SBIR

Small Business Innovation Research Program

ABSTRACTS OF PHASE I AWARDS FOR FISCAL YEAR 2011

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

INTRODUCTION

The Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), through the Small Business Innovation Research (SBIR) program, awarded 10 Phase I contracts for FY 2011. These awards are up to $95,000 each, and totaling approximately $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 2011 (NOAA 2011-1)." 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 7 Phase II contracts in FY 2011 for a total of approximately $2.5 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 169 proposals were received by DOC/NOAA in response to its FY 2011 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, only 10 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 2011 PHASE I AWARD WINNER

FIRM:	Sonalysts, Inc. 215 Parkway North P.O. Box 280 Waterford, CT 06385-1209
AWARD:	$95,000
PHONE:	860-326-3621
FAX:	860-326-3748
E-MAIL:	bailey_m@sonalysts.com
PRINCIPAL INVESTIGATOR:	Margaret Bailey, VP Software Development

TITLE OF PROJECT:	Automated Detection of Whale Blows in Infrared Video
SUBTOPIC NUMBER:	8.1.6F

TECHNICAL ABSTRACT:

The gray whale migration generates many hours of video that must be examined carefully to identify passing whales and get an accurate count of their numbers. Unfortunately, humans lack the necessary attention span. To solve this problem, a detector will be developed that can process hours of video, detecting whale blows while minimizing false positives and negatives. With an accurate record of the time and position of whale blows, it is possible to calculate the numbers of animals in each group, their average swimming speed, and, in the longer view, to measure the species abundance. Sonalysts, along with the University of Dayton's School of Engineering and Whale Acoustics, will design a software architecture that encourages the loose coupling of pluggable components for: input processing of sensor streams, analysis algorithms, visualization systems, and storage components to support the workflow of whale population monitoring. This solution will draw upon our research-grade Heuristic Intelligent Storage System, a distributed, intelligent, large stream data ingest, data mining and storage system. This framework, coupled with image processing algorithms and whale population density estimation expertise, will define a video processing system that will produce more accurate results with less labor.

SUMMARY OF ANTICIPATED RESULTS:

The resulting Robust Analysis and Processing of ISR Data (RAPID) system will benefit whale population monitoring efforts by automating the video and statistical analysis. RAPID will make use of existing algorithms, ingestion systems, and visualization systems while providing a framework for new systems and algorithms to plug into to add processing capability. Utilizing the system for whale avoidance on large ships would benefit surface navies and the commercial shipping industry. RAPID will benefit operators of large sensor grids, including the DoD, DHS, Border Security, and private security firms.

FY 2011 PHASE I AWARD WINNER

FIRM:	PCCI, Inc. 300 North Lee Street, Suite 201 Alexandria, VA 22314-2640
AWARD:	$95,000
PHONE:	703-229-1108
FAX:	703-684-5343
E-MAIL:	rloesch@pccii.com
PRINCIPAL INVESTIGATOR:	Robert M. Loesch, P.E., Senior Engineer III

TITLE OF PROJECT: Compact and portable Hyperlite Multi-Occupant Hyperbaric Chamber

SUBTOPIC NUMBER: 8.1.3N,R

TECHNICAL ABSTRACT:

PCCI, Inc. has partnered with SOS Hyperlite, Ltd.; the original developer and sole manufacturer of the Hyperlite Emergency Evacuation Hyperbaric Stretcher (EEHS), the only non-metallic hyperbaric chamber currently constructed in accordance with ASME PVHO-1 for Human Occupancy and meeting U.S. Navy Diving and Hyperbaric Systems Safety Certification. This partnership was originally formed in 2002 to manufacture and market a Government version of the EEHS. Since that time, the technology utilized on the EEHS has been upgraded to improve durability and manufacturing has shifted to the United States. The PCCI team now proposes to demonstrate the technical feasibility of extending the single occupancy EEHS technology to develop a two or three occupant, double-lock folding hyperbaric chamber meeting the SBIR subtopic technical requirements. This new compact, portable and light-weight chamber will allow the transfer of medics in and out at any time, to perform full hands-on medical care and treatment for even the most critically ill patients, while delivering hyperbaric oxygen, the treatment of choice for diving related pressure injuries. This Phase I effort will focus on the engineering to demonstrate the technical feasibility of manufacturing an ASME PVHO-1, and Case 12, compliant chamber capable of compressing occupants to 60 feet depth.

