



SBIR



Small Business Innovation Research Program

ABSTRACTS OF AWARDS FOR FISCAL YEAR 2019 Phase II

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

INTRODUCTION

The Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), through the Small Business Innovation Research (SBIR) program, awarded 17 NOAA SBIR Phase II contracts for FY 2019.

In Phase II, funding is provided for projects that are most promising after Phase I is completed from the previous year. These awards are up to \$400,000 each, and totaling approximately \$6.8M. The awards are for a two-year effort to continue the research and development of the innovative approach they proposed during the Phase I project. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

FY 2019 PHASE II
List of Awardees

Proposal Number	Company Name	Subtopic Number
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18-2-035	Desert Star Systems	8.1.2
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FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 389,279.89

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:

The S-100 specification is a new geospatial standard for hydrographic data, that is presently under development by the International Hydrographic Organization (IHO). Once the S-100 based products and services are fully developed by the IHO, current datasets will be scheduled for obsolescence, and the Hydrographic Offices (HOs) will no longer produce them. Companies offering e-navigation solutions will need to develop new tools, modules, and applications to continue to support mariners' hydrographic needs for safe navigation. Without these new tools, ships will be at increased risk when navigating worldwide ports and waterways. The objective of this project is the continued research and development 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), Electronic Charting System (ECS), Portable Pilot Units (PPUs), and other situational awareness applications to obtain and use S-129 Exchange Sets developed for a planned route. The primary innovations within the architecture are the use of the Lua programming language as the technology in the S-100 model transformation engine, the dynamic script loading analysis engine, and the multi-product database derived from a S-100 General Data Model schema.

SUMMARY OF ANTICIPATED RESULTS:

Upon completion of this SBIR Phase II, WR will have developed an Under Keel Clearance – Risk Management System built on a S-100 Geospatial - Architecture (G-Arc) Runtime engine to support safe navigation for maritime vessels.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,678.00

PHONE: 831-236-7750

E-MAIL: marco.flagg@desertstar.com

PRINCIPAL INVESTIGATOR: Marco Flagg

TITLE OF PROJECT: SeaTag-SP: A family of acoustic detecting satellite tags for spawning detection and more

SUBTOPIC NUMBER: 8.1.2

TECHNICAL ABSTRACT:

Phase-1 demonstrated the powerful and unusual remote sensing opportunities available by adding acoustic signal detection to pop-up satellite tags (PSAT). The time and location of spawning define the starting point in the life history of fish. Yet this event, which is of critical importance to fishery researchers and managers seeking to gain an understanding of distinct reproductive populations and the eventual development fish biomass, remains poorly understood including for many important commercial species. Our phase-1 work focused on spawning detection by observing the loss-of-signal of a tiny acoustic pinger injected in the ovary of a fish and subsequently ejected with the spawn. We manufactured and validated a prototype detector. Building on this foundation, we will refine and enhance this detector and then miniaturize the concept, making spawning studies practical for smaller and faster species. Underwater acoustic remote sensing and reporting is a concept with broad applicability. The development and test of a 'software defined acoustic receiver' for PSAT will conclude this project, and provide a first family of acoustic detecting PSAT suitable for interests including the study of spawning, predation and social interaction among marine animals, the passive acoustic detection of whale presence via their vocalizations and more.

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 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,964.00

PHONE: 703-413-0290

E-MAIL: contracts2@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 a proof of concept system demonstrated the technical feasibility to measure visibility using passive sensors. Phase II will produce a low power, self-contained 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 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,997.13

PHONE: 434-973-1215

E-MAIL: barron@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 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,903.29

PHONE: 603-643-3800

E-MAIL: contractsmgr@creare.com

PRINCIPAL INVESTIGATOR: Jeffrey J. Breedlove

TITLE OF PROJECT: A Compact Turbo-Rankine Energy Conversion System

SUBTOPIC NUMBER: 8.2.11

TECHNICAL ABSTRACT:

