SBIR

Small Business Innovation Research Program

ABSTRACTS OF PHASE I AWARDS FOR FISCAL YEAR 2022

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 23 Phase I grants for FY 2022. These awards are up to $150,000 each totaling approximately $3.5 million. The awards are for a six-month effort to demonstrate the feasibility of innovative approaches to the research topics identified in the “NOAA SBIR FY 2022 Phase I” Notice of Funding Opportunity. 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 272 proposals were received by DOC/NOAA in response to its FY 2022 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available, 23 were selected for an award. Final selection was based upon the results of the reviews, and the project’s potential for commercialization.

FY 2022 Phase I List of Awardees

Award Number	Company Name	Topic Number
NA22OAR0210591	AirMettle, Inc.	9.1
NA22OAR0210584	Project Vesta, PBC	9.1
NA22OAR0210575	60Hertz, Inc.	9.2
NA22OAR0210579	ACME AtronOmatic, LLC DBA MyRadar	9.2
NA22OAR0210588	Dragoon Technology, LLC	9.2
NA22OAR0210583	Improving Aviation, LLC	9.2
NA22OAR0210592	Intellisense Systems, Inc.	9.2
NA22OAR0210573	Marine Advanced Robotics, Inc.	9.2
NA22OAR0210570	Morphobotics, LLC	9.2
NA22OAR0210586	Weathervane Labs, LLC	9.2
NA22OAR0210568	Aerodyne Research, Inc.	9.3
NA22OAR0210581	Ai.Fish, LLC	9.3
NA22OAR0210589	Blue Ocean Gear, Inc.	9.3
NA22OAR0210574	Biospherical Instruments, Inc.	9.3
NA22OAR0210587	CoastalOceanVision, Inc.	9.3
NA22OAR0210580	Field Data Services, LLC	9.3
NA22OAR0210578	FPN LLC dba PhytoSmart	9.3
NA22OAR0210590	Goeppert, LLC	9.3
NA22OAR0210577	LobsterLift, LLC	9.3
NA22OAR0210582	Ocean's Balance, Inc.	9.3
NA22OAR0210569	Wolverine Radar Company	9.3
NA22OAR0210572	Adaptive Management and Engineering, LLC	9.4
NA22OAR0210571	Geometric Data Analytics, Inc.	9.4

FY 2022 PHASE I AWARD WINNER

FIRM:	AirMettle, Inc. 2700 Post Oak Blvd, 21st Floor Houston, TX 77056
AWARD:	$150,00.00
PHONE:	646-872-2124
E-MAIL:	donpaul@airmettle.com
PRINCIPAL INVESTIGATOR (PI):	Donpaul Stephens

TITLE OF PROJECT:	Accelerated in-situ analysis of multi-dimensional data
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

The massive volumes of multi-dimensional array-oriented data generated by NOAA programs and the scientific community at large are predominantly stored in industry standard Network Common Data Form (NetCDF). Key challenges exist in making use of data stored in netCDF: data sets are often too large to be copied and transferred across networks for every user, and each time data is accessed by an analytics tool it must be retrieved, subsets extracted, and subsequently formatted, among other requirements, which can account for 80-90% of the total time needed to insight. To unlock the enormous potential of petabyte scale netCDF-formatted data stored at different locations, in this SBIR Phase I project, AirMettle, Inc. with its research partners from the University of Wisconsin Madison proposes to explore the feasibility of integrating in-situ analysis capabilities for multi-dimensional data (netCDF) into our highly innovative real-time smart data lake solution. Dramatically accelerated data analytics performed at the storage layer addresses key challenges noted within the Climate Adaptation and Mitigation Topic. Reducing data traffic between sites, shrinking required compute resources, and lowering costs – all while accelerating climate analyses by an order of magnitude – would bring great benefit to NOAA and the broader scientific community.

SUMMARY OF ANTICIPATED RESULTS:

If successful, the project will lead toward a powerful new research tool for both industry and the scientific community implemented in the data lake storage layer for performing netCDF-based data analytics preprocessing including extracting subsets and performing other ad hoc queries that accelerate overall analytics by 10x to 100x while reducing network traffic. Thousands of public and private organizations worldwide utilize netCDF formatted data for research and engineering purposes; the commercial potential and public benefit within the education, scientific, governmental, and business sectors are essentially limitless.

FY 2022 PHASE I AWARD WINNER

FIRM:	Project Vesta, PBC 584 Castro St. #2054 San Francisco, CA 94114
AWARD:	$149,957.00
PHONE:	407-590-4121
E-MAIL:	nate@vesta.earth
PRINCIPAL INVESTIGATOR (PI):	Nathan Walworth

TITLE OF PROJECT:	Technological Development for Measuring, Reporting, and Verifying Olivine-mediated Ocean CO2 Sequestration
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

The National Academy of Sciences have called for the rapid implementation of silicate-based CO2 removal to help sequester >1000 GtCO2 by 2100. This represents an unprecedented opportunity to connect the weathering of the silicate mineral, olivine, to rapidly growing carbon markets through the development of measurement, reporting, and verification (MRV) technologies. Project Vesta proposes to develop a novel MRV approach for in situ olivine-derived ocean alkalinity enhancement (OAE) through the development of integrated sensor technology within custom designed microcosms that simulate natural, coastal conditions. Project Vesta will fill major knowledge gaps and provide the necessary framework to constrain stoichiometric relationships among the optimal set of dissolution products and the measurement accuracy and precision needed for robust detection across space and time.

SUMMARY OF ANTICIPATED RESULTS:

MRV is critical to unlock the broader industry of OAE and link it to the rapidly growing carbon market, projected to surpass $1 trillion in 2050. This will in turn attract the necessary resources for gigaton-scale carbon removal. MRV will enable Project Vesta to license this technology to other organizations wishing to implement ocean-based CDR. Our vision is to help seed a global ecosystem of OAE organizations through the successful development of MRV in concert with safe olivine deployments.

