



# SBIR



## **Small Business Innovation Research Program**

**ABSTRACTS OF PHASE I  
AWARDS FOR FISCAL YEAR 2021**

**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 19 Phase I grants for FY 2021. These awards are up to \$150,000 each totaling approximately \$3 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 2021.” 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 194 proposals were received by DOC/NOAA in response to its FY 2021 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 19 were selected for an award. Final selection was based upon the results of the reviews, and the project’s potential for commercialization.

## FY 2021 Phase I List of Awardees

<u>Award Number</u>	<u>Company Name</u>	<u>Topic Number</u>
NA21OAR0210480	Tampa Deep Sea Xplorers, LLC	9.1
NA21OAR0210481	Elder Research, Inc.	9.2
NA21OAR0210482	Radmantis LLC	9.1
NA21OAR0210483	Toyon Research Corporation	9.3
NA21OAR0210484	Synthetik Applied Technologies LLC	9.3
NA21OAR0210486	Tridentis Advanced Marine Vehicles, LLC.	9.1
NA21OAR0210487	Hummingbird Nano, Inc	9.2
NA21OAR0210488	InferLink Corporation	9.5
NA21OAR0210489	Sunburst Sensors, LLC	9.5
NA21OAR0210490	Maritime Applied Physics Corporation	9.4
NA21OAR0210491	Swift Engineering Inc.	9.1
NA21OAR0210492	Live Advantage Bait LLC	9.1
NA21OAR0210493	International Association of Virtual Organizations, Inc.	9.5
NA21OAR0210494	Nearview, LLC	9.4
NA21OAR0210495	Areté Associates	9.1
NA21OAR0210496	Mimetics, LLC	9.1
NA21OAR0210497	Syntro Tek Corporation	9.5
NA21OAR0210498	Cell Matrix Corporation	9.5
NA21OAR0210499	StratoSolutions, Inc	9.4

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Tampa Deep Sea Xplorers, LLC  
14007 Clubhouse Circle, Suite 706  
Tampa, FL 33618

AWARD: \$128,918.00

PHONE: 813-999-6043

E-MAIL: elarson@tampadeepsea.com

PRINCIPAL INVESTIGATOR (PI): Edward Larson

TITLE OF PROJECT: Tampa Deep Sea Xplorers Compact Low Cost AUV Platform for Next Generation Seafloor and Water Column 3D Imaging Sensors

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

Tampa Deep Sea Xplorers (TDSX) will conduct research into the feasibility of integrating a compact underwater LiDAR system for small ROVs and AUVs. LiDAR has revolutionized the collection of archeological, geographical, and cartographic data on dry land. Its use below the water's surface however has been severely limited. The Phase I SBIR is a collaborative effort between TDSX and BeamSea Associates to prove the feasibility of developing a LiDAR system to collect data from a small platform vehicle. The Phase I SBIR will prove the feasibility of reducing the size and weight of a LiDAR system for internal installation in a micro or mini-ROV or AUV.

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

The AUV platform that will be used for this development will be a TDSX Barracuda. The Barracuda platform is suitable to prove that a light weight compact LiDAR system can be developed to be carried internally or as an add-on module for micro and mini-ROVs and AUVs. This proposal has the potential to put a state-of-the-art data collection platform into the hands of individuals, small institutions, and research laboratories that otherwise would not be able to afford an underwater LiDAR mounted on a remote vehicle for subsea data collection.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Elder Research, Inc.  
300 W Main St, Suite 301  
Charlottesville, VA 22903

AWARD: \$149,992.00

PHONE: 434-973-7673

E-MAIL: alexander.koeppel@elderresearch.com

PRINCIPAL INVESTIGATOR (PI): Alexander Koeppel

TITLE OF PROJECT: HABSSSED: Harmful Algal Bloom Surveillance by Sequencing of Environmental DNA

TOPIC NUMBER: 9.2

### **TECHNICAL ABSTRACT:**

Harmful Algal Blooms (HABs) pose a significant and increasing risk, both to human health and to the Blue Economy. 'Omics approaches to early detection promise to help mitigate these risks. We propose to develop HABSSSED (HAB Surveillance by Sequencing of Environmental DNA) a portable, reliable, rapid, low-cost pipeline for detecting HABs in the field using 3rd generation sequencing with the Oxford Nanopore MinION device. We propose to demonstrate the efficacy of our approach by sequencing existing samples collected by our collaborators at James Madison University from a NOAA GLERL on Lake Erie. We will sequence eDNA from samples drawn before, during, and after a Microcystis bloom, and estimate the abundance of HAB-associated taxa. We hope to show that this approach will allow for more efficient detection of HABs when compared to conventional approaches. Results from our pilot sequencing runs in Phase I will be used to optimize and streamline the extraction, sequencing, and analysis processes for the development of HABSSSED in Phase II. Our team includes expert bioinformaticians, data scientists, MinION sequencing experts, and HAB SMEs, and is uniquely suited to develop and deliver this product to assist NOAA in mitigating this threat to the Blue Economy.

