked or Submersible Operation

SUBTOPIC NUMBER: 8.2.1

TECHNICAL ABSTRACT:

We propose to develop and commercialize the next generation of low cost, low power, ruggedized, and accurate phytoplankton single cell and whole colony counting, characterization and classification system called HABStats. We will accomplish this using the following three unique and innovative approaches: 1) High-throughput color, Light Field Imaging Flow Cytometry to acquire morphological information (area, major-micro axis, granularity, color pattern, circularity, shape, etc.), combined with 2) Raman and fluorescence spectroscopy to acquire species-specific molecular information on combinations of pigments (B-Carotenes, Chlorophylls, Xanthophylls, Phycobilliproteins, etc.), triglycerides, and amino acids and proteins. HAB toxins will be characterized and quantified by Raman spectroscopy, and 3) The optical package will be integrated into a flow cytometer-on-a-chip using acoustic focusing to center the stream of cells, and provide a small form factor instrument with a web-enabled processor. Convolutional Deep Neural Networks provide for Deep Learning data integration and artificial taxonomist, and WiFi communications for hand-held, distributed networking, or submersible (1000 m) operations. For Water Quality Monitoring Professionals that need real-time detection and identification of toxic algae and their toxins, CoastalOceanVision's HABStats imaging and spectroscopic innovation will provide for this need. This proposal directly addresses SUBTOPIC 8.2.1: Portable, Fast, and Intelligent Phytoplankton Species-identifier and Counter.

SUMMARY OF ANTICIPATED RESULTS:

Completing the work plan in this Phase I proposal will result in a highly detailed design and feasibility report on constructing a prototype flow-through imaging instrument for quantifying and classifying phytoplankton cells, including harmful algae and their toxins in fresh and marine systems. Through building a library of spectral signatures and features extracted from 3-D images of cells, and using Deep Learning techniques like Convolutional Deep Neural Nets, the prototype will have the capability to accurately classify phytoplankton cells and characterize

toxins in real-time with high throughput in a hand-held or remote networked package. The commercialization plan is to complete the prototype and its real-world testing and verification in Phase II, followed by Phase III where the instrument will be mass marketed for the detection and management of phytoplankton, both toxic and non-toxic.

FY 2018 PHASE I AWARD WINNER

FIRM: R3 Digital Sciences, Inc.
2000 Kraft Drive, Suite 1111
Blacksburg, VA 24060

AWARD: \$119,889.08

PHONE: 540-907-3995'

E-MAIL: brent.roeder@r3-ds.com

PRINCIPAL INVESTIGATOR: Brent Roeder

TITLE OF PROJECT: "Big Eye" Binoculars Extension Kit for Automating Bearing/Range Measurement and Image Storage

SUBTOPIC NUMBER: 8.2.3

TECHNICAL ABSTRACT:

R3 Digital Sciences, Inc. (R3-DS) proposes to develop and commercialize an extension kit for "Big-Eye" and other binoculars that will automatically compute and store distance and bearing assessments by combining vertical reticle and stereoscopy measurement with motion analysis techniques. It will also capture and store photographic and video evidence of what the observer sees through the binocular.

SUMMARY OF ANTICIPATED RESULTS:

This Phase I SBIR will demonstrate feasibility and result in a preliminary concept design concept of operations, and additional commitments from end-users. The Phase II SBIR will result in an advanced prototype extension kit that will be demonstrated in multiple ocean trials.\ Phase III will leverage private and federal funds and result in low volume sales of first article extension kits to early adopters from the scientific, military and civil ian sectors.

FY 2018 PHASE I AWARD WINNER

FIRM: Toyon Research Corporation
6800 Cortona Dr.
Goleta, CA 93117-3021

AWARD: \$120,000

PHONE: 805-968-6787

E-MAIL: mlindbery@toyon.com

PRINCIPAL INVESTIGATOR: Scott A. McNally

TITLE OF PROJECT: Low-cost Mooring Location Beacon for Coastal Applications

SUBTOPIC NUMBER: 8.2.5

TECHNICAL ABSTRACT:

Subsurface mooring beacons are used to provide notifications and assist in locating moored assets that have surfaced and are free drifting so that they can be recovered. Their nominal design is driven by the requirements for offshore use where they need to survive extreme depths and utilize satellite constellations for communication and geo-location. These beacons serve their purpose well, but their high cost makes them impractical for low budget or high unit count projects. Toyon Research aims to make a variant of the subsurface mooring beacon that is tailored for coastal applications with a goal of significantly reduced cost. By limiting the maximum depth and potentially utilizing on-shore wireless infrastructure the per-unit fabrication and component costs can be reduced. It will include standard functionality such as surface detection, fast geo-location and transmission, and extended battery lifetime. The low price-point of this new class of subsurface mooring beacon will enable its adoption for a wide variety of projects in coastal and inland waterway environments.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated result of the proposed Phase I is a functional proof-of-concept system that will be used for testing and performance characterization in the field. The Phase II effort will focus on testing, refining, and maturing the design. At the end of the Phase II effort when the final version of the beacon has been proven in the field, with NOAA's agreement, Toyon will open source the project. This will entail hardware design, mechanical design, embedded processor software, and documentation. The documentation will include all details needed for a third party to successfully build and deploy the coastal beacons. This also opens up the possibility of the development community modifying the design for continued refinement after Toyon's effort has ended.

