



SBIR



Small Business Innovation Research Program

ABSTRACTS OF PHASE I AWARDS FOR FISCAL YEAR 2016

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

INTRODUCTION

The Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), through the Small Business Innovation Research (SBIR) program, awarded 27 Phase I contracts for FY 2016. These awards are up to \$120,000 each, and totaling approximately \$3,236,115.87. The awards are for a six-month effort to demonstrate the feasibility of innovative approaches to the research topics identified in the "DOC/NOAA SBIR Program Solicitation for FY 2017 (NOAA 2016-1)." Abstracts of the successful Phase I proposals submitted under this solicitation, and brief comments on their anticipated results are provided in this publication.

The SBIR program is highly competitive. A total of 130 proposals were received by DOC/NOAA in response to its FY 2017 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 27 were selected for an award. Final selection was based upon the results of the reviews, relative importance to DOC/NOAA needs, relationship to on-going research, and potential for commercialization.

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$120,000.00

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

PRINCIPAL INVESTIGATOR: Will Cooper

TITLE OF PROJECT: L-Band Radio Frequency Interference Filtering

SUBTOPIC NUMBER: 8.4.4D

TECHNICAL ABSTRACT:

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

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

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

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

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

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

SUMMARY OF ANTICIPATED RESULTS:

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

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,810

PHONE: (978) 932-0266

E-MAIL: herndon@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. Scott Herndon

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

SUBTOPIC NUMBER: 8.3.3D

TECHNICAL ABSTRACT:

Atmospheric methane (CH₄) is a potent greenhouse gas and ozone precursor that is increasingly important in our understanding and modeling of climate change. Identifying and differentiating methane sources are crucial to any strategies aimed at reducing CH₄ emissions. Isotopic composition and ethane content are both dependent upon methane origin, making them valuable diagnostics for source attribution. Instrumentation capable of fast, high precision quantification of CH₄ isotopes and ethane aboard an aircraft platform will advance scientifically backed methane mitigation strategies.

This proposal aims to develop a flight-capable laser-based monitor for ¹²CH₄, ¹³CH₄, CH₃D, and C₂H₆. The 1 Hz standard deviation performance targets of d-¹³CH₄ precision of 0.5 per mil and d-CH₃D precision of 10 per mil delta units, and C₂H₆ mixing ratio precision of 10 parts per trillion will be achieved in this work. These performance goals will be met using direct absorption infrared spectrometry, which has been demonstrated to achieve the desired precision under laboratory conditions. As outlined in the proposal, the technical challenges are: i) identifying and eliminating sources of measurement drift due to aircraft motion, temperature and pressure changes, ii) developing innovative zeroing and calibration methods amenable to these high precision measurements, and iii) designing a flight-ready instrumentation package.

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,930

PHONE: (978) 932-0228

E-MAIL: Tyacovitch@aerodyne.com

PRINCIPAL INVESTIGATOR: Dr. Tara Yacovitch

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

SUBTOPIC NUMBER: 8.3.1C

TECHNICAL ABSTRACT:

In order to understand how and why methane (CH₄) concentrations change over time, it is necessary to understand their sources and sinks. Stable isotope measurements of ¹³CH₄:¹²CH₄ and CH₃D:¹²CH₄ ratios constrain these sinks and sources. This is particularly crucial for methane of microbial origin since other tracers such as ethane and propane are not co-emitted. Global measurements of these ratios are currently performed using isotope ratio mass spectrometry (IRMS) on flasks collected by NOAA's Cooperative Air Sampling Network. However, IRMS is labor intensive and costly.

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

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

FIRM: Boulder Environmental Sciences and Technology
5171 Eldorado Springs Drive, Suite A,
Boulder, Colorado 80303-9672

AWARD: \$120,000

PHONE: (303) 532-1198, x111

E-MAIL: marian.klein@boulderest.com

PRINCIPAL INVESTIGATOR: Marian Klein

TITLE OF PROJECT: Development of a sensor interface, communication and a power module - a SensorCSP module.

SUBTOPIC NUMBER: 8.5.2TT

TECHNICAL ABSTRACT:

Many applications in areas such as geophysics, biology, agriculture, security, and others require long-term observations of parameters at a distant location where power or communication links are not available and are impractical or too expensive to install. Examples for such measurements are various in situ measurements in the middle of the ocean on a buoy or ship, measurements of soil moisture, soil temperature, local temperature, humidity, pressure, snow depth, precipitation rate, tectonic movements, and many others. Some observations of wildlife can also be done electronically, using a camera and/or a motion sensor, to provide information about wildlife behavior, animal counts, etc.

The spread of drones, or unmanned aerial vehicles, is inevitable, and some airborne measurements require real time transmission to a base recording system. Having a system independent of the aircraft control communications can provide a significant advantage, especially if the drone is beyond the line of sight of the base.

