



# SBIR

**Small Business  
Innovation  
Research  
Program**

**ABSTRACTS OF  
AWARDS FOR  
FISCAL YEAR 2009**

**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 12 Phase I contracts for FY 2009. These awards of up to \$95,000 each, and totaling approximately \$1.1 million. 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 2009 (NOAA 2009-1)." Abstracts of the successful Phase I proposals submitted under this solicitation, and brief comments on their anticipated results are provided in this publication.

In Phase II, funding is provided for projects that are most promising after Phase I is completed. These awards can be for up to \$400,000 each and for two years. The DOC/NOAA awarded a total of 8 Phase II contracts in FY 2009 for a total of approximately \$2.9 million. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

The SBIR program is highly competitive. A total of 89 proposals were received by DOC/NOAA in response to its FY 2009 solicitation. DOC/NOAA scientists and/or engineers independently reviewed the proposals. With the funds available, only 12 were selected for an award. Final selection was based upon the results of the reviews, relative importance to DOC/NOAA needs, relationship to on-going research, and potential for commercialization.

## **FY 2009 PHASE I AWARD WINNER**

**FIRM:** Haereticus Environmental Laboratory  
106 S. Saratoga Drive  
Lynchburg, VA 24502-5439

**AWARD:** \$90,000

**PHONE:** 434-263-5740  
**FAX:** 4.34-263-5740  
**E-MAIL:** Haereticus1@hughes.net

**PRINCIPAL INVESTIGATOR:** Craig A. Downs, Executive Director

**TITLE OF PROJECT:** Coral Tissue Engineering for Mass-Production of Coral for the recreational Marine Aquarium Trade

**SUBTOPIC NUMBER:** 8.1.2N

### **TECHNICAL ABSTRACT:**

Over 10 million coral specimens a year are traded in the +\$100 million/year ornamental-recreational aquaria industry. Over ninety percent of commercial coral specimens come from some form of mass harvesting of wild corals from coral reefs. This can have a detrimental impact to coral reefs. We have invented a method of perpetual propagation of corals through tissue engineering. Hundreds to thousands of microscopic tissue explants are generated from a single coral polyp. These explants can be induced to undergo “remorphogenesis” and develop into primary coral polyps and colonization. In Phase I, it’s proposed to optimize this technology for mass-production and to augment cryo-preservation methods to control production rates. Culture media and environmental conditions will be tested for optimal productivity. Phase II will expand this technology to a wide-range of coral species, and to establish a DNA “fingerprint” system to certify specimens that are tissue-engineered vs. wild-collected specimens.

### **SUMMARY OF ANTICIPATED RESULTS:**

Results from the work in Phases I and II, will produce a technical protocol to mass produce at least five different coral species using a tissue-engineering biotechnology. Mass production of tissue-engineered coral for commercial distribution can limit the impact of mass-harvesting of wild corals, thereby limiting the adverse impacts of this industry-based activity, and consistently providing the customer with a significantly cheaper and higher quality product.

## FY 2009 PHASE I AWARD WINNER

FIRM: Desert Star Systems, LLC  
3261 Imjin Road  
Marina, CA 93933-5103

AWARD: \$85,671

PHONE: 831-384-8000 x117  
FAX: 831-384-8062  
E-MAIL: mf@desertstar.com

PRINCIPAL INVESTIGATOR: Marco Flagg, Chief Engineer and CEO

TITLE OF PROJECT: APA: Air Pressure Alert Device

SUBTOPIC NUMBER: 8.1.4 R, F

### TECHNICAL ABSTRACT:

Out of air situations present a hazard. They can result in a dangerous emergency ascent, or failure of a diver to reach the surface. A low air pressure alert (APA) device can provide a valuable margin of safety, but careful design is required. The device must be effective. In order for the device to be adopted and success, its ease of use, ergonomics and cost must be attractive in relationship to the probability and severity of the hazard.

This proposal results in a small alert device system of moderate cost. The APA will be purposely designed as a safety device that serves as a backup, not replacement, to existing gauges. Featuring strong 360-degree alert light pulses and sound, it uses its wireless transmission technology to also include a "buddy alert" for better dive team coordination (conclusion of dive reminder) and a self-test to confirm operation before a dive.

### SUMMARY OF ANTICIPATED RESULTS:

The Phase I work will start with a test and evaluation of techniques to implement the APA core function, specifically the pressure switch, wireless transmission, alert functions and power requirements. Its proceeds to the design and manufacture of a small number of APA prototypes for field testing by the end of Phase I. Field test results will guide the Phase 2 design. Phase 2 will concentrate substantially on the refinement of manufacturing techniques to provide a streamlined, reliable and cost effective device to NOAA and other customers.

