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Primary Contact: J. Ruairidh Morrison,
Northeastern Regional Association of Coastal Ocean Observing Systems
(NERACOOS)
570 Ocean Blvd., Rye, NH, 03870
(603) 319 1785 - Phone
(603) 319 1799 - Fax
Ru.Morrison@neracoos.org

Financial Contact: James Chase
Seacoast Science Center
570 Ocean Blvd., Rye, NH, 03870
(603) 436 8043 ext 22 - Phone
(603) 433 2235 - Fax
j.chase@seacentr.org

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(NERACOOS)

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Primary Contact: J. Ruairidh Morrison,
Northeastern Regional Association of Coastal Ocean Observing Systems
(NERACOOS)
570 Ocean Blvd., Rye, NH, 03870
(603) 319 1785 - Phone
(603) 319 1799 - Fax
Ru.Morrison@neracoos.org

Recipient Institution: Northeastern Regional Association of Coastal Ocean Observing Systems
(NERACOOS)

Other Investigators: Changsheng Chen (University of Massachusetts, Dartmouth), Robert Beardsley (Woods Hole Oceanographic Institution, WHOI), Scott Gallagher (WHOI), Michele Dionne (Wells National Estuarine Research Reserve), Paul Currier (New Hampshire Department of Environmental Services), Neal Pettigrew (University of Maine), James O'Donnell (University of Connecticut), Doug Vandemark (University of New Hampshire), Al Hanson (University of Rhode Island), Tom Shyka (Gulf of Maine Research Institute), Peter Smith (Bedford Institute of Oceanography), Annette deCharon (University of Maine), Hauke Kite-Powell (WHOI), James Manning (NOAA, National Marine Fisheries, Northeast Fisheries Science Center)

Project Summary:

The Northeast region of the US Integrated Ocean Observing System (IOOS) is geographically complex with five states and two Canadian Provinces, coastal waters and watersheds of the Scotian Shelf, Gulf of Maine, Southern New England Bight, and Long Island Sound. The proposed project seeks to continue the improvement and integration of the coastal ocean observing system that has been developed under the auspices of the Northeastern Regional Association of Coastal Ocean Observing System (NERACOOS) through a cooperative agreement with NOAA. Close collaboration with regional organizations, especially the Northeast Regional Ocean Council (NROC), a state-federal partnership that provides a forum for tackling and prioritizing regional scale problems, will ensure that NERACOOS directly addresses pressing regional scale issues of societal benefit. To that end NERACOOS has adopted the four priority theme areas of NROC and formalized our collaboration with a Memorandum of Understanding. The existing highly-leveraged observing, modeling, data integration, and product development infrastructure provides practical operational capacity in each priority area and the proposed

effort, where possible, seeks to maintain the capacity previously funded. Under the theme of **Maritime Safety and Security**, the proposed work will provide real-time observations and forecasts directly for maritime operational safety, inform US and Canadian Coast Guard Search and Rescue Operations, and introduce new and enhance existing weather forecast products. In the area of **Ocean and Coastal Ecosystem Health**, harmful algal bloom monitoring and forecasting will be improved, monitoring and integration of water quality information will be enhanced, ecosystem based fisheries management and marine spatial planning will be enabled, and ocean acidification monitored. For the **Ocean Energy** theme, NERACOOS will provide the necessary oceanographic information to facilitate the renewable energy sector and the Data Integration Framework required for a regional approach to facilities siting. To improve **Coastal Hazards Resiliency** the proposed work will enhance and evaluate street-level inundation forecasting, expand forecasts for coastal flooding and erosion, and support emergency spill response. **Climate Change** is a central theme that cross-cuts all others as few issues may be addressed without its consideration. Continued development and implementation of a **Data Integration Framework** is central to the delivery of information and products to users of the system. Metrics for **Performance and Evaluation** will enable tracking the return on investment and **Education and Outreach** will engage our users to ensure information and products meet their needs.