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

Our proposed pipeline consists of COTS technologies, but HABSSSED combines these technologies in new ways specific to the detection of HABs. HABSSSED will allow for rapid HAB detection with field-portable equipment, and at a much lower cost than conventional methods. In addition to the delivery and support of HABSSSED itself, we plan to license out training in its use to fisheries managers, ecology students, and other interested parties. We also plan to host a cloud environment containing the pipeline and all of the underlying data infrastructure, which we would make available to customers as a subscription service.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Radmantis LLC  
1108 N Reynolds Rd  
Toledo, OH 43615

AWARD: \$150,000.00

PHONE: 405-990-5288

E-MAIL: cmk@radmantis.com

PRINCIPAL INVESTIGATOR (PI): Chris Kemp

TITLE OF PROJECT: Adopt existing technologies for improved seafood production and to better feed a growing world

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

Expansion of aquaculture production depends crucially on the development of technologies that are able to perform functions important in a fish farming facility, without human input. For instance, early detection of a disease or parasite outbreak is critical in intensive aquaculture settings. Parasites, such as Sea Lice in Salmonid aquaculture are responsible for large losses. Existing options for dealing with outbreaks are unpalatable. The present Phase I proposal aims to pioneer the use and smooth integration of image detection, machine learning (ML) inference, and automated harvesting, into autonomously operating devices within current aquaculture workflows. Optimized for low-power consumption, our product plans rely on open source frameworks and single board edge computing, with on-board, tensor-flow co-processing. The result will be a flexible and adaptable, automated system that permits the sorting and handling of fish by a number of characteristics, including growth rates/condition, morphological features, behavior, skin abnormalities, diseases such as Bacterial Cold Water Disease (BCWD), or parasite load from sea lice.

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

In this SBIR Phase I project, Radmantis will develop devices that permit the completion of important tasks in aquaculture. We will apply our proprietary technology for fish classification to custom devices able to perform the routine monitoring of individual fish, the detection of diseases and parasites, and the extraction of these individuals based upon the specified criteria.

## **FY 2021 PHASE I AWARD WINNER**

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

AWARD: \$150,000.00

PHONE: 805-968-6787

E-MAIL: ksullivan@toyon.com

PRINCIPAL INVESTIGATOR (PI): Kevin Sullivan

TITLE OF PROJECT: Detecting and Classifying Marine Mammals in Infrared Video Using AI

TOPIC NUMBER: 9.3

### **TECHNICAL ABSTRACT:**

We propose to develop an artificial intelligence (AI) system that can automatically process infrared video to detect and classify marine mammals. We will use a novel deep neural architecture developed at Toyon based on the latest research in artificial neural networks. Our approach is able to capture both temporal and spatial features that are present in the infrared video. We plan to train our network using months of recorded long wave infrared (LWIR) video from multiple cameras that observed the ocean day and night for months at a time with marine mammals present on occasion. Our training process will involve the use of human-developed algorithms and semi-automated tools for data extraction. We will evaluate the performance of our AI system and compare its performance to existing human-developed algorithms.

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

The successful completion of this research effort will create an AI system that can process large volumes of infrared or visible video to detect marine mammals. This capability can be used by the military and oil and gas industries to mitigate potential harm to marine mammals when operating loud acoustic sources. It can also be used by the shipping and cruise line industries to reduce the number of ship strikes on large whales. Recreational boaters will also be interested in this technology to avoid collisions with large marine mammals. The potential combined market for all of these applications exceeds \$1B and numerous animals could be spared damage and/or death if this research is successful.

## **FY 2021 PHASE I AWARD WINNER**

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

AWARD: \$149,562.00

PHONE: 360-441-5010

E-MAIL: hatfield@synthetik-technologies.com

PRINCIPAL INVESTIGATOR (PI): Josh Hatfield

TITLE OF PROJECT: DeepSpace-AI - A Deep-Learning Based Offshore Monitoring System Using Satellite Imagery

TOPIC NUMBER: 9.3

### **TECHNICAL ABSTRACT:**

High-resolution images from satellites and airplanes have become ubiquitous in the current digital landscape, and readily available to the public. In recent years, deep learning approaches, and in particular deep convolutional neural networks have revolutionized computer vision. Such deep learning models thrive with an abundance of data, creating enormous potential at the nexus of computer vision and satellite imaging. To this end, we propose to develop DeepSpace-AI, a robust platform to automate processing and object recognition in satellite imaging for a range of applications in marine environmental monitoring and beyond. DeepSpace-AI will serve as a platform for the annotation of satellite image datasets, training of deep learning models, automated object recognition in real-time, and a dashboard for analyzing and interpreting results. Providing a single platform for multiple object recognition tasks will provide unprecedented opportunities for observing behaviors and trends involving combinations of visible phenomena. Finally, the proposed system will automate the import of publicly available aerial and satellite data as it becomes available, enabling pseudo real-time monitoring and rapid detection of global environmental events.