FY 2022 PHASE I AWARD WINNER

FIRM:	60Hertz, Inc. 750 W 2nd Ave. Suite 101 Anchorage, AK 99501
AWARD:	$147,904.00
PHONE:	970-355-9221
E-MAIL:	piper.wilder@60hertzenergy.com
PRINCIPAL INVESTIGATOR (PI):	Piper Foster Wilder

TITLE OF PROJECT:	Artificial Intelligence (AI) based algorithms for predictive maintenance using NOAA data-sets for renewable energy assets
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:
We propose to use Aerosol Optical Depth (AOD) measurements as an early warning system, to cue on-site validation of the soiling station and any available meteorological (MET) station data to validate if a work order to clean deposited particulate matter is necessary. This would move from reactive maintenance – often weeks delayed, to proactive maintenance – getting ahead of the weather impact if possible. Through this research, we will develop a suite of algorithms and ultimately software tools, that fuse multiple public and private (GOES-R ABI AOD, and local site MET/soiling station) datasets with features like project economics, asset location, weather forecast, etc. to hasten solar service company's decision times with regard to cleaning and/or protecting renewable generation assets. Our approach is to fuse the data and then explore feature relationships (correlative, causal) in the data using Machine Learning pattern identification and relationship learning algorithms along with Machine Reasoning visual pattern detection and tracking, and then developing models to predict behaviors and outcomes of those relationships using Machine Learning, Modeling and Simulation, and Optimization techniques. Phase II allows a significant opportunity to tune the solution to other localized phenomena an approach closer to true predictive maintenance.

SUMMARY OF ANTICIPATED RESULTS:

The results will yield a suite of algorithms that compose a decision support tool that facilitates solar service companies' "Clean or Wait" evaluation. Since utility-scale solar cleaning efforts cost upwards of $15,000 per event, yet dirty panels decrease generation by 40%, this evaluation across a portfolio of hundreds of sites is problematic for solar developers and/or their service subcontractors. This first-of-a-kind research question will yield results the market is seeking: it's timely given the increase of wildfire alongside unprecedented investment in solar projects greater than 1 MW, particularly across the solar resource rich but drought and fire probable American West. Given more than 2,400 solar services, each with at least ten sites, the revenue potential to 60Hertz of this Weather-informed maintenance feature is $200,000 in year one, with $6,000,000 by 2025. The revenue this feature would salvage for our partner solar service company at the test site identified, if deployed four times per year, is approximately $18,000 or 2% of annual income from a single site project. Across their portfolio, this could yield $180,000 in annual increase in generation. For developers with increasingly thin margins, this revenue is meaningful.

FY 2022 PHASE I AWARD WINNER

FIRM:	ACME AtronOmatic, LLC DBA MyRadar 111 W Jefferson ST, STE 200 Orlando, FL, 32801
AWARD:	$150,000.00
PHONE:	503-708-2555
E-MAIL:	vesh@acmeaom.com
PRINCIPAL INVESTIGATOR (PI):	Sarvesh Garimella, PhD
TITLE OF PROJECT:	Orbital Wildfire Resilience
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

ACME AtronOmatic, LLC is proposing development of an orbital data platform for improving household and community wildfire resilience. With a changing climate and near-urban environments, resilience requires access to actionable information about how to build, move, and/or fortify homes and communities: the proposed project would increase the resilience of stakeholders by clarifying through unique data the tradeoffs, risks, and likely outcomes when facing such decisions.

The AI-enhanced hyperspectral measurements from ACME's CubeSats (low-cost, miniaturized satellites), currently under development, provide insights about land and vegetation properties as they evolve on relevant length (10s of meters) and time (days) scales. With careful preflight validation and in-orbit calibration, these CubeSats may be used to generate dynamic risk maps for wildfire-related destructive forces that evolve at the same scales as the underlying phenomena. The risk maps, along with media outreach to contextualize how various risks may affect decisions, will be presented in ACME's established market leading and free MyRadar application, providing a broad reach to over 13 million monthly active users. Specifically, we propose delivering:

• dynamic wildland-urban risk factor maps that incorporate ACME's CubeSat data
• data feeds via our APIs and mobile applications that provide actionable information for stakeholders

SUMMARY OF ANTICIPATED RESULTS:

Through a successful Phase I grant we will determine that applying hyperspectral remote-sensing capabilities in a CubeSat constellation will overcome the traditional barriers to implementation including cost, SWaP for onboard processing utilizing CubeSats, and downlink bandwidth constraints. We will be able to validate the feasibility of our Artificial Intelligence software to analyze and compress data from a CubeSat platform to uniquely identify vegetation and weather data to enhance wildfire resilience.

ACME AtronOmatic, LLC, a Weather-Ready Nation Ambassador, has a successful track record for enhancing the MyRadar application to drive increased adoption and revenue through expert weather data integration, visualization and alerting. We have generated over $37 million in revenue with over 13 million active monthly users. Our data shows extreme weather is a top driver of application use. Our customer base includes various groups that rely on rainfall and wind data, which are key for prevention and wildfire resilience use cases.

Developing and deploying our hyperspectral CubeSat constellation will drive widespread use of hyperspectral data in applications such as wildfire resilience. The Small Satellite market is projected to grow to over $7 billion by 2026 and we believe there is an enormous opportunity to expand our customer base to consumers, commercial and government markets.

FY 2022 PHASE I AWARD WINNER

FIRM:	Dragoon Technology, LLC 12855 N Corsair Drive Oro Valley, AZ 85755
AWARD:	$149,889.00
PHONE:	520-661-2753
E-MAIL:	jasondouglas@dragoon.tech
PRINCIPAL INVESTIGATOR (PI):	Jason Douglas
TITLE OF PROJECT:	Single Use Uncrewed Aircraft with Oceanic Range
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:
Tropical Cyclone meteorological data from the Atlantic main development region (MDR) is difficult to collect due to the remoteness of the location and difficulty of deploying manned aircraft to the region. Data collection is frequent upon development of a major hurricane but many tropical disturbances in the MDR leading up to hurricane development are of interest. Being able to collect meteorological data nearly on-demand could be of great benefit, both in predicting hurricane formation and in tasking manned assets for higher fidelity data collection. Dragoon proposes that a lightweight (sub-30 lbs), disposable, long endurance (more than 24 hrs) small UAS be developed for tropical cyclone meteorological data collection. The platform will utilize Dragoon's internally developed hybrid electric propulsion system and integrated avionics package. Phase I will involve a demonstration of a long duration data collection flight using an existing demonstration aircraft. The flight will show feasibility of the propulsion system as well as data collection and upload via a satellite link. A roadmap for de-risking regulatory approval for future flights will be developed, as well as a high-level design for the prototype aircraft used for in-situ measurements in Phase II.

SUMMARY OF ANTICIPATED RESULTS:

Dragoon anticipates that the feasibility research outlined in this proposal will show that very long duration meteorological data collection using unmanned aircraft is viable for tropical cyclone research. This capability has the potential to increase the fidelity of the Global Forecast System by providing in-situ observations in areas where they are not readily available. Current commercial platforms suffer from a cycle where the cost of the system is too high for widespread adoption, which prevents economies of scale in manufacturing. This is the problem that Dragoon is trying to solve. The development of a long duration, inexpensive unmanned aircraft platform like the one proposed herein has many applications outside of hurricane research, which are not currently economically feasible. These include linear infrastructure inspection, wildfire monitoring, communications relays, and even package delivery.