## **FY 2009 PHASE I AWARD WINNER**

**FIRM:** Aerial Imaging Solutions  
5 Myrica Way  
Old Lyme, CT 06371-1874

**AWARD:** \$75,000

**PHONE:** 860-434-3637  
**FAX:** 860-434-0225  
**E-MAIL:** dleroi@aol.com

**PRINCIPAL INVESTIGATOR:** Donald J. Leroi,

**TITLE OF PROJECT:** Multiple Digital Camera Mount with FMC

**SUBTOPIC NUMBER:** 8.1.7F

### **TECHNICAL ABSTRACT:**

NOAA uses large-format aerial film camera systems to collect data for the monitoring of marine mammal populations protected under the Marine Mammal Protection Act and the U.S. Endangered Species Act. Historically, the major users of these cameras and film have been the military and government mapping agencies. As these users move to newer technology, manufacturers are ending, or severely cutting back, the production of aerial films and camera repair parts. Consequently, NOAA requires a digital camera system that will deliver high resolution aerial imagery equivalent to the imagery they currently gather. Aerial Imaging Solutions proposes to design a multiple digital camera, forward motion compensated, stabilized mount and control system to fill NOAA's sampling needs. The Phase I goal is to develop a prototype that will match or exceed the image quality and coverage of the venerable film camera systems NOAA now uses.

### **SUMMARY OF ANTICIPATED RESULTS:**

At the completion of Phase I, Aerial Imaging Solutions will demonstrate a working prototype of a turn-key, three-sensor, forward motion compensated, stabilized digital camera and data collection system.

## FY 2009 PHASE I AWARD WINNER

FIRM: Optechnology, Inc.  
5000 Allendale Drive  
Huntsville, AL 35811-8971

AWARD: \$94,994.62

PHONE: 256-508-2487  
E-MAIL: Thomas.lavin@optechnology.com

PRINCIPAL INVESTIGATOR: Dr. Thomas Lavin

TITLE OF PROJECT: Creating Resilient Structures with Polymer Coatings

SUBTOPIC NUMBER: 8.1.9SG

### TECHNICAL ABSTRACT:

The first goal of our team is to design and develop highly cement mortar composites using novel patent applied for technology which has been shown to produce materials with high energy absorption, decreased modulus, higher tensile strength, and greater toughness than standard or ultra high performance concretes or fibercements. These materials will be used to produce NEMA Class 5 flood resistant building panels which are also capable of withstanding hurricane forces to comply with Florida and North Carolina State Building Codes, ASTM 1886E-05 and ultimately to meet FEMA 320/FEMA 361 standards. In order to achieve our design goals, we may further strengthen the panels by reinforcing them with interlayers and polymer coatings.

We will strive to make our products acceptable to the building community. The panels will be able to be tapped, sawn, and screwed with standard jobsite power equipment without the need for diamond blades or water tables.

Our second goal is to test the effectiveness of using field applied polymer coatings to solve issues of roof joist to wall framing attachment and foundation-rim joist wall framing to produce a continuous foundation to roof load pathway and to supplement standard hurricane and construction ties.

### SUMMARY OF ANTICIPATED RESULTS:

Our work will result in the optimization of mix and panel design for a NEMA Class 5 structural wall pane, and will provide standard torsion, tension, and shear testing of polymer strengthened framing ties. Analytical models for panels and tie strengthening characteristics will be developed.

## FY 2009 PHASE I AWARD WINNER

FIRM: Troutlodge, Inc.  
P.O. Box 1290  
Sumner, WA 98390-1290

AWARD: \$90,975

PHONE: 253-863-9463  
FAX: 253-863-4715  
E-MAIL: parsons@troutlodge.com

PRINCIPAL INVESTIGATOR: James E. Parsons, Senior Vice-President

TITLE OF PROJECT: Induction of Triploidy and Gynogenesis in  
Cobia (*Rachycentron canadum*)

SUBTOPIC NUMBER: 8.1.10SG

### TECHNICAL ABSTRACT:

Cobia (*Rachycentron canadum*) exhibit differential growth rates between the sexes, with females growing faster than males. Sex determination mechanisms have not been elucidated for this species, nor are there any literature reports regarding the induction of sterility through triploidy or attempts at generating uniparental inheritance.