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

Beyond providing an environmental monitoring tool to government entities, DeepSpace-AI will provide multi-faceted commercial value in a number of application spaces. First, the proposed platform will provide a monitoring solution to support permitting efforts for offshore facilities such as wind farms and aquaculture installations, and generally provide a tool for environmental impact analysis. More broadly, the system can be adapted to virtually any object recognition task, both marine or terrestrial, with this data provided as a consumable GIS layer on a subscription basis. Finally, we will develop and deliver object detection and classification models as a cloud-based service.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Tridentis Advanced Marine Vehicles, LLC.  
73-4460 Queen Kaahumanu Hwy. #138  
Kailua-Kona, HI 96740-2632

AWARD: \$149,865.00

PHONE: 540-903-5544

E-MAIL: william.latham@tridentis.com

PRINCIPAL INVESTIGATOR (PI): William Latham

TITLE OF PROJECT: Enhanced Aquaculture Monitoring

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

The purpose of this proposal is to analyze the monitoring requirements for near shore aquaculture installations and determine the best technical solution to continuously monitor these growing sites. By providing continuous monitoring of the water quality, shellfish/finfish quality can be inferred and then transmitted to the consumer as an enhanced food security certification. Tridentis Advanced Marine Vehicles (AMV) in conjunction with the Washington College Watershed Innovation Laboratory (WIL) intend to establish a baseline testing regimen for a near-shore shellfish aquaculture farms and develop a material solution to monitor the environmental conditions efficiently, in real time, accurately, and in a cost-effective manner within aquaculture installations. AMV intends to develop technology for use on our Advanced Coastal Monitor (ACM) to provide a cost-effective solution to improve monitoring capabilities. The Watershed Innovation Lab will supply Basic Observation Buoy (BOB) monitoring buoys that measure and transmit data real-time to be used in concert during this study. The ACM is a cost-effective solution and greatly reduces the labor hours required to survey the aquaculture growing areas. The BOB is a fixed floating buoy that continuously monitors water quality and transmits the data in real-time to a shore monitoring station.

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

Food security is a growing concern from a regulatory and consumer perspective. Agriculture is easily monitored spatially and frequently. Aquaculture is more difficult to confidently observe. We trust that the water that covers the marine ecosystem is safe, clean and uncontaminated. The development of the autonomous vehicle and sentinel buoy monitor systems will provide ubiquitous security that our food is safe to consume from its point of origin to the shelf where we pick it from. The commercial application is global to ever expanding aquaculture and mariculture farms that will become increasingly critical as food needs expand with global populations.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Hummingbird Nano, Inc  
450 John C Watts Drive  
Nicholasville, KY40356

AWARD: \$150,000.00

PHONE: 859-539-1874

E-MAIL: hawes@hummingbirdnano.com

PRINCIPAL INVESTIGATOR (PI): Eleanor Derbyshire

TITLE OF PROJECT: Pressure Based Microfluidics to Increase the Speed Automation, and Portability of Elisa for Microcystin Detection

TOPIC NUMBER: 9.2

### **TECHNICAL ABSTRACT:**

Harmful algal blooms can devastate ecological and economic systems; federal disasters are declared, public drinking water systems shut down, fisheries closed, and mass wildlife die offs and acute toxicity/death for humans occur. By the numbers, the negative financial impact of HABs globally is \$10B and, as temperatures climb, conditions are increasingly favorable for HAB events. HABs can be controlled with damage mitigated, and early detection of a bloom is a critical step in avoiding disaster. The most prevalent toxin associated with HABs is the hepatotoxin microcystin. Screening for microcystins uses ELISA to assess the total number of microcystins in a sample. ELISA tests typically take 2-4 hours and are limited in sensitivity. The long test time for ELISA is dominated by the binding time of antigens and antibodies to analytes. Hummingbird Nano, Inc., proposes an innovative microfluidic pressure-based methodology to significantly reduce this binding time while increasing sensitivity. The proposal expands on initial promising work to fully investigate the innovation in terms of time and sensitivity. The ultimate goal of the work is to have an automated system that uses pressure feedback loops to indicate when binding capacity is saturated, and vastly increase the speed and sensitivity of the test.