FY 2018 PHASE I AWARD WINNER

FIRM: Guild Associates, Inc. DBA Guild Biosciences
5750 Shier Rings Rd
Dublin, OH 43016-1234

AWARD: \$ 119,983.84

PHONE: 843-573-0095

E-MAIL: msmiechowski@guildbiosciences.com

PRINCIPAL INVESTIGATOR: Dr. Matthew Smiechowski

TITLE OF PROJECT: Immobilized Enzyme Additive Package for Plant-Based
Finfish Aquaculture Feed

SUBTOPIC NUMBER: 8.3.5

TECHNICAL ABSTRACT:

A cost-effective, nutritious feed that minimally impacts the surrounding environment is critical to the profitability of a commercial aquaculture operations. As common sources of protein, such as fishmeal and fish processing byproducts, are becoming limited and more expensive to use, feed producers have turned to plant-based proteins. Plant-based feeds however, come with their own complications, including the need for supplementation with proteins, vitamins and amino acids needed for fish survival and growth, and the requirement to remove natural anti-nutritional factors during processing. For the proposed project Guild BioSciences will utilize our patented immobilized enzyme platform to develop an enzyme-based additive for soybean meal feeds that 1) can maintain effectiveness after being blended into pelleted feed at the point of manufacture, 2) removes anti-nutritional factors related to soybean meal after the feed has been ingested, 3) does not adversely affect the health of the fish, and 4) does not adversely affect the aquaculture environment. Feasibility of this effort will be proven through production and in vitro validation of the enzyme-based additive package's functionality and a demonstration of in vivo efficacy of a fully formulated feed containing the additive package using rainbow trout.

SUMMARY OF ANTICIPATED RESULTS:

The proposed additive package will augment the quality of current processed soybean meal containing aquafeeds, and is expected to improve the production performance, digestibility, and physiological response of fish. The improved digestibility will lead to less aquatic pollution as most of the nutrients will now be utilized by the fish instead of excreted. On a cost per unit protein basis the additive will make soybean meal a more attractive protein source than fishmeal for most farmed finfish. Completion of the proposed project will enlarge the portfolio of feed ingredients available to the feed industry and promote U.S. grown soy.

FY 2018 PHASE I AWARD WINNER

FIRM: Atmospheric & Space Technology Research Associates,
LLC
5777 Central Avenue, Ste 221
Boulder, CO 80301-2870

AWARD: \$ 119,900.09

PHONE: 303-993-8039

E-MAIL: estromberg@astraspace.net

PRINCIPAL INVESTIGATOR: Erik Stromberg

TITLE OF PROJECT: Next Generation National Water Level Observation
System

SUBTOPIC NUMBER: 8.2.10

TECHNICAL ABSTRACT:

Accurate knowledge of water levels is crucial for day-to-day operations and planning of many US coastal activities. This information is used for the safe navigation of thousands of vessels on a daily basis, including passage of large vessels and cargos under and around coastal and river infrastructures. The NOAA Center for Operational Oceanographic Products and Services (CO-OPS) manages a combination network of 210 long-term (permanent) and 100 short-term (mobile; relocatable) water level observation stations comprising the National Water Level Observation Network (NWLON). The existing NWLON sensors and measurement systems have been in operation for 15+ years; well past their intended operational lifetimes and out of date with today's technologies. NOAA is now seeking the development of the next generation NWLO system (NWLOS) design to perform real-time measurement, processing, and storage of collected instrument data from deployed locations. ASTRA proposes to develop this next generation NWLOS design (Phase I), fabricate a prototype system (Phase II), and demonstrate the system in a relevant environment (Phase II). This next generation NWLOS would be capable of integration into existing NWLON stations to support the integration and implementation of multiple NOAA sensor packages.

SUMMARY OF ANTICIPATED RESULTS:

The proposed Phase I effort will result in the development of a preliminary design of the National Water Level Observation System (NWLOS) that meets the requirements of the solicitation, including in-depth analysis and trade studies of performance. Additionally, we will develop an economical and technically viable manufacturable solution for the NWLOS to progress into Phase II. The Phase I effort will result in a PDR presentation of the proposed solution, with recommendations and plans for the Phase II. The Phase II effort will result in the fabrication, validation, and demonstration of a prototype system deployed in a relative environment.

FY 2018 PHASE I AWARD WINNER

FIRM: Brandywine Photonics LLC
748 Springdale Dr. Suite 125
Exton PA 19341

AWARD: \$ 119,999.23

PHONE: 484-459-9589

E-MAIL: ifisher@bphotonics.com

PRINCIPAL INVESTIGATOR: John Fisher

TITLE OF PROJECT: Doppler Wind Temperature Sounder

SUBTOPIC NUMBER: 8.2.12

TECHNICAL ABSTRACT:

We propose developing a new observational capability for measuring upper atmosphere (20-Km to 200-Km+ altitude) wind and temperature dynamics, based on Doppler imaging of Limb concentrations of NO, N₂O, and CO₂ called the Doppler Wind Temperature Sounder. The principle of operation is that by measuring the Doppler shift of trace gases created by the differential velocity between the spacecraft and the air mass, one can derive both air mass velocity and temperature, with much higher spatial resolution and accuracy than now performed by other methods. The instrument is a very simple, low-cost design with a large format midwave infrared camera with gas cells containing one each of the three gases, compared to three matched calibration reference cells. The final implementation will be designed for incorporation into a 6U (single channel) or 12U (three channel) CubeSat.