SUMMARY OF ANTICIPATED RESULTS:

In Phase I, the PCI team will prepare a 35% design package for use in Phase II. The 35% design package will document the engineering of a large diameter hyperlite unit suitable for the treatment of an unconscious patient by a medic, or for the treatment of two patients simultaneously. Documentation will include specification of a suitable tensile braid and AutoCAD drawings of a large diameter window and door assembly, end dome assemblies, protection ring seating system, and transportation and packaging case.

FY 2011 PHASE I AWARD WINNER

FIRM:	Prescient Weather, Ltd. 200 Innovation Blvd., Suite 257 State College, PA 16803-6602
AWARD:	$94,969
PHONE:	814-466-2331
FAX:	814-234-5869
E-MAIL:	john.dutton@prescientweather.com
PRINCIPAL INVESTIGATOR:	John A. Dutton, President

TITLE OF PROJECT:	Client-Centered Calibration of the NOAA Climate Forecast System
SUBTOPIC NUMBER:	8.2.1C

TECHNICAL ABSTRACT:

Prescient Weather proposes four Phase I tasks to increase the value of the new NOAA Climate Forecast System to commercial customers. The capabilities demonstrated and explored in Phase I will be developed and integrated in Phase II as components of a new Seasonal Information and Decision Support System (SIDSS) for our World Climate Service customers. The Phase I tasks are:

- Improve season forecast calibration with a new climate-conserving calibration algorithm that produces relatively flat rank probability diagrams;
- Convert calibrated forecasts of meteorological variables into forecasts of impact and decision variables such as degree days or wind power availability'
- Explore calibration of two-to-four week forecasts with conditioning on expected flow patterns;
- Explore the potential of model output statistics (MOS) to calibrate and improve weekly and monthly forecasts of seasonal variability.

Several of the tasks will explore the use of principal component methods to project forecasts on the historical verification data and to define flow regimes for conditional calibration.

The SIDSS development in Phase II will focus on the client decision context, present historical and predicted information including numerical and analog forecast, and facilitate client development of individualized forecasts. It is a key part of our commercialization strategy.

SUMMARY OF ANTICIPATED RESULTS:

Client-centered calibration of the new NOAA Climate Forecast System will improve the skill and reliability of the forecasts on the scale of weeks and months thus enhancing their value to a wide range of activities impacted by weather or climate. A focus on the client decision context with a Seasonal Information and Decision Support System (SIDSS) to present the calibrated forecasts will further increase their commercial value

FY 2011 PHASE I AWARD WINNER

FIRM:	Hyperion Technology Group, Inc.
AWARD:	$94,896.16
PHONE:	662-823-0601
FAX:	662-823-0501
E-MAIL:	gcarter@hyperiontechgroup.com
PRINCIPAL INVESTIGATOR:	Geoffrey E. Carter, P.E., President

TITLE OF PROJECT: Multi-Modal Sensor with Real-Time Telemetry For Storm Surge and Other Meteorological Measurements

SUBTOPIC NUMBER: 8.3.6N

TECHNICAL ABSTRACT:

Storm surge poses a grave threat to both life and property as hurricanes make landfall. The ability to monitor surge in real-time using a densely-space network of sensors with integrated data recording and telemetry would provide NOAA with a unique capability. Our approach is to offer a system which incorporates a flexible multi-modal data acquisition platform with integrated telemetry for real-time control and monitoring. The sensors will be designed for densely-spaced non-permanent deployments onshore in regions of interest in advance of hurricanes. The system will be very low power, hardened for extremely severe conditions, and capable of being installed quickly with minimal training or specialized expertise. This sensor platform will support the measurement of surge level, barometric pressure, temperature, humidity, and anemometry. Additional sensor modules could be developed in future phases of research and connected to the system controller via a standardized serial data bus. A GPS receiver will be used to provide real-time geolocation and temporal alignment of the sampled data. Both cellular-modems and satellite-based will be used for telemetry and control.