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

There are ~148,000 public water systems across the US that are required to screen for microcystins. As global instances of HABs increases, legislation regarding microcystins testing is also increasing in individual states, federally, and internationally, thereby putting an additional financial onus on these water systems. An automated, sensitive, faster system frees up experienced personnel, and allows for faster implementation to mitigate the spread of the toxin. The current business plan is to sell an affordable system unit and generate revenues by selling consumable microfluidic cartridges used in the system.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: InferLink Corporation  
2361 Rosecrans Ave., Ste 348,  
El Segundo, CA 90245-4929

AWARD: \$150,000.00

PHONE: 310-441-2446

E-MAIL: sminton@inferlink.com

PRINCIPAL INVESTIGATOR (PI): Steven Minton

TITLE OF PROJECT: Auto-Transcription for Citizen Science

TOPIC NUMBER: 9.5

### **TECHNICAL ABSTRACT:**

We propose to develop a system for transcribing semi-structured data, including tables, from handwritten or typed document images. Our objective is to design an end-to-end system that takes document images as inputs and extracts a digital, tabular output. The proposed approach employs a joint reasoning architecture where optical character recognition and structure recognition is combined in a single neural network to achieve high accuracy.

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

In addition, our approach will allow users to rapidly fix any extraction mistakes in a “example-based” manner, so that working as a man-machine team the complete task can be efficiently accomplished, even in cases where the system does not initially produce a perfect result. Our aim is to empower citizen scientists to quickly and easily participate in the extraction process in an intuitive way.

## **FY 2021 PHASE I AWARD WINNER**

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

AWARD: \$149,991.00

PHONE: 406-532-3246

E-MAIL: Reggie@sunburstsensors.com

PRINCIPAL INVESTIGATOR (PI): Reggie Spaulding, PhD

TITLE OF PROJECT: pHyter: An Oceanographic Tool for Citizen Science and STEM Education

TOPIC NUMBER: 9.5

### **TECHNICAL ABSTRACT:**

NOAA SBIR topic 9.5 includes as a research priority the development of tools, platforms, ... to make environmental information... more accessible, usable, understandable, and relatable to students, citizen scientists, and the public. Sunburst Sensors has twice used NOAA SBIR funding to successfully create new products. We propose using phase 1 funding to demonstrate the prototype pHyter as a tool for students and citizen scientists to collect ocean biogeochemical data. The pHyter is an inexpensive instrument that accurately measures pH using colorimetric methods. It uses an iPhone app that records location, time, temperature, pH and meta-data via Bluetooth. The instrument will work well in the hands of students and citizen scientists, and it will serve as basis for the development of other inexpensive instrumentation in phase 2. The prototype instrument was developed over the past few years and requires real-world demonstration. We will build 50 instruments and distribute them to 3 programs doing educational or citizen science work requiring accurate pH measurements. We will assess performance both in terms of data quality and user experience. Simultaneously we will develop a dual platform application (iOS and Android) for the device and evaluate existing data portals as potential repositories for collected data.

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

The pHyter will be an inexpensive useful tool for the measurement of coastal ocean pH for use by citizen scientists and STEM education programs. Funding of this project will improve the current prototype design, making it a viable real-world product. Improvements will include better accuracy, support of both Android and iOS devices, and changes based on feedback of our partner organizations who will test the device in real world scenarios. This development will lead to phase 2 work, where similar useful devices will be developed, tested and brought to market.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Maritime Applied Physics Corporation  
1850 Frankfurst Ave  
Baltimore, MD 21226

AWARD: \$149,800.00

PHONE: 443-524-3330 ext. 144

E-MAIL: pseiffert@mapcorp.com

PRINCIPAL INVESTIGATOR (PI): Paul Seiffert

TITLE OF PROJECT: TALONS for Marine Mammal Detection

TOPIC NUMBER: 9.4

### **TECHNICAL ABSTRACT:**

While increases in maritime shipping traffic continue on an exponential trend, marine mammals, especially the critically endangered Right whale, is experiencing ever increasing injuries and deaths due to ship strikes and fishing gear entanglements. This SBIR seeks to combine two fielded prototype technologies- a parafoil built for the US Navy (TALONS), and a whale detection sensor system that would give ship captains a greater chance of reacting well before a ship crosses paths with a whale. This technology combination also shows great promise for A) vessel-strike mitigation, B) noise mitigation during windfarm construction and piledriving as well as NOAA scientific applications for marine mammal tracking and detection.