The DWTS mission will address atmospheric dynamics having important implications for the neutral atmosphere from the cloud top into the mesosphere, with important boundary data for NWP models. These measurements will be synergistic with atmospheric lidar (single measurement but limited coverage), and AMVs (limited in altitude.) No previous, present, nor planned instrument or mission (e.g., OAWL or GOLD) has such unique and comprehensive measurement capabilities.

SUMMARY OF ANTICIPATED RESULTS:

The results shall be a CDR-level design of a CubeSat Instrument capable of measuring wind and temperatures from altitudes of 20-Km to 200+ Km with a low-cost Gas Filter-based limb imager. Scientific algorithms for processing the data shall be demonstrated based on previous satellite data, with simulations of the expected accuracy and error budget. Results shall include a mission analysis for coverage by a full ~12-satellite constellation.

FY 2018 PHASE I AWARD WINNER

FIRM: Triton Systems Inc.
200 Turnpike Rd.
Chelmsford, MA 01824

AWARD: \$ 119,095.67

PHONE: 978-856-4193

E-MAIL: rmandujano@tritonsys.com

PRINCIPAL INVESTIGATOR: Rafael Mandujano

TITLE OF PROJECT: Low-cost Mooring Location Beacon for Coastal Applications

SUBTOPIC NUMBER: 8.2.5

TECHNICAL ABSTRACT:

Triton Systems, Inc. proposes development of the Open-Source Oceanographic Asset Recovery Beacon (OpenORB) that will allow the deployment of coastal instrumentation moorings with affordable protection against loss. This open-source kit would significantly reduce the purchase price of a commercial location beacon by allowing the end-user to assemble a customized system with minimal time and effort. Attached to a subsurface mooring, OpenORB is capable of detecting a surfacing event and transmitting cellular or satellite signals based on network availability. Upon surfacing, the beacon activates and sends several transmissions per day for a period of 2 months to aid in the recovery of displaced moorings. While submerged, the beacon has a standby period of 8 months. The device is powered by user-replaceable AA batteries and can operate in all water environments, from temperatures of -10 to 60 degrees Celsius. OceanORB is designed for coastal applications and has a depth rating of 500 meters.

SUMMARY OF ANTICIPATED RESULTS:

Demonstrate beacon functionality with open-source components at an attractive price point, including modular communications capability, low power operation, a reliable surfacing detector, and a rugged design.

FY 2018 PHASE I AWARD WINNER

FIRM: Blue Storm Associates, Inc dba PEMDAS Technologies & Innovations
200 Turnpike Rd.
Chelmsford, MA 01824

AWARD: \$119,996.09

PHONE: 703-628-1676

E-MAIL: susan.mason@pemdastech.com

PRINCIPAL INVESTIGATOR: Michael Gauthier

TITLE OF PROJECT: Development of the Weather "Action Chain" Enabler (ACE) Application

SUBTOPIC NUMBER: 8.3.4

TECHNICAL ABSTRACT:

In this Phase I effort, PEMDAS Technologies and Innovations (PEMDAS), in collaboration with subcontractor Westover Studios, proposes to assess the feasibility of developing an innovative tool that allows forecasters to easily provide real-time threat tracking information to be used by the public to confirm the existence and location of a weather- or water-related hazards in a manner that a nonscientific user can understand. Combining Westover's experience in the innovative communication of actionable information to the public with PEMDAS' expertise in the areas of operational meteorology, impacts assessment, and decision support tools, we propose the design and development of the Weather "Action-Chain" Enabler (Weather ACE) application. As outlined in the proposal, research will focus on developing a comprehensive understanding of what is needed to facilitate end-user response upon receipt of time-sensitive actionable information along with the associated technologies needed to enable each component of the action-chain. An extensive review and evaluation of currently available literature and technologies will be conducted in assessment and design of the Weather ACE application. A demonstration of the pre-prototype feasibility of coupling NWS forecast products with user-defined alert criteria to generate color-coded point and polygon impact assessments will be conducted.

SUMMARY OF ANTICIPATED RESULTS:

The outcome of this Phase I effort will be the development of a preliminary design for the Weather ACE application based on a comprehensive assessment of available technologies capable of meeting NWS 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 2018 PHASE I AWARD WINNER

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

AWARD: \$ 119,990.60

PHONE: 978-663-9500

E-MAIL: escross@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. Eben Cross

TITLE OF PROJECT: Developing a robust and scalable calibration approach to low-cost AQ sensing

SUBTOPIC NUMBER: 8.1.3

TECHNICAL ABSTRACT:

Poor air quality represents a major public health risk, contributing to an estimated one of every eight deaths worldwide. Low-cost air quality sensors have developed rapidly over the last few years and offer the opportunity to make air quality monitoring inexpensive and widespread. However, low-cost sensors are currently unable to deliver accurate, reliable data due to a lack of understanding of what parameters impact performance and due to calibration models that inadequately describe sensor behavior under ambient conditions. This proposal will develop improved calibration models for electrochemical sensors utilizing realistically constrained, short-term laboratory calibration chamber experiments and long-term (24-month) sensor-to-reference co-location field deployments. Various machine learning techniques will be trained and evaluated using sensor and reference data from both calibration chamber experiments and ambient co-located field data. The end result of the Phase I project will be a robust calibration method that clearly identifies the parameters that impact performance over the lifetime of electrochemical sensors. The Phase I effort will provide the empirical foundation from which the optimized machine learning techniques can be adapted in Phase II to provide robust, universal calibration methods for electrochemical sensor systems at scale.