The research outlined in this proposal will establish protocols for the induction of gynogenesis and triploidy in cobia. Specifically we will determine the appropriate methods for suppression of second meiosis in newly fertilized eggs and the protocols needed for inactivating parental sperm DNA.

### SUMMARY OF ANTICIPATED RESULTS:

Success in this project will enable the development of sterile triploid and monosex female stocks of cobia for use in production operations. Both technologies will lead to improved and more efficient production of cobia.

## FY 2009 PHASE I AWARD WINNER

FIRM: Picarro, Inc.  
480 Oakmead Parkway  
Sunnyvale, CA 94085-4708

AWARD: \$94,605

PHONE: 408-962-3913  
FAX: 408-962-3200  
E-MAIL: ecrosson@picarro.com

PRINCIPAL INVESTIGATOR: Dr. Eric R. Crosson, Chief Technical Officer

TITLE OF PROJECT: Isotopic Carbon Dioxide Analyzer for  
Atmospheric Studies

SUBTOPIC NUMBER: 8.2.2C

### TECHNICAL ABSTRACT:

Picarro has as part of its current product offering, a CRDS-based isotopic ( $^{13}\text{CO}_2/^{12}\text{CO}_2$ ) carbon dioxide analyzer capable of measuring atmospheric levels of  $\text{CO}_2$  to a precision of 0.3% in a five-minute measurement. This slow analyzer operated at 1.6  $\mu\text{m}$ . At this wavelength, we have pushed the very limits of what CRDS is capable of delivering for isotopic  $\text{CO}_2$ . The isotopic product proposed in this Phase I effort will operate at 2  $\mu\text{m}$ . At 2  $\mu\text{m}$  the line strength is 20 times that of the spectral features available at 1.6  $\mu\text{m}$  providing the reduced measurement time and increased isotopic ratio precision target in this proposal. Although there are a number of technical challenges that need to be overcome, this additional line strength will enable Picarro to greatly improve the precision while still maintaining the drift, ease of use, and environmental insensitivity that exists in our current 1.6  $\mu\text{m}$  product.

### SUMMARY OF ANTICIPATED RESULTS:

Picarro proposes to build a  $\text{CO}_2$  isotopic monitor based on cavity ring-down spectroscopy (CRDS) capable of measuring the isotopic composition and the concentration of atmospheric  $\text{CO}_2$  with high speed, precision, and accuracy. The analyzer is expected to achieve a precision of 0.2% for the isotopic measurement of  $\text{CO}_2$  in a 1-second measurement time and with averaging achieve a precision of better than 0.05% in 30 seconds. In addition to quantifying and understanding the carbon cycle, this analyzer will provide high speed, high precision and high accuracy necessary to aid researchers in gaining an understanding of various natural and anthropogenic processes including those related to combustion, enzymatic biochemistry, or resistances to gas or liquid fluxes.



## FY 2009 PHASE I AWARD WINNER

FIRM: Argos Intelligence, LLC  
3417 Chartley Lane  
Roswell, GA 30075-6135

AWARD: \$94,938.90

PHONE: 404-790-1850  
FAX: 770-649-0169  
E-MAIL: ckerce@gmail.com

PRINCIPAL INVESTIGATOR: J. Clayton Kerce, Principal Research Scientist

TITLE OF PROJECT: A Stochastic Integration Toolkit for  
Comprehensive Global Weather and Climate  
Models

SUBTOPIC NUMBER: 8.2.3C

### TECHNICAL ABSTRACT:

Argos Intelligence proposes the Stochastic Parameterization Toolkit (SPT) to bridge the technology gap between the established stochastic integration techniques and operations numerical prediction models. SPT will provide a platform to introduce stochastic terms into existing code base using a simple, high-level, user-friendly language. The SPT paradigm is based on parsing and pre-processing the code, producing an modified version of the original files. These modified files incorporate the desired stochastic effects into the original code and run with the models existing, deterministic numerical integration routine. In addition, the theoretical underpinning to the SPT routines will provide an understanding of the stability and convergence characteristics of the resulting integration routines.

### SUMMARY OF ANTICIPATED RESULTS:

The Stochastic Parameterization Toolkit will provide a platform to introduce stochastic terms into existing code base using a simple, high-level, user-friendly language. The SPT paradigm is based on parsing and pre-processing the code, producing a modified version of the original files. These modified files incorporate the desired stochastic effects into the original code and run with the model's existing, deterministic numerical integration routine. In addition, the theoretical underpinning to the SPT routines will provide an understanding of the stability and convergence characteristics of the resulting integration routines.

