Report to Congress on the National Oceanographic Partnership Program Fiscal Year 2021

Prepared by the
Interagency Working Group
on the National Oceanographic Partnership Program
of the
Ocean Science and Technology Subcommittee *of the*
Ocean Policy Committee

October 2022

About the Ocean Policy Committee

The Ocean Policy Committee (OPC) was codified in the National Defense Authorization Act for Fiscal Year 2021 to coordinate federal actions on ocean-related matters and is co-chaired by the Director of the Office of Science and Technology Policy (OSTP) and the Chair of the Council on Environmental Quality (CEQ). The OPC is directed to engage and collaborate with the ocean community on ocean-related matters, identify priority ocean science and technology needs, and to leverage resources and expertise to maximize the effectiveness of federal investments in ocean research. For more information about the work of the OPC, please see noaa.gov/interagency-ocean-policy.

About the Office of Science and Technology Policy

The OSTP was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of federal research and development in budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the federal government. More information is available at http://www.whitehouse.gov/ostp.

About the Ocean Science and Technology Subcommittee

The purpose of the Ocean Science and Technology (OST) Subcommittee under the OPC is to advise and assist on national issues of ocean science and technology. The OST contributes to the goals for federal ocean science and technology, including developing coordinated interagency strategies and fostering national ocean science and technology priorities.

About the National Oceanographic Partnership Program

The National Oceanographic Partnership Program (NOPP) was established by Congress in 1997 and reauthorized in 2021 to promote the national goals of advancing economic development, protecting quality of life, strengthening science education and communication, and assuring national security by improving knowledge of the ocean. These goals are achieved through partnerships among federal agencies, academia, industry, and non-governmental organizations that advance interagency initiatives and federal science and technology priorities and cut across agency missions and multiple disciplines. Through NOPP, public and private sectors across the ocean science community coordinate to support larger, comprehensive projects, promote sharing of resources, and foster community-wide innovative advances in ocean science, data, technology development, resources, education, and communication.

About this Document

Under the National Oceanographic Partnership Act (Public Law 116–283, §1055(b)(2)(A)), the OPC is required to report to Congress annually on NOPP activities. This report details activities in fiscal year 2021.

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Executive Summary

The National Oceanographic Partnership Program (NOPP) marked its 23rd year in fiscal year (FY) 2021. Since its establishment through the FY 1997 Defense Act (Public Law 104-201, 10 U.S. Code §7901-7903), NOPP has forged interagency and multi-sector cooperation through cross-cutting ocean science and technology research and education projects. NOPP is an effective forum for developing new interagency activities that advance ocean knowledge and augment marine stewardship by transcending single agency research and education missions.

In FY 2021, NOPP focused on two strategic goals:

- Facilitate and promote interagency ocean research partnerships
- Catalyze and support scientific and technological research on critical and emerging issues

In FY 2021, NOPP partner agencies funded seven new projects:

1) *Predicting Hurricane Coastal Impacts*
2) *Offshore Wind, Fisheries and Protected Species Science to Address the U.S. Climate Crisis*
3) *The Effects of Sea Level Rise: Surface Transportation Resilience in Collaboration with the Department of Transportation*
4) *Ocean Surface Topography Science Team*
5) *Using Uncrewed Underwater Vehicles for Mapping and Characterization with Application to Pollution Response*
6) *U.S. Exclusive Economic Zone Mapping and Exploration in the Aleutian Islands*
7) *Piloting Bio-GO-SHIP on U.S. cruises: Towards a Global Analysis of Large-Scale Changes to Ocean Plankton Systems*

These seven projects bring the total number of active awards to 89 and total number of awards funded since NOPP's inception to 304. The funding dedicated to new FY 2021 projects totaled $5.91M. The total FY 2021 investment in all NOPP-solicited activities, both new and continuing, was $15.39M.

A NOPP Broad Agency Announcement (BAA) was released in FY 2021, providing up to $23M over five years. The solicitation focused on two topics:

1) *A Global Multi-agency Experiment on Internal Wave Energy, Mixing and Interactions in the Ocean and Their Representation in Global Ocean Models and Operational Forecasts*
2) *High Resolution Ocean Models for Coupled Earth System Prediction across Space and Time Scales.*

Proposals will be received, reviewed, and selected for funding starting in FY 2022.

Introduction

The National Oceanographic Partnership Program (NOPP) was established by Congress in fiscal year (FY) 1997 to promote the goals of assuring national security, advancing economic development, protecting quality of life, and strengthening science education and communication by improving knowledge of the ocean (Public Law 104-201, 10 U.S. Code §7901-7903 and more recently, Public Law 116–283, §1055(b)(2)(A)). These goals are accomplished through partnerships among federal agencies, academia, industry, and non-governmental organizations. The program is an effective forum for the advancement of national goals through the development of interagency initiatives and projects that span agency missions, research sectors, and scientific and technological disciplines.

NOPP Interagency Interactions

Interagency partnership is a central tenet of NOPP. As such, the engagement of partner agencies is essential to the success of NOPP initiatives and is accomplished through participation in committees, working groups, and panels. In FY 2021, agency participation in NOPP included sponsoring research through partnership funding opportunities and a prize competition.

National Oceanographic Partnership Program

The objective of the Interagency Working Group (IWG) NOPP is to develop, plan, and oversee NOPP ocean research and technology projects that result from agency partnerships and to address topics of mutual and emerging interest. This interagency working group targets projects that benefit from the collaboration of more than one agency, require government-private-academic partnerships, and work toward fulfilling the missions from multiple agencies. Partnerships facilitated through NOPP address a broad range of ocean science, technology, and marine resource management priorities. The IWG-NOPP met 11 times in FY 2021 to discuss topics for future ocean science and technology research.

Ocean Research Advisory Panel

The Ocean Research Advisory Panel is in the process of being reconstituted as a Federal Advisory Committee Act Panel under the National Oceanic and Atmospheric Administration (NOAA).

Fiscal Year 2021 NOPP Activities

Annual Solicitation

Each year, NOPP partner agencies identify ocean research and technology topics of mutual interest that would benefit from cross-agency and cross-sector partnerships, leading to an agency-issued formal Broad Agency Announcement (BAA), Request For Proposal, or Federal Funding Opportunity. Proposals are received, usually in the fall, and funded projects are then selected through a formal merit review process developed with the guidance and approval of the participating federal agencies. Details of the procedure for developing these funding opportunities are described in Appendix 1.

Office of Naval Research (ONR) selected award recipients in response to the FY 2020 *Predicting*

Hurricane Coastal Impacts BAA (https://nopp.org/2020/predicting-hurricane-coastal-impacts-fy21-24/). The BAA solicited science and technology to address four research Tasks:

1) Digital Elevation Models
2) Remote Sensing
3) *In Situ* Measurements
4) Wave, Surge, Sediment Transport and Structure Response Forecasting

A total of $12.1M over 4 years will fund nine multidisciplinary teams across the four Tasks. The National Geospatial-Intelligence Agency, National Oceanic and Atmospheric Administration (NOAA), and U.S. Geological Survey (USGS) joined ONR in partnership on this project. Abstracts, partners, and lead principal investigators (PIs) for each team can be found in Appendix 2, and on the project website: https://nopphurricane.sofarocean.com/.

NOAA partnered with U.S. Naval Research Laboratory (NRL), Bureau of Ocean Energy Management (BOEM), Federal Highway Administration, National Aeronautics and Space Administration (NASA), Environmental Protection Agency (EPA), and National Science Foundation (NSF) to apply its FY 2021 NOPP appropriation of $3M in support of six projects:

1) *Offshore Wind, Fisheries and Protected Species Science to address the U.S. Climate Crisis*
2) *The Effects of Sea Level Rise: Surface Transportation Resilience in Collaboration with the Department of Transportation*
3) *Ocean Surface Topography Science Team*
4) *Using Uncrewed Underwater Vehicles For Mapping and Characterization with Application to Pollution Respons*
5) *U.S. Exclusive Economic Zone Mapping and Exploration in the Aleutian Islands*
6) *Piloting Bio-GO-SHIP on U.S. cruises: Towards a Global Analysis of Large-Scale Changes to Ocean Plankton Systems*.

The abstracts, partners, and lead PIs of the six projects can be found in Appendix 2.

The IWG-NOPP developed topics and language for an FY 2022 BAA, which was published on October 6, 2021. The solicitation may provide up to $23M over five years and focused on two topics:

1) *A Global Multi-agency Experiment on Internal Wave Energy, Mixing and Interactions in the Ocean and Their Representation in Global Ocean Models and Operational Forecasts*
2) *High Resolution Ocean Models for Coupled Earth System Prediction across Space and Time Scales.*

Proposals will be received, reviewed, and selected for funding in FY 2022.

In FY 2022, the IWG-NOPP will continue to identify, facilitate, and foster collaboration on priority interagency ocean research projects through engagement with representatives from federal ocean agencies and other appropriate avenues. The IWG-NOPP is in discussion concerning topics potentially for a second FY 2022 BAA to foster NOPP ocean science and technology partnership projects that are supportive of federal marine science and technology priorities.

Meeting Support and Public Outreach

The IWG-NOPP was without a program office for FY 2021 and conducted outreach via social media and website postings. A contract was awarded for a new NOPP Program Office in September 2022.

NOPP Excellence in Partnering Award

A NOPP Excellence in Partnering Award was not made in FY 2021.

Summary of NOPP Investments

Fiscal year 2021 funding under NOPP totaled $15.39M. From FY 1997 through FY 2021 the total expenditures on NOPP are $501M. Figure 1 shows a sand chart of recent NOPP funding by agency and year. The same data are presented as a table in Appendix 3. Appendix 4 provides a list of the 89 active NOPP projects; all 304 NOPP projects can be found at www.nopp.org.

