SBIR

Small Business Innovation Research Program

ABSTRACTS OF AWARDS FOR FISCAL YEAR 2019 PHASE I

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, has awarded 29 Phase I contracts for FY 2019. These awards are up to $120,000 each totaling approximately $3.4 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 2019." 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 136 proposals were received by DOC/NOAA in response to its FY 2019 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 29 were selected for an award. Final selection was based upon the results of the reviews, and the project's potential for commercialization.

In Phase II, funding is provided for projects that are most promising after Phase I is completed from the previous year. These awards can be for up to $400,000 each and for two years. The DOC/NOAA awarded a total of 17 Phase II contracts in FY 2019 for a total of approximately $6.8 million.

FY 2019 Phase I List of Awardees

Proposal Number	Company Name	Subtopic Number
19-1-003	C Vision AI	9.3.02
19-1-016	Onu Technology	9.4.01
19-1-018	Intellisense Systems	9.6.01
19-1-019	Kitware	9.5.01
19-1-020	ASTRA - Atmospheric and Space Technology Research Associates	9.6.01
19-1-026	Adelphi Technology	9.1.01
19-1-027	Coastal Ocean Vision	9.6.03
19-1-034	Infini-Sea	9.1.03
19-1-038	BJE Environmental Optics	9.6.01
19-1-039	Nalu Scientific	9.6.01
19-1-048	Synthetic Applied Technologies	9.2.02
19-1-052	Texas Research Institute, Austin	9.2.01
19-1-056	Attogene	9.2.03
19-1-058	Wardenclyffe Chemicals	9.2.01
19-1-061	Nanohmics	9.2.03
19-1-065	Computational Physics	9.3.02
19-1-070	Metna	9.2.01
19-1-072	TIAX	9.2.01
19-1-074	Blue Ocean Gear	9.2.04
19-1-075	Lynntech	9.2.02
19-1-080	TCarta Marine	9.6.03
19-1-081	SARA - Scientific Applications & Research Associates	9.5.01
19-1-092	Crab Raft	9.2.04
19-1-096	Black Swift Technologies	9.5.01
19-1-099	Marine Advanced Robotics	9.6.03
19-1-118	Badvr	9.4.01
19-1-128	CFD Research	9.4.01
19-1-130	Charles River Analytics	9.5.01
19-1-132	Prescient Weather	9.3.01

FY 2019 PHASE I AWARD WINNER

FIRM:	C Vision AI, Inc. 81 West Street Medford, MA 02155
AWARD:	$119,501.00
PHONE:	619-933-2085
E-MAIL:	jonathan.takahashi@cvisionai.com
PRINCIPAL INVESTIGATOR (PI):	Jonathan Takahashi
TITLE OF PROJECT:	(Anno)Tator Online: A Web Application for Exploration and Curation of Underwater Video and Imagery
SUBTOPIC NUMBER:	9.3.02

TECHNICAL ABSTRACT:

Using modern web technologies, we will build an application that can be used to explore, enrich, and evaluate the wealth of underwater video and imagery being collected by NOAA and its partners. Existing data portals are primarily for text based or keyword search, and for viewing of existing data, lacking the ability for rich interaction, visualization of metadata, and adding new types of annotations. Similarly, existing annotation tools are not meant to be responsive web clients with lightweight footprints for video playback and image viewing of large corpora of data.

The application, which we have named (Anno)Tator Online, will enable scaleable access to vast amounts of video and imagery assets, as well as the ability to curate subsets based on image searching of rich metadata, algorithm results, or other criteria. This will enable new paradigms of use for existing data that will unlock the benefit of the NOAA mission for a host of public use cases (e.g. building image sets of certain species for school lesson plans). The seamless integration of data curation, annotation, metadata enrichment, and algorithm pipelines make Tator Online a unique tool with invaluable benefits.

SUMMARY OF ANTICIPATED RESULTS:

While the focus of this SBIR is on marine video footage, there is no specific limitation to the content or modality of the media. For instance, aerial or satellite imagery would just as easily fit into this paradigm, or sonar imagery. We expect that there is a large potential for domain hopping of this technology, especially into areas where computer vision and machine learning are progressing at the same pace as in the marine science domain. This technology could reasonable form the base for a variety of commercial offerings.

FY 2019 PHASE I AWARD WINNER

FIRM:	Onu Technology, Inc. 7280 Blue Hill Dr. Suite 10 San Jose, CA 95129
AWARD:	$ 117,499.00
PHONE:	408-714-9253
E-MAIL:	guha@onai.com
PRINCIPAL INVESTIGATOR (PI):	Guha Jayachandran
TITLE OF PROJECT:	Enabling the Rapid Creation of Custom Predictive Models with GOES-16 and NEXRAD Data
SUBTOPIC NUMBER:	9.4.01

TECHNICAL ABSTRACT:

NOAA's Big Data Project (BDP) has made several valuable datasets available on major cloud platforms. While a critical step, many organizations that would benefit from the data are not technologically capable of performing state-of-the-art machine learning. We propose to unlock the power of the data for those who can most benefit by developing technology that automatically trains deep learning models on GOES-16 and NEXRAD data, given a target objective.

We have great expertise in performing large-scale deep learning on rich multimodal data (visual, quantitative, time-based, etc.), including for DARPA and NASA, and we propose to automate this expertise for the benefit of users across a range of industries— starting with agriculture— who can benefit from NOAA data. While cloud providers offer certain machine learning functionalities, there are no solutions in the marketplace targeted at fully unlocking the value of GOES-16 and NEXRAD data for those unfamiliar with big data technologies, let alone for nondevelopers.

SUMMARY OF ANTICIPATED RESULTS:

As an example application, a grower may securely provide data yield from the past several years localized by field, and our proposed technology will automatically determine whether any model (combining satellite imagery and radar over time) can be trained to be predictive of these yields on a localized basis. Similarly, city authorities or developers may utilize the service to gain insight into flood potential or the timing of flooding (or fires). While BDP has made data accessible, our proposed innovation will directly make insights accessible as well. We include explicit support for our proposals from initial target users.

FY 2019 PHASE I AWARD WINNER

FIRM: Intellisense Systems, Inc.
20600 Gramercy Place
Torrance, CA 90501

AWARD: $ 119,988.00

PHONE: 310-320-1827

E-MAIL: pe@intellisenseinc.com

PRINCIPAL INVESTIGATOR (PI): Chris Ulmer

TITLE OF PROJECT: Environmental and Oceanographic Measurement and Data System

SUBTOPIC NUMBER: 9.6.01

TECHNICAL ABSTRACT:

To address the NOAA's need for cost-effective, highly reliable, readily deployable, platform-independent sensors and observing systems, Intellisense Systems, Inc. (ISI) proposes to develop the new Environmental and Oceanographic Measurement and Data (NOMAD) system based on a new design that utilizes previously developed mature components. Specifically, innovations in low-power and ultra-compact size based on pioneering ISI technologies achieve breakthrough size, ease of deployment, modularity, and adaptability to enable a wide range of sensing capabilities without reliance on any existing platform. The data system includes quality control at the sensor level using efficient edge computing, augmented with data management at the network level to directly address NOAA requirements. In Phase I, ISI will demonstrate the feasibility of NOMAD by developing a full prototype reaching TRL-7 and performing real-world testing in the Pacific Ocean. In Phase II, ISI plans to develop additional sensor options and to prepare production tooling and procedures necessary in order to begin the transition of NOMAD towards TRL-9 for qualification testing and full rate production.