## **FY 2009 PHASE I AWARD WINNER**

**FIRM:** Boulder Nonlinear Systems, Inc.  
450 Courtney Way  
LaFayette, CO 80026-8878

**AWARD:** \$94,995

**PHONE:** 303-604-0077  
**FAX:** 303-604-0066  
**E-MAIL:** jstockley@bnonlinear.com

**PRINCIPAL INVESTIGATOR:** Dr. Jay Stockley, Research Scientist

**TITLE OF PROJECT:** Hyperspectral Imaging Projector Based on  
Liquid Crystal on Silicon Displays

**SUBTOPIC NUMBER:** 8.2.5D

### **TECHNICAL ABSTRACT:**

This proposal outlines a novel architecture for a hyperspectral imaging projector based on liquid crystal on silicon micro-displays.

### **SUMMARY OF ANTICIPATED RESULTS:**

The result will be a visible-infrared hip system capable of producing realistic images with excellent spatial and spectral resolution.

## **FY 2009 PHASE I AWARD WINNER**

**FIRM:** International Met Systems  
4460 40<sup>th</sup> Street SE  
Grand Rapids, MI 49512-4035

**AWARD:** \$94,627

**PHONE:** 616-285-7810 x210  
**FAX:** 616-957-1280  
**E-MAIL:** rwierenga@intermetssystemns.com

**PRINCIPAL INVESTIGATOR:** Rod Wierenga, Vice President of Program Management

**TITLE OF PROJECT:** GPS Reference for Radiosonde Validation

**SUBTOPIC NUMBER:** 8.3.1W

### **TECHNICAL ABSTRACT:**

Qualifying the accuracy of GPS systems is both expensive and time consuming. This situation is especially true when validating GPS systems on radiosondes. A new and unique GPS reference system is presented that gives radiosonde evaluators a very low cost, highly accurate GPS reference for use in validating GPS data. The accuracy of the proposed GPS reference system depends on several key features including an improved GPS receiver on the GPS reference, and software. The proposed approach takes into account the improved performance of the GPS receivers along with software algorithms in coming up with positional accuracies of +/- 1 meter.

The GPS reference proposed would use existing systems that the National Weather Service as well as other users of radiosonde processing systems is familiar with along with newly developed hardware and software.

### **SUMMARY OF ANTICIPATED RESULTS:**

The anticipated results of this work will determine the optimal GPS system in both cost and precision and will present analysis that shows the desired accuracies required. There will also be analysis that estimates how this GPS reference will be applicable in other areas.

## FY 2009 PHASE I AWARD WINNER

FIRM: Physical Sciences, Inc.  
20 New England Business Center  
Andover, MA 01810-1077

AWARD: \$94,962

PHONE: 978-689-0003  
FAX: 978-689-3232  
E-MAIL: sonnenfroh@psicorp.com

PRINCIPAL INVESTIGATOR: David Sonnenfroh, Principal Research  
Scientist

TITLE OF PROJECT: Near-IR Differential Absorption Lidar for  
Automated Water Vapor Profiling

SUBTOPIC NUMBER: 8.3.2W

### TECHNICAL ABSTRACT:

Measurement of vertical profiles of H<sub>2</sub>O vapor density in the troposphere can provide new understanding of H<sub>2</sub>O vapor mass transport. Increased density of such measurements can improve predictive capability for precipitation in meteorology and can increase our understanding of feedback mechanisms involving the interaction of H<sub>2</sub>O vapor, radiative balance and precipitation that are important in global climate change modeling. While techniques exist to measure these vertical profiles, there is still a need for a compact, economical, and automated sensor that can make these measurements around the clock. Physical Sciences, Inc. proposes to develop and demonstrate a compact lidar for these measurements using newly available tunable diode laser seeded fiber amplifiers operating in the near-infrared (1-2  $\mu\text{m}$ ).

### SUMMARY OF ANTICIPATED RESULTS:

The Phase I program will develop the sensor design and demonstration plan. A prototype near-IR Lidar will be fabricated and demonstrated in Phase II. Upon successful field demonstration, the compact, automated differential absorption lidar could be adapted for remotely sensing other trace gases with commercial applications in homeland defense, law enforcement, and environmental monitoring and compliance.