Partners:

Bedford Institute of Oceanography (BIO)
Gulf of Maine Ocean Observing System
(GoMOOS)
Gulf of Maine Research Institute (GMRI)
New Hampshire Department of Environmental
Services (NHDES)
University of Connecticut (UConn)
University of Maine (UMaine)

University of Massachusetts, Dartmouth
(UMassD)
University of New Hampshire (UNH)
University of Rhode Island (URI)
Wells National Estuarine Research Reserve
(Wells, NERR)
Woods Hole Oceanographic Institution (WHOI)
NOAA, National Marine Fisheries, Northeast
Fisheries Science Center
(NOAA/NMFS/NEFSC)

PROJECT DESCRIPTION

Goals and Objectives

The Northeast region is geographically complex with five states and two Canadian Provinces, coastal waters and watersheds of the Scotian Shelf, Gulf of Maine (GoM) and Southern New England. The proposed project seeks to continue the development and integration of the coastal ocean observing system that has been developed by the Northeastern Regional Association of Coastal Ocean Observing System (NERACOOS). NERACOOS has formed a close collaboration with the Northeast Regional Ocean Council (NROC) and adopted the four priority theme areas to guide prioritization of activities: Maritime Safety and Security, Ocean Energy, Ocean and Coastal Ecosystem Health, and Coastal Hazards Resiliency. Climate Change is a theme that cross-cuts all others as few issues may be addressed without its consideration. Clearly, NERACOOS and NROC both address the mission goals of the National Oceanic and Atmospheric Administration (NOAA).

The first goal of the proposed work is the continued delivery of products, services, and information to stakeholders and end users in each of these four priority areas. The existing highly-leveraged observing, modeling, data integration, and product development infrastructure provides practical operational capacity in each priority area and the proposed effort, where possible, seeks to maintain the capacity previously funded. However, with level funding and increasing operating costs, only a prioritized subset of the current capacity will be maintained to ensure core services are delivered to end users and retain their engagement.

The second goal is an incremental increase in capacity scaling with available funds. This additional funding will restore capability lost to inflating costs; increase our contributions to regional end-to-end solutions for managers of harmful algal blooms, water quality, and coastal inundation forecasting; maintain regional Ocean Acidification observations; and enhance Education and Outreach and Performance and Evaluation activities.

Background

The Northeastern Region extends from the waters of the Canadian Maritimes to those off Connecticut (see Map 1 in Appendix). The region is fed by numerous rivers and forced by strong tides. It is connected by a region-wide southwestward-flowing current over the shelf and slope, which originates in the Gulf of Saint Lawrence and Labrador Sea. The region is diverse. Much of the shore of the GoM is sparsely settled but more than 8 million people live in the watershed of LIS. The region spans Cape Cod, a bio-geographical boundary, making species composition and distributions very sensitive to climate variability and trends. For example, Greene and Pershing (2007) have described the ecosystem response to salinity variations and Howell et al. (2005) showed evidence that increased bottom water temperatures in LIS to be associated with increased mortality of American Lobsters.

NERACOOS was established as an independent non-profit organization in the fall of 2008 after a three-year NOAA-funded planning activity that brought together all interested parties to develop an effective governance structure. NERACOOS is administered by a Board of Directors, an Executive Director and staff, and advised by a Strategic Planning and Implementation (SPI) Team. The directors are drawn from three pools; state coastal management nominated by the NROC, academic institutions nominated by a regional consortium, and other stakeholders nominated by the region's Sea Grant entities. The SPI Team includes coastal managers, scientists, and engineers with the expertise necessary to operate observing system infrastructure, model the complex marine environment, and manage the resulting information. (For more detailed information on NERACOOS please visit www.neracoos.org).

Regional Ocean Councils have been established throughout the US to facilitate federal, state, local, and tribal management of the ocean across jurisdictions and boundaries and at a scale commensurate with ocean ecosystems. NROC was created in 2005 by the New England governors in response to recommendations for novel institutions for regional coastal and ocean governance by the US Commission on Ocean Policy. NROC brings together representatives from state and federal agencies to identify and pursue region-wide issues and priorities. Four priority issue areas were identified at a

regional Ocean Congress in 2007. Climate change was a central cross-cutting theme that was embodied in each of the priority issue areas which were; Ocean and Coastal Ecosystem Health, Coastal Hazards Resilience, Ocean Energy Planning and Management, and Maritime Security (and Safety). NERACOOS has adopted the four priority theme areas of NROC and formalized our collaboration with a Memorandum of Understanding.