FY 2022 PHASE I AWARD WINNER

FIRM:	Improving Aviation, LLC 1016 Normandy Trace Rd Tampa, FL, 33602
AWARD:	$149,834.00
PHONE:	203-909-5784
E-MAIL:	yanabebieva@gmail.com
PRINCIPAL INVESTIGATOR (PI):	Yana Bebieva

TITLE OF PROJECT:	Nowcasting wildfire ember risk in the Wildland Urban Interface (WUI) with WindTL
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

Atmospheric processes in the atmospheric boundary layer significantly influence the behavior of wildfires. Temporal and spatial variability of ne-scale winds at re fronts play a key role in controlling the rate of fire spread. Available wind information from satellites and numerical weather prediction models does not meet the need for the temporal and spatial resolution for precise modeling of wildfires, especially the fire spread through ember dispersal within wildland-urban interfaces (WUI). We propose a fully automated wind observing system, “WindTL", that allows measurements of local velocity components and their statistics close to the fire front.

SUMMARY OF ANTICIPATED RESULTS:

The deliverable product from WindTL would be (1) a synthesized dataset containing real-time fine-scale spatial resolution wind measurements at a wildfire front and (2) a first-order wildfire ember spread risk heat map updated in real-time with captured background wind changes. The WindTL system is a weather ready national tool ensuring the safety and health of the population and preventing disruptions to the economy and the environment. The proposed solution is envisioned to be scaled from a data provider to a standalone wildfire ember spread model application used by emergency managers and insurance providers to deploy the required resources in a timely manner, avoiding property losses and fatalities.

FY 2022 PHASE I AWARD WINNER

FIRM:	Intellisense Systems, Inc. 21041 S. Western Ave Torrance, CA 90501
AWARD:	$149,998.00
PHONE:	310-320-1827
E-MAIL:	proposals@intellisenseinc.com
PRINCIPAL INVESTIGATOR (PI):	Kevin Pichay
TITLE OF PROJECT:	Flood Location and Alerting
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

To address NOAA's need for a weather-ready nation, Intellisense Systems, Inc. (Intellisense) proposes to develop a new Flood Location and Alerting (FLOA) software system based on integrating data from IoT flood sensors such as Intellisense's AWARE in combination with publicly available data, into Waze, a mobile-based navigation application, as well as FEMA's IPAWS. Specifically, the innovation in an extensible software platform capable of ingesting sensor and publicly available data and its compatibility with Waze and other mass notification systems (MNS) will improve the process of disseminating flood hazard information and ultimately reducing loss of life, property, and disruption from high-impact events, as well as improving transportation efficiency and safety. As a result, this system offers extensibility to integrate future sensors while being easy to deploy and capable of integrating with multiple notification systems, which directly addresses NOAA program requirements. In Phase I, Intellisense will demonstrate the feasibility of FLOA by building its core architecture and functionality, then demonstrating its end-to-end capability of ingesting sensor data and generating hazard notifications. In Phase II, Intellisense plans to build upon FLOA's architecture, add new functionality, and obtain approvals to demonstrate in a representative environment.

SUMMARY OF ANTICIPATED RESULTS:

FLOA will immediately impact areas prone to flooding by providing mass notifications to its residents in response to flashflood hazards, thus reducing loss of life and property. Its integration with Waze and other navigation applications will also improve safety and efficiency in navigating travel by alerting and rerouting users and emergency responders to avoid dangerous environments and quickly reach safety. FLOA's extensibility positions itself well for future enhancements, supporting additional sensing modalities, such as lightning, tornados, wildfires, air quality, and seismic sensing. Furthermore, FLOA can be linked to infrastructure for automated tasking.

FY 2022 PHASE I AWARD WINNER

FIRM:	Marine Advanced Robotics, Inc. 1301 S 46th St., Bldg. 300A Richmond, CA 94804
AWARD:	$150,000.00
PHONE:	510-232-1685
E-MAIL:	jmehlman@oceanpowertech.com
PRINCIPAL INVESTIGATOR (PI):	Joshua Mehlman

TITLE OF PROJECT:	Dynamic Swarming of USVs for Hydrographic Surveys in Disaster Recovery
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

Marine Advanced Robotics (MAR) has developed a family of uncrewed surface vehicles (USVs) based on our patented WAM-V® technology. WAM-V stands for Wave Adaptive Modular Vessel – a highly stable, portable, foldable, and energy-efficient class of watercraft. These sturdy, scalable USVs can be re-staged prior to a hurricane, stored in standard shipping containers, and deployed without existing infrastructure; they can be quickly assembled and launched from the beach by a small team of people. Marine Advanced Robotics and our customers use this versatile USV for multiple hydrographic survey applications, including but not limited to, force multiplier applications with crewed survey vessels. MAR proposes to further develop the collaborative algorithms used in the autonomous teaming of the WAM-Vs such that a survey area can be predefined, and the swarm of WAM-Vs will autonomously map and make line plan adjustments based on real-time water depth from the sonar, the number of USVs in the swarm, and the desired overlap. The sonar coverage from the USVs will be visible on one instance of the acquisition sonar, and the surveyor can make real-time adjustments (e.g., percent overlap, number of USVs, survey area, minimum depth of survey) during the survey operation from a safe location on shore.

SUMMARY OF ANTICIPATED RESULTS:

Collaborative autonomy or “swarming” of USVs for hydrographic survey will have multiple benefits to commercial hydrographic survey applications. USVs are currently being leveraged by multiple commercial entities for mapping of Exclusive Economic Zones (EEZs), offshore wind farms, dredging operations, and nautical charting. The proposed work for this development effort will further leverage the benefits of USVs to hydrographic survey activities. Beyond the ability of swarming USVs for disaster response, MAR will be able to include this swarming functionality in our crewed or uncrewed vessel teaming arrangements. Additionally, WAM-Vs are currently being developed to deploy other uncrewed vehicles (such as ROVs and UAVs), and we anticipate that aspects of this work can be further leveraged for multi-domain (air, sea, and subsea) uncrewed systems.The WAM-V is an established commercial product in the hydrographic survey market. WAM-Vs have proven technology benefits for collecting high-quality hydrographic survey data in adverse sea conditions. MAR has an established base of commercial customers and a track record of quickly leveraging the benefits of collaborative autonomy with existing customers, which we expect will speed the pace of market adoption. As a wholly owned subsidiary of Ocean Power Technologies (OPT), MAR will be able to leverage OPT’s global sales network to identify new commercial opportunities.

