



SBIR



Small Business Innovation Research Program

**ABSTRACTS OF PHASE II
AWARDS FOR FISCAL YEAR 2020**

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 20 NOAA SBIR Phase II contracts for FY 2020.

In Phase II, funding is provided for projects that are most promising after Phase I is completed from the previous year. These awards are up to \$400,000 each, and totaling approximately \$8M. The awards are for a two-year effort to continue the research and development of the innovative approach they proposed during the Phase I project. Abstracts of successful Phase II proposals and comments on their anticipated results are also provided in this publication.

FY 2020 Phase II List of Awardees

<u>Award Number</u>	<u>Company Name</u>	<u>Subtopic Number</u>
NA21OAR0210098	NALU SCIENTIFIC, LLC	9.6.01
NA21OAR0210099	CRAB RAFT INC	9.2.04
NA21OAR0210100	ADELPHI TECHNOLOGY INC	9.1.01
NA21OAR0210101	BLUE OCEAN GEAR INC	9.2.04
NA21OAR0210102	COASTALOCEANVISION, INC	9.6.03
NA21OAR0210103	TIAX LLC	9.2.01
NA21OAR0210104	ATMOSPHERIC & SPACE TECHNOLOGY RESEARCH ASSOCIATES, L.L.C.	9.6.01
NA21OAR0210105	PRESCIENT WEATHER LTD	9.3.01
NA21OAR0210106	CFD RESEARCH CORPORATION	9.4.01
NA21OAR0210107	TCARTA MARINE LLC	9.6.03
NA21OAR0210108	LYNNTECH INC	9.2.02
NA21OAR0210109	CHARLES RIVER ANALYTICS, INC.	9.5.01
NA21OAR0210110	BLACK SWIFT TECHNOLOGIES LLC	9.5.01
NA21OAR0210111	BADVR, INC.	9.4.01
NA21OAR0210112	KITWARE, INC.	9.5.01
NA21OAR0210113	INTELLISENSE SYSTEMS, INC.	9.6.01
NA21OAR0210114	METNA CO	9.2.01
NA21OAR0210115	SYNTHETIK APPLIED TECHNOLOGIES LLC	9.2.02
NA21OAR0210116	BJE ENVIRONMENTAL OPTICS LLC	9.6.01
NA21OAR0210117	CVISION AI INC	9.3.02

FY 2020 PHASE II AWARD WINNER

FIRM: NALU SCIENTIFIC, LLC
2800 Woodlawn Dr. Ste #240
Honolulu, HI, 96822

AWARD: \$400,000.00

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E-MAIL: isar@naluscientific.com

PRINCIPAL INVESTIGATOR (PI): Isar Mostafanezhad

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

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. The project will result in a cost effective method for monitoring and estimating the upper ocean biogeochemical processes, tracking microorganisms 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, researchers, system integrators and sensor companies.

SUMMARY OF ANTICIPATED RESULTS:

Lidar in general is a technically challenging system and each market segment has its own criteria on cost, technical specifications, and maturity. The competitive landscape is rather expansive in this field. However, such a market offers the opportunity to collaborate with other industry leaders and form strategic partnerships. Nalu Scientific has a strong relationship with one of the leading scientific instrument providers (SeaBird Scientific- see letter of support) and we plan to work together to bring the OLEAS Lidar Technology to market once industry standards are reached following the successful completion of Phase II. In addition, NSL is currently in negotiation stages to have its readout digitizer chips distributed as commercial products on CAEN's lineup of offerings. CAEN is considered a household name in the radiation readout industry. NSL has also been in contact with management at Quanergy (leading automotive lidar startup) who have expressed interest in the success of our technology. Attached with this proposal is a strong letter of support (LOS) from Quyanergy's director of Electronics lab. Given the early stage of R&D we anticipate starting to commercialize the new product in 2022-2023 We currently have beta versions under test at various locations and have received patents for our base technology (US patent # 62/758,714) [43].

