



# SBIR



## **Small Business Innovation Research Program**

## **ABSTRACTS OF PHASE I AWARDS FOR FISCAL YEAR 2015**

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

## INTRODUCTION

The Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), through the Small Business Innovation Research (SBIR) program, awarded 19 Phase I contracts for FY 2015. These awards are up to \$95,000 each, and totaling approximately \$1,805,000. The awards are for a six-month effort to demonstrate the feasibility of innovative approaches to the research topics identified in the “DOC/NOAA SBIR Program Solicitation for FY 2015 (NOAA 2015-1).” 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 80 proposals were received by DOC/NOAA in response to its FY 2015 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 19 were selected for an award. Final selection was based upon the results of the reviews, relative importance to DOC/NOAA needs, relationship to on-going research, and potential for commercialization.

## FY 2015 PHASE I AWARD WINNER

FIRM: Arete Associates  
1550 Crystal Dr, Suite 703  
Arlington, VA 22202

AWARD: \$94,951.79

PHONE: 703-413-0290  
E-MAIL: [contracts@arete.com](mailto:contracts@arete.com)

PRINCIPAL INVESTIGATOR: Dr. Clayton R. Chinn

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

SUBTOPIC NUMBER: 8.3.2D

### TECHNICAL ABSTRACT:

Areté Associates proposes the Coastal Eyes, a multi-mission sensor system to respond to NOAA's core mission objectives for coastal emergency management measurements to map land and surface water topography over coastal, waterways and fresh water regions; surface (fresh and oceans) currents, debris detections and storm surges. Arété will develop a responsive, cost-effective sensor solution, which will use enabling algorithms developed by Arété to meet this need. Coastal Eyes includes an innovative 3D SAR processor that uses a COTS Synthetic Aperture Radar (SAR) for topographic measurements over wide-swaths; the current retrieval capability of Arété's RiverEye and the commercial Remote Ocean Current Imaging System (ROCIS). Coastal Eyes also integrates the Pushbroom Imaging Littoral LIDAR (PILLS), a compact LIDAR developed by Arété, with a Standard SAR, and with a real-time processor to produce a responsive solution to quickly provide actionable results to the user.

### SUMMARY OF ANTICIPATED RESULTS:

Phase 1 will produce a preliminary system design for the Coastal Eyes sensor system, estimates for feasibility and cost for fabrication of a prototype, operational and installation requirements, a performance model of Coastal Eyes, a Phase 2 plan to produce and demonstrate a prototype system, and a commercialization application study.

## FY 2015 PHASE I AWARD WINNER

FIRM: Bio-waves, Inc.  
364 2<sup>nd</sup> Street, Suite #3  
Encinitas, CA 92024

AWARD: \$94,801.00

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E-MAIL: [Thomas.f.norris@bio-waves.net](mailto:Thomas.f.norris@bio-waves.net)

PRINCIPAL INVESTIGATOR: Thomas F. Norris

TITLE OF PROJECT: The X-3D Array: An Affordable Three Dimensional, High Speed, Towed Hydrophone Array

SUBTOPIC NUMBER: 8.2.1F

### TECHNICAL ABSTRACT:

We proposed to test, design, and modify an existing 'X-Array' tetrahedral (3-D) hydrophone array prototype and design with the ultimate goal of developing a production prototype called the 'X-3D Array'. We will analyze field data collected previously from the first prototype, conduct hydrodynamic modeling of the array design, and research possible torque imbalances in the tow-cable, and use this information to make the necessary design changes to resolve the noise and twisting issues identified in the first prototype. We will then conduct field tests of the new X-3D Array to ensure it is meeting the necessary technical and operational specifications, such as towing it at 10 knots. We will consider the materials and fabrication processes throughout this process so that a production prototype will be ready for Phase II. We have chosen this accelerated approach because an initial prototype already exists. We have assembled a team of world renowned technical experts from the Scripps Institution of Oceanography's Marine Physical Lab. Desert Star Systems LLC will provide guidance on the commercialization aspects of this effort. Bio-Waves Inc., a small business specializing in passive acoustic technologies, will oversee the project management and field testing aspects of the effort.