SUMMARY OF ANTICIPATED RESULTS:

The NOMAD system benefits NOAA and other agencies by serving as a self-contained hardware sensor product complete with its own communications platform and data processing platform. The platform-independence, low-cost, and small size in turn enable the emplacement of sensors in areas that are currently cost-prohibitive. Beyond immediate NOAA applications, river-drifting applications for the U.S. military, and disaster prevention and recovery applications that require rapid response and quick deployment lend themselves to DHS and FEMA applications. Commercial applications such as security and transportation logistics could benefit from NOMAD's capabilities such as on-the-water imaging, route monitoring, and weather measurement.

FY 2019 PHASE I AWARD WINNER

FIRM:	Kitware, Inc. 1712 Route 9 Suite 300 Clifton Park, NY 12065
AWARD:	$ 119,999.00
PHONE:	919-869-8884
E-MAIL:	matt.brown@kitware.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Matthew Brown
TITLE OF PROJECT:	Autonomous Data Acquisition and Processing Payload for Small Unmanned Aircraft Systems
SUBTOPIC NUMBER:	9.5.01

TECHNICAL ABSTRACT:

In response to NOAA-OAR-OAR TPO-2019-2005899 topic 9.5.01, Kitware proposes a compact data collection and processing payload that can be hosted from small unmanned aircraft systems to support autonomous beyond line of sight missions. This innovative payload will manage collections from onboard sensors with optimizations collection paradigms. It will produce curated, geo-registered data archives, which can be exfiltrated and ingested into Kitware's VIAME application. VIAME, which is in use at all six NOAA National Marine Fisheries Science Centers, allows NOAA personnel to annotate data and train deep neural network models providing mission-critical image processing. These models can be uploaded back onto the payload to enable real-time, in flight processing. For large-scale surveys of ice mammals, in-flight animal detection allows the majority of imagery without sufficient evidence to be omitted from the data archive, allowing greater ground coverage before filling onboard storage. Autonomous, online mission planning could incorporate real-time detections to adjust the flight plan for higher-quality data where animals are detected by revisiting at lower altitude or with additional sensors. Another example is in-flight semantic image segmentation of boundaries between regions, such as land–water, habitat, biomass fire interfaces, which could be used to alter flight path for optimal collection.

SUMMARY OF ANTICIPATED RESULTS:

The aerial imaging market is estimated to be greater than $4 Billion by 2024 as sUAS are rapidly being adopted for aerial imaging supporting agriculture, emergency response, public safety, environmental monitoring, urban planning, and inspection. As government regulations become more favorable, companies will be looking to extend capabilities to beyond line of sight operation. We anticipate customers to include both the data-collection service providers looking to transition to sUAS-based collections as well as those who already have in-house sUAS capabilities but are looking to optimize operations or accommodate new types of missions, such as Insitu, PrecisionHawk, DroneDeploy, Airobotics, and AeroVironment.

FY 2019 PHASE I AWARD WINNER

FIRM:	ASTRA - Atmospheric and Space Technology Research Associates, LLC 282 Century Place Suite 1000 Louisville, CO 80027
AWARD:	$ 119,859.00
PHONE:	303-993-8039
E-MAIL:	gthompson@astraspace.net
PRINCIPAL INVESTIGATOR (PI):	Dr. Patrick McBride
TITLE OF PROJECT:	Small Satellite Cloud Observation System
SUBTOPIC NUMBER:	9.6.01

TECHNICAL ABSTRACT:

We propose the design of an optical instrument package capable of making cloud observations and deployable on a CubeSat. The design will be based on decades of research in cloud remote sensing and each spectral channel will be comprised of a commercial-off-the-shelf camera and a spectral filter as needed. The base design will be comprised of three channels, two in the shortwave infrared and one in the visible, which will enable the creation of cloud masks including the detection and mapping of cirrus clouds. We will target a design for a 6U or 12U CubeSat. We will include thermal infrared channels if the size, weight, and power parameters allow it. The spectral characteristics of all channels will be determined through a Phase I modeling effort. We will design the electronics required to process, store, and transfer the data. The inexpensive systems will allow a constellation to be deployed for less money than a single traditional weather satellite and allow for cloud processes to be monitored on the scale of minutes to hours.

SUMMARY OF ANTICIPATED RESULTS:

Design an optical instrument package deployable on a single or a constellation of CubeSats. Model the spectral channels to determine the ideal bandpass requirements. Design an electronics package to support the processing, storage, and communication of the observations. Oversight by ASTRA's Space Systems Division to ensure the final designs comply with the norms of a small satellite design.

FY 2019 PHASE I AWARD WINNER

FIRM: Adelphi Technology, Inc.
                    2003 East Bayshore Road
                    Redwood City, CA 94063

AWARD: $ 120,000.00

PHONE: 650-474-2750 ext. 116

E-MAIL: ted@adelphitech.com

PRINCIPAL INVESTIGATOR (PI):   Dr. Jay Cremer

TITLE OF PROJECT: Portable Analyzer for Ultra-sensitive Detection and
                     Quantification of Polycyclic Aromatic Hydrocarbons in Shellfish.

SUBTOPIC NUMBER: 9.1.01

TECHNICAL ABSTRACT:

The proposed device is a compact, portable and robust battery-powered analytical instrument for analysis of complex multicomponent mixtures of polycyclic aromatic hydrocarbons (PAHs) in shellfish. The device is based on principles of analytical gas chromatography (GC) and utilizes a novel highly-integrated multisensory detector.

Implementation of a multisensory detector allows the device to collect multiple chromatograms in a single run. The sensors in the integrated MEMS platform are near-orthogonal and possess very distinct catalytic properties. The time separation by chromatographic column is complemented by catalytic separation by a multisensory detector.

The outcome of our GC/MEMS hybrid technology is the ability to monitor a very broad range of analytes from light to heavy on a relatively short and compact GC column in a short period of time of 12.5 min for a broad range of concentrations from sub-ppb to hundreds of ppm.

Our SBIR Phase I focuses on the design and fabrication of a compact instrument for automatic detection and quantification of PAHs in ppb to ppm concentration range. Major objectives include increase of number of detectible chemicals without increase of device physical dimensions and weight, and redesigning electronic hardware and firmware for automatic measurements and concentration reporting

SUMMARY OF ANTICIPATED RESULTS:

Adelphi Technology will manufacture or license a commercial instrument for detection and analysis of analysis of complex multicomponent mixtures of polycyclic aromatic hydrocarbons (PAHs) in shellfish and fish, other food sources, such as meats, vegetables, and fruits, and the pharmaceutical industry, as well as monitoring air quality.

Unlike the present competition, the small size and low cost of our proposed device allows detection and analysis of PAH and other toxic chemicals. An array of our proposed devices can be placed in a facility or deployed statically or mobile mode and tracked by GPS and controlled remotely with a handheld device.

FY 2019 PHASE I AWARD WINNER

FIRM:	Coastal Ocean Vision, Inc. 10 Edgerton Drive North Falmouth, MA 02556
AWARD:	$ 120,000.000
PHONE:	508-472-5520
E-MAIL:	sgallager@coastaloceanvision.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Scott Gallager
TITLE OF PROJECT:	Benthic Mapping of Geological, Biogeochemical and Biodiversity Parameters through an Autonomous Vehicle and Deep Learning Software Workflow
SUBTOPIC NUMBER:	9.6.03

TECHNICAL ABSTRACT:

The time has come to integrate the capabilities we have developed for real-time habitat processing on shipboard with the HabCam towed vehicle, into an autonomous vehicle with 3D reconstruction of seafloor topology, substrate classification, single target identification, hyperspectral imaging for physiological information, and plankton classification as an index of ecosystem health. Integrated together, these data streams represent a full description of habitat that supports a variety of organisms, communities, and a defined biodiversity. Designed and built at WHOI by Gallager's team, HARIM (Habitat Aware Reconnaissance and Imaging Module), is a complete package of sensors and processing capability to survey habitat at depths from 0 to 6000m, depending on which REMUS vehicle is used. Our goal for this Phase I project is to fully integrate information being collected by HARIM with the vehicles' navigational system to create a dynamic sampling capability depending on habitat information. Deep learning CDNN models of habitat will be built from stereo images in a variety of habitats, Habitat Suitability Modeling will be used to project habitats using statistical inference, and topic modeling will be used to label habitat components and specific targets to ascertain the degree of information content. A dynamic sampling scheme will understand when habitat information is changing or when it is stable and guide the vehicle to maximize information content.

SUMMARY OF ANTICIPATED RESULTS:

The market for habitat characterization is large- from wind farm siting and monitoring to oil and gas prospecting and environmental monitoring to research and exploration of novel environments and assessment of damage to both shallow and deep coral reef systems. This Phase I will complete the software workflow for HARIM and test it under rigorous field conditions. Phase II will commercialize the product by rugedizing the hardware and hardening the software. The product will be a habitat characterization module that fits on a variety of autonomous and human controlled platforms from AUVs to ROVs.

FIRM:	Infini-SEA, LLC 672 Creek Road Severna Park, MD 21146
AWARD:	$ 120,000.00
PHONE:	410-979-2088
E-MAIL:	infinisea.info@gmail.com
PRINCIPAL INVESTIGATOR (PI):	Jaros Phinchongsakuldit
TITLE OF PROJECT:	Development of Universal SNP chips for Pacific White Shrimp
SUBTOPIC NUMBER:	9.1.03

TECHNICAL ABSTRACT:

Pacific white shrimp is the most important species in shrimp aquaculture, making up the majority of the US$6.5 Billion worth of farmed shrimp imported into the US in 2017. The dominance of this species in shrimp aquaculture is due to the development of domesticated strains and years of continuous genetic improvement. Recent advancements in genome selection allow faster and more accurate selection of important traits, and the implementation of this technology is recently acknowledged in Pacific White Shrimp. To implement genomic selection, a high throughput genotyping of a massive number of SNPs is required. A commercial SNP chip is now available for Pacific White Shrimp. However, this SNP chip was developed from captive stocks with narrow genetic diversity, and may not be effective for stocks of different origins. This proposed project aims to develop universal SNP chips, derived from wild stocks across the geographic range of the species, and can therefore be used in any breeding program. The proposed SNP chips will have densities ranging from 14,000-50,000 loci, discovered using genotyping by sequencing. SNP frequencies will be compared between populations in order to screen for informative SNPs.

SUMMARY OF ANTICIPATED RESULTS:

In the commercialization step, the list of informative SNPs that can be applied on the solid-state SNP genotyping array could be designed for specific applications such as identifying stock origin, predicting genomic breeding values in domesticated lines of known origin, or investigating genome-wide association study. These designed SNP chips can be sold as products. In addition, Infini-SEA can provide consulting services on genome selection to Pacific White Shrimp breeding companies, using the developed SNP chips to evaluate the genomic prediction.

FIRM:	BJE Environmental Optics, LLC
	127 S Hoover Ave
	Louisville, CO 80027
AWARD:	$ 116,550.00
PHONE:	720-684-9143
E-MAIL:	steve23n@gmail.com
PRINCIPAL INVESTIGATOR (PI):	Dr. John Barnes
TITLE OF PROJECT:	A Low-Cost Atmospheric Aerosol Monitoring System for Boundary Layer Air Quality, Visibility, Cloud Ceiling Height and Aerosol Properties
SUBTOPIC NUMBER:	9.6.01

TECHNICAL ABSTRACT:

This proposal addresses subtopic 9.6.01, Low-cost Oceanic and Atmospheric Sensors and Observing Systems. It is proposed that two instruments for measuring atmospheric aerosols be commercialized to operate automatically and routinely. Both instruments have been used in research settings for many years and share several aspects of technology. They could both be commercialized with significant advantages in cost and performance over currently available instruments.

The first is the CLidar which measures aerosol profiles and also operates as a star-photometer to measure aerosol optical depth (AOD). Visibility and cloud ceiling are directly calculated from the data collected. The CLidar is currently limited to twilight and nighttime conditions but use of an infrared camera and laser may allow daytime operation.

The second instrument is an imaging polar nephelometer (IPN) that has been patented by the principle investigator (PI). The IPN gives a detailed in-situ measurement, day and night, of scattered light from aerosols. The IPN measures the angular dependence of the scattered light. There are many commercial integrating nephelometers available but much information is lost when only the total scattered light is measured. The IPN has an excellent potential for measuring detailed aerosol properties relating to the aerosol size distribution, composition and shape.

SUMMARY OF ANTICIPATED RESULTS:

This Phase I proposal will adapt two proven aerosol research instruments to the commercial air quality monitoring marketplace. The first is the CLidar or camera lidar and the second is the Imaging Polar Nephelometer (IPN). There already are multiple profitable vendors of aerosol lidars (laser radars) as well as many for integrating nephelometers. Both the CLidar and IPN have very unique advantages with lower cost and improved scientific value of the data produced. Air quality monitoring is projected to increase both nationally and internationally and these instruments would directly impact that marketplace.

FY 2019 PHASE I AWARD WINNER

FIRM: Nalu Scientific
                                         2800 Woodlawn Dr. Ste. #240
                                         Honolulu, HI 96822

AWARD: $ 120,000.00

PHONE: 808-343-9204

E-MAIL: isar@naluscientific.com

PRINCIPAL INVESTIGATOR (PI):   Dr. Isar Mostafanezhad

TITLE OF PROJECT: Design and fabrication of the "OLEAS": Oceanographic Lidar for
                                         Environmental Assesment

SUBTOPIC NUMBER: 9.6.01

TECHNICAL ABSTRACT:

Passive ocean color remote sensing has revolutionized our ability to quantify the horizontal distribution of phytoplankton across the ocean surface. Lidar (Light Detection And Ranging) technology has the potential to similarly revolutionize our ability to remotely measure the vertical distribution of optical properties and suspended particles in natural waters, significantly improving our predictive understanding of ocean biogeochemical processes in 3-dimensional space and time. For Lidar technology to be effective in providing such measurements in the field (ocean), it needs to be low Size, Weight and Power (SWaP), while maintaining high performance. In this project we propose the "OLEAS": Oceanographic Lidar for Environmental Assessment We will take the next important step in oceanographic lidar by developing a low-cost, compact, rugged system, capable of remotely characterizing the spatial structure of optical and biogeochemical properties of the water column from moored platforms, surface vessels and underwater vehicles.

A successful completion of the project would be a welcome addition for all facilities that need to continuously and remotely monitor and estimate the vertical distribution of optical properties and suspended particles in natural waters, significantly improving our ability to model upper ocean biogeochemical processes.

SUMMARY OF ANTICIPATED RESULTS:

The project will result in a cost effective method for monitoring and estimating the upper ocean biogeochemical processes, tracking microorganism that serve as the basis of the oceanic food web on which modern human society relies for >15% of its total daily protein.

We anticipate interest from three types of end-users: cities in coastal areas, governments and international bodies, hobbyists, system integrators and sensor companies.

Additionally it is very likely that one of the bigger players in the ocean science and sensing field, might be interested in licensing the technology or establish an OEM relationship with Nalu Scientific.