Product and Services Based Planning - The NERACOOS SPI Team was charged with developing a Strategic and Implementation Plan at its first meeting in February, 2009. Delivering priority products and services to stakeholders and users followed by designing the appropriate observing system was central to the process in developing this plan. To achieve this, seven Working Groups were established, four for priority areas already identified by NROC as well as ones for; Data Integration Framework (DIF), Education and Outreach, and Performance and Evaluation. Working Group membership, like that of the SPI Team comprised representatives from state and federal agencies as well as non-governmental organizations and research scientists. At a meeting in May, 2009 members of the priority theme Working Groups were charged to identify key products and services that NERACOOS could deliver building on previous prioritizing efforts such as NROC work plans. Further refinement and prioritizing continued throughout the summer months with an extensive search of previous regional planning efforts by a contractor and weekly teleconferences. A final set of prioritized products and the infrastructure needed to support them was produced by consensus of the entire SPI Team at a meeting on September 16 and three subsequent teleconferences and was later ratified by the Board of Directors. The Strategic Plan for NERACOOS will be published in November. In addition, NERACOOS and NROC have recently established a Memorandum of Understanding to further an ongoing coordinated approach to the identification and implementation of regional management priorities.

NERACOOS is a collaborative organization that works with Federal, State, local, and regional partners to achieve solutions. These regional partners include NROC, the Northeast Coastal and Ocean Data Partnership (NeCODP), the new NOAA-funded Cooperative Institute for the North Atlantic

Region (CINAR), the New England Ocean Science Education Collaborative (NEOSEC), and the Massachusetts Ocean Partnership (MOP). This proposal builds upon the intensive seven-month planning process to produce a stakeholder-driven regional observing system that expands upon previous NOAA and non-NOAA funded efforts for this geographically complex and economically important region.

Audience and Approach

For each of the four priority theme areas and for a number of specific product areas, the audience and the approach are described below. Climate Change is a central theme that cross-cuts all others as no issue may be addressed without its consideration. Sustained observations are required for monitoring, predicting, and adapting to Climate Change.

Maritime Safety and Security

Providing real-time observations and forecasts directly for Maritime Operational Safety

Before leaving land and at sea, mariners, both commercial and recreational, routinely consult NERACOOS buoy data as well as NERACOOS and National Weather Service (NWS) forecasts. Buoy observations provide reliable real-time information on wind, waves, currents, and visibility and complement the forecasts which predict what is to come. Users frequently compare the two sources of information to assess the value of the forecasts. As such, the real-time buoy data are the front-line infrastructure of maritime safety in the NERACOOS region. The NERACOOS web presence (www.neracoos.org), which integrates Federal and non-Federal observing assets, was developed specifically to deliver buoy observations to the maritime operations community. These data are relied upon by fishermen, pilots, recreational boaters, and the US and Canadian Coast Guards, and are crucial to safe offshore operations. Providing information that helps prevent accidents is undoubtedly the best way to ensure maritime safety and security.

The NERACOOS buoy array in the GoM is the most extensive and operational IOOS array in the country. Established in 2001 as part of the GoMOOS, the array has been operated since that time by the UMaine. In LIS, a similar array was established in 2004 and operated by UConn. These buoys carry a

very comprehensive sensor suite that includes the full complement of meteorological sensors carried by the standard NDBC buoys, and in addition commonly include atmospheric visibility, surface currents, water-column current profiles, temperature and conductivity at multiple depths, and at some locations sensors for water quality. Dual telemetry systems ensure a high delivery rate of observations (>90%) even in adverse weather conditions. The GoM and LIS buoy arrays are highly leveraged by formal and informal partners with funding from many sources.

The work plan for providing real-time observations for maritime operational safety includes the continued operation of the NERACOOS buoy arrays. Specifically we will operate and maintain up to 6 buoys of the historical GoM array, up to three buoys in LIS, one in Great Bay (NH), and an additional CDIP directional wave buoy in the GoM depending on funding. