



SBIR



Small Business Innovation Research Program

ABSTRACTS OF PHASE I AWARDS FOR FISCAL YEAR 2012

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 8 Phase I contracts for FY 2012. These awards are up to \$95,000 each, and totaling approximately \$760,000. 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 2012 (NOAA 2012-1)." Abstracts of the successful Phase I proposals submitted under this solicitation, and brief comments on their anticipated results are provided in this publication.

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 5 Phase II contracts in FY 2012 for a total of approximately \$1.9 million. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

The SBIR program is highly competitive. A total of 139 proposals were received by DOC/NOAA in response to its FY 2012 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, only 8 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 2012 PHASE I AWARD WINNER

FIRM: Sunburst Sensors, LLC
1226 W. Broadway
Missoula, MT 598023915

AWARD: \$94,998

PHONE: 406-532-3246
FAX: 406-532-3247
E-MAIL: jim@sunburstsensors.com

PRINCIPAL INVESTIGATOR: James C. Beck, MSME, President/CEO

TITLE OF PROJECT: Development of a Long Term pH and $p\text{CO}_2$
Lagrangian Drifter

SUBTOPIC NUMBER: 8.3.1C

TECHNICAL ABSTRACT:

Quantifying oceanic CO_2 uptake and ocean acidification and understanding their impact on global climate and ocean ecology are key goals of NOAA's climate change research programs. NOAA's request for *Development of a long-term Lagrangian pH and $p\text{CO}_2$ drifter* aims to address these goals by developing technology that measures both $p\text{CO}_2$ and pH that can be widely deployed in the world's oceans.

Sunburst Sensors proposes to develop an innovative pH and $p\text{CO}_2$ prototype sensor based on the patented technology of its SAMI sensors. We will determine the feasibility of a new compact, cost-effective sensor design that can reliably measure both quantities with the required accuracy and precision.

We will investigate two innovations that will significantly simplify and reduce the cost of our current sensors. First, we will combine the optics and flow cell using microfluidics techniques, resulting in a compact, inexpensive, modular sensor. Second, we will use a single reagent for both $p\text{CO}_2$ and pH measurements in a single system.

Phase I will culminate with a design based on the success of these innovations. This design will be refined and integrated into a surface float with satellite telemetry and become available as a commercial product in Phase II.

SUMMARY OF ANTICIPATED RESULTS:

This research will result in a design for new compact, cost-effective sensor designs that can reliably measure both pH and $p\text{CO}_2$ with the required accuracy and precision for oceanographic carbon cycle research.

FY 2012 PHASE I AWARD WINNER

FIRM: Mercury Science, Inc.
4802 Glendarion Drive
Durham, NC 27713-8025

AWARD: \$95,000

PHONE: 866-861-5836
FAX: 407-982-7502
E-MAIL: tom@mercuryscience.com

PRINCIPAL INVESTIGATOR: Thomas Stewart, President

TITLE OF PROJECT: Porous Membrane Electrode for Quantitative
Detection of Toxins

SUBTOPIC NUMBER: 8.1.6N

TECHNICAL ABSTRACT:

There is a need for a simple, portable, quantitative method to monitor the presence of Harmful Algal Blooms. Electrochemical detection offers some advantages for analysis, but traditional sensors are not practical for routine field use. Adapting colorimetric immunoassays on porous, flow-through electrodes can provide a means for rapid, low-cost, portable quantitative environmental analysis.

This concept will be demonstrated in Phase I with a novel conductive, porous-membrane immunosensor for domoic acid. Antibodies will be attached to the electrode surface for capture of domoic acid and domoic acid-horseradish peroxidase conjugate. The immunoassay response will be measure using hydrogen peroxide and 3,3,5,5-tetramethylbenzidine as the enzyme comparison of the sample signal to a calibration curve. The porous design of the electrode allows assays to be performed quickly, simply and accurately.

Phase I will focus on:

1. Production of conductive, porous membranes with a layer of antibody attached to the conductive surface.
 2. Demonstration of electrochemical detection of domoic acid using these membranes.
- Phase II will incorporate the prototype membrane electrode and assay into a portable, low-cost, automated potentiostat that will be designed.

