SBIR

Small Business Innovation Research Program

ABSTRACTS OF AWARDS FOR FISCAL YEAR 2014

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 11 Phase I contracts for FY 2014. These awards are up to $95,000 each, and totaling approximately $1,045,000. 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 2014 (NOAA 2014-1)." 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 76 proposals were received by DOC/NOAA in response to its FY 2014 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, only 11 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 9 Phase II contracts in FY 2014 for a total of approximately $3.6 million. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

FY 2014 PHASE I AWARD WINNER

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

AWARD: $94,992.00

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

PRINCIPAL INVESTIGATOR: Dr. David D. Nelson

TITLE OF PROJECT: Ultra-High Precision Laser Isotope Monitor for 13CO2, CO18O and CO17O

SUBTOPIC NUMBER: 8.3.1R,C

TECHNICAL ABSTRACT:

Greenhouse gas (GHG) emissions to the atmosphere are primary drivers of global climate change and hence there is a crucial need to quantify their sources and sinks. A general technique to constrain source and sink strengths is the analysis of the relative proportions of isotopic variants of GHG's. These measurements must be performed with extremely high precision. The gold standard technique, isotope ratio mass spectrometry, is limited by laborious sample processing requirements, high capital cost and impracticality of field deployment. Aerodyne Research has developed an alternative approach based on tunable laser infrared spectroscopy that avoids these limitations. Our commercial isotope monitor for the most important GHG gas, carbon dioxide, very nearly meets the measurement precision specified in Sub-Topic 8.3.1 for δ13C (0.01%0) and δ180 (0.02%0). The current instrument is designed for fast response continuous flow measurements whereas the solicitation calls for the measurement of discreet samples with ultra-high precision. We will improve the measurement precision to routinely exceed the solicitation requirements while measuring small discreet samples (60 ml or less). This will be accomplished with two innovations: a small volume, high vacuum multiple-pass cell and a rapid sample switching method to promote long term signal averaging without drift.

SUMMARY OF ANTICIPATED RESULTS:

The proposed instrument will have an immediate technical impact in several research fields which utilize isotope ratio mass spectrometry of C02: atmospheric chemistry, ecology, climate change and geochemistry. An instrument with equivalent precision but with lower capital and operating costs will increase productivity and encourage wider use of C02 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 monitors including monitors for the clumped isotopes of C02.

FY 2014 PHASE I AWARD WINNER

FIRM: 3SRM, Inc.
965 Hao St.
Honolulu, HI 96821

AWARD: $94,996

PHONE: 808-373-3243
FAX:
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 (Sandy Supplemental Subtopic)

TECHNICAL ABSTRACT:

Rip currents cause multiple drowning deaths each year as swimmers are often unaware of the location and strength of coastal currents. Currently, ocean safety officials do not have an affordable and reliable commercial system which can measure coastal currents. The goal of this Phase I study is to test a stereo camera system to measure the speed, direction, and location of alongshore currents and rip currents. The proposed stereo camera system will employ cameras mounted on pan-tilt systems for flexible use. As an additional tool, a smart phone application will be tested to measure currents over a limited area. Test measurement will be carried out with different camera configurations and for different beach settings. The creation of the new stereo camera system and the smart phone application will give ocean safety officials and beach goers a way to measure coastal currents before entering the water hopefully preventing dangerous events. Best practices for using the new observations will be studied as part of an expert and general public meeting and recommendation will be documented.

SUMMARY OF ANTICIPATED RESULTS:

Drownings occur each year because beach goers are unaware of dangerous rip current conditions. Current sensors are not commercially available. As part of this Phase I project, several stereo and single camera imaging methods will be tested and compared with independent current measurements. Procedures for alerting the public of dangers will be studied and recommendations documented.

FY 2014 PHASE I AWARD WINNER

FIRM:	Riverside Technologies 2950 E Harmony Road, Suite 390 Fort Collins, CO 80528
AWARD:	$94,586.37
PHONE:	970-484-7573
E-MAIL:	robert.allen@riverside.com
PRINCIPAL INVESTIGATOR:	Robert Allen, Ph.D

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:

Climate variability and the increased frequency of climate-related risks are redefining how communities address urban development and planning, Better storm risk assessment will lead directly to better preparedness which will save lives, reduce costs, and increase resiliency. Riverside proposes a data integration and visualization tool that will enable communities to assess climate-related risks, visualize the impacts and potential adaptation measures, and communicate real-time information at a neighborhood scale. Riverside will couple our multi-hazard decision support systems operational expertise with the University of North Carolina (UNC) in Asheville's National Environmental Modeling and Analysis Center (NEMAC). The Riverside/NEMAC team will design and develop Application Programming Interface (API) services to dynamically discover, access, and present to users various components of the National Climatic Data Center (NCDC's) severe weather database. We propose to create an online application that links the current severe weather data base products, including NCDC's Severe Weather Data Inventory (SWDI), to social and demographic databases to allow users to assess populations and infrastructure at risk. This is a "connecting technology solution" that will bridge the gap between the rich databases at NCDC and the required application that the end users need.