## FY 2009 PHASE I AWARD WINNER

FIRM: Bennett Aerospace, LLC  
2054 Kildaire Farm Road, #181  
Cary, NC 27518-6614

AWARD: \$95,000

PHONE: 919-810-8509  
FAX: 919-256-6686  
E-MAIL: DBennett@BennettAerospace.com

PRINCIPAL INVESTIGATOR: Douglas Bennett, CEO

TITLE OF PROJECT: Ground-Based Water Vapor Profiling Lidar

SUBTOPIC NUMBER: 8.3.2W

### TECHNICAL ABSTRACT:

The vertical water vapor profile into the atmosphere is measured around the world using balloon-borne radiosondes that take measurements twice a day when the balloons are launched. The objective of this proposal is to establish the feasibility of measuring the amount of water vapor vertically, in the atmosphere as a function of altitude using a Light Detection and Ranging (lidar) operating in the eye-safe spectral region. The system would have to set in place to operate autonomously, relaying data back to a central collection database.

We will analyze lidars using the Raman technique, differential absorption lidar (DIAL), and optical parametric oscillators (OPOs). We will arrive at an optimized solution space that will define the characteristics and behavior of the Bennett Aerospace Water Vapor Profiler system (WaV-Pro<sup>TM</sup>). WaV-Pro<sup>TM</sup> will be developed and commercialized over three program phases with the goal of dramatically increasing the amount of data for water vapor profiling.

### SUMMARY OF ANTICIPATED RESULTS:

The WaV-Pro<sup>TM</sup> system would dramatically increase the amount of data collected – far beyond what is available today using radiosondes, and at a lower cost. The benefits could be enormous. The spatial and temporal resolution of such a system could enable significant breakthroughs in atmospheric science. The data will be gathered 24/7, autonomously, with a large mean time between failures to minimize cost and maximize data collection.

## FY 2009 PHASE I AWARD WINNER

FIRM: FreEnt Technologies  
P.O. Box 22463  
Huntsville, AL 35814-2463

AWARD: \$94,968.39

PHONE: 256-651-5673  
FAX: 866-228-0854  
E-MAIL: huf2000@aol.com

PRINCIPAL INVESTIGATOR: Herbert U. Fluhler

TITLE OF PROJECT: A Superior Lower-Cost Dual-Polarized  
MPAR Array Antenna

SUBTOPIC NUMBER: 8.3.3R

### TECHNICAL ABSTRACT:

FreEnt proposes a next generation low cost, dual-polarization Ultra-Wide Band (UWB) Connected Array antenna for MPAR. The new array supports both weather surveillance and surveillance with pristine cross polarization performance. Key attributes are low cost COTS, complete frequency and waveform flexibility, and pristine polarization performance and isolation with the following benefits:

- Pristine Polarization Diversity – Designed with both H and V polarizations. Laboratory measurements indicate current crosspol port isolation better than -35 dB.
- Low Cost – The design eliminates supporting components such as impedance transformers, baluns, circulators, etc., and reduces the number of phase shifters significantly. This will result in reduced size and cost savings.
- Unlimited Bandwidth Without Dispersion – Our array is limited only by physical size of the array for low frequency cutoff and by the closest manufactured element spacing for high frequency cutoff. Thus any in-band frequency and waveform is supported.

### SUMMARY OF ANTICIPATED RESULTS:

Providing outstanding cross polarization isolation between channels and producing pristine polarization beams. Axial ratio does change with scan angle, but this is a known function that can be calibrated out of the system because the cross polarization isolation is still exceptional.

## FY 2009 PHASE II AWARD WINNER

FIRM: Intelligent Optical Systems, Inc.  
2520 W. 237<sup>th</sup> Street  
Torrance, CA 90505-5217

AWARD: \$399,995

PHONE: 424-263-6346  
FAX: 310-530-7417  
E-MAIL: sbirproposals@intopsys.com

PRINCIPAL INVESTIGATOR: Indu Saxena, Senior Scientist

TITLE OF PROJECT: High Fidelity, Low Power, Omnidirectional Hydrophone

SUBTOPIC NUMBER: 8.1.3R

### TECHNICAL ABSTRACT:

There is a need to advance the state of the art low power, portable autonomous underwater hydrophones for recording fish spawning calls and other marine acoustics. Affordable and reliable autonomous underwater vehicle (AUV) mountable hydrophones that can detect such signals in the presence of AUV motor noise are required. A system that includes software to automatically determine fish size, type, and location would be extremely useful for monitoring fish populations, and for helping to understand the effects of climatic and environmental changes. Current underwater monitoring systems are presently prohibitively expensive, and have long-term reliability issues because the electronic acoustic sensors, and their associated metallic conduits, are intrinsically prone to degradation from salt water. In Phase I, Intelligent Optical Systems, Inc. (IOS) demonstrated the feasibility of developing a fiber optic-based hydrophone sensor head consuming low power, and offering a high signal-to-noise ratio in the frequency range desired for monitoring marine acoustics. In Phase II, IOS proposes to design, develop, and test an AUV-mountable, low power, battery operated high fidelity, omnidirectional hydrophone that will provide high sensitivity and reliability at depths down to ~1000m, and high SNR in the frequency range desired for fish acoustic monitoring.

