SBIR

Small Business Innovation Research Program

ABSTRACTS OF
PHASE I and Phase II AWARDS
FOR
FISCAL YEAR 2016

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 27 Phase I contracts for FY 2016. These awards are up to $120,000 each, and totaling approximately $3,236,115.87. The awards are for a six-month effort to demonstrate the feasibility of innovative approaches to the research topics identified in the "DOC/NOAA SBIR Program Solicitation for FY 2017 (NOAA 2016-1)." 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 130 proposals were received by DOC/NOAA in response to its FY 2017 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 27 were selected for an award. Final selection was based upon the results of the reviews, relative importance to DOC/NOAA needs, relationship to on-going research, and potential for commercialization.

In Phase II, funding is provided for projects that are most promising after Phase I is completed. These awards can be for up to $400,000 each and for two years. The DOC/NOAA awarded a total of 14 Phase II contracts in FY 2016 for a total of approximately $5.6 million. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

FY 2016 PHASE I AWARD WINNER

FIRM: Adaptive Dynamics Inc.
                                   15373 Innovation Dr, Ste 115
                                   San Diego, CA 92128-3424

AWARD: $120,000.00

PHONE: (858) 673-1016

E-MAIL: will.cooper@adaptive-dynamics.com

PRINCIPAL INVESTIGATOR: Will Cooper

TITLE OF PROJECT: L-Band Radio Frequency Interference Filtering

SUBTOPIC NUMBER: 8.4.4D

TECHNICAL ABSTRACT:

In Phase 1, Adaptive Dynamics Inc. (ADI) propose to do a PHY layer MATLAB simulation and optimization of the 'IMPS' Wideband MAGIC® Interference Mitigation (IM) filter for NOAA.

This will demonstrate the feasibility and performance of the IMPS Wideband MAGIC® IM filter algorithm in effectively identifying and separating out unwanted interference from the desired signal of interest (SOI), without 'a priori' knowledge of the interference or SOI.

In this case, the SOI's are NOAA GOES/POES downlink received QPSK SATCOM signals and the unwanted interference comes from terrestrial-based Long-Term Evolution (LTE) Orthogonal Frequency Division Multiplex (OFDM) uplink mobile user wireless signals in the 1695-1710 MHz band.

As part of the MATLAB simulation, ADI propose to develop an algorithm to automatically alarm when undesired interference is detected and to characterize the interference type and severity.

Additionally, ADI propose to do a demo of the Comtech CDM-MAGIC930, an L-Band real-time interference mitigation and data capture/playback applique for SATCOM signals developed under a Navy Rapid Innovation Funding (RIF) contract.

If a Phase 2 contract were awarded, ADI would then implement the optimized IMPS MAGIC® interference mitigation algorithm into suitable FPGA hardware for the NOAA L-Band SATCOM application.

SUMMARY OF ANTICIPATED RESULTS:

Based on the results already obtained with the MAGIC® IM filter algorithm separating interference from SATCOM signals for the US Navy as part of the MUOS PRISM and CDM-MAGIC930 'Rapid Innovation Fund' (RIF) projects, ADI is confident that the IMPS Wideband

MAGIC® IM filter algorithm simulation and optimization effort will demonstrate significant interference mitigation performance for the GOES/POES signals.

FY 2016 PHASE I AWARD WINNER

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

AWARD: $119,810

PHONE: (978) 932-0266

E-MAIL: herndon@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. Scott Herndon

TITLE OF PROJECT: A Direct Absorption Spectrometer for Low Drift and High
                                           Accuracy Measurements of Methane Isot…

SUBTOPIC NUMBER: 8.3.3D

TECHNICAL ABSTRACT:

Atmospheric methane (CH_4) is a potent greenhouse gas and ozone precursor that is increasingly important in our understanding and modeling of climate change. Identifying and differentiating methane sources are crucial to any strategies aimed at reducing CH_4 emissions. Isotopic composition and ethane content are both dependent upon methane origin, making them valuable diagnostics for source attribution. Instrumentation capable of fast, high precision quantification of CH_4 isotopes and ethane aboard an aircraft platform will advance scientifically backed methane mitigation strategies.

This proposal aims to develop a flight-capable laser-based monitor for $^{12}CH_4$, $^{13}CH_4$, CH_3D, and C_2H_6. The 1 Hz standard deviation performance targets of d-$^{13}CH_4$ precision of 0.5 per mil and d-CH_3D precision of 10 per mil delta units, and C_2H_6 mixing ratio precision of 10 parts per trillion will be achieved in this work. These performance goals will be met using direct absorption infrared spectrometry, which has been demonstrated to achieve the desired precision under laboratory conditions. As outlined in the proposal, the technical challenges are: i) identifying and eliminating sources of measurement drift due to aircraft motion, temperature and pressure changes, ii) developing innovative zeroing and calibration methods amenable to these high precision measurements, and iii) designing a flight-ready instrumentation package.

SUMMARY OF ANTICIPATED RESULTS:

The outcome of the Phase I work will first be demonstration of measurement precision and accuracy under controlled laboratory conditions. Second, we will identify and quantify optical (and electronic) noise sources as a result of testing the measurement platform (a dual-laser infrared spectrometer) in simulated turbulence and under high acceleration in all three dimensions. Third, we will demonstrate zeroing and calibration capability that allows for high accuracy and precision isotope ratios and ethane quantification referenced to a standard. Finally, these results from first three parts will lead to the design of the final measurement package, which we plan build and test during Phase II.

FY 2016 PHASE I AWARD WINNER

FIRM:	Aerodyne Research, Inc. 45 Manning Road, Billerica, MA 01821-3976
AWARD:	$119,930
PHONE:	(978) 932-0228
E-MAIL:	Tyacovitch@aerodyne.com
PRINCIPAL INVESTIGATOR:	Dr. Tara Yacovitch
TITLE OF PROJECT:	A Direct Absorption Spectrometer for Low Drift and High Accuracy Measurements of Methane Isot…
SUBTOPIC NUMBER:	8.3.1C

TECHNICAL ABSTRACT:

In order to understand how and why methane (CH_4) concentrations change over time, it is necessary to understand their sources and sinks. Stable isotope measurements of $^{13}CH_4$:$^{12}CH_4$ and CH_3D:$^{12}CH_4$ ratios constrain these sinks and sources. This is particularly crucial for methane of microbial origin since other tracers such as ethane and propane are not co-emitted. Global measurements of these ratios are currently performed using isotope ratio mass spectrometry (IRMS) on flasks collected by NOAA's Cooperative Air Sampling Network. However, IRMS is labor intensive and costly.

We propose to adapt and improve an existing laser isotope monitor to enable fast, precise measurements of methane isotope ratios ($\delta^{13}C$ and δ^2H) of flask samples. A prototype sampling system will be implemented to measure low-pressure trapped samples of whole air and working standard in quick succession. This strategy allows for improvements in both precision and accuracy of the methane isotope measurements. No sample preparation will be required to achieve final precisions of 0.03‰ for $\delta^{13}C$ and 1‰ for δ^2H.

The proof-of-concept developments described within will set the stage for an overhaul of currently used mass-spectrometry-based isotope laboratory instrumentation that will make measurements of methane isotopes much easier, faster and less costly.

SUMMARY OF ANTICIPATED RESULTS:

The prototype instrument and sampling system will be inexpensive in both capital and operational costs (as compared to current isotope ratio mass spectrometers), require no preprocessing of samples, and offer excellent precision in well under 20 minutes per sample.

FY 2016 PHASE I AWARD WINNER

FIRM:	Boulder Environmental Sciences and Technology 5171 Eldorado Springs Drive, Suite A, Boulder, Colorado 80303-9672
AWARD:	$120,000
PHONE:	(303) 532-1198, x111
E-MAIL:	marian.klein@boulderest.com
PRINCIPAL INVESTIGATOR:	Marian Klein
TITLE OF PROJECT:	Development of a sensor interface, communication and a power module - a SensorCSP module.
SUBTOPIC NUMBER:	8.5.2TT

TECHNICAL ABSTRACT:

Many applications in areas such as geophysics, biology, agriculture, security, and others require long-term observations of parameters at a distant location where power or communication links are not available and are impractical or too expensive to install. Examples for such measurements are various in situ measurements in the middle of the ocean on a buoy or ship, measurements of soil moisture, soil temperature, local temperature, humidity, pressure, snow depth, precipitation rate, tectonic movements, and many others. Some observations of wildlife can also be done electronically, using a camera and/or a motion sensor, to provide information about wildlife behavior, animal counts, etc.
The spread of drones, or unmanned aerial vehicles, is inevitable, and some airborne measurements require real time transmission to a base recording system. Having a system independent of the aircraft control communications can provide a significant advantage, especially if the drone is beyond the line of sight of the base.
The objective of the proposed technology transfer project is to develop one or more commercially viable products based on the NOAA's patent pending Smart Module technology, developed by the engineers at National Data Buoy Center.

SUMMARY OF ANTICIPATED RESULTS:

The goal of the Phase I project is a development of a preliminary design of a SensorCSP Module where CSP is referring to a sensor interface module providing communications, storage of data, and power. 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.
Potential applications include the Earth science research in areas such as meteorology, weather forecasting, climate monitoring, precision agriculture, seismology, oceanography, transportation, aviation, and natural disaster prediction and observations.