### SUMMARY OF ANTICIPATED RESULTS:

We anticipate development of a field tested production X-3D prototype that will be ready for additional testing and commercialization in Phase II. We will provide a report that summarizes any issues encountered and how these were resolved and provide recommendations for any issues that remain. We expect that the X-3D Array will have numerous application beyond monitoring sounds from marine mammals, such as searching for pingers (e.g. from tagged fish), locating transponders (e.g. from oceanographic instrumentation and even black boxes from downed airplanes).

## FY 2015 PHASE I AWARD WINNER

FIRM: Catalina Sea Ranch, LLC  
820 South Seaside Ave.  
Terminal Island, CA 90731

AWARD: \$95,000.00

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E-MAIL: [Kelly@catalinasearanch.com](mailto: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: 8.1.1F

### TECHNICAL ABSTRACT:

The problem this proposal seeks to remedy has positive and profound ramifications for the advancement of aquaculture. The aquaculture industry lags in genetically based selective breeding programs when compared to terrestrial commercial crops. This perpetuates our nation's \$11 billion dollar seafood deficit, puts U.S. aquaculture entrepreneurs at a disadvantage for success, and increases risk for bivalve crop degradation from climate change. Heterosis in bivalve crops have been documented in scientific literature, but studies remain scant and rarely address the genetic components of selection from breeding. To address this gap, a novel family line system will be developed 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 three goals for Phase I: **1)** to establish genetically distinct family lines of blue mussels, focusing on desirable commercial characteristics, **2)** investigate genetics of viability and selection, and **3)** determine mutation rates and their impact on domesticated shellfish cultivars. These data will then be used (in Phases II/III) to develop genetic based selective breeding protocols. This research will provide immediate benefits to the U.S. economy, and have a long term global impact on a sustainable protein production from the sea.

### SUMMARY OF ANTICIPATED RESULTS:

#### Phase I Deliverables:

- Generation of 30 families of F1 inbred lines, to be used in future scientific and commercial endeavors.
- Measured differential growth and survival rates among families.
- Mapped annotation of genes associated with growth and survival characteristics, and description of time of earliest possible detection in larval cohort.
- Inherent mutation rate of Southern California *Mytilus galloprovincialis*.
- Working 'blue-house' facilities on Catalina Island, ensuring future research for CSR and various scientific teams.

#### Phase II Deliverables:

- Simple commercial strategies and protocols for genetic based selective breeding programs for blue mussels, and shellfish in general.
- Byssal thread strength and shell robustness measurements between families and associated genetic profiles.
- Continued inbreeding in family lines, and Isolation of improved cultivars (strategy depending on mutation rate described in Phase I).

## FY 2015 PHASE I AWARD WINNER

FIRM: Climate Forecast Applications Network, LLC  
845 Spring St. NW #129  
Atlanta, GA 30308

AWARD: \$94,849.06

PHONE: 404-803-2012  
E-MAIL: [curry.judith@gmail.com](mailto:curry.judith@gmail.com)

PRINCIPAL INVESTIGATOR: Mark Jelinek

TITLE OF PROJECT: Probabilistic subseasonal weather forecasts for the energy & agricultural sectors

SUBTOPIC NUMBER: 8.3.1C

### TECHNICAL ABSTRACT:

The proposed research addresses Climate Adaptation and Mitigation: Probability Forecasts of Business Impact Variables from CFS2 Ensembles. Climate Forecast Applications Network (CFAN) develops innovative weather and climate forecast tools that support decision-oriented solutions for our clients. The focus of this proposal is on business-relevant subseasonal forecasts for the energy and agricultural sectors, including applications to renewable energy. Analysis of the reforecast library against observation and analyses enables predictability assessment of business-relevant variables by region, initial and target month, and enables predictability assessment and recent forecast errors to correct for model bias error to improve the shape of the ensemble distribution. A multi-model prediction system using the CFSv2 and ECMWF forecasts will be developed to exploit the advantages of each model using ensemble clustering techniques. A strategy for assessing confidence of each forecast is based on a comprehensive forecast evaluation, predictability assessment, and ensemble characteristics. A web-based dashboard system is designed to display and deliver the forecast information in a flexible manner to aid decision support integration. Commercial applications of the forecast products will be targeted at the energy and agricultural sectors in the U.S. and Asia.

### SUMMARY OF ANTICIPATED RESULTS:

At the end of Phase II, 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. 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 sectors.