FY 2019 PHASE I AWARD WINNER

FIRM: Synthetik Applied Technologies
28696 Tree Farm Road
Pierre, SD, 57501

AWARD: $ 119,914.00

PHONE: 605-593-5500

E-MAIL: vonk@synthetik-technologies.com

PRINCIPAL INVESTIGATOR (PI): Peter J. Vonk

TITLE OF PROJECT: DeepCTIS: A New Low-Cost Hyperspectral Imaging Module and Distributed Deep Learning Platform to Combat Illegal, Unreported, and Unregulated Fishing in the Marketplace at Scale

SUBTOPIC NUMBER: 9.2.02

TECHNICAL ABSTRACT:

We propose an innovative yet straightforward approach to developing and delivering a readily deployable product to support combating IUU. We combine newly available low-cost hyperspectral sensors with state-of-the-art deep learning-based real-time data processing and deploy it on high-availability commodity cloud computing hardware - our solution is compatible with both existing systems as well as a new generation of proposed low-cost/high-quality hyperspectral imaging systems. We propose to develop a small CTIS objective compatible with the Raspberry Pi NOIR Camera Modules; to create an inexpensive high-resolution hyperspectral imaging system built from COTS components -- this will enable cheap and scalable high-resolution hyperspectral imaging for widespread IUU data collection. We also apply modern deep learning-based data processing techniques to fish and seafood hyperspectral datasets (existing and generated with the proposed Raspberry Pi Hyperspectral Module) to the specific problems associated with IUU (e.g. fish species classification, detection of pharmaceuticals/chemicals, adulteration, fraud, origin classification, etc. Finally, we deliver a truly cost-effective and scalable solution to combat the growing problem of IUU that uses inexpensive and ubiquitous cloud computing to deploy our DCNN-based model combined with cheap CTIS hyperspectral sensors (with Raspberry Pi, mobile phones, etc.) and existing table-top systems.

SUMMARY OF ANTICIPATED RESULTS:

We are developing a hyperspectral imaging platform, including supporting CTIS-based lenses and hardware that can be deployed on portable devices that perform real-time data processing in the cloud, the end cost of the technology will be between 10-20x cheaper than current systems. Furthermore, the direct applicability of the technology to commercial private organizations is equally feasible and such firms are likely to be interested in the potential benefits afforded by such a capability. In summary, we see several direct routes to commercialization of the proposed technology developed as part of this program, with an estimated $30,000,000 10 year ROI.

FY 2019 PHASE I AWARD WINNER

FIRM:
Texas Research Institute Austin, Inc.
9063 Bee Caves Road
Austin, TX 78733

AWARD:
$120,000.00

PHONE:
512-263-2101

E-MAIL:
hperkinson@tri-austin.com

PRINCIPAL INVESTIGATOR (PI):
Harry Perkinson

TITLE OF PROJECT:
Coral Adhesive

SUBTOPIC NUMBER:
9.2.01

TECHNICAL ABSTRACT:

Texas Research Institute Austin (TRI Austin) will develop a fast acting, strong, tough, adhesive that will bond underwater without extensive surface preparations. TRI Austin will formulate the adhesive to optimize setup time, establish charge weight for the adhesive to reduce adhesive underwater preparation time, and develop the procedures for using the adhesive to bond coral to reef substrates. An appropriate dispensing system will be developed that allows the full charge to be expended from the dispenser when used with procedures that account for the fast setup time for the resin. Tensile and shear strength of the adhesive will be measured. A toxicology study will be conducted on the adhesive components and the cured adhesive to determine the toxicity to coral. The toxicity study will also evaluate the ability of the tack to hold the coral in position before the adhesive cures and whether the adhesive is detrimental to the oral when in direct tissue contact. The optimized resin formulation, optimal dispensing equipment, and ecologically sound bonding procedures will be demonstrated in setting up the toxicology study. A program plan for the further development and qualification of the proposed adhesive will be developed as part of the Phase I effort.

SUMMARY OF ANTICIPATED RESULTS:

The adhesive being proposed in the Texas Research Institute Austin has underwater applications beyond bonding coral to reef substrates. The adhesive can be used commercially to provide quick repairs to subsea structures used in the oil and gas industry, commercial fishing, sport fishing, and maritime shipping industry. Because the adhesive is so strong and tough (high strain capability), the applications can be highly loaded. Because the adhesive can cure (setup) so rapidly, the adhesive can be used in emergency situation where speed of repair is critical; perfect for repairing punctured inflated devices. The adhesive can also be used in military applications.

FY 2019 PHASE I AWARD WINNER

FIRM:	Attogene Corporation 350 Catalina Lane Austin, TX 78737
AWARD:	$ 120,000.000
PHONE:	512-301-7876
E-MAIL:	lford@attogene.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Lance Ford
TITLE OF PROJECT:	Novel assay for the detection of water-born algae toxins
SUBTOPIC NUMBER:	9.2.03

TECHNICAL ABSTRACT:

Ciguatera fish poisoning is an illness suffered by > 50,000 people yearly after consumption of fish containing ciguatoxins (CTXs) or exposure to a harmful algae bloom (HAB). Manufacturing of critical reagents to develop assays to detect ciguatoxin have been elusive due to the constraints in production of viable amounts of the toxin. Thankfully, a significant amount of work has been done to demonstrate the natural binding site for ciguatoxin is the voltage sensitive sodium channel (VSSC). Based on this physiological association, several approaches have been developed to analyze ciguatoxin using receptor binding assays. The binding of ciguatoxins to VSSCs offers versatility from conventional approaches and has opened the door for readily evaluating CTXs. The current assays analyze CTXs impact on cell physiology or binding properties to VSSCs. Because these approaches require expensive and sophisticated methods and equipment they are not used widely for screening. Therefore, advancing assays that simplify CTX screening is important to prevent illness, we propose to develop an easier, faster, field deployable and lower cost assay that will enable visual readouts without the need for expensive equipment or technical training. Similar receptor binding assays have been widely successful for rapidly screening for antibiotics residues in the food industry and are a real-world example of how receptor binding proteins can be successfully leveraged in a commercial setting for analyte detection. We are confident that VSSCs can be adapted in a similar fashion.

SUMMARY OF ANTICIPATED RESULTS:

Many receptor binding assays are time consuming and typically rely on fluorescence detection, expensive equipment and sophisticated detection technologies that require a highly skilled workforce. Our goal is to convert the fluorescent ciguatoxin-VSSC receptor binding assays into a rapid, user-friendly and robust visual detection methodology. We expect that this assay will have significant commercial applications because it will be simple to perform, low cost, robust and is expected to be valuable for monitoring ciguatoxin, its precursor gambiertoxin and possibly a large spectrum of important compounds including maitotoxin, antillatoxin, kalkitoxin, or jamaicamide.

FIRM:	Wardenclyffe Chemicals, Inc.
	301 Nassau Street Ste. 7
	Princeton, NJ 08540
AWARD:	$ 119,797.00
PHONE:	917-697-9352
E-MAIL:	anderson@wardenchem.com
PRINCIPAL INVESTIGATOR (PI):	Eric Anderson
TITLE OF PROJECT:	Biomimetic Adhesives for Restoration of Coral Reefs
SUBTOPIC NUMBER:	9.2.01

TECHNICAL ABSTRACT:

Restoration of coral reefs is dependent upon an ability to adhere young corals, grown in tanks, onto inorganic substrates within the seas. The epoxies in current use do not provide a viable path to restoration owing to poor adhesion underwater, lengthy mixing of components needed, clouds of toxic epoxy precursors released into the water, and extensive diver time needed to clean the underlying coral substrates for enabling bonding. Poly(catechol-styrene) is a biomimetic polymer modeled after the adhesive proteins of marine mussels. Extensive data indicate that this polymer is one of the strongest underwater adhesives seen to date. Furthermore, flexibility with regard to formulation permits tailoring of properties such as viscosity, delivery method, and cure time. Tests planned here will evaluate how changes in solvents, fillers, cross-linkers, and concentration of the polymer affect poly(catechol-styrene)'s adhesive qualities with regard to the efficiency and integrity of coral restoration. These formulations will be used in tanks of sea water for bonding young corals to rocks. In the end, we anticipate having new and promising adhesives for coral restoration efforts on the reefs.