FY 2016 PHASE I AWARD WINNER

FIRM: C.A. Goudey & Associates
                               21 Marlboro Street,
                               Newburyport, MA 01950-3127

AWARD: $120,000

PHONE: (978) 914-1901

E-MAIL: cliffgoudey@gmail.com

PRINCIPAL INVESTIGATOR: Clifford A. Goudey

TITLE OF PROJECT: Engineering Structures for Offshore Macroalgae Farming

SUBTOPIC NUMBER: 8.1.2F

TECHNICAL ABSTRACT:

This project aims to identify and prove the feasibility of innovative, commercial-scale systems and methods for the cultivation of macroalgae on the high seas. The project team will achieve this goal by identifying candidate areas of the US EEZ that provide favorable conditions for industrial-scale macroalgae production and determine the environmental conditions in those areas that drive system design. We will then identify suitable macroalgae species and estimate their achievable culture density and growth rates. This information will guide our design of affordable and survivable systems that will enable the production of algal biomass in sufficient quantities to support biofuel production and carbon sequestration. We will test the most promising system at model scale in a wave basin to determine mooring tensions and internal forces under various combinations of currents and waves. These tests will also determine the structural adequacy of the system. Based on our wave basin finding, estimates of system costs, biomass capacity and growth rates, an economic analysis will be performed to determine the system's commercial potential.

SUMMARY OF ANTICIPATED RESULTS:

This project will bring disruptive systems to the marketplace that will enable the growth of the ocean-based algal production at scales necessary to replace our present use of fossil fuels and thereby drastically reduce GHG emissions. These culture systems when deployed on the oceans will absorb vast amounts of CO_2 from the atmosphere while reducing ocean acidity. Properly sited high-seas macroalgae farms will absorb excess nutrients and benefit surrounding ocean ecosystems.

FY 2016 PHASE I AWARD WINNER

FIRM: C-2 Innovations, Inc
                                    102 Peabody Drive
                                    Stow, MA 01775

AWARD: $119,210.40

PHONE: (978) 257-4820

E-MAIL: amangolds@c-2iinc.com

PRINCIPAL INVESTIGATOR: Arnis Mansolds

TITLE OF PROJECT: Mobile Observation Platform

SUBTOPIC NUMBER: 8.2.1N

TECHNICAL ABSTRACT:

The Mobile Observation Platform ((MOP) will leverage the Bottom Crawler (BC) Sea Otter system that C-2ih as developed and tested in very similar environments and operational conditions. Capable of 300-ft depths and 10 mile autonomous transits across mixed environments including soft ground and heavy surf, the Sea Otter will be able to act as realistic surrogate for the MOP and allow C-2i to focus on the wireless control, video and energy sustainability. C-2i has already performed RF propagation tests across water with low height antenna for control data and it will extend the results to video image transfer. Two sustainability solutions have been developed which will be tested on the existing vehicle. A buoy design incorporating the power, transceivers and antenna will be constructed and tested on the Sea Otter surrogate for stability in high energy conditions.

SUMMARY OF ANTICIPATED RESULTS:

A light weight, affordable bottom crawler capable of long term operation. Real time data transfer and positional control will allow observers and researchers to respond to discoveries as they occur. The low ground pressure, amphibious nature and low profile will allow observation mapping and characterization of new regions under sea states that were never before possible. Shore-launch or small boat boat deployment will greatly reduce the logistic foot print further reducing costs.

FY 2016 PHASE I AWARD WINNER

FIRM: Entanglement Technologies, Inc.
                                   42 Adrian Court,
                                   Burlingame, CA 94010-2101

AWARD: $120,000

PHONE: (650) 204-7875

E-MAIL: marmen@entanglementtech.com

PRINCIPAL INVESTIGATOR: Michael Armen

TITLE OF PROJECT: Ethane/isotopic methane CRDS analyzer

SUBTOPIC NUMBER: 8.3.3D

TECHNICAL ABSTRACT:

Entanglement Technologies, Inc. (ET) proposes to develop a gas analyzer for ethane and isotopologues of methane to study of methane sources and sinks, using cavity ring-down spectroscopy (CRDS). Methane is an important contributor to global climate change, and a participant in air pollutant reactions such as ozone. Understanding methane sources, sinks, and transport between them is crucial to predict its effect on climate and pollution. CRDS is an ultra-sensitive and precise optical measurement technique which is already successfully commercially deployed to monitor a wide variety of atmospheric molecules including isotopes of methane. However, these commercial analyzers lack the requisite sensitivity for NOAA research. Other methods to monitor isotopic methane (e.g. multi-pass optical absorption and mid-wave infrared spectroscopy) are difficult to reduce in size and weight for airborne deployment. CRDS can potentially achieve comparable performance with a small gas cell and air pump and short-wave (3 microns) spectrsocopy that is easier to implement than 6-8 microns. ET proposes to develop a mid-infrared CRDS analyzer using short-wave spectroscopy to measure ethane concentration to a precision of 10 parts per trillion by volume (pptv), and isotopes of methane with precisions of *0.5%0* for 13CH4/12CH4 and *10%0* for 12CH3D/12CH4, at 1 Hz measurement rate.

SUMMARY OF ANTICIPATED RESULTS:

The end result after phase II of this project will be a self-contained prototype ethane/isotopic methane analyzer
appropriate for laboratory testing. Although the analyzer will operate at 1 Hz measurement rate for the NOAA application, reducing this rate will improve the precision. The analyzer will also be appropriate for commercial applcations in natural gas leak detection and forensics, oil and gas exploration, and well lifetime monitoring. Its high precision and 12CH3D capability, not currently available in deployed commercial analyzers, will substantially improve the efficiency of the natural gas industry.

FIRM: Forever Oceans Corporation
                                     403 Holiday Court, Suite 104,
                                     Warrenton, VA 20186-4362

AWARD: $ 119,823

PHONE: (484) 352-2090

E-MAIL: joseph.denny@foreveroceans.com

PRINCIPAL INVESTIGATOR: Joseph Denny

TITLE OF PROJECT: RUSH: Robotic Underwater Seine Harvester

SUBTOPIC NUMBER: 8.1.2F

TECHNICAL ABSTRACT:

The Robotic Underwater Seine Harvester (RUSH) is an innovative concept which brings legacy fish harvesting techniques into the 21st century. Offshore aquaculture is an inherently difficult and often dangerous endeavor, but much of this can be mitigated through use of submerged cages. Harvesting is one such critical task in aquaculture and has its own difficulties, particularly when using submerged cages. There is a glaring industry need for a simple, modular, cost-saving solution which can harvest fish and keep team members out of harm's way. The RUSH system is that answer. RUSH will enable safe and efficient harvesting from a submerged cage. RUSH is a drop in, "robot of robots" system that will work to corral fish for harvesting. Phase I efforts will focus on modeling and simulation of the full system as well as prototyping critical components to corroborate designs as well as better inform the simulations. Through the Phase I efforts, the enabling technologies of RUSH will be tested and refined; providing offshore aquaculture a major step forward on the road to automated harvesting from a submerged cage.

SUMMARY OF ANTICIPATED RESULTS:

Phase I efforts result in a fully functional RUSH prototype crawler. Through rigorous testing and evaluation, the critical drive train parameters (ex. minimum turn radius) will be determined to help further refine control algorithms. Wear and tear of critical components will be validated to ensure life expectancy. Additionally, the forces exerted on the RUSH crawler by ocean current will be simulated and modeled by industry professionals.

FY 2016 PHASE I AWARD WINNER

FIRM: Giner, Inc.
                               89 Rumford Avenue,
                               Newton MA 02466-1311

AWARD: $119,978

PHONE: (781) 529-0520

E-MAIL: bdweik@ginerinc.com

PRINCIPAL INVESTIGATOR: Badawi M. Dweik, Ph.D.

TITLE OF PROJECT: Sensor for Rapid Determination of Oxygen Demand in
                               Natural water

SUBTOPIC NUMBER: 8.2.3D

TECHNICAL ABSTRACT:

Real-time monitoring of organic compounds in water and wastewater is important for management of pollution levels. Current verification measurements relating to the nutrient content of the water cannot be done at frequent intervals or on-site, for example biological oxygen demand (BOD5) yields slow results (five days); another standard method, chemical oxygen demand (COD), uses hazardous chemicals and does not provide information directly relevant to ecological pollution.

The objective of this is to develop a low-cost, field deploy¬able and real-time monitor to characterize the solution constituents and to assess water quality for management of pollution levels. This monitor will generate on site quick response with a handheld instrument and probe which can be deployed from a variety of platforms (e.g., small research vessel, submersible probe, or an in-line installed monitor). An important aspect of the proposed work is benchmarking the new measurement technique for simultaneously and directly measuring biochemical oxygen demand (BOD) and chemical oxygen demand (COD) in both freshwater and marine environments.

SUMMARY OF ANTICIPATED RESULTS:

Successful demonstration of this study will allow for easy-to-use sensor method/device to provide new accredited standards for water quality with convenience and low cost advantages over traditional laboratory methods. The real-time instrument can be used to provide simple and timely verification data for monitoring, forecasting, and managing aquatic ecosystems with sensitivity performance exceeding current and emerging field methods.

FY 2016 PHASE I AWARD WINNER

FIRM: GIRD Svstems
                                   310 Terrace Ave.,
                                   Cincinnati, OH 45220-2078

AWARD: $119,998

PHONE: (513) 281-2900 x103

E-MAIL: jcaffery@girdsystems.com

PRINCIPAL INVESTIGATOR: Dr. James Caffery

TITLE OF PROJECT: Adaptive Digital Enhancement & Excision Technology
                                   (ADEPT)

SUBTOPIC NUMBER: 8.4.4D

TECHNICAL ABSTRACT:

GIRD Systems leverages its extensive experience with interference cancellation systems, particularly for military SATCOM (UFO and MUOS), to propose two fundamental architectures for mitigating the wireless mobile uplink interference expected once spectrum sharing in the 1695-1710 MHz band begins. GIRD's ADEPT digital solution leverages the latest advances in digital technology to develop algorithms that are far more capable than RF-based solutions. Several approaches are identified under the two proposed architectures for extensive evaluation in a Phase I trade study. The architectures share the key characteristics of being interference agnostic (i.e., narrowband, wideband, modulation type, in-band, out-of-band, etc.).   The solutions that are proposed can be characterized as "black box", or "add-on", solutions which reside between the satellite receive antenna and the satellite receiver.   The filtering system will take as input a mixture of the desired and interfering signals and output the satellite signals with interference significantly mitigated (i.e., filtered). The output is then passed to the satellite receiver to process as if the interference were never present.