FY 2022 PHASE I AWARD WINNER

FIRM:	Morphobotics, LLC 47 Wood Ave, Ste 2 Barrington, RI 02806
AWARD:	$149,640.00
PHONE:	508-596-6433
E-MAIL:	erin@morphobots.com
PRINCIPAL INVESTIGATOR (PI):	Erin Linebarger
TITLE OF PROJECT:	Autonomous Environmental UAV Survey System for Wildfire Assessments
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

Wildfire response planning is limited by the lack of high-resolution data for use in wildfire prediction. Wildfire models depend on many variables, including weather, topography, vegetation type and arrangement, fuel moisture content, and regional fire prevention measures, among others. Some of these variables are static or nearly so, but some of these are highly dynamic. In particular, live fuel moisture content can vary on a timescale of days or weeks, and is highly spatially dynamic as well. We propose to develop a wildfire fuel mapping capability onboard a UAS, with special emphasis on live fuel moisture content estimation. Additional mapped variables will include vegetation type and arrangement among other common wildfire modeling inputs. The technical innovation is in combining this perception module with our UAS subcanopy forest survey capability, which is enabled by our exploration-based autonomous control system. The commercial innovation is in our target application. The product's primary purpose is to collect a digital forest inventory for commercial forest management, and by simultaneously collecting a high-resolution wildfire fuel map, we enable enhanced rapid response in the event of a wildfire, reducing loss of life, property, and disruption from high-impact events.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated result is an improved wildfire prediction capability based on our UAV-collected data. We will demonstrate improved predictions by comparing industry standard wildfire models using our data with the same models using LANDFIRE data, a common source of wildfire prediction inputs. The first potential commercial application of this product is in commercial forest management due to its primary design as a digital inventory tool. This design aligns wildfire response needs with commercial foresters' incentives. This approach could optimize the efficiency of wildfire prevention efforts, since the large bulk of wildfire response spending is put toward suppression. By demonstrating technical feasibility of UAS subcanopy wildfire fuel mapping for commercial forestry, we could eventually expand to broader commercial applications including wildfire fuel mapping for public forests or active wildfire mapping.

FY 2022 PHASE I AWARD WINNER

FIRM:	Weathervane Labs, LLC. 400 S 4th Ste. 401-444 Minneapolis, MN 55415
AWARD:	$150,000.00
PHONE:	612-567-0379
E-MAIL:	brian@weathervane.io
PRINCIPAL INVESTIGATOR (PI):	Brian Smoliak, PhD

TITLE OF PROJECT:	Novel Personal Thermal Comfort Models for Weather-Ready Decision-Making
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

In this Phase I project, we will demonstrate proof of concept for Climatize ™ , a cloud-based software platform with the novel capability to determine and deliver user-specific thermal comfort information for weather-ready decision-making. People and organizations in a Weather-Ready Nation adapt to weather changes and environmental events with resilience. A challenge of building a Weather- Ready Nation is delivering messages that are consistently meaningful based on the user's unique physiology, psychology, behavior, and location. For the first time, outdoor enthusiasts and workers will weather forecasts personalized through the lens of thermal comfort, the state of mind and sensation associated with the thermal environment. This shift in perspective surpasses hyperlocal forecasts by putting each consumer at the center of the weather universe. Climatize has the potential to unlock valuable benefits consistent with NOAA's long-term goals, objectives, and science and technology focus areas, such as new opportunities for citizen science, reduced injury and loss of life, a more productive economy, and more resilient communities adapting to their environment.

SUMMARY OF ANTICIPATED RESULTS:

Commercialization of the Climatize software platform will provide outdoor enthusiasts and workers with personalized weather information to simplify daily decisions, save time, relieve stress, and potentially save lives by addressing the pain point of not being prepared for changing weather and climate. It will build weather-readiness by informing choices around clothing, gear, and activity, and by creating healthy habits of engagement with weather information and the natural world. This will stimulate recreation economies by highlighting seasonable opportunities for activities and increase savings to individuals, businesses, and society during extreme events by protecting against health costs and lost productivity.

FY 2022 PHASE I AWARD WINNER

FIRM:	Aerodyne Research, Inc. 45 Manning Rd, Billerica, MA 01821
AWARD:	$149,996.00
PHONE:	978-663-9500
E-MAIL:	shorter@aerodyne.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Joanne Shorter

TITLE OF PROJECT:	Novel Probes for Real Time Monitoring of Dissolved Gases and their Isotopologues in Aquatic Ecosystems
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Ocean ecosystems are critical to the regulation of Earth's climate and biodiversity, while also hosting a range of direct and indirect benefits to people, from food supply to recreation. Coastal ocean systems are dynamic regions especially rich in diverse biological and geochemical interactions. However, major gaps exist in our knowledge of the primary biogeochemical processes and the factors regulating their relative importance. Nitrous oxide (N2O) and methane (CH4), produced and cycled within coastal and ocean environments, are important greenhouse gases with major roles in climate change. Our understanding of the distribution and dynamics of the underlying processes controlling their fluxes is limited by a lack of high-resolution spatial-temporal measurements.

The overall objective of the project is to design a field deployable, real-time, in situ system to quantify dissolved greenhouse gases (N2O and CH4 and their isotopologues) in ocean ecosystems. In Phase I we will develop permeable, hydrophobic probes to extract dissolved gases without intrusion of liquid water; configure a collection protocol for efficient transfer of the gases; interface probes and extraction and sampling system with high-sensitivity infrared spectrometry; demonstrate the overall system with ocean seawater; and outline the Phase II system and field demonstration.

SUMMARY OF ANTICIPATED RESULTS:

The proposed research will result in a system for real-time, in situ, spatially resolved measurements of dissolved N2O and its isotopologues, CH4 and its isotopes, and other trace gases. The proposed technical advances will elevate the entire Aerodyne trace gas product line. The research market includes government, academic, and industrial researchers in the U.S. and abroad addressing the study of ocean systems, including marine and coastal areas, to understand their impact on climate change, to inform water conservation and resource management decisions, and to advise ecological water policy. Industrial applications include quantifying the impact of industrial and agricultural activities upon local water resources and identifying potential pollution concerns.

FY 2022 PHASE I AWARD WINNER

FIRM:	Ai.Fish, LLC 424 Lliwahi Loop Kailua, HI 96734
AWARD:	$150,000.00
PHONE:	951-834-8597
E-MAIL:	justin@ai.fish
PRINCIPAL INVESTIGATOR (PI):	Justin Kay

TITLE OF PROJECT:	A Multimodal Computer Vision System for Fisheries Monitoring
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Monitoring modern-day fisheries is extremely challenging. Every day, millions of vessels harvest the oceans, and many remain unregulated, putting target and non-target fish populations at risk of overexploitation and collapse. To combat this, fisheries managers are increasingly turning to Electronic Monitoring (EM) technologies – integrated systems of cameras and sensors – to record onboard activity and gather the large amounts of data required to make sound regulatory decisions.