FY 2020 PHASE II AWARD WINNER

FIRM: CRAB RAFT INC
1003 Iowa Heights Rd
Sedro Woolley, WA 98284

AWARD: \$399,828.00

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E-MAIL: dngreenberg@gmail.com

PRINCIPAL INVESTIGATOR (PI): Daniel Greenberg

TITLE OF PROJECT: Manufacturing Ropeless Gear for Commercial Lobster/Crabbing and Other Fishing Industries

SUBTOPIC NUMBER: 9.2.04

TECHNICAL ABSTRACT:

North Atlantic Right Whales and many other endangered marine species have experienced negative effects by entanglement with bottom set fishing gear. Crab Raft Inc. has developed, tested and demonstrated its innovative, ropeless lift bag fishing gear, targeted primarily for the crab and lobster fishing industries. With no ropes, Crab Raft Inc. ropeless fishing gear has no entanglement potential for marine life. This innovative fishing gear fulfills many needs of fishermen and regulators and has extensive US manufacturing potential. Crab Raft Inc. gear utilizes patented & patent pending variable buoyancy, acoustically actuated, lift bag fishing gear modules that retrieve/haul commercial and recreational trap/pot fisheries to the surface without buoys or end lines but with lift bags. This invention's proven practical integrations present various other commercial applications throughout oceangoing industries. Crab Raft Inc. proposes SBIR Phase II funds to equip a specialized manufacturing facility, build demonstration prototypes of Crab Raft gear from SBIR Phase I BOM developments, construct digital and analog acoustic trigger prototypes, integrate Smart Buoy location and oceanographic data collection/communication devices, continue testing lift bag ropeless gear with commercial fishermen and prepare for SBIR Phase III: mass production of Crab Raft Inc. innovative ropeless lift bag fishing gear.

SUMMARY OF ANTICIPATED RESULTS:

Throughout research and development SBIR-Phase I: bringing practical ropeless lift bag fishing gear to commercial lobster fisheries; Crab Raft Inc. has understood that one barrier to market is convincing longtime commercial fishermen to replace their lines and buoys with this innovative gear we build. Meeting this threshold presents significant commercial applications and demand only held back by regulations, supply-chain & an acceptable price point. Producing ropeless gear to reduce entanglements and increase economy of scale while also serving oceanographic research, conservation efforts to remove ocean debris, specialized ocean salvage and high end recreational markets presents an exciting range of commercialization targets.

FY 2020 PHASE II AWARD WINNER

FIRM: ADELPHI TECHNOLOGY INC
2003 East Bayshore Road
Redwood City, CA, 94063

AWARD: \$400,000.00

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PRINCIPAL INVESTIGATOR (PI): 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:

Adelphi Technology Inc. in collaboration with the Applied Physics Institute of Western Kentucky University developed a compact, portable, and robust battery-powered analytical instrument for analysis of PAHs in the field. The instrument is based on principles of analytical gas chromatography (GC) and has high environmental tolerance to impact, temperature, humidity, and contamination. The key advantages of our technology are the utilization of scrubbed ambient air as a carrier gas and the utilization of novel multisensory highly integrated platform as a GC detector. The detector's short response and recovery time together with ultra-high sensitivity allowed us to obtain high-resolution chromatograms for PAHs from light to heavy on a single compact GC column. In our design, special attention was given to robustness and user friendliness of the device, so that a person with minimal technical skills could operate it with ease and confidence. Our SBIR Phase II project will be focused on transition to a commercial prototype through miniaturization and structural optimization, on achieving ppb limits of detection for heavy PAHs through implementation of pre-concentrator, on optimizing the time of scan through a flexible and variable temperature ramping and on technology validation by using laboratory GC-MS system as a reference.

SUMMARY OF ANTICIPATED RESULTS:

Adelphi Technology will manufacture or license a commercial instrument for detection and 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 2020 PHASE II AWARD WINNER

FIRM: BLUE OCEAN GEAR INC
914 Edgecliff Way
Redwood City, CA, 94061

AWARD: \$399,613.00

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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 rapid retrieval if gear surfaces at a different place and/or time than expected. Blue Ocean Gear has demonstrated the capability of innovative Smart Buoy devices to locate ropeless buoy systems immediately upon reaching the surface. This proposed project will prove operational compatibility on a larger scale and in more fisheries. This technology improves commercial ropeless operations by providing fishermen with an immediate location signal upon surfacing, allowing them to recover gear more reliably and efficiently and time their trips if the ropeless device is passively activated. This technology allows trap fishermen to fish responsibly using ropeless techniques, avoiding whale entanglements as well as lost gear. The Smart Buoy is equipped with GPS tracking and conveys position data to a mobile application on a fisherman's smart device. The system is affordable, reliable, and compatible with any fixed-gear configurations. This proposed project will evaluate performance in joint deployments with ropeless buoy systems with commercial fishermen in various fisheries, incorporating any improvements to the design based on feedback from the fishers. Design-to-manufacturing considerations will be implemented in preparation for manufacturing and production is put into place.