Creare is developing a miniature power system for NOAA weather monitoring stations in remote locations. This system can provide electric power continuously from naturally occurring temperature differences that exist between ambient air and water in environments such as the Arctic Ocean and the Great Lakes. Generating power directly from these temperature difference uses the atmosphere and ocean/lake as effectively infinite thermal reservoirs to provide an inexhaustible source of pollution-free energy. Our approach leverages decades of advanced development at Creare devoted to small thermodynamic systems with miniature turbomachines. During Phase I project, we specified designed details and demonstrated power generation at prototypical temperatures with a simplified breadboard assembly. We are now ready to fabricate a complete prototype system and demonstrate its operation and performance in a simulated Arctic environment during Phase II.

SUMMARY OF ANTICIPATED RESULTS:

Our power system will have a profound impact on the capabilities and persistence of NOAA weather and ocean monitoring stations, science instruments, military sensors, and communication nodes. The core technology can also produce electricity from a wide variety of other heat sources, including conventional fuel and biomass combustion, refuse incineration, geothermal energy and solar radiation.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,983.62

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:

The Bottom Feeder project is designed to prove out the research done in Phase I using a prototype platform. The prototype will be a full size version of the platform designed during Phase I. The Phase I platform was designed to work in two operational configurations, a highly efficient mode and a highly maneuverable mode, with the ability to switch between them while submerged. The platform is equipped with a modular science bay that is capable of employing a number of different types of scientific sensors while providing a simplified method of switching sensor types. The platform was designed to provide both tethered and autonomous submerged operations. This allows for both autonomous survey operations similar to other Unmanned Underwater Vehicles (UUV) and tethered operations similar to Remotely Operated Vehicles (ROV) when precise handling is required to get in close to delicate coral formations or other underwater objects of interest. The platform will additionally be capable of tethered UUV operations allowing for real time, high bandwidth data streaming.

SUMMARY OF ANTICIPATED RESULTS:

Our anticipated results will include the successful testing of the prototype platform including the design of the modular science bay. The platform will be tested in both the high efficiency and high maneuverability modes for both autonomous and tethered operations. This design will be suitable to take into contract and detail design cycles to commercialize in Phase III.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,995.00

PHONE: 314-630-0191

E-MAIL: bryan@nightcrewlabs.com

PRINCIPAL INVESTIGATOR: Bryan Chan

TITLE OF PROJECT: Development of a Functional Balloon-borne GNSS-RO System Prototype

SUBTOPIC NUMBER: 8.1.1

TECHNICAL ABSTRACT:

The SBIR Phase II proposal outlines the approach of Night Crew Labs (NCL) in designing, and developing, and testing a system prototype to perform Global Navigation Satellite System radio occultations (GNSS-ROs) from a high-altitude balloon platform. NCL will continue building from the positive results achieved in Phase I that successfully demonstrated the feasibility of performing balloon-borne GNSS-RO.

Significant effort will be placed in: a) developing a long-duration high-altitude balloon system to accommodate GNSS-RO scientific missions, and b) readying a GNSS-RO prototype for a long duration balloon flight to collect relevant data.

After collecting GNSS-RO sounding measurements on these test flights, data products such as bending angle, refractivity, and atmospheric temperature and humidity profiles will be retrieved using RO retrieval software specifically developed for balloon applications. These balloon-borne RO data products will be assessed for accuracy and validity by comparing them to well-established data sources.

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 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,555.27

PHONE: 970-818-7520

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 lack generalizability from one location (or season) to the next, making them impractical for implementation. Access Sensor Technologies (AST) proposes to improve and validate 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). In Phase I, we concluded that SPARC is a good calibration tool for low-cost sensors with performance that approaches federal equivalent methods. There are no commercial technologies that currently meet SPARC's cost and specifications- especially not integrating size-selective inlets, an easily-exchangeable filter cartridge, a pump, and accompanying sensors into one, solar-powered housing. Phase II will further improve the SPARC to meet customer-voiced needs, such as increased flow rate, power optimization, integrated wireless communications, and additional optional sensors. The proposed Phase II concludes with customer-led field studies to gather performance data, user feedback, and validate the value proposition. Successful completion of this project will yield a versatile air sampling technology that can help improve the reliability and data quality of low-cost air monitoring networks.