Fisheries managers require advanced data analysis tools to handle the surplus of data produced by these systems. A single commercial fishing trip can produce over 1000 hours of video, which must be manually reviewed on-land to quantify all fishing activities, including fish that are caught and discarded, and encounters with protected species. Due to the substantial time required for processing, without significant technological advancements these technologies are forecast to cover only 1.5% of the world's fishing activity by 2030.

This project will build upon recent research in artificial intelligence and computer vision to automate fisheries data processing, making EM technologies viable for widespread adoption. Specifically, Ai.Fish will prototype a specialized computer vision system for counting and classifying fish onboard commercial fishing vessels using video and sensor data from EM systems.

SUMMARY OF ANTICIPATED RESULTS:

This innovation will enable Electronic Monitoring (EM) service providers, regulatory agencies, and fisheries to perform and scale fisheries monitoring at a low cost and high accuracy. This innovation will reduce the cost and time requirements of EM review by upwards of 80% while adding value in the form of increased accuracy by upwards of 10%, making this large industry transformation viable. A business model built around the sale of these automated review services targets a total addressable market of $500 million annually while helping to conserve and sustain marine ecosystems and fish populations around the globe.

FY 2022 PHASE I AWARD WINNER

FIRM:	Blue Ocean Gear, Inc. 914 Edgecliff Way Redwood City, CA 94061
AWARD:	$149,478.00
PHONE:	650-823-1704
E-MAIL:	kortney.opshaug@blueoceangear.com
PRINCIPAL INVESTIGATOR (PI):	Kortney Opshaug
TITLE OF PROJECT:	Improving Data Measurements in Alaskan Waters While Reducing Ghost Gear Using Smart Fishing Technology
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Climate change impacts on Alaskan waters have created challenges for both fisheries ecosystems as well as the operational safety of mariners in the region, necessitating more accurate weather and ocean condition forecasts. Blue Ocean Gear will demonstrate the application of innovative Smart Buoy devices on fishing gear to capture and transmit data on sea surface temperature and other key ocean conditions in the Bering Sea. The use of fishing gear-based sensors will provide regional meteorologists with more localized data points than currently available, regardless of weather conditions, improving forecast accuracy using fishing gear in exactly the areas where the information is needed most.

Blue Ocean Gear's Smart Buoy is equipped with GPS tracking and other ocean condition sensors and transmits data to a cloud-based database, capable of conveying that information to either a mobile or desktop app. The integrated system is affordable, reliable, and compatible with any fixed-gear configuration. This includes traps, nets, longlines, and aquaculture arrays, all of which are utilized in open Alaskan waters across an area of over 500,000 square miles. This proposal will develop and evaluate a more ruggedized design with increased depth and impact performance as well as the addition of key ocean condition sensors.

SUMMARY OF ANTICIPATED RESULTS:

Alaskan seafood harvesters have expressed a need for Smart Buoy technology, as local conditions create a difficult environment in which to track gear. With existing and potential customers in crab, halibut, black cod, salmon, and kelp farming, the Alaskan market represents roughly $75M in sales for hardware and $15M in annual data fees. Smart Buoys have been deployed from the arctic to the tropics, with potential for worldwide applicability for gear tracking. Additional buoy sensors will allow Blue Ocean Gear to create the largest ocean data network, providing data to a wide range of private and public market customers.

FY 2022 PHASE I AWARD WINNER

FIRM:	Biospherical Instruments, Inc. 05340 Riley St. San Diego, CA 92110
AWARD:	$149,998.00
PHONE:	619-659-5965
E-MAIL:	bernhard@biospherical.com
PRINCIPAL INVESTIGATOR (PI):	Germar Bernhard

TITLE OF PROJECT:	Innovative UV Biofouling Mitigation Technique for In-water Optical Sensors
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

A new technology for reducing biofouling (accumulation of biological matter on submerged surfaces) on radiometers measuring light in the water column will be developed. This technology will improve the long-term accuracy of sensors monitoring the health of the oceans and their data products (e.g., concentration of chlorophyll and dissolved organics). Inhibition of biofouling will be achieved using germicidal UV-C radiation. Irradiating instruments with external UV-C sources has been shown to prevent biofouling, but this method cannot be applied to radiometers requiring unobstructed field-of-views. As optical components (windows) of radiometers considered here are made of materials that are transparent to UV-C radiation (PTFE, quartz glass), we will use UV-C LEDs installed inside the instruments. The main objectives in Phase I are to find the best LED type, duty cycle, power system, and geometry without interfering with the radiometric measurements. One challenge will be to irradiate surfaces surrounding the entrance window because organisms accumulating in this area may grow into the window. The design will be aided by the optical modeling capabilities of our subcontractor. Fixtures with various optical configurations will be designed and tested. In Phase II, we will build and test prototype radiometers with this new technology.

SUMMARY OF ANTICIPATED RESULTS:

Accurate measurements of sunlight are the basis for biological research and management of the Earth's hydrosphere. Biofouling limits the duration of high accuracy radiometer deployments to relatively short terms (weeks). Long-term in-water moorings must be cleaned regularly at great expense, either by divers or by pulling the units back to the surface. By offering a technology that can reliably delay or prevent biofouling, the proposed project would open the market for cost-effective, long-term, in-water monitoring applications on underwater observatories, AUVs, buoys, and floats, such as the BGC-Argo network. The new technology would (1) allow real-time in-situ detection of harmful algal blooms and run-offs; (2) help document the ecological health of coastal wetlands, estuaries, lakes, reservoirs, and irrigation ponds; and (3) support aquaculture operations, which are vulnerable to algal blooms or rapid degradation of water quality from terrestrial run-off. For example, the aquaculture market size in the U.S. was estimated at 2.7 Billion US$ in 2020 (www.globenewswire.com) and the global market is projected to reach 378 Billion US$ by 2027 (www.alliedmarketresearch.com). Most aquaculture operations currently do not use moored optical radiometers because of biofouling and the associated maintenance cost. However, a moored monitoring system equipped with biofouling-resistant radiometers would be attractive.

