SBIR

Small Business Innovation Research Program

ABSTRACTS OF PHASE I AWARDS FOR FISCAL YEAR 2023

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 30 Phase I grants for FY 2023. These awards are up to $175,000 each totaling approximately $5.2 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 2023 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 317 proposal submissions were received by DOC/NOAA in response to its FY 2023 solicitation. Internal and external scientists and/or engineers independently reviewed the proposals. With the funds available,30 were selected for an award. Final selection was based upon the results of the reviews, and the project’s potential for commercialization.

Fiscal Year 2023 Phase I List of Awardees

Award Number	Company Name	Topic Number
NA23OAR0210549	Anuma Aerospace, LLC	9.1
NA23OAR0210553	Applied Ocean Sciences	9.3
NA23OAR0210567	Atlantis Industrles, INC.	9.5
NA23OAR0210559	CFD Research Corporation	9.1
NA23OAR0210573	Climate Forecast Applications Network, LLC	9.1
NA23OAR0210561	Connectsix LLC	9.2
NA23OAR0210554	DeepSpace Technologies, Inc	9.4
NA23OAR0210546	Ensemble Government Services, LLC	9.5
NA23OAR0210547	FarSounder Inc	9.3
NA23OAR0210545	Hydrosat Inc.	9.4
NA23OAR0210557	Intelligent Optical Systems, Inc.	9.2
NA23OAR0210564	Jaia Robotics, Inc.	9.6
NA23OAR0210550	LineSpect LLC	9.2
NA23OAR0210558	Metron, Incorporated	9.1
NA23OAR0210568	NeXolve Holding Company	9.5
NA23OAR0210562	NextGen Federal Systems, LLC	9.5
NA23OAR0210570	Oceanit Laboratories Inc.	9.3
NA23OAR0210569	Orbotic Systems Inc.	9.5
NA23OAR0210555	Pacific Hybreed, Inc.	9.3
NA23OAR0210574	Salient Predictions, Inc.	9.4
NA23OAR0210556	Space Balloon Technologies Corp.	9.6
NA23OAR0210544	Space Environment Technologies	9.5
NA23OAR0210551	SPEC Sensors DBA Interlink Electronics Inc.	9.1
NA23OAR0210560	StratoSolutions, Inc.	9.1
NA23OAR0210548	Synthetik Applied Technologies LLC	9.1
NA23OAR0210552	Transcend Engineering and Technology, LLC	9.4
NA23OAR0210565	Upstream PBC	9.4
NA23OAR0210575	Viable Gear LLC	9.3
NA23OAR0210563	WaiHome LLC	9.2
NA23OAR0210566	Yankee Environmental Systems, Inc.	9.1

FY 2023 PHASE I AWARD WINNER

FIRM:	Anuma Aerospace, LLC 720 Pebblebrook Drive Raleigh, NC 27609
AWARD:	$174,788
PHONE:	919-389-8885
E-MAIL:	jamie.little@anumaaerospace.com
PRINCIPAL INVESTIGATOR (PI):	James D Little
TITLE OF PROJECT:	Persistently Elevated Gas-free Aerostatic Sensor Utility System (PEGASUS)
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

Anuma Aerospace seeks to develop the conceptual design for, and determine the technical and economic feasibility of, a Persistently-Elevated, Gas-free, Aerostatic Sensor Utility System (PEGASUS), which will work like a data buoy in the sky, continuously collecting and transmitting weather data from the marine atmospheric boundary layer (ABL) with the data being made available via application programming interface (API) on the (internet) cloud. We believe this may be accomplished by using Anuma Aerospace's patent pending, Partial-Vacuum Lift (PVL) cell as the aerostatic lift component with onboard photovoltaic equipment and batteries to provide power to onboard systems, including weather data sensors, communications equipment, vacuum pump for buoyancy control, and a semi-autonomous control system. The main technical advantages of the PVL cell are the ability to vary aerostatic lift and therefore altitude by varying the internal pressure, the ability to maintain long-term persistence, and the elimination of expensive, non-renewable helium lifting gas. PEGASUS is intended to remain aloft indefinitely with the semi-autonomous control system navigating winds and air currents to remain within predefined geofence boundaries.

SUMMARY OF ANTICIPATED RESULTS:

The main technical advantages of the PVL cell are the ability to vary aerostatic lift and therefore altitude by varying the internal pressure, the ability to maintain long-term persistence, and the elimination of expensive, non-renewable helium lifting gas. PEGASUS is intended to remain aloft indefinitely with the semi-autonomous control system navigating winds and air currents to remain within predefined geofence boundaries.

FY 2023 PHASE I AWARD WINNER

FIRM:	Applied Ocean Sciences 11006 Clara Barton Drive Fairfax Station, VA 22039
AWARD:	$175,000
PHONE:	503-290-4581
E-MAIL:	katie.verlinden@appliedoceansciences.com
PRINCIPAL INVESTIGATOR (PI):	Katie Verlinden
TITLE OF PROJECT:	A Visibility Risk-Assessment Tool for Maritime Operations
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Fog and smog reduce visibility at sea, greatly impacting ship navigation and safety. Low Visibility marine conditions decrease speed and safety of commercial fleets and increase costs through poor fuel load planning. The COVID-19 pandemic underscored the importance of maritime operations to the supply chain; therefore, decreasing associated cost and risk are of the utmost importance. Applied Ocean Sciences, LLC proposes to create a visibility risk-assessment tool for maritime operations. Such a tool will consider meteorologic, oceanographic, and bathymetric conditions with safety thresholds to create discretize spatial risk maps. Ensemble models of environmental data feed into the risk-assessment codes. Safety thresholds will be created for three types of maritime traffic navigation: harbor operations; small support boat operations, including Search and Rescue; and recreational watercraft. Risk assessment performance will be evaluated against visibility observations to determine proper tuning of these thresholds.

SUMMARY OF ANTICIPATED RESULTS:

Phase I will focus on maritime operations in the Gulf of Mexico, with plans to expand the spatial domain in future phases. The products resulting from this line of R&D will be web based risk maps available via a subscription service. In addition to maps, resultant risk assessment data will be accessible in multiple formats tailored to meet user demand.

FY 2023 PHASE I AWARD WINNER

FIRM:	Atlantis Industries, Inc. 2825 Rio Cordillera Boerne, TX 78006
AWARD:	$174,900
PHONE:	210-380-6189
E-MAIL:	Brad.Morrison@atlantis-industries.com
PRINCIPAL INVESTIGATOR (PI):	Brad Morrison

TITLE OF PROJECT:	Proposed Project Title Atlantis AI Based Long Range Space Weather Prediction System
TOPIC NUMBER:	9.5

TECHNICAL ABSTRACT:

To date, no realizable method of predicting the occurrence or magnitude of a Solar Energetic Particle (SEP) event has been developed. There are multiple models currently available in the Community Coordinated Modeling Center (CCMC) through Goddard Space Flight Center that attempt to provide timely and accurate event propagation (e.g.MAG4, Enlil, and SEPMOD). None of these have yet achieved the goal of mid to long term forecasting, and so additional approaches need to be developed, tested, and verified to achieve this goal. The idea that a cascading event will develop through a series of sub-event signals that are not uniform in standard time, but instead distributed in an energy and frequency space, has the potential to be applied to space weather systems as well.