## FY 2015 PHASE I AWARD WINNER

FIRM: The Cultured Abalone Farm, LLC  
9580 Dos Pueblos Canyon Road  
Goleta, CA 93117

AWARD: \$94,647.00

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PRINCIPAL INVESTIGATOR: Dr. Daniel S. Swezey

TITLE OF PROJECT: Developing Ocean Acidification Resistance in Commercial Red Abalone

SUBTOPIC NUMBER: 8.1.1.1F

### TECHNICAL ABSTRACT:

It is now recognized that the pH of the world's oceans is becoming more acidic as a consequence of increasing atmospheric CO<sub>2</sub>. This process, termed "ocean acidification" (OA) will affect the aquaculture of marine shellfish. In order to maintain current levels of commercial mollusk production, the identification and commercialization of resilient shellfish strains will be required. Emerging evidence suggests that wild shellfish populations may be locally adapted to variable pH conditions along the California coast. Our firm will exploit this natural variation, carrying out research towards the development of an OA resistant strain of red abalone. We will also work to develop a reproducible commercial diet and feeding approach that conveys resistance to OA. These products may hold significant commercial and market potential, setting an example for efforts in other shellfish industries. Our proposed OA culture experiment will investigate the relative resilience of different abalone populations under OA, and the effects of varying maternal and juvenile diet. We will identify resilient strains using both growth observations and advanced genetic techniques in collaboration with partner researchers. Our work will identify the genetic signatures of resilience to OA and will provide a foundation for future selective breeding efforts.

### SUMMARY OF ANTICIPATED RESULTS:

Our work will identify abalone strains that are resilient to OA, and generate an assessment of the portions of the red abalone genome that are affected by acidification stress. This will enable the detection of "resilience signatures" in rapidly growing individuals. These analyses will include an assessment of the genetic heritability of this resilience as the foundation for selective breeding efforts. We will also generate an initial assessment of dietary components that convey resilience to OA under commercial aquaculture settings with the goal of developing a feedstock for abalone that conveys OA resistance.



## FY 2015 PHASE I AWARD WINNER

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

AWARD: \$94,996.00

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PRINCIPAL INVESTIGATOR: Avni A. Argun, Ph.D.

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

SUBTOPIC NUMBER: 8.1.2N  
TECHNICAL ABSTRACT:

During the harmful algal blooms (HAB), marine algal toxins reach concentrations high enough to cause various neurological and gastrointestinal disorders through inhalation of the toxin or consumption of contaminated shellfish. Brevetoxins, produced by dinoflagellate *Karenia brevis*, are known to disrupt neurological processes to cause an illness called neurotoxic shellfish poisoning. The timely recognition of this toxin in marine environment is thus of great importance for human health. However, the toxic levels of brevetoxin are on the order of parts-per-billion (ppb), making its detection very difficult and costly using the current analytical methods and biological assays. Furthermore, the correlation of the brevetoxin levels with the amount of *K. brevis* is not straightforward, further complicating the assessment of conditions dangerous to humans. This project aims to develop a low-cost, handheld electrochemical sensor device that will enable measurement of brevetoxin levels with high sensitivity while lowering the field detection limits down to sub ppb levels via utilization of an analyte concentration method. An accurate assessment of sample toxicity will be demonstrated by combining the brevetoxin levels with toxic *K. brevis* cell amounts using a single detection platform that is simple.

### SUMMARY OF ANTICIPATED RESULTS:

The proposed program will develop an electrochemical sensor device that would enable highly sensitive and selective measurement of brevetoxin and *K. brevis* cells in ocean water. Successful demonstration of this study will allow for on-site, near real-time monitoring of toxic conditions at low cost. The final handheld product will provide rapid and accurate toxicity information to coastal managers and fisheries for decisions related to beach closure and seafood safety.

