SBIR

Small Business Innovation Research Program

ABSTRACTS OF PHASE II 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 10 Phase II contracts in FY 2015. These awards can be for up to $400,000 each for a total of approximately $4 million. These awards are a two year effort to build upon their Phase I project by furthering research and development.

FY 2015 PHASE II AWARD WINNER

FIRM:	3SRM Inc. 965 Hao St. Honolulu, HI 96821
AWARD:	$399,865.00
PHONE:	808-373-3243
E-MAIL:	porterj005@hawaii.rr.com
PRINCIPAL INVESTIGATOR:	Dr. John N. Porter

TITLE OF PROJECT: A Stereo Camera System for Measuring Coastal Currents

SUBTOPIC NUMBER: 8.4.4W-P

TECHNICAL ABSTRACT:

Inexperienced swimmers are often unaware of the presence of treacherous rip currents and this leads to many drowning deaths each year. Even when signs are posted, the public probably does not clearly understand the danger. It would be more informative if the public were ale to maps of the location, speed, and direction of coastal currents. Ocean safety officials are using various methods to inform the public of these dangers but at this time they do not have an easy way to map out the location, speed, and direction of coastal currents. New sensors are needed to address this need. The goal of this Phase 2 project is to develop camera systems which will measure the location, speed, and direction of coastal currents. Three approaches will be developed including a cell phone application, a single camera system, and a stereo camera system. When mounted on a pan-tilt system (with accurate encoders), it will be possible to measure distant coastal currents in a quantitative manner. The data stream can also be made compatible with existing regional protocols.

SUMMARY OF ANTICIPATED RESULTS:

The 3SRM Inc. company will build, test, and demonstrate three imaging systems for measuring coastal currents. These consist of a cell phone application, a single camera system and a stereo system. As part of this effort a fast low cost micro-computer will be programmed for data collection and the data processing. At the end of the phase 2 effort, the first commercial version of the camera systems will be completed and ready for sales. During the Phase 2 project tests and validation measurements will be carried out in Hawaii during the first year. During the second year additional measurement will be carried out to the East and Gulf Coasts during periods of elevated surf. A variety of cases will be tested including 1) large and small surf, 2) regions with surface foam and no surface foam, and 3) windy and calm conditions. The results will be presented in a scientific paper and in a technology paper. Several meetings of ocean safety experts will be carried out to discuss new technologies and their utilization. The information gained from these meetings will guide the way in which the information is collected, presented and disseminated.

FY 2015 PHASE II AWARD WINNER

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

AWARD: $399,996.00

PHONE: 978-663-9500
E-MAIL: ddn@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. David Nelson

TITLE OF PROJECT: Ultra-High Precision Laser Isotope Monitor for 13CO2, CO180 and CO170

SUBTOPIC NUMBER: 8.3.1R,C

TECHNICAL ABSTRACT:

Greenhouse gas (GHG) emissions are primary drivers of global climate change. Hence there is a crucial need to quantify their sources and sinks. A powerful method to constrain source and sink strengths is the analysis of the relative proportions of isotopic variants of GHG's in atmospheric samples like those collected globally by NOAA's Cooperative Air Sampling Network. Measurements that are capable of informing climate science require extremely high precision. The standard technique, isotope ratio mass spectrometry (IRMS), is precise but is limited by laborious sample processing requirements, high capital cost, high maintenance and impracticality of field deployment. We avoid these limitations with an alternative method to measure the isotopic composition of the most important GHG: carbon dioxide. Using Tunable Infrared Laser Direct Absorption Spectroscopy (TILDAS), we demonstrate measurement precision at least as good as IRMS and exceeding that requested until Sub-Topic 8.3.1 for ō13C-CO2 (0.006 vs. 0.01‰_ and ō18O-CO2 (0.007 vs. 0.02‰). During Phase II we will produce and demonstrate a commercial instrument meeting this standard while measuring small discreet air samples (<60 ml). We rely on two innovations: a small volume, high vacuum optical cell and a rapid sample switching method promoting long term signal averaging, without measurement drift.