SUMMARY OF ANTICIPATED RESULTS:

The goal of this investigation is to determine a baseline response for a space weather natural time evaluation system, and then build upon that baseline to incorporate machine learning and artificial intelligence techniques. The use of AI/ML techniques provides additional possibilities for filtering and signal identification that could otherwise be overlooked.

FY 2023 PHASE I AWARD WINNER

FIRM:	CFD Research Corporation 6820 Moquin Dr NW Huntsville, AL 35806
AWARD:	$174,983
PHONE:	205-202-0579
E-MAIL:	jake.reed@cfd-research.com
PRINCIPAL INVESTIGATOR (PI):	Jacob Reed

TITLE OF PROJECT: Product	Developing the Drought Risk Overview (DROP): Improving Flash Drought Forecasts and Early Warning Using Machine Learning and Extreme Value Theory Techniques
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

Drought is responsible for $327.7B in economic loss since 1980 in the United States and typically precedes, co occurs, or initiates other hazards like wildfires or prolonged periods of intense heat. The compounding or cascading of these hazards routinely threatens the wellbeing and stability of communities. The economic impact from drought can be especially harsh when the drought begins rapidly in what is known as a flash drought. In this Phase I effort, CFD Research seeks to address the dynamics of flash droughts and improve the prediction and monitoring of their occurrence by developing an AI Convolutional Neural Network (CNN) and Long ShortTerm Memory (LSTM) applying deep learning and pattern recognition. An existing spatiotemporal tracking algorithm will be used to automatically categorize flash droughts from climate models and observational data into severity classes based on an adaptation of the Heat Severity and Coverage Index (HSCI) and Drought Severity and Coverage Index.

SUMMARY OF ANTICIPATED RESULTS:

Together, this will inform the development of DROP, the Drought Risk Overview Product. DROP is an application designed to address the needs of decision makers by providing higher resolution spatial and temporal drought risk intelligence to better prepare for and monitor the development of flash drought.

FY 2023 PHASE I AWARD WINNER

FIRM:	Climate Forecast Applications Network, LLC 20 Woodchuck Ct Reno, NV 89519
AWARD:	$174,708
PHONE:	678-772-3118
E-MAIL:	vtoma@cfanclimate.com
PRINCIPAL INVESTIGATOR (PI):	Violeta Toma
TITLE OF PROJECT:	Applications of AI to ensemble forecasts of compound extreme weather events in support of operational adaptation of electric utilities
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

We propose a high-impact innovation for weather forecasting that integrates global ensemble weather forecasts with an AI-driven post-processing model of extreme weather indices. This innovation will provide the basis for skillful probabilistic forecasts of compound extreme weather events at extended lead times. Extreme weather/climate events of relevance to electric utilities focused on in Phase I are heat and cold extremes, wind droughts, extreme wind gusts, hail and lightning. The Phase I project focuses on specific needs for increased resilience of electric utilities in the face of compound extreme weather/climate events, including risks from the increasing penetration of renewable energy. CFAN's clients in the energy and insurance sectors have communicated the need for probabilistic forecasts of compound severe weather events with greater granularity and longer lead times than is currently produced by NOAA and other market providers. Advanced online decision support tools based on Visual Analytics will be developed in Phase II. Training these tools with data-driven and human insight will empower algorithms and experts continue to learn from and validate each other – this feedback will support operational adaptation to extreme weather events in a changing climate.

SUMMARY OF ANTICIPATED RESULTS:

Advanced online decision support tools based on Visual Analytics will be developed in Phase II. Training these tools with data-driven and human insight will empower algorithms and experts continue to learn from and validate each other – this feedback will support operational adaptation to extreme weather events in a changing climate.

FY 2023 PHASE I AWARD WINNER

FIRM:	Connectsix LLC 4707 140th Avenue North Suite 212 Clearwater, FL 33762
AWARD:	$174,977
PHONE:	727-348-9935
E-MAIL:	scott@sayweather.com
PRINCIPAL INVESTIGATOR (PI):	Scott Samson
TITLE OF PROJECT:	Time-Gated Optical Oceanographic Sensors (TGOOS)
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

There is a need for more capable and affordable means to measure optical properties and biological constituents of marine and freshwater environments. These measures are crucial for estimating the abundance of organisms such as those producing harmful algal blooms (HABs). Affordable and effective methods to extend the measurement range and improve sensitivity of traditional optical instruments will enable scientists to greatly improve HAB prediction. The proposed research and development effort combines new Time-of-Flight (TOF) optical detectors with pulsed light sources, to produce new high sensitivity, low-noise optical sensing capabilities that can measure time-synchronized photons within an asynchronous ambient light field that includes scattered light (noise). Fluorescence produced by phytoplankton at a distance from the sensor will be determined by the time-of-flight and spatial distribution of the received photons from source-to-plankton-to-detector. The TOF sensors will use on-chip capture and accumulation of the desired signal and ambient light “snapshots".

SUMMARY OF ANTICIPATED RESULTS:

On-chip nano-second scale time-gated accumulation will improve signal-to-noise as compared to conventional instruments, which use photodiodes and off-chip processing. Further, the proposed approach adds the capability to select measurement distance from the sensor. The project will investigate several types of TOF optical detectors and evaluate them for use as chlorophyll fluorometer sensors.

FY 2023 PHASE I AWARD WINNER

FIRM:	DeepSpace Technologies, Inc 8865 Stanford Blvd Suite 183 Columbia, MD 21045
AWARD:	$165,952
PHONE:	410-440-9037
E-MAIL:	damon.bradley@deep-space.io
PRINCIPAL INVESTIGATOR (PI):	Dr. Damon Bradley

TITLE OF PROJECT:	An Ultrawideband RFI-Mitigating Software Defined Radiometer
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

Anthropogenic Radio-Frequency Interference (RFI), or interference from human-generated sources, continues to plague spaceborne microwave radiometer and sounder instruments. Unmitigated RFI adversely affects the quality and reliability of Earth remote sensing data used for determining water availability, quality, and risk. Proliferation of wireless technologies, Earth-orbiting commercial satellite constellations, and crowding of spectral resources creates a dynamic cloud of interfering signals that corrupt naturally-occurring radio signals received by radiometers used to accurately monitor the Earth's water cycle. Despite recent advances in digital radiometer technology and international regulation of passive Earth Observation radio frequency bands, RFI itself is becoming more complex and elusive to mitigate. This problem worsens at higher frequencies that have multi-GHz passive spectrum allocations adjacent to interfering sources. New wideband receiver technology and accompanying algorithms that mitigate more complex and wider bandwidth RFI is needed now. DeepSpace Technologies proposes such technology.