SUMMARY OF ANTICIPATED RESULTS:

This sensor technology would provide the government with an enhanced capability for the real-time collection of surge level and other meteorological data in severe weather events. This information could be quickly disseminated to support the various levels of NWS forecasting, FEMA emergency responders, and damage assessment teams. This sensor would also be applicable to the measurement of environmental conditions in response to man-caused disasters or other national emergencies. It may also be marketed as a decision support tool for state and local governments in flood plain regions, a data gathering device for academic research laboratories, and a disaster assessment tool supported by the insurance industry.

FY 2011 PHASE I AWARD WINNER

FIRM:	Salo IT Solutions, Inc. 1313 5th Street SE, Mail Unit 86 Minneapolis, MN 55414-4504
AWARD:	$94,428.18
PHONE:	612-605-6896
E-MAIL:	salo@saloits.com
PRINCIPAL INVESTIGATOR:	Timothy J. Salo, President

TITLE OF PROJECT:	Wide-area Environmental Sensing and alerTing networks (WESTnets)
SUBTOPIC NUMBER:	8.4.1W

TECHNICAL ABSTRACT:

Salo IT Solutions, Inc. will design and implement the Wide-area, Environmental Sensing and alterTing network (WESTnet) protocols, a next-generation suite of wireless network protocols that will provide enhanced services for hydrologic warning systems and other large-scale, wide-area environmental monitoring activities. The WESTnet protocols will offer significant functionality over that available with the existing solutions; they will also provide an upgrade for both the original ALERT protocol, which is widely deployed in hydrologic warning systems, and the more recent ALERT2 protocols. They will provide two-way communications, which will enable hydrologic warning systems to remotely control devices such as distant warning sirens, as well as manage nodes remotely. The WESTnet protocols can coexist with the ALERT protocol or the ALERT2 network. Perhaps more importantly, the WESTnet protocols will permit shared networks to be deployed that support both near-real-time hydrologic warning and non-real-time environmental monitoring, such as water quality monitoring. These shared networks may permit costs to be shared between, for example, a hydrologic warning system and an environmental monitoring system that covers the same geographical area.

SUMMARY OF ANTICIPATED RESULTS:

This Phase I project will develop, test and evaluate a proof-of-concept (POC) software implementation of the WESTnet protocols. This POC software will demonstrate the feasibility of a Phase II project that uses a commodity computer running the Linux operating system as the hardware and software platform upon which a successful WESTnet product can be built.

FY 2011 PHASE I AWARD WINNER

FIRM:	Remote Sensing Solutions, Inc. 3179 Main Street Unit #3, P.O. Box 1092 Barnstable, MA 02630
AWARD:	$94,888.07
PHONE:	508-362-9400
FAX:	508-519-9175
E-MAIL:	carswell@remotesensingsolutions.com
PRINCIPAL INVESTIGATOR:	James R. Carswell, Ph.D., President

TITLE OF PROJECT:	A Single Aperture Dual-Wavelength Dual-Polarized Antenna for AWRAP
SUBTOPIC NUMBER:	8.3.4D

TECHNICAL ABSTRACT:

Severe weather impacts our daily lives, society and nation's economy. From an average of $10B (2005 dollars) annual loss due to tropical cyclones since 1900 to $200B in the commercial shipping industry that is threatened by severe ocean storms to the hundreds of lives and assets being lost in the $20B recreational boating industry. In these cases and many more, accurate now-casting and forecasting could prevent these losses and reduce risks. Key observation to improve our knowledge of the weather is the ocean vector wind. NOAA is embarking on an ambitious but needed effort to launch a new satellite-based instrument called the Dual Frequency Scatterometer (DFS) that will provide accurate global mapping of the ocean vector wind in a timely manner. The Advance Wind and Rain Airborne Profiler (AWRAP) can play a pivotal role for this mission by providing critical measurements to improve the geophysical model function that DFS will relay to estimate the winds. However, AWRAP requires a novel antenna to collect dual polarized, dual wavelength measurements. This proposed Phase I study will develop a single aperture, narrow beam C/Ku-band polarimetric antenna for AWRAP that will enable the acquisition of the necessary measurements from the NOAA WP-3D aircraft.