SUMMARY OF ANTICIPATED RESULTS:

Poly(catechol-styrene) is a, non-toxic, wet-setting adhesive that can be formulated to suit the requirements of several markets. This biomimetic polymer system appears to be ideal for restoration of coral reefs, a young and rapidly growing market. With reformulation, poly(catechol-styrene) can then be used for maritime repairs/construction at offshore oil and gas facilities. Further applications include replacing toxic adhesives in current use with wood products (filler/binding for composites), cosmetics (application of artificial nails), dentistry (application of dental implants), and surgeries (connect soft and/or hard tissues). The novel properties of being non-toxic and wet-bonding will open several adhesive market opportunities.

FY 2019 PHASE I AWARD WINNER

FIRM: Nanohmics, Inc.
6201 E. Oltorf St., Ste.400
Austin, TX 78741

AWARD: $ 120,000.00

PHONE: 512-389-9990

E-MAIL: jbruno@nanohmics.com

PRINCIPAL INVESTIGATOR (PI): Dr. John Bruno

TITLE OF PROJECT: Fluorescent Qdot-Antibody or -Aptamer Test Strips for Ultrasensitive Algal Toxin Detection

SUBTOPIC NUMBER: 9.2.03

TECHNICAL ABSTRACT:

Nanohmics, Inc. proposes to develop the most sensitive antibody and/or DNA aptamer-quantum dot (Qdot)-based lateral flow (LF) test strips possible for detection of harmful algal bloom (HAB) toxins in fresh or saltwater and seafood rinsates. Although commercial colloidal gold-LF test strips for some HABs and anti-HAB toxin aptamer DNA sequences already exist, Nanohmics' innovation of incorporating aptamers and fluorescent Qdots into LF test strips will significantly improve sensitivity. In addition, multiple line LF strips can be constructed with multiple colored fluorescent emissions based on Qdot size (multiplexing) with one common UV excitation source such as a simple mineral light. In addition to visual assessment, the LF test strips will be quantified via a smart phone camera adaptor to make fieldbased quantitation of algal toxins simple and easy with rapid sharing of data via the internet and cloud storage. In Phase II, Nanohmics will expand its menu of HAB toxin assays and complete its smart phone sensor integration. Nanohmics will then deliver a prototype system to NOAA for testing and evaluation and either manufacture the sensors and LF test strips itself or license the technology to companies already in the algal toxin assay space.

SUMMARY OF ANTICIPATED RESULTS:

Additional commercial applications for facile and highly sensitive antibody and/or aptamer-Qdot LF test strips coupled to a cell phone reader exist in many diagnostic arenas including environmental, agricultural, clinical/medical, veterinary, chem-bio threat agent and other portable diagnostics.

FY 2019 PHASE I AWARD WINNER

FIRM:	Computational Physics, Inc. 8001 Braddock Road Suite 210 Springfield, VA 22151
AWARD:	$ 119,822.00
PHONE:	303-442-3992
E-MAIL:	gannon@cpi.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Jennifer Gannon
TITLE OF PROJECT:	Developing Regional GIC Hazard Tools for Power Utility Planning and Operations
SUBTOPIC NUMBER:	9.3.02

TECHNICAL ABSTRACT:

Geomagnetically induced current (GIC) hazard is a recognized threat to the United States power system. Federal models to support hazard specification and prediction for critical infrastructure are at an advanced state, including models of space weather, the Earth's conductive structure, and regional geoelectric field. We propose to use existing NOAA Space Weather Prediction Center (NOAA-SWPC) model output of surface geoelectric fields to produce a value-added local index for GIC hazard in support of growing power industry needs, and gain feedback on the effectiveness of these new tools from operational and planning perspectives through the use of a power industry beta tester panel.

SUMMARY OF ANTICIPATED RESULTS:

A value-added product based on federal geoelectric field model output will allow power utilities to leverage outside expertise in space weather and geophysics to improve GIC mitigation planning. In addition, these new GIC hazard tools will facilitate power utility compliance with new federal operational and planning regulations (EOP-010-1 and TPL- 007-1) for transmission companies with EHV transformer assets.

FIRM:	Metna Co. 1926 Turner Street Lansing, MI 48906
AWARD:	$ 120,000.00
PHONE:	517-485-9583
E-MAIL:	metnaco11@gmail.com
PRINCIPAL INVESTIGATOR (PI):	Anagi Balachandra
TITLE OF PROJECT:	Underwater Adhesive for Coral Restoration
SUBTOPIC NUMBER:	9.2.01

TECHNICAL ABSTRACT:

Coral transplantation is a primary management option for rehabilitation of degraded reefs. Stabilization (via adhesion, etc.) of transplants on existing reef or artificial substrates notably improves their survival rate. Improved underwater adhesives are needed for expedient and convenient stabilization of coral transplants with improved survival rate. A new hybrid organic-inorganic adhesive is proposed to address this need. Prompt setting and rapid curing of the hybrid adhesive will be triggered by seawater. This adhesive offers an inherent affinity for binding to reef and other surfaces, and stimulates self-attachment and survival of the transplanted coral. It can be deployed easily and expediently from a caulk gun or a small nozzle/syringe for bulk or precise applications. The new adhesive would also be non-toxic, compatible with seawater and economical. The hybrid adhesive embodies some underlying principles of biomineralization, bone and dental adhesives. Plans are proposed for development and market transition of the hybrid adhesive, and a team of technical experts and commercial partners has been assembled to implement these plans. The proposed Phase I effort will identify the inorganic and organic constituents of the hybrid adhesive, and will develop and characterize a first-generation coral reef adhesive.

SUMMARY OF ANTICIPATED RESULTS:

Marine (including coral reef) adhesives account for about $0.5 billion annual sales, with an annual growth rate of about 5%. When compared with existing (epoxy, acrylic, polyurethane, etc.) marine adhesives, the proposed hybrid adhesive offers distinct features for grabbing and adhering onto diverse surfaces, expedient and convenient application, rapid setting and curing, and stimulating the coral self-attachment and survival. A leading manufacturer of marine adhesives (Gougeon Brothers Inc – GBI) has joined the proposed effort with the objective of transitioning the end product, in the context of a license agreements, to markets for coral reef and broader ecological restoration.

FY 2019 PHASE I AWARD WINNER

FIRM:	TIAX, LLC 35 Hartwell Avenue Lexington, MA 02421
AWARD:	$ 119,878.00
PHONE:	781-879-1236
E-MAIL:	jakubowski.michael@tiaxllc.com
PRINCIPAL INVESTIGATOR (PI):	Michael Jakubowski
TITLE OF PROJECT:	Underwater Adhesive for Coral Restoration
SUBTOPIC NUMBER:	9.2.01

TECHNICAL ABSTRACT:

TIAX proposes to demonstrate the feasibility of a quick tack, long pot life, and high strength underwater adhesive formulated to be delivered through a caulk gun like application device. This two part adhesive will pass through a static mixing nozzle during application, removing the need for hand-mixing the adhesive prior to use. Our adhesive will adhere strongly to commonly used artificial and natural coral substrates and reef materials. We will use statistical design of experiment techniques to help formulate candidate adhesive resin systems that possess the desired qualities. TIAX's adhesive will represent a significant improvement in efficiency over existing underwater adhesive options. Innovative performance aspects of our adhesive include:

• Quicker physical attachment of corals to substrates underwater
• Instant tack as well as long-life adhesive strength under water
• Improved adhesive durability in energetic environments
• Ambient temperature cure
• Minimal to no surface preparation (e.g., adherence to substrates coated with biofilm)
• Adhesive formulation rheology that supports easy, reproducible application methods
• Non-toxic to marine life
• Able to be applied in salt water

Our optimized adhesive and its delivery method will eventually allow divers to move more quickly through their tasks, reducing labor and project costs.