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

In long-run one could imagine autonomous vehicles equipped with such systems to track individual whales of highly endangered species (e.g. North Atlantic right whale) and create mobile high-awareness zones to protect those animals.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Swift Engineering Inc.  
1141 Via Callejon  
San Clemente, CA 92054

AWARD: \$150,000.00

PHONE: 714-315-2792

E-MAIL: grae@swiftengineering.com

PRINCIPAL INVESTIGATOR (PI): Graeme Rae

TITLE OF PROJECT: A Modular Water Quality Observation System to Accelerate the Blue Economy

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

Swift Engineering proposes to provide a high quality, affordable, Internet of Things (IoT) enabled Multi-functional, water sensor solution called "Kelp." An affordable and self-powered buoy platform, Kelp will be adaptable to changing needs of the global blue economy market. The first generation of this product specifically targets emerging markets in Estuarine Environmental Monitoring, Dam and Large-Scale Water Storage facilities, Harmful Algae Bloom (HAB) Monitoring, and Sewage and Chemical Outfall Monitoring. Each of these markets presents a unique need to monitor multiple water quality parameters with high resolution and near real time data collection, which Kelp is uniquely designed to provide.

To serve the needs of these market, Swift will develop several key features of the Kelp system. Swift will develop software and hardware layouts to turn Kelp into a modular system that allows for the addition of custom 3rd party sensors. Kelp will also be developed with readily available materials and electronic components. This approach ensures that Kelp units will be affordable, with the ability to undercut competitors by at least 50%. Development also aims to provide more categories of data than any competitors, and new sensors will be integrated in addition to the various water quality parameters already offered by current Kelp systems (pH, Dissolved Oxygen, Water Temperature, Salinity) To manage multiple data channels, Kelp development will produce a configuration and data display dashboard accessible via a laptop or smart phone. Deployment of Kelp units themselves only requires a single person. To ensure reliable data transmission, development will also preserve Kelp's existing communications versatility. Kelp units will be able to transmit data and be controlled over WiFi, Lora, and Satellite communication.

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

Swift will follow a thorough program plan to integrate these features into its existing Kelp system. Swift will conduct a size, weight, power and cost (SWaP-C) analysis to determine program risk associated with integrating each sensor into the Kelp platform. Comparing the SWaP-C against market potential studies conducted for each category of sensor enables Swift to determine which sensors can be integrated and commercialized with the lowest amount of program risk. After selecting the sensors with the highest potential for program success, Swift carries out hardware and software development to integrate sensors into the Kelp platform. Swift will also carry out development to integrate the entire Kelp platform into existing satellite communication networks. These offer global coverage and will enable Kelp systems to transmit data in real time from any location on Earth. To complete this Phase I, Swift will produce prototype Kelp buoys to field test the specialized Kelp product and deploy with beta customers. The information gained from field deployments and customer experience will position Swift to efficiently develop and commercialize Kelp and serve more customers in a Phase II.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Live Advantage Bait LLC  
5728 Old Fort Jupiter Road  
Jupiter, FL 33458

AWARD: \$150,000.00

PHONE: 561-818-0173

E-MAIL: nkirchhoff@gmail.com

PRINCIPAL INVESTIGATOR (PI): Nicole Kirchhoff

TITLE OF PROJECT: Rapid diagnostic testing for marine velvet disease, *Amyloodinium ocellatum*: a potential game changer for disease prevention and economic gain for fisheries and aquaculture

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

One of the most prominent challenges for the safe cultivation and maintenance of animals is control of infectious diseases. *A. ocellatum* is a parasitic infection that impacts all fish within the wide environmental range resulting in mass mortalities in captivity. With a broad host and geographic range, all fish in aquaculture (\$10B annually), aquarium trade species (\$278M annually),<sup>24</sup> and conservation species (\$7.6B), or a total of \$18B annually are susceptible to *A. ocellatum*. Due to its rapid onset, there are often no signs of infestation before mortalities begin to appear within a system, making it imperative to diagnose and treat as early as possible. Current methodologies for detecting *A. ocellatum* are insufficient to circumvent outbreaks. This project proposes two innovative approaches to develop a successful rapid diagnostic test for *A. ocellatum*: (1) utilization of a Next Generation approach of producing highly specific monoclonal antibodies (mAbs) for *A. ocellatum* dinospores and trophonts and (2) developing a standard operating procedure to pre-treat and concentrate aquarium water to enhance detection limits. On-farm testing as well as high sensitivity make this product novel in the industry and would make it an invaluable tool worldwide for aquaculture, aquarium, and aquatic conservation industries.