SUMMARY OF ANTICIPATED RESULTS:

Given the solid theoretical foundation of the proposed interference rejection architectures which will be evaluated in the Phase I trade study, we anticipate that the recommended solution will provide the requisite performance to enable spectrum sharing between POES/GOES satellite downlinks and wireless mobile uplinks. The simplicity of the solution and ease of integration with existing equipment make the technology attractive for adoption in the field.

FIRM: Kampachi Farms
                                   PO Box 4239 ,
                                   Kailua-Kona, Hawaii, 96745

AWARD: $119,519.76

PHONE: (808) 443-9881

E-MAIL: gavin@kampachifarm.com

PRINCIPAL INVESTIGATOR: Gavin Key

TITLE OF PROJECT: Tofu-tolerant Mariculture: Genomics-assisted Breeding of
                                   a High-Quality Marine Finfish for Enhanced Performance
                                   on Sustainable, Scalable Soy-based Feeds

SUBTOPIC NUMBER: 8.1.1F

TECHNICAL ABSTRACT:

While certain forage fisheries remain sustainable and well-maintained, they clearly are not scalable – to expand domestic marine aquaculture and increase the nation's seafood security, aquafeed formulations must be adapted to make greater use of sustainable agriculture proteins and oils produced in America's heartland. Kampachi Farms and University of Nebraska have been working jointly to replace fishmeal in diets for our Kampachi (Seriola rivoliana) with soy protein concentrate (SPC). This research has been successful, with fish performing acceptably on diets containing 40% SPC and <12% fishmeal. However, the end goal is to develop a wild-marine-free diet formula, and soy inclusion rates above 42.5% have resulted in gastroenteric stress, decreased performance, and increased susceptibility to disease. Thus far, Kampachi have been cultured from wild broodstock without any genetic manipulation or improvement. Collaborating with the genetics team at Center for Aquaculture Technologies, Kampachi Farms now proposes to utilize genetic marker-assisted selection techniques to develop a strain of fish that are more tolerant of plant-derived proteins and their associated antinutritional factors than the "wild-genotype" fish currently under culture.

SUMMARY OF ANTICIPATED RESULTS:

This work will identify genetic markers associated with increased soy-protein tolerance in Kampachi, and construct a single-nucleotide polymorphism (SNP) marker panel to allow rapid high-throughput genotyping of fish for selective breeding purposes. Phase II research would expand this work into a demonstration-scale selective breeding program, and explore the feasibility of commercializing the developed technology through broad application across Kampachi Farms' and partners' commercial operations and the marketing of genotyping services and genetically-improved fish to other marine aquaculture operators. By developing and commercializing a strain of high-quality marine fish capable of thriving on sustainable, scalable agriculture plant-based feeds, this work will contribute to U.S. food security, the

revitalization of economically depressed working waterfronts, and the further softening of mankind's foot print on the seas.

FY 2016 PHASE I AWARD WINNER

FIRM: LI-COR Biosciences, Inc.
                                             4647 Superior Street
                                             Lincoln, NE, 68504-1357

AWARD: $119,959

PHONE: (408) 992-0722

E-MAIL: Serguei.koulikov@licor.com

PRINCIPAL INVESTIGATOR: Serguei Koulikov

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

SUBTOPIC NUMBER: 8.3.2D

TECHNICAL ABSTRACT:

LI-COR proposes to develop a next-generation CO_2/CH_4/H_2O analyzer that will offer an unprecedented combination of high precision and stability, making it the first high-performance gas analyzer suitable for long-term unattended operation. The instrument will be smaller, lighter, and far less expensive than competing technologies. LI-COR's approach exploits a proprietary, revolutionary design that overcomes the limitations of existing techniques and enables a sophisticated spectroscopic analysis strategy that is far more robust than competing approaches. The objective of Phase I is to prove feasibility of meeting NOAA's proposed specifications through demonstration of a laboratory prototype that achieves the precision requirements and demonstrates stability for one month (limited by the six month duration of Phase I and the time required to design, build and test the prototype). In Phase II we will more thoroughly characterize stability over 12 months.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated result of Phase I is a laboratory prototype that proves feasibility of LI-COR's approach. The anticipated result of Phase II is a mature engineering prototype that will enable subsequent commercialization. The advantages of the commercial product — ultra-high performance, ultra-low drift, suitability for long-term unattended operation, small size, low weight, and low — will enable widespread deployment for climate studies and emissions verification in applications that are not currently feasible, such as onboard commercial aircraft. In addition to environmental research and compliance monitoring, the instrument will also address other spectroscopic applications in industrial process control, medicine, and agriculture.

FY 2016 PHASE I AWARD WINNER

FIRM:	Makel Engineering, Inc 1585 Marauder Street Chico, CA 95973-9064
AWARD:	$120,000
PHONE:	(530) 895-2771
E-MAIL:	dmakel@makelengineering.com
PRINCIPAL INVESTIGATOR:	Darby B. Makel
TITLE OF PROJECT:	High Sensitivity Miniaturized CO Sensor for Airborne Use on Small UAV.
SUBTOPIC NUMBER:	8.3.5R

TECHNICAL ABSTRACT:

The team of Makel Engineering, Inc. Fifth Gait Technologies, TruWeather Solutions proposes to develop a novel, high sensitivity, fast response, solid state, electrochemical carbon monoxide sensor for use in small UAVs which is capable of PPB level atmospheric measurements. The sensor is based on a thick film multi-element potentiometric micro sensor approach which has been developed by MEI. Using the same sensor design approach MEI has recently developed a highly sensitive and selective CO sensor capable of low PPB measurements for use in early fire detection and exhaust emissions. Using this novel, miniaturized sensor developed by MEI, our team proposes to develop a rugged, low cost, compact, flight capable CO sensor system payload for small UAVs which will include flight packaging, air sampling system, and control electronics.

SUMMARY OF ANTICIPATED RESULTS:

This project will produce a low cost CO sensing system which could be widely deployed on small UAVs. Phase I will design, fabricate, and test prototype system do validate the sensor can meet all detection requirements. Successful development of this sensor system will lead to automated CO detection for industrial leak detection.

FY 2016 PHASE I AWARD WINNER

FIRM: Mechelen, LLC
                               Bldg 9114
                               Stennis Space Center, MS

AWARD: $120,000

PHONE: (228) 688-3626

E-MAIL: ssstubbs@charter.net

PRINCIPAL INVESTIGATOR: Shelly Stubbs

TITLE OF PROJECT: Smart Module Commercial Development Research

SUBTOPIC NUMBER: 8.5.2TT

TECHNICAL ABSTRACT:

Most sensor data collection systems are unique to a given application, sensors do not easily
transcend across applications or platforms. Smart sensor development improved the ability to
utilize common communications to a certain degree, where most used RS-232 or RS-485 type
communications protocols, but differences are still found and no uniformity exists in the
commercial markets.

The Smart Module concept could be a device utilized to standardize communication links to
interface dumb sensors or smart sensors to any type of collection system for network
distribution.

The purpose of this SBIR project is to research the status of sensors, processing, and
communications links on the open commercial market and determine the need of the Smart
Module to further enhance the In-situ measurements for multiple applications, processing, and
the transfer of data to scientist and engineers for control and analysis.
This SBIR will review current markets for need and application and define the best approach to
satisfy current issues with a new commercial product capable of unifying sensor manufacturers
and communications networks. It will also provide rudimentary test results with suggested
modular firmware formats to show proof of concept.

SUMMARY OF ANTICIPATED RESULTS:

Anticipated results would be to identify and document government and commercial markets that
would benefit from a customizable remote data acquisition system capable of interfacing to
existing network systems. Also to identify and document a varied array of sensors that could be
incorporated into a custom data acquisition system. Using the Smart Module hardware/software
where needed to convert the sensors into smart sensors developing a common networked
system.

FY 2016 PHASE I AWARD WINNER

FIRM: Michigan Aerospace Corporation
                                     1777 Highland Drive, Suite B
                                     Ann Arbor, MI 48108-2285

AWARD: $119,977.44

PHONE: (734) 975-8777

E-MAIL: wjohnson@michaero.com

PRINCIPAL INVESTIGATOR: Dr. Will Johnson

TITLE OF PROJECT: Pequod: An Oceanic Profiler of Temperature, Salinity,
                                     Dissolved Oxygen, Chlorophyll Biomass, and Subsurface
                                     Flow Speeds

SUBTOPIC NUMBER: 8.3.4N

TECHNICAL ABSTRACT:

Michigan Aerospace Corporation proposes to develop an underwater analogue to its
atmospheric LIDAR systems. This underwater laser-based sensing system, to be named
Pequod, will provide depth-resolved measurements of ocean temperature, salinity, dissolved
oxygen, chlorophyll biomass, and dissolved organic matter classification with a common laser
and receiver. The aim of the Phase I effort will be to modify our existing LIDAR simulation
software to account for the ocean environment and then explore the design trade space to
identify and design a LIDAR system best suited to making precise depth-resolved
measurements of temperature, salinity, dissolved oxygen, chlorophyll biomass, and dissolved
organic matter classification with a ship-mounted instrument that can deliver real-time data
products to end users.