SUMMARY OF ANTICIPATED RESULTS:

The calibration method for low-cost air quality sensors developed in this project will lead to widely expanded measurements of air quality and to improved understanding and mitigation of air pollution. It will also increase sales of Aerodyne's low-cost air quality sensor package.

FY 2018 PHASE I AWARD WINNER

FIRM: Black Swift Technologies LLC
3200 Valmont Rd Ste 7
Boulder, CO 80301

AWARD: \$ 119,872.94

PHONE: 720-638-9656

E-MAIL: elstonj@blackswifttech.com

PRINCIPAL INVESTIGATOR: Jack S Elston

TITLE OF PROJECT: The S0 UAS, and Air Deployed Solution for Boundary Layer Observations in Turbulent Environment

SUBTOPIC NUMBER: 8.2.13

TECHNICAL ABSTRACT:

Previous efforts have demonstrated that targeted observations of tropical storms by UAS can provide extremely valuable data sets for improving forecasts and models, but are also difficult to obtain. A number of obstacles including regulations and the distance required to intercept evolving storms have limited the number of land based flights. The use of airborne deployed UAS have recently overcome some of those limitations, and have generated targeted data that compares quite well with measurements obtained using proven methods. However, even these UAS are plagued by obstacles including the high cost of the platform, and the relatively limited observation time.

As the next step in boundary layer and sea surface observations, Black Swift Technologies proposes the development and flight validation of the S0, a commercial UAS platform designed for air deployment which will build on the successes of the Aerosonde and Coyote platform. The S0 will be designed to gather 3D wind measurements along with PTH measurements, sea surface temperature, and vehicle height from the water at lower altitudes. The key innovation is to reduce the complexity and weight compared with existing platforms, offering an order of magnitude decrease in cost while maintaining endurance without sacrificing performance and measurement quality.

SUMMARY OF ANTICIPATED RESULTS:

The primary technical objective of the proposed effort is to develop a low-cost, air deployed UAS to sample kinematics and thermodynamics of the lower part of the boundary layer. Specifically, the following goals are proposed: 1) Price near \$5000 2) Measure 3D winds and PTH 3) Sea surface characterization using a laser altimeter and thermal IR sensor 4) 2 hours of endurance 5) AVAPS telemetry 6) A simple to use interface to pre-program the aircraft

FY 2018 PHASE I AWARD WINNER

FIRM: InnovaPrep LLC
132 East Main Street #68
Drexel, MO 64742-0068

AWARD: \$ 120,000.00

PHONE: 816-619-3375

E-MAIL: mhornback@innovaprep.com

PRINCIPAL INVESTIGATOR: Michael Hornback

TITLE OF PROJECT: Development of a Rapid Monitoring System for Detection of Pathogens in Marine Aquaculture Operations

SUBTOPIC NUMBER: 8.3.6

TECHNICAL ABSTRACT:

InnovaPrep proposes to develop a rapid sample-to-answer monitoring system for detecting pathogens in marine aquaculture waters. An assessment of industry needs will include a kickoff meeting with NOAA and a visit to Toby Island Bay Oyster Farm. Following the assessment and report, a TRL-4 breadboard prototype system will be developed that will include the combination of sample concentration, cell lysis, and DNA purification. Finally, the system will be demonstrated at two concentrations using the BSL-1 species, *Vibrio harveyi*, as a surrogate pathogen. The bacteria will be spiked into simulated seawater at 0.1 CFU/mL (low level) and 10 CFU/mL (high level). The final prepared samples will be analyzed by real-time quantitative Polymerase Chain Reaction. An InnovaPrep funded, preliminary marketing study will also be performed during Phase I.

SUMMARY OF ANTICIPATED RESULTS:

Anticipated results of the Phase I effort and the parallel marketing study, include a market size estimate for a commercial version of a mature system, and data confirming that such a system can achieve detection levels that are significant to the aquaculture industry. We anticipate confirming that the prototype system will achieve >700X concentration of analysis-ready DNA from 1L of seawater and detection of the surrogate at 285 CFU/mL.

FY 2018 PHASE I AWARD WINNER

FIRM: American Benchmark Machine Works
926 Unit A 79th Ave. S.E.
Olympia, WA 98501-5897

AWARD: \$ 119,108

PHONE: 360-584-9303

E-MAIL: steve@americanbenchmark.com

PRINCIPAL INVESTIGATOR: Steve Jacobson

TITLE OF PROJECT: A Blubber- or Dorsal Fin-Piercing Tag Attachment System
for Remotely-Deployed Cetacean Tags

SUBTOPIC NUMBER: 8.2.4

TECHNICAL ABSTRACT:

Animal-borne electronic instruments (tags) are critical tools for monitoring the behavior and ecology of cetaceans, providing data needed for managing their populations and mitigating the threats they face. Although remote-deployment of tags onto cetaceans that cannot be captured has provided valuable data, attachment durations have been frustratingly short and variable. Our Phase I objective is to demonstrate the feasibility of an alternative tag attachment element for remote deployment of tags, onto small- to medium-sized cetaceans, that eliminates implanted sharp surfaces, has a compliance closer to tissue than the current generation of rigid metallic implants, and decreases the chances of attachment element breakage. We propose a truly biocompatible tag attachment element that pierces only blubber or dorsal fin tissue. Our approach will include CAD, finite element analysis, and production of prototypes for conducting static and dynamic force testing. The biomaterial offering the best combination of strength, flexibility, elasticity, and biocompatibility, while still functioning effectively to anchor an external tag package will be determined. This innovation would be readily commercialized, as we have done for many other biomedical/surgical products, and it would realize the goal of longer and more consistent attachment durations while minimizing the impact on tagged whales.

SUMMARY OF ANTICIPATED RESULTS:

We will expand on our preliminary results and demonstrate that a blubber- or dorsal fin-piercing attachment element provides greater resistance to detachment when exposed to external forces, while minimizing the transfer of forces to the implanted element. This will reduce the mechanical irritation of tissues, and decouple the extreme forces of con-specific interactions, resulting in longer, more consistent attachment, beyond multi-month. A successful Phase I and II study will result in a vastly improved product for attaching and securing a wide variety of biotelemetry tags to cetaceans, and that product will be beneficial to cetacean scientists in academia and in the Federal Government, especially the NOAA Fisheries regional science centers.

FY 2018 PHASE I AWARD WINNER

FIRM: Synthetik Applied Technologies LLC
28696 Tree Farm Road
Pierre, SD 57501-6194

AWARD: \$ 119,990.32

PHONE: 605-593-5500

E-MAIL: vonk@synthetik-technologies.com

PRINCIPAL INVESTIGATOR: Peter Jeffrey Vonk

TITLE OF PROJECT: Deep Sea Vision AI: Deep Learning-Based Real-Time Marine Animal Detection for Entanglement Mitigation

SUBTOPIC NUMBER: 8.3.2

TECHNICAL ABSTRACT:

The objective of this project is to develop and implement a real-time detection and warning system to mitigate marine entanglement events in offshore aquaculture operations. In order to achieve this, we leverage the latest advances in computer vision, deep learning, and real-time object detection to develop a real-time marine life detection, classification and tracking pipeline: Deep Sea Vision AI (DSV-AI). We deploy our real-time detection pipeline on robust yet inexpensive off-the-shelf (OTS) hardware. The complete DSV-AI detection system is designed to be usable in multiple configurations, including from Unmanned Aerial Vehicles (UAVs), stationary, pole-mounted or marine bouy-mounted platforms.

Phase I is primarily focused on developing and demonstrating the feasibility of the deep learning and computer vision-based software pipeline. This pipeline consists of several software components to: 1) acquire real-time video, 2) pre-process (de-noise/image enhancement) video frames, 3) detection and classification of marine animals of interest, 4) real-time tracking, position and velocity calculation, 5) activation of deterrents to discourage entanglement, and 6) provide real-time alerts and supporting data to stakeholders.

SUMMARY OF ANTICIPATED RESULTS:

The image annotation platform developed during Phase I be further extended to Phase II and utilized to annotate and classify thousands of images for all of the marine animals of interest. The hardware and software combination developed during Phase I may be adapted based on lessons learned during the performance profiling and testing stages. This will aid in informing Phase 2 work, particularly with regard to specific system components which may need to be modified based on results of the feasibility study and prototype developed during Phase I. The convolutional objects detection model utilized during Phase I may be supplanted by a faster or more accurate model during the time required to complete the Phase I effort and prior to or after commencement of Phase II.

FY2018 NOAA SBIR Phase II Awards

FY 2018
List of NOAA SBIR Phase II awardees

<u>Proposal #</u>	<u>Company Name</u>
• 17-2-016	Pisces Molecular
• 17-2-021	Space Environment Technologies
• 17-2-022	Creare LLC
• 17-2-032	Forever Oceans Corporation
• 17-2-044	Creare LLC
• 17-2-049	CODAR Ocean Sensors, Ltd.
• 17-2-060	Creare LLC
• 17-2-066	Aerodyne Research Inc.
• 17-2-067	Blue Storm Associates, Inc dba PEMDAS Technologies & Innovations
• 17-2-070	Remote Sensing Solutions, Inc.
• 17-2-071	Metron, Incorporated
• 17-2-072	Swift Engineering, Inc.
• 17-2-083	Actinix
• 17-2-086	Latitude Engineering, LLC
• 17-2-087	High Precision Devices, Inc.
• 17-2-091	Aerodyne Research Inc.
• 17-2-102	Atmospheric & Space Technology Research Associates, LLC (ASTRA)
• 17-2-108	Tridentis LLC.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,601.95

PHONE: 303-546-9300

E-MAIL: jwood@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:

We believe that employing current molecular biology techniques it is possible to develop plasmid DNA based positive control standard kits for a wide variety molecular assays for environmental organisms, and that this represents a significant commercial opportunity. In Phase I we demonstrated that plasmid DNA-based qPCR positive controls are stable, perform as well as genomic DNA positive controls and are technically feasible to produce at a commercially viable cost. In Phase II we intend to both improve the stability and ease of use of plasmid DNA based controls in laboratory PCR and qPCR assays as well as explore a wider variety of potential applications for such controls. Our objectives are to test methods to limit evaporation, determine minimum handling requirements and performance with & without background DNA of plasmid DNA controls. Additionally, we will test the utility of plasmids DNA controls to define the detection limits of multiple targets at different ratios in a multiplex qPCR, validate the detection sensitivity of new amplification technologies, and measure the stability and recovery efficiency of environmental DNA during collection, preservation and DNA extraction of environmental DNA samples..