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

Biosecurity and the costs of infection with *A. ocellatum* can risk the financial security and sustainability of fish holding and culture, with a cost each year estimated at \$900 million. For this reason, *A. ocellatum* was ranked as one of the highest diseases of concern for industry. Our aim is to develop a rapid diagnostic test that can alert the aquarist of infection and/or screen new animals before introduction to a tank. On-farm testing as well as high sensitivity make this product novel in the industry and an invaluable tool worldwide for aquaculture, aquarium, and aquatic conservation industries.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: International Association of Virtual Organizations, Inc.  
3721-D University Dr.,  
Durham, NC 27707-6231

AWARD: \$149,882.00

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E-MAIL: jvosburgh@iavo-rs.com

PRINCIPAL INVESTIGATOR (PI): Jacob Vosburgh

TITLE OF PROJECT: Setac: Enhancing Usability of Archived Weather Data in the Digital Age

TOPIC NUMBER: 9.5

### **TECHNICAL ABSTRACT:**

NOAA has used historical documents such as ship logs and many other resources to collect weather data critical to modeling global and regional climate and weather conditions. To date, the optical character recognition (OCR) technology developed over the past three decades remains limited in the ability to recognize handwriting and reliably extract text in context. Machine Learning (ML) algorithms can help improve the processes. Given the importance of accuracy for weather data, we propose the development and testing of a custom OCR/text extraction application built using OpenCV and Tesseract. Both are open-source and operate within the open-source Python environment. PyTorch will be evaluated as the deep learning library to optimize the OpenCV and Tesseract integration and post processing. We submit that this integration will provide more flexible pre-processing without undue complexity and understanding, require less post-processing, and establish a framework to add automation to pre/post processing and tuning compared to previous efforts. Our objectives are to; demonstrate feasibility of OpenCV as an image pre-processing tool for document layout analysis, demonstrate feasibility of Tesseract as text extraction tool, demonstrate feasibility of using PyTorch as adaptive deep learning library for post-processing and information extraction, and validate performance.

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

OCR markets are rapidly evolving. We plan to commercialize an AI-based OCR capability integrated with operational transportation infrastructure logistical systems. The emphasis is on AI-OCR processing of written/typed logs and thereafter utilizing the output for integrated logistical support. Our product is envisioned as a web-based software system, fully aligned with prevailing preferences for "cloud" and web-services solutions. We believe the SBIR will result in: (1) a commercial software system, (2) achieving sales greater than \$5M/year, and (3) doing so within 36 months of the SBIR. Sales will be largely based on one-time licensing fees and then annual subscription renewals thereafter.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Nearview, LLC  
36 Maplewood Ave.,  
Portsmouth, NH 03801-3712

AWARD: \$149,999.00

PHONE: 207-200-7879

E-MAIL: stefan@nearview.net

PRINCIPAL INVESTIGATOR (PI): Stefan Claesson

TITLE OF PROJECT: AI Model for Automated Detection and Mapping of Intertidal Vegetation

TOPIC NUMBER: 9.4

### **TECHNICAL ABSTRACT:**

There is a dearth of accessible information and innovative tools to map and obtain biomass data for analysis, conservation, and sustainable resource management of intertidal vegetation in the United States and globally. A major technical problem is the integration of biological and physical data at small spatial scales (2 meters). We propose Unoccupied Aerial Systems (UAS) can be used for quality control, co-registration, training, and validation of satellite or high-altitude or space-based aerial imagery. Specifically, we propose to develop training data using Unoccupied Aerial Systems (UAS) to bridge the gap between small- and large-scale ecological and remote sensing data, and to use Artificial Intelligence (AI) and Machine Learning (ML) to accurately map, classify, and estimate biomass of intertidal vegetation such as macroalgae. This Phase I study will assess the feasibility to develop a deep learning model based on UAS-acquired data and satellite imagery in the detection, classification, and biomass estimation of intertidal vegetation at local, as well as state-wide or regional scales.

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

Nearview LLC aims to develop training data libraries and AI/ML algorithms for automated classification of vegetation in intertidal zones. The resulting platform will allow conservation authorities, government agencies, and various stakeholders (e.g., seaweed harvesters, NGOs) to automate mapping of intertidal vegetation distributions, estimate biomass, and monitor ecosystem health. The platform will be the foundation for monitoring multiple coastal zone resources (e.g., wetlands, seagrasses, macroalgae, and riparian vegetation), which are known indicators of environmental quality. Access to quantifiable data will provide the information needed to detect, adapt to, and mitigate anthropogenic and natural impacts to coastal ecosystems and fisheries.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Areté Associates  
9301 Corbin Avenue, Suite 2000.  
Northridge, CA 91324-2508