SUMMARY OF ANTICIPATED RESULTS:

The Climate Impact Visualization Tools will enable the larger community of developers in government, academia, and the private sector to interact with the National Climatic Data Center’s (NCDC's) severe weather database and provide a data access structure upon which future improvements can be built. This platform of services will be more accessible to a wide variety of users as the user-layer APIs will allow queries to be made and information returned in the context of the user's analysis or decision needs, without the need for in-depth knowledge of data structures or locations.

FY 2014 PHASE I AWARD WINNER

FIRM: Dioxide Materials, Inc.
60 Hazelwood Dr
Champaign Il 61820

AWARD: $95,000

PHONE: 217-239-1400
E-MAIL: richard.ni@dioxidematerials.com

PRINCIPAL INVESTIGATOR: Zheng Richard Ni

TITLE OF PROJECT: Optimized C02 Gas Sensor for Autonomous Measurement of Ocean Carbon

SUBTOPIC NUMBER: 8.2.2R

TECHNICAL ABSTRACT:

The objective of the proposed work is to determine whether Dioxide Materials' miniature C02 sensors have the potential to be adapted for autonomous measurement of ocean carbon. The existing sensors have many advantages for measurements of ocean carbon. They are much smaller and less costly than the existing sensors, work with much smaller gas samples, and use much less power. The sensors were designed for HVAC systems not seawater sampling, and so improvements are needed if the sensors are to be used for autonomous measurement of ocean carbon. Still, if we are successful, our sensors will allow a C02 detection system to change from something the size of a desk to something that is about the size and weight of a household thermostat and use milliwatts of power.

The objective of the Phase I effort will be to modify the sensors to meet the specifications in the BAA. That includes changing the structure of the sensor to allow differential C02 measurements, improving the algorithms and electronics to lower the noise, determining whether it is necessary to thermostat the sensors or use calibration gases. Our sensor is so small, that thermostating the sensor would only require 40 milliwatts of power, while a 2 milliliter syringe would hold enough calibration gas for 15 months of measurements at a measurement rate of one every 6 hours.

SUMMARY OF ANTICIPATED RESULTS:

We anticipate that at the end of phase I we will provide a final report detailing proposed C02 gas sensor conceptual design, including specifics on the detector, and sensor calibration methodology.

FY 2014 PHASE I AWARD WINNER

FIRM:	Piasecki Aircraft 519 West Second Street Essington, PA 19029
AWARD:	$94,870.51
PHONE:	610-521-5700
E-MAIL:	geiger_br@piasecki.com
PRINCIPAL INVESTIGATOR:	Brian Geiger

TITLE OF PROJECT:	120-X -2 Unmanned Aircraft System-Borne Atmospheric & Sea Surface Temperature (SST) Sensing
SUBTOPIC NUMBER:	8.4.5R,W-P (Sandy Supplemental Subtopic)

TECHNICAL ABSTRACT:

To capture critical weather and SST data in the Tropical Cyclone Boundary Layer (TCBL), Piasecki Aircraft proposes to evaluate existing meteorological sensor packages, integrate new off-the-shelf MEMS sensors, and design an air-launched UAS to improve the resolution of observations captured in the TCBL. Capturing latent and sensible heat fluxes can be achieved reliably with a powered UAS (compared to a dropsonde) through the ability to revisit a previous flight path and collect a new set of measurements. The challenge of measuring wind vector, latent and sensible heat flux, and SST in the TCBL is approached through the adaptation and improvement of existing methods that have been demonstrated in small scale aboard a UAS by team members. The sensor package and UAS meeting the TCBL observation requirements will be documented, the power and communications links defined, and system cost estimates for prototype and production variants will be produced in Phase I. A specific focus of the Phase I work is to show feasibility of a mass production approach for UAS fabrication such that the resulting system is competitive with existing dropsondes in terms of cost and measurement capabilities.

SUMMARY OF ANTICIPATED RESULTS:

At the end of Phase I, a conceptual design of a low-cost air-launched UAS system capable of measuring wind vector, pressure, temperature, humidity, SST, and latent and sensible heat flux will be documented in the final report with an aerodynamic database, preliminary structural analysis, and CAD drawings. In addition, the design of the sensor package, including component selection, power and communication interface, and physical interface will be documented. Finally, a cost estimate for a Phase II prototype and production variant will be produced and included in the Final report. We intend to show an air launched UAS design that is cost and measurement competitive with existing dropsondes.