SUMMARY OF ANTICIPATED RESULTS:

In Phase II 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. The proposed Phase II will conclude with customer-led field testing to collect performance data, evaluate value proposition, and gather feedback on usability. The data generated will be used to further validate the performance of the SPARC technology and to evaluate the efficacy of several sensor calibration techniques. To accomplish this work we will produce 15 early-adopter prototypes that include an improved feature-set based on customer inputs.

FY 2019 PHASE II AWARD WINNER

FIRM: CoastalOceanVision, Inc
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North Falmouth, Ma 02556

AWARD: \$ 400.000

PHONE: 508 472 5520

E-MAIL: sgallager@coastaloceanvision.com

PRINCIPAL INVESTIGATOR: Scott M. Gallager

TITLE OF PROJECT: Phase II Commercialization of HABStats: A Harmful Algal Bloom Species, Toxin and Total Phytoplankton Identification System

SUBTOPIC NUMBER: 8.2.1

TECHNICAL ABSTRACT:

In Phase I, we developed a prototype instrument for counting, sizing and identifying both non-toxic and toxic Harmful Algal Bloom (HAB) species. We did this by integrating three innovative technologies: High-throughput color, Light Field Imaging Flow Cytometry to acquire morphological information for each cell, Raman spectroscopy to acquire species-specific molecular information on pigments and triglycerides, and Convolutional Deep Neural Networks providing Deep Learning data integration and an artificial taxonomist. We showed that at least 10 to 100 cells per second could be processed in real-time. We built an image and Raman library of more than 22 marine and 30 freshwater HAB species. Several HAB toxins were characterized and quantified by Raman spectroscopy. Phase II Objectives: continue building Raman libraries focusing on HAB toxins; examine the specificity of Raman compared to HPLC and ELISA analysis of HAB toxins; complete integration of 3-D imaging, Raman spectroscopy, and Deep Learning classification of cells and toxins into a Gen2 prototype that may be provided to beta-testers; work with Lockheed Martin to develop a Design for Manufacturing Plan for the HABStats instrument; construct four Gen2 HABStats and provide them to beta-testers involved in management and research of both marine and freshwater HABs.

SUMMARY OF ANTICIPATED RESULTS:

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. At the end of Phase II, we will have a Design for Manufacturing Plan working with a major engineering and manufacturer, Lockheed-Martin, and be ready for Phase III, full manufacturing of the instrument. This proposal directly addresses SUBTOPIC 8.2.1: Portable, Fast, and Intelligent Phytoplankton Species-identifier and Counter.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$400,000

PHONE: 805-968-6787

E-MAIL: smcnally@toyon.com

PRINCIPAL INVESTIGATOR: Scott 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. Their nominal design is driven by the requirements for offshore use where they need to survive extreme depths and remote deployment, most often using satellite constellations for communication and geo-location. Existing beacons serve their purpose well, but their high cost makes them impractical for low budget or high unit count projects. Toyon Research Corp. aims to produce a subsurface mooring beacon that is tailored for coastal applications with a goal of significantly reduced cost. By limiting the maximum depth and using commercial-off-the-shelf components, the beacon unit costs can be reduced. Toyon's solution includes standard functionality such as surface detection, fast geo-location and transmission, as well as 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 Phase II effort will focus on the refinement, maturation, and testing of the beacon design created in the Phase I. The anticipated result of the proposed Phase II is a fully functional and validated low-cost mooring beacon, which will be ready for commercial sales. The low-cost of the beacon will create a new segment within the market for low-value mooring payloads. This will allow the beacon's use on mooring payloads where it would not have previously been cost effective. Limitations on the use of existing beacons are due to the low cost of the payload (compared to the beacon) or the high unit count of moorings, where the total cost of the devices would have been impractical. The Phase II effort will have an emphasis on testing and validation of the new beacon design in order to guarantee it is robust to long term exposure to the marine environment and meets all of objective operational performance requirements for such a beacon.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,744.00

PHONE: 978-250-4200

E-MAIL: rwatson@tritonsys.com

PRINCIPAL INVESTIGATOR: Robert Watson

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 can detect 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. OpenORB is designed for coastal applications and has a depth rating of 500 meters. Additionally, OpenORB contains a local communications capability which can be used at a range of up to 10km for real-time communication of asset location during search and recovery.