SUMMARY OF ANTICIPATED RESULTS:

NOAA will benefit by receiving a new technology for oceanographic research, one based on
proven land-based LIDAR technology. Other potential customers for similar data for research
include universities and oceanographic institutes, the US Navy (particularly the Office of Naval
Research), and other state and federal environmental agencies. Extending atmospheric LIDAR
to the ocean realm will likely lead to unanticipated applications as research progresses.

FY 2016 PHASE I AWARD WINNER

FIRM:	NEOEx Systems, Inc.
AWARD:	$119,989.62
PHONE:	(440) 506-8231
E-MAIL:	Mark1001@twc.com
PRINCIPAL INVESTIGATOR:	Mark S. Haberbusch
TITLE OF PROJECT:	Low Cost, Long Endurance, Aerial Vehicle for Weather Monitoring
SUBTOPIC NUMBER:	8.4.1W

TECHNICAL ABSTRACT:

NEOEx Systems, Inc. proposes to use advanced energy and power systems technology to significantly improve Unmanned Aerial Systems (UAS) endurance and capabilities required to meet the NOAA NWS anticipate mission scenarios. Our innovative approach integrates high technology readiness level power and energy subsystems into existing and proven commercial off the shelf aeronautical subsystems for airframe, aerodynamics, propulsion, and guidance and navigation to conduct autonomous operations that exceed over 50 hours of endurance at speeds greater than 40 mph. In Phase I we will integrate high resolution imagery as well as atmospheric science instruments into the UAS and demonstrate a low cost approach to meeting Phase I NOAA objectives.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated result of the Phase I effort includes a flight demonstration of our Unmanned Aerial Vehicle with National Weather Service (NWS) payloads for measuring atmospheric conditions and the taking of video. Our goal is to fly for a minimum of 10 continuous hours up to a maximum of 24 hours to demonstrate the endurance capability of the vehicle for meeting the diverse mission requirements of NWS.

FY 2016 PHASE I AWARD WINNER

FIRM:	Opto-Knowledge Systems, Inc. 19805 Hamilton Ave. Torrance CA 90502-1341
AWARD:	$120,000
PHONE:	(310) 756-0520
E-MAIL:	jason@oksi.com
PRINCIPAL INVESTIGATOR:	Jason M. Kriesel
TITLE OF PROJECT:	Capillary Absorption Spectrometer for In-Situ, Underwater Gas Analysis
SUBTOPIC NUMBER:	8.2.6R

TECHNICAL ABSTRACT:

A Capillary Absorption Spectrometer (CAS) is proposed for in-situ, underwater gas concentration and isotope measurements. The concept utilizes mid-infrared laser absorption spectroscopy within a hollow fiber optic capillary that both confines a gas sample and acts as an optical waveguide. A tunable laser beam propagates through the hollow fiber to a detector with near unity overlap between the beam and the analyte. The CAS can perform fast (~ 1 s) and precise (isotope ratio ~ 1 ‰) measurements within the ultra-small sample volume (V ~ 0.1 mL) of the hollow fiber, enabling 3 to 4 orders of magnitude more sensitivity than related cavity-ring-down and multi-pass systems. Compared to these other systems, the sensor proposed here will have higher throughput analysis of dissolved gasses within a smaller size, weight, and power package. In this project, the concept will be extended and specifically proven for methane isotope analysis ($\square$13CCH4 and $\square$2HCH4), building on the team's ongoing development of CO_2, SO_2, and H_2O isotope sensors for NASA planetary applications. In addition, improvements over typical sample inlet methods (e.g., membranes) will be developed for deep-ocean monitoring. Specifically, degassing of discrete water samples will be enabled due to the ultra-small sample volume of the CAS.

SUMMARY OF ANTICIPATED RESULTS:

This project will result in development of an in-situ, underwater sensor for analyzing dissolved gases including from seeps, vents, and leaks. The novel, compact concept will open up new opportunities to perform real-time, in-situ measurements for a range of research studies and commercial applications, including the analysis of novel microbial communities, greenhouse gas sources and sinks, potential energy sources, and industrial leaks.

FY 2016 PHASE I AWARD WINNER

FIRM:	Polestar Technologies, Inc.
	220 Reservoir Street, Suite 3,
	Needham Heights, MA 02494
AWARD:	$119,952
PHONE:	(781) 449-2284
E-MAIL:	yufeng@polestartech.com
PRINCIPAL INVESTIGATOR:	Yufeng Ma
TITLE OF PROJECT:	Carbon Nanotube Array-based Nanosensor for Autonomous and Direct Measurement of Carbonate
SUBTOPIC NUMBER:	8.2.5R

TECHNICAL ABSTRACT:

Polestar Technologies Inc. proposes a Phase I Small Business Innovation Research project to develop a deployable sensor for direct measurements of carbonate in saline waters. The designed sensor combines selectivity of carbonate ionophore with the unique structure of a carbon nanotube array. Detection will be based on rapid, inexpensive, low power and precise electrochemical methods. The proposed sensor will be deployable for autonomous monitoring of carbonate ions in the ocean. Phase I project will focus on feasibility of proof-of-concept for sensitive, fast and selective detection of carbonate ions with a sensitivity of 5 µM in saline waters.

SUMMARY OF ANTICIPATED RESULTS:

The proposed development will lead to the development of a unique sensor for direct measurement of carbonate ions in saline water. Currently the carbonate ion concentration is monitored by measuring many parameters of the ocean. The ability to directly and sensitively measure the carbonate ion concentration will lead to a significant cost reduction in monitoring the acidity of the ocean. It will also lead to a new capability to autonomously monitor the carbonate ion concentration and the Ocean acidity.

FY 2016 PHASE I AWARD WINNER

FIRM: R3 Digital Sciences, LLC
                                   1514 Oriole Drive
                                   Blacksburg, VA 24060

AWARD: $119,991

PHONE: (540) 907-3995

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

PRINCIPAL INVESTIGATOR: Brent Roeder

TITLE OF PROJECT: Fish Trap Extension Kit for Lionfish Control

SUBTOPIC NUMBER: 8.2.2N

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

The result of this project will be a solution that can capture lionfish in large numbers, while
eliminating bycatch as well as "ghost fishing."

FY 2016 PHASE I AWARD WINNER

FIRM:	Remote Sensing Solutions, Inc. 3179 Main Street, Unit 3 PO Box 1092 Barnstable, MA 02630
AWARD:	$120,000
PHONE:	(508) 362-9400
E-MAIL:	carswell@remotesensingsolutions.com
PRINCIPAL INVESTIGATOR:	Dr. James Carswell
TITLE OF PROJECT:	The Marine Debris and Small Object Mapping (DSOM) Radar System
SUBTOPIC NUMBER:	8.2.4D

TECHNICAL ABSTRACT:

Remote Sensing Solutions (RSS) proposes to design and evaluate the Debris and Small Object Mapping (DSOM) Radar System. DSOM Radar System is a wide swath sensor for accurate detection and mapping of marine debris and objects in our oceans, coastal waters, inland waters and marine navigation routes. The DSOM Radar System will employ an innovative measurement technique that not only will enable it to detect marine debris and objects over large areas and a broad range of environmental and surface conditions but will be platform agnostic enabling its deployment on land, ship, aerial and even future satellite platforms. This game changing technology will overcome many of the challenges faced by existing systems in order to provide a superior level of performance across all of these platforms and various application spaces with respect to detecting and mapping marine debris and objects. The approach of the Phase I will be to fully develop the problem definition through baseline requirements and then develop a preliminary design that meets these requirements. With a scene generator the end-to-end performance of the design will be vetted for each of the targeted applications.

SUMMARY OF ANTICIPATED RESULTS:

The Phase I effort will develop the baseline requirements, system requirements and preliminary system design for the DSOM Radar System. The feasibility and cost to construct a prototype through a Phase II effort will be determined and the anticipated performance of this prototype documented.

FY 2016 PHASE I AWARD WINNER

FIRM: Robo Nautica LLC
                                   225 Butte Drive Ste C
                                   Los Osos, CA 93402

AWARD: $119,298.65

PHONE: (805) 458-0364

E-MAIL: ed@robonautica.com

PRINCIPAL INVESTIGATOR: Eddie H. Williams

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

SUBTOPIC NUMBER: 8.2.1N

TECHNICAL ABSTRACT:

There is currently no low-cost, high performance, minimally invasive, bottom-crawling ROV system for monitoring coastal and littoral benthic environments which is also deployable by a single marine researcher. Such a system augmenting diver's observations would greatly expand the quantity and quality of data critical to managing coastal environments and preserving the economic benefits derived by their local communities. In 2014, Robo Nautica used its innovative system of low-cost high-performance underwater robotics components to build a working proof-of-concept prototype bottom-crawling robot which exceeded minimum requirements and successfully demonstrate it at Gray's Reef NMS. In Phase 1, that robot will be used for empirical testing of improved components and configurations, identified by trade studies, which will minimize deployment size and weight while extending the depth and duration of operation, radio range for piloting, and the variety of cameras and sensors it supports. In Phase 2, based on those test results, we will develop an improved prototype bottom-crawling robot, with greater reliability, increased use of COTS components, and industry standard practices. It will be near ready for commercialization. We will make it available for extended testing by NOAA personnel.

SUMMARY OF ANTICIPATED RESULTS:

In phase 1 Robo Nautica's proof of concept bottom-crawling robot will be reassembled as a test platform and used to complete the five required trade study and feasibility study tasks' In phase 2 The BE-ROVER bottom-crawler robot will be productized, and multiple copies of the BE-ROVER will be built. One or more BE-ROVERs will be available to NOAA for test and evaluation.