FY 2022 PHASE I AWARD WINNER

FIRM:	CoastalOceanVision, Inc 10 Edgerton Drive North Falmouth, MA 02556
AWARD:	$150,000.00
PHONE:	508-472-5520
E-MAIL:	sgallager@coastaloceanvision.com
PRINCIPAL INVESTIGATOR (PI):	Scott Gallager
TITLE OF PROJECT:	In Situ and Point of Sale Quantification of Human Pathogens Associated with Aquaculture and Shellfish Farming Using Novel Surface Enhanced Raman SpectroscopyNavigation
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

There is a dire need in multiple market segments for technology to rapidly and accurately detect and quantify Escherichia coli and Vibrio parahaemolyticus and total fecal coliforms. We propose to develop a novel approach to Surface Enhanced Raman Spectroscopy (SERS) for detecting human pathogens in seafood reared and harvested from aquaculture farms, at point-of-sale in seafood markets, and in the environment. Our approach uses a higher energy laser wavelength (422 and 532nm) compared with the lower energy of more the commonly used laser at 785nm, a novel mixture and preparation of Ag-coated Nano Particles (AgNPs), a fiber optic probe that may be used directly on seafood tissue and environmental samples, and the use of barcoding the Raman spectra with Deep Learning classification through a Convolutional Deep Learning Neural Network (CDLNN). Taken together, the novel microfluidic instrument will allow hand held or in situ identification and quantification of pathogen species and their dominant strains. Real-time detection of E. coli and other fecal coliforms from buoys or the end of docks would allow for immediate mapping of contamination source and early response by environmental managers

SUMMARY OF ANTICIPATED RESULTS:

Potential market segments including federal, regional, state, and municipal managers who must ensure water quality and establish thresholds for pathogens associated with food poisoning in shellfish. Aquatic researchers in academia are early adopters compelled to purchase innovative technologies. Commercial aquaculturists and shellfish growers who make up a larger group are distinguished by their need for rapid, highly accurate measurements that ensure resource quality control and provide early warnings of environmental threats. The cost of preventive measures to combat pathogen contamination is estimated to be ~$6.9 billion annually in the U.S., according to the Economic Research Service (NSSP, 2017). No real-time pathogen detector for E coli and V parahaemolyticus and total fecal coliforms exist on the market today

FY 2022 PHASE I AWARD WINNER

FIRM:	Field Data Services, LLC 454 Parma Dr. Essex, MT. 59916
AWARD:	$148,516.00
PHONE:	406-830-0373
E-MAIL:	doug@fielddata.tech
PRINCIPAL INVESTIGATOR (PI):	Douglas Bonham

TITLE OF PROJECT:	Automated Monitoring of Salmon Streams with a New Solid-State LiDAR
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Field Data Services (FDS) proposes a technical feasibility study of newly available solid state LiDAR sensor chips for detecting migrating anadromous fish in small spawning streams. The LiDAR chip, first introduced in October 2020, uses an invisible infrared laser to measure time-of-flight distances to nearby objects with millimeter accuracy. This tiny computer chip is breakthrough technology that could enable low-cost detection of salmonids as they move over shallow riffles in small and currently unmonitored spawning streams. FDS will build an automated test system for acquiring statistically valid data that characterizes the LiDAR's ability to detect salmonids as they move across a controlled flow tank. The experiments will be designed to define the range of streamflow, depth, weather, lighting and moving target characteristics that can be reliably detected by an array of LiDAR chips. These tests will determine the commercial feasibility of a small, portable and easily-deployed device that can be placed above shallow streams for counting migrating salmonids. The LiDAR sensor chips will be incorporated into an existing field-proven digital platform that includes an AI-enabled smart camera and long-distance wireless link. Such a device would enable small organizations and citizen scientists to fill data gaps for numerous salmonid spawning streams.

SUMMARY OF ANTICIPATED RESULTS:

Many main stem rivers have existing concrete features that enable accurate monitoring of migrating salmonids. Concrete and steel channel modifications at dams and weirs provide opportunities for visual salmon counts or installations of technologies including sonar, optical and resistivity sensors. These large and expensive installations are not practical for the thousands of small and remote streams where much of the spawning activity takes place. Technically complex installations also tend to exclude meaningful participation by many small agencies, organizations, tribes, schools and citizen scientists who might otherwise benefit from being stakeholders in local scientific data acquisition and land management practices. A small portable device that is no larger or more expensive than a smartphone, and that can be installed seasonally on small salmon streams could provide meaningful engagement by local communities in the science and management of species that bring unmatched cultural, ecological and economic importance.

FY 2022 PHASE I AWARD WINNER

FIRM:	FPN LLC dba PhytoSmart 74 Orion St. Brunswick, ME 04011
AWARD:	$150,000.00
PHONE:	207-751-6809
E-MAIL:	patrick@phytosmart.com
PRINCIPAL INVESTIGATOR (PI):	Patrick Cregten

TITLE OF PROJECT:	Development and evaluation of peroxide free fin-fish nursery feeds with active DHA-synthase enzyme (DSe)
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

The marine microalgae Crypthecodinium cohnii (C. cohnii) contains high levels of DHA and DHA synthase enzyme (DSe) both of which may provide nutritional benefits to finfish for human consumption. Field Phyto-Nutrients LLC has developed a process for algae-based feed preparation where the algae is dried under low temperature (<40ºC) and under an atmosphere of inert gas to prevent lipid peroxidation and denaturation of enzymes. The process results in flakes and/or powder products called KoniSap (KS) aimed to supplement aquafeeds. KS can also be fed to zooplankton such as Artemia to be used as an enriched live feed. In a preliminary trial, salmon fry fed commercial starter feeds supplemented by KS exhibited higher DHA concentrations in fish tissues when compared to control groups. The observed differences may be attributed to the enhanced DHA as well as potential activity of DSe. The proposed trials will evaluate the use and effects of KS as a supplemental flake feed for steelhead trout (Oncorhynchus mykiss) and as an Artemia enrichment for marine fish larvae (inland silversides; Menidia beryllina). An intentionally denatured KS flake is proposed as a negative control to evaluate DSe as a potential pathway for DHA production.

SUMMARY OF ANTICIPATED RESULTS:

The anticipated result from Phase I is DHA-enriched, safe (i.e. peroxide free) finfish nursery feed, be it KS flake feeds or through Artemia enrichment. With these in mind the Phase II goal will be the reduction of peroxides and optimization of DHA content in fed fish at their harvest. Should DSe activity be successful, the nursery feed may be used to market fed fish as “rich in DHA.” The overall goal of this project is to create a novel and sustainable finfish feed that is peroxide free, rich in DHA and more sustainable than wild fish oil/meal. Successful commercialization will result in the potential to reduce the aquafeed industries’ dependency on wild forage fish such as herring, sardines, shad, menhaden as sources of Highly Unsaturated Fatty Acids sources, thereby making feed production more sustainable.