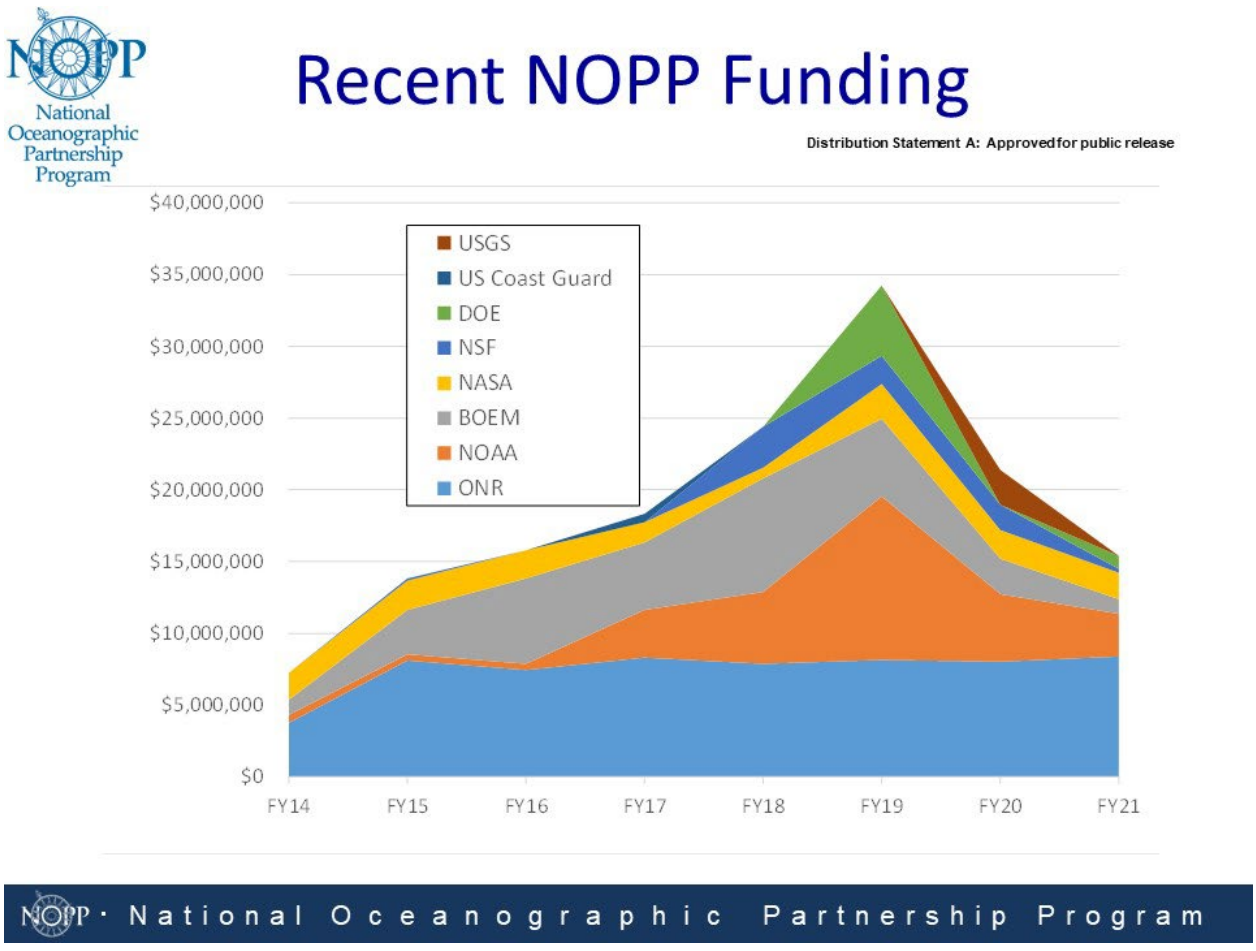

Figure 1. Reported agency contributions to National Oceanographic Partnership Program projects

from fiscal year 2014 to fiscal year 2021.

Conclusion

In FY 2021, NOPP launched seven new projects and supported a prize competition while continuing successful projects from previous years. NOPP's FY 2021 BAA announcing the possible award of $23M over five years is the largest in recent years. Going forward, NOPP will draw upon its 24 years of experience and lessons learned to serve as an efficient mechanism for implementing productive ocean partnerships among federal agencies, industry, academia, and other sectors; supporting interagency working groups focused on key ocean research and facilities issues; and supporting federal ocean science priorities.

Appendix 1. Development and Process for NOPP Solicitations

To be a funded NOPP project requires multi-sector partnerships among academia, industry (including non-government organizations), and government (including state, local, and Tribal entities).

Agency program officers and managers work together to initiate research topics for NOPP funding, most often at IWG-NOPP meetings. Partner agencies then discuss the research topic with other agencies through NOPP. At this point, a follow-up meeting is conducted where interagency partnerships are formed and tentative levels of support are pledged on an as-available basis. The research goals, partner resources, solicitation mechanisms, and solicitation language are proposed, and the lead agency and agency project coordinator are identified.

Once the lead agency and its partners approve the solicitation, NOPP reviews the funding announcement language, which is then released as either a Broad Agency Announcement, Request For Proposals, or Federal Funding Opportunity by the lead agency on behalf of NOPP.

Once a funding opportunity is announced, submitted proposals undergo a review process that fulfills the review standards of all agencies sponsoring that topic. For instance, when the NSF is a co-sponsor, the review process may be some combination of mail and panel peer review. Proposals are reviewed based on:

- Relevance of the proposed research to NOPP objectives and federal science and technology priorities;
- Overall scientific and technical merits of the proposal;
- Level of support of critical research objectives or operational goals;
- Quality of proposed partnerships;
- The offeror's capabilities, related experience, and access to facilities that are critical to the proposal objectives;
- The long-term commitment of the partners to the proposed objectives;
- The qualifications and experience of the proposed principal investigator and key personnel; and
- Rationale of proposed cost.

At the conclusion of the review process, agency program officers or managers make a recommendation for funding. The awarded research projects are announced following NOPP discussion and receipt of appropriations.

Appendix 2. New NOPP-Solicited Activities in Fiscal Year 2021

NOPP BAA: Predicting Hurricane Coastal Impacts (1 project, 9 teams, $12.1M total funding over 4 years)

Project Website: https://nopphurricane.sofarocean.com

Air-deployed wave buoys for hurricane forecast improvements

PI: Jim Thomson, University of Washington, Applied Physics Laboratory

Partners: ONR, NOAA, University of Washington, Sofar Ocean Technologies, University of Colorado Boulder

The proposed project will air-drop wave buoys in front of hurricanes and provide real-time data for assimilation into wave forecast systems. The project will expand an existing buoy design (Sofar Ocean Spotters) for operational deployments from open-door aircraft, such as the C-130. The project will simultaneously test prototype buoys (Applied Physics Laboratory - University of Washington microSWIFTs and NOAA ADMBs) for research deployments from dropsonde tubes in pressurized aircraft, such as the P3. A total of 10 hurricanes will be sampled over 4 years, nominally as 1-3-3-3, by year. The project will include research to optimize the spacing and timing of the wave buoys relative to the predicted hurricane track.

Coastal Elevation Models and Land Surface Variables for Use in Forecasting Hurricane Impacts

PI: Dean Gesch, USGS

Partners: ONR, USGS, NOAA, University of Colorado Boulder, Marda Science LLC, University of North Carolina Greensboro

The U.S. Gulf and Atlantic coasts are increasingly threatened by large tropical storms that can have substantial impacts, including flooding, erosion, overwash, breaching, and destruction of built features. Forecasts of the impacts of these hurricanes have improved, but there are still significant uncertainties in projected coastal impacts, often due to how land conditions are inadequately represented in forecast models. The objectives of this proposed effort in addressing NOPP project Task 1 are to:

1) develop and maintain updated topobathymetric digital elevation models (TBDEMs)
2) collate and characterize coastal sediment type and grade that can be used as inputs for morphodynamic models
3) develop general coastal vegetation characteristics that can be used as inputs for models
4) inventory and characterize structures and infrastructure types spatially such that they can be ingested by models

These results will better equip coastal models leading to improved hurricane impact projections. Here, we leverage a range of existing and operational efforts (such as national elevation data products,

conterminous U.S. [CONUS] land use/land cover products, a CONUS-wide tidal marsh biomass dataset, and the USGS National Structures Dataset). The products from this Task will provide the other NOPP project teams with rich datasets for use as baseline conditions for producing remotely sensed digital elevation models (Task 2), collecting *in situ* measurements (Task 3), and modeling storm impacts (Task 4).

The study area for this effort will include the U.S. Gulf of Mexico coast and the U.S. Atlantic Seaboard. Along these coastal margins, the study area will span from the close out depth (depths of minimal sediment movement) to the NOAA National Hurricane Center Maximum of the Maximum Envelope of High Water for a Category 4 storm for Virginia northward and Category 5 storm south of Virginia. The elevation-based nature of our proposed study area will provide models with boundary condition data needed to predict impacts from extreme storms, especially in coastal areas with low terrain slope such as the southeastern United States.

Due to the large extent of the study area, the team will use a three-tier approach. While these tiers may differ slightly for each product type (TBDEMs, sediment, vegetation, and structures and infrastructure), the general approach will be similar. Tier I products will provide coverage for the entire study area by the end of the first year of the project. Tier II products will include enhancements to the initial Tier I products over the project life cycle. Tier III products will focus on advancing research and development related to coastal TBDEM uncertainty, grain size mapping at high-resolution from satellite imagery, remotely sensed vegetation characteristics, and assessing post-storm structure and infrastructure damage. Collectively, these Tier III products and analyses will provide opportunities to advance the science of coastal dynamics, storm impacts, and advancing coastal morphologic modeling. The Team will use one Tier III site per coast. The Gulf of Mexico site is the western Deltaic Plain of Louisiana and the Atlantic Seaboard site is the Outer Banks of North Carolina.

The outcome of the research and development will be manyfold. Complete coverage of updated high-resolution TBDEMs, high-resolution vegetation maps with corresponding vegetation structure parameters, an approach for estimating sediment grain size from space, and updated structure and infrastructure layers and enhanced storm damage summaries are among the highlights of the proposed research. In addition to the critical datasets delivered to coastal modelers for improved hurricane impact forecasts, scientific journal articles will document the advances in coastal mapping and land feature characterization for hazard assessment.