SUMMARY OF ANTICIPATED RESULTS:

DeepSpace Technologies proposes the Ultrawideband RFI-Mitigating Software-Defined Radiometer (URMiRAD), a digital receiver that uses real-time onboard cyclostationarity signal processing to clean RFI microwave measurements. We anticipate our technology will be sold to commercial providers of satellite services to the Earth Science, Military, and Commercial Space communities, including customers such as NASA, Northrop Grumman, and Hawkeye 360.

FY 2023 PHASE I AWARD WINNER

FIRM:	Ensemble Government Services, LLC 4005 Buchanan Street Hyattsville, MD 20781
AWARD:	$175,000
PHONE:	301-842-7055
E-MAIL:	mcontreras@ensembleconsultancy.com
PRINCIPAL INVESTIGATOR (PI):	Michael Contreras
TITLE OF PROJECT:	Developing a proof-of-concept Neutral Density Monitoring and Alert Service for satellite operators.
TOPIC NUMBER:	9.5

TECHNICAL ABSTRACT:

Ensemble intends to develop a proof-of concept Neutral Density Monitoring and Alert Service. To establish an innovative and accurate space weather analytics service, Ensemble has partnered with CU Boulder's SWx-TREC, who offer leading space weather research-to-operations support. Ensemble will create the foundational architecture for Neutral Density Alerts and Notifications for commercial satellite operators using functionalized NOAA Space Weather Prediction Center (SWPC) WAM-IPE output data to 1) generate density profiles across LEO altitudes and 2) generate local density drag profiles based on a satellite's two-line element. Ensemble will extract, functionalize, analyze, and store daily WAM-IPE output, evaluating the model at specific times and altitudes within LEO. Using this information, we will compute global average density profiles. The team will then generate predicted local neutral density profiles for a satellite's orbital trajectory. This will lay the groundwork to create energy-based drag calculations, aiding in the estimation of a spacecraft's daily altitude loss. Ensemble will design a dashboard interface for users to interact with the WAM-IPE model, visualize forecasts, and customize alerts. The interface design will be tailored to a commercial satellite operator needs. Ensemble seeks to demonstrate the value of functionalized space weather data for the commercial satellite industry and pave the way for future space weather commercial services.

SUMMARY OF ANTICIPATED RESULTS:

The interface design will be tailored to a commercial satellite operator needs. Ensemble seeks to demonstrate the value of functionalized space weather data for the commercial satellite industry and pave the way for future space weather commercial services.

FY 2023 PHASE I AWARD WINNER

FIRM:	FarSounder Inc 151 Lavan Street Warwick, RI 02888
AWARD:	$174,971
PHONE:	401-784-6700
E-MAIL:	heath.henley@farsounder.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Heath Henley
TITLE OF PROJECT:	Enabling Expanded Crowdsourced Bathymetry Contributions With High Quality Metadata Via Commercially Sustainable Incentives To Contributors
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

A cloud based system for sharing bathymetric survey data collected by FarSounder customers is proposed as a way(1) to improve safety of navigation on our oceans, (2) to collect measurements for the broader scientific and maritime communities and (3) to generally explore and broadly share information about our oceans in fulfillment of ideas proposed in Topic 9.3 “The Changing Ocean”, and in accordance with NOAA’s overall Mission. The proposed solution vows continued contributions of subsets of collected bathymetric data to the Data Center for Digital Bathymetry’s Crowdsourced Bathymetry Database, while becoming commercially viable by offering value added data based products (overlays of gridded survey data collected by FarSounder customers) to navigators.

SUMMARY OF ANTICIPATED RESULTS:

The result of Phase I and Phase II of this project will be the design, implementation, and deployment of a commercially sustainable cloud based crowdsourced bathymetry service that allows FarSounder customers to (1) back up their raw bathymetric data to the cloud, (2) obtain value added bathymetric data layers based on raw crowdsourced 3D Forward Looking Sonar (FLS) measurements either from only their own vessel fleet, or from FarSounder customers as a whole, (3) to contribute to initiatives to improve the knowledge of our oceans by contributing to the CSB database at DCDB and Seabed 2030 and finally, produces a data only product which could be made available to non-FarSounder sonar customers via third-party distributors.

FY 2023 PHASE I AWARD WINNER

FIRM:	Hydrosat Inc. 1250 Connecticut Ave NW STE 700-009 Washington, DC 20036
AWARD:	$174,956
PHONE:	203-912-8165
E-MAIL:	jfisher@hydrosat.com
PRINCIPAL INVESTIGATOR (PI):	Joshua Fisher
TITLE OF PROJECT:	Hydrosat: Next Generation High-Resolution Daily Surface Temperature for Interconnected Earth Processes
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

Temperature is the critical signal that allows monitoring of a myriad of Earth's processes. From direct measurements of wildfire and urban heat to more complex relationships with drought, agriculture, aquaculture, and biodiversity, maintaining a steady pulse on Earth's surface temperature enables us to mitigate for and adapt to the impacts of extreme events and increasingly variable water availability under a changing climate. All these Earth processes are highly dynamic in space and time; the underlying problem is that they require high spatial and high temporal resolution measurements of temperature. Hydrosat is innovating through this space-time barrier to provide 20 m surface temperature data every day, globally. We propose in this 6-months Phase I investigation to conduct a sensitivity analysis and impact assessment framework to determine how much high spatiotemporal resolution surface temperature can improve applications across: I) wildfire; II) drought; III) urban heat; IV) agriculture; and, V) aquaculture.

SUMMARY OF ANTICIPATED RESULTS:

The results of this analysis will streamline a Phase II investigation into a subset of these applications and will integrate the technology development with the Hydrosat satellite constellation.

FY 2023 PHASE I AWARD WINNER

FIRM:	Intelligent Optical Systems, Inc. 19601 Mariner Avenue Torrance,CA 90503
AWARD:	$174,957
PHONE:	424-263-6355
E-MAIL:	gerardoi@intopsys.com
PRINCIPAL INVESTIGATOR (PI):	Gerardo Ico
TITLE OF PROJECT:	Low SWaP, UxS-Mounted System for In-Situ Monitoring of Harmful Algal Blooms
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

The brevetoxins (PbTx) produced by Karenia brevis cause harmful algal blooms (HAB) or "red tide" in seawater. Currently, the only available ways of detecting PbTx are laboratory tests such as enzyme-linked immunosorbent assays, which are expensive and slow, and require complex instrumentation and multiple processing steps. In previous work Intelligent Optical Systems (IOS) demonstrated a compact lateral flow assay with a highly specific labeled PbTx antibody, a quick in-situ test that matches the detection capabilities of dedicated laboratory test instruments. We now propose to incorporate our PbTx probes into a miniaturized fluid delivery system with an in-situ readout unit, and leverage our experience in optoelectronic design and uncrewed system (UxS) integration to merge a low size, weight and power system onto a COTS UxS for the real-time, in-situ detection of HABs.