SUMMARY OF ANTICIPATED RESULTS:

The proposed instrument will have an immediate technical impact in several research fields that utilize isotope ratio mass spectrometry of CO2: atmospheric chemistry, ecology, climate science and geochemistry. This instrument, with equivalent or better precision and lower capital and operating costs than IRMS, will increase productivity and encourage wider use of CO2 isotope measurements, thus promoting commercialization within these research communities. Additional commercial opportunities exist in oil and gas prospecting (already in use) and in human breath analysis as a medical diagnostic. Development of this technology will also lead to additional laser isotope applications, including monitors for the clumped isotopes of CO2.

FY 2015 PHASE II AWARD WINNER

FIRM:	Boston Engineering Corporation 300 Bear Hill Road Waltham, MA 02451
AWARD:	$399,992.81
PHONE:	781-466-8010
E-MAIL:	mrufo@boston-engineering.com
PRINCIPAL INVESTIGATOR:	Michael Rufo

TITLE OF PROJECT:	Multipurpose Above Surface/Below Surface Expendable Dropsonde
SUBTOPIC NUMBER:	8.4.2W

TECHNICAL ABSTRACT:

There are currently no inexpensive, expendable air-deployed monitoring systems (Dropsondes) that measure atmospheric data and oceanographic as a function of depth. These are important data in predicting the intensity and path of hurricanes. Boston Engineering proposes to provide NOAA with a solution to this challenge with the Multi-Purpose Above Surface/Below Surface Expendable Dropsonde (MASED) proven feasible in Phase I. Our team will work closely with NOAA to develop the MASED to be able to conduct an aerial deployment at the end of the Phase II SBIR, collecting meteorological data during the aerial descent followed by 5 descent-ascent cycles collecting marine data to 200 meters depth. In addition to hurricane forecasting, the data will have general oceanographic applications, and the dropsonde can be fitted with a dissolved oxygen sensor that may be used to map areas of hypoxia, with application to fisheries and the fishing industry. In Phase II, Boston Engineering will design, test and refine MASED prototypes, and will demonstrate operation under actual conditions. Boston Engineering has developed a plan to carry the Phase II program to the commercial product level through a combination of licensing and manufacture and sale of products.

SUMMARY OF ANTICIPATED RESULTS:

Today, hurricanes in the United States typically cause damages of $1 to $3 billion annually with an average death rate of 19.6 residents. The total cost of warning and emergency response to a typical year with three hurricanes is $787.5 million, representing some $0.5 million to $1 million per mile of coast ine. Hurricane Katrina which made landfall on the Gulf Coast of the United States in 2005 caused an estimated $96-125 billion in damage with economic losses potentially as high as $250 billion. The ability for the MASED system to collect atmospheric data and then subsea data for hurricanes will provide forecasters with data for better prediction of hurricane force. Current methods just measure the surface temperature of the ocean, which does not give data on the available oceanic energy the hurricane can build upon. The MASED approach provides data to calculate this energy, abased on underwater thermal gradients.

FY 2015 PHASE II AWARD WINNER

FIRM: Carr Astronautics
6404 Ivy Lane Suite 333
Greenbelt, MD 20770

AWARD: $391,283.40

PHONE: 301-220-7340
E-MAIL: rgillespie@carrastro.com

PRINCIPAL INVESTIGATOR: Robert Gillespie

TITLE OF PROJECT: New METSAT Display System for Weather-Ready Nation

SUBTOPIC NUMBER: 8.4.3.W-P

TECHNICAL ABSTRACT:

Phase II of the New METSAT Display project will produce a working beta version of the Earth Imaging product customized for NWS/NOAA as outlined in the Phase I proof of concept. This product will ingest imagery from a data source (in this case a web service of NOAA satellite imagery) and display it accurately on a globe of the Earth. Vector data such as roads, cities, towns, counties, states, etc. will be layered with the images. In addition other data—for example Radar imagery and forecast data—will be integrated with the satellite imagery. Users will be provided with an abundance of tools to localize and analyze the imagery and weather data. Imagery will be automatically ingested from a web service and provide real time data to users. Users will be able to select an area of interest and display the most recent, or archived data for that region. Users will be able to animate the available imagery in order to detect patters and weather developments in their chosen area of interest.