Conterminous U.S. Landing Hurricane Wind Forcing

PI: William Komaromi, NRL, Monterey, CA

Partners: ONR, NRL

The goal of this project is to provide surface winds and other key variables using the Navy's Coupled Ocean-Atmosphere Mesoscale Prediction System for Tropical Cyclones (COAMPS-TC®) deterministic model and the COAMPS-TC ensemble system in support of the ONR NOPP Project: Predicting Hurricane Coastal Impacts. The project team will run COAMPS-TC and the 11-member ensemble at high horizontal resolution (4 km) in real time during the 2022-2024 Atlantic and East Pacific hurricane seasons in support of the NOPP team, providing a variety of real-time fields and forecast aids to the NOPP team. The project will also produce three hindcasts per year, with accurate tropical cyclone track, size, and intensity, over the course of three years (nine total) for retrospective analysis given highly accurate atmospheric reforecasts and reanalyses. The team will coordinate closely with the other team members

to make certain all scientists are able to ingest and analyze the COAMPS-TC fields in real time and utilize these data in their research.

Coupled Ocean Atmosphere Waves Sediment Transport - Waves, Sediment, Surge and Structure Response Forecasting System

PI: Maitane Olabarrieta Lizaso, University of Florida
Partners: ONR, USGS, University of Florida, Fathom Science LLC, Louisiana State University

The ability to accurately forecast coastal change from large storms such as hurricanes is necessary to characterize military battlespace and civilian hazards. Important oceanic and terrestrial parameters include wave characteristics (height, period, and direction), water levels, currents, coastal morphologic response, and damage to infrastructure. Numerical models of coastal atmosphere-ocean processes and morphological change resolve complex physics and can make detailed forecasts. The fidelity of these types of models, when hindcasting past extreme storm events, depends on several factors, including atmospheric forecast uncertainty, model physics, open boundary conditions, model spatial resolution, and coastal elevation and land use.

Forecasting the coastal impacts of extreme storms poses technical and scientific challenges. Given the urgent societal need for accurate coastal impact forecasting systems, it is imperative to:

1) develop the computational architecture needed to run these types of models in forecast mode;
2) run the coastal impact models in real-time forecast mode;
3) verify the results of the model; and
4) analyze the most efficient ways of disseminating the results and the uncertainty associated with these results to the public.

This team will develop a real-time forecasting system to meet these needs, based on the Coupled Ocean Atmosphere Waves Sediment Transport framework to predict the coastal impacts from landfall hurricanes, including waves, total water levels, flooding extent and duration, maximum current speeds, sediment transport (erosion and accretion above and below mean sea level), integrated hydrographs, structure interaction, and damage. The drivers for the forecasting system will be written in Python. The system is conceptualized such that it is easily transferable within the community and allows further nesting for specific applications and the inclusion of new grids. A series of static and dynamic grids will enable prediction of gross coastal hazards at the regional scale and detailed morphological change at the local scale, where the highest impacts are predicted.

Results from this NOPP project (e.g. development/verification of coastal flooding, erosion, and infrastructure damage forecasting systems) will be highly beneficial to other government research and coastal management programs focused on coastal hazards and risk (NOAA, Federal Emergency Management Agency, USGS, NSF, National Park Service, and many other agencies).

Forecasting Coastal Impacts from Tropical Cyclones along the U.S. East and Gulf Coasts using the ADCIRC Prediction System

PI: Rick Luettich, University of North Carolina Chapel Hill

Partners: ONR, NOAA, University of Georgia, Renaissance Computing Institute, University of North Carolina Chapel Hill, The Water Institute of the Gulf, Oregon State University, North Carolina State University, Seahorse Coastal Consulting, University of Rhode Island

The proposed project will develop, deploy, and critically evaluate a forecasting system that is capable of predicting wave, surge, sediment transport, and damage assessment, down to human scales, due to tropical cyclones impacting the U.S. East and Gulf of Mexico coasts. The proposed forecasting system will leverage and greatly expand the capabilities of the existing ADvanced CIRCulation (ADCIRC) Prediction System (APS) which is comprised of:

1) the coupled ADCIRC+Simulating Waves Nearshore (SWAN) computational core;
2) a national-regional system of unstructured computational meshes that contain information on bathymetry, topography, land cover, and sub-grid scale features;
3) interfaces to multiple meteorological models for forcing;
4) the ADCIRC Surge Guidance System to manage/execute the forecast process, including execution of ensembles; and
5) extensive experience performing event based forecasting for tropical cyclones impacting the U.S. East and Gulf of Mexico coasts.

APS forecasts (often several hundred for each storm including ensemble members) have been generated for every significant tropical cyclone that has threatened the U.S. East and Gulf of Mexico coasts during the past decade.

For the proposed project, the APS will be enhanced to include updated computational meshes including new bathymetry, topography, and land cover data provided by team members engaged in Task 1 of the proposed NOPP project; ingest of the Navy's Coupled Ocean/Atmosphere Mesoscale Prediction System for Tropical Cyclones (COAMPS-TC) tropical cyclone meteorological model as forcing; evaluation of the newly available ADCIRC+WaveWatchIII computational core; inclusion of enhanced wave-surge physics; and assimilation of coastal water levels. APS output will be coupled to a suite of 1D and 2D XBeach simulations to evaluate morphology change and sediment transport at differing levels of detail as a storm approaches land. Water level and wave output directly from APS and from the APS+XBeach simulations will then be used for damage assessment from aggregated to local scales. Year one efforts will focus on modifications to the APS software, e.g., ingest of COAMPS-TC, initial ADCIRC+WWIII evaluation, wave-surge physics enhancements, mesh updates, setting up XBeach at a national scale, and evaluating the system for hindcast events and/or reanalysis of forecast events. Model updates and evaluation will continue in years two to four primarily outside of hurricane season, whereas during hurricane season we will produce daily forecasts of coastal impacts beginning five days prior to predicted landfall for at least three named storms per year.

Forecasting of wave, surge, sediment transport (erosion and accretion above and below mean sea level), structure interaction, and damage

PI: Kees Nederhoff, Deltares USA
Partners: ONR, USGS, NRL, Deltares, University of Central Florida, IHE Delft Institute for Water Education

Over the past few decades, the meteorological community has made considerable progress in forecasting hurricanes. Concurrently, the oceanographic and coastal science communities have made significant advances in understanding physical hydrodynamic processes that drive coastal impacts due to hurricanes. While operational forecasts of storm surge and waves are now common practice and fairly robust, forecasts of morphological impacts are lagging. However, with much of the important physics now incorporated in numerical models and the faster processing times due to increased computational capabilities, it is now feasible to reliably compute the hydro-morphological response due to hydro-meteo events if accurate forcing and initial conditions (such as topography, vegetation, etc.) are known.

In cooperation with U.S. agencies such as the ONR, NRL, and USGS, coastal processes have been incorporated in the numerical modeling package Delft3D, which has been under continuous development since the 90's and was acquired by the U.S. Navy in 2001 as a platform for operational forecasts of nearshore hydrodynamics. In the ongoing ONR-funded "Increasing Fidelity of Morphological Storm Predictions" project, the new generation Delft3D-FM (Flexible Mesh) large-scale model was used to drive detailed morphodynamic XBeach models on domains of 10 x 2 kilometers with which accurate hindcasts of morphodynamic change including breaching were possible (Van der Lugt et al., 2019). USGS and Deltares are currently working on probabilistic coastal response models such as a Bayesian Network to predict storm impact at low computational cost across large spatial scales based on the Parameterized Island Gaussian Fit method and Coastal Storm Modeling System (CoSMoS-COAST), a data-assimilated, ensemble Kalman filter shoreline model to predict shoreline change due to probabilistic hurricane tracks. We propose to integrate and further develop these existing components in order to make real-time forecasts of hurricane impacts on CONUS coasts.

In-situ measurements of ocean surface waves from air-deployed Directional Wave Spectra Drifters (DWSD™) and Air Launched Autonomous Micro-Observer (ALAMO™) Floats

PI: Luca Centurioni, Scripps Institution of Oceanography, University of California, San Diego

Partners: ONR, NOAA, University of California San Diego, University of Miami, Woods Hole Oceanographic Institution, U.S. Naval Academy, MRV Systems LLC

In the last decade the PIs of this proposal have been conducting routine observations of directional wave spectra from specialized drifters and floats that are available in ship and air-deployable configurations. The data collected by the PIs have been provided in real-time to forecasters through operational data relay systems as well as to researchers through dedicated data relay systems (both real-time and delayed mode) maintained by the Lagrangian Drifter laboratory of Scripps and by NOAA's Atlantic Oceanographic and Meteorological Laboratory. The team will work with other NOPP participants to target observations and deploy instrumentation to help improve understanding of coastal impacts hurricanes through off-shore waves wind, atmospheric mesoscale events, and coastal surge and inundation.

The new generation of A-size wave drifters are now deployable from NOAA's P3 and other smaller planes and, as such, are creating new deployment opportunities because of their versatility and ease of deployment. The instruments for thie project were developed by the Lagrangian Drifter Laboratory (Scripps Institution of Oceanography) and Marine Robotic Vehicles (Woods Hole Oceanographic

Institution) are already cleared for deployment by the 53rd Weather Reconnaissance Squadron "Hurricane Hunters" WC-130J aircraft.

The project targets offshore wave observations under hurricane conditions that will serve, among other uses, to constrain the boundary conditions of coastal inundation models. The two instrument packages (i.e., drifters and floats) will provide a complete picture of the offshore ocean conditions including surface velocity and integrated upper-level velocity, mixed-layer structure, sea-level-pressure, surface winds, and temperature as well as three-dimensional wave spectra.

The technical developments have already been concluded and the technology of air-deployable DWSD™ and ALAMO™ floats is ready to be applied to scientific investigations and in a near-operational context. The team will fabricate and deploy 32 A-size DWSBD™ as well as an ALAMO™ float with a wave sensor in each of the three years of fieldwork and provide the quality-controlled data to the NOPP participants. The locations for deployment of the instruments will be determined in collaboration with the Task 1-2 and Task 4 modeling partners to test theories of targeted observations.

Real-time and Observed Measurements of Hurricane-Induced Hydrodynamics and Flooding

PI: Jenna Brown, USGS

Partners: ONR, USGS, NOAA, Sofar Ocean

The objective of this proposal is to provide *in situ* measurements of offshore waves, and both offshore and inland water levels, to validate predictions of waves, surge, and structure interaction and damage due to hurricanes and extreme storms. This proposal emphasizes collecting measurements in shore-perpendicular transects of the transformation of waves and water levels in the nearshore region and flooding extents inland, thereby relating the offshore forcing conditions in deep water, to the extremely dynamic surf zone and shoreline conditions, and subsequent impacts on coastal barriers and communities; the co-location and coherence of these measurements will provide critical observations for comparing with coupled numerical models. This work aims to advance rapid response capabilities for measuring storm-induced hydrodynamics, particularly within the nearshore waters and at the shoreline, which is notoriously difficult but extremely important for improving our scientific understanding of storm-induced coastal processes.