The objective of the proposed technology transfer project is to develop one or more commercially viable products based on the NOAA's patent pending Smart Module technology, developed by the engineers at National Data Buoy Center.

SUMMARY OF ANTICIPATED RESULTS:

The goal of the Phase I project is a development of a preliminary design of a SensorCSP Module where CSP is referring to a sensor interface module providing communications, storage of data, and power. During Phase II we will finalize the design of the complete prototype, evaluate it with respect to the requirements and specifications from Phase I, fabricate a working prototype, and evaluate its performance.

Potential applications include the Earth science research in areas such as meteorology, weather forecasting, climate monitoring, precision agriculture, seismology, oceanography, transportation, aviation, and natural disaster prediction and observations.

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$120,000

PHONE: (978) 914-1901

E-MAIL: cliffgoudey@gmail.com

PRINCIPAL INVESTIGATOR: Clifford A. Goudey

TITLE OF PROJECT: Engineering Structures for Offshore Macroalgae Farming

SUBTOPIC NUMBER: 8.1.2F

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

This project will bring disruptive systems to the marketplace that will enable the growth of the ocean-based algal production at scales necessary to replace our present use of fossil fuels and thereby drastically reduce GHG emissions. These culture systems when deployed on the oceans will absorb vast amounts of CO₂ from the atmosphere while reducing ocean acidity. Properly sited high-seas macroalgae farms will absorb excess nutrients and benefit surrounding ocean ecosystems.

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,210.40

PHONE: (978) 257-4820

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

PRINCIPAL INVESTIGATOR: Arnis Mansolds

TITLE OF PROJECT: Mobile Observation Platform

SUBTOPIC NUMBER: 8.2.1N

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$120,000

PHONE: (650) 204-7875

E-MAIL: marmen@entanglementtech.com

PRINCIPAL INVESTIGATOR: Michael Armen

TITLE OF PROJECT: Ethane/isotopic methane CRDS analyzer

SUBTOPIC NUMBER: 8.3.3D

TECHNICAL ABSTRACT:

Entanglement Technologies, Inc. (ET) proposes to develop a gas analyzer for ethane and isotopologues of methane to study of methane sources and sinks, using cavity ring-down spectroscopy (CRDS). Methane is an important contributor to global climate change, and a participant in air pollutant reactions such as ozone. Understanding methane sources, sinks, and transport between them is crucial to predict its effect on climate and pollution. CRDS is an ultra-sensitive and precise optical measurement technique which is already successfully commercially deployed to monitor a wide variety of atmospheric molecules including isotopes of methane. However, these commercial analyzers lack the requisite sensitivity for NOAA research. Other methods to monitor isotopic methane (e.g. multi-pass optical absorption and mid-wave infrared spectroscopy) are difficult to reduce in size and weight for airborne deployment. CRDS can potentially achieve comparable performance with a small gas cell and air pump and short-wave (3 microns) spectroscopy that is easier to implement than 6-8 microns. ET proposes to develop a mid-infrared CRDS analyzer using short-wave spectroscopy to measure ethane concentration to a precision of 10 parts per trillion by volume (pptv), and isotopes of methane with precisions of 0.5% for $^{13}\text{CH}_4/^{12}\text{CH}_4$ and 10% for $^{12}\text{CH}_3\text{D}/^{12}\text{CH}_4$, at 1 Hz measurement rate.

SUMMARY OF ANTICIPATED RESULTS:

The end result after phase II of this project will be a self-contained prototype ethane/isotopic methane analyzer appropriate for laboratory testing. Although the analyzer will operate at 1 Hz measurement rate for the NOAA application, reducing this rate will improve the precision. The analyzer will also be appropriate for commercial applications in natural gas leak detection and forensics, oil and gas exploration, and well lifetime monitoring. Its high precision and $^{12}\text{CH}_3\text{D}$ capability, not currently available in deployed commercial analyzers, will substantially improve the efficiency of the natural gas industry.