FY 2022 PHASE I AWARD WINNER

FIRM:	Goeppert, LLC 3401 Grays Ferry Ave., Building 450 Philadelphia, PA 19146
AWARD:	$150,000.00
PHONE:	443-240-3618
E-MAIL:	zx@gppert.com
PRINCIPAL INVESTIGATOR (PI):	Zehui Xia

TITLE OF PROJECT:	Rapid detection of nanoplastics with advanced solid-state nanopore sensors
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Nanoplastics (plastic debris <1 μm in diameter) are a growing threat to our oceans, as nanoplastics demonstrate toxicity and are biomagnified through the aquatic food chain. Current detection methods for nanoplastics suffer from low specificity, inaccurate quantification, or require high-cost equipment, non-portable equipment which limits testing. There is a need for rapid, inexpensive testing methodology capable of discerning the size and chemical composition of nanoplastics. Here we propose to develop our compact, portable, easy-to-operate solid-state nanopore system for the detection and quantification of nanoplastics. We hypothesize that we can differentiate NPs from organic particles due to differences in electrical signals generated as the particles pass through nanopores. To test our hypothesis, we will fabricate low aspect ratio nanopores and validate these for detection of NPs using NIST traceable particle size standards. Finally, we will use our nanopore system to detect pure PET and PVC NPs of varying sizes. We anticipate our system will be capable of differentiating nanoplastics by size, shape, and chemical composition. Our low-cost, compact instrument will be useful for field studies of nanoplastics contamination, or for routine analyses of drinking water, and in production of water and wastewater in manufacturing and food industries.

SUMMARY OF ANTICIPATED RESULTS:

- Routine drinking water analysis to satisfy current and future regulations concerning nanoplastics contamination
- Analysis of processing water in food and beverage manufacturing
- Analysis of process wastewater in manufacturing and industrial applications to meet current and future regulations concerning the discharge of nanoplastics
- Analysis of habitat waters for harvested and/or farmed seafood to ascertain the risk of nanoplastics contamination
- Field surveys of nanoplastics contamination of fresh and marine waters by environmental and human health protection agencies and others

FY 2022 PHASE I AWARD WINNER

FIRM:	LobsterLift, LLC 12 W Albert St. Lowell, MA 01851
AWARD:	$150,000.00
PHONE:	978-337-6837
E-MAIL:	lobsterliftllc@gmail.com
PRINCIPAL INVESTIGATOR (PI):	Cormac Hondros-McCarthy

TITLE OF PROJECT:	Developing and testing ropeless fishing gear with inshore lobstermen while focusing on speed, cost, and safety
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

LobsterLift is a ropeless fishing device that will enable lobstermen to continue to use their lobster trap fishing gear without requiring the traditional vertical ropes that endanger the North Atlantic right whale (NARW), a species on the brink of extinction. We are seeking a 6-month research grant for $150,000 that will enable LobsterLift LLC to conduct feasibility research, product development, and ultimately adoption of a system that has the potential to significantly reduce the amount of bycatch caused by current lobster trap fishing gear. Our focus is to develop an on-boat docking station which would allow for the LobsterLift to be implemented seamlessly into lobstermen's typical daily work tasks. Five on-board docking stations would be developed, along with developing and building a supply of fifteen to thirty underwater LobsterLift' devices to be provided to inshore lobster fishers in Mount Desert Island, ME and Gloucester, MA. This testing will provide insights on the feasibility for broad adoption of ropeless systems with regards to how the incorporation of our ropeless gear effects fishers' work efficiency and speed, the cost of the devices, and implications of safety for fishermen

SUMMARY OF ANTICIPATED RESULTS:

Today, lobstermen are being pressured by both regulatory mandates and environmentally conscious consumer concerns as fishing closure areas are increasing with an ever-dwindling NARW population, and the American Lobster may be "red-listed" by the Seafood Watch. The research results from testing LobsterLift ropeless gear and its docking station could provide the necessary insights to allow a clear and realistic path for incorporation and adoption of the ropeless gear for fishers, as well as provide the data and confidence in the gear to influence rule makings such as government subsidies and broad legalization of the use of ropeless devices in closure areas that would forward progress in solving this environmental issue. Improvements in productivity, cost, and safety are the three major attributes lobstermen are looking for when it comes to accepting ropeless gear and could encourage and incentivize the adoption of this technology into their long-standing, traditional fishing processes. This proposed grant aims to provide reports on time studies, system efficacy results, and third-party lobstering safety expert assessments to understand the workday implications of switching to an all ropeless fishery during closure periods.

FY 2022 PHASE I AWARD WINNER

FIRM:	Ocean's Balance, Inc PO Box 2150 South Portland, Maine 04116
AWARD:	$150,000.00
PHONE:	917-319-5887
E-MAIL:	mlench@oceansbalance.com
PRINCIPAL INVESTIGATOR (PI):	Mitchell Lench

TITLE OF PROJECT:	Sustainable seed production for North Atlantic kelp aquaculture
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Demand for seaweed products has dramatically increased in the U.S.; however, only 1% is met with domestic production. Expansion of seaweed aquaculture is crucial to protect wild populations from extinction by overharvesting, which impacts entire marine ecosystems. Current kelp aquaculture methods rely on harvested reproductive tissue, which is not sustainable. In response to NOAA Topic 9.3, Healthy Oceans, Ocean's Balance Inc.—working with the Woods Hole Oceanographic Institution—proposes to develop procedures to scale the growth of skinny kelp (Saccharina latissima forma angustissima) gametophytes in culture to produce a commercial-scale seedstring product that does not rely on repeated wild tissue harvests. Skinny kelp is a fast growing phenotype of sugar kelp with desirable commercial characteristics native to Maine. The resulting seedstring product will allow existing seaweed farms to expand production, increase yields, and extend their growing season without damaging fragile coastal environments. More off-season fishermen will be able to augment their income by starting new seaweed farms. This project will research best practices for producing seedstring with skinny kelp gametophyte cultures and assess its superiority to seedstring prepared with meiospore seeding techniques and assess extending the growing season in preparation for scaling production in Phase II.

SUMMARY OF ANTICIPATED RESULTS:

This Phase I project will prove feasibility of culturing skinny kelp gametophytes in the laboratory for production of seedstring and Phase II will research methods for commercial-scale production. This approach to kelp aquaculture will facilitate expansion of Maine's aquaculture industry, reduce startup costs for new farmers, and increase yields - all without relying on harvested reproductive tissue that threatens wild populations and fragile marine ecosystems. Ocean's Balance has a 5-year history of growing kelp, partnering with other growers, and developing and manufacturing value-added products that will help ensure the success of this project. There are currently over 30 kelp farms in Maine, triple the number 20 years ago, and the industry is still growing. Ocean's Balance expects this project could reduce the cost of kelp seedstring by as much as 50%. The U.S. commercial seaweed market is forecasted to surpass $1.4 billion by 2025. Maine is the U.S. leader in seaweed aquaculture and is well-positioned to remain dominant for years to come. This project will help Ocean's Balance and other Maine seaweed farmers capture a greater share of the U.S. commercial seaweed market, and the methods developed in this project will be applicable to other kelp species.