Remote Sensing of the U.S. Coastline Impacted by Land-Falling Hurricanes

PI: Roland Romeiser, University of Miami

Partners: ONR, National Geospatial-Intelligence Agency, University of Miami, Airbus USA, University of Amherst, Capella Space

This proposal in response to the NOPP BAA, Topic Predicting Hurricane Coastal Impacts, Task 2: Remote Sensing requests funding to implement a suite of advanced remote sensing techniques for characterizing conditions of coastal regions before, during, and after a hurricane. The data products to be generated will provide improved boundary conditions for the numerical modeling and prediction of hurricane-related damages by winds, waves, storm surge, and rising water levels. Team members from the University of Miami's Rosenstiel School of Marine and Atmospheric Science and its receiving and

processing facility for satellite data, the Center for Southeastern Tropical Advanced Remote Sensing (CSTARS), will work with Airbus USA and a leading government agency partner to combine techniques of synthetic aperture radar (SAR) interferometry, radargrammetry, surface characterization and coherent and amplitude-based change detection based on SAR intensity images and optical images, as well as SAR-based wind, wave, and coastal bathymetry retrievals in a synergistic approach to generate high-resolution maps of a variety of geophysical parameters of interest. These parameters include terrain and surface elevations, surface types such as different sediment types, vegetation, infrastructure, and buildings; shorelines and inland water levels, and the coastal underwater bathymetry, each before and after a hurricane. Furthermore, maps of SAR-derived winds and wave heights will be provided repeatedly and in near-real time on the days before, during, and after a hurricane's landfall. These efforts will be complemented by contributions from scientists at the Microwave Remote Sensing Laboratory (MIRSL), University of Massachusetts Amherst, who will work with data from a new fleet of up to 36 SAR satellites operated by Capella Space. The variety of geophysical parameters resulting from the combined analysis of spaceborne radar and optical data from various sources will provide an unprecedented amount of information on the hurricane-impacted coastal regions at high spatial resolution and accuracy.

The main SAR satellites to be used by the CSTARS team are the German TerraSAR-X and its two companions of the same type, TDX and Paz. The SAR data will be acquired and processed by CSTARS in close collaboration with partners at Airbus USA, who will support the generation of digital elevation models and digital terrain models using state-of-the-art radar interferometry and radargrammetry algorithms. Other SAR systems, such as COSMO-SkyMed, RADARSAT-2, and Sentinel-1, will be used as well. MIRSL will generate similar products from data acquired by the Capella Space fleet of SAR satellites. This fleet is still in the process of being implemented (3 of 36 satellites launched so far), but promises very short access times when fully operational, which is very attractive for disaster monitoring tasks. High-resolution optical satellite imagery will be provided by a government agency partner, who will also participate in the definition and qualitative evaluation of the newly developed synergistic data products. The complete acquisition and processing of data for one hurricane landfall event will take about one week before and after the landfall, with some products being available much sooner. We will produce first test products in 2021 and complete sets of products for three hurricane landfalls per year in 2022, 2023, and 2024. This will be done in close collaboration with the investigators selected for Tasks 1, 3, and 4 of the NOPP Topic.

Other NOPP funding opportunities

The Effects of Sea Level Rise (ESLR): Surface transportation resilience in collaboration with the Department of Transportation (1 project, 2 teams)

Program manager: David Kidwell, NOAA National Centers for Coastal Ocean Science

Partners: NOAA, Federal Highway Administration, Auburn University, University of South Alabama, University of Wisconsin-Madison, Alabama Department of Transportation, University of New Hampshire, Rockingham (New Hampshire) Planning Commission, JFK Environmental Services LLC, South Coast Engineers Inc.

The NOAA National Centers for Coastal Ocean Science Competitive Research Program executes the Effects of Sea Level Rise (ESLR) program. ESLR delivers science products and information that inform coastal managers and decision makers of both local coastal vulnerability and solutions to mitigate flood risk to communities, infrastructure, and ecosystems in their region. In fiscal year 2021, ESLR published a Notice of Funding Opportunity to solicit proposals for projects with two focal areas, surface transportation and general coastal resilience. The surface transportation focal area represents a partnership with the Federal Highway Administration to focus on adaptation planning for surface transportation and focuses specifically on projects that evaluate natural and hybrid options for mitigating impacts of inundation (e.g., storm surge, nuisance flooding, and/or wave actions) on surface transportation infrastructure (i.e., roads, public transportation, and rail). A total of 22 high quality proposals were received, which were encouraged from an initial 72 letters of intent, and a panel review and selection process chose three final projects to fund. The team received $500,000 of matching funds from NOAA NOPP to complement funding from NOAA and Federal Highway Administration, which allowed us to fund two projects in fiscal year 2021.

Matching funds from NOPP were used to support two projects:

1. "Surface Transportation, Sea Level Rise, and Coastal Storms: A Sustainable Path to Increased Resilience." This is a collaboration with the Alabama Department of Transportation to evaluate the effects of sea level rise on road and ferry access infrastructure in coastal Alabama and determine the ability of natural and nature-based features to mitigate those effects. The project is led by Dr. Benjamin Bowers of Auburn University with co-investigators Jose Vasconcelos (Auburn University), Robert Holmes (Auburn University), Bret Webb (University of South Alabama), Daniel Wright (University of Wisconsin-Madison), J. Brian Anderson (Auburn University), and Frances O'Donnell (Auburn University). More information on this project can be found at: https://coastalscience.noaa.gov/project/surface-transportation-sea-level-rise-and-coastal-storms-a-sustainable-path-to-increased-resilience/
2. "Pavement Resilience to Sea Level Rise and Potential Mitigation Options Using Natural and Nature-Based Features." This project will investigate coastal processes and hazards that damage roadway pavement and develop a toolkit for decision makers to evaluate roadway vulnerability to sea level rise and flooding. The effectiveness of natural and nature-based features to protect roadway infrastructure will also be explored. This work is focused in coastal New England (New Hampshire) and the Gulf Coast (Alabama). The project is led by Professor Jo Sias (University of New Hampshire) with a multi-disciplinary team of co-investigators: Dr. Eshan Dave and Dr. Jennifer Jacobs of the University of New Hampshire; Dr. Bret Webb of the University of South Alabama; Julie LaBranche, Timothy Roache, and David Walker of the Rockingham (NH) Planning Commission; Dr. Jayne Knott of JFK Environmental Services LLC (Upton, MA); and Dr. Scott Douglass of South Coast Engineers, Inc. (Fairhope, AL). More information about this project can be found at: https://coastalscience.noaa.gov/project/coastal-communities-pavement-resilience-to-sea-level-rise-using-natural-and-nature-based-features/

Ocean Surface Topography Science Team (1 project, 4 teams)

Program manager: Eric Leuliette, NOAA Center for Satellite Applications and Research

Partners: NOAA, NASA, University of Maryland, Rutgers University, Global Science & Technology Inc.

The Ocean Surface Topography Science Team (OSTST) brings together international scientists to understand Earth's oceans and their interaction within the climate system using ocean altimetry satellite observations. Over the past 28 years, measurements of ocean surface topography have been provided by the U.S.-European series of satellite missions, which began with the TOPEX/Poseidon satellite mission in 1992-2005 and continued through the Jason-1 in 2001-2013, OSTM/Jason-2 in 2008-2019, and currently by Jason-3 missions, with the latter launched in 2016. The first mission in the Jason Continuity of Service program, Sentinel-6 Michael Freilich, was launched in November 2020, as a continued international partnership between the U.S. and Europe, and will be used operationally at NOAA. Sentinel-6 extends the altimetry reference mission to at least 2030. NASA and NOAA jointly select and support U.S. investigations for the OSTST through the Research Opportunities in Space and Earth Science. For Europe, the European Organization for the Exploitation of Meteorological Satellites and the French National Center for Space Studies make a similar joint selection of team members.

The OSTST NOAA Jason/Sentinel-6 program supported four investigations for the period 2021-2024:

1) Improving Tropical Cyclone Intensity Forecasts by Assimilating Ocean Surface Drifter paths with altimeter sea level in a Coupled Atmosphere-Ocean Forecast System (James Carton, University of Maryland)
2) Towards an Improved Reconciliation of High- and Low-Resolution Ocean Altimeter Measurements Under Changing Surface Wave Structure Conditions (Alejandro Egido, Global Science & Technology Inc.)
3) High-Latitude Multi-Altimeter Observations of the Arctic Ocean and its Sea Ice Cover (Sinead Farrell, University of Maryland)
4) Mesoscale to submesoscale ocean state estimation by 2-way nested 4-dimensional variational data assimilation utilizing multi-mission nadir altimetry with supporting high resolution satellite and in situ observations (John Wilkin, Rutgers University)

Offshore Wind, Fisheries and Protected Species Science to address the U.S. Climate Crisis

Program manager: Andrew Lipsky, NOAA Northeast Fisheries Science Center

Partners: NOAA, NRL, BOEM

Offshore wind energy development is rapidly advancing in marine waters of the United States and poised to support $70 billion in capital expenditures by 2030. President Biden plans to double offshore wind production by 2030 to address the impacts of climate change and energy security while promoting ocean co-use and the conservation of marine biodiversity. In the northeastern United States, there are 16 active leases encompassing over 1.7 million acres, with an additional 8 million acres considered for future leasing and new areas also planned for the Gulf of Mexico and Pacific coasts. This rapid expansion requires immediate attention to address the significant interactions between offshore wind and all NOAA trust resources. Scientific research investment to address these needs is critical to achieving U.S. climate policy objectives, while balancing coexistence of offshore wind, fisheries, and protected

species. Further, because current NOAA survey designs and sampling methods are largely incompatible with wind energy areas, new and innovative ecosystem observation technologies are needed.