SUMMARY OF ANTICIPATED RESULTS:

The potential commercial applications of TIAX's innovative underwater, high strength adhesive (HSA-UW) that is the focus of our Phase I work include both private sector and government enduses. In addition to use as underwater adhesives for coral restoration, TIAX plans to tailor HSAUW for use in other significant end-use applications of marine adhesives such as boat, cargo ship, passenger ship and other naval and marine vehicle construction and repair; underwater pipeline construction and repair; attachment of underwater sensors; and commercial and recreational applications such as swimming pool, spa applications as well as home and public aquariums.

FY 2019 PHASE I AWARD WINNER

FIRM: Blue Ocean Gear
                                         914 Edgecliff Way
                                         Redwood City, CA 94061

AWARD: $ 101,951.00

PHONE: 650-823-1704

E-MAIL: kortney.opshaug@blueoceangear.com

PRINCIPAL INVESTIGATOR (PI):   Kortney Opshaug

TITLE OF PROJECT: Smart Buoy Device to Locate Ropeless Fishing Gear

SUBTOPIC NUMBER: 9.2.04

TECHNICAL ABSTRACT:

Responsible operation of ropeless fishing gear to avoid whale entanglements must involve a method of retrieval if the gear surfaces at a different place and/or time than expected. Blue Ocean Gear will demonstrate the capability of innovative Smart Buoy devices to detect and locate ropeless buoy systems once they have reached the surface, whether planned or unplanned. This will improve commercial operations by providing fishermen with an immediate location signal upon surfacing, allowing them to find and haul their gear more reliably and efficiently, as well as alerts if their gear has come to the surface inadvertently without being signaled to release. This will allow trap fishermen to fish responsibly using ropeless techniques, helping to avoid whale entanglements as well as lost gear.

The Smart Buoy design is a standard fishing buoy equipped with GPS tracking as well as communications electronics capable of conveying positioning data to a map display on the fisherman's smart device. The system is low-cost, reliable, and compatible with current gear configurations. This proposal will evaluate performance under deployment with a ropeless buoy system with commercial fishermen under typical operational conditions.

SUMMARY OF ANTICIPATED RESULTS:

The entry market for Smart Buoys is the crab and lobster trap fisheries in North America. The same technology and basic design can also be used for any fixed-gear fishery, such as set nets, as well as offshore aquaculture to track their pens and other marine industries, such as tidal energy platforms, that require gear tracking in the ocean. Additional sensors can be added for various research parameters, allowing fishermen to work in conjunction with research institutions who can take advantage of their tremendous amounts of time out on the water to provide real-time data.

FY 2019 PHASE I AWARD WINNER

FIRM:	Lynntech, Inc. 2501 Earl Rudder Freeway South College Station, TX 77845
AWARD:	$ 119,997.00
PHONE:	979-764-2244
E-MAIL:	christi.parham@lynntech.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Christi Parham
TITLE OF PROJECT:	Rapid Point of Use Method to Identify Seafood Species
SUBTOPIC NUMBER:	9.2.02

TECHNICAL ABSTRACT:

Species substitution with a product of lesser value has become an increasing problem within the seafood industry. Increased international trade, rising consumption rates, and high profit incentives have all contributed to the intentional mislabeling of seafood. While whole, unprocessed fish can generally be identified by their morphological features, processing of seafood makes identification challenging. Current methods to identify seafood species require a laboratory environment, trained users and these methods are time-consuming. Lynntech's proposed detection system will provide an economical, rapid, user-friendly, field-ready method to determine species identification. In this Phase I feasibility effort, we will develop our assay to detect a single dietary fish, as well as two species that are illegally used as seafood substitutes. During Phase II, we will expand our assay to detect additional species and conduct field studies. Our final product will allow for the identification of at least five commercially important fish species and will be Wi-Fi capable. The Lynntech ditection assay will advance efforts to prevent illegally harvested fish from entering the marketplace and ports as well as in restaurants.

SUMMARY OF ANTICIPATED RESULTS:

Lynntech's point of use fish identification assay will have considerable commercial potential based on its ability to rapidly identify substitution by a product of lesser value. Increased international trade, rising worldwide consumption, high demand with limited supply, high profit incentive and lack of regulation enforcement/implementation have all contributed to the intentional mislabeling of seafood. The global seafood market reached a value of 121 billion dollars in 2016, and is forecasted to reach about 155 billion dollars by 2023. Should Lynntech capture a modest 0.1% of the projected market in 2023, our seafood fraud detection platform could gross $155M annually.

FY 2019 PHASE I AWARD WINNER

FIRM: TCarta Marine, LLC
                                              3015 W 9th Ave
                                              Denver, CO 80204

AWARD: $ 102,858.00

PHONE: 605-721-0268

E-MAIL: kl@tcarta.com

PRINCIPAL INVESTIGATOR (PI):   Dr. Karl Lalonde

TITLE OF PROJECT: An Innovative Approach to Seafloor Classification: Applying Advanced Unsupervised Machine Learning in Complex and Variable Bottom Types with Multispectral Satellite Imagery

SUBTOPIC NUMBER: 9.6.03

TECHNICAL ABSTRACT:

Machine learning and unsupervised classification have been applied to seafloor classification and benthic mapping using multibeam echosounders (MBES), Light Ranging and Detection (LiDAR), airborne hyperspectral, underwater optical cameras, and satellite imagery. Regardless of the sensor, data dimensionality reduction is an integral processing step of seabed mapping workflows. The most commonly implemented pre-classification dimensionality reduction technique is Principal Components Analysis (PCA).

TCarta proposes research into a powerful alternative to PCA, Unsupervised Topological Data Analysis (UTDA) to address the established methods' shortcomings as applied to WorldView 2/3 multispectral imagery. This research will offer a direct comparison of these two dimensionality reduction tools for three scenarios.

The first scenario, with training data input and in situ control, will be St. Croix, US Virgin Islands; the second, Puerto Rico, within the same geographical region with no further training applied to determine predictive ability and accuracy; and the final test area will be a remote location with no local training applied, Kiribati.

This research will determine the feasibility of this alternative to established unsupervised classification methods for seafloor classification and spectra-based data dimensionality reduction. If successful this research could lead to a potentially highly scalable and predictive tool for multi-sensor marine geospatial analysis.

SUMMARY OF ANTICIPATED RESULTS:

The potential commercial applications of the research results include the creation of maps of the seafloor depicting different bottom types (e.g. rock, sand, coral) and their characteristics using multispectral, hyperspectral, multibeam echosounder, LiDAR, and other multi-band sensors used in marine remote sensing and imaging of the seafloor utilizing boat, airborne, and satellite-based platforms.

This research will provide a pathway for development of an advanced predictive multi-sensor seafloor classification system via semi-supervised machine learning, facilitating rapid, efficient and highly precise benthic mapping in high resolution and over large areas.