FY 2015 PHASE I AWARD WINNER

FIRM: Share Spectrum Company
                               1593 Spring Hill Road, Suite 700
                               Vienna, VA 22182-2245

AWARD: $119,993

PHONE: 703-761-2818 x118

E-MAIL: iakbar@sharedspectrum.com

PRINCIPAL INVESTIGATOR: Ihsan Akbar

TITLE OF PROJECT: Satellite Downlink Interference Filtering and Monitoring
                               System (SDIFMS)

SUBTOPIC NUMBER: 8.4.4D

TECHNICAL ABSTRACT:

In this SBIR project, Shared Spectrum Company (SSC) develops the Satellite Downlink
Interference Filtering and Monitoring System (SDIFMS). This innovative system mitigates
interference signals to NOAA satellite ground stations from wireless user transmitters (such as,
handheld smart phones and devices). The SDIFMS eliminates aggregate LTE interference from
multiple, simultaneous interferers. The interferers can be below the noise level. In addition, the
SDIFMS monitors and identifies the interference. The SDIFMS uses a circular array of
monitoring antennas (surrounding the NOAA satellite downlink antenna) that continuously sense
the interference signals. The sampled interference signals are digitally processed to coherently
subtract them out of the desired NOAA satellite downlink signal. The number of monitor
antennas (4 to 20) is scalable depending on the amount of interfering signals. The SDIFMS has
a reconfigurable architecture that is agnostic to the specified frequency band, signal waveforms
and standards. The SDIFMS hardware uses COTS digitizers and graphical processors to
minimize development costs. Cyclostationary-based signal detection and classification
algorithms support the identification of signals buried under the noise floor. During Phase I, SSC
implements and field tests a non-real time system canceling real signals using COTS digitizers
and MATLAB signal processing.

SUMMARY OF ANTICIPATED RESULTS:

The anticipate results include: (1) A detailed system design document that includes algorithm
descriptions, the software architecture, and the hardware design/costs. (2) Validation of the
design using field measurements that are processed (signal detection, cancellation weight
determination, and weight application) in MATLAB. SSC's commercialization plan includes
implementing the real-time SDIFMS signal processing and field testing for a real-time system
demonstration within the SBIR Phase II funding. SSC already has much of the SDIFMS
monitoring software complete now.

FY 2016 PHASE I AWARD WINNER

FIRM: Space Hazards Applications, LLC
                                   1909 Arapahoe St,
                                   Golden, CO 80401

AWARD: $118,770

PHONE: (720) 222-0533

E-MAIL: jgreen@spacehaz.com

PRINCIPAL INVESTIGATOR: Dr. Janet Green

TITLE OF PROJECT: A Satellite Charging Assessment Tool (SatCAT)

SUBTOPIC NUMBER: 8.4.2W

TECHNICAL ABSTRACT:

Our purpose is to give government decision makers as well as satellite industry operators and designers a tool for assessing and mitigating space weather effects on satellites. Satellite engineers employ a variety of strategies to safeguard their assets from space weather but avoiding all impacts is not feasible. One consequence is that satellites quickly become electrically charged. Resultant breakdowns and discharges may damage solar arrays, cause false commands, and damage components. What drives the need for space weather tools now and a new market for services is the expansion and evolution of the industry to emerging areas such as satellite internet.

Our two-step objective is to 1) engage in deep-dives with industry leading operators to uniquely develop our understanding of their specifific needs and 2) build a prototype tool that connects an advanced global radiation environment model and measured data with engineering codes and methods used to defifine hazards to specifific satellite structures in real time. Our value proposition is this: For operators, designers, and decision makers who need to maintain mission operations and resolve unavoidable satellite anomalies, our product is a tool that summarizes space weather impacts to your assets so you can take the right mitigating action.

SUMMARY OF ANTICIPATED RESULTS:

The results of the project will be a report on the satellite industry space weather needs and a prototype tool that can be developed into a marketable product with some additional enhancements. We anticipate that the satellite industry report will show the needs and potential vulnerabilities of the industry to space weather. The prototype tool will demonstrate the feasibility and effectiveness of our approach. It will provide information for government decision makers to asses global space weather impacts and lay the foundation for building a marketable product with additional enhancements such as robust operational considerations and commercial user displays.

FY 2016 PHASE I AWARD WINNER

FIRM: Sunburst Sensors, LLC
                               1226 West Broadway,
                               Missoula, MT 59802-3915

AWARD: $119,995

PHONE: (406) 532-3246

E-MAIL: reggie@sunburstsensors.com

PRINCIPAL INVESTIGATOR: Reggie Spaulding

TITLE OF PROJECT: Autonomous direct measure of carbonate ion in saline

SUBTOPIC NUMBER: 8.2.5R

TECHNICAL ABSTRACT:

Increasing atmospheric CO2 from anthropogenic sources is changing the chemistry of the oceans and altering the marine food web and the health of :isheries. NOAA's National Ocean Service is responsible for maintaining the health of coastal regions to preserve :isheries. The ability to monitor the impact of increasing CO2 on marine organisms is crucial to this responsibility. NOAA's call for *autonomous direct measurement of carbonate ion in saline waters* (SBIR topic # 8.2.5R) addresses the need to understand ocean chemistry, including changing pH and saturation states of calcite and aragonite ($CaCO_3$) in response to increased atmospheric CO2 (pCO2). Ocean acidi:ication is changing entire ecosystems – affecting reproduction, growth, and respiration of a wide range of marine organisms. Sunburst Sensors, in collaboration with the University of South Florida (USF), proposes to determine the feasibility of developing an autonomous instrument to measure carbonate ion, based on combining the patented SAMI technology with a lead complexation-ultraviolet (UV) absorbance method for detection of carbonate anion. In Phase I, we will determine temperature dependence of the Pb^{2+} + CO_3^{2-} reaction and molar absorbances, and investigate the feasibility of using UV LEDs or a deuterium light source and a UV spectrometer in an in situ sensor.

SUMMARY OF ANTICIPATED RESULTS:

In Phase 1 we anticipate to complete work on the temperature dependence of the Pb^{2+} + CO_3^{2-} reaction and molar absorbances, laying the foundation for the sensing method. We will concurrently be working on determining the design of a prototype instrument by investigating potential UV optic systems and fluidic schemes. Phase 1 will culminate with a prototype design description that will serve as the centerpiece of a phase 2 proposal and ultimately lead to a new, important product for marine carbonate research.

FY 2016 PHASE I AWARD WINNER

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

AWARD: $120,000

PHONE: (805) 968-6787

E-MAIL: rgagley@toyon.com

PRINCIPAL INVESTIGATOR: Richard E. Cagley, Ph.D.

TITLE OF PROJECT: Optical Continuous Three-dimensional Observation and
                                Portrayal of Underwater Scenes (OCTOPUS)

SUBTOPIC NUMBER: 8.1.3F

TECHNICAL ABSTRACT:

The health of marine fish populations is currently monitored by several techniques including the use of submerged camera rigs. The video from the camera rigs has proven to be useful for detecting and counting fish, but accurately counting the fish is challenging because the fish can move in and out of the field of view of a camera. We propose to develop a camera that covers 360 degrees in azimuth, allowing for continuous monitoring and counting of fish. An additional challenge with today's systems involves the ability to get an accurate measurement of fish length due to low resolution, poor synchronization, and small stereoscopic baselines. We propose to design a system that provides the ability to accurately measure length using high resolution cameras with accurate synchronization and baselines sufficient to get accurate length measurements. The camera system will be capable of creating a panoramic display of the scene that is stitched from multiple cameras and will allow for 3D modeling of scenes using sets of stereoscopic cameras. We propose to develop and test a pair(s) of stereo cameras in Phase I so that we can demonstrate the feasibility of our approach. We will also create a brassboard system, which we can build into a complete system in a Phase II effort, using multiple copies of the stereo pair along with additional control elements and software.

SUMMARY OF ANTICIPATED RESULTS:

The successful completion of this research will result in the creation of a new camera system that allows biologists to more accurately count the number of fish of each species and the length of each fish when conducting underwater surveys. This will allow fish management agencies to make better decisions regarding fishing regulations so that we can maintain healthy populations of fish that can support commercial and recreational fishing far into the future. This technology also has other applications involving the need for 360 degree coverage of a scene, such as for virtual reality and 360 video captures of recreational diving and above-water events.

FY 2016 PHASE I AWARD WINNER

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

AWARD: $120,000

PHONE: (805) 968-6787

E-MAIL: esandoz@toyon.com

PRINCIPAL INVESTIGATOR: Eric E. Sandoz

TITLE OF PROJECT: Small UAS Platform for NWS Missions

SUBTOPIC NUMBER: 8.4.1W

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

The Waptor UAV's VTOL capability enables it to launch and land vertically in tight areas without bulky and costly launch/catch equipment. The waterproof airframe enables unique missions like landing sensors on the water as well ability to fly in heavy precipitation. The focus on open-source software based systems reduces platform cost and cost of ownership.

FY 2016 PHASE I AWARD WINNER

FIRM: USML LLC (dba US Microwave Laboratories)
                                150 Fox Trail,
                                Summerfield NC 27358-8280

AWARD: $119,921

PHONE: (336) 582-0603

E-MAIL: cfajardo@usmicrolabs.com

PRINCIPAL INVESTIGATOR: Claudia P. Fajardo

TITLE OF PROJECT: Satellite ground station network for real-time space
                                weather data

SUBTOPIC NUMBER: 8.4.3W

TECHNICAL ABSTRACT:

The goal of this project is to determine the feasibility of developing a ground station network capable of delivering real time space weather data to end users. Specifically, the proposed works seek to assess existing and future communications requirements for providing better than 15 minute latency (threshold objective) for transfer of data from NOAA space weather assets to the ground for distribution to end users. This study will include space weather assets in LEO, MEO, HEO, GEO and at the L1 and L5 Lagrange points. The range of orbits for this study is extreme, from LEO to Lagrange points (hundreds of km to millions of km). Therefore, it is likely that no single system will satisfy the requirements. Basically, a potential solution for LEO may not work for Lagrange points and vice versa. A detailed list of the various requirements for the different mission profiles (LEO to L5) will be delivered as part of this study.