Piloting Bio-GO-SHIP on U.S. cruises: Towards a global analysis of large-scale changes to ocean plankton systems

PI: Adam Martiny, University of California, Irvine

Partners: NOAA, NASA, NSF, Ocean Carbon and Biogeochemistry Program, Northern Gulf Institute, Mississippi State University, University of California Irvine, Oregon State University, Woods Hole Oceanographic Institution, Bigelow Laboratory for Ocean Sciences, Old Dominion University

NOAA's Global Ocean Monitoring and Observing Program (GOMO) and Integrated Ocean Observing System (IOOS), is partnering with NASA Ocean Biology and Biogeochemistry Program, NSF Physical and Chemical Oceanography Programs, and the Ocean Carbon and Biogeochemistry Program to assess marine ecosystem health and the influence of changing ocean dynamics on plankton. These critical microscopic organisms sustain entire marine food webs, and through their photosynthesis, phytoplankton generate approximately half of the oxygen in the atmosphere. Ocean biological measurements are fundamental to studying and monitoring the evolving state of marine ecosystems but are currently missing from most global survey programs, which has impeded our capacity to explore the inextricable links between climate, changing ocean conditions, and marine life. Integration of biological and core GO-SHIP measurements will provide invaluable insights into how plankton communities respond to ocean changes and how biological processes feed back on carbon, oxygen and nutrient cycles.

This two-year project is part of a larger multi-agency effort and will leverage the global-reaching NOAA- and NSF-led U.S. Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) platforms to investigate the distributions and biogeochemical roles of plankton in the global ocean. The availability of mature technologies to measure key biological variables (Boss et al., 2020), combined with the potential to leverage the GO-SHIP operational platform and its large suite of complementary physical and biogeochemical measurements (e.g., temperature, salinity, O2, nutrients, tracers, organic and inorganic carbon) offer for the first time ever the opportunity for a truly integrated global repeat sampling program.

Over the next two years, researchers will incorporate biological measurements on three U.S. GO-SHIP hydrographic cruises in the Atlantic, Pacific and Indian Oceans using established methodologies, novel techniques, and cross-disciplinary ocean observations as recommended by SCOR WG154 (Boss et al., 2020). This research team includes NOAA/OAR/AOML, NOAA/NESDIS/STAR, University of Maine, University of California at Irvine, Oregon State University, Old Dominion University, Mississippi State University, Bigelow Laboratory for Ocean Sciences, and the Woods Hole Oceanographic Institution. Specifically, this project will quantify the molecular diversity, size spectrum, chemical composition, and abundances of plankton communities across large spatial, vertical, and eventually temporal scales through systematic, high quality, and calibrated sampling of genomics, transcriptomics, plankton imaging and cytometry, pigments (in situ and also used for calibration/validation of ocean color satellite sensors), particle chemistry, and optical techniques as operational oceanographic tools.

Project URL: https://biogoship.org/

U.S. Exclusive Economic Zone Mapping and Exploration in the Aleutian Islands

PI: Larry Mayer, University of New Hampshire

Partners: NOAA, BOEM, University of New Hampshire, Ocean Exploration Cooperative Institute, Saildrone Inc., Monterey Bay Aquarium Research Institute

The Aleutian Island chain in western Alaska is one of the most remote and understudied regions of the U.S. Exclusive Economic Zone (EEZ). As an oceanic-arc subduction zone, the chain has consistently been identified as a priority area for NOAA programs such as the Office of Ocean Exploration and Research, Pacific Marine Environmental Laboratory, Deep-Sea Coral Research and Technology Program, and the Office of Coast Survey, as well as other agencies with cross-disciplinary interests. Before any substantive exploration and characterization work can be completed, however, high resolution bathymetry coverage is needed across almost the entire region. At just 28% percent mapped, Alaska is the least mapped region of the U.S. EEZ by far. This project proposes using the recently launched Saildrone Surveyor, a 72-ft autonomous surface vessel that is equipped with both shallow and deep water multibeam mapping systems and a full suite of oceanographic sensors, to map remote areas of the Aleutians that have been identified as priorities for multiple NOAA programs, interagency partners, and external stakeholders. Priority polygons covering approximately 78,000 sq km (~95 days at sea) have been identified at varying depth ranges (200-6000 m). The exact amount of coverage achieved from this project is fully scalable depending on ultimate funding received and will capitalize on the recent philanthropic donation of data acquired and submitted to the National Centers for Environmental Information in the Aleutian Trench by Caladan Oceanic. Additional exploration and characterization projects are planned for the region starting in fiscal year 2023, and these projects will be accelerated by this initial investment as they will not have to expend costly sea days collecting mapping data and can instead focus their efforts on more intensive surveys using remotely operated vehicles, autonomous underwater vehicles, and other sensor technologies. BOEM in partnership with USGS has funded a five-year study through its Environmental Studies Program for further data collection in support of marine minerals exploration in and around the Aleutian area from fiscal year 2022 to fiscal year 2025. NOAA Ship *Okeanos Explorer* is anticipated to be in the region in fiscal year 2023 and will rely on the Saildrone data to plan remotely operated vehicle exploration missions.

Using Uncrewed Underwater Vessels For Mapping and Characterization with Application to Pollution Response

PI: Eric Terrill, Scripps Institution of Oceanography, University of California San Diego

Partners: NOAA, EPA, University of California San Diego

An area off the coast of California with known and suspected dumping of drums of potential DDT-containing wastes will be surveyed by multiple uncrewed underwater vessels (UUVs) simultaneously deployed from an auxiliary general oceanographic research ship using high-resolution acoustic bathymetry and sidescan imagery. This project supports multiple NOAA missions as well as the missions of multiple Federal partners. The high-resolution mapping techniques using UUVs and a new class of ships similar in design to planned NOAA builds will be evaluated by NOAA participants.

Appendix 3. Reported Annual Agency Contributions to NOPP Projects

Agency	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
BOEM	$1,052,620	$3,100,025	$5,968,527	$4,694,001	$7,913,019	$5,391,734	$2,475,464	$990,269
Department of Energy	$0	$0	$0	$0	$0	$4,900,000	$100,000	$890,000
NASA	$1,881,041	$2,044,965	$1,978,308	$1,411,618	$776,886	$2,447,638	$2,000,000	$1,861,996
NOAA	$550,000	$438,321	$409,000	$3,347,554	$5,009,402	$11,412,750	$4,700,000	$3,000,000
NSF	$0	$149,416	$0	$0	$2,824,953	$1,940,721	$1,767,013	$287,408
ONR	$3,750,000	$8,094,000	$7,441,000	$8,278,806	$7,864,000	$8,137,000	$8,034,238	$8,364,000
U.S. Coast Guard	$0	$0	$0	$586,250	$0	$0	$0	$0
USGS	$0	$0	$0	$0	$0	$0	$2,400,000	$0
Total	**$7,233,661**	**$13,826,727**	**$15,796,835**	**$18,318,229**	**$24,388,260**	**$34,229,843**	**$19,076,715**	**$15,393,673**

Appendix 4. All NOPP Projects Active through Fiscal Year 2021

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
COAMPS-TC deterministic, ensemble, and nowcast model support of the ONR NOPP project: Predicting hurricane coastal impacts	https://nopp.org/projects/coamps-tc-deterministic-ensemble-and-nowcast-model-support-of-the-onr-nopp-project-predicting-hurricane-coastal-impacts/	ONR, NRL	Komaromi, William	NRL	1	2021
Coastal Elevation Models and Land Surface Variables for Use in Forecasting Hurricane Impacts	https://nopp.org/projects/coastal-elevation-models-and-land-surface-variables-for-use-in-forecasting-hurricane-impacts/	ONR, USGS, NOAA, University of Colorado Boulder, Marda Science LLC, University of North Carolina Greensboro	Gesch, Dean	USGS	4	2021
Remote Sensing of the U.S. Coastline Impacted by Land-Falling Hurricanes	https://nopp.org/projects/remote-sensing-of-the-u-s-coastline-impacted-by-land-falling-hurricanes/	ONR, National Geospatial Intelligence Agency, University of Miami, Airbus USA, University of Amherst, Capella Space	Romeiser, Roland	University of Miami	4	2021
In-situ measurements of ocean waves from air-deployed Directional Wave Spectra Drifters (DWSD) and Alamo Floats	https://nopp.org/projects/in-situ-measurements-of-ocean-surface-waves-from-air-deployed-directional-wave-spectra-drifters-dwsd-and-air-launched-autonomous-micro-observer-alamo-floats/	ONR, NOAA, University of California San Diego, University of Miami, Woods Hole Oceanographic Institution, U.S. Naval Academy, MRV Systems LLC	Centurioni, Luca	Scripps Institution of Oceanography	4	2021

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
Air-deployed wave buoys for hurricane forecast improvements	https://nopp.org/projects/air-deployed-wave-buoys-for-hurricane-forecast-improvements/	ONR, NOAA, University of Washington, Sofar Ocean Technologies, University of Colorado Boulder	Thomson, Jim	University of Washington	4	2021
Real-time and observed measurements of hurricane-induced hydrodynamics and flooding	https://nopp.org/projects/real-time-and-observed-measurements-of-hurricane-induced-hydrodynamics-and-flooding/	ONR, USGS, NOAA, Sofar Ocean Technologies	Brown, Jenna	USGS	1	2021
Forecasting Coastal Impacts from Tropical Cyclones along the U.S. East and Gulf Coasts using the ADCIRC Prediction System	https://nopp.org/projects/forecasting-coastal-impacts-from-tropical-cyclones-along-the-us-east-and-gulf-coasts-using-the-adcirc-prediction-system/	ONR, NOAA, University of Georgia, Renaissance Computing Institute, University of North Carolina Chapel Hill, The Water Institute of the Gulf, Oregon State University, North Carolina State University, Seahorse Coastal Consulting, University of Rhode Island	Luettich, Richard	University of North Carolina Chapel Hill	4	2021
Forecasting Hurricane Impacts on CoastS - FHICS	https://nopp.org/projects/forecasting-hurricane-impacts-on-coasts-fhics/	ONR, USGS, Deltares, University of Central Florida, NRL, IHE Delft Institute for Water Education	Nederhoff, Kees	Deltares USA	3	2021
Coupled Ocean Atmosphere Waves Sediment Transport	https://nopp.org/projects/coawst-wsssr-coupled-ocean-	ONR, USGS, University of Florida, Fathom Science	Olabarrieta Lizaso, Maitane	University of Florida	4	2021