SUMMARY OF ANTICIPATED RESULTS:

The PbTx probes, enhanced with surface plasmon detection and our own pH indicator, will be combined with our newly developed optical fiber fluorimeter that incorporates both excitation and detection components. The fluid delivery system will dispense small volumes of ocean water for sampling, and for washing to remove bound PbTx, making the sensor reversible.

FY 2023 PHASE I AWARD WINNER

FIRM:	Jaia Robotics, Inc. 22 Burnside St Jaia Robotics - Suite # 203 Bristol, RI 02809
AWARD:	$174,948
PHONE:	401-835-0411
E-MAIL:	ian@jaia.tech
PRINCIPAL INVESTIGATOR (PI):	Ian Estaphan Owen
TITLE OF PROJECT:	Sea Air Boundary Energy Transfer Measurements Using Micro-Sized UxVs
TOPIC NUMBER:	9.6

TECHNICAL ABSTRACT:

Jaia Robotics' low-cost, micro-sized hybrid uncrewed surface/underwater vehicles called JaiaBotsTM can be deployed from the shore or vessels. The system enables truly affordable multi vehicle operations that can be scaled to provide wide area synoptic data collection. In the proposed effort the project team will develop a JaiaBot which is air-deployable from sonobuoy launch tubes to collect atmospheric data from the launch point to the sea surface collecting wind speed, humidity, and temperature data, and then collect near-surface ocean data including surface current vectors, wave heights, temperature, and salinity. The JaiaBots are able to conduct multiple profile dives to collect subsurface temperature and salinity data to depths of up to 100m. Deploying multiple JaiaBots to form a picket line along the forecasted hurricane track at the tropical storm boundary will provide researchers with the data needed to visualize the spatial variability of ocean features and energy transfer over a wide area.

SUMMARY OF ANTICIPATED RESULTS:

The data collected will be communicated wirelessly via satellite comms. Jaia will partner with Nautilus Defense to develop a deployment parachute using their state-of-the art textile-integrated systems technologies. The parachute will be designed to detach on surface impact enabling the JaiaBot to conduct surface transits and subsurface profile dives.

FY 2023 PHASE I AWARD WINNER

FIRM:	LineSpect LLC 100 Shoreline Hwy, Suite B275 Mill Valley, CA 94941
AWARD:	$174,992
PHONE:	408-647-4751
E-MAIL:	ikevc@linespect.com
PRINCIPAL INVESTIGATOR (PI):	Izak van Cruyningen
TITLE OF PROJECT:	HABCamera Harmful Algae Bloom Predictor
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

Harmful Algal Blooms negatively impact the environment, economy, and health of waterfront communities. The earlier a potential bloom is detected, the more time to plan and execute a response, the smaller the remedial action required, and the less the expense and environmental impact. The proposed submersible camera combines multiple spectral images with artificial intelligence to identify and count HAB species. Adding environmental sensors for nutrients, temperature, light, and other growth variables provide a complete solution for the earliest possible prediction of bloom potential. The camera has a large field of view and frequent sampling to optimize the HAB detectability limit.
The product is unique in taking in-situ multispectral images and analyzing them in real time. It brings the lab to the field in a compact form that can be deployed on autonomous underwater vehicles. The HABCamera will provide earlier, more accurate, and more cost-effective predictions.

SUMMARY OF ANTICIPATED RESULTS:

Adapting the flexible optics and retraining the core AI technology addresses numerous other needs. For example, to detect and quantify ocean microplastics, optimize algae production, confirm wastewater treatment, test
water quality, and enhance aquatic research.

FY 2023 PHASE I AWARD WINNER

FIRM:	Metron Incorporated 1818 Library Street Suite 600 Reston, VA 20190
AWARD:	$153,323
PHONE:	703-326-2927
E-MAIL:	foley@metsci.com
PRINCIPAL INVESTIGATOR (PI):	Dr. John Foley

TITLE OF PROJECT:	EXCLAIM: a Decision Support Toolkit to Mitigate Impacts of Cascading Climate Hazards
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

Metron proposes to develop user-friendly software to promote understanding of impacts due to cascading climate hazards and extreme weather events, in collaboration with George Mason University (GMU). Climate and extreme weather (CEW) hazards pose significant risks to life and property. As extreme events become more prevalent, risks associated with cascading, compound events come to the fore, such as hurricane activity causing coastal storm surges and extreme precipitation. Sound risk mitigation decisions require understanding of both potential CEW hazards and vulnerabilities of local communities. Metron-GMU will design and develop a user-friendly toolkit to address these challenges: Extreme Climate Analysis of Impact for Mitigation (EXCLAIM). EXCLAIM strategically focuses on the near-term risks with the highest impact potential. This minimizes modeling demands to project CEW hazards and allows us to apply modern statistical and machine learning methods to capture tail-event behavior.

SUMMARY OF ANTICIPATED RESULTS:

By bringing together high-quality data from across the U.S. government, we will predict impact risk from CEW hazard projections, actuarial risk factors and social indicators of vulnerability. Our application of general purpose, spatio-temporal models enables map-based visualization of EXCLAIM data products to democratize access to near-term impact risk analytics due to CEW hazards.

FY 2023 PHASE I AWARD WINNER

FIRM:	NeXolve Holding Company 290 Dunlop Blvd Building 200 Huntsville, AL 35824
AWARD:	$174,985
PHONE:	256-836-7782
E-MAIL:	Brandon.Farmer@nexolve.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Brandon Farmer
TITLE OF PROJECT:	Active Material Technology to Improve Solar Sail Performance for Space Weather Monitoring
TOPIC NUMBER:	9.6

TECHNICAL ABSTRACT:

Development of a reflection control and direction device (RCDD) is proposed. This innovative device will progress the state of the art for propulsion of solar sails used to fly space weather monitoring sensors to sub-LaGrange point orbits for earlier warning times of impending destructive space weather events. A reflection control device (RCD) utilizes polymer dispersed liquid crystal (PDLC) material encapsulated between thin membrane layers of clear polyimide film to create a material that can switch between opaque and transparent by applying an electrical voltage across the material. This RCD will be integrated with a flexible membrane diffraction grating that will change the direction of the incident light transmitted through the RCD. With this innovation, the device becomes an RCDD. The RCDD will have the ability to produce forces on the sail in both the sail out-of-plane and in-plane directions. This ability to produce in-plane force as well as out-of-plane force means that the device can be used to control both orientation and roll of the solar sail. The RCDD will be able to support full six-degree-of-freedom control of the spacecraft compared to the RCD which has no roll control authority. This innovation will eliminate the need for heavy and complex opto-mechanical devices such as motorized tip vanes, sail warping mechanisms or other current solutions available for 6DOF sailcraft control. The resulting lighter weight of the sailcraft will increase the system's characteristic acceleration providing lower sub-LaGrange point orbits and improving warning time for adverse space weather events.