SUMMARY OF ANTICIPATED RESULTS:

We anticipate an exhaustive analysis of existing NOAA satellite capabilities, both in space and on the ground, followed by a recommendation on how to optimize the current resources and acquire new ones to achieve the goal of better than 15 minute latency for transfer of data from NOAA space weather assets to the ground for distribution to end users.

FY 2016 PHASE II AWARD WINNER

FIRM: Almeria Analytics
                                75 Spring Rd NE
                                Rio Rancho, NM 87124-2561

AWARD: $380,239

PHONE: (505) 603-4959

E-MAIL: Fernandezsj01@aol.com

PRINCIPAL INVESTIGATOR: Steven Fernandez

TITLE OF PROJECT: Commercial VERDE – Phase 2

SUBTOPIC NUMBER: 8.5.1X

TECHNICAL ABSTRACT:

The wide spread use of NOAA developed products including future climate scenarios, weather products, and infrastructure impacts are not used as widely by public decision makers or the public as possible because it is difficult to explore the data without expensive help manipulating the data or expressing their queries. The technical objective is to establish a prototype service and platform for web standards and 1) deliver products to workstations, mobile applications and tablets, 2) receive queries from users and 3) permit decision-makers to structure new future scenarios inexpensively viewed on workstations, mobile applications, and tablets by the hazard community. A prototype portal will be the first open web streaming services testbed to allow the users to structure their look ahead models and apply local knowledge; 2) a common spatial climate models. Integration of the models provides a framework for existing high-resolution climate modeling output, infrastructure model data and population movements in a common reference grid.

SUMMARY OF ANTICIPATED RESULTS:

A portal will provide open, shareable and actionable information on current hazards as a complement to the existing NOAA products and data feeds. This requires the real-time feeds are reliable even in the face of cyber, weather, and physical hazards during emergency operations and open, shareable, and actionable Datasets in a inexpensive delivery system for NOAA and University researchers. Prototype systems will be able to accommodate incorporating those models identified in this task through commercial demand from researchers and planners. New modeling runs and data sets based on prioritized scenarios will be developed and these data sets will be placed within the prototype testbed.

FIRM: Amethyst Research Incorporated
                                     123 Case Circle
                                     Ardmore, OK 73401-0643

AWARD: $399,999.28

PHONE: (580) 657-2575

E-MAIL: admin@amethystresearch.com

PRINCIPAL INVESTIGATOR: Rob Kuester

TITLE OF PROJECT: Ultra High Sensitivity SWIR Methane Imaging Camera

SUBTOPIC NUMBER: 8.6.1X

TECHNICAL ABSTRACT:

Methane is the third most prevalent greenhouse gas, whose atmospheric concentration is currently over 1.7 ppm and is about 21 times more potent when compared to CO2. Thus, while the quantitative monitoring of methane levels is necessary, it is also critically important to directly identify the sources of the methane emissions, for example, in ice floes, leaks in pipelines, and also from drilling/fracking and other anthropogenic activities. The Phase I effort has indicated that a new class of detector – resonant cavity enhanced photo detector – can be successfully manufactured with excellent resonance at the absorption band for methane. This is a significant result, and provides for the first time narrow band infrared detector that has significantly improved performance over any existing infrared detector. For the Phase II effort we will develop an inexpensive methane gas imaging camera, that can be used for direct observation of methane gas/emission. The imaging array uses the advanced resonant cavity enhanced photo-detector (RCE-PD) design that can be tuned to the absorption spectrum of the gas (i.e. methane). This camera will be high sensitivity, low power, and lightweight so it can be readily integrated onto UAV's platforms and hand held systems.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated benefits of the proposed methane gas imaging camera are sensitivity, low cost, and low weight making this imaging system technology ideal for sensing and imaging a wide variety of trace gases, in both land-based and airborne measurements. These advantages will allow the technology to serve the dual markets of industrial and environmental detection and analysis. Examples of trace gases that can be measured include greenhouse gases, emissions from burning of fossil fuels. The important areas of public application include environmental, homeland security, industrial process control, and emission monitoring.

FY 2016 PHASE II AWARD WINNER

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

AWARD: $399,900

PHONE: (703) 413-0290

E-MAIL: cchinn@arete.com

PRINCIPAL INVESTIGATOR: Clayton Chinn

TITLE OF PROJECT: Coastal Eyes, a Multi-Mission Topographic, Current
                                Retrieval and Debris Mapping Sensor System

SUBTOPIC NUMBER: 8.3.2D

TECHNICAL ABSTRACT:

NOAA seeks to characterize the impact of severe weather on coastal areas with a cost-effective, responsive multi-mission sensor system. In response Areté Associates proposes a conceptual design for an affordable, responsive, compact airborne sensor system called "Coastal Eyes" which will rapidly provide land and surface water topography, surface current, debris and storm surge mapping over wide swaths of the coastal zone. CoastalEyes is cost-effective, able to be deployed on many aircraft and can be tasked quickly to support emergency management needs. .

Benefits include:
• Low-risk approach exploits existing COTS sensors and established processing techniques
• Wide-area monitoring of topographic and ocean variability using compact commercial radar
• Able to operate at high altitudes in day/night and a variety of weather conditions
• High-resolution land and ocean topography; near-shore bathymetry, and currents using compact LIDAR and time-series imaging systems
• Flexible and adaptive solution useable with a range of small manned aircraft and adaptable to unmanned platforms
• Commercial transition path embraces partnership with an established leader in airborne surveys.

In Phase 1, Areté developed the Coastal Eyes system design and quantified the achievable performance for the core missions.

Phase 2 will produce a CoastalEyes prototype and perform a demonstration of the five core missions.
SUMMARY OF ANTICIPATED RESULTS:

n Phase 2, the prototype demonstration will illustrate the ability of CoastalEyes to perform all five core missions in support of emergency management efforts in coastal regions with a focus

on storm damage assessment. The demonstration will mimic real-world scenarios with 24 hour, day and night time surveillance and data collection.

FY 2016 PHASE II AWARD WINNER

FIRM: Catalina Sea Ranch
                                   820 S Seaside Ave;
                                   San Pedro, CA 90731-

AWARD: $399,635

PHONE: (316) 993-1486

E-MAIL: kelly@catalinasearanch.com

PRINCIPAL INVESTIGATOR: Kelly Stromberg

TITLE OF PROJECT: Development of Genetics-Based Selective Breeding
                                   Protocols for Improvement of the Mediterranean Mussel,
                                   Mytilus Galloprovincialis, and Advancement of Aquaculture

SUBTOPIC NUMBER: 8.6.1X

TECHNICAL ABSTRACT:

The aquaculture industry lags in genetically based selective breeding programs when compared to terrestrial commercial crops. This aggravates the United States' (U.S.) $11 billion dollar seafood deficit, puts U.S. aquaculture entrepreneurs at an early disadvantage for success, and increases risk of bivalve crop degradation from climate change. Heterosis in bivalve crops, the phenomenon in which hybrid offspring exhibit enhanced traits compared to parental trait values, has been documented in scientific literature, but studies still remain scant and rarely address the genetic components of selection from breeding. To address this gap, Catalina Sea Ranch, LLC (CSR) will develop a novel family line system within the emerging model organism Mytilus galloprovincialis, which will be used to generate the framework for a genetics based selective breeding protocol.

Within this framework, there are 2 main goals for Phase II of SBIR funding: 1) to further develop family line resources in order to have the statistical power to identify specific genes responsible for commercial traits from Phase I; 2) to develop selective breeding protocols based on emerging techniques such as RNA interference and gene counting techniques in order to assess crop value at the earliest possible stages.

SUMMARY OF ANTICIPATED RESULTS:

Through Phase II, CSR will develop invaluable genetic phenotypes of Mga for the aquaculture industry which will indicate how the mutation rate will effect domestication of Mga as well as what inbreeding effects might occur within the selective breeding program. A conditioning tank set up and a holding tank system has the potential to make CSR the first shellfish hatchery that has the capability to store gravid shellfish year around. This would mean a steady, year round supply of seed for the company and for the West coast industry. CSR plans to place two patents in Phase II, the baseline genetic phenotypes as well as a kit–based methodology to access

broodstock genetic potential. If successful, this study will lend immediate benefits to the U.S. economy and have a long term global impact on sustainable protein production from the sea.

FIRM:	Climate Forecast Applications Network, LLC 845 Spring Street; NW #129 Atlanta, GA 30308-
AWARD:	$399,987
PHONE:	(404) 919-2673
E-MAIL:	mjelinek@cfanclimate.com
PRINCIPAL INVESTIGATOR:	Mark Jelinek
TITLE OF PROJECT:	Probablistic seasonal weather forecasts for the energy & agriculture sectors
SUBTOPIC NUMBER:	8.3.1C

TECHNICAL ABSTRACT:

This proposal from Climate Forecast Applications Network addresses the challenge of providing business-relevant subseasonal forecasts for the energy and agricultural sectors, including applications to renewable energy. An innovative multi-model prediction system using the CFSv2 and ECMWF forecasts will be developed to exploit the advantages of each model. An interactive web-based dashboard system is designed to display and deliver the forecast information in a flexible and dynamic manner to aid decision support integration. A comprehensive assessment of predictability of businessrelevant variables by region, initial and target month, and atmospheric flow regimes provides the basis for assessing the confidence of individual forecasts and for identifying forecast 'windows of opportunity'. An ensemble calibration scheme uses predictability assessment, reforecasts and recent forecast errors to correct for model bias error and to improve the shape of the ensemble distribution. Advanced ensemble interpretation techniques support scenario predictions of extreme events. A strategy for assessing confidence of each forecast is based on a comprehensive forecast evaluation, predictability assessment, and ensemble characteristics.