SUMMARY OF ANTICIPATED RESULTS:

The entry market for Smart Buoys is the crab and lobster trap fisheries in North America, for application with both conventional and ropeless gear. The same technology and design can also be used in any fixed-gear fishery, including longline, as well as offshore aquaculture. Additional ocean condition sensors on the buoys will allow Blue Ocean Gear to create the largest ocean data network on the water, using Smart Buoys on fishing gear to provide data such as temperature, salinity, and ocean currents to third parties including government, research, and shipping entities.

FY 2020 PHASE II AWARD WINNER

FIRM: COASTALOCEANVISION, INC
10 Edgerton Drive
North Falmouth, MA, 02556

AWARD: \$400,000.00

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E-MAIL: sgallager@coastaloceanvision.com

PRINCIPAL INVESTIGATOR (PI): 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:

We propose 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 and chemical information, and plankton classification as an index of ecosystem health. Together, these data streams represent a full description of habitat characterizing a variety of organisms, communities, and biodiversity. In Phase I, we designed and built a prototype HARIM (Habitat Aware Reconnaissance and Imaging Module), which is a complete package of sensors and processing capability to survey habitat at depths from 0 to 600m. In this Phase II proposal, we will integrate information being collected by HARIM with a REMUS-600 navigational system to create a dynamic sampling capability. Deep Learning 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 for exploration of novel environments and assessment of damage to both shallow and deep coral reef systems. This Phase II will complete the software workflow for HARIM and test it under rigorous field conditions. We will commercialize the product by ruggedizing the hardware and hardening the software. Potential customers include the US Navy, offshore windfarm developers, oil and gas developers and prospectors, and the NOAA Office of Ocean Exploration and Research.

FY 2020 PHASE II AWARD WINNER

FIRM: TIAX LLC
35 Hartwell Ave
Lexington, MA, 02421

AWARD: \$399,999.00

PHONE: 781-879-1236

E-MAIL: jakubowski.m@tiaxllc.com

PRINCIPAL INVESTIGATOR (PI): Michael Jakubowski

TITLE OF PROJECT: Underwater Adhesive for Coral Reef Restoration

SUBTOPIC NUMBER: 9.2.01

TECHNICAL ABSTRACT:

TIAX proposes to continue to demonstrate the feasibility of a quick tack, long pot life, high strength underwater adhesive formulated to be delivered through a caulk gun like application device. Our two-part adhesive that we developed in Phase I is easily dispensed through a static mixing nozzle during application, removing the need for hand-mixing the adhesive prior to use. Our adhesive has demonstrated strong adhesion to a commonly used artificial substrate. We have leveraged our extensive skills in polymer and adhesive formulation to choose the proper resin system, synergistic fillers, beneficial crosslinkers and other additives to develop a strong and durable adhesive that quickly sets underwater and cannot be dislodged by water or animal motion. In Phase II, we will further develop our adhesive system to improve its properties such as quick tack, pot-life, bond strength, and rheological characteristics. We will then demonstrate our adhesives ability to adhere through biofilm covered surfaces and confirm that our adhesive is non-toxic to surrounding flora and fauna. We will further develop the adhesive applicator for quick, easy and comfortable dispensing of the adhesive. Finally, we will demonstrate manufacturability with a pilot scale production run before establishing real-world usability with a small field trial.

SUMMARY OF ANTICIPATED RESULTS:

Our overall objective for Phase II will be to formulate a product that is ready for field testing. Marine adhesive is key to programs encompassing thousands of person-hours of effort in growing, transporting, and planting replacement corals. As our adhesive becomes more established in the coral market, formulation variants can be produced that will be useful for other marine applications, both government and commercial. These applications may include repair of water craft, attachment of underwater sensors, aquaculture and fisheries applications, and marine structural engineering applications.