SUMMARY OF ANTICIPATED RESULTS:

The resulting lighter weight of the sailcraft will increase the system's characteristic acceleration providing lower sub-LaGrange point orbits and improving warning time for adverse space weather events.

FY 2023 PHASE I AWARD WINNER

FIRM:	NextGen Federal Systems, LLC 1399 Stewartstown Road Suite 350 Morgantown, WV 26505
AWARD:	$174,966
PHONE:	978-621-5880
E-MAIL:	aengell@nextgenfed.com
PRINCIPAL INVESTIGATOR (PI):	Alexander Engell

TITLE OF PROJECT:	Machine Intelligence for Space Weather (MINTS)
TOPIC NUMBER:	9.5

TECHNICAL ABSTRACT:

NextGen Federal Systems (NextGen), a Small Business Concern (SBC), is excited to propose a powerful software package, coupled database, and a machine-learning (ML) workflow to support streamlined evaluation and research-to-operations (R2O) of space weather ML models and techniques. In response to the NOAA Effect of Space Weather subtopic (NOAA SBIR 9.5), we propose the Machine Intelligence for Space Weather (MINTS) capability. MINTS addresses the SBIR topic call for “integrating emergent technologies, such as machine learning and artificial intelligence to enhance space weather capabilities.” Space weather data-driven ML approaches have been shown to outperform statistical and physics-based approaches in many settings. However, ML results in the literature have historically been difficult to reproduce when the code or datasets are not available, and the runtime environment is not well documented. This makes it challenging to evaluate for potential transition to testbed operations. To combat this, NextGen proposes MINTS for space weather. It provides the space weather research and operations communities the means to move towards an ‘open-source’ approach, where code and data are encouraged to be made publicly available to ensure reproducibility.

SUMMARY OF ANTICIPATED RESULTS:

To combat this, NextGen proposes MINTS for space weather. It provides the space weather research and operations communities the means to move towards an ‘open-source’ approach, where code and data are encouraged to be made publicly available to ensure reproducibility.

FY 2023 PHASE I AWARD WINNER

FIRM:	Oceanit Laboratories Inc. 828 Fort Street Mall Suite 600 Honolulu, HI 96813
AWARD:	$175,000
PHONE:	808-531-3017
E-MAIL:	kjim@oceanit.com
PRINCIPAL INVESTIGATOR (PI):	Kevin Jim
TITLE OF PROJECT:	Carbon-Negative Oceanit Reef for Aquatic Life (CORAL) Surveying via Hyperspectral Imaging-Equipped Littoral Drones (SHIELD)
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Oceanit proposes the design, construction, and testing of a hyperspectral imaging equipped Unmanned Aerial System (UAS) for the detection of various coral species and the monitoring of coral health. This system will be the prototype for the sensor part of a robust, COTS-based UAS system to aid the NOAA National Coral Reef Monitoring Program. Different coral families and species will be identified by close inspection of spectral responses combined with advanced machine learning algorithms.[1] Once a system is built to collect hyperspectral aerial imagery of corals, Oceanit will apply computer vision and machine learning techniques to identify coral families and species based on this data. There have been significant advances in differentiation of bottom types, coral fami-lies, and coral species over the years.[2] [3] Bottom type classification is well-established, and coral species identifi-cation has been performed for several coral species around the world. Oceanit's CORAL SHIELD will give NOAA and ocean researchers new capabilities to build maps of coral reefs and track populations of endangered and threatened coral species in a more timely and cost-effective manner. Our proposed system could also be used to find rare coral types, to determine overall health states of coral, and to enable rapid response to disease outbreaks. [4] CORAL SHIELD will decrease the requirement for manual coral counting and identification using divers, enabling researchers to collect data quickly and accurately.

SUMMARY OF ANTICIPATED RESULTS:

Initial prototypes will be built around a rotary-wing UAS to provide a low cost and ease of use solution. Later systems could be built around a fixed-wing UAS to enable imagery of corals at longer range or under autonomous control.

FY 2023 PHASE I AWARD WINNER

FIRM:	Orbotic Systems Inc. 275 E Hillcrest Drive Thousand Oaks, CA 91360
AWARD:	$174,999
PHONE:	805-941-1028
E-MAIL:	admin@orboticsystems.com
PRINCIPAL INVESTIGATOR (PI):	Erik Long

TITLE OF PROJECT:	In-Situ Space Weather Analysis
TOPIC NUMBER:	9.5

TECHNICAL ABSTRACT:

The goal of this Phase 1 SBIR is for Orbotic Systems to prove the feasibility of generating in-situ, global, ionospheric thermospheric neutral density and wind ion data on a near real-time basis. Orbotic Systems is developing an instrument called WIND (Wind Ion Neutral Density). This proposal leverages Technology Readiness Level (TRL) 7 and 8 hardware and software as the basis to develop a new generation of space-based space weather observation remote sensors inside of a CubeSat platform. As fully described in this proposal's Technical Content section, the WIND instrument builds on the earlier success of the space-qualified WINCS instrument (Wind Ion Neutral Composition Suite), flown on the following missions: GPIM, STPSat-3, SENSE (CubeSat), Politech.1 (CubeSat), CADRE (CubeSat). Recent Orbotic Systems discussions with NOAA's Space Weather Prediction Center (SWPC) show that there is a clear need to generate global atmospheric neutral density data on a real-time basis in the 200km to 700km altitude range.

SUMMARY OF ANTICIPATED RESULTS:

Orbotic Systems is responsive to this need and has identified a means to obtain in-situ density readings to assist NOAA and the private sector in space weather forecasting efforts. Further, WIND will validate SWPC models and other data-assimilation thermospheric models. The Phase 1 deliverables will establish the requirements for a WIND prototype.