## FY 2015 PHASE I AWARD WINNER

FIRM: Innovative Imaging & Research Corp  
Building 1103, Suite 140C  
Stennis Space Center, MS 39529

AWARD: \$95,000.00

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PRINCIPAL INVESTIGATOR: Dr. Robert E. Ryan

TITLE OF PROJECT: VIIRS DNB HGS Radiometric Calibration Source

SUBTOPIC NUMBER: 8.4.3D

### TECHNICAL ABSTRACT:

A new radiometric vicarious calibration approach for the Suomi NPP VIIRS Day/Night Band's (DNB) high gain stage (HGS) is proposed that will complement traditional, extended source, radiance-based calibrations, which are based on natural lunar illumination and not as accurate as desired. The proposed research will produce affordable, field-deployable, NIST-traceable point source lamps that can achieve HGS DNB radiance per pixel with a long-term, post-correction source stability of better than 1%. Using radiative transfer modeling and VIIRS DNB characteristics, the top-of-atmosphere absolute radiometric accuracy will be better than 5% under clear sky conditions. The artificial source's spectral distribution can be made similar to that of natural lunar illuminated scenes to ensure this new approach is compatible with ongoing lunar illumination-based vicarious radiometric calibrations. Other spectral distributions can also be produced if needed. To increase energy efficiency and reliability, the source will be remotely controlled and monitored. The source will only turn on during the VIIRS DNB site overpass, when observation conditions are optimal. Built-in lamp sensors will provide lamp health information and auxiliary sensors will provide site environmental conditions. This new approach should be applicable to other nighttime imagers and will help calibrate other point sources observed by VIIRS.

### SUMMARY OF ANTICIPATED RESULTS:

The technology that will be developed during this SBIR project will enable radiometric calibration of the VIIRS DNB HGS to within 5%. Current methods yield accuracies closer to only 15% and rely on models that are not always tied to national standards. Potential commercial applications include calibration light sources and related services to both satellite and aerial imagery providers. Calibrated high spatial resolution night time aerial imagery can be used to produce accurate lighting surveys and lighting maps to municipalities and commercial property owners including lamp/bulb type identification.

## FY 2015 PHASE I AWARD WINNER

FIRM: Intelligent Optical Systems, Inc.  
2520 W. 237<sup>th</sup> Street  
Torrance, CA 90505

AWARD: \$94,954.43

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PRINCIPAL INVESTIGATOR: Manal Beshay

TITLE OF PROJECT: Rapid Lateral Flow Assay for Field Detection of Brevetoxins

SUBTOPIC NUMBER: 8.1.2N

### 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. In collaboration with Dr. Leanne Flewelling of the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute, Intelligent Optical Systems, Inc. (IOS) proposes to develop a shore-side, portable, fast, cost-effective PbTx detection immunoassay using lateral flow assays (LFA). Coupling of detector antibodies to high quantum yield labeling technology will enhance assay sensitivity. With this beachside assay, unlike the current laboratory-based assays, NOAA can then implement routine coastal monitoring. In Phase I, IOS will evaluate the feasibility of developing a cost-effective lateral flow assay for the rapid detection of brevetoxins in seawater, with analysis made possible by the use of a portable test strip reader for fluorescent measurement that can be extended to shellfish testing in Phase II.

### SUMMARY OF ANTICIPATED RESULTS:

In Phase I, IOS will explore the feasibility of developing a rapid lateral flow assay that will report brevetoxin levels as low as 0.3 ppb in seawater or lower. The assay will yield results in 10-15 min. in a variety of environmental conditions. Once successfully developed, this low-cost (per-sample cost \$10 or less) beach side assay will immediately identify brevetoxins and contribute to routine coastal monitoring. The possibility of applying this assay to shellfish matrices would greatly increase potential commercial applications for state and federal agencies that routinely test for brevetoxin in shellfish in order to protect human health. Use with shellfish would require a homogenization and extraction step under laboratory conditions, but the assay would increase speed and reduce cost compared to existing testing methods.

## FY 2015 PHASE I AWARD WINNER

FIRM: Northwest Research Associates, Inc.  
3380 Mitchell Lane  
Boulder, CO 80301

AWARD: \$94,935.00

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E-MAIL: [Lindsey@nwra.com](mailto:Lindsey@nwra.com)

PRINCIPAL INVESTIGATOR: Dr. Charles Lindsey

TITLE OF PROJECT: Monitoring Active Region Development on the Far-Side of the Sun

SUBTOPIC NUMBER: 8.4.1W

### TECHNICAL ABSTRACT:

Solar active regions have a major impact on space weather. Knowledge of active regions in the Sun's far hemisphere can improve forecasts of impending solar storms and future UV irradiance variations that negatively impact spacecraft, communications, and navigation facilities, thus making knowledge of active region locations and strengths of great benefit to society. We will use algorithms based on seismology of acoustic waves in the Sun to monitor the Sun's far hemisphere: computational seismic holography and time-distance tomography. We will develop a large-active-region discriminator, capable of partitioning seismic signatures into simple individual elements for the purpose of identifying and characterizing the far-side active regions. For the Phase I study, primary emphasis will be on validating the helioseismic assessment of the locations, strengths, and growth rates of active regions in the Sun's far hemisphere in terms of stability and consistency over a 5-year period. Based upon these results, we will develop plans for a Phase II project to make synoptic seismic monitoring of the Sun's far hemisphere a crucial role of helioseismic observatories in space weather forecasting in the twenty-first century.