### SUMMARY OF ANTICIPATED RESULTS:

IOS's AUV-mountable omnidirectional hydrophone system will enable marine life to be monitored more effectively and efficiently and for longer periods, at potentially lower costs than current monitoring methods.

## FY 2009 PHASE II AWARD WINNER

FIRM: Techshot, Inc.  
7200 Highway 150  
Greenville, IN 47124-9515

AWARD: \$399,973

PHONE: 812-923-9591 x242  
FAX: 812-923-9598  
E-MAIL: ptodd@techshot.com

PRINCIPAL INVESTIGATOR: Dr. Paul Todd, Chief Scientist

TITLE OF PROJECT: High Pressure Specimen Chamber (HPSC)

SUBTOPIC NUMBER: 8.1.4R

### TECHNICAL ABSTRACT:

Even today as a highly technical and advanced world civilization, the physiology of deep sea fish and invertebrates continues to remain mysterious and poorly known. Past specimen containers fail to either have the size or volume needed or lack the robustness for high pressure containment of in many cases, lack the repeatability necessary to ensure a reasonable lifetime of continuous use. The Techshot solution for a High Pressure Specimen Chamber is a solid design incorporating modern materials, innovative hatch and containment features with a unique adjustable pressure compensator for specimen collection down to 2000 meters. The Techshot High Pressure Specimen Chamber is an intuitive, user-friendly system allowing for easy pre and post containment operation by human and remotely operated vehicles alike. Techshot's experience developing specimen enclosures for harsh environments permeates this simplistic yet highly innovative High Pressure Specimen Chamber.

### SUMMARY OF ANTICIPATED RESULTS:

Techshot anticipates upon completion of the Phase II design effort the High Pressure Specimen Chamber will be ready for qualification and immediate use in the field. This robust high pressure specimen chamber will have a long and useful life retrieving live specimens from depths up to 2000 meters.



## FY 2009 PHASE II AWARD WINNER

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

AWARD: \$299,986

PHONE: 781-529-0505  
FAX: 781-893-6470  
E-MAIL: jkosek@ginerinc.com

PRINCIPAL INVESTIGATOR: Dr. John A. Kosek

TITLE OF PROJECT: A Miniaturized Carbon Dioxide Detector

SUBTOPIC NUMBER: 8.1.9SG

### TECHNICAL ABSTRACT:

NOAA supports over 25,000 underwater dive programs per year. To increase the duration and depth of these dives, the use of closed circuit mixed gas rebreathers (CCRs) is being considered. As there currently are no sensors to detect CO<sub>2</sub> levels in the breathing gas, Giner, Inc. proposes to continue development of an electrochemical CO<sub>2</sub> sensor for CCR use. The technical innovation is the use of a reversible CO<sub>2</sub> sensing electrode in a solid-polymer electrolyte configuration. The overall objective of the proposed Phase II program is to continue development of a miniaturized, novel, solid state, inexpensive thick-film electrochemical sensor that can selectively and accurately detect CO<sub>2</sub> over the range 0.5 to 5% surface equivalent to quantify CO<sub>2</sub> levels in a closed circuit mixed gas rebreather. The program goal is to fabricate and deliver a complete sensor system that will detect both O<sub>2</sub> and CO<sub>2</sub> in the recirculated gas stream. The CO<sub>2</sub> sensor will accurately monitor up to 5% CO<sub>2</sub> in real time. Our approach to develop the proposed CO<sub>2</sub> sensor will be to the continued development of a unique sensing electrode that is specific to CO<sub>2</sub>.

### SUMMARY OF ANTICIPATED RESULTS:

At the end of the program we will have fabricated a complete CO<sub>2</sub> sensor based on thick-film technology. The CO<sub>2</sub> sensor will be integrated into a complete sensor array that will be demonstrated in a closed circuit mixed gas rebreather assembly. Thick-film sensor calibration intervals and regeneration techniques will have been identified.