FY 2023 PHASE I AWARD WINNER

FIRM:	Pacific Hybreed, Inc. 10610 NE Manitou Park Blvd Bainbridge Island, WA 98110
AWARD:	$128,671
PHONE:	(626) 241-5325
E-MAIL:	francis@pacifichybreed.com
PRINCIPAL INVESTIGATOR (PI):	Francis Pan
TITLE OF PROJECT:	Family-based breeding for production of higher-yielding Manila clam seed
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Farming of marine bivalves provides high-quality protein and has a positive impact on the coastal environment. The U.S. is a top producer of the Manila clam (Japanese carpet shell, Ruditapes philippinarum) with reported sales of $31 M in 2019. Production of clams, however, has depended almost entirely on seed from wild stocks and natural recruitment, leaving the industry vulnerable to ocean change. In response to Topic Area 9.3 The Changing Ocean, this Phase I proposal seeks to develop a family-based breeding program for R. philippinarum and select for families with differential sex-ratios that may have contrasting yield potentials and environmental resilience. This proposal builds on prior research showing a relationship between sex-ratios and growth rates, and the possibility of identifying sex based on mitochondrial segregation patterns in embryonic clams.

SUMMARY OF ANTICIPATED RESULTS:

We propose to combine several technological innovations: (1) development of a repository of pair-mated, full-sibling families; (2) identification of primary sex-ratios at embryonic stages; (3) out-planting of families with differential sex-ratios for assessments of yield performances. Expected results could enable the development of future projects that will be focused on investigating the genetic bases for sex determination and biological underpinnings of differential growth and survival for the species.

FY 2023 PHASE I AWARD WINNER

FIRM:	Salient Predictions, Inc. 39 Gull Rd. Falmouth, MA 92011
AWARD:	$174,946
PHONE:	508-566-1231
E-MAIL:	rschmitt@salientpredictions.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Raymond Schmitt

TITLE OF PROJECT:	Machine Learning and ocean variables for improved predictions of water availability in the US
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

Salient Predictions Inc. proposes to develop new technology for accurate subseasonal to seasonal (S2S) water availability forecasts so that communities may manage water resources in preparation for hazardous events like floods and droughts. Current hydrological models face challenges related to data inputs, as climate change has been presenting weather patterns atypical from historical data. Without quality data inputs, the accuracy of the output from hydrological models suffers. To overcome these challenges, Salient Predictions proposes to use improved S2S forecasts as the weather input to Variable Infiltration Capacity (VIC) hydrological forecasts, thus providing improved water availability forecasts spanning from 2- to 52- weeks into the future. Salient's base S2S forecast technology uses machine learning and various oceanic,atmospheric, and land-based variables to make improved predictions of weather up to a year in advance. This core technology evolved from decades of research at Woods Hole Oceanographic Institution and the Massachusetts Institute of Technology.

SUMMARY OF ANTICIPATED RESULTS:

Phase I will address challenges related to 1) the spatio-temporal gap between S2S forecast variables and those required to capture more heterogeneous hydrological processes, and 2) the need to include climate change projections into S2S forecasting, as many recent hydrological events are being at least partially attributed to climate change.

FY 2023 PHASE I AWARD WINNER

FIRM:	Space Balloon Technologies Corp. 1 Aerospace Boulevard, MicaPlex Suite 210, Daytona Beach, FL 32114
AWARD:	$175,000
PHONE:	305-613-6709
E-MAIL:	pradeep.shinde@spaceloon.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Pradeep Shinde
TITLE OF PROJECT:	Controlled Altitude Ballooning (CAB) for monitoring Energetic Particle effects on the Atmosphere
TOPIC NUMBER:	9.6

TECHNICAL ABSTRACT:

SpaceLoon proposes to design, prototype, and test a consistent, reliable, and bi-directional Controlled Altitude Ballooning (CAB) system for monitoring climate constituents, such as energetic particles (solar and cosmic) and thermodynamic variables, across various atmospheric layers. The absence of linkage between space weather events and atmospheric physics, chemistry, and dynamics, creates voids in understanding climate variability. To harness measurements directly connecting space weather phenomena with atmospheric response and dynamics across multiple atmospheric layers, better balloon platforms are required.

SUMMARY OF ANTICIPATED RESULTS:

SpaceLoon's CAB, a patent-pending technology, is a combination of hardware and software that provides controlled altitude balloon flight for environmental data collection by varying the balloon size without bursting and facilitates access to the desired altitudes throughout the atmosphere from ground to the Mesosphere. Controlled balloon size variation within the burst limit enables the CAB to conduct multiple profile sequences in one single flight.

FY 2023 PHASE I AWARD WINNER

FIRM:	Space Environment Technologies 528 Palisades Dr. Ste. 164 Pacific Palisades, CA 90272
AWARD:	$174,995
PHONE:	310-573-4185
E-MAIL:	ktobiska@spacewx.com
PRINCIPAL INVESTIGATOR (PI):	Dr. Kent Tobiska
TITLE OF PROJECT:	Nitric Oxide Measurements to improve Atmospheric Densities (NOMAD)
TOPIC NUMBER:	9.5

TECHNICAL ABSTRACT:

The Ionosphere-Thermosphere-Electrodynamics (I-T-E) Earth system varies markedly on different spatial and temporal scales and this variation can have adverse effects on human operations and systems. There is a need to specify and forecast near-Earth I-T-E space weather to reduce the risks from hazards to systems that operate in this environment. An indicator of the current state and the near-term evolution of large geomagnetic storms is the presence of nitric oxide (NO), a minor species, which is produced during geomagnetic storms. It is created in the 100–160 km region due to precipitating charged particles along Earth's magnetic field lines that enter the higher latitude atmosphere. Geomagnetic disturbances lead to episodic heating and expansion of the thermosphere. The expansion then increases density at fixed altitudes and causes more atmospheric drag on LEO objects. As a geomagnetic storm's Joule heating and particle precipitation heat the auroral regions, there is increased infrared (IR) emission. This is from NO that is produced and then subsequently leads to efficient cooling, i.e., a natural "thermostat" effect reducing densities. This proposed work will provide a pathway for operationally sensing the lower thermospheric NO density on a 24/7 basis. Specifically, this proposed work will help expand observational tools that support short- and long-term space weather predictions, will advance region-specific space weather products that provide decision makers with improved characterization and prediction of the timing, intensity, and impact of space weather events on critical infrastructure, and will help develop procedures that facilitate advanced warning of geomagnetic storms. We will design in Phase I and develop in Phase II a nitric oxide (NO) sensor system to continuously fly on a stratospheric uncrewed aerial vehicle (drone) at 20 km for extended periods of time.

SUMMARY OF ANTICIPATED RESULTS:

The NO instrument will have viewing through the top of the drone's avionics bay cover so that a 45° viewing cone will observe the overhead sky. We will design as a feasibility study the NO instrument, the integration to the drone avionics, and the data retrieval and distribution systems in Phase I.