SUMMARY OF ANTICIPATED RESULTS:

The Phase I and II effort will result in the development of a low profile, single aperture, dual wavelength, dual polarized antenna. Using a hybrid design approach, C and Ku-band radiating elements that support vertical and horizontal polarization will be interleaved to efficiency utilize the available aperture. With this antenna, the AWRAP system can be significantly reduced in size and its sensitivity greatly enhanced. This new system can provide the weather reconnaissance, forecaster and weather modeling communities with a powerful new tool that can map the atmospheric and ocean vector winds and precipitation. This system can also provide a high resolution, all weather mapping system for search and rescue operations and hazard mitigation operations such as open ocean oil spills.

FY 2011 PHASE I AWARD WINNER

FIRM:	Hyper Sensing, LLC 14 La Pointe Terrace Madison, WI 53719
AWARD:	$94,946
PHONE:	608-628-2468
FAX:	608-836-8252
E-MAIL:	ah7117@gmail.com
PRINCIPAL INVESTIGATOR:	Allen Huang, Principal Scientist

TITLE OF PROJECT:	Development of a GPU-Based High-Performance Community Radiative Transfer Model
SUBTOPIC NUMBER:	8.3.5D

TECHNICAL ABSTRACT:

Computation of the radiative transfer model for a hyperspectral sounder with thousands of spectral channels is very time-consuming. Consequently, operational data assimilation systems can assimilate only a few hundred channels. The radiative transfer model is very suitable for GPU implementation to take advantage of GPU massively parallel computing capability, where radiances at various channels can be calculated simultaneously. Our recent paper demonstrated that a GPU-based radiative transfer model for the IASI sounder with 8461 channels could be 1523x faster than its original single-threaded CPU version. It means that one day's amount of 1,296,000 IASI spectra can be calculated within 15 minutes on a low-cost GPU computer, whereas the original CPU code would take more than 15 days in the host PC. The innovation of this work is our development of heterogeneous pipelining and asynchronous transfer between CPUs and GPUs for the significant speedup.

Inspired by this success, we propose to develop a GPU-based high-performance Community Radiative Transfer Modeling (CRTM) for NOAA. During Phase 1, we will demonstrate the feasibility of further enhancing our GPU techniques to allow simultaneous computation of multiple hyperspectral radiance spectra on GPUs. We expect to double the speedup (~3000x) for use in data assimilation and atmospheric soundings.

FY 2011 PHASE I AWARD WINNER

FIRM:	Toyon Research Corporation 6800 Cortona Drive Goleta, CA 93117-3021
AWARD:	$95,000
PHONE:	805-968-6787
FAX:	805-685-8089
E-MAIL:	ksullivan@toyon.com
PRINCIPAL INVESTIGATOR:	Kevin J. Sullivan, Vice President & Senior Scientist

TITLE OF PROJECT: Program for Estimating Whale Migration Statistics

SUBTOPIC NUMBER: 8.1.6F

TECHNICAL ABSTRACT:

Toyon proposes to develop software that can process infrared video streams to automatically detect gray whale blows. Additionally, the software will count the number of blows and estimate the speed and the number of whales that are present. We will make use of a novel technique for whale blow detection that Toyon has demonstrated on infrared video of humpback whales. The approach makes use of both the spatial and temporal characteristics of the whale blow to effectively detect it without large numbers of false alarms. In order to estimate the speed and number of whales, we will use a particle filter. We will prove the feasibility of our algorithms in Phase I by processing video supplied by the government and video collected by Toyon at a nearby gray whale migration route. We propose to work with the Gray Whales Count organization, whose whale counting site is located within five miles of Toyon, and/or other organizations specified by the government to collect infrared video of migrating whales and to compare our results with the results collected by trained humans.