FY 2014 PHASE I AWARD WINNER

FIRM: TRUNAV LLC
118 E 32nd St
Chicago, Illinois 60616-3836

AWARD: $94,403.33

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, implement, and experimentally validate a new Differential Global Navigation Satellite System (DGNSS) capable of providing sub-centimeter positioning accuracy for quasi-static scientific, mapping, and survey applications. The main feature of the proposed DGNSS solution is that it leverages GNSS reference data from existing NOAA's Continuously Operational Reference Stations (CORS). External augmentation services are not required, and because the proposed system is a DGNSS-based, neither are externally generated precise GNSS orbit and clock data. Advanced filtering algorithms are developed to provide reliable and economical sub-centimeter accuracy for a variety of static and quasi-static scientific and commercial applications.

SUMMARY OF ANTICIPATED RESULTS:

The proposed system is directly applicable to monitoring slow vertical movement of NOAA's 205 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 the rapid development of commercial autonomous vehicle systems, which are fundamentally reliant on precise positioning technology for detailed and accurate maps needed for navigation and guidance.

FY 2014 PHASE I AWARD WINNER

FIRM: Maine Fresh Sea Farms, LLC
256 Lower Round Pond Rd
Bristol, Maine 04539-3214

AWARD: $94,999.00

PHONE: 207-380-6427
E-MAIL: pfisher246@gmail.com

PRINCIPAL INVESTIGATOR: Seth Barker

TITLE OF PROJECT: Development of sustainable, multi-seasonal, multi-species, marine algal aquaculture in coastal Maine

SUBTOPIC NUMBER: 8.1.1F

TECHNICAL ABSTRACT:

This Phase I proposal determines the feasibility of growing multiple species of macroalgae in commercial marine aquafarm environments. Marine aquaculture is a logical outgrowth of successful wild harvest seaweed businesses over the last several years. Developing a marine aquaculture prototype will foster the science of sea farming. Extending growing seasons for multi-species would provide year round fresh sea vegetables for various growing markets where currently only dried and frozen product is available.

Nursery production is the first step to successful grow-out while commercial success depends on careful cultivation. Our project collaborates with ongoing Sea Grant research in Maine and New Hampshire and University of Maine's Center for Cooperative Aquaculture (CCAR), to evaluate aquaculture seed stock and grow-out techniques. For each species obtained from CCAR, our team will gather data on water quality, nutrients, light levels, and hydrographic dynamics to assemble profiles of key parameters that determine optimum algal growth and evaluate factors that will be important for growing high quality sea vegetables year round. The six-month Phase I time frame investigates a limited period of the growing season but the data gathered can be used to project cultivation strategies for prototype aquaculture farms during Phase II.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results of this proposed research and feasibility study will be a testable protocol for the sea farming of multiple species of sea vegetables over a year round growing season. The focus of the study will be the collection of information about the key variables that affect growth and the final condition of the sea plants before harvest, optimal harvest and holding strategies and the identification of factors that might limit production. This protocol will aid in the creation of a Phase II prototype farm capable of commercial scale sea vegetable production to meet growing market demand.

FY 2014 PHASE I AWARD WINNER

FIRM:	Toyon Research Corporation 6800 Cortona Dr, Goleta, CA 93117
AWARD:	$95,000.00
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 Stills
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 applications. The proposed system is capable of processing images collected from aircraft, including unmanned aerial vehicles, as well as images collected using boat-mounted or handheld cameras used to observe fish catches landed on the decks of vessels. The proposed system provides automated fish classification using images of fish collected against a wide range of relevant backgrounds, both for individual fish and for groups of fish assembled in any configuration. Furthermore, the system provides fish size estimation using two or more digital still images collected from unknown ranges. The proposed system is based on advanced algorithms, which will be implemented in real-time software with a convenient user interface. In Phase I, data collection will be performed for species of fish found in the Pacific Ocean. Algorithms for fish species classification and fish size estimation will be developed, tested, and evaluated. A comprehensive feasibility study will be performed, and the results of the research and development will be documented. In addition, an initial design for the Phase II system will be presented, and recommendations for future research and development will be provided.

SUMMARY OF ANTICIPATED RESULTS:

The proposed research and development will supply 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.

FY 2014 PHASE I AWARD WINNER

FIRM: Applied Food Technologies, Inc.
12085 Research Drive
Alachua, FL 32615

AWARD: $94,640.00

PHONE: 386-462-0875
E-MAIL: lapplewhite@appliedfoodtechnologies.com

PRINCIPAL INVESTIGATOR: LeeAnn Applewhite

TITLE OF PROJECT: Development of a Robust, Accurate, and Automated Method for Species and Origin Identification in Processed Seafood.