SUMMARY OF ANTICIPATED RESULTS:

Develop a beta version of the Earth Imaging Product which will be customized to meet NWS/NOAA needs for a New METSAT Display for weather.gov and other web assets. This customized product will be demonstrated to NOAA using NOAA image data. A full set of design and testing documentation will be written to support this development effort. Vector data and other weather data will be layered with the satellite imagery allowing users to localize the imagery and other data accurately and to use it to support decision making. It will be possible to animate the imagery to capture the dynamic pattern of weather formation.

FY 2015 PHASE II AWARD WINNER

FIRM: Dioxide Materials
3651 FAU Blvd
Boca Raton, FL 33431

AWARD: $400,000.00

PHONE: 561-613-1991
E-MAIL: Richard.ni@dioxidematerials.com

PRINCIPAL INVESTIGATOR: Zheng Richard Ni

TITLE OF PROJECT: SBIR Phase II: Optimized CO2 Gas Sensor for Autonomous Measurement of Ocean Carbon

SUBTOPIC NUMBER: 8.2.2R

TECHNICAL ABSTRACT:

The objective of the proposed work is to create low cost, low power sensors for autonomous measurement of ocean carbon. In our Phase I effort, we showed that Dioxide Materials' miniature CO2 sensors have the speed and sensitivity to meet NOAA's requirements for sensing ocean carbon. The objective of the proposed work is to further develop the sensors so that they can be used directly in NOAA's existing ocean carbon measurement system. Work incudes temperature compensation, so the devices can work in the Arctic, interface changes so the devices can communicate with NOAA's existing hardware, and other changes. At the end of the program we propose doing a field test at NOAA's location so we can verify performance for the intended application.

SUMMARY OF ANTICIPATED RESULTS:

If we are successful, we will allow NOAA to build systems that are smaller, lighter and require much less power.

FY 2015 PHASE II AWARD WINNER

FIRM:	Maine Fresh Sea Farms 256 Lower Round Pond Rd Bristol, ME 04539
AWARD:	$399,999.00
PHONE:	207-380-6478
E-MAIL:	mainefreshseafarms@gmail.com
PRINCIPAL INVESTIGATOR:	Peter Arnold

TITLE OF PROJECT:	The Development of Sustainable, Multi-seasonal, Multi-species, Marine Algal Aquaculture in Coastal Maine
SUBTOPIC NUMBER:	8.1.1F

TECHNICAL ABSTRACT:

Maine Fresh Sea Farms (MFSF) will build a multi-species, multi-season prototype farm with the goal of having crops of fresh sea vegetables available throughout the year. What isn't utilized fresh will be dried for longer-term storage and used in other products. Our team will gather data on water quality, nutrients, light levels, and hydrodynamics to assemble profiles of key parameters that determine optimum algal growth and evaluate factors that will be important for growing high quality sea vegetables. In addition to moving forward on the science of sea farming, we will build the necessary technology and expertise in handling, processing, and marketing to assure a clear path to commercialization. MFSF will continue our emphasis on sales of fresh sea vegetable to local and regional markets and more fully research these markets to identify all possible buyers and users. The results of this work will be requisite for the establishment of other farms.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results of this Phase II effort will be a prototype farm producing multiple species of sea vegetables over a year round growing season. The work will entail the collection of information about key variables that affect grown and the final conditions of the sea plants before harvest, optimal harvest and holding strategies and the identification of factors that might limit production. Mariculture along the coast of Maine has a valid claim to being truly organic and we will pursue certification for our production. We will have a clear path to the production of a number of products and have the technology in hand to move to full scale commercialization.