SUMMARY OF ANTICIPATED RESULTS:

The expected outcomes are innovations in ensemble interpretation and calibration suitable for subseasonal time scales that provide the basis for web-based decision support tools for the energy and agricultural sectors. The improved forecast skill and comprehensive assessment of forecast uncertainty and confidence level will build user confidence in the forecast products. These solutions will find commercial markets with existing providers of weather/climate services looking to enhance their product offerings, as well as directly with key end user segments in the energy and agricultural sector.

FY 2016 PHASE II AWARD WINNER

FIRM: Giner, Inc.
                                  89 Rumford Avenue;
                                  Newton, MA 02466-1311

AWARD: $399,584

PHONE: (781) 529-0581

E-MAIL: aargun@ginerinc.com

PRINCIPAL INVESTIGATOR: Dr. Avni Argun

TITLE OF PROJECT: Rapid and Low-Cost Field Toxin Analysis to Monitor
                                  Harmful Algal Blooms

SUBTOPIC NUMBER: 8.3.1C

TECHNICAL ABSTRACT:

Brevetoxins are a group of marine algal toxic compounds that are produced by microscopic
dinoflagellate algae such as Karenia brevis. During harmful algal blooms (HAB), brevetoxins
reach concentrations high enough to cause human neurological and gastrointestinal illnesses
through inhalation of the airborne toxins or consumption of contaminated shellfish. The timely
recognition of this toxin in marine environment is of great importance for public safety, human
health, human recreation, marine ecology, and the marine economy. Therefore, it would be
extremely valuable to provide coastal managers and fisheries with a practical field device that
would accurately assess brevetoxin toxicity levels. The overall objective of this program is to
develop a low-cost and easy-to-use electrochemical test for rapid and quantitative detection of
brevetoxin species in seawater. This versatile field device will allow near real-time monitoring of
brevetoxin levels in seawater and aerosols throughout the progression of a red tide bloom. The
developed platform technology has the potential to go beyond detection of brevetoxin as
indicator of HABs and could find applications in areas where rapid, accurate, and selective
detection of marine (and other) toxins are needed.

SUMMARY OF ANTICIPATED RESULTS:

The proposed program will develop a portable electrochemical sensor device that would enable
highly sensitive and selective field measurement of brevetoxin in ocean water. Successful
demonstration of this device will allow for on-site, near real-time monitoring of toxic conditions at
low cost. Rapid and accurate toxicity information, provided by the final handheld product, could
be used by coastal managers and fisheries to make public safety related decisions.

FY 2016 PHASE II AWARD WINNER

FIRM: Innovative Imaging and Research Corp.
                                Building 1103; Suite 140C
                                Stennis Space Center, MS 39529-0001

AWARD: $400,000

PHONE: (228) 688-2276

E-MAIL: rryan@i2rcorp.com

PRINCIPAL INVESTIGATOR: Dr. Robert Ryan

TITLE OF PROJECT: VIIRS HGS DNB Radiometric Calibration Source

SUBTOPIC NUMBER: 8.1.1F

TECHNICAL ABSTRACT:

This project's aim is to develop an Accurate Active Light Source (AALS) that can be fielded at
selected calibration sites to address NOAA's unmet needs and improve the calibration of the
Suomi NPP VIIRS Day Night Band (DNB) operating in the high gain stage (HGS) under low light
level conditions. The DNB HGS has extreme low-light sensitivity that enables a new generation
of nighttime imaging. Many of these emerging applications' utility however depend on absolute
radiometric accuracy and sensor stability. Currently the DNB HGS calibration hinges on
transferring calibration from the low and medium gain stages to the HGS using a solar diffuser,
which is more than seven orders of magnitude brighter than many of the faintly lit targets
imaged using the HGS. As a result, the HGS absolute calibration accuracy under extreme low
light may be too low to provide quantifiable information and detect change. Our new AALS will
improve our small target radiometry/point source understanding. Combining our national
standards-traceable AALS with a sensitive VIIRS nighttime imaging capability has the potential
to create game changing new commercial and military applications. Key to commercialization
and economic viability is the ability to design and field a cost-effective AALS.

SUMMARY OF ANTICIPATED RESULTS:

This project will result in a ruggedized field tested AALS active source prototype along with LED
laboratory characterization data, a validated VIIRS calibration technique, a list of potential AALS
deployment sites and expected suitability, early AALS stability data, an updated calibration error
budget and AALS market research data.

FIRM:	Intelligent Optical Systems, Inc. 2520 W. 237th Street; Torrance, CA 90505-
AWARD:	$399,955.92
PHONE:	(424) 363-6360
E-MAIL:	sbirproposals@intopsys.com
PRINCIPAL INVESTIGATOR:	Manal Beshay
TITLE OF PROJECT:	Rapid Lateral Flow Assay for Field Detection of Brevetoxins
SUBTOPIC NUMBER:	8.1.1F

TECHNICAL ABSTRACT:

The bloom-forming algae *Karenia brevis* produces neurotoxins known as brevetoxins (PbTx) that can cause illness in humans and marine wildlife. During *K. brevis* blooms, also known as red tides, elevated levels of brevetoxins have been linked to massive bird, fish, and marine mammal kills. In addition, human consumption of brevetoxin contaminated shellfish leads to neurotoxic shellfish poisoning. The economic impact of *K. brevis* blooms in Florida alone has been estimated to be upwards of $30M/year.[1] In collaboration with Dr. Leanne Flewelling of the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute, NeoClone, Catalina Sea Ranch, and VICAM, Intelligent Optical Systems, Inc. (IOS) proposes to continue its development of a fast and portable shoreside lateral flow assay (LFA) for cost-effective immunoassay detection of PbTx. Coupling of detector antibodies to highly fluorescent labels technology has proved in Phase I to enhance assay sensitivity. As a result, with this beach-side assay, unlike the current laboratory assays, NOAA can implement routine coastal monitoring. In Phase II, IOS will validate assay sensitivity and develop a cost-effective sampling and testing kit for the rapid detection of brevetoxins in seawater, and ultimately in shellfish meat.

SUMMARY OF ANTICIPATED RESULTS:

In Phase II, IOS will continue its development of a rapid lateral flow assay that will report brevetoxin levels as low as ~0.3 ppb in seawater. The assay will yield results in 10-15 min. in a broad range of representative environmental conditions. Upon successful completion of Phase II, this low-cost (per-sample cost of $10 or less) beachside assay will immediately identify brevetoxins, making routine coastal monitoring practical. Applying this assay to shellfish matrices will greatly increase the effectiveness of state and federal agencies' routine testing for brevetoxin in shellfish to protect human health. Shellfish testing under laboratory conditions requires a homogenization and extraction step, but the proposed assay will increase speed and reduce cost compared to those existing testing methods.

FY 2016 PHASE II AWARD WINNER

FIRM: Mano Nanotechnologies Inc.
                                   151 Willow Street;
                                   Guilderland, NY 12180-

AWARD: $399,999.96

PHONE: (518) 542-2395

E-MAIL: jmanobianco@verizon.net

PRINCIPAL INVESTIGATOR: John Manobianco

TITLE OF PROJECT: GlobalSense: A New Atmospheric Observing System
                                   Featuring Innovative Airborne Probes

SUBTOPIC NUMBER: 8.2.1F

TECHNICAL ABSTRACT:

The underlying framework for modern-day weather forecasting is numerical weather prediction (NWP). Even the current and planned weather observing platforms leave gaps that are insufficient to meet the requirements of NWP. Mano Nanotechnologies, Inc. proposes to commercialize a new environmental sensing system, known as "GlobalSense", which will enable transformational forecast improvements by filling these critical data gaps and benefit a broad range of applications with sensitivity to atmospheric conditions.

The GlobalSense system features an ensemble of completely disposable airborne probes, mechanisms to deploy probes, and receiver platforms to gather data from probes. The ultra-compact probes, called environmental Motes or eMotes, will function as passive drifters in the atmosphere using no active propulsion or flight. The novel eMote design exploits component miniaturization as well as integration of micro- and nanotechnology-based components in a bio-inspired form factor to minimize complexity, cost, size, mass, terminal velocity, and power consumption.

The Phase II project objective is to develop, test, and demonstrate a complete prototype GlobalSense system in the atmosphere. This objective will be met using mainly commercial off-the-shelf components with parallel and overlapping fabrication efforts on each system component following the specifications, component lists, and other design documentation resulting from the Phase I effort.

SUMMARY OF ANTICIPATED RESULTS:

At the conclusion of Phase I, the GlobalSense system was at technology readiness level (TRL) 3, consistent with completion of analytic critical function and characteristic proof-of-concept. A successful prototype demonstration in the relevant environment of the atmosphere by the end of Phase II will increase the TRL from 3 to 6 and represents a critical milestone that must be met

on the path to commercialization. The GlobalSense value proposition for weather applications is improved forecasting that translates directly to economic and social benefits for a multitude of weather-sensitive sectors worldwide. A GlobalSense system can have much broader commercial potential beyond traditional weather forecasting by measuring parameters of interest for air quality, greenhouse gas (climate change), surveillance, reconnaissance, and related applications.