FY 2019 PHASE I AWARD WINNER

FIRM:	SARA – Scientific Applications & Research Associates, Inc. 6300 Gateway Drive Cypress, CA 90630
AWARD:	$ 119,938.00
PHONE:	719-302-3117 ext. 330
E-MAIL:	jklang@sara.com
PRINCIPAL INVESTIGATOR (PI):	Jesse Klang
TITLE OF PROJECT:	BLOS Kit with Acoustic Sensor for Non-Cooperative Aircraft
SUBTOPIC NUMBER:	9.5.01

TECHNICAL ABSTRACT:

SARA proposes to integrate a Beyond Line of Sight (BLOS) system on a NOAA-selected UAS platform. The BLOS system will detect cooperative aircraft as well as non-cooperative aircraft by including SARA's Passive Acoustic Noncooperative aircraft Collision Avoidance System (PANCAS). PANCAS is an acoustic system which is low weight, low cost and has a 360-degree field of view. SARA will develop a safety case for the integrated system, including an autonomous collision avoidance maneuver. SARA has performed similar integrations on NOAA relevant platforms and can leverage this experience to offer NOAA an accelerated timeline and cost savings. SARA has a working relationship with multiple UAS manufacturers who endorse this proposal.

SUMMARY OF ANTICIPATED RESULTS:

The commercial applications for BLOS UAS operations is vast and well known. However, market analysis assumes the regulation of UAS BVLOS operations and the corresponding market explosion of UAS services. Thus, PANCAS and technologies supporting safe, autonomous BVLOS operation are critical market enablers. Due to PANCAS's extreme low SWaP, reliable performance and potential for low cost mass production; we have developed strategic partnerships with many of the world's leading UAS manufacturers and service providers. We have established a distributor to provide marketing and sales support and have advanced waivers for BVLOS progressing through approval authorities.

FIRM: Crab Raft Inc.
1003 Iowa Heights Rd
Sedro Woolley, WA 98284

AWARD: $ 120,000.00

PHONE: 360-303-9338

E-MAIL: annmarieriels@gmail.com

PRINCIPAL INVESTIGATOR (PI):   Richard Riels

TITLE OF PROJECT: Manufacturing Ropeless gear to be used in commercial Lobstering/Crabbing and other bottom set fishing industries, use of this gear will reduce entanglement of North Atlantic Right Whales/marine life.

SUBTOPIC NUMBER: 9.2.04

TECHNICAL ABSTRACT:

The North Atlantic Right Whale and other large marine species have experienced dramatic negative effects by entanglement with bottom set fishing gear. Crab Raft Inc. has developed, tested and demonstrated innovative, truly Rope-Less Fishing Gear, targeted primarily for the Crab and Lobster fishing industries. With no ropes, Crab Raft Inc. Fishing Gear has no entanglement potential. This innovative Fishing Gear fulfills the needs of fishers and regulators and has extensive manufacturing potential. The Crab Raft Gear utilizes patent pending variable buoyancy, acoustically actuated, lift bag Fishing Gear modules that retrieve commercial and recreational trap/pot fisheries to the surface without buoys or end-lines. Fishing Gear will be marked on USCG navigational maps/electronic charts allowing fishers to avoid Gear conflicts and regulators to track Rope-Less Fishing Gear inventories. Fishing Gear is retrieved with encoded acoustic signals allowing only the fishers who own that Gear to retrieve their Gear and as well allow regulators to retrieve, inspect and reset Gear if required.

Crab Raft Inc. will utilize SBIR-NOAA-OAR-OAR-TPO-2019-2005899 funds to further refine acoustic trigger manufacturing systems, develop USCG GIS mapping integration systems, identify and gather training with specialty tooling and produce manufacturing feasibility studies for mass production of innovative Rope-Less Fishing Gear.

SUMMARY OF ANTICIPATED RESULTS:

Crab Raft Inc. recognizes many private sector commercial applications for Crab Raft acoustically triggered Lift-Bag Rope-Less fishing gear. SBIR NOAA-OAR-OAR-

TPO-2019-2005899 funding for feasibility and defining manufacturing systems for this innovative gear will allow Crab Raft Gear to demonstrate applications throughout a diverse fishing industry; including, but not limited to: commercial and recreational bottom set fishing of Lobster, Crab, Black Cod, Sea Bass and Shrimp as well as Kelp Farming, Oyster Farming, Bottom Net Systems, economic oceanographic equipment and asset/gear/debris recovery systems.

Research results will accelerate the timeline and define tooling for commercialization creating manufacturing opportunities for Crab Raft Gear.

FY 2019 PHASE I AWARD WINNER

FIRM: Black Swift Technologies, LLC
                                           3200 Valmont Rd, Ste. 7
                                           Boulder, CO 80301

AWARD: $ 116,095.00

PHONE: 720-638-9656

E-MAIL: elstonj@blackswifttech.com

PRINCIPAL INVESTIGATOR (PI):   Jack Elston

TITLE OF PROJECT: Enabling BLOS UAS Operations through a Diverse-Source
                                           Global Positioning System

SUBTOPIC NUMBER: 9.5.01

TECHNICAL ABSTRACT:

Enabling BLOS operations in the National Airspace System is largely an issue of improved sensing. Under the UTM rules, BLOS operations require performance authorization from the FAA centered around navigation, communications, sharing of intent, avoiding other aircraft, and connecting to the FAA in near real-time. The current plan initially is for these performance metrics to be evaluated by the FAA case-by-case, but as experience is gained by FAA reviewers, standard packages of operational plans and technological capabilities will lead to streamlined approvals. Based on past experience working with the FAA, Black Swift Technologies has identified that remote operations will require several new and improved capabilities. One of those capabilities is the focus of this effort, to provide position information in GPS-denied areas during BLOS operations through an augmented sensor suite and machine learning capabilities. The system will be capable of providing accurate localization through several sources without the use of GPS. It will be grounded in the UTM rules, allowing an unmanned aircraft to continue providing position information to the UAS Service Supplier in the event of GPS jamming or spoofing.

SUMMARY OF ANTICIPATED RESULTS:

The primary target market for the proposed product is both government and commercial users looking to map or fly over longer distances. This represents a vast number of currently under-utilized applications for UAS due to capability and regulation, and includes activities such as coast line monitoring or powerline and pipeline inspection. Not surprisingly the commercial drone use is expected to accelerate over the next several years. However, it is our premise that this larger adoption of UAS we believe will be largely due to the expanded functionality afforded by BLOS flights.

FY 2019 PHASE I AWARD WINNER

FIRM:	Marine Advanced Robotics, Inc.
	1301 S 46th Street, Bldg. 300A
	Richmond, CA 94804
AWARD:	$ 119,989.00
PHONE:	510-232-1685
E-MAIL:	mgundersen@wam-v.com
PRINCIPAL INVESTIGATOR (PI):	Ugo Conti
TITLE OF PROJECT:	Autonomous LARS for Subsea Vehicles
SUBTOPIC NUMBER:	9.6.03

TECHNICAL ABSTRACT:

High resolution deep ocean mapping has historically been a cost prohibitive endeavor for all but the most well-funded governments, companies, individuals, and institutions. It is limited by the acquisition and operational costs of the assets required.

Fully autonomous solutions have the potential to dramatically lower the acquisition costs and increase access to the data. One of the key missing pieces is an autonomous Launch and Recovery System (LARS) to unlock the potential of multi-domain marine autonomous systems. Our proposal seeks to address that by providing an autonomous LARS for an USV/AUV combination that also has cross platform applicability. Our solution will increase data acquisition and lower operational costs.

SUMMARY OF ANTICIPATED RESULTS:

The ability to autonomously launch and recover Autonomous Underwater Vehicles (AUVs) in adverse sea conditions will dramatically lower the cost of deep ocean data acquisition. This will open the door for deep ocean mapping, resource exploration, wreck searches and other commercial activities.