FY 2020 PHASE II AWARD WINNER

FIRM: ATMOSPHERIC & SPACE TECHNOLOGY RESEARCH
ASSOCIATES, L.L.C. (ASTRA)
282 Century Place, Ste 1000
Louisville, CO, 80027

AWARD: \$399,999.00

PHONE: 303-993-8039

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PRINCIPAL INVESTIGATOR (PI): Patrick McBride

TITLE OF PROJECT: Ocean Color and Cloud Monitor (OCCAM)

SUBTOPIC NUMBER: 9.6.01

TECHNICAL ABSTRACT:

The Ocean Color and Cloud Monitor (OCCaM) is a hyperspectral based instrument suite with ocean color and cloud observational capabilities. Following the successful Phase I SBIR design period, the Phase II effort will focus on the integration of the Phase I design into a benchtop unit for testing and validation of the design concept. The payload was designed to meet the SWaP requirements of a commercially available 12U CubeSat bus. This Phase II effort will assemble a benchtop unit to determine the functionality of the Phase I design. The design will be assembled and integrated with the 12U form factor in mind, but space qualifying the unit will be part of future efforts.

SUMMARY OF ANTICIPATED RESULTS:

Commercial data products from OCCaM will provide data for weather and meteorology disciplines, agriculture and forestry, and commercial fishing to name a few. Additionally, using the selected thermal infrared channels, volcanic ash monitoring will also be possible which impacts the health of safety and the operations of the airline industry. As OCCaM matures, deploying this system alongside ASTRA's bathymetric lidar system will allow for data fusion techniques that will provide both ocean color and underwater structure.

FY 2020 PHASE II AWARD WINNER

FIRM: PRESCIENT WEATHER LTD
200 Innovation Blvd, STE 229
State College, PA, 16803

AWARD: \$398,208.00

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PRINCIPAL INVESTIGATOR (PI): John Dutton

TITLE OF PROJECT: Enhancing Subseasonal and Seasonal (S2S) Forecasts to Better Serve Business and Industry

SUBTOPIC NUMBER: 9.3.01

TECHNICAL ABSTRACT:

The importance of weather and climate variability forecasts in the U.S. is amply demonstrated by the billions of dollars appropriated annually for the NWS and for surface, air, and satellite observations and by the existence of a vibrant private weather enterprise delivering value-added forms of NWS information to a wide range of public and private users. We have loyal customers in the energy sector, here and abroad, and are developing a strong reputation and following with our crop yield and production forecasts. Phase II accomplishments will include: ♣ Development and implementation of an optimally skillful global multi-model for probability forecasts ♣ Model calibration conditioned on climate indices ♣ A new focus on predicting extreme events ♣ Creation of ensembles combining both dynamical and statistical forecasts ♣ Exploration of promising new forecast opportunities with statistical methods and machine learning ♣ Collaboration with selected energy and agriculture customers to sharpen understanding of user needs ♣ Development of products focused on user decision-making processes Thus we will strengthen our assistance to NOAA in meeting its mission to share its information and will better serve our customers in business and industry, thereby assisting NOAA in meeting the mandates of the Weather Act (PL 115-25,2017).

SUMMARY OF ANTICIPATED RESULTS:

The multi-model probability forecasts of our World Climate Service are widely used and respected, including by some of the world's largest electric utilities. Our Crop Prophet yield and production system is a rapidly-growing industry leader. The S2S forecasts enhanced in Phase II and the new products focused directly on user needs in energy and agriculture will prove attractive to a larger audience and will help us ensure that the business is self-sufficient and can finance continued product development and improvement. Improved data sets and new statistical and machine-learning prediction methods offer promising opportunities for service to business and industry.