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results of this project will be readily available, accurately quantified positive control kits for molecular assays for environmental organisms that can provide more accurate and trustworthy results from testing that can have economic or public health impacts, better comparisons between results from different laboratories or procedures, or even different assays for the same organism.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$400,000

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 an order of magnitude improved TEC position correction maps. These will be publicly and globally accessible. A significant 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 Phases 11-111, we will implement and demonstrate a prototype operational capability, construct a deployment and improvement plan, and deploy this system commercially on a test basis for first users. Implementation and demonstration tasks include using the existing GAIM Gauss-Markov (GM) model to produce global TEC correction maps and correction coefficients that can replace Klobuchar correction coefficients. These will be continuously updated and available from a server site at the end of Phase II. In Phase III will then extend the system to use the GAIM Full Physics (FP) model in an 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 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 positioning 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 the system deployed on their operational servers.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,920.38

PHONE: 603-643-3800

E-MAIL: dbk@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 and enable early detection of problems. Citizen science programs have been shown to provide a highly effective method of monitoring water quality.

Create is developing an open-source water quality monitoring system that is both easy to use and inexpensive. Our system incorporates a wireless sensor along with a cloud-based data repository. During Phase I we developed and demonstrated a prototype version of the system and demonstrated it to environmental researchers and water quality experts. During Phase II, we will finalize development and validation of the system and use the system in a pilot citizen science water quality monitoring study. Hardware designs 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 powerful tools for data assurance, visualization, and analysis.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,497

PHONE: 646-979-0066

E-MAIL: mat@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:

Phase II will build upon the advances made in Phase I and result in the development a cloud-based, computer vision framework which will facilitate the acquisition, segmentation, and classification of continuous, real-time video, rapid training and testing of neural network models, and the management of the entire process from a web-enabled dashboard.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,910.52

PHONE: 603-643-3800

E-MAIL: bhc@creare.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. Existing multi-rotor systems suffer from limited payload and endurance. Existing fixed wing systems offer improved endurance and payload, but require significant support hardware and high-risk recovery tactics for shipboard operations, such as catching the aircraft in a net or by a wingtip-mounted arrester hook. A compact UAS with vertical takeoff and landing (VTOL) capabilities is needed to meet NOAA requirements, including shipboard operations. To meet this need, Creare proposes a low cost VTOL UAS, the Quad-Biplane. The wings are configured as a biplane to reduce drag and increase endurance up to a factor of two compared to a monoplane with the same wingspan. The Quad-Biplane aircraft employs a novel control method that eliminates the added weight and complexity of traditional control surfaces (e.g., elevators and ailerons) and also reduces weight by using a single propulsion system for vertical and horizontal flight. In Phase I, we demonstrated the feasibility of our proposed approach through design, analysis, and flight testing. In Phase II, we will develop, build, and demonstrate system capabilities through flight testing and shipboard testing.

SUMMARY OF ANTICIPATED RESULTS:

Our proposed system will enable shipboard deployment of a low-cost, fixed-wing UAS for measurement of 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 in support of 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 2018 PHASE II AWARD WINNER

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

AWARD: \$399,875.99

PHONE: 408-773-8240

E-MAIL: chad@codar.com

PRINCIPAL INVESTIGATOR: Chad Whelan

TITLE OF PROJECT: Single-Mast Transmit-Receive Antenna for Long-Range 4-5.5 MHz Coastal HF Radars

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 with offshore ranges and resolutions of 160-220 km and 6 km, respectively. Currents provided by this network have numerous applications, most critically Coast Guard search & rescue and oil spill response. LR HFR stations presently require separate transmit and receive antennas, spaced approximately 60 m, which precludes mounting on most buildings or platforms and limits most to ground mounts in areas prone to storm surge. Hurricanes Irene (2011) and Sandy (2012) proved HFR to be a key observation tool, combined with others, to better predict hurricane intensity ahead of landfall. Sandy's storm surge destroyed part or all of many HFR stations in the Mid-Atlantic, costing tens of millions of dollars to replace and leaving operators to choose between losing hardware or making critical measurements during the next storm. CODAR proposes to build a LR HFR transmit/receive antenna for a single-mast installation on more resilient coastal structures. CODAR will demonstrate this antenna on a weather-hardened Sentinel water level monitoring station in Freeport, TX.