FY 2023 PHASE I AWARD WINNER

FIRM:	SPEC Sensors **DBA Interlink Electronics Inc.** 1 Jenner Suite 200 Irvine, CA 92618
AWARD:	$174,997
PHONE:	510-244-4531
E-MAIL:	truss@iesensors.com
PRINCIPAL INVESTIGATOR (PI):	Tamara Russ
TITLE OF PROJECT:	Low-Cost, Low-Power Sensor Nodes for Monitoring Air Quality Impacted by Wildfire Smoke
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

The impact of wildfires on air quality in the surrounding hundreds of miles has been discussed since the ‘70s. There have been a number of studies investigating the severity of the impact of wildfire smoke on the health of people in affected areas that have shown that hundreds of thousands of people die as a consequence of smoke-tainted air. Many studies focus on the impact of particulate matter even though it is by far not the only harmful component of wildfire smoke. Wildfire smoke is a complex mixture of many different gasses in addition to particulate matter. These gasses include CO, NO2, SO2, CO2 and O3, all of which have severe health effects when surpassing certain threshold levels. Current available air quality assessment methods are not sufficient to properly warn people of wildfire emission tainted air. Additionally, there are certain areas where the density of air quality monitoring stations are not high enough and models are used to predict air quality. These models are often based on monitoring stations with low measuring rates (one data point every few hours or even less often) resulting in poor accuracy.

SUMMARY OF ANTICIPATED RESULTS:

Developing a low-cost sensor node that can track air quality with nearly comparable measurement performance to the expensive air quality measurement tools will allow for creation of a denser network of monitoring stations and combined with a significantly higher measurement rates (down to 1 value per second is possible with these sensors) would be of significant benefit to understanding the impact of wildfire smoke on air quality. The proposed research, based on prior work ([12], EPA and USDA grants), will test our hypothesis that the low-cost sensor nodes can provide AQ data significantly improved over existing systems at a 10-100 times lower cost.

FY 2023 PHASE I AWARD WINNER

FIRM:	StratoSolutions, Inc. 33555 N Ivy Lane Grayslake, IL 60030
AWARD:	$175,000
PHONE:	503-807-7776
E-MAIL:	rchan@stratosolutionsinc.com
PRINCIPAL INVESTIGATOR (PI):	Raymond Chan

TITLE OF PROJECT: AeroLite Sense: Atmospheric Aerosols and Particulates Observations from the Stratosphere

TOPIC NUMBER: 9.1

TECHNICAL ABSTRACT:

The long endurance “StratoSonde" lighter-than-air, uncrewed system combines a low-cost, <2.7kg,self-navigating High-Altitude Balloon (HAB) with a micro-dropsonde dispensing system, enabling meteorological observations over remote areas of the globe by dispensing micro-dropsondes from the stratosphere. This disruptive capability is being used to obtain very high vertical resolution data from stratosphere down to sea-level and targeting specific regions and priority use cases. The existing micro-dropsonde system weighs just 20g and measures temperature, relative humidity, wind speed and pressure at 10m (30ft) vertical resolution. The >5day endurance StratoSonde supports up to 10 micro-dropsondes, which when released from the HAB, descend safely through the entire atmospheric column under a ribbon drogue while reporting observations directly back to the HAB.

SUMMARY OF ANTICIPATED RESULTS:

This project will assess the feasibility of integrating a disposable miniature aerosol and particulates sensor into a new type of micro-dropsonde capability, while retaining the ability to be dispensed from the StratoSonde HAB system. This will enable high resolution sensing for many use cases including volcanic ash plume detection and bio-aerosol detection of pollens, dust, and industrial pollution. This will enable meteorologists to account for aerosol and particulates on large scale meteorological mechanisms and ultimately improve the long-term forecast accuracy of extreme weather events.

FY 2023 PHASE I AWARD WINNER

FIRM:	Synthetik Applied Technologies LLC 28696 Tree Farm Rd Pierre, SD 57501
AWARD:	$174,809
PHONE:	360-441-5010
E-MAIL:	hatfield@synthetik-technologies.com
PRINCIPAL INVESTIGATOR (PI):	Joshua Hatfield

TITLE OF PROJECT:	UrbanScale: Physics Informed Deep Learning Framework to Generate High-Resolution Urban Temperature Data
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

Elevated temperatures observed in urban areas have significant implications for human health, energy consumption and infrastructure reliability, and their negative effects disproportionately impact disadvantaged populations. Increasing scientific and practical understanding of urban heat islands is an important step in identifying those regions at elevated risk, and effective mitigation strategies. The urban heat island effect is most readily quantified through the measurement of land surface temperature (LST) in urban regions. Despite the importance of LST to informed decision making and preparing for extreme heat events, there is a current lack of widely available tools that can determine and predict LST at the high-resolution appropriate for the geometric complexity and high degree of heterogeneity present in urban environments. Physics-informed deep learning approaches combining data-driven approaches and physical modeling have demonstrated significant promise in a number of earth-science applications.

SUMMARY OF ANTICIPATED RESULTS:

We propose to evaluate several architectures of physics-informed neural networks to the problem of downscaling or generating high-resolution predictions of LST. Identification of the most promising candidates during Phase I will enable inclusion of these algorithms in a direct user-facing software application during Phase II.

FY 2023 PHASE I AWARD WINNER

FIRM:	Transcend Engineering and Technology, LLC 768 S. Main Street Unit 2 Bethel, VT 05032
AWARD:	$174,977
PHONE:	802-431-3456
E-MAIL:	sfarrington@transcendengineering.com
PRINCIPAL INVESTIGATOR (PI):	Stephen Farrington
TITLE OF PROJECT:	Increasing Water Use Efficiency by Addressing Sensor Cost Barriers Using Novel Technology
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

The project objective is to greatly reduce the cost of monitoring soil water content in a highly-resolved vertical profile to promote increased adoption of more efficient water management tools. Cost is the most significant barrier to adoption of sophisticated data-driven irrigation management in permanent agriculture. Highly-resolved vertical soil water profiles are needed to learn soil-specific hydraulic response and to accurately infer crop water uptake and deep drainage fluxes from monitored changes in the storage profile. Basing irrigation decisions on the time-varying soil hydraulic behavior learned in situ will enable the improvement of water and energy conservation, resource protection, and adaptability to climate change. The massive proliferation of wireless accessories has driven the cost of integrated circuit (IC) based programmable RF transceivers unprecedentedly low and usability unprecedentedly high. We propose to repurpose low-cost RF chips as soil water sensing devices arranged in a dense linear profile for high resolution vertical water content profiling. Electromagnetic waves transmitted through a material are affected by the dielectric permittivity of the material. Preliminary work has demonstrated a relationship between signal strength and permittivity of the surrounding material which is a strong indicator of soil water content.

SUMMARY OF ANTICIPATED RESULTS:

The new multi-level sensor will replace and improve on significantly more expensive multilevel soil moisture technologies currently on the market. Applying a machine intelligence (MI) we have developed, this and other multi-level sensors can accurately determine root uptake and deep drainage which form the basis for a sophisticated irrigation decision support system offered by our precision ag commercialization partner.