SUMMARY OF ANTICIPATED RESULTS:

A novel porous electrode will be developed and adapted for use with immunoassays. Feasibility will be demonstrated by developing a quantitative assay for domoic acid. The electrodes will be used for rapid, onsite environmental analysis when paired with a portable, amperometric instrument similar to a blood glucose meter.

FY 2012 PHASE I AWARD WINNER

FIRM: Boulder Environmental Sciences and Technology
4425 Hastings Drive
Boulder, CO 80305-6614

AWARD: \$95,000

PHONE: 303-800-6210
FAX: 303-835-7190
E-MAIL: marian.klein@boulderest.com

PRINCIPAL INVESTIGATOR: Marian Klein, Ph.D.

TITLE OF PROJECT: Hyperspectral Microwave Sensor

SUBTOPIC NUMBER: 8.4.5D

TECHNICAL ABSTRACT:

Hyperspectral remote sensing in the microwave offers the opportunity to substantially improve the atmospheric information provided to numerical weather prediction data assimilation systems, enabling advancements in forecast skill.

This Phase I project proposes a numerical study leading to selection of optimal channels for a space borne hyperspectral sensor. Based on the recommendations from a numerical modeling, a potential hardware implementation will be proposed.

The Phase II project will aim to build a prototype of a hyperspectral sensor, based on the design developed in Phase I. The prototype sensor will be ground-based and will address the technological challenges in hardware, such as reduced radiometer noise levels, local oscillator stability, antenna design, optimization of filters block, power, volume and cost requirements. Successful realization of the sensor will have applications not only to satellite instrument advancement, but also in ground-based passive microwave remote sensing.

SUMMARY OF ANTICIPATED RESULTS:

A space-borne implementation of the hyperspectral microwave sensor offers the prospect of improving forecast skills of numerical weather prediction models, especially if its deployment will allow extensive spatial coverage and frequent temporal sampling. Renewable energy sources depend on a reliable weather forecast. Their production depends on current atmospheric conditions.

At the end of Phase I we will have a design for a potential hardware implementation of a hyperspectral microwave sensor. At the end of Phase II we expect to have a working prototype of a hyperspectral sensor for ground-based observations.

FY 2011 PHASE I AWARD WINNER

FIRM: Polestar Technologies
220 Reservoir Street, Suite 3
Needham Heights, MA 02494-3133

AWARD: \$94,684

PHONE: 781-449-2284
FAX: 781-449-1072
E-MAIL: rshashidhar@polestartech.com

PRINCIPAL INVESTIGATOR: Ranganathan Shashidhar, Ph.D., Senior Vice President

TITLE OF PROJECT: Dip and Read Nanosensor for Calcium Ion Measurement in Sea Water

SUBTOPIC NUMBER: 8.2.2R

TECHNICAL ABSTRACT:

The topic (8.2.2R) requires the capability for enabling high sensitive/high precision measurements of calcium concentrates in seawater. The proposal aims to demonstrate the feasibility of a novel high sensitive nanosensor that can be used to determine very low concentrations of calcium in seawater in the presence of large backgrounds calcium concentration. The sensor approach will use the benefits of nanotechnology to increase the dynamic range. It will also use the molecular recognition to achieve high sensor sensitivity and high specificity so that the measurements are not affected by other ions like magnesium. The calcium ion would bind the sensor element and the event will be transduced into an electronic signal, which can be measured by a hand held unit to be developed in Phase II. Phase I results are expected to demonstrate a calcium detection sensitivity of a few μM in the presence of mM concentrations of calcium in salt water.

SUMMARY OF ANTICIPATED RESULTS:

The sensor package is envisaged as a simple dip and read unit. The sensor part can be plugged into the electronic read out part which will be a hand held unit. The ability to detect very small amounts of calcium concentrates in the presence of a large background concentration of calcium in the sea water will be very useful for monitoring the calcification rate in reef-building corals and in other calcifying marine organism like crustose coralline algae.