## FY 2009 PHASE II AWARD WINNER

FIRM: Applied Mathematics, Inc.  
1622 Route 12  
P.O. Box 637  
Gales Ferry, CT 06335-0637

AWARD: \$400,000

PHONE: 860-464-7259  
FAX: 860-464-6036  
E-MAIL: tew@applmath.com

PRINCIPAL INVESTIGATOR: Thomas E. Wood, Computer Scientist

TITLE OF PROJECT: Acoustic Propagation Analysis Program  
for Marine Scientists

SUBTOPIC NUMBER: 8.1.9F

### TECHNICAL ABSTRACT:

The goal of the Phase II project is to develop a prototype of the Marine Acoustic Propagation System (MAPS). MAPS is a computer system designed in a client-server architecture that provides NOAA marine scientists, who do not have an extensive background in underwater acoustics, with a tool that selects the appropriate acoustic model for estimating underwater propagation loss for anthropogenic noise sources. The prototype system will allow a marine scientist to specify the characteristics of an anthropogenic noise source and the environment in which it will occur through a client computer program. The information entered into the client program will then be sent to a server which will select the appropriate acoustic propagation loss model, and run the required calculations. The propagation loss calculation results will then be sent back to the client program which will allow the marine scientist to view and analyze the results. The development of the prototype system requires obtaining and implementing the propagation loss models and associated databases, developing the MAPS concept of operations, developing and testing computer software for both the client and server computers and demonstrating the system for the program sponsor.

### SUMMARY OF ANTICIPATED RESULTS:

The anticipated results for the Phase II project include the implementation of Navy standard acoustic models and databases on a computer system that will allow for the calculation of underwater acoustic propagation loss; the development of client and server software for a prototype MAPS system; and develop the requirements for a Phase III MAPS system.

## **FY 2009 PHASE II AWARD WINNER**

**FIRM:** HLS Research, Inc.  
3366 N. Torrey Pines Court  
Suite 310  
La Jolla, CA 92037-1025

**AWARD:** \$396,957

**PHONE:** 858-457-0800 x101  
**FAX:** 858-457-0811  
**E-MAIL:** Mike.Porter@hlsresearch.com

**PRINCIPAL INVESTIGATOR:** Michael Porter, President and CEO

**TITLE OF PROJECT:** A Simplified Sound Propagation Tool

**SUBTOPIC NUMBER:** 8.1.9F

### **TECHNICAL ABSTRACT:**

In recent years, there has been increasing concern about the role of man-made sound on the marine environment. For this effort, we propose developing an intuitive software interface for sound propagation modeling. This will be based on software developed at HLS Research, Inc. for similar applications. The software will use existing propagation modeling codes that have a long history in the underwater acoustics community. Due to the complex nature of the ocean environment and the disparate types of sound sources and marine life, the software requires a suite of underwater acoustic source and propagation models. The interface will embody a seemingly simplistic and guided approach to enable a user without highly specialized knowledge to select appropriate model inputs in order to attain meaningful received level metrics. GUI based software tools will be provided to easily manipulate the results for visual representation or for distillation into text-based parameters for risk assessment.

### **SUMMARY OF ANTICIPATED RESULTS:**

Software for evaluation by NOAA and a final report summarizing Phase II results.

## FY 2009 PHASE II AWARD WINNER

FIRM: Ocean Farm Technologies, Inc.  
114 Higgins Road N.  
Searsmont, ME 04973-9712

AWARD: \$299,998

PHONE: 207-322-43221  
FAX: 207-433-1300  
E-MAIL: spage@oceanfarmtech.com

PRINCIPAL INVESTIGATOR: Stephen H. Page, President and CEO

TITLE OF PROJECT: Wave Energy Conversion to Power Offshore  
Aquaculture Operations

SUBTOPIC NUMBER: 8.1.14SG

### TECHNICAL ABSTRACT:

Ocean Farm Technologies, Inc. (OFT) proposes to continue investigating using ocean wave energy in the form of compressed air to power open ocean aquaculture operations. In Phase I, OPT designed, built and began testing an affordable and efficient wave energy converter (WEC) that generated and stored compressed air. In Phase II OFT will demonstrate using compressed air from an improved WEC design to provide operational power for remote buoyancy and rotation control on Aquapod™ net pens. The prototype "AirWEC" produced during Phase II will be lighter, more durable, and less expensive than the Phase I model based on the substantial experience gained from the feasibility study. Successful completion of Phase II will produce enough performance data to determine economic viability of this innovative technology and the potential size of its market. OFT intends to commercialize the resulting technology to enhance the performance of its Aquapod system and market the Air compression Wave Energy Converter (AirWEC) system in the broader open ocean aquaculture sector globally.