FY 2020 PHASE II AWARD WINNER

FIRM: CFD RESEARCH CORPORATION
6820 Moquin Drive NW
Huntsville, AL, 35806

AWARD: \$400,000.00

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PRINCIPAL INVESTIGATOR (PI): Elise Schultz

TITLE OF PROJECT: Developing Lightning Data Services for Commercial and Public Applications

SUBTOPIC NUMBER: 9.4.01

TECHNICAL ABSTRACT:

Lightning impacts many aspects of our daily lives and is responsible for billions of dollars in property and industry losses every year. This Phase II effort proposes the development of a lightning services API using data from the GOES-R Series Geostationary Lightning Mapper (GLM) and the development of short-term lightning prediction products including lightning initiation and lightning cessation. The API will include real-time functionality and the ability to analyze archived GLM data throughout the entire field-of-view. 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:

This Phase II effort will provide a functioning prototype API for GLM data and derived Lightning Nowcast products and interactive front-end interface for real-time and archived applications. The lightning services API is developed for app developers, forecasters, broadcast meteorologists, research, and others focused on accessing lightning information for safety and decision-support activities. The inclusion of lightning nowcast information including operational lightning initiation and cessation algorithms available via an API can directly benefit safety applications and decisionsupport activities for industry and outdoor events.

FY 2020 PHASE II AWARD WINNER

FIRM: TCARTA MARINE LLC
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Denver, CO, 80204

AWARD: \$399,126.00

PHONE: 303-284-6144

E-MAIL: df@tcarta.com

PRINCIPAL INVESTIGATOR (PI): David Flanagan

TITLE OF PROJECT: Optimization of high resolution multispectral satellite imagery collection for Arctic conditions through custom sensor parameterization and multi-sensor integration for through-the-water space-based seafloor imaging in support of coastal hydrographic surveying

SUBTOPIC NUMBER: 9.6.03

TECHNICAL ABSTRACT:

A long time ago before GPS, satellites and multibeam sonars one Old Man and the Sea thought, "It is better to be lucky. But I would rather be exact. Then when luck comes you are ready." There is no room for luck when conducting hydrographic surveying in Arctic coastal waters. Satellites can play a key role in operational efficiency, cost effective use of existing technology and risk reduction. More precise and extensible satellite-based technologies, when leveraged to inform hydrographic surveying operations, allow operators to be more exact in their operations. To fully exploit the precision of Earth observation multispectral satellites for marine applications and specifically for Arctic conditions of short collection timeframes, challenging weather conditions and highly dynamic coastal areas, imagery collection must be exact and optimized to the nuances and unknowns inherent to the region. This research will integrate space-based multispectral, laser and radar sensors in a multi-sensor approach, using one sensor to inform the collection scheme for another, to be exacting and precise when deploying these assets. This research fuses multiple existing space-based technologies and new applications for future satellite constellations through cross-platform systems integration and near real-time interoperability with hydrographic survey operations and routines.

SUMMARY OF ANTICIPATED RESULTS:

Hydrographic surveying is expensive and carries risk; therefore efficiencies that improve safety and efficiency have compounding operational benefits. Satellite technologies are proven to provide operational risk reduction and to inform efficient use of more precise but expensive technology. Small investment in satellite-based reconnaissance has a compounding effect on operational efficiency in hydrographic surveying, especially in Arctic waters. The proposed hydrographic mapping support technology will enable NOAA, international hydrographic organizations, and commercial marine surveying companies to mitigate economic and operational risks associated with airborne and marine hydrographic surveys using precision tasking of satellites under prescribed optimal conditions.

FY 2020 PHASE II AWARD WINNER

FIRM: LYNNTech INC
2501 Earl Rudder Freeway South
College Station, TX, 77845

AWARD: \$399,174.00

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E-MAIL: john.mueller@lynntech.com

PRINCIPAL INVESTIGATOR (PI): John Mueller

TITLE OF PROJECT: Rapid Point of Use Method to Identify Seafood Species

SUBTOPIC NUMBER: 9.2.02

TECHNICAL ABSTRACT:

Substitutions, replacing high-priced, quality fish with fish of lesser value is an ever-growing concern in the seafood industry. Recent studies have shown that 33% of the seafood samples tested in a US study were mislabeled. The most common mislabeled samples were those sold as snapper (89%). In fact, 94% of the samples labeled as red snapper were NOT red snapper. In response to this problem, Lynntech is developing a DNA-based technology that will identify specific seafood species. This will be a field-ready, point-of-use identification system to expose seafood mislabeling. It is designed to be exquisitely specific, user-friendly, and competitively priced. Our eventual Seafood Authenticity System will provide a sample-to-answer analysis of the seafood sample in approximately one hour. Indeed, development of our seafood identification system will have a positive impact on the seafood industry and commercial market, preventing mislabeled fish from entering the marketplace and ports, as well as grocery stores and restaurants. An added benefit of Lynntech's Seafood Authenticity System is that it can be readily modified to identify additional fish beyond those proposed in this study.