AWARD: \$149,913.00

PHONE: 720-759-4414

E-MAIL: spanderson@arete.com

PRINCIPAL INVESTIGATOR (PI): Steven P. Anderson

TITLE OF PROJECT: Infrared Polarimetric Wave Imaging (I-PWI) for Passive Remote Sensing of Sea State

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

The surface of the ocean is a dynamic and challenging work environment. Many operations are limited by sea state and surface currents. Knowledge of ocean wave conditions is critical for maritime safety and operations. We propose to develop a new Infrared Polarimetric Wave Imaging (I-PWI) sea state sensor. IPWI will be deployed on offshore structures such as oil platforms and wind turbines. The technology complements existing monitoring capabilities including a real-time, NOAA maintained data buoy array, numerical models, and regional ocean observation systems. I-PWI leverages new camera technology and recent advances in the physical understanding of Structure from Polarization (SfP) to capture surface slope fields used to derive sea state (wave height, period, and directional wave spectra). I-PWI also uses well established space-time processing techniques to provide estimates of surface currents from image sequences. The system (camera and processing module) is mounted well above the sea surface, and looks down and away from the platform. This configuration reduces installation and maintenance cost relative to in situ instruments and buoys, and avoids wake contamination from the platform. We anticipate that this Phase I study will demonstrate the feasibility of I-PWI to provide a compelling commercial solution.

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

The proposed I-PWI sea state sensor addresses the needs of three market segments: Offshore Energy, Civil Government (including NOAA), and Defense. Our initial commercial "beachhead" is the offshore energy exploration and production industry. Globally, there are well over 500 offshore oil and gas platforms. This in itself provides a sizable near-term market opportunity. We will then work with NOAA and the U.S. Navy to adapt the technology to meet their specific needs and requirements.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Mimetics, LLC  
6 Davis Drive, Ste 530  
Durham, NC 27709

AWARD: \$149,191.00

PHONE: 919-558-1370

E-MAIL: adam.leman@mimeticsbiosci.com

PRINCIPAL INVESTIGATOR (PI): Adam Leman

TITLE OF PROJECT: Yeast-Based Biosensors for Detecting Pathogenic Bacteria in Aquaculture Systems

TOPIC NUMBER: 9.1

### **TECHNICAL ABSTRACT:**

This Phase I SBIR Project proposes the development of a novel Yeast-Based Biosensor for detecting pathogenic microbes in aquaculture water. Diseases due to bacteria and viruses cost aquaculture producers tens of millions of dollars annually in lost production. Early detection of the microbes that cause these diseases is the key to stopping the spread of the disease and limiting losses. Current tests are slow and require laboratory facilities and cannot be conducted on site. The new Biosensor provides rapid, low cost detection of microbes on site, without requiring laboratory facilities, equipment or specially trained personnel. The Biosensor will be packaged as a test kit. To use the kit, a small water sample is placed into a test tube and the contents of a small packet of yeast and an antibody that targets the microbe in question are squeezed into the tube as well. Then a 'dipstick' is inserted. A control test tube is handled similarly. After ~3 hours the dipsticks are removed and compared. If the sample dipstick has changed color, the test has detected the targeted microbe and the producer is alerted to the fact that steps need to be taken.

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

The Yeast-Based Biosensor is designed for application to the microbes that directly impact Aquaculture. The Biosensor will be packaged as a kit and sold to Aquaculture producers as a stand-alone test. Producers will want to use the test during those times when the fish are most susceptible to disease or when they have been stressed. The kit can also be adapted for use in testing water in other areas of agriculture such as growing fresh produce, where contamination of irrigation water is the cause of food-borne illnesses that cause massive recalls of produce costing hundreds of millions of dollars.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Syntro Tek Corporation  
3641 N Cederblom St.  
Couer D Alene, ID 83815

AWARD: \$150,000.00

PHONE: 208-967-2042

E-MAIL: rcthomas@syntrotek.com

PRINCIPAL INVESTIGATOR (PI): Dr. Ross Thomas

TITLE OF PROJECT: Smartphone Water Quality Monitoring Platform for Increasing Public Engagement

TOPIC NUMBER: 9.5

### **TECHNICAL ABSTRACT:**

This Small Business Innovation Research project addresses the development of a new smartphone enabled water quality monitoring data platform supporting NOAA's mandate to maximize pathways for the public to engage with environmental research and monitoring applications. For example, NOAA has a rich history of Citizen Scientist involvement in the pursuit of the best social, economic and environmental outcomes. There is a growing need, however, for new advancements in data platforms focused on water quality monitoring activities that are a fraction of the cost, widely available and, most of all, easy to operate with the level of understanding commensurate with a lay person. Phase I R&D efforts will focus on developing: (1) quantitative water test strips using fortified standards; (2) smartphone app consisting of automated data acquisition and analysis algorithms; (3) relational database employing AI-based scrubbing methods. Phase I R&D efforts will also focus on completing a pilot study with Citizen Scientists to help optimize the end-user application of the proposed technology. Successfully completing the proposed project will provide a new pathway for growing workforce NOAA's proficiency and water pollution management operations via an expanding number of American civilians interested in helping protect coastal lagoons, deltas, estuaries and bays.