FY 2022 PHASE I AWARD WINNER

FIRM:	Wolverine Radar Company 1102 Ravenwood ST Ann Arbor, MI, 48103
AWARD:	$150,000.00
PHONE:	734-383-0710
E-MAIL:	jeff@wolverineradar.com
PRINCIPAL INVESTIGATOR (PI):	Jeffrey Pennings

TITLE OF PROJECT:	Measuring Stormwater Overflow with Synthetic Aperture Radar
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:
Many municipalities in the United States have begun to use impermeability measurements to incentivize storm water retention as part of the architectural and landscaping design process. These measurements are performed through analysis of high-resolution aerial photography and updated on an annual or semi-annual basis. The practice of using high resolution aerial or even satellite photography is prohibitively expensive to deploy on a global scale. Wolverine Radar Company was founded in 2021 to create Synthetic Aperture Radar (SAR) processing solutions that can cost effectively scale to monitor large swathes of the planet with commercially available SAR data.

Wolverine Radar proposes to compare Ann Arbor, Michigan's publicly available impermeability score to dual-polarization coherency scores derived from publicly available Copernicus Sentinel 1 data. While the sentinel data has a coarser resolution than the available impermeability scores, it is more sensitive to the presence of man-made objects than optical photography, because coherence is measured at the wavelength of the transmitter electromagnetic waveform. In addition, Sentinel performs dual-polarization collection on every square mile of the Earth's surface every 12 days. This refresh rate would enable a more proactive system of measurement than the current annual approaches and provide more rapid feedback mechanisms to promote change.

SUMMARY OF ANTICIPATED RESULTS:

This study will demonstrate how radar coherency data can be used as a surrogate metric for impermeability. If impermeability can be measured in such a way that storm-water incentives are maintained with a reasonable degree of accuracy, this technique could then be scaled to monitor corporate efforts to reduce stormwater run-off at a global scale. This third-party metric could be used to encourage the use of rain gardens, green roofs, and the planting of trees on commercially owned properties to ultimately reduce the total run-off from corporate properties into the lakes and rivers that feed into our oceans. Companies that assess ESG performance in the investment community would pay for this data feed as an important part of measuring corporate progress towards objective sustainability goals.

FY 2022 PHASE I AWARD WINNER

FIRM:	Adaptive Management and Engineering, LLC 12232 Industriplex Blvd, Building B, Suite 6, Baton Rouge, LA 70809
AWARD:	$150,000.00
PHONE:	225-424-7869
E-MAIL:	venu@amesouth.com
PRINCIPAL INVESTIGATOR (PI):	Venu Tammineni
TITLE OF PROJECT:	Developing IOT Sensor Systems to Reduce Cost of Dredging for Coastal Restoration Initiatives
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

Rising sea levels and increased storm events leave many areas around the country more vulnerable to accelerating rates of coastal erosion and land loss, resulting in the need for nation-wide coastal restoration initiatives to protect our infrastructure. Dredging and beneficial use of dredge material is a major component that helps maintain and protect the coast. However, there are numerous sites where excess dredge fill (DF) is placed due to lack of real-time data accounting for DF variation. To bridge the gap between design and construction, Adaptive Management and Engineering (AME) is developing the Instrumented Grade Stake (IGS). The IGS is a Supervisory Control and Data Acquisition (SCADA) system that addresses (A) the type and rate of flow of material into DF sites in real time, and (B) calculation of field values at the site from multiple points of measurement. According to The Water Institute, just a 10% reduction in the cost of dredging would result in $2.2 billion dollars saved in the state of Louisiana alone. By developing a low cost IOT marsh creation monitoring system, AME can optimize DF placement, minimize waste, and reduce the need for dredge equipment re-mobilization, thereby achieving the 10% cost reduction.

SUMMARY OF ANTICIPATED RESULTS:

AME will focus on these objectives: (1) develop novel sensor technologies to monitor the placement of DF more effectively during dredging (2) eliminate the need for expensive cloud computing services, and (3) lower the cost of edge processing and communication. By partnering with Sparkfun and Sixfab (vendors with a history of open-source hardware support), AME can implement a SCADA system at a tenth of the cost of industrial closed-source systems. By prototyping novel sensor configurations for the IGS, AME can test new data sources which may prove useful for coastal restoration. These systems should be able to last at project sites for years while continuing to collect data. Such durability is lacking in current technologies, and is cost-prohibitive given the per sensor costs of current solutions. The ability to monitor sediment deposition and loss of a restored marsh years after construction would be a valuable data source to inform predictive modeling in future restoration projects.

FY 2022 PHASE I AWARD WINNER

FIRM:	Geometric Data Analytics, Inc. 343 W Main Street Durhaml, NC 27701
AWARD:	$149,902.00
PHONE:	919-670-0808
E-MAIL:	james.polly@geomdata.com
PRINCIPAL INVESTIGATOR (PI):	James Polly
TITLE OF PROJECT:	Logistics Management of Drifters and Predictive Methods for Ocean Sensing
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

We propose AI capabilities that improve modeling complex ocean dynamics and assist in the logistical management and planning of uncrewed deployment campaigns. Uncrewed sensor platforms sense and collect data for many interests, including tracking chemical and biological tracers, assimilating ocean dynamics observations into forecast models, and enhancing naval situational awareness. The recent emergence of the Ocean of Things has motivated initial development of technologies which serve these domains, including our Float Field Geometric Health (FFGH) software. FFGH provides drifter position and regional sensor coverage, command and control of on-board sensors, and flexible interfaces for streaming float data. We predict future positions of floating platforms with a blend of leading ocean flow models, first-principles physics, and learned float dynamics via FFGH. To improve the logistical management and planning of deployment campaigns, the model will be combined with planning tools, such as command and control capability, deep multi-agent reinforcement learning, and other analytical measures. Phase I will lay the groundwork for novel analysis of uncertainty and sensitivity, data assimilation methods for floats of varied design, and larger scale float planning. Our Phase I e↵ort will seek to implement these software capabilities in an experimental, scalable, deployment to occur in Phase II.

SUMMARY OF ANTICIPATED RESULTS:

Our predictive and planning FFGH product o↵ers a novel operational tool which can be marketed to ocean drifter and glider manufacturers, along with the growing industry interested in their data products. These groups include government agencies and private sector entities, both of which are becoming increasingly interested in the “Ocean of Things” network of multimodal-floating-sensor platforms. The commercial viability of our tools is primarily due to the insights gained in the scientific and logistics application domains where information on vast and otherwise unmonitored swaths of ocean surface are increasingly valuable.