SUMMARY OF ANTICIPATED RESULTS:

Market analysts have indicated that the seafood authenticity market may reach \$1B (USD) by 2023. Unlike many other portable, point-of-use detection/identification systems, Lynntech's Seafood Authenticity System will provide on-site analysis with exquisite DNA-based sensitivity and specificity. As a result, Lynntech has an excellent opportunity to enter this seafood authenticity market and partake in its thriving 7.7% forecasted growth.

FY 2020 PHASE II AWARD WINNER

FIRM: CHARLES RIVER ANALYTICS, INC.
625 Mount Auburn Street
Cambridge, MA, 02138

AWARD: \$399,965.00

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PRINCIPAL INVESTIGATOR (PI): Daniel Stouch

TITLE OF PROJECT: 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 dangerous, dynamic, and unpredictable environments. For UAS to operate reliably and effectively among other aircraft, replace manned aircraft on missions, and enable effective beyond visual line of sight (BVLOS) operations, new capabilities are needed. Charles River proposes to implement a concept design, develop a prototype system, 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 BVLOS 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 that provides an autonomous rapid survey capability to accomplish diverse missions in challenging environments (e.g., wildfire tracking, post natural disaster damage assessment, radiological monitoring, missing person search). We will license this technology to UAS manufacturers such as Boeing, AeroVironment, and Lockheed Martin to use in appliqué kits on their current platforms.

FY 2020 PHASE II AWARD WINNER

FIRM: BLACK SWIFT TECHNOLOGIES LLC
2840 Wilderness PI, STE D
Boulder, CO, 80301

AWARD: \$395,601.00

PHONE: 720-638-9656

E-MAIL: elstonj@blackswifttech.com

PRINCIPAL INVESTIGATOR (PI): Jack S 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, spoofing, or hardware failure.

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. These applications include activities such as coast line monitoring, power line and pipeline inspection, or package delivery. 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 2020 PHASE II AWARD WINNER

FIRM: BADVR, INC.
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AWARD: \$400,000.00

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PRINCIPAL INVESTIGATOR (PI): Jad Meouchy

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

SUBTOPIC NUMBER: 9.4.01

TECHNICAL ABSTRACT:

The proposed research uses virtual reality to improve the viewing, analysis, and communication of complex weather data. Extracting insights is currently a technically demanding task and the process excludes most non-technical users. Recently, the NOAA Big Data Project made significant progress to publish hundreds of terabytes worth of encoded weather measurements including raw NEXRAD radar volumes. This project will increase the accessibility and value of that effort by bringing that data into an immersive and multi-user visualization environment. Phase II will continue upon Phase I's work toward commercialization by adding real-time interactivity and team collaboration features that directly solve many challenges stakeholders face when planning for or reacting to weather. This project will fundamentally transform the way weather data is communicated from the "blocky" 2D weather maps of yesterday to an immersive 3D analytics experience of tomorrow.

SUMMARY OF ANTICIPATED RESULTS:

This project will result in a commercial demonstration VR application that allows multiple users to simultaneously explore, interact with, and annotate live NEXRAD radar data in three dimensions. The proposed research will make an impact in public safety, meteorology, and defense by greatly enhancing the capabilities and efficiencies of operational weather information. When deployed to first responders and other mission-critical stakeholders, this technology has the potential to reduce loss of life and the economic impact of weather effects and emergencies.