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
(COAWST) - Waves, Sediment, Surge and Structure Response (WSSSR) Forecasting System	atmosphere-waves-sediment-transport-waves-sediment-surge-and-structure-response-forecasting-system/	LLC, Louisiana State University				
Offshore Wind, Fisheries and Protected Species Science to address the U.S. Climate Crisis	https://nopp.org/projects/offshore-wind-fisheries-and-protected-species-science-to-address-the-u-s-climate-crisis/	NOAA, BOEM, NRL	Lipsky, Andrew (program manager)	NOAA Northeast Fisheries Science Center	3	2021
The Effects of Sea Level Rise (ESLR): surface transportation resilience in collaboration with the Department of Transportation	https://nopp.org/projects/the-effects-of-sea-level-rise-eslr-surface-transportation-resilience-in-collaboration-with-the-department-of-transportation/	NOAA, Federal Highway Administration, Auburn University, University of South Alabama, University of Wisconsin-Madison, Alabama Department of Transportation, University of New Hampshire, Rockingham (New Hampshire) Planning Commission, JFK Environmental Services LLC, South Coast Engineers Inc.	Bowers, Benjamin; Sias, Jo	Auburn University; University of New Hampshire	2	2021
Ocean Surface Topography Science Team	https://nopp.org/projects/ocean-surface-topography-science-team/	NOAA, NASA, University of Maryland, Global Science & Technology Inc., Rutgers University	Carton, James; Egido, Alejandro; Farrell, Sinead; Wilkin, John	University of Maryland; Global Science & Technology Inc.; Rutgers University	3	2021

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
Using Uncrewed Underwater Vessels for Mapping and Characterization with application to Pollution Response	https://nopp.org/projects/using-uncrewed-underwater-vessels-for-mapping-and-characterization-with-application-to-pollution-response/	NOAA, EPA, University of California San Diego	Terrill, Eric	University of California San Diego	1	2021
U.S. EEZ Mapping and Exploration in the Aleutian Islands	https://nopp.org/projects/u-s-eez-mapping-and-exploration-in-the-aleutian-islands/	NOAA, BOEM, University of New Hampshire, Saildrone Inc., Monterey Bay Aquarium Research Institute	Mayer, Larry	University of New Hampshire	3	2021
Piloting Bio-GO-SHIP on US cruises: Towards a global analysis of large-scale changes to ocean plankton systems	https://nopp.org/projects/piloting-bio-go-ship-on-us-cruises-towards-a-global-analysis-of-large-scale-changes-to-ocean-plankton-systems/	NOAA, NSF, NASA, University of California Irvine, Woods Hole Oceanographic Institution, Old Dominion University, Oregon State University, Bigelow Laboratory for Ocean Sciences, Mississippi State University	Martiny, Adam	University of California, Irvine	2	2021
Satellite Hosting Atmospheric and Littoral Ocean Water Sensors (SHALLOWS) Project: Phase A 2 (continuation from 2018 start)	https://nopp.org/projects/satellite-hosting-atmospheric-and-littoral-ocean-water-sensors-shallows-project-phase-a-2/	ONR, NASA, NOAA, U.S. Army Corps of Engineers, University of Cincinnati, Air Force Institute of Technology, University of Alabama	Tolbert, Carol	NASA Glenn Research Center	1	2021 (from 2018 start)

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
Development of lightweight, power-efficient, soft electronic sensor systems for next-generation oceanographic measurements (continuation from 2018 start)	https://nopp.org/projects/development-of-lightweight-power-efficient-soft-electronic-sensor-systems-for-next-generation-oceanographic-measurements/	ONR, Department of Energy, University of Connecticut, Northwestern University, Teledyne	Wang, Xueju	University of Connecticut	2	2021 (from 2018 start)
Bichromatic Littoral Temperature Observer (BLTO) Instrument (continuation from 2018 start)	https://nopp.org/projects/bichromatic-littoral-temperature-observer-blto-instrument/	ONR, Sierra Lobo Inc., University of Cincinnati	Putman, Philip	Sierra Lobo Inc.	2	2021 (from 2018 start)
SOAR Cellular Ocean Altimetry / Scatterometry Technology (COAST), Phase A-2 (continuation from 2018 start)	https://nopp.org/projects/soar-cellular-ocean-altimetry-scatterometry-technology-coast-phase-a-2/	ONR, GeoOptics, University of Colorado	Yunck, Thomas	GeoOptics	1	2021 (from 2018 start)
Escanaba Trough hydrothermal sulfide system - exploring the seafloor and oceanic footprints	https://nopp.org/projects/escanaba-trough-hydrothermal-sulfide-system-exploring-the-seafloor-and-oceanic-footprints/	USGS, NOAA, BOEM, University of Hawai'i at Mānoa, Memorial University, National Oceanography Centre, University of California Davis, University of Washington, University of Bergen	Gartman, Amy	USGS	1.5	2020

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
A Low Cost Optical Sensor to Measure Underwater Flow	https://nopp.org/projects/a-low-cost-optical-sensor-to-measure-underwater-flow/	ONR, University of California San Diego, Creare LLC	Jaffe, Jules	University of California San Diego	3	2020
Proposal for unified handling of ADCP data from ocean data collection projects. Includes the development of standardized data formats and software converters	https://nopp.org/projects/unified-access-to-adcp-data/	ONR, NortekUSA Inc., Teledyne RDI	Lohrmann, Alte	NortekUSA Inc	2	2020
Onboard Processing and Transmission of Slocum Glider Acoustic Current Profiler Velocity Profiles	https://nopp.org/projects/onboard-processing-and-transmission-of-slocum-glider-acoustic-current-profiler-velocity-profiles/	ONR, Rutgers University, Teledyne Webb Research	Miles, Travis	Rutgers, The State University of New Jersey	2	2020
Electromagnetic Velocity Profiling float: velocity and mixing measurements with adaptive sampling capabilities	https://nopp.org/projects/electromagnetic-velocity-profiling-float-velocity-and-mixing-measurements-with-adaptive-sampling-capabilities/	ONR, University of Washington, Teledyne Webb Research	Szuts, Zoltan	University of Washington	3	2020
Seafloor Habitat Characterization in Cordell Bank, Greater Farallones and Monterey Bay National Marine Sanctuaries	https://nopp.org/projects/seafloor-habitat-characterization-in-cordell-bank-greater-farallones-and-monterey-bay-national-marine-sanctuaries/	NOAA, USGS, California Academy of Sciences, Greater Farallones Association	Lipski, Danielle	NOAA Office of National Marine Sanctuaries	2	2020
Advancing sustainable shellfish aquaculture through machine learning and	https://nopp.org/projects/advancing-sustainable-shellfish-aquaculture-through-machine-	NOAA, USGS, University of Washington, Microsoft, Taylor Shellfish	Sanderson, Beth	NOAA Northwest Fisheries Science Center	2	2020

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
automated data collection on fish communities	learning-and-automated-data-collection-on-fish-communities/					
Developing and scaling up emerging image-based technology for evaluating Mission: Iconic Reefs large-scale coral restoration in the Florida Keys National Marine Sanctuary	https://nopp.org/projects/developing-and-scaling-up-emerging-image-based-technology-for-evaluating-mission-iconic-reefs-large-scale-coral-restoration-in-the-florida-keys-national-marine-sanctuary/	NOAA, USGS, University of Miami, University of California San Diego, Coral Restoration Foundation, Mote Marine Laboratory, Reef Renewal USA	Viehman, Shay	NOAA National Centers for Coastal Ocean Science	2	2020
High-fidelity three-dimensional coastal compound flooding prediction system in support of disaster mitigation and safe navigation	https://nopp.org/projects/high-fidelity-three-dimensional-coastal-compound-flooding-prediction-system-in-support-of-disaster-mitigation-and-safe-navigation/	NOAA, ONR, USGS, Virginia Institute of Marine Science, Axiom	Pe'eri, Shachak	NOAA Office of Coast Survey	2	2020
Basin-Scale Marine Mammal Monitoring: A Case Study Using Artificial Intelligence and Cloud Computing to Track Humpback Whales from their Breeding to their Feeding Grounds	https://nopp.org/projects/basin-scale-marine-mammal-monitoring-a-case-study-using-artificial-intelligence-and-cloud-computing-to-track-humpback-whales-from-their-breeding-to-their-feeding-grounds/	NOAA, ONR, University of Washington, Google	Berchok, Catherine	NOAA Alaska Fisheries Science Center	2	2020
Demonstrating an Estuarine Soundscape Observatory Network in the Southeast: Understanding baseline rhythms of biological sounds and correlations to traditional biodiversity	https://nopp.org/projects/demonstrating-an-estuarine-soundscape-observatory-network-in-the-southeast-understanding-baseline-rhythms-of-biological-sounds-and-correlations-to-traditional-	NOAA, University of South Carolina Beaufort, Southeast Coastal Ocean Observing Regional Association, South	Canonico, Gabrielle	NOAA Integrated Ocean Observing System	1	2020

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
measurements to support long-term sustainable monitoring	biodiversity-measurements-to-support-lon/	Carolina Department of Natural Resources				
Saildrone as a research and operational platform for the Eastern Tropical Pacific	https://nopp.org/projects/saildrone-as-a-research-and-operational-platform-for-the-eastern-tropical-pacific/	NOAA, University of Washington, Saildrone Inc., Center for Scientific Research and Higher Education at Ensenada, French National Research Institute for Sustainable Development	Cronin, Meghan	NOAA Pacific Marine Environmental Laboratory	3	2020
Leveraging transformative 'omics technologies to alleviate barriers to American shellfish production	https://nopp.org/projects/leveraging-transformative-omics-technologies-to-alleviate-barriers-to-american-shellfish-production/	NOAA, Pacific Hybreed, University of Washington, Washington Sea Grant	Gavery, Mackenzie	NOAA Northwest Fisheries Science Center	2	2020
Enhancement of Private Sector Partnerships and NOAA Vessel Infrastructure for 'Omics Tracking of Ecosystem Condition and Trends	https://nopp.org/projects/enhancement-of-private-sector-partnerships-and-noaa-vessel-infrastructure-for-omics-tracking-of-ecosystem-condition-and-trends/	NOAA, CosmosID, Monterey Bay Aquarium Research Institute	Goodwin, Kelly	NOAA Atlantic Oceanographic and Meteorological Laboratory	3	2020
The Geologic Origin and Biology of Unexplored Seamounts in the Expansion Area of the	https://nopp.org/projects/the-geologic-origin-and-biology-of-unexplored-seamounts-in-the-expansion-area-of-the-	NOAA, Ocean Exploration Trust, University of Hawai'i at Mānoa	Kosaki, Randall; Fukunaga, Atsuko	NOAA Office of National Marine Sanctuaries	1.5	2020