### SUMMARY OF ANTICIPATED RESULTS:

The study will result in a quantitative assessment of how well different methods of helioseismology and active region discriminators can determine the locations, strengths, and growth rates of active regions on the far side of the Sun. From this, a recommendation will be made about what technique(s) are worthy of further development.

## FY 2015 PHASE I AWARD WINNER

FIRM: Prescient Weather  
200 Innovation Blvd, Suite 229  
State College, PA 16803

AWARD: \$94,692.00

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E-MAIL: [info@prescientweather.com](mailto:info@prescientweather.com)

PRINCIPAL INVESTIGATOR: John A. Dutton

TITLE OF PROJECT: Probability Forecasts of Business Impact Variables From CFS2 Ensembles

SUBTOPIC NUMBER: 8.3.1.C

### TECHNICAL ABSTRACT:

The value of the subseasonal and seasonal probability forecasts of the National Weather Service (NWS) will be enhanced when the information about standard meteorological variables is converted into information about business impact variables such as degree days, wind and solar power potential, and end-of-season crop yield. Toward that goal, in Phase I we will identify a suite of such action variables for a broad range of industries and activities, develop algorithms to obtain probabilities about a representative sample of such variables from the NWS Climate Forecast System Version 2 (CFS2) forecasts, and develop methods for verifying forecasts about action variables. Computing the forecasts and verification over a historical period will provide an estimate of the skill of the forecasts of the impact variables.

The ongoing CFS2 forecasts can then be combined with forecast skill to show decision makers the expected consequences of acting at various predicted probabilities to seize opportunity or mitigate adverse events. This will lead in Phase II to web-based interactive decision advisory systems tailored to industries such as energy, agriculture, transportation, and insurance and finance that will allow their decision makers to assess alternative actions, reduce climate variability risk, and increase profits.

### 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 risk and opportunity on the scale of weeks to seasons, thereby increasing the return on the national investment in atmospheric observations, research, and computer forecasts.

## FY 2015 PHASE I AWARD WINNER

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

AWARD: \$95,000.00

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E-MAIL: [sean@proteustechnology.com](mailto:sean@proteustechnology.com)

PRINCIPAL INVESTIGATOR: Sean Griffin

TITLE OF PROJECT: Stable, Towed, Volumetric Hydrophone Array

SUBTOPIC NUMBER: 8.2.1F

### TECHNICAL ABSTRACT:

Detecting the presence of marine mammals is paramount in lessening man's impact on the environment as we search the oceans for natural resources. Most human operations in oceans use high powered acoustic sources that can disturb, disrupt, main or kill marine mammals. The ability to detect, identify and locate marine mammals is critical during these operations to mitigate harm. Passive acoustics has been found to be a highly reliable method to detect marine mammals but work is required to improve the process of locating them and decrease the system cost. There is significant literature on detection of marine mammals but little is available on systems that can determine bearing and range especially over the broad spectrum of marine mammal phonation. Such systems exist in expensive military hardware but low cost methods are required due to the economics that drive marine mammal detection. Low noise and highly sensitive systems are required to detect and locate marine mammals at the farthest range possible thus providing the widest coverage. The government has imposed regulations requiring marine mammal detection when ocean operations may harm the animals, so there is a significant need for low cost, real-time, high performance, reliable, towed passive acoustic system.

### SUMMARY OF ANTICIPATED RESULTS:

Proteus's anticipated results are that we can provide a stable, towed, volumetric hydrophone array prototype at the end of the Phase I effort. The design will be capable of cost effective fabrication. The array will be capable of providing acoustic data that will detect and be capable of being used to calculate the bearing to a marine mammal.