FY 2020 PHASE II AWARD WINNER

FIRM: KITWARE, INC.
1712 Route 9, Ste 300
Clifton Park, NY, 12065

AWARD: \$399,999.00

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PRINCIPAL INVESTIGATOR (PI): Matthew Brown

TITLE OF PROJECT: ADAPT: Autonomous Data Acquisition and Processing Technologies Payload for Small Unmanned Aircraft Systems

SUBTOPIC NUMBER: 9.5.01

TECHNICAL ABSTRACT:

We propose the continuation of development for the Autonomous Data Acquisition and Processing Technologies (ADAPT) payload. This open source system will manage data collection from onboard sensors, particularly imaging sensors, and provide actionable intelligence by enabling in-flight, real-time application of DNN image processing to support a variety of missions. We will substantially reduce the barrier to training and deploying useful DNN-powered monitoring solutions at the edge by laying the groundwork with with an open-source baseline payload, solving the data collection, geolocation, and model deployment aspects of payload design in a way that is agnostic to the drone platform of choice. For this effort, the particular problem of river ice detection will be pursued in order to demonstrate the efficacy of the ADAPT payload for solving the problem of real time flood monitoring during icing months in Alaska. This will result in a first of its kind dense river ice segmentation dataset, a trained state-of-the-art river ice segmentation model, a small unmanned aerial vehicle (sUAS) payload for real time deployment of the developed model, and open source software and system architecture documentation for ease of reproducibility.

SUMMARY OF ANTICIPATED RESULTS:

ADAPT has the potential to aid a far-reaching customer and user base internationally as it caters to different applications, missions, domains, and industries. Affordability, flexibility, extensibility, accessibility, and the ability to provide real-time intelligent analyses are critical areas where existing systems do not meet this need or are only meeting this need partially. Commercial applications supporting environment monitoring, search and rescue, disaster management and more can be easily realized. Kitware will leverage its proven track record for strategically financing open source solutions to build a coalition of support and an active user community around ADAPT.

FY 2020 PHASE II AWARD WINNER

FIRM: INTELLISENSE SYSTEMS, INC.
21041 S. Western Ave.
Torrance, CA, 90501

AWARD: \$399,983.00

PHONE: 310-320-1827

E-MAIL: notify@intellisenseinc.com

PRINCIPAL INVESTIGATOR (PI): Chris Ulmer

TITLE OF PROJECT: Environmental and Oceanographic Measurement and Data (NOMAD) 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. (Intellisense) proposes to continue to develop the new Environmental and Oceanographic Measurement and Data (NOMAD) system based on a low-power, ultra-compact design that utilizes previously developed mature components and pioneering Intellisense technologies to achieve breakthrough size, ease of deployment, modularity, and adaptability and to provide a wide range of sensing capabilities without relying on any existing platform. The data system includes quality control at the sensor level using efficient edge computing, augmented by data management at the network level to directly address NOAA requirements. In Phase I, Intellisense demonstrated the feasibility of NOMAD by developing a full prototype, reaching TRL-7, and performing real-world testing in the Pacific Ocean, where the mechanical float design was proven and panoramic full-color images, water temperature data, and ambient light sensing data were transmitted through Iridium to a basic user interface. In Phase II, Intellisense plans to develop additional sensor options for incorporation and evaluation in the Phase I prototype, and to prepare production tooling and procedures necessary to begin the transition of NOMAD toward TRL-8 for qualification testing and full-rate production.

SUMMARY OF ANTICIPATED RESULTS:

NOMAD benefits NOAA and other agencies by serving as a self-contained hardware sensor system complete with its own communications and data processing platforms. NOMAD's platform-independence, low-cost, and small size enable the emplacement of a persistent, autonomous, unmanned oceanographic data-collection system in previously cost-prohibitive areas. Beyond immediate NOAA applications, NOMAD can be used by the U.S. military for river-drifting applications and by DHS and FEMA for disaster prevention and recovery applications that require rapid response and quick deployment. Commercial applications such as security and transportation logistics could also benefit from NOMAD's capabilities, such as on-the-water imaging, route monitoring, and weather measurement.