SUBTOPIC NUMBER: 8.1.3SG

TECHNICAL ABSTRACT:

The accurate identification of seafood species and origin has become an extremely important topic in the food industry. Mislabeling a lower valued seafood product to represent a species of higher value constitute economic fraud. In addition, this mislabeling compromises proper geographic origin labeling and fishery management efforts.

DNA barcoding for seafood species identification provides reliable species level discrimination in most cases and currently is the molecular technique recommended by FDA. While the principles of DNA barcoding are well documented, the current guidelines for each component of the process: DNA extraction, amplification purification, sequencing and bioinformatics; are labor intensive and are NOT currently robust or conducive to streamlining and automation. New technologies and techniques must be investigated and developed in order to streamline and automate the overall principles of DNA barcoding to meet both FDA's quality parameters for regulatory compliance testing and NOAA's project objectives for accurate, robust, fast seafood species and origin identification. In addition, current protocols for DNA barcoding are not sufficient for highly processed seafood. Applied Food Technologies (AFT) proposes to extensively investigate each component of DNA barcoding and develop robust, fast, streamlined and automated technique required to accomplish every goal of this solicitation.

SUMMARY OF ANTICIPATED RESULTS:

The Phase I efforts will dictate the "components" that we will need in order to move forward in the Phase I efforts to develop and then beta test a prototype machine/system. This single system will be able to extract DNA samples from both fresh and processed tissues, amplify the samples, sequence the samples, query the sequencing results to a validated database, and then provide accurate species identification of all of the samples with over 98% accuracy in less than eight hours. Once the Phase I and II work is complete, there will be significant commercialization potential through the private sector, which would also be coupled with training and implementation of this new technology as a new approach to the industry as well as government sector.

FY 2014 PHASE I AWARD WINNER

FIRM:	Boston Engineering Corporation 300 Bear Hill Rd Waltham, MA 02451
AWARD:	$94,995.22
PHONE:	781-466-8010
E-MAIL:	mrufo@boston-engineering.com
PRINCIPAL INVESTIGATOR:	Michael Rufo

TITLE OF PROJECT:	Multipurpose Atmospheric/Underwater Expendable Dropsonde
SUBTOPIC NUMBER:	8.4.2W

TECHNICAL ABSTRACT:

There are currently no inexpensive observing systems that detect temperature, salinity and currents under the ocean's surface - all important factors in predicting the intensity of hurricanes. Boston Engineering proposes to develop the Multi-Purpose Above Surface/Below Surface Expendable Dropsondes (MASED). Our design builds on the highly successful air dropsondes already in use, combined with an innovative yet inexpensive underwater sonde that has the ability to measure all underwater parameters of interest, and surface and dive several times using a controlled buoyancy system. The major benefits of our proposed approach are: low cost components, a buoyancy control system to allow several dive/surface trips, a modular design to add or remove certain sensors, a structure that can withstand the impact of hitting the ocean surface after deployment from an aircraft, and integrating the technology from the widely used dropsondes on the market.

SUMMARY OF ANTICIPATED RESULTS:

Collecting both atmospheric and underwater data will provide hurricane forecasters with air temperature, speed and direction along with underwater temperature, and water current versus depth information that can be used to calculate the thermal energy of the ocean. This data can subsequently be used to forecast how quickly the hurricane will be expected to gain or lose strength. Ocean temperature at depths will be a great improvement over the current method of using satellites to measure only the ocean's surface temperature. This system will also cover wide areas when locating hypoxia zones for the assessment of fishery stocks. Hypoxia zones can change at different depths so the multipurpose sonde has the ability to help forecast locations of the zones and the impact on fisheries.

FY 2014 PHASE I AWARD WINNER

FIRM: Carr Astronautics
6404 Ivy Ln #333
Greenbelt, MD 20770

AWARD: $94,117.00

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

PRINCIPAL INVESTIGATOR: Robert Gillespie

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

SUBTOPIC NUMBER: 8.4.3W-P (Sandy Supplemental Subtopic)

TECHNICAL ABSTRACT:

NOAA has identified a problem with the display and usability of satellite imagery on NWS websites. This proposal provides analysis of the feasibility and usability of a proposed system to address this concern. Our goal in the project is to create a heuristically sound conceptual design and tool set for display and interaction with satellite imagery on the NWS site. The project will also explore possible components for the integration and presentation of weather satellite imagery, other important weather data and information as well examine the processing tools necessary to achieve the end user functionality desired in the solicitation. The work will include a proof of concept demonstration for NOAA and will culminate in an operational concept model.

SUMMARY OF ANTICIPATED RESULTS:

The results of this SBIR will be a feasibility usability analysis and design concept for an improved satellite imaging user facing system for NWS and a proof of concept based on this analysis using the best in class toolset we have proposed.