SUMMARY OF ANTICIPATED RESULTS:

By making affordable protection against loss available to a wider community at a lower price point, OpenORB will decrease the number of lost buoys, the amount of lost data, and the amount of time spent in search and recovery operations in projects world-wide. We anticipate demonstrating 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 while performing long endurance tests in operational environments

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,941.55

PHONE: 321-431-6408

E-MAIL: michael.hauthier@pemdastech.com

PRINCIPAL INVESTIGATOR: Michael Gauthier

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

SUBTOPIC NUMBER: 8.3.4

TECHNICAL ABSTRACT:

In this Phase II effort, PEMDAS Technologies and Innovations (PEMDAS), in collaboration with subcontractor Westover Studios, proposes to develop a functional prototype of the Weather "Action Chain" Enabler (ACE) application using the technologies identified, knowledge gained, and preliminary design conceived during the Phase I effort. As designed, the Weather ACE application will be a non-intrusive software solution that leverages geo-fencing technologies to correlate user location (static or mobile), with weather threats or hazards (as forecast by NWS forecasters), to provide targeted and tailored alerts and notifications to affected users in a format designed to evoke safety seeking responses.

As outlined in the proposal, supplemental research will drive closure to open items illuminated during Phase I, and will be used to refine and finalize the Phase I preliminary design from which the prototype will be constructed. The functionality of the Weather ACE application will be demonstrated to Government Stakeholders at the conclusion of this Phase II SBIR.

SUMMARY OF ANTICIPATED RESULTS:

The outcome of this Phase II effort will be the development of a functional prototype for the Weather ACE application, along with a functional demonstration of the prototype application to Government Stakeholders. The Weather ACE application will greatly enhance the NWS forecaster's ability to communicate with the general public (as well as broadcast meteorologists, emergency responders, and other consumers) in a more targeted fashion, and do so in a manner that enhances safety-seeking responses by those in harm's way.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 400,000

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 widespread at an affordable price. However, low-cost sensors are currently unable to deliver accurate, reliable data due to a lack of understanding of what parameters impact performance and a lack of adequate calibration methods. This project is developing a robust, scalable calibration technique, involving a laboratory calibration chamber for rapid exposure of sensors to the full range of atmospheric and pollutant conditions and a sophisticated, adaptive machine learning algorithm. The end result of the Phase II project will be a calibration method that enables rapid calibration of tens of low-cost sensors at a time, and sufficient information about the longer-term behavior of the sensors to scale the calibration method to hundreds of sensors for use in large, distributed networks. In addition, a new database architecture will ingest, analyze and display the air quality data for a variety of end users, including atmospheric scientists, public health researchers and government agencies.

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 better understanding and mitigation of air pollution. It will also increase sales of Aerodyne's low-cost air quality sensor package..

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,578.08

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 reliability, 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) 1 hour of endurance 5) AVAPS telemetry 6) A simple to use interface to pre-program the aircraft

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,947.23

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. Phase II research will look to improve sample concentration, cell lysis, and DNA purification techniques that were developed in Phase I. More specifically, optimization of the prototype lysis/elution fluid will be further developed for cell lysis using BSL-1 organisms, *Vibrio harveyi*, a surrogate for pathogenic *Vibrio* spp. Techniques will be developed to overcome qPCR inhibition related to co-concentration of organic material from sea water sample, including prefiltration of sediment and humic acid removal. A prototype DNA purification kit will also be developed and optimized to facilitate DNA purification from lysed *V. harveyi* concentrated from experimentally infected sea water. The system will be tested in-house as *V. harveyi* will be spiked into one liter of sea water at 0.1 CFU/mL (low level) and 10 CFU/mL (high level), concentrated, lysed, and genomic DNA purified and analyzed by real-time quantitative Polymerase Chain Reaction. Finally, an independent evaluation of the complete prototype concentration, lysis, and purification system will be performed.