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$ 119,823

PHONE: (484) 352-2090

E-MAIL: joseph.denny@foreveroceans.com

PRINCIPAL INVESTIGATOR: Joseph Denny

TITLE OF PROJECT: RUSH: Robotic Underwater Seine Harvester

SUBTOPIC NUMBER: 8.1.2F

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,978

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E-MAIL: bdweik@ginerinc.com

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

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

SUBTOPIC NUMBER: 8.2.3D

TECHNICAL ABSTRACT:

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

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,998

PHONE: (513) 281-2900 x103

E-MAIL: jcaffery@girdsystems.com

PRINCIPAL INVESTIGATOR: Dr. James Caffery

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

SUBTOPIC NUMBER: 8.4.4D

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,519.76

PHONE: (808) 443-9881

E-MAIL: gavin@kampachifarm.com

PRINCIPAL INVESTIGATOR: Gavin Key

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

SUBTOPIC NUMBER: 8.1.1F

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,959

PHONE: (408) 992-0722

E-MAIL: Serguei.koulikov@licor.com

PRINCIPAL INVESTIGATOR: Serguei Koulikov

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

SUBTOPIC NUMBER: 8.3.2D

TECHNICAL ABSTRACT:

LI-COR proposes to develop a next-generation CO₂/CH₄/H₂O analyzer that will offer an unprecedented combination of high precision and stability, making it the first high-performance gas analyzer suitable for long-term unattended operation. The instrument will be smaller, lighter, and far less expensive than competing technologies. LI-COR's approach exploits a proprietary, revolutionary design that overcomes the limitations of existing techniques and enables a sophisticated spectroscopic analysis strategy that is far more robust than competing approaches. The objective of Phase I is to prove feasibility of meeting NOAA's proposed specifications through demonstration of a laboratory prototype that achieves the precision requirements and demonstrates stability for one month (limited by the six month duration of Phase I and the time required to design, build and test the prototype). In Phase II we will more thoroughly characterize stability over 12 months.

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

FIRM: Makel Engineering, Inc
1585 Marauder Street
Chico, CA 95973-9064

AWARD: \$120,000

PHONE: (530) 895-2771

E-MAIL: dmakel@makelengineering.com

PRINCIPAL INVESTIGATOR: Darby B. Makel

TITLE OF PROJECT: High Sensitivity Miniaturized CO Sensor for Airborne Use on Small UAV.

SUBTOPIC NUMBER: 8.3.5R

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$120,000

PHONE: (228) 688-3626

E-MAIL: ssstubbs@charter.net

PRINCIPAL INVESTIGATOR: Shelly Stubbs

TITLE OF PROJECT: Smart Module Commercial Development Research

SUBTOPIC NUMBER: 8.5.2TT

TECHNICAL ABSTRACT:

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

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

The purpose of this SBIR project is to research the status of sensors, processing, and communications links on the open commercial market and determine the need of the Smart Module to further enhance the In-situ measurements for multiple applications, processing, and the transfer of data to scientist and engineers for control and analysis.

This SBIR will review current markets for need and application and define the best approach to satisfy current issues with a new commercial product capable of unifying sensor manufacturers and communications networks. It will also provide rudimentary test results with suggested modular firmware formats to show proof of concept.

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,977.44

PHONE: (734) 975-8777

E-MAIL: wjohnson@michaero.com

PRINCIPAL INVESTIGATOR: Dr. Will Johnson

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

SUBTOPIC NUMBER: 8.3.4N

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

FIRM: Opto-Knowledge Systems, Inc.
19805 Hamilton Ave.
Torrance CA 90502-1341

AWARD: \$120,000

PHONE: (310) 756-0520

E-MAIL: jason@oksi.com

PRINCIPAL INVESTIGATOR: Jason M. Kriesel

TITLE OF PROJECT: Capillary Absorption Spectrometer for In-Situ, Underwater Gas Analysis

SUBTOPIC NUMBER: 8.2.6R

TECHNICAL ABSTRACT:

A Capillary Absorption Spectrometer (CAS) is proposed for in-situ, underwater gas concentration and isotope measurements. The concept utilizes mid-infrared laser absorption spectroscopy within a hollow fiber optic capillary that both confines a gas sample and acts as an optical waveguide. A tunable laser beam propagates through the hollow fiber to a detector with near unity overlap between the beam and the analyte. The CAS can perform fast (~ 1 s) and precise (isotope ratio ~ 1 ‰) measurements within the ultra-small sample volume ($V \sim 0.1$ mL) of the hollow fiber, enabling 3 to 4 orders of magnitude more sensitivity than related cavity-ring-down and multi-pass systems. Compared to these other systems, the sensor proposed here will have higher throughput analysis of dissolved gasses within a smaller size, weight, and power package. In this project, the concept will be extended and specifically proven for methane isotope analysis ($\delta^{13}\text{CCH}_4$ and $\delta^2\text{HCH}_4$), building on the team's ongoing development of CO_2 , SO_2 , and H_2O isotope sensors for NASA planetary applications. In addition, improvements over typical sample inlet methods (e.g., membranes) will be developed for deep-ocean monitoring. Specifically, degassing of discrete water samples will be enabled due to the ultra-small sample volume of the CAS.