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
Papahānaumokuākea Marine National Monument	papahanaumokuakea-marine-national-monument/					
Building the genomic infrastructure for cetacean research and management	https://nopp.org/projects/building-the-genomic-infrastructure-for-cetacean-research-and-management/	NOAA, Rockefeller University, San Diego Zoo Wildlife Alliance, Revive & Restore	Morin, Phillip	NOAA Southwest Fisheries Science Center	3	2020
Expanding exploration and using innovative technologies to assess the rapidly changing Bering and Chukchi Seas	https://nopp.org/projects/expanding-exploration-and-using-innovative-technologies-to-assess-the-rapidly-changing-bering-and-chukchi-seas/	NOAA, University of Washington, Oregon State University, Bigelow Laboratory for Ocean Sciences	Stabeno, Phyllis	NOAA Pacific Marine Environmental Laboratory	2	2020
A Mixed-Precision Hybrid Saddle-Point 4D-Var System for ROMS with Application to Assimilation of Remotely-Sensed Bio-Optical Properties	https://nopp.org/projects/a-mixed-precision-hybrid-saddle-point-4d-var-system-for-roms-with-application-to-assimilation-of-remotely-sensed-bio-optical-properties/	ONR, NOAA, Rutgers University, University of California Santa Cruz	Wilkin, John	Rutgers, The State University of New Jersey	3	2019
Sea Surface Salinity From a Cubesat with Novel Spatial Light Modulator Imaging System	https://nopp.org/projects/sea-surface-salinity-from-a-cubesat-with-novel-spatial-light-modulator-imaging-system/	ONR, NASA, Florida Atlantic University, Texas Christian University, Space and Naval Warfare Systems Center Pacific	Twardowski, Mike	Florida Atlantic University	2	2019
Flexible Sensor Technologies for In-Situ Ocean Monitoring	https://nopp.org/projects/flexible-sensor-technologies-for-in-situ-ocean-monitoring/	ONR, University of Southern Mississippi, University of California San Diego, Sea-Bird Scientific	Azoulay, Jason	University of Southern Mississippi	3	2019

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Lagrangian and Coupled Data Assimilation enhanced by Machine Learning to improve Operational Ocean Prediction	https://nopp.org/projects/lagrangian-and-coupled-data-assimilation-enhanced-by-machine-learning-to-improve-operational-ocean-prediction/	ONR, University of Maryland, University of California San Diego, NRL	Carton, James (formerly Stephen Penny)	University of Maryland	3	2019
COAST: A CubeSat for Measuring Sea Surface Salinity with Integrated Atmospheric Correction Capabilities	https://nopp.org/projects/coast-cubesat-ocean-atmosphere-sensor-technology-a-cubesat-for-measuring-sea-surface-salinity-with-integrated-atmospheric-correction-capabilities/	ONR, Woods Hole Oceanographic Institution, Massachusetts Insitute of Technology, NRL	Gawarkiewicz, Glen	Woods Hole Oceanographic Institution	2	2019
An Innovative CubeSat Exploring Littoral Oceanographic & Atmospheric Dynamics	https://nopp.org/projects/an-innovative-cubesat-exploring-littoral-oceanographic-and-atmospheric-dynamics-iceload/	ONR, University of Miami	Graber, Hans	University of Miami	2	2019
Ultrafast and Compact Fiber-Optic Temperature Sensor for Unmanned Underwater Vehicles	https://nopp.org/projects/ultrafast-and-compact-fiber-optic-temperature-sensor-for-unmanned-underwater-vehicles/	ONR, Michigan State University, NRL	Han, Ming	Michigan State University	3	2019
Global Multi-Resolution Ocean Prediction/Analysis with Scale Recursive Estimation and Multi Sensor Data Fusion	https://nopp.org/projects/global-multi-resolution-ocean-prediction-analysis-with-scale-recursive-estimation-and-multi-sensor-data-fusion/	ONR, University of Miami, Florida State University, Tendral LLC, Woods Hole Group Inc.	Iskandarani, Mohammed	University of Miami	3	2019
Further development of the Coupled COAMPS-ROMS modeling system	https://nopp.org/projects/further-development-of-the-coupled-coamps-roms-modeling-system/	ONR, University of California Santa Cruz, NRL, Rutgers University	Moore, Andrew	University of California Santa Cruz	1	2019

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Real-time Analysis of Turbulent Spectra for Adaptive Tracking of Environmental Features and UUV Wakes	https://nopp.org/projects/real-time-analysis-of-turbulent-spectra-for-adaptive-tracking-of-environmental-features-and-uuv-wakes/	ONR, University of California Santa Barbara, Rockland Scientific	Nidzieko, Nicholas	University of California Santa Barbara	3	2019
Cost Effective Soft Material Conductivity, Temperature and Depth (CTD) Sensors	https://nopp.org/projects/cost-effective-soft-material-conductivity-temperature-and-depth-ctd-sensors/	ONR, Johns Hopkins University, Naval Postgraduate School, RBR-Global, Materials Dynamics & Devices Inc.	Xia, Zhiyong	Johns Hopkins University Applied Physics Laboratory	3	2019
EXpanding Pacific Research and Exploration of Submerged Systems (EXPRESS)	https://nopp.org/projects/expanding-pacific-research-and-exploration-of-submerged-systems-express/	NOAA, USGS, BOEM, Global Foundation for Ocean Exploration	Clarke, Elizabeth	NOAA Northwest Fisheries Science Center	1	2019
EPIC-DAUG: An Enhanced Propulsion Integrated Capability – Deep Autonomous Underwater Glider for Shore Launch/Recovery and High-Endurance Unattended Mapping	https://nopp.org/projects/epic-daug-an-enhanced-propulsion-integrated-capability-deep-autonomous-underwater-glider-for-shore-launch-recovery-and-high-endurance-unattended-mapping/	NOAA, Naval Postgraduate School, Woods Hole Oceanographic Institution, Teledyne Webb	Camilli, Richard	Woods Hole Oceanographic Institution	3	2019
Developing an autonomous biogeochemical profiling float to monitor biological productivity, ocean-atmosphere CO_2 fluxes, and	https://nopp.org/projects/new-bgc-argo-projects-funded-by-noaa-cpo-oomd/	NOAA, NASA, University of California San Diego, MRV Systems LLC, Monterey Bay Aquarium Research Institute	Purkey, Sarah	Scripps Institution of Oceanography	3	2019

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hypoxia in the Tropical Pacific Ocean						
Improvements to Profiling Float Technology in Support of Equatorial Pacific Biogeochemical Studies	https://nopp.org/projects/new-bgc-argo-projects-funded-by-noaa-cpo-oomd/	NOAA, NASA, University of Washington, Monterey Bay Aquarium Research Institute, Sea-Bird Scientific	Riser, Stephen	University of Washington	3	2019
The CeNCOOS MBON: Integrating remote sensing, in situ data and models to understand central California ecosystem responses to environmental change	https://marinebon.org/us-mbon/california-central/	NOAA, University of California Santa Cruz, Oregon State University, Monterey Bay Aquarium Research Institute, Point Blue, Humboldt State University, Central and Northern California Ocean Observing System	Chavez, Francisco	Monterey Bay Aquarium Research Institute	3	2019
A sustainable, integrated AMBON in the Chukchi Sea	https://marinebon.org/us-mbon/arctic/	NOAA, University of Alaska Fairbanks	Iken, Katrin	University of Alaska - Fairbanks	3	2019
Marine Biodiversity Observing Network in the Northern California Current: Understanding patterns and drivers of biodiversity and ecosystem functioning from plankton to seascapes	https://marinebon.org/us-mbon/pacific-northwest/	NOAA, Oregon State University, Northwest Association of Networked Ocean Observing Systems	Kavanaugh, Maria	Oregon State University	3	2019

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
Saildrone Surveyor: Autonomous Mapping and Environmental Characterization	https://nopp.org/projects/saildrone-surveyor-autonomous-mapping-and-environmental-characterization/	NOAA, University of New Hampshire, Monterey Bay Aquarium Research Institute, Saildrone Inc.	Mayer, Larry	University of New Hampshire	3	2019
Southern California Bight Marine Biodiversity Observation Network	https://marinebon.org/us-mbon/california-southern/	NOAA, University of California Santa Barbara, California Cooperative Fisheries Investigations, Southern California Coastal Water Research Project	Miller, Bob	University of California - Santa Barbara	3	2019
Implementing a Marine Biodiversity Observation Network (MBON) in South Florida to Advance Ecosystem-Based Management	https://marinebon.org/us-mbon/south-florida/	NOAA, University of South Florida	Muller-Karger, Frank	University of South Florida	3	2019
MBON expansion into the Gulf of Maine: the NERACOOS/NROC Integrated Sentinel Monitoring Network (ISMN)	https://marinebon.org/us-mbon/gulf-of-maine/	NOAA, Northeastern Regional Association of Coastal Ocean Observing Systems, Northeast Regional Ocean Council	Runge, Jeffrey	Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)	3	2019
Shore Launched Autonomous Underwater Vehicle Demonstration Leading Towards Shipless Deepwater	https://nopp.org/projects/shore-launched-autonomous-underwater-vehicle-demonstration-leading-towards-	NSF, NOAA, Woods Hole Oceanographic Institution	Hartsfield, J. Carl (formerly Carl Kaiser)	Woods Hole Oceanographic Institution	4	2019