FY 2014 PHASE II AWARD WINNER

FIRM: Areté Associates
1550 Crystal Drive
Suite 703
Arlington, VA 22201

AWARD: $

PHONE: 703-413-0260
E-MAIL: contracts2@arete.com

PRINCIPAL INVESTIGATOR: Steven P. Anderson

TITLE OF PROJECT: An Advanced Algorithm for Radar Derived Bathymetry

SUBTOPIC NUMBER: 9.1.3N Bathymetric Radar

TECHNICAL ABSTRACT:

NOAA can reduce costs and improve efficiency by remotely monitoring harbors, navigations channels and coastlines for bathymetric changes. This will aid NOAA and its mission to maintain waterways and assure maritime safety. This remote sensing can be accomplished by implementing a new radar derived bathymetry capability.

Areté Associated proposes to implement an advanced algorithm to derive bathymetry from times-series wave imagery obtained from shore based navigation radars. NOAA will benefit directly from our experience developing and transitioning other remote bathymetry solutions.

Our approach includes the following benefits:

- A low risk approach that exploits linear wave dispersion and Fourier analysis
- High spatial resolutions and accuracy retrievals using new variational assimilation approach.
- Algorithm testing and implementation to prototype operational software executable with documentation delivered to NOAA.
- A flexible and adaptive solution that can be used with NOAA's existing radar systems and extended to other platforms.

The success of Phase II will produce prototype software for a real-time, shore based radar bathymetry capability. This demonstration software is the next step towards NOAA long term goal of an operational remote bathymetric measurement system suitable for both and land and ship based radar systems.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated results include the collection of one-month of radar, development of prototype operational software, and implementation of both a Fourier Analysis approach and a variational assimilation approach. We expect the variational assimilation methodology will provide higher spatial resolution and accuracy bathymetry than has previously been possible.

FY 2014 PHASE II AWARD WINNER

FIRM: Intelligent Automation, Inc.
15400 Calhoun Drive
Suite 400
Rockville, MD 20855

AWARD: $400,000

PHONE: 301-294-4253
E-MAIL: jhenriksson@i-a-i.com

PRINCIPAL INVESTIGATOR: Jakob Henriksson

TITLE OF PROJECT: Climate Impact Visualization Tools using 3D City for Community based Panning and Outreach

SUBTOPIC NUMBER: 9.3.1R,C

TECHNICAL ABSTRACT:

To build a climate-smart and resilient nation, we need to foster a climate-literate public that understands its vulnerabilities to a changing climate and makes informed decisions. A core component of this challenge is to develop simple, intuitive and high-impact visualizations of climate data-data that is and will be made available through the President's Climate Data Initiative-for education and outreach activities. Intelligent Automation Inc., together with Center for GIS (Towson University), is developing the Virtual 3D City Communication and Outreach Management System (COMS) Web Portal. The Web portal will be home to education and outreach products created from visualizing existing storm surge and coastal inundation datasets from climate models (e.g. SLOSH, ADCIRC) in the popular Unity game engine. We are developing a flexible Unity SDK plugin that can create virtual 3D city models for any coastal town from USGS elevation data, point cloud LiDAR data and crowd-sourced OpenStreetMap data. Using our COMS portal, local planners and communities can visualize scientifically computed water levels in Unity to understand the effect of the storm surges and inundation. The visualizations can be recorded and distributed through social media to communicate and educate communities and policy makers about coastal area vulnerabilities and climate-preparedness.

SUMMARY OF ANTICIPATED RESULTS:

We anticipate several results from our Phase II effort. The three main results correspond to the three core components of our approach: 1) We will have a Unity SDK plugin that can be used the generate virtual 3D city models for potentially any coastal area of the US (and beyond the US given appropriate input data): 2) We will be able to visualize existing NOAA climate datasets in 3D environments and capture the visualizations as videos and pictures for distribution as education and outreach media artifacts: 3) We will have a Communication and Outreach Management System (COMS) Web portal that will host education and outreach products related to climate data.

The creation of virtual 3D city models has many applications beyond climate data is critical for other agencies such as the DHS and the DOJ. The ability to visualize NOAA climate datasets in

3D environments and capture these intuitive visualizations for distribution has many applications. For example, this can be used to educate the public about the risks of storm surges and climate change (e.g. sea level rise). This can be done at the local level with community members, or in museums as educational displays, or via news outlets (e.g. TV news channels). Furthermore, planners and emergency personnel can use the captured education and outreach media artifacts to communicate with, and educate, policy makers at various levels of governance. Fianally, another important anticipated result is the use of our 3D visualizations of NOAA climate data as a demonstrator for the President's Climate Data Initiative.