## FY 2015 PHASE I AWARD WINNER

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

AWARD: \$94,992.00

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PRINCIPAL INVESTIGATOR: Steven Fernandez

TITLE OF PROJECT: Commercial Verde

SUBTOPIC NUMBER: 8.5.1

### TECHNICAL ABSTRACT:

Public and commercial application of NOAA developed products such as climate observations, weather products, and datasets are underutilized by public decision makers, infrastructure asset owners, or the public. Communities realize the risk posed by increases in storm intensity, flooding, and heat waves. However, communities lack understandable models targets to stakeholder questions that are affordable, on-demand, interactive, and understandable. Almeria Analytics' (AA) in partnership with Street Legal Industries (SLI) propose a system based on the Visualizing Energy Resources Dynamically on Earth (VERDE) system. AA principals are inventors of VERDE (developed over the last decade at DOE's Oak Ridge National Laboratory) and AA is obtaining licenses for the VERDE patents to be available early in the Phase I period of performance.

VERDE combines situation awareness and modeling to provide a web-streaming platform based on open geospatial standards and issues look-ahead forecasts and analysis. Phase I deliverables include establishing the feasibility of the service simultaneously to workstations, smartphones and tablets. The Website in Phase I will gather requirements from user focus groups and demonstrate technical feasibility. Phase II objectives will include communication of critical analytic data to University of Tennessee partners and identified new desirable functions for the Phase II deliverable.

## FY 2015 PHASE I AWARD WINNER

FIRM: Amethyst Research  
123 Case Circle  
Ardmore, OK 73401

AWARD: \$94,994.50

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PRINCIPAL INVESTIGATOR: Dr. Weerasinghe Priyantha

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 atmosphere concentration is currently over 1.7 ppm. Methane is about 21 times more potent when compared to CO<sub>2</sub>. Even though its concentration in the atmosphere is more than 200 times lower than carbon dioxide, methane is responsible for 20% of the greenhouse effect. The main natural resources for methane include wetlands, termites and the oceans. Natural sources create 36% of methane emissions. The main anthropogenic sources come from landfills, livestock farming, and in the production, transportation and use of fossil fuels accounting for 64% of the total. While the quantitative monitoring of methane levels is necessary, it is also critically important to directly identify the sources of methane, for example, such as leaks in pipelines, and also from drilling/fracking and other human activities. In this NOAA SBIR program, Amethyst Research proposes to develop a relatively inexpensive methane gas imaging camera that can be used for direct observation of methane gas/emissions. This camera will be high sensitivity, low power, low cost and light so it can be integrated onto UAV's platforms and hand held systems.

### SUMMARY OF ANTICIPATED RESULTS:

The anticipated benefits of the proposed methane gas imaging sensor 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 and emissions from the burning of fossil fuels, and the release of chemical weapons. The important areas of public application include homeland security, industrial process control, and emission monitoring.



## FY 2015 PHASE I AWARD WINNER

FIRM: Chemled Technologies, LLC  
574 Stone Hill Rd  
Orange, CT 06477

AWARD: \$95,000.00

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PRINCIPAL INVESTIGATOR: Radoslaw M. Sobczynski, Ph.D.

TITLE OF PROJECT: Laser Sensor for Unattended, and Precise Determination of Calcium and Strontium in Seawater

SUBTOPIC NUMBER: 8.6.1X

### TECHNICAL ABSTRACT:

The use of unattended floats, platforms, and drones addresses the immense challenge of cost-effectively characterizing the chemistry of the oceans. The proposed program strengthens this capability by demonstrating the feasibility of Laser Fluorescence Enhanced Flame Spectrophotometry (LFEFS) for the simultaneous and high precision measurement of calcium and strontium. These are key elements of the human food chain at risk due to ocean acidification. LFEFS offers ICP-AES-comparable precision with greater chemical selectivity and immunity to interference with compact and light weight design. The LFEFS innovation is enabled by the incorporation of the recently developed IPSSL (Intracavity Plasma Solid State Laser) platform. IPSSL is an atomic resonant wavelength laser with an embedded atomic standard. The resulting wavelength stability (ranging from 0.1 to 1 picometers) virtually eliminates wavelength drift and simplifies instrument design. High precision and signal-to-noise are promoted by (1) optical power levels sufficient to saturate the resonant transition eliminating quenching of excited atoms, and (2) operation based on ground state rather than excited state transitions. The beam can be electronically modulated for noise reduction, and no spectrometer is required.