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
Exploration of the U.S. Exclusive Economic Zone	shipless-deepwater-exploration-of-the-u-s-exclusive-economic-zone/					
HABsat-2 – Multi-resolution, Radiation Resistant, VNIR Hyperspectral Imaging 6U CubeSat Constellation for Littoral Ocean, Great Lakes and Tributary Inland Water Studies	https://nopp.org/projects/habsat-2-multi-resolution-radiation-resistant-vnir-hyperspectral-imaging-6u-cubesat-constellation-for-littoral-ocean-great-lakes-and-tributary-inland-water-studies/	ONR, U.S. Army Corps of Engineers, NASA, NOAA, University of Cincinnati	Beck, Richard	University of Cincinnati	2	2018
Small-Sat Lidar Sea Surface Vector Winds and Height Measurements System	https://nopp.org/projects/small-sat-lidar-sea-surface-vector-winds-and-height-measurements-system/	ONR, NASA, University of California Irvine	Boyraz, Ozdal	University of California Irvine	2	2018
CubeSat Fully-Polarimetric Imaging Radiometer	https://nopp.org/projects/cubesat-fully-polarimetric-imaging-radiometer/	ONR, NASA, Tendeg LLC, California Institute of Technology	Freebury, Gregg	Tendeg LLC	2	2018
Rainbow: a multistatic space lidar constellation	https://nopp.org/projects/rainbow-a-multistatic-space-lidar-constellation/	ONR, NASA, NRL, FiberTek Inc.	Josset, Damien	NRL Stennis	2	2018

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
FLOC, a Folded-Optic CubeSat Sensor for Littoral Observations	https://nopp.org/projects/floc-a-folded-optic-cubsat-sensor-for-littoral-observations/	ONR, NASA, The Charles Stark Draper Laboratory Inc.	Landis, David	The Charles Stark Draper Laboratory Inc	2	2018
Developing a Compact 670-GHz Polarmetric Radiometer for CubeSat with Novel Spatial Light Modulator Imaging System	https://nopp.org/projects/developing-a-compact-670-ghz-polarmetric-radiometer-for-cubesat-with-novel-spatial-light-modulator-imaging-system/	ONR, NASA, Virginia Diodes Inc.	Racette, Paul	NASA Goddard Space Flight Center	2	2018
Multi-Modal Oceanographic Sensing with Hybrid Soft Electronic Skin	https://nopp.org/projects/multi-modal-oceanographic-sensing-with-hybrid-soft-electronic-skin/	ONR, Carnegie Mellon University, Lifeware Labs LLC	Majidi, Carmel	Carnegie Mellon University	3	2018
Long Wave Infrared Instrument for Sea Surface Temperature Measurement by CubeSats	https://nopp.org/projects/long-wave-infrared-instrument-for-sea-surface-temperature-measurement-by-cubesats/	ONR, Sierra Lobo Inc., Teledyne Judson, University of Cincinnati	Putman, Phil	Sierra Lobo Inc	2	2018
Laboratory and Field Evaluation of a new Conductivity - Temperature - Depth (CTD) Sensor for use on Unmanned Underwater Vehicles and Platforms	https://nopp.org/projects/laboratory-and-field-evaluation-of-a-new-conductivity-temperature-depth-ctd-sensor-for-use-on-unmanned-underwater-vehicles-and-platforms/	ONR, Woods Hole Oceanographic Institution, D-2 Inc.	Toole, John	Woods Hole Oceanographic Institution	2	2018

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High Quality Littoral Ocean and Aerosol Characterization from a CubeSat With Novel Spatial Light Modulator Imaging System	https://nopp.org/projects/high-quality-littoral-ocean-and-aerosol-characterization-from-a-cubesat-with-novel-spatial-light-modulator-imaging-system/	ONR, Florida Atlantic University, Space and Naval Warfare Systems Center Pacific, University of Maryland Baltimore County	Twardowski, Michael	Florida Atlantic University	2	2018
Cellular Ocean Altimetry / Scatterometry Technology (COAST)	https://nopp.org/projects/soar-cellular-ocean-altimetry-scatterometry-technology-coast-phase-a-2/	ONR, GeoOptics Inc., University of Colorado	Yunck, Thomas	GeoOptics Inc	2	2018
Multi-sensor Improved Sea Surface Temperature: continuing the GHRSST Partnership and Arctic Data	https://nopp.org/projects/multi-sensor-improved-sea-surface-temperature-continuing-the-ghrsst-partnership-and-arctic-data/	NOAA, NASA, Earth and Space Research, University of Colorado, University of Miami, University of Washington, University of Maryland	Gentemann, Chelle	Earth and Space Research	4	2018
Membrane-free In-situ Underwater Gas Analyzer Using Laser Spectroscopy in a Compact Hollow Fiber Cell	https://nopp.org/projects/membrane-free-in-situ-underwater-gas-analyzer-using-laser-spectroscopy-in-a-compact-hollow-fiber-cell/	NOAA, NASA, Opto-Knowledge Systems Inc., California Institute of Technology, University of Washington, Oregon State University	Kriesel, Jason	Opto-Knowledge Systems	3	2018

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Air-Sea CO_2 and Dissolved Inorganic Carbon System for Autonomous Moored and Surface Vehicle Applications	https://nopp.org/projects/air-sea-co2-and-dissolved-inorganic-carbon-system-for-autonomous-moored-and-surface-vehicle-applications/	NOAA, University of Washington, Monterey Bay Aquarium Research Institute, University of Hawai'i	Sutton, Adrienne	NOAA Pacific Marine Environmental Laboratory	3	2018
Improving the Technology Readiness Level of the 6000-m capable Conductivity Temperature Depth sensor mounted on Deep Argo floats	https://nopp.org/projects/improving-the-technology-readiness-level-of-the-6000-m-capable-conductivity-temperature-depth-sensor-mounted-on-deep-argo-floats/	NOAA, University of California San Diego, Sea-Bird Scientific	Zilberman, Nathalie	University of California San Diego	3	2018
Development of Drifting Buoys to Measure Dynamic Ocean Topography and Precipitable Water Vapor	https://nopp.org/projects/development-of-drifting-buoys-to-measure-dynamic-ocean-topography-and-precipitable-water-vapor/	NSF, NOAA, NASA, University of Washington	Morison, James	University of Washington	3	2018
Dissolved Methane Sensor	https://nopp.org/projects/dissolved-methane-sensor/	NSF, NOAA, Woods Hole Oceanographic Institution RingIR Inc., National Academy of Sciences	Michel, Anna	Woods Hole Oceanographic Institution	3	2018

Title	Project Web Link	Partners	Lead Principal Investigator(s)	Lead Institution(s)	Duration (years)	Start (fiscal year)
SCUID: A Carbon Nanotube Based Sensor for Measurement of Dissolved Gases in Water	https://nopp.org/projects/scuid-a-carbon-nanotube-based-sensor-for-measurement-of-dissolved-gases-in-water/	NSF, NASA, University of Washington, Pro-Oceanus	Nawaz, Anuscheh	University of Washington	3	2018
Development of a Carbon Seaglider for ocean acidification Monitoring and Inorganic Carbon Processes Studies	https://nopp.org/projects/development-of-a-carbon-seaglider-for-ocean-acidification-monitoring-and-inorganic-carbon-processes-studies/	NSF, University of Alaska Fairbanks, Alutiiq Pride Shellfish Hatchery, Kongsberg Underwater Technology	Hauri, Claudine	University of Alaska Fairbanks	3	2018
Minions: A Low-cost Float for Distributed, Lagrangian Observations of the biological Carbon Pump	https://nopp.org/projects/minions-a-low-cost-float-for-distributed-langrangian-observations-of-the-biological-carbon-pump/	NSF, NASA, University of Rhode Island, Monterey Bay Aquarium Research Institute, Massachusetts Institute of Technology, Woods Hole Oceanographic Institution, Universities Space Research Association	Omand, Melissa	University of Rhode Island	3	2018
Spray 2.0: Development and technology transition of a next-generation underwater glider	https://nopp.org/projects/spray-2-0-development-and-technology-transition-of-a-next-generation-underwater-glider/	NSF, University of California San Diego, Marine Robotic Vehicles	Rudnick, Daniel	University of California, San Diego	2	2018

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Autonomous and Lagrangian Platforms and Sensors: A Scientific and Technical Review	https://nopp.org/projects/autonomous-and-lagrangian-platforms-and-sensors-a-scientific-and-technical-review/	ONR, NSF, University of California San Diego, University of California Santa Cruz, Monterey Bay Aquarium Research Institute, University of Washington, Yale University	Rudnick, Daniel	Scripps Institution of Oceanography	1	2017
Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS)	https://nopp.org/projects/gommapps/	BOEM, NOAA, USGS, U.S. Fish and Wildlife Service	Damour, Melanie J.	Bureau of Ocean Energy Management	4	2017
Deepwater Atlantic Habitats II: Continued Atlantic Research and Exploration in Deepwater Ecosystems with Focus on Coral, Canyon, and Seep Communities (DEEP Search)	https://nopp.org/projects/deep-search/	BOEM, NOAA, USGS, Temple University, TDI Brooks International, University of Georgia, Nova Southeastern University, Florida State University, University of New Hampshire, Harvey Mudd College, Netherlands Institute of Sea Research	Cordes, Erik	Temple University	5	2017
Atlantic Deepwater Ecosystem Observatory Network (ADEON) - An Integrated System	https://nopp.org/projects/adeon/	BOEM, ONR, NOAA, University of New Hampshire, TNO, JASCO, Stony Brook University, Applied Ocean Sciences	Miksis-Olds, Jennifer	University of New Hampshire	5	2016

Acronyms

ALAMO	Air Launched Autonomous Micro-Observer
APS	ADCIRC Prediction System
BAA	Broad Agency Announcement
BOEM	Bureau of Ocean Energy Management
CEQ	Council on Environmental Quality
COAMPS-TC	Coupled Ocean-Atmosphere Mesoscale Prediction System for Tropical Cyclones
CONUS	Conterminous United States
CSTARS	Center for Southeastern Tropical Advanced Remote Sensing
DWSD	Directional Wave Spectra Drifter
EEZ	Exclusive Economic Zone
ESLR	Effects of Sea Level Rise
EPA	Environmental Protection Agency
FY	Fiscal Year
GO-SHIP	Global Ocean Ship-based Hydrographic Investigations Program
IWG	Interagency Working Group
MIRSL	Microwave Remote Sensing Laboratory
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Oceanographic Partnership Program
NSF	National Science Foundation
ONR	Office of Naval Research
OPC	Ocean Policy Committee
OST	Ocean Science and Technology Subcommittee
OSTP	Office of Science and Technology Policy
OSTST	Ocean Surface Topography Science Team
PI	Principal Investigator
ROV	Remotely Operated Vehicle
SAR	Synthetic Aperture Radar
TBDEM	Topobathymetric Digital Elevation Model
USGS	United States Geological Survey
UUV	Uncrewed Underwater Vessel