FY 2014 PHASE II AWARD WINNER

FIRM:	McQ Inc. 1551 Forbes Street Fredericksburg, VA 22405
AWARD:	$399,999.94
PHONE:	540-373-2374
E-MAIL:	karmstrong@mcqinc.com
PRINCIPAL INVESTIGATOR:	Mark Winston, Senior Engineer

TITLE OF PROJECT:	Buoy Guard System
SUBTOPIC NUMBER:	9.3.2W

TECHNICAL ABSTRACT:

Buoy vandalism occurs all over the world for many different reasons, and costs NOAA and other buoy operators an estimated $1 million annually to replace and repair them. To deter vandals and report any vandal attempts to NOAA, McQ has developed the Buoy Guard System (BGS). BGS is a small, extremely low power sensor system that will detect the presence of intruders first approaching and then boarding the buoy. The primary intruder detection mode will be acoustic augmented by accelerometer. Once detected, the system will automatically capture images of the intruders and send them back via satellite communications (satcom) to buoy operators for action. Image processing will determine the optimal images to send back over satcom and optical character recognition (OCR) processing will send back the text read from the stern or sides of the intruding vessel. The detections and imagery will also be stored securely in BGS on the buoy for later retrieval. Additionally the system will have non-lethal deterrents (specifically strobe lights, an audio alarm, supplemented with sonic nausea) to ward off both ill-intentioned as well as curious intruders. The system is completely self-contained and can easily be installed on a wide variety of buoy designs.

SUMMARY OF ANTICIPATED RESULTS:

The design that we are proposing the BGS can be readily adapted to a wide variety of buoys. The problem that BGS is designed to solve is common to all high value buoys. The scope of the problem is well documented as described in the first section of this proposal. The benefits of a BGS (reduction in loss of service, reduction in repair and replacement costs, improved weather predictions, improved safety) will make a compelling argument for sales-the cost/benefit should be viewed very favorably by buoy operators. We believe that the BGS system can also be extended to other maritime applications as well. Examples of these might be remote maritime structures such as historic lighthouses, oil rigs, research stations or other isolated structures. They could benefit from a BGS where other more traditional burglar alarm systems would not be viable for a variety of reasons. There are numerous other types of buoys such as navigation buoys and research buoys that could contribute substantially to the market for BGS.

FY 2014 PHASE II AWARD WINNER

FIRM:	NorthWest Research Associates, Inc. 4118 148th Ave NE Redmond, WA 98052
AWARD:	$399,995
PHONE:	425-556-9055
E-MAIL:	leka@nwra.com
PRINCIPAL INVESTIGATOR:	KD Leka, Senior Research Scientist

TITLE OF PROJECT: Delivering a Solar Flare Forecast Model that Improves Flare Forecast (Timing and Magnitude) Accuracy by 25%

SUBTOPIC NUMBER: 9.4.3W

TECHNICAL ABSTRACT:

NorthWest Research Associates proposes to develop a prototype system to forecast solar flares for NOAA/Space Weather Prediction Center. Many activities and technological systems prevalent in today's society—air traffic control and air travel, the power grids, communications, deep-water drilling operations, human spaceflight—are vulnerable to the effects of flares from our Sun, which can suddenly produce orders-of-magnitude increases in gamma-and X-rays and high-energy particles. Resilience on satellite-based high-precision positioning is particularly vulnerable. The Discriminant Analysis Flare Forecasting System (DAFFS) characterizes the magnetic field of the solar photosphere and corona, its recent evolution, and prior flaring history. DAFFA then delivers a categorical or probabilistic forecast for future flaring above a given size and over a specified time-frame. DAFFS out-performs the present NOAA/SWPC forecasts for most categories, in particular for extended forecasts of large events. The Phase I feasibility study demonstrated its appropriateness for extension into a real-time operational tool. The objectives of this Phase II are to (1) develop and demonstrate an operational prototype and (2) incorporate the many degrees of customization that we envision are of interest for commercial customers and other government agencies.

SUMMARY OF ANTICIPATED RESULTS:

We expect the prototype DAFFS to be automated, computationally inexpensive, and to improve upon the accuracy of the present solar flare forecast model used by NOAA/SWPC. DAFFS can be customized with respect to lead-time, forecast windows, targets, and with respect to the relative cost of false alarms and misses. Potential markets include protecting on-orbit and high-altitude humans and hardware, and for alerts as to upcoming possible HF communication outages and disruptions of high-precision satellite-based timing and location signals.