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

FIRM: Polestar Technologies, Inc.
220 Reservoir Street, Suite 3,
Needham Heights, MA 02494

AWARD: \$119,952

PHONE: (781) 449-2284

E-MAIL: yufeng@polestartech.com

PRINCIPAL INVESTIGATOR: Yufeng Ma

TITLE OF PROJECT: Carbon Nanotube Array-based Nanosensor for
Autonomous and Direct Measurement of Carbonate

SUBTOPIC NUMBER: 8.2.5R

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,991

PHONE: (540) 907-3995

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

PRINCIPAL INVESTIGATOR: Brent Roeder

TITLE OF PROJECT: Fish Trap Extension Kit for Lionfish Control

SUBTOPIC NUMBER: 8.2.2N

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

FIRM: Remote Sensing Solutions, Inc.
3179 Main Street, Unit 3
PO Box 1092
Barnstable, MA 02630

AWARD: \$120,000

PHONE: (508) 362-9400

E-MAIL: carswell@remotesensingsolutions.com

PRINCIPAL INVESTIGATOR: Dr. James Carswell

TITLE OF PROJECT: The Marine Debris and Small Object Mapping (DSOM)
Radar System

SUBTOPIC NUMBER: 8.2.4D

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,298.65

PHONE: (805) 458-0364

E-MAIL: ed@robonautica.com

PRINCIPAL INVESTIGATOR: Eddie H. Williams

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

SUBTOPIC NUMBER: 8.2.1N

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2015 PHASE I AWARD WINNER

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

AWARD: \$119,993

PHONE: 703-761-2818 x118

E-MAIL: iakbar@sharespectrum.com

PRINCIPAL INVESTIGATOR: Ihsan Akbar

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

SUBTOPIC NUMBER: 8.4.4D

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$118,770

PHONE: (720) 222-0533

E-MAIL: jgreen@spacehaz.com

PRINCIPAL INVESTIGATOR: Dr. Janet Green

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

SUBTOPIC NUMBER: 8.4.2W

TECHNICAL ABSTRACT:

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

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,995

PHONE: (406) 532-3246

E-MAIL: reggie@sunburstsensors.com

PRINCIPAL INVESTIGATOR: Reggie Spaulding

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

SUBTOPIC NUMBER: 8.2.5R

TECHNICAL ABSTRACT:

Increasing atmospheric CO₂ from anthropogenic sources is changing the chemistry of the oceans and altering the marine food web and the health of fisheries. NOAA's National Ocean Service is responsible for maintaining the health of coastal regions to preserve fisheries. The ability to monitor the impact of increasing CO₂ on marine organisms is crucial to this responsibility. NOAA's call for *autonomous direct measurement of carbonate ion in saline waters* (SBIR topic # 8.2.5R) addresses the need to understand ocean chemistry, including changing pH and saturation states of calcite and aragonite (CaCO₃) in response to increased atmospheric CO₂ (pCO₂). Ocean acidification is changing entire ecosystems – affecting reproduction, growth, and respiration of a wide range of marine organisms. Sunburst Sensors, in collaboration with the University of South Florida (USF), proposes to determine the feasibility of developing an autonomous instrument to measure carbonate ion, based on combining the patented SAMI technology with a lead complexation-ultraviolet (UV) absorbance method for detection of carbonate anion. In Phase I, we will determine temperature dependence of the Pb²⁺ + CO₃²⁻ reaction and molar absorbances, and investigate the feasibility of using UV LEDs or a deuterium light source and a UV spectrometer in an in situ sensor.

SUMMARY OF ANTICIPATED RESULTS:

In Phase 1 we anticipate to complete work on the temperature dependence of the Pb²⁺ + CO₃²⁻ reaction and molar absorbances, laying the foundation for the sensing method. We will concurrently be working on determining the design of a prototype instrument by investigating potential UV optic systems and fluidic schemes. Phase 1 will culminate with a prototype design description that will serve as the centerpiece of a phase 2 proposal and ultimately lead to a new, important product for marine carbonate research.

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$120,000

PHONE: (805) 968-6787

E-MAIL: rgagley@toyon.com

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

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

SUBTOPIC NUMBER: 8.1.3F

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$120,000

PHONE: (805) 968-6787

E-MAIL: esandoz@toyon.com

PRINCIPAL INVESTIGATOR: Eric E. Sandoz

TITLE OF PROJECT: Small UAS Platform for NWS Missions

SUBTOPIC NUMBER: 8.4.1W

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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

FY 2016 PHASE I AWARD WINNER

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

AWARD: \$119,921

PHONE: (336) 582-0603

E-MAIL: cfajardo@usmicrolabs.com

PRINCIPAL INVESTIGATOR: Claudia P. Fajardo

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

SUBTOPIC NUMBER: 8.4.3W

TECHNICAL ABSTRACT:

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

SUMMARY OF ANTICIPATED RESULTS:

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