FY 2015 PHASE II AWARD WINNER

FIRM: Piasecki Aircraft Corporation
P.O. Box 360
2nd Street West
Essington, PA 19029

AWARD: $399,941.00

PHONE: 610-521-5700
E-MAIL: Geiger_br@piasecki.com

PRINCIPAL INVESTIGATOR: Dr. Brian Geiger

TITLE OF PROJECT: "Whimbrel" Unmanned Aircraft System-Borne Atmospheric and Sea Surface Temperature (SST) Sensing

SUBTOPIC NUMBER: 8.4.5R, W-P

TECHNICAL ABSTRACT:

Piasecki Aircraft (PiAC) proposes to continue development and testing efforts of the Whimbrel UAS, a low cost, expendable, air-deployed weather survey unmanned aircraft system. The Whimbrel UAS, a low cost, expendable, air-deployed weather survey unmanned aircraft system. The Whimbrel USA has been developed to support the Tropical Cyclone Boundary Layer mission requirements and contains sensors and data processing algorithms to measure temperature, pressure, humidity, wind vector, Sea Surface Temperature (SST), and sensible and latent heat flux. The Phase II effort will consist of a detailed design with updated stress, aerodynamics, and joint dynamic analyses from the Phase I effort. We will fabricate four prototypes for component and integrated system testing, culminating in a week long validation test effort at the Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) main site in the Southern Great Plans (SGP). We will perform 8 air launches to validate launch method reliability and aerodynamic performance (glide, ratio, power use) will be recorded for later analysis. The validation effort will make use of thee collection of reference sensors at the SGP site to document uncertainty ranges of the Whimbrel sensor suite.

SUMMARY OF ANTICIPATED RESULTS:

The Whimbrel has been designed to be a low-cost UAS from the start. Typically, widespread use of an UAS for an expendable mission has up to now been impractical due to the high system cost. Through mass production techniques and avoidance of machined parts, the Whimbrel design targets a cost point that enables an increased use profile similar to how dropsondes are currently used. Compared to a dropsonde, the Whimbrel offers additional sensing time and the measurement of Sea Surface Temperature and heat fluxes, the latter, of which generally requires a platform capable of maneuvering or a very expensive sensor. The direct benefits of the Phase II effort will be verification of our performance and sensing accuracy claims made in Phase I.

FY 2015 PHASE II AWARD WINNER

FIRM:	Riverside Technology, Inc. 2950 East Harmony Road, Suite 390 Fort Collins, CO 80528
AWARD:	$399,998.00
PHONE:	970-484-7573
E-MAIL:	angi.connolly@riverside.com
PRINCIPAL INVESTIGATOR:	George F. Smith

TITLE OF PROJECT: Increasing the Availability and Utility of Weather and Climate Data to Meet Decision Maker Needs

SUBTOPIC NUMBER: 8.4.1D

TECHNICAL ABSTRACT:

In Phase I, Riverside investigated the need for increased access to NCDC storm data using web Application Programming Interfaces (APIs) to connect severe weather and socioeconomic information. The focus of Phase I was to design and validate an architecture that specifies the methods through which the NCDC Storm data can be programmatically accessed, processed, and displayed in easy to use interfaces. Phase I market research verified the need for tools and software algorithms for accessing the NCDC data combined with socioeconomic data for the purpose of risk identification and assessment. We have designed a software product to move customers through the process of scoping and identifying climate-and weather-based risks to assets of interest. Through discussions with potential customers we have identified prospective markets for our proposed products. For Phase II, we have identified seven main objectives to create a commercially viable product. These objectives are: Refine Product Requirements, Develop User Interface, Develop API, Acquire Data, Incorporate Additional Datasets, Develop Workflow Framework, and Create Risk Assessment and Calculation Tools.

SUMMARY OF ANTICIPATED RESULTS:

The expected outcome of this project is a commercially viable software package that will meet the demands of our identified markets. The application will be used to increase environmental intelligence through access and visualization of NCDC storm data and other applicable data sources. Customers will be able to combine environmental and socioeconomic data to create new data products, and perform risk identification and analysis. The product will allow customers to identify assets at risk and then generate ‘what-if’ scenarios to help them create mitigation strategies to protect those assets. Initial development will focus on risk associated with severe weather events, but the intent is to expand the product to target broader markets such as agriculture and supply-chain dependent manufacturing companies.