FY 2012 PHASE I AWARD WINNER

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

AWARD: \$95,000

PHONE: 770-795-8181
FAX: 678-384-3401
E-MAIL: contracts@pra-corp.com

PRINCIPAL INVESTIGATOR: Bonnie Valant-Spaight, Senior Scientist

TITLE OF PROJECT: Reducing Impact of Severe Space Weather on
Global Positioning System (GPS) Satellite Users

SUBTOPIC NUMBER: 8.4.4W

TECHNICAL ABSTRACT:

Propagation Research Associates, Inc., (PRA) proposes to utilize its unique capabilities in atmospheric effects characterization and GPS signal processing to develop algorithms that nowcast ionospheric scintillation at GPS frequencies. To this end, PRA proposes to partner with the Jet Propulsion Laboratory to use real-time GPS data to create a map of ionospheric scintillation parameters over the United States. These maps will be used in conjunction with a simulated software receiver to nowcast scintillation impacts on GPS devices. PRA will then design a specification product, using input from various GPS user communities, to communicate the scintillation impacts in a format that is both easily understood and allows the user to access as much or as little detail about the impacts as he or she desire. In Phase II, PRA will develop a prototype real-time nowcast product for the United States, including Alaska. PRA will also investigate using an expanded set of real-time GPS data to enlarge the nowcast to areas outside the U.S. The possibility of forecasting scintillation effects using existing SWPC nowcast and forecast software products will also be investigated.

SUMMARY OF ANTICIPATED RESULTS:

The PRA GPS scintillation effects nowcast will allow members of the general public to learn in real-time when space weather conditions are affecting the accuracy and availability of GPS position, navigation, and timing services. This work will also investigate the possibility of forecasting ionospheric scintillation effects on GPS signals.

FY 2012 PHASE I AWARD WINNER

FIRM: Zeigler Brothers, Inc.
400 Gardners Station Road
P.O. Box 95
Gardners, PA 17324

AWARD: \$95,000

PHONE: 717-677-6181
FAX: 717-677-6826
E-MAIL: info@zeiglerfeed.com

PRINCIPAL INVESTIGATOR: Scott Snyder, Ph. D., Animal Nutritionist

TITLE OF PROJECT: Development of manufacturing technology for the practical application of specialized and environmentally sensitive nutrients, enzymes, immune-stimulating compounds and biologics to aquafeeds

SUBTOPIC NUMBER: 8.2.3F

TECHNICAL ABSTRACT:

Zeigler Bros., Inc. (ZBI) has teamed with Harrisvaccines, Inc. (HV) to develop a new aquafeed manufacturing platform for the practical application of underutilized feed additives. These include enzymes, immune-stimulating compounds and biologics that require specialized protection to ensure they are delivered to the animal as viable compounds. ZBI pioneered microparticle feeds and will use this technology to manufacture inclusion particles capable of stabilizing these underutilized additives. RNA interference (RANi) is a promising, emerging technology that has demonstrated a range of applications in aquaculture as an antiviral/immune-stimulating compound. It is proposed that double-stranded RNA (dsRNA) constitute the RNAi effector molecules that provide that antiviral effect. Furthermore, RNA provides an environmentally sensitive model that has a pre-existing base for molecular assays for detection. HV can produce large-scale amounts of RNA that make a commercially feasible feed additive and they have shown that these RNA molecules can protect against lethal White Spot Syndrome Virus (WSSV) challenge. The immediate impact from a successful Phase I project will be the first candidate orally delivered molecular WSSV vaccine for clinical trial. With subsequent Phase II funding ZBI and HV will qualify this platform for effectiveness in controlling other aquaculture diseases, reducing effluents and increasing nutrient utilization.