FY 2023 PHASE I AWARD WINNER

FIRM:	Upstream PBC 2401 Monarch St #23 Alameda, CA 94501
AWARD:	$174,990
PHONE:	206-963-8669
E-MAIL:	grants@upstream.tech
PRINCIPAL INVESTIGATOR (PI):	Alden Sampson
TITLE OF PROJECT:	HydroForecast Seasonal: Improving operational water supply forecasts to enable risk-based decisions and planning
TOPIC NUMBER:	9.4

TECHNICAL ABSTRACT:

Ensuring a safe water supply for society and the sectors that rely on water for economic and environmental purposes is a difficult problem that needs significant investment in R&D across public and private organizations. Climate change accelerates and exacerbates this challenge, causing a breakdown in some traditional approaches that use the past to predict the future streamflow on a seasonal (10 day to one year) horizon. Water managers planning on this seasonal timescale need help advancing models, tools, and transforming model results into actionable information for making decisions. In this Phase I effort, Upstream Tech proposes to expand its HydroForecast Seasonal prototype by achieving three technical objectives: 1) improve methodology and data used for generating weather forecast inputs, 2) integrate a new weather forecasting source to improve accuracy at longer lead times, and 3) benchmark performance in critical basins that benefit customers and society.

SUMMARY OF ANTICIPATED RESULTS:

At the conclusion of Phase I, we will have created a set of seasonal models in key basins of interest to managers, hydropower, state agencies etc., and performed a robust benchmark evaluation of HydroForecast Seasonal and how it complements with NOAA models.

FY 2023 PHASE I AWARD WINNER

FIRM:	Viable Gear LLC 66 Parsons Rd. Portland, ME 04103
AWARD:	$175,000
PHONE:	207-975-2595
E-MAIL:	katie@viablegearco.com
PRINCIPAL INVESTIGATOR (PI):	Katie Weiler
TITLE OF PROJECT:	Seaweed-based bioplastic replacement for commercial lobster fishing gear.
TOPIC NUMBER:	9.3

TECHNICAL ABSTRACT:

Viable Gear will provide proof-of-concept for a seaweed-based bioplastic to be used in manufacturing a compostable biotwine for marine equipment, designed to replace petroleum-based plastics. This addresses NOM-SBIR research topic area 9.3, The Changing Ocean - specifically to "support increased protection and restoration of marine and coastal habitats to enhance vital ecosystems", by helping decrease macro and microplastic pollution. This is a critical need, since broken-down or lost fishing/aquaculture gear comprises ~ 70% of ocean-based macroplastics. Technical questions to be addressed include whether seaweed can be the primary component of a bioplastics durable enough to last in the ocean for a minimum of six months and whether it can be created without petroleum-based toxic additives that are typical in mainstream plastics and bioplastics.

SUMMARY OF ANTICIPATED RESULTS:

Seaweed-based fiber twine using brown macroalgae (class Phaeophycean) will be created, and the project will test alginate ratios, other polysaccharide additives like agar and carrageenan and innovating with additives such as chitin and cellulose, and wool for a biotwine that will be used to replace nylon and poly gear used in bait bags in the commercial fishing industry. The biotwine will be ocean tested for strength and durability. A preliminary cost analysis will also be compiled.

FY 2023 PHASE I AWARD WINNER

FIRM:	WaiHome LLC 59-477 Hoalike Road Haleiwa, HI 96712
AWARD:	$175,000
PHONE:	808-979-6941
E-MAIL:	thewaihome@gmail.com
PRINCIPAL INVESTIGATOR (PI):	James Roberts
TITLE OF PROJECT:	Affordable Wastewater Disposal for Coastal Households Adapting to Sea Level Rise
TOPIC NUMBER:	9.2

TECHNICAL ABSTRACT:

Rising sea levels and king tide flooding in coastal areas across America are saturating onsite wastewater disposal systems (OSDS), resulting in the degradation of coastal ecosystems and 200,000+ illnesses annually. Many States are mandating system upgrades, with 88,000 upgrades required by 2050 in Hawaii alone. Unfortunately, existing upgrade options are unaffordable for 97% of Hawaiian homeowners and offer poor performance for coastal properties with high groundwater levels. In response to this pressing issue that will cost Hawaiian homeowners an estimated $1.75B between now and 2050, WaiHome LLC is developing an aboveground and affordable wastewater disposal system for coastal households adapting to sea level rise.

SUMMARY OF ANTICIPATED RESULTS:

Under this Phase I SBIR project, WaiHome is proposing to investigate the regulatory and technical feasibility of its proprietary Rail above ground disposal system. WaiHome will summarize regulatory approaches to similar systems and interview regulators from coastal states across America. WaiHome will also evaluate locally available system components, and innovative manufacturing and installation methods to decrease labor and material costs. Finally, WaiHome will build and install a proof-of-concept system at the company's Hawaiian pilot site to evaluate the impact of geometric design parameters on disposal performance.

FY 2023 PHASE I AWARD WINNER

FIRM:	Yankee Environmental Systems, Inc. 101 Industrial Blvd Turners Falls, MA 01376
AWARD:	$175,000
PHONE:	413-863-0200 x7201
E-MAIL:	mcb@yesinc.com
PRINCIPAL INVESTIGATOR (PI):	Mark Beaubien
TITLE OF PROJECT:	Smokesonde: Low cost in-situ sampling of smoke and convective storm intensity supporting fire weather and incident meteorology
TOPIC NUMBER:	9.1

TECHNICAL ABSTRACT:

We propose to develop in-situ low cost sensors to support fire meteorology for wildland fire emergency response, by blanketing the fire area with real time measurements. Sensors can be air-deployed to provide vertical atmospheric measurement profiles or hand-emplaced for augmenting existing surface fire weather stations. Each telemeter has precision measurements of air temperature, solar radiation, imagery, daytime cloud cover, lightning, rain, and soil temperature/moisture. Smoke imaging, lightning sferic and moisture sensors will be integrated. CO2 or SO2 gas sensors as options can support monitoring of volcanic plumes. Our R&D involves leveraging miniature light-scattering dust sensors that sample air passing through a XDD dropsonde body during the descending/ascending phase. A camera will provide close-in fire scene imagery and measure daytime cloud cover. Grid impedance sensors will detect precipitation and determine soil moisture. Ground temperature will be measured via an infrared thermometer while a fast-responding fine grid thermometer sensor detects fluctuations arising from rapid convection.

SUMMARY OF ANTICIPATED RESULTS:

It will help quantify the on scene thermodynamic picture. It will capture the spatial distribution and intensity from sferic activity and discern cloud-to-ground vs. cloud-to-cloud strokes, and stroke frequency to capture convective storm intensity/evolution so important to fire weather and severe storm meteorology.