SUMMARY OF ANTICIPATED RESULTS:

Based on the results obtained in Phase I, CODAR will build a prototype combined transmit/receive antenna for operating in the 4-5.5 MHz band. Texas A&M University will build an autonomous power system and install it on the Freeport, TX Sentinel platform along with a Low Power SeaSonde connected to the new antenna. Performance of the new antenna on the Sentinel will be tested against performance on a ground mount as well as against the nearby Long Range SeaSonde installed at Surfside Beach, TX.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,945.16

PHONE: 603-643-2445

E-MAIL: iyb@creare.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, Creare proposes to develop and commercialize the MarineCitizen software for collection and aggregation of marine observations using smartphones. MarineCitizen enables collection of crowd sourced marine observations through different modes of operation, including entry of manual observations (including text, audio, and images), automated polling of internal phone sensors (e.g., barometer), and Bluetooth connectivity to external weather stations. The observational data are uploaded to a central MarineCitizen server for dissemination via a web interface, as well as sharing on social media sites such as Twitter. Machine learning techniques will also be used for labeling of marine conditions from submitted images.

SUMMARY OF ANTICIPATED RESULTS:

MarineCitizen will enable aggregation of 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 by marine forecasters and weather researchers for improvement of maps of current and future conditions, data assimilation of numerical weather forecasts, and post-evaluations of forecast accuracy.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,254.02

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 (GC) and mass spectrometric (MS) 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 will be able to process large multi-dimensional data sets, including those produced with advanced time-of-flight high-resolution mass spectrometers and will address the current lack of suitable analysis tools for these instruments which are increasingly critical for atmospheric research. Scientists who use GC/MS instruments will be able to reduce their analysis time to a small fraction of what is currently required, with improved accuracy, access to new data, and efficient quality control. 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 2018 PHASE II AWARD WINNER

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

AWARD: \$399,983.74

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 II effort, PEMDAS Technologies and Innovations (PEMDAS), in collaboration with subcontractor Aerovel, Inc., proposes to fully develop a prototype Low-Altitude Maritime Survey-Sampling (LAMSS) System using the technologies identified and knowledge gained during our Phase I effort. The proposed innovation will deliver the necessary capabilities for electro-optical and infrared (EO/IR) and full motion video (FMV) maritime surveys while leveraging an onboard Automatic Identification System (AIS); the LAMSS system will also simultaneously collect planetary boundary layer (PBL) observations, better enabling monitoring of the planet's air and water resources in remote maritime locations, and measurement of its boundary layer more safely and with greater effectiveness.

As outlined in the proposal, the technical challenges associated with this Phase II effort primarily surround: (1) the identification of a viable Air Quality (AQ) sensor capable of meeting the operational requirements detailed in the subtopic description; (2) formal evaluation and down-select of the final algorithm to be used for derivation of wind speed and direction; and (3) the integration of downselected technologies and algorithms into a single (LAMSS) system to deliver a multi-mission, transdisciplinary unmanned aerial prototype, capable of fulfilling NOAA's requirement to survey, map and collect on our nation's natural ecosystems.

SUMMARY OF ANTICIPATED RESULTS:

The outcome of this Phase II effort will be a functional prototype of the LAMSS System capable of meeting NOAA's operational requirements, and ready for commercialization (Phase III).

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$400,000

PHONE: 508-362-9400

E-MAIL: 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 continue the development of a generalized 3DVAR data assimilation module, in an open-source and non-proprietary programming language, which is compatible with FVCOM and incorporated into the Lake Erie Operational Forecast System (LEOFS). We will leverage our experience and expertise in using 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 perform a hindcast experiment and demonstrate the ability of 3DVAR to 1) incorporate both in situ and satellite observational data sets into the existing LEOFS, 2) run efficiently from a computational perspective, and 3) improve over non-assimilating simulations. Our innovation is to include an Ensemble Kalman Filter (EnKF) module and develop a data assimilation roadmap towards a hybrid ensemble-variational (EnVar) data assimilation system

SUMMARY OF ANTICIPATED RESULTS:

Successful completion of the proposed work will demonstrate the positive impact of 3DVAR assimilation of both in situ and satellite observations on the performance of the Lake Erie Operational Forecast System (LEOFS). Through 3DVAR data assimilation, the impact of observational data on the operational forecast system will be quantified. Specific delivery includes an advanced 3DVAR data assimilation module, in an open-source and non-proprietary programming language, which is compatible with FVCOM and incorporated into the LEOFS. The EnKF data assimilation system will also be developed for the LEOFS with a goal to formulate a data assimilation roadmap that will guide future improvement of the 3DVAR data assimilation. The outlook for the commercial need and market penetration for the ocean data assimilation technology is very promising. 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 2018 PHASE II AWARD WINNER

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

AWARD: \$399,981.17

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:

During Phase I, Metron designed and implemented an efficient, scalable, end-to-end prototype system for collecting, storing, and viewing mariner weather observations: the Mariner Report App (MARApp). The MARApp Client is a mobile application that transforms smartphones and tablets at sea into forward geospatial/environmental sensors. It can take weather measurements from sensors built into a mobile device, external sensors connected via Bluetooth, or manual input by the user. The Client transmits time-stamped, geo-located weather reports in real time to the cloud-based MARApp Server, which stores the reports and provides an interface to view and export aggregated weather data from a browser on any web-enabled device. In Phase II, Metron will make significant additions and enhancements to the MARApp prototype to:

- Support the iOS operating system;
- Integrate with multiple external weather data sources via Bluetooth;
- Provide enhanced reporting, alerts, filtering, and visualization capabilities;
- Implement industry-standard security; and
- Integrate with social media.

In addition, Metron will develop and begin executing a comprehensive commercialization plan for continued enhancement and sustainment of MARApp in the years to come.