Experimental IR&D results using IPSSL-Rb are supportive of proposal contentions. A successful program will result in products for immediate commercialization.

### SUMMARY OF ANTICIPATED RESULTS:

Feasibility of the LFEFS chemical analytical method will be demonstrated for single element (calcium only) and multi-element (calcium and strontium simultaneously) calibrated concentration determinations. Feasibility of single-wavelength IPSSL-Ca and dual-wavelength IPSSL-Ca-Sr laser will also be demonstrated. The later will be patented, and both lasers will be commercialized through the company's manufacturing gate system.

## FY 2015 PHASE I AWARD WINNER

FIRM: Industrial Economics  
2067 Massachusetts Ave  
Cambridge, MA 02476

AWARD: \$93,812.83

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E-MAIL: [DHudgens@indecon.com](mailto:DHudgens@indecon.com)

PRINCIPAL INVESTIGATOR: Daniel E. Hudgens

TITLE OF PROJECT: Supporting Local Decision Making through a  
Comprehensive Community Driven Data Tool

SUBTOPIC NUMBER: 8.5.1X

### TECHNICAL ABSTRACT:

A central part of NOAA's mission is to develop and distribute scientific data, including large-scale climate, weather, marine, and coastal information for regional and national analysis. NOAA has also developed local data gathering tools on an as-needed basis. While these approaches demonstrate the power of local data collection, no existing tool meets the broad needs of environmental community groups leading such efforts. Significant challenges hinder both the collection and distribution of local-scale data, and aggregation into large-scale data sets. Our proposed method, community driven data (CD2) collection, assists decision makers and data collectors, with the goal of combining local information to create regional and national level data. We aim to research and design our CD2 application and demonstrate its feasibility to: (1) connect community groups with existing NOAA data sources relevant to decision making needs; (2) provide a platform for deploying new mobile collection forms, engaging the group members/volunteers, and standardizing the data prior to aggregation in a data warehouse; and (3) utilize a web-based portal for connecting subscribers to regional and national aggregations of collected data.

### SUMMARY OF ANTICIPATED RESULTS:

For the Phase I effort, we plan to complete the feasibility assessment and design of the CD2 toolset. We expect to build relationships with data providers and community groups to obtain substantial information on stakeholder needs and identify individuals willing to comment on draft design proposals. Next, we will determine barriers and challenges both in terms of technology and use adoption as well as likely solutions to each and develop technical code in order to identify the best approach for development. We anticipate testing scenarios that can be used to guide the full Phase II prototype and initial application and preparing a final report summarizing the above research and associated requirements for follow-on development and product commercialization. Our target market for CD2 is through the sale of, or subscription service to, the regional and national data created through the application.

## FY 2015 PHASE I AWARD WINNER

FIRM: Mano Nanotechnologies  
151 Willow Street  
Guilderland, NY 12180

AWARD: \$94,952.07

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E-MAIL: [imanobianco@verizon.net](mailto:imanobianco@verizon.net)

PRINCIPAL INVESTIGATOR: John Manobianco

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

SUBTOPIC NUMBER: 8.6.1X

### 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 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 known as eMotes will leverage ongoing trends in component integration and miniaturization to provide low cost, wireless sensing capability and will function as passive drifters using no active propulsion or flight. eMotes will be designed to remain airborne and make measurements of temperature, humidity, pressure, and wind velocity for hours or longer depending on atmospheric conditions and deployment altitude.

The Phase I project objective is to design and simulate various elements of the GlobalSense system. Commercial modeling and design software will be used to optimize eMote mechanical and electrical architecture as well as address functional system specifications that resulted from previous tradeoff studies.