FY 2020 PHASE II AWARD WINNER

FIRM: METNA CO
3927 Dobie Road
Okemos, MI, 48864

AWARD: \$400,000.00

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:

The decline of coral reefs can be feasibly reversed by introducing coral transplants that are stabilized via adhesion to substrates. An adhesive is under development to safely and economically improve the speed and success rate of stabilizing coral transplants. This adhesive comprises a bioactive inorganic and an organic polymer constituent that function synergistically to enable rapid and controlled underwater application at different scales, achieve high set and cure rates in seawater, minimize any need for surface preparation, stimulate the self-attachment and growth of transplants, avoid any threat to marine life, and offer favorable economics and sustainability. The Phase I project developed and characterized the bioactive inorganic and the refined organic constituents, integrated them to produce the hybrid, bioactive adhesive, and evaluated the structure and properties of the new adhesive, its ability to enhance the growth rate of coral transplants in seawater aquaria, and its competitive cost and sustainability merits. The proposed Phase II project will further refine and optimize the hybrid, bioactive adhesive, thoroughly evaluate its performance in laboratory, seawater aquaria and representative offshore sites, verify the scalability, performance, cost and sustainability advantages of the optimized adhesive, and address the proprietary, teaming and regulatory needs in preparation for market entry.

SUMMARY OF ANTICIPATED RESULTS:

The new hybrid, bioactive adhesive is developed to address the needs of the coral restoration markets, which have significant overlaps with those of the aquarium industry. By safely and economically improving the speed and efficiency of the coral transplantation process, and by enhancing the selfattachment, survival and growth rates of coral transplants, the new adhesive benefits the coral restoration efforts. Significant economic and societal benefits can be realized by slowing down and eventually reversing the rapid decline of coral reefs. In the long term, refined variations of the new adhesive can find applications as marine, bone and dental adhesives.

FY 2020 PHASE II AWARD WINNER

FIRM: SYNTHETIK APPLIED TECHNOLOGIES LLC
28696 TREE FARM ROAD
PIERRE, SD, 57501

AWARD: \$399,972.00

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E-MAIL: vonk@synthetik-technologies.com

PRINCIPAL INVESTIGATOR (PI): Peter Vonk

TITLE OF PROJECT: DeepCTIS: A New Low-Cost Hyperspectral Imaging Module and Distributed Deep Learning Platform to Combat Seafood Fraud, and 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 low-cost COTS optical sensor modules; to create an inexpensive yet 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 inexpensive 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 using CTIS-based image reconstruction and low-cost 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 2020 PHASE II AWARD WINNER

FIRM: BJE ENVIRONMENTAL OPTICS LLC
127 South Hoover Ave
Louisville, CO, 80027

AWARD: \$398,671.00

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E-MAIL: Steve23n@gmail.com

PRINCIPAL INVESTIGATOR (PI): 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. 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 II proposal will continue development of 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 2020 PHASE II AWARD WINNER

FIRM: CVISION AI INC
81 West St
Medford, MA, 02155

AWARD: \$398,483.00

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E-MAIL: benjamin.woodward@cvisionai.com

PRINCIPAL INVESTIGATOR (PI): Benjamin Woodward

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:

During phase I we created a web-based media analytics platform, Tator, as a foundation for the exploration, enrichment, and evaluation of underwater video and imagery. Tator supports collaborative annotation, customizable metadata, advanced playback features, third-party programming interfaces, and registering and running algorithm workflows. In phase II we will expand the core capabilities of Tator and introduce libraries of algorithms and media in conjunction with project partners and related efforts such as FathomNet, the MIT Open Ocean Initiative, and the Ocean Discovery League. This will enable enrichment of new and existing underwater media through automated annotation and provide researchers tools to curate and transform media into algorithm training data. The core Tator platform will be matured into enterprise-grade software, enabling in-app analyses and reports, advanced annotation, task management features, and standards compliant project templates. To improve commercial viability of our cloud-based managed offering, Tator Cloud, we will optimize our cloud architecture to reduce costs. To facilitate annotation during data collection efforts, as well as future real time algorithm deployment, a ruggedized "Tator-in-a-box" module for use on local area networks will be created to help curation and annotation of dive data in real time, further reducing lag between data capture analysis.

SUMMARY OF ANTICIPATED RESULTS:

Tator is used internally at CVision to streamline data management and algorithm development, solving many issues we faced previously by centralizing project resources and allowing shared access and collaboration. Upon completion of this Phase II effort, Tator will be at a level of maturity such that we can begin focusing on marketing and sales of our managed cloud-based offering of Tator, Tator Cloud. Current customers already include organizations that collect underwater video and videos for electronic monitoring on fishing vessels. We will expand our customer base within these domains, but also to expand to new domains.