SUMMARY OF ANTICIPATED RESULTS:

At the end of Phase II, Metron will deliver a robust, intuitive, and secure end-to-end capability for marine weather reporting, data aggregation and fusion, customized alerts, and environmental model validation that will greatly improve mariner safety in coastal and inland water areas. Metron will release a fully functional version of MARApp to the maritime community for everyday use, accessible via a dedicated website and the Android and Apple App Stores.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,929.81

PHONE: 949-492-6608

E-MAIL: jschloss@swiftengineering.com

PRINCIPAL INVESTIGATOR: Jacob Schloss

TITLE OF PROJECT: Low Cost, High Precision Water Monitoring System

SUBTOPIC NUMBER: 8.3.3

TECHNICAL ABSTRACT:

This paper proposes development of a low-cost water monitoring system wirelessly networked to upload data to FieldKit for cloud based data visualization and validation. This will enable citizen scientists to collect a variety of parameters including conductivity, temperature, depth, and ocean noise measurements on an adhoc basis while contributing to a 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 platform for exchange of scientific data between citizen scientists and professional researchers. The implementation of FieldKit combined with the water monitoring system with both industry, government, and public support will lower the barrier to entry and enable the implementation of data driven tools for local decision making.

SUMMARY OF ANTICIPATED RESULTS:

A water monitoring system with wireless connectivity will be produced as well as an application that will allow for data visualization and sharing via an open on-line platform that is being developed by National Geographic Fieldkit.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$400,000

PHONE: 831-252-5163

E-MAIL: jimjacob@actinix.com

PRINCIPAL INVESTIGATOR: James Jacob

TITLE OF PROJECT: Adaptive mask flow photometer

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. This tool will measure aquatic optical properties over the wavelength range from 400 nm to 700 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 III commercialization.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$400,000

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 provide the feasibility of the HQ-55 by creating an initial design and a prototype airframe, which was successfully flown. Phase II will see the refinement and "productionization" of the airframe, the integration of NOAA's aerosol sampling payload and flight tests conducted from a NOAA ship at sea.

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. In Phase II, the airframe will be refined, including full integration of a fuel injected engine, transponder, and communication systems. Flight testing throughout the performance envelope will be conducted, including from a NOAA ship pending availability.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,999.74

PHONE: 303-447-2558

E-MAIL: kmill@hpd-online.com

PRINCIPAL INVESTIGATOR: Kevin Miller

TITLE OF PROJECT: Multichannel Commercial Cavity Ringdown Spectrometer
for Oxides of Nitrogen and Ozone

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 NOAA's patented NO(y) CRDS technology offers outstanding potential for commercialization based on its excellent performance and robustness and stability of the optical cavities and cage system. Our team provides well 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 II effort will refine design requirements to support development of a research grade prototype for commercial markets, update and refine the commercialization plan to include all market segments, including research applications as well as other future markets, including detailed input regarding needs and priorities from prospective customers and users in the market segments beyond the research community, such as air quality and regulatory compliance, and advance the Phase I commercial design into an engineering hardware demonstration and initial prototype of the research instrument. Phase II efforts will include the stepwise development and validation of the key subassemblies and subsystems prior to development and test a fully integrated engineering instrument. The results of development and test of this instrument will be leveraged in the design, development and test of the multi-channel Commercial CRDS (C-CRDS). Development results will be included in ongoing commercialization interviews with atmospheric researchers and environmental monitoring

organizations. Interview results, market analyses and development and recurring unit cost analyses will be used to finalize the C-CRDS commercialization plan.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,267.61

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. In Phase I, we met all of our goals. We demonstrated a novel trace gas monitor that can sensitively (15 ppt noise at 1 Hz) and continuously monitor HCl without inlet artifacts. Our patented active passivation technique was extended from HNO₃ to HCl, enabling HCl sampling with minimal surface interactions despite its stickiness. During Phase II we will improve the HCl monitor to provide more stable flight operation, develop an inlet switching system to measure reactive chlorine (ClNO₂ and Cl₂) and deploy the instrument for extended testing at a field site that is expected to show halogen photochemistry.

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 autonomous and flight ready 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 2018 PHASE II AWARD WINNER

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

AWARD: \$399,969

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 Precise Point Position (PPP) error maps for single- and dual-frequency GNSS receivers. The proposed Phase II research effort will develop a prototype software framework to provide now-casting and 1-3 day forecasting of GPS PPP and timing errors and for estimating ionospheric scintillations via Rate of TEC Index (ROTI) over the Continental United States (CONUS).

SUMMARY OF ANTICIPATED RESULTS:

At the end of Phase II, we will have demonstrated the performance and capabilities of the software framework system to create maps of PPP uncertainties as well as timing errors in now-casting and forecasting modes. These new data products will be produced in real-time at NOAA.

FY 2018 PHASE II AWARD WINNER

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

AWARD: \$399,974.50

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 prove out the research done in Phase I using a Proof of Concept demonstration craft. The Proof of Concept demonstrator will be a geometrically scaled version of the craft designed during Phase I. The Phase I craft, the Advanced Coastal Monitor (ACM) was designed to use 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 was 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 incorporated the latest unmanned vessel controls that conform to current Collision Regulations (COLREGS) and obstacle (surface and sub-surface) avoidance technology. The ACM was 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 successful testing of the Proof of Concept demonstration craft including the design 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 commercialize in Phase III.