SUMMARY OF ANTICIPATED RESULTS:

The successful completion of this work will result in the creation of software that can automatically detect whales in infrared video. This has great utility for biologists that seek to collect whale data. Additionally, this technology can be used to detect whales in danger of being struck by large boats and ships, cueing an alarm that can be used to avoid collision.

FY 2011 PHASE I AWARD WINNER

FIRM:	Dynaflow, Inc. 10621-J Iron Bridge Road Jessup, MD 20794-9381
AWARD:	$95,000
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E-MAIL:	gregl@dynaflow-inc.com
PRINCIPAL INVESTIGATOR:	Gregory Loraine, Ph.D., Senior Research Scientist

TITLE OF PROJECT:	Extraction of Bioproducts from Algae in Water using Cavitating Jets
SUBTOPIC NUMBER:	8.1.2SG

TECHNICAL ABSTRACT:

One of the most promising biomass sources for fuels and other feedstocks is photosynthetic algae. Algae can produce lipids, proteins, and other compounds, and can be grown in salt water. Current production practices rely on expensive means of harvesting, concentrating, and extracting the algae. This makes the “bio-crude” produced by algae more expensive than petroleum. Recovering the cellular contents of the algae directly from the growth media would reduce production costs and improve profitability. This proposal is to develop a method for lysing the algae and recovering the bio-crude without pre-concentrating or dewatering.

Hydrodynamic cavitation using submerged jets uses fluid shear flow to create high pressure fluctuations in the shear layer to cause bubbles to grow and collapse using a fraction of the energy required for ultrasonic cavitation. Cavitation has been shown to have the capability to rupture algal cell membranes and release the cell contents. Cavitating jets also create clouds of fine bubbles that can attach to lipids in the water and lift them to the surface. By controlling the creation and collection of the resulting foam the lipids can be concentrated and recovered from the growth media with minimal energy input.

SUMMARY OF ANTICIPATED RESULTS:

This project will result in a technology that can recover high value cellular materials without having to harvest and concentrate the algae prior to extraction. This method will recover lipids and other bio-products directly from the growth tanks. This will greatly increase the profitability of biofuel production from algae. It can also be applied with other biotechnologies.

FY 2011 PHASE I AWARD WINNER

FIRM:	Peregrine Power, LLC 27350 SW 95th Avenue, Suite 3022 Wilsonville, OR 97070-7709
AWARD:	$94,945
PHONE:	503-682-7001
FAX:	503-682-6014
E-MAIL:	dmarckx@peregrinepower.com
PRINCIPAL INVESTIGATOR:	Dallas Marckx, Managing Member (CEO)
TITLE OF PROJECT:	Wave Energy Harvesting System
SUBTOPIC NUMBER:	8.1.2SG

TECHNICAL ABSTRACT:

The applicant will develop a wave energy harvesting system for NOAA buoys. It will ve entirely self-contained (no protruding elements), modular, scalable, and easily deployed. The system employs a unique, inertial mechanism that responds to acceleration forces created by waves. This mechanism will be combined with (1) a proprietary generator that is sensitive to very low levels of torque and has essentially no cogging torque to overcome, and (2) an electronic power conditioning and management subsystem, which can receive erratic power from intermittent water movement and produce regulated DC for charging batteries or other uses.

SUMMARY OF ANTICIPATED RESULTS:

The result will be that NOAA will have a highly versatile wave energy scavenging system that can be used on many different types of data buoys for charging batteries, thus minimizing the costly requirement of servicing batteries by ship. In addition, the scavenging system can be used by the Navy for military purposes, by the Coast Guard for thousands of navigation buoys and by civilian coastal defense authorities.