### SUMMARY OF ANTICIPATED RESULTS:

OFT expects to demonstrate that safe, inexpensive and clean energy generated locally from a wave energy converter will provide ample energy for open ocean aquaculture farms. This will improve the economic viability of open ocean fish farming and help hasten the growth of this promising industry sector. The technologies to be developed under this project have the added benefit of contributing to fish health management by eliminating above- and under-water noise pollution and toxic fossil fuels.

## FY 2009 PHASE II AWARD WINNER

FIRM: Riverside Technology, Inc.  
2290 E. Prospect Road, Suite 1  
Fort Collins, CO 80525

AWARD: \$396,318.87

PHONE: 970-484-7573  
FAX: 970-484-7593  
E-MAIL: Jay.Day@riverside.com

PRINCIPAL INVESTIGATOR: Dr. Gerald N. Day, Director, Operations

TITLE OF PROJECT: A Web-based Climate Change Drought  
Decision Support System (C2D2S2)

SUBTOPIC NUMBER: 8.2.3C

### TECHNICAL ABSTRACT:

In Phase I, we identified the need for a readily accessible web-based framework that integrates a credible hydrologic model with climate change and forecast products for hydrological impact studies and water supply projections. The focus in developing the Phase I Climate Change Drought Decision Support System (C2D2S2) prototype was to develop an infrastructure that addresses the critical decision needs of water managers, and supports: i) selecting a climate change emissions scenario, a particular GACMA simulation, and an associated downscaled dataset; ii) executing a hydrologic model to simulate projected basin streamflow; and iii) producing displays that enable users to assess and compare results. The Phase II proposal identifies key scientific and technical objectives that must be accomplished to make C2D2S2 operational with commercial potential. These objectives include: evaluations and meeting customer needs, upgrading the hardware/software system to be operational, including additional hydrologic models, providing tools for drought analysis, providing an interface to external river basin models, providing data and information from different downscaling methods, providing tools for display and analysis of paleohydrology data, providing tools for assessment of uncertainty in the results, and providing outreach to ensure that appropriate science is included and that user requirements are met.

### SUMMARY OF ANTICIPATED RESULTS:

Phase II will produce a commercially viable C2D2S2 that provides an infrastructure for water users to make informed decisions by comparing GCM and downscaled datasets, selecting scenarios, executing hydrologic models, performing analyses, and exporting results.

## FY 2009 PHASE II AWARD WINNER

FIRM: Airborne Technologies, Inc.  
4338 N. Gunflint Trail  
Wasilla, AK 99654-9217

AWARD: \$399,997.26

PHONE: 907-357-1500  
FAX: 907-357-1501  
E-MAIL: tveenstra@atiak.com

PRINCIPAL INVESTIGATOR: Timothy S. Veenstra, President

TITLE OF PROJECT: Vessel Launched Unmanned Aircraft System  
for Marine Debris Detection and Tracking

SUBTOPIC NUMBER: 8.4.3D

### TECHNICAL ABSTRACT:

Airborne Technologies, Inc. Phase II effort will be to build and demonstrate a low-cost marinized Unmanned Aircraft System (UAS) that can be operated easily from small or large vessels and is capable of reliable and repeatable operations in an ocean environment. The UAS will be utilized for the detecting and tracking of marine debris, sea-life or other objects in the open ocean. The system includes a small UAS deployable buoy that will communicate its GPS position back to the vessel via a satellite communication network. Using anomaly detection software designed under this project, the UAS will locate items in the water and either autonomously or through remote operator input, mark the location of the anomaly by deploying a tracking buoy. A number of imaging sensors will be tested and evaluated for effectiveness in open ocean detection of various targets, both biological and anthropogenic. The data can be processed or stored either onboard the aircraft or transmitted back to the vessel. The complete system will be robust and designed with simple user interaction in mind; it will be portable, adaptable and scalable to a variety of vessels and applications.

### SUMMARY OF ANTICIPATED RESULTS:

NOAA will have an operational small UAS that will be adaptable to a variety of vessels and missions and will be a solid platform for future development work. ATI will market the UAS and sub-systems to meet the needs of other potential customers and will continue to advance the UAS through internal research and development.