FY 2016 PHASE II AWARD WINNER

FIRM:	Northwest Research Associates, Inc. 3380 Mitchell Lane; Boulder, CO 80301-
AWARD:	$399,953
PHONE:	(303) 415-9701
E-MAIL:	clindsey@nwra.com
PRINCIPAL INVESTIGATOR:	Dr. Charles Lindsey
TITLE OF PROJECT:	Monitoring Active Region Development on the Far-Side of the Sun
SUBTOPIC NUMBER:	8.1.1F

TECHNICAL ABSTRACT:

Magnetic regions in the Sun's outer atmosphere exert major impacts on space weather in the near-Earth environment. Near-term impacts at Earth are predominantly due to magnetic regions in the Sun's near hemisphere; however, because the Sun rotates, mag- netic regions in the far hemisphere cross into the near hemisphere with little warning—except for our ability to monitor the Sun's far hemisphere from vantages in the helio- sphere other than that of Earth. For the past several years NASA's twin STEREO spacecraft have been in positions to view the entirety of the far hemisphere from the far side of the solar system. We are now approaching a period of most of a decade in length during which STEREO coverage of the Sun's far hemisphere will be greatly diminished or nil. We have developed algorithms capable of analyzing seismic observations of the Sun's near hemisphere to map large active regions with full coverage of the Sun's far hemisphere. We propose to use these algorithms to produce a data product of synoptic seismic maps of the Sun's far hemisphere that can take over the role of STEREO in the service of our nation's space-weather forecasting needs.

SUMMARY OF ANTICIPATED RESULTS:

The Phase-II project will result in a reliable seismic monitor of large active regions in the Sun's far hemisphere whose signatures are realistically calibrated for expectation magnetic fluxes, areas and EUV irradiances of said active regions in EUV spectral bands observed by NASA's STEREO spacecraft and the Solar Dynamics Observatory's Atmospheric Imaging Assembly. The seismic monitor will be operable for an indefinite period in which NASA's STEREO spacecraft can no longer fully cover the Sun's far hemisphere. The regions recognized by this facility will include those with the highest potentiality for the production of flares, CMEs and excess EUV irradiance.

FY 2016 PHASE II AWARD WINNER

FIRM: Precient Weather LTD
                                   200 Innovation Blvd; Suite 229
                                   State College, PA 16803-

AWARD: $399,909

PHONE: (814) 466-2231

E-MAIL: john.dutton@prescientweather.com

PRINCIPAL INVESTIGATOR: John A Dutton

TITLE OF PROJECT: Probabilities of Business Inpact Variables from CFS2
                                   Ensembles

SUBTOPIC NUMBER: 8.4.3D

TECHNICAL ABSTRACT:

The value of the subseasonal and seasonal probability (S2S) forecasts of the NWS Climate Forecast System Version 2 (CFS2) will increase substantially when they are converted into forecasts about business impact variables such as degree days, wind and solar power potential, end-of-season crop yield, water resource variables, and extremes of both weather and impacts themselves. In Phase II, our Phase I developmental forecasts of impact variables created from CFS2 forecasts will become operational and available to customers. Computing the forecasts and verification over a historical period will demonstrate the remarkable skill and reliability achieved as a result of new and novel calibration techniques developed in Phase I.

The impact variable forecasts from operational CFS2 forecasts can then be combined with that forecast skill to show decision makers the expected consequences of acting at various predicted probabilities to seize opportunity or mitigate adverse events. Phase II will provide web-based interactive decision advisory systems tailored to industries such as energy, agriculture, transportation, insurance, and finance so that decision makers can assess alternative action, reduce climate variability risk, and increase profit, thus demonstrating that the value of our forecasts lies in the action they motivate and the favorable consequences that follow.

SUMMARY OF ANTICIPATED RESULTS:

This project will produce subseasonal and seasonal probability forecasts about the key business variables of major national industries that will assist decision-makers to meet the challenge of managing climate variability risk and opportunity on the scale of weeks to seasons, thereby contributing to economic vitality and increasing the return on the national investment in atmospheric observations, research, and supercomputer forecasts.

FY 2016 PHASE II AWARD WINNER

FIRM: Proteus Technologies LLC
                                    1040 Old Spanish Trail; Suite 7
                                    Slidell, LA 70458-

AWARD: $400,000

PHONE: (985) 231-2222

E-MAIL: sean@proteustechnology.com

PRINCIPAL INVESTIGATOR: Sean Griffin

TITLE OF PROJECT: The Trident Array: A Stable, Towed, Tetrahedral
                                    Hydrophone Array

SUBTOPIC NUMBER: 8.6.1X

TECHNICAL ABSTRACT:

Detecting the presence of marine mammals in paramount in lessening man's impact on the
environment as we search the oceans for natural resources. Many human ocean activities use
high powered acoustic sources that can disturb, disrupt, maim or kill marine animals. The ability
to detect, identify and locate marine mammals is critical during these operations to mitigate
harm. Passive acoustics is a reliable method to detect and localize marine mammals but the
necessary volumetric acoustic methods generally require expensive systems that are also
expensive to deploy. During Proteus' Phase I effort, we demonstrated real-time detection and
localization at high tow speeds with a small, low cost volumetric array. The design proved to be
highly stable at 10 knots tow speeds. During the Phase II effort, our plans are to improve our
basic Phase I prototype design into a fully operational pre-production design that improves on
the localization performance of the Phase I prototype that is low cost, reliable, modular and
rugged. There is significant worldwide commercial potential for such as system in marine
mammal population studies and mitigation efforts.

SUMMARY OF ANTICIPATED RESULTS:

Proteus anticipates at the completion of the Phase II that we will have a fully functioning pre-
production volumetric array that is stable when towed at 10 knots and is capable of real-time
localization of marine mammals. The array will have a more modular design than the Phase I
prototype, will be more cost effective and more rugged while still meeting the performance
objectives. The planned pre-production design will maintain the basic shape and architecture
but will be made of different materials and easily replaceable components. The acoustic array
performance will also be optimized and characterized. Additionally, the electronics will be
improved with wet side digitization. Electronics design changes will improve the noise
performance, reduce ship-to-ship noise variations, reduce dry side electronics footprint, reduce
the tow cable wire count requirements and reduce the overall system cost. The significant
commercial potential in marine mammal research, population study surveys and mitigation work

due to laws protecting marine mammals nationally and internationally. Proteus will be ready upon completion of the Phase II effort to fill this market need.

FY 2016 PHASE II AWARD WINNER

FIRM:	Southwest Sciences, Inc. 1570 Pacheco Street; Suite E-11 Santa Fe, NM 87505-
AWARD:	$400,000
PHONE:	(505) 984-1322
E-MAIL:	jsilver@swsciences.com
PRINCIPAL INVESTIGATOR:	Dr. Joel A. Silver
TITLE OF PROJECT:	Portable High Precision Nitrogen Gas Analyzer for Eddy Covariance Flux Measurements
SUBTOPIC NUMBER:	8.3.2D

TECHNICAL ABSTRACT:

Recent research has suggested that the commonly used assumption of dry air having no net flux is erroneous and can lead to significant errors in reported observations for eddy correlation flux measurements. If the density of nitrogen was measured directly, the accuracy of these measurements would be improved greatly. Southwest Sciences, Inc. proposes to develop a portable analyzer that would be used in conjunction with sonic anemometers to improve the performance of eddy covariance flux measurements. This instrument would use a new optical method to detect ambient nitrogen gas density with good precision and fast time response. The Phase I research demonstrated that required performance specifications could be achieved. The Phase II research would result in the construction, characterization and field testing of a prototype instrument.

SUMMARY OF ANTICIPATED RESULTS:

The Phase II prototype instrument will demonstrate the feasibility of this approach and provide a solid basis for further development of a commercial product. This portable, autonomous device would be relatively inexpensive and would be of use in the many locations where greenhouse gas fluxes are measured, both at academic and governmental sites.

FY 2016 PHASE II AWARD WINNER

FIRM:	The Cultured Abalone Farm 9580 Dos Pueblos Canyon Road; Goleta, CA 93117-
AWARD:	$400,000
PHONE:	(805) 685-1956
E-MAIL:	dswezey@culturedabalone.com
PRINCIPAL INVESTIGATOR:	Daniel Swezey
TITLE OF PROJECT:	Developing Ocean Acidification Resistance in Commercial Red Abalone Aquaculture
SUBTOPIC NUMBER:	8.5.1X

TECHNICAL ABSTRACT:

The pH of the global ocean is becoming more acidic as a consequence of oceanic absorption of increasing atmospheric CO2 concentrations. This process, termed "ocean acidification" (OA), will likely affect the aquaculture of marine shellfish. Maintaining current levels of commercial mollusc production will require the identification and commercialization of resilient seedstock. Through Phase I research efforts, we have discovered genotypes within the red abalone (*Haliotis rufescens*) metapopulation that exhibit resilience to future OA. In collaboration with university partners, our firm will identify the genetic signatures associated with tolerance to low pH, which will enable us to develop an OA-resilient strain of red abalone. We will verify their enhanced performance using advanced dissolved CO2 testing infrastructure, developed by our project PI in collaboration with university colleagues. We will also work to develop a robust commercial coralline algae feedstock, which our Phase I research indicates conveys additional resilience to OA. These products hold significant commercial promise, and could serve as an example for adaptation efforts in other shellfish sectors.

SUMMARY OF ANTICIPATED RESULTS:

Our work will identify abalone strains and their genomic signatures that confer resilience to OA stress. These efforts will include an assessment of the genetic heritability of this resilience as the foundation for selective breeding efforts. We will also work to develop coralline algae as a viable food source for commercial abalone aquaculture applications, with the goal of exploiting this feedstock's capacity to convey enhanced resilience to OA in post-settlement abalone culture**.**