FY 2019 PHASE I AWARD WINNER

FIRM: BADVR, INC.
                                               938 S Orange Grove Ave
                                               Los Angeles, CA 90036

AWARD: $ 120,000.00

PHONE: 540-250-7753

E-MAIL: jad@badvr.com

PRINCIPAL INVESTIGATOR (PI):   Jad Meouchy

TITLE OF PROJECT: Interactive Visualization of 3D NEXRAD Data in Virtual Reality

SUBTOPIC NUMBER: 9.4.01

TECHNICAL ABSTRACT:

This project will create a proof-of-concept application that visualizes 3D NEXRAD data from NOAA's Big Data Project inside virtual reality (VR). By integrating unique processing and projection algorithms into low-cost VR headsets, this initiative will increase the accessibility of data to meteorologists, fire departments, and first responders during critical decision-making.

During the recent California wildfires of Summer 2018, complex and dynamic weather conditions greatly complicated the firefighting efforts. If stakeholders had access to better predictive models and analytical tools, the loss of life and economic impact may have been reduced. This project will use the NEXRAD dataset for that event to show how a better understanding and communication of weather data can make a positive impact on public health and safety.

The novel application of immersive technology for NEXRAD data will fundamentally transform weather presentation from the "blocky" 2D weather maps of yesterday to the engaging and accessible 3D experience of tomorrow. This proposal is led by a team of engineers, data scientists, and psychologists with a successful history of deploying similar geospatial and VR data visualization tools.

SUMMARY OF ANTICIPATED RESULTS:

Commercialization of this new technology begins with public and private entities directly invested in public health and safety. This project's emphasis on low-cost deployment immediately opens the market of over 29,000 fire departments in the US, with 1.16M firefighters as potential users.

Utility and energy companies also seek out innovations like this to help them more effectively plan and execute the maintenance of critical infrastructure. Beyond the public sector, media companies have already shown interest in leveraging VR/AR for weather broadcasts. Given the high engagement and effectiveness of immersive content, there is potential for commercialization across numerous industries.

FY 2019 PHASE I AWARD WINNER

FIRM:	CFD Research Corporation 701 McMillian Way, Ste. D Huntsville, AL 35806
AWARD:	$ 119,939.00
PHONE:	256-726-4800
E-MAIL:	elise.schultz@cfdrc.com
PRINCIPAL INVESTIGATOR (PI):	Elise Schultz
TITLE OF PROJECT:	Developing Lightning Data Services for Commercial and Public Applications
SUBTOPIC NUMBER:	9.4.01

TECHNICAL ABSTRACT:

In this Phase I effort, CFD Research proposes the creation of a lightning services API using data from the GOES-16/17 Geostationary Lightning Mapper (GLM) and the development of valued-added lightning initiation and cessation products. Leveraging CFD Research's experience in software and API development and atmospheric sciences for lightning research applications, this API will provide a simplified framework for serving near-hemispheric lightning information available on NOAA's Big Data Project. The proposed work seeks to build upon and transition research and operational lightning information into applications that can be readily used and understood for the average, non-meteorologist, API user. These data services address the weather enterprise's goal of reducing potential for injury and decreasing loss productivity due to lightning.

SUMMARY OF ANTICIPATED RESULTS:

The results from this Phase I effort is the creation of a prototype lightning services API to provide data and value-added algorithms that can be demonstrated by the end of the Phase I and fully expanded to operational capabilities during the Phase II. The Phase II deliverable is a fully tested version 1 API released to the public for commercial use in research and software applications.

FY 2019 PHASE I AWARD WINNER

FIRM: Charles River Analytics Inc.
625 Mount Auburn Street
Cambridge, MA 02138

AWARD: $ 119,953.00

PHONE: 617-491-3474 ext. 593

E-MAIL: dstouch@cra.com

PRINCIPAL INVESTIGATOR (PI): Daniel Stouch

TITLE OF PROJECT: Ship-based Operations for UAS Swarms with Autonomous Pinniped Homing Over Nasty Environments (SOUSAPHONE)

SUBTOPIC NUMBER: 9.5.01

TECHNICAL ABSTRACT:

Small Unmanned aircraft systems (UAS) play a critical and growing role in government, military, commercial, and scientific operations across a range of missions such as weather monitoring, natural disaster assessment, surveillance, and infrastructure inspection. Their versatility, maneuverability, and dependability, coupled with their ability to keep operators out of harm's way, make them critical assets in a wide range of domains, but especially so in hostile, unpredictable, and dynamic environments. To operate reliably and effectively among other aircraft, replace manned aircraft missions with unmanned systems, and enable effective beyond line of sight (BLOS) operations, new capabilities are needed. Charles River proposes to develop a concept design, perform a feasibility assessment, and conduct limited risk reduction experiments for Ship-based Operations for UAS Swarms with Autonomous Pinniped Homing Over Nasty Environments (SOUSAPHONE). SOUSAPHONE is an aircraft and autopilot agnostic software framework that enables multiple ship-launched UAS to safely coordinate semi-autonomous BLOS wildlife survey operations (e.g., for pinnipeds) using advanced artificial intelligence and machine learning (AI/ML)-based computer vision and relative navigation techniques in challenging environments such as the Alaskan arctic.

SUMMARY OF ANTICIPATED RESULTS:

We will extend our existing VisionKit® commercial product to increase its appeal to additional markets and customers. SOUSAPHONE algorithms will have immediate and tangible benefit for many federal and local government agencies, and non-profits (e.g., environmental, search and rescue, humanitarian relief). The algorithms will enable multi-UAS coordination among relay aircraft to coordinate with multiple mission tasked aircraft to safely extend mission areas beyond line of sight (BLOS) in challenging environments. We will also license this technology to UAS manufacturers such as Boeing, AeroVironment, and Lockheed Martin as applique kits for their current platforms.

FY 2019 PHASE I AWARD WINNER

FIRM:	Prescient Weather LTD 200 Innovation Blvd, Ste. 229 State College, PA 16803
AWARD:	$ 119,520.00
PHONE:	814-466-2231
E-MAIL:	john.dutton@prescientweather.com
PRINCIPAL INVESTIGATOR (PI):	Dr. John Dutton
TITLE OF PROJECT:	Enhancing Subseasonal and Seasonal (S2S) Forecasts
SUBTOPIC NUMBER:	9.3.01

TECHNICAL ABSTRACT:

Computer forecasts of weather and climate variability created by the U.S. and other nations on the subseasonal scale (weeks) and on the seasonal scale (months) are increasingly used by private and public activities to mitigate risk and seize opportunity. These forecasts are produced as ensembles of tens of individual computer forecasts and are most useful when calibrated by comparing histories of both forecasts and observations and then presented as probabilities of future events.

This project will explore several techniques for creating new forecast systems in two phases: first by using superensembles assembled from forecasts by U.S. agencies and then by using broader collections that include forecasts from some of the most prominent national and international forecast centers.

The goal is:

Improve the skill and statistical reliability of subseasonal to seasonal (S2S) forecasts in ways that lead to more effective decisions and actions by the users.

First, the project will explore how the performance of superensembles varies with the number and skill of contributed forecast systems. The second effort will attempt to create hybrid forecasts that combine the conventional computer forecasts with statistical forecasts. The third effort will examine improvements in forecast performance achieved with innovative new forecast calibration strategies.

SUMMARY OF ANTICIPATED RESULTS:

Improved and more reliable subseasonal and seasonal (S2S) forecasts will be attractive to customers in the energy, agricultural, and other industries and thus enhance the value of World Climate Service (WCS) products and lead to greater commercial success. Customers in both energy and agriculture are asking for a broader set of forecast models to be considered and this project will provide strategies to meet that need. Social media sales techniques proved effective in increasing sales of a crop forecast system in the 2017 season and will be expanded to advertise the new WCS S2S forecasts created by this project.