### SUMMARY OF ANTICIPATED RESULTS:

The Phase I project will result in hardware and software designs for eMotes, receivers, and deployment mechanisms. Work in Phase I will focus on critical system/component functions and characteristic proof of concept to provide the foundation for prototype development and demonstration in Phase II. 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 of the global economy. 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 2015 PHASE I AWARD WINNER

FIRM: Propagation Research Associates  
1275 Kennestone Circle, Suite 100  
Marietta, GA 30066

AWARD: \$95,000.00

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PRINCIPAL INVESTIGATOR: Bonnie Valant-Spaight

TITLE OF PROJECT: Novel Method for Ground-based GNSS Radio Occultation Measurement

SUBTOPIC NUMBER: 8.6.1X

### TECHNICAL ABSTRACT:

Propagation Research Associates, Inc., (PRA) proposes to redesign our existing Enhanced Tropospheric Effects Compensation ground-based radio occultation (RO) measurement system, which was developed, prototyped, and demonstrated under previous SBIR contracts, for the purpose of optimizing cost and performance. Assimilation of space-based RO measurements into numerical weather models is a proven method for increasing model forecast skill. Development of ground-based RO has to this point been limited to mountaintop locations and airborne platforms. PRA's proposed system would be a novel approach to a ground-based radio occultation measurement. PRA's hardware will allow RO measurements from any land location at any altitude. In Phase I, we will focus on redesigning the data acquisition system, demonstrating parts of our design through an experiment, and optimizing the antenna performance. We will also expand the system design to collect other Global Navigation Satellite System constellation signals, such as the Russian GLONASS and European Galileo systems, in addition to the existing Global Positioning System (GPS) capability.

### SUMMARY OF ANTICIPATED RESULTS:

By the end of Phase I, PRA expects to have a design for a commercially viable system for ground-based RO measurements. The benefits include vastly expanding the number of RO measurements for a specific location over current space-based methods, thus allowing improved forecasting for the location of interest.

FY 2015 PHASE I AWARD WINNER

FIRM: Salo IT Solutions  
P.O. Box 141049  
Minneapolis, MN 55414

AWARD: \$94,580.00

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PRINCIPAL INVESTIGATOR: Timothy J. Salo

TITLE OF PROJECT: NOAA/eNvironmental Beacon (nBeacon) System

SUBTOPIC NUMBER: 8.5.1X

TECHNICAL ABSTRACT:

The nBeacon system will push localized, timely, relevant NOAA data products to public users' smartphones, tablets, and other mobile devices in a convenient, unobtrusive, accessible, easily understandable format. In essence, the nBeacon system will provide a new distribution channel for NOAA data products and services to the general public.

SUMMARY OF ANTICIPATED RESULTS:

The Phase I project will demonstrate the technical feasibility of the nBeacon System by developing prototypes of the Android user experience, which will display NOAA data products on the public users' smartphones, and of the nBeacon server, which will retrieve NOAA data products from NOAA servers and deliver them to public users' smartphones.

## FY 2015 PHASE I AWARD WINNER

FIRM: Southwest Sciences  
15740 Pacheco Street, Suite E-11  
Santa Fe, NM 87505

AWARD: \$95,000.00

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PRINCIPAL INVESTIGATOR: Dr. Joel A. Silver

TITLE OF PROJECT: Portable high precision nitrogen gas analyzer for eddy covariance flux measurements

SUBTOPIC NUMBER: 8.6.1X

### TECHNICAL ABSTRACT:

Recent theoretical studies of eddy flux correlation have suggested that the commonly used assumption of dry air having no net flux is erroneous and can lead to significant errors in reported observations. Presently, dry air density is calculated indirectly from measured temperature, pressure and relative humidity, all of which contribute to increased uncertainties in the result. If instead the density of nitrogen, which has no net vertical flux, was measured directly, the accuracy of eddy correlation measurements could be improved substantially. Southwest Sciences, Inc. proposes to develop a portable nitrogen analyzer that would be used in conjunction with sonic anemometers to greatly improve the performance of eddy covariance flux measurements. These studies are critical for characterizing the sinks and sources of greenhouse gases.

In Phase I, we will demonstrate the viability of a spectroscopic technique that can measure atmospheric nitrogen with high precision and time response, yet meet the needs of a portable field instrument. Critical tradeoffs in laser selection and analyzer design will be studied to determine the optimum operating configuration. The precision of the analyzer will be evaluated over the expected range of temperatures and pressures required for field operation.

### SUMMARY OF ANTICIPATED RESULTS:

The Phase I research will determine the best possible configuration for a high precision nitrogen eddy flux analyzer, so as to lay the groundwork for building and demonstrating a field-deployable instrument that can provide improved data for understanding climate change. Such a commercial instrument may provide less costly instrumentation for measuring specific gases that are otherwise difficult to detect using more common absorption methods. Expanded market areas of this technology beyond environmental monitoring include applications in natural gas production and industrial process monitoring.