FY 2014 PHASE II AWARD WINNER

FIRM: Phase Sensitive Innovations
51 East Main Street
Suite 201
Newark, DE 19711

AWARD: $399,979.35

PHONE: 302-456-9003
E-MAIL: dillon@phaseensitiveinc.com

PRINCIPAL INVESTIGATOR: Thomas Dillon, Senior Research Engineer

TITLE OF PROJECT: Dynamic Frequency Passive Millemeter-wave Radiometer Based on Optical Up-conversion

SUBTOPIC NUMBER: 9.4.1D

TECHNICAL ABSTRACT:

Passive microwave sensors aboard satellites provide valuable information regarding weather conditions by measuring atmospheric attenuation over a broad range of frequencies from 0-200 GHz. Additional ground-based sensors are desirable to provide complementary upward looking measurements that can be used to refine existing attenuation models. Operating over such a large bandwidth, however, places significant demands on the receiver architecture; a common approach to this challenge involves channelizing the receiver for each frequency band of interest. Unfortunately, this limits the flexibility of the system and finding components that can operate at these higher frequencies is challenging. The approach is taken by Phase Sensitive Innovations involves conversion of the collected radio frequency signals to optical frequencies, where these signals are relatively narrowband and can be processed using conventional photonic components. Optical up-conversion is accomplished using our own high speed (up to 300 GHz) lithium niobate phase modulators acting as broadband mixers. Subsequently an optical heterodyne mixer is used to tune the receiver and bring the desired frequency signals to baseband for detection. Such an approach offers significant advantages in terms of overall simplicity of the receiver design and the ability to operate efficiently at high frequencies up to and exceeding 200 GHz.

SUMMARY OF ANTICIPATED RESULTS:

A passive microwave sensor operating at frequencies from 0-200 GHz will be developed. Both horizontal and vertical polarizations will be detected. Furthermore the sensor will be gimbal mounted to provide the scanning ability.

FY 2014 PHASE II AWARD WINNER

FIRM: Aurora Flight Sciences Corporation
4 Cambridge Center, Floor 11
Cambridge, MA 02142

AWARD: $399,903.92

PHONE: 617-500-3978
E-MAIL: jwissler@aurora.aero

PRINCIPAL INVESTIGATOR: John Wissler, Director, Systems Engineering

TITLE OF PROJECT: Surveying Earth's Gravity with Unmanned Aerial Vehicles

SUBTOPIC NUMBER: 9.1.2R,N

TECHNICAL ABSTRACT:

During the Phase I program, Aurora conducted a comprehensive survey of potential platforms that included government owned and furnished UAVs and manned aircraft as well as Aurora's Centaur Optionally Piloted Aircraft (OPA). The survey concluded, in part, that UAVs offer a significant improvement in data collection capability when compared to manned aircraft that are currently fielded by NOAA. The Centaur OPA has the potential to serve as a scientific research platform that enables significant mission flexibility to the end user by allowing for both unmanned flight over littorals and spare regions and manned flight over populated or high traffic areas. Further, the survey concluded that the Centaur OPA offers significant cost savings compared to UAVs currently fielded by government agencies. During the Phase II program, Aurora will integrate a Micro-g Lacoste TAGS-6 gravity meter in the Centaur OPA and demonstrate the Centaur/TAGS-6 platforms' ability to autonomously gather gravity data. The Centaur OPA will fly gravity survey missions that are representative of the gravimeter flight campaigns currently underway by the GRAV-D program. Aurora intends to demonstrate the capabilities of the Centaur/TAGS-6 platform and its suitability for the GRAV-D program and commercial gravity data gathering applications.

SUMMARY OF ANTICIPATED RESULTS:

At the conclusion of the Phase II effort, Aurora anticipates having successfully demonstrated the utility of Centaur for performing a variety of scientific missions. Aurora anticipates that successful flight demonstration will show that the Centaur/TAGS-6 platform is a cost effective research platform capable of gathering usable gravity data.

FY 2014 PHASE II AWARD WINNER

FIRM: Bell Aquaculture
9885 Indiana 67
Redkey, IN 47373

AWARD: $400,000

PHONE: 765-369-2718
E-MAIL: steve.craig@bellaquaculture.com

PRINCIPAL INVESTIGATOR: Steven Craig, PhD Senior Research Scientist

TITLE OF PROJECT: Improving Commercial Fish Meal Free Aquaculture Diets

SUBTOPIC NUMBER: 9.2.2F

TECHNICAL ABSTRACT:

Domestic US aquaculture is moving toward fishmeal replacement in aquafeeds with a variety of alternative protein sources including plant-based, terrestrial and marine proteins. In our Phase I work we showed the feasibility of modifying the protein quality of several alternate protein sources, specifically animal byproduct meals, and its potential significant impacts on marine fish production. The next step in our Phase II is to continue this work focused upon fishmeal-free aquafeeds using specifically rendered and formulated ingredients made as complete diets in our new feedmill for feed testing and commercial production. Furthermore our work suggests that processing of specific feed ingredients destroys or modifies essential micronutrients resulting in poorer performances under commercial aquaculture conditions and we will work with modifications of these ingredient exposed to modified processes to formulate and manufacture fish meal free production diets and conducting extensive feeding trials with representative marine, brackish and freshwater aquaculture species, thereby correlating the presence of absence of these nutrients back to production performance. These feeds will be tested and sold to U.S. aquaculture producers targeting feed development toward marine and freshwater species for expected international and domestic adoption based on analysis of the economic variables and marketing of the final aquafeeds.