FY 2015 PHASE II AWARD WINNER

FIRM:	Toyon Reseach Corporation 6800 Cortona Drive Goltea, CA 93117
AWARD:	$400,000.00
PHONE:	805-968-6787
E-MAIL:	abrown@toyon.com
PRINCIPAL INVESTIGATOR:	Andrew P. Brown, Ph.D.

TITLE OF PROJECT:	Automated Analysis of Fisheries Information from Digital Skills
SUBTOPIC NUMBER:	8.2.1F

TECHNICAL ABSTRACT:

Toyon proposes development of a system which performs automated analysis of images for fish population monitoring and fishing regulation enforcement application. The proposed system is capable of processing images collected from autonomous underwater vehicles (AUVs) and remotely operated vehicles (ROVs), as well as images collected using electronic monitoring (EM) cameras used to observe fish catches landed on the decks of vessels. The proposed software prototype will include functions for assisting humans in rapidly and consistently analyzing stereo images, including automation of 3D length measurement of fish, and assisting humans in fish counting and classification applications by cueing to fish locations in video image/data streams. The proposed system is based on advanced algorithms developed in Phase I, which will be optimized and implemented in real-time software with a convenient user interface in Phase II. The software prototype will be optimized for assisting NOAA scientists in AUV imagery analysis, and Toyon will support software integration and testing in collaboration with NOAA scientists in Phase II. The utility of the algorithms for EM applications will also be tested and demonstrated, and commercialization opportunities in the commercial fishing industry will be pursued in conjunction with deployment of EM systems.

SUMMARY OF ANTICIPATED RESULTS:

The proposed research and development will support the National Marine Fisheries Service (NMFS) in its mission of monitoring, regulating, and protecting fish populations and habitats to ensure sustainment of commercial and recreational resources, and to protect the environment. In particular, development of technology which provides automation for analysis of digital images collected by NMFS assets is proposed, to enable improved efficiency, accuracy, and consistency in performing monitoring and enforcement functions. The prototype system developed in Phase II will provide tangible benefits to NOAA scientists by assisting them in their field studies and research, and will facilitate demonstrations enabling transition into commercial fishing industry electronic monitoring applications.

FY 2015 PHASE II AWARD WINNER

FIRM: TRUNAV LLC
19437 Edgebrook Ln
Tinley Park, IL 60487

AWARD: $399,105.86

PHONE: 312-753-9431
E-MAIL: samer@trunav.net

PRINCIPAL INVESTIGATOR: Samer Khanafseh

TITLE OF PROJECT: Self-Contained Sub-Centimeter Positioning Platform

SUBTOPIC NUMBER: 8.1.2N

TECHNICAL ABSTRACT:

The goal of this project is to develop, prototype, and experimentally validate a new Differential Global Navigation Satellite System (DGNSS) capable of providing sub-centimeter positioning accuracy for quasi-static scientific, survey, and structural health monitoring application. The main feature of the proposed DGNSS solution is that it leverages publically available GNSS reference data from existing NOAA's Continuously Operational Reference Stations (CORS). Customized GNSS reference receiver networks or subscription services are not needed. Advanced filtering algorithms and error modeling techniques are developed to provide reliable and economical sub-centimeter accuracy for a variety of static and quasi-static scientific and commercial application. In Phase-II, TruNav will develop and implement new algorithms to make the system more robust to data outages, erroneous data, and even measurement faults. Positioning accuracy in kinematic applications will also be improved using advanced modeling and estimation techniques.

SUMMARY OF ANTICIPATED RESULTS:

The proposed system is directly applicable to monitoring slow vertical movement of NOAA's 200+ National Water Level Observation Network (NWLON) platforms, as well as easy positioning of new NWLON sites to cover current gap areas. It will also be directly useful in structural health monitoring systems for bridges and high rise buildings, for surveying, and will be a more cost effective alternative to Real-Time Kinematic (RTK) GNSS systems.