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

A rapid increase in populations near coastal areas has resulted in large-scale exploitation of coastal resources. The proposed project has the potential to create a disruptive market opportunity for a new environmental water quality monitoring platform with the following key advantages: (1) low cost; (2) quantitative results; (3) minimal training, (4) data intelligence accessed via the cloud. Successfully completing the proposed project will also enable an important new pathway that provides Citizen Scientists with a mechanism for helping gather coastal water quality data while simultaneously increasing their participation with environmental decision makers at all levels of government.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: Cell Matrix Corporation  
244 Sexton LN  
Newport, VA 24128-3508

AWARD: \$149,872.00

PHONE: 540-230-0885

E-MAIL: ccr3@cellmatrix.com

PRINCIPAL INVESTIGATOR (PI): Dr. Lisa Durbeck

TITLE OF PROJECT: Participatory Sensor Networks for Marine Navigation

TOPIC NUMBER: 9.5

### **TECHNICAL ABSTRACT:**

The primary objective of the proposed endeavor is to build a community-driven marine coastal data harvesting ecosystem that not only provides a benefit to the individuals within the coastal community, but also enhances the data quality, completeness and timeliness of maritime safety and navigation databases. The approach leverages volunteered geographic information to motivate dataset generation for automated analytics. The investigators propose the creation of a participatory sensor network for augmenting conventional marine navigation with timely updates of geospatial features. Aspects investigated include (a) a scalable cloud service that supports geographic objects and geospatial and temporal database query operations, (b) a motivating mobile client app for mariners that promotes interaction, (c) the viability of creating an ultra low cost marine-grade image sensor unit for identifying and coarsely classifying objects, (d) the social and economic forces and attractors in this market that will establish the critical mass of users needed to catalyze adoption, and (e) integration into contemporary data exchange interfaces, including OSM, MapQuest's Open Geocoding API, and Google's Geolocation API. This work will be performed as a collaborative effort between Cell Matrix Corporation and Virginia Tech.

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

The investigators will create a community-driven, highly distributed, multi-faceted data harvesting system, driven by a community consisting of recreational boaters, recreational and commercial fishermen, and other marine professionals that is free to use. Supporting products include a client application plug-in for mariner participation, and a cloud-based image refinement/tagging/understanding/querying service; yet the primary product will be an accurate-up-to-the-minute marine coastal geospatial database that promotes greater safety of navigation. Additionally, will develop a low-cost image sensor for automatic observation logging and confirmation. Revenue will come from data licensing and unobtrusive/assistive ad insertion.

## **FY 2021 PHASE I AWARD WINNER**

FIRM: StratoSolutions, Inc  
6457 W Howard St.  
Niles, IL 60714-3301

AWARD: \$150,000.00

PHONE: 847-802-9048

E-MAIL: rchan@stratosolutionsinc.com

PRINCIPAL INVESTIGATOR (PI): Mr. Raymond Chan

TITLE OF PROJECT: Stratospheric HAPS for enhancing societal resilience to extreme weather

TOPIC NUMBER: 9.4

### **TECHNICAL ABSTRACT:**

Remote areas, particularly over the oceans, represent regions with the least observation coverage and contribute significantly to reducing the potential accuracy of Numerical Weather Prediction (NWP) models. In addition to space-based observations, dropsondes are possibly the only viable meteorological sensors for use over remote areas, where there is no cost-effective approach to permit regular release of radiosondes. Technology improvements have enabled the miniaturization in the size and weight of dropsondes, thereby allowing new approaches for dropsonde stowage and deployment. Solar-powered stratospheric high altitude pseudo-satellite (HAPS) unmanned aerial vehicles (UAVs) are a new class of unmanned aircraft capable of flying continuously in the stratosphere for several months between landings. The integration of these miniaturized dropsonde to HAPS UAVs opens a level of weather data gathering not possible today.

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

The goal of the Phase I project is to validate that the HAPS-Dropsonde system specification (i.e. sensor capability, reliability in operational environment) meets that of existing dropsondes, identify additional sensor technologies to enhance observation data value, and develop the mission planning system for the "Stratosonde" platform through analysis of mission scenarios with end users and subject matter experts.