SUMMARY OF ANTICIPATED RESULTS:

Anticipated results of Phase II effort will confirm a prototype concentration, lysis, and DNA purification system that will achieve >2,000X concentration of analysis-ready DNA from 1 liter of seawater and detection limit of 100 CFU/mL of spike surrogate. The total process time to be under 30 minutes, with a total process efficiency, combining concentration, lysis, and DNA purification, of >50%.

FY 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,874.00

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 II goal is to develop an alternative tag attachment system for remote deployment of tags, onto small- to medium-sized cetaceans, that includes a fully-piercing implanted element with no sharp surfaces and a compliance closer to tissue than the current dart technology. It will also significantly decrease attachment element breakage risk. We propose a truly biocompatible tag attachment element that pierces only blubber or dorsal fin tissue, and a device for remote attachment of the system. We will build upon our Phase I results by refining our fully-piercing tag attachment system design, build prototypes of the full system, including implant elements, the connection to the external tag package, and the apparatus for remote deployment. Critically, in Phase II we will conduct rigorous testing and subsequent design iterations, ultimately allowing us to conclude Phase II with a prototype system that is ready for application to cetaceans, and successful commercialization.

SUMMARY OF ANTICIPATED RESULTS:

We will expand on our Phase I results by refining our design for a blubber- or dorsal fin-piercing attachment element and system for deployment. We will construct prototypes, subject them to extremely thorough testing that simulates both in the laboratory and in the ocean the anticipated environment that the system will be exposed to. This system reduce the mechanical irritation of tissues, and decouple the extreme forces of conspecific interactions, resulting in longer, more consistent attachment, beyond multi-month. A successful Phase 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 2019 PHASE II AWARD WINNER

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

AWARD: \$ 399,999.61

PHONE: 605-593-5500

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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:

Marine life entanglement is one of the critical permitting issues that is currently constraining the growth of domestic offshore aquaculture. Synthetik Applied Technologies is proposing to develop a low-cost entanglement detection system for offshore aquaculture operators. The system will use a combination of near real-time satellite imagery, intelligent on-site cameras (both above and below the water line), and acoustic sensors.

Our technology – called DeepSeaVision-AI – will be offered as a low-cost subscription service to operators and will reduce investment and operating risks associated with offshore aquaculture.

Our project team has been developing Artificial Intelligence and Machine Learning models for DARPA and the Department of Defense for nearly a decade and this experience and technology has been leveraged during the conduct of the Phase I work for NOAA, where we demonstrated system feasibility.

Moving to Phase II, we are excited about the potential to develop a ‘NOAA-approved’ and permit-ready monitoring system, and we plan to leverage the permitted offshore aquaculture sites operated by our teaming partners at the University of New Hampshire (fin-fish nets), and Salem State University (mussel long lines) as initial deployment examples.

SUMMARY OF ANTICIPATED RESULTS:

The DeepSeaVision-AI system will provide domestic aquaculture operators with an affordable tool to reliably mitigate animal entanglements, which is obviously better for marine life, but also better for farmers because operation is less likely to experience equipment damage or disruption of production caused by an entanglement event. Furthermore, inclusion of an effective marine life monitoring tool, such as DeepSeaVision-AI, at planned aquaculture sites will streamline and expedite permitting applications by satisfying permitting bodies that

adequate mitigation measures are in place to monitor marine life interactions. By addressing this key bottleneck in the permitting and regulation of aquaculture it is hoped that that the number and rate of successful permit applications will swiftly rise leading to an expansion in domestic aquaculture production.