SUMMARY OF ANTICIPATED RESULTS:

-Performance of modified fishmeal free aquafeeds using new feedmill and processing methods.
-Development of species and production specific aquafeeds for domestic aquaculture markets.
-Optimization of micronutrient composition of feeds for Recirculating Aquaculture Systems.
-Data required for economic analysis and marketing in U.S. and abroad.

FY 2014PHASE II AWARD WINNER

FIRM:	Toyon Research Corporation 6800 Cortona Drive Goleta, CA 931117
AWARD:	$400,000
PHONE:	805-968-6787
E-MAIL:	kezal@toyon.com
PRINCIPAL INVESTIGATOR:	Kenan O. Ezal, Senior Scientist

TITLE OF PROJECT: Mobile VHF Lightning Mapping System

SUBTOPIC NUMBER: 9.4.2R,D,W

TECHNICAL ABSTRACT:

A preliminary design of a mobile receiver system for intra-cloud lightning detection, mapping, and tracking was completed and analyzed during the Phase I program. The direction-finding (DF) receiver design is small enough for use on small UAVs and utilizes the full VHF spectrum. The lightning Mapping Unmanned Sensor (LITMUS) design will be finalized, fabricated, assembled, and demonstrated during the Phase II effort. The LITMUS system comprises (a) multiple remote nodes, each equipped with the VHF receiver and communication hardware, and (b) a centralized control station hosting a graphical user interface called the Emitter Localization and Mission Planning Tool, or Empath, communication hardware, and a waveform correlation engine. Although the LITMUS system will be backward compatible with the low-bandwidth legacy lightning mapping arrays currently in existence, it will also include high-bandwith waveform data that will achieve higher signal-to-noise-power ratios and will enable the detection and tracking of lightning flashes from much larger standoff distances and with better resolution. By the completion of the Phase II effort, a deliverable prototype LITMUS system will have been demonstrated in real-time and under realistic conditions and will be capable of mapping the entire flash sequence of intra-cloud lightning from beginning to end.

SUMMARY OF ANTICIPATED RESULTS:

Under appropriate deployment geometries the lightning localization accuracy of the LITMUS system is expected to be better than the 10-m spherical error probable (SEP). The system has two independent runnable channels that will enable direction-finding (DF) and the ability to “bridge” between two existing lightning mapping arrays (LMA) operating at two different frequencies. The system can be used to detect other emitters within the operational band of the system and the Empath user interface can be used for any military or civilian emitter localization and tracking application. Furthermore, a UAV-based LITMUS system has the potential to save a significant number of lives because it will have much better visibility into approaching storm systems and will be able to provide earlier warnings of severe weather, thereby giving residents and utility companies more time to prepare for the storm. The electronics developed for this program can also be used for sferics-aided navigation when GPS is denied, and is relevant to the mission of virtually all NOAA organizations.

FY 2014PHASE II AWARD WINNER

FIRM:	Toyon Research Corporation 6800 Cortona Drive Goleta, CA 931117
AWARD:	$400,000
PHONE:	805-968-6787
E-MAIL:	ksullivan@toyon.com
PRINCIPAL INVESTIGATOR:	Kevin Sullivan

TITLE OF PROJECT:	Automated Detection, Tracking Measurement, and Classification of Fish Observed by Underwater Cameras
SUBTOPIC NUMBER:	9.2.1F

TECHNICAL ABSTRACT:

We propose to develop a system that can automatically detect, track, measure, and classify fish seen in video collected by stationary underwater cameras. Our approach makes use of a novel method for detecting motion that can mitigate false alarms due to swaying underwater vegetation. We propose a novel technique for tracking the fish in three spatial dimensions allowing for improved knowledge of the potential target dynamics, occlusion by other fish and submerged objects, and length measurements. Our system will be capable of working with two or more cameras. Our classification module will work with multiple segmented images of fish. Classification decisions will be made using as few as one frame of data, but most decisions will be based on multiple looks at each fish, taking advantage of the fact that most video cameras collect many images per second. We will create a software tool that allows an operator to view video with overlays indicating fish in track along with their estimated length and classification.

SUMMARY OF ANTICIPATED RESULTS

The successful completion of this research will result in a system that helps NOAA biologists to more effectively conduct fish surveys. The technology also has the potential to protect fishing industries such as the commercial salmon industry by supporting tasks such as the counting of fish that travel through fish ladders. The technology could also have applications in fishing regulation enforcement where fish types and lengths are automatically identified using handheld camera. Additionally, the technology could be used by recreational fishermen to ensure that they do not violate fishing regulations by identifying their catch prior to possible release.