SUMMARY OF ANTICIPATED RESULTS:

- Aquafeed manufacturing platform for incorporating underutilized feed additives.
- Candidate WSSV oral vaccine for shrimp.
- New products that will improve the environmental sustainability and competitiveness of US marine aquaculture

FY 2012 PHASE I AWARD WINNER

FIRM: Dehlsen Associates, LLC
101 E. Victoria Street, Suite F
Santa Barbara, CA 93101

AWARD: \$95,000

PHONE: 805-845-7575
FAX: 805-845-7266
E-MAIL: afleming@ecomerittech.com

PRINCIPAL INVESTIGATOR: Alexander Fleming, Vice President of Engineering

TITLE OF PROJECT: Siting for Marine Hydrokinetic Devices by Means of a Self-Propulsion Glider

SUBTOPIC NUMBER: 8.1.2SG

TECHNICAL ABSTRACT:

Dehlsen Associates, LLC (DA) founders have a long history with renewable energy, establishing both Clipper Windpower and Zond Systems (now GE Wind). DA's Aquantis C-Plane is designed to provide 4MW per platform in ocean currents with a target cost of energy of 0.08 \$/kWh by means of off-the-shelf, highly reliable components. Though previous ADCP sampling was performed in partnership with Florida Atlantic University from 2000-2002, these results offer low resolution 15-min averages, insufficient for the design. Finer spatial and temporal resolution data is required in order to outline turbulence characteristics, wave orbital distribution with depth, and also quantify concerns of potentially harmful events such as internal waves, hurricane surge, and eddies for stability and blade design. A stationary, real-time data acquisition system will be installed in May at the Navy SFOMF offshore Dania Beach to collect this necessary resource data. The proposed mobile glider would be used for commercial siting by: characterizing regions with high flow rates, providing environmental data in these regions, and would be correlated with fish finders and parametric sub-bottom profilers would be used to characterize the resource and site environmental conditions.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results of this Phase I will: outline a methodology for performing data analysis is the resource data collected at the stationary site (to be installed May 2012); determine a suitable glider (mobile site) option and concept of operations for determining a commercial site locations; outline a methodology for performing Measure-Correlate-Predict (MCP) analyses with a stationary and mobile site; determine appropriate sensor packages for the glider for acquiring environmental data for the commercial site; and correlate with Cost of Energy (COE) models and spatial planning efforts.

FY 2012 PHASE I AWARD WINNER

FIRM: RE Vision Consulting, LLC
6630 14th Street
Sacramento, CA 95831

AWARD: \$95,000

PHONE: 916-977-3970
FAX:
E-MAIL: mirko@re-vision.net

PRINCIPAL INVESTIGATOR: Mirko Previsic, Principal

TITLE OF PROJECT: GIS based Techno-Economic Site Assessment Tool

SUBTOPIC NUMBER: 8.1.3SG

TECHNICAL ABSTRACT:

In order to site marine renewable projects a wide range of stakeholders will need to understand the driving considerations for siting projects in certain areas. Marine renewable energy sources include; (1) wave energy, (2) offshore wind, (3) ocean current, and (4) ocean thermal energy conversion. These resources are estimated to be able to provide a significant portion of the US national demand for electricity and hence are strategically important.

Constraints, involve a wide range of environmental and human use constraints as well as the sites economic attractiveness. Different spatial planning efforts have been aimed at addressing the marine spatial planning issues. One of the more prominent ones is the Multi-purpose Marines Cadastre (MMC).

What is missing with all these data-sets is the ability to determine a sites commercial potential in a meaningful way. While some of the data-sets provided in the MMC can be used by device developers to perform such studies, there is no adequate way to determine the commercial potential of deployment areas.

RE Vision is proposing to develop an easy to use GIS-based techno-economic scenario-modeling tool that allows users to characterize the commercial potential of a particular site or larger geographic areas. It will do so by utilizing the experience gained over the past decade in developing such scenarios for a wide range of clients. This toolbox development is a direct extension of past modeling efforts undertaken by the PI.

SUMMARY OF ANTICIPATED RESULTS:

The end-product will be a modeling tool that will allow a wide range of users to evaluate the commercial potential of Marine Renewable Energy site. Phase I will focus on developing a tool for wave energy conversion, while phase II will incorporate offshore wind, tidal, ocean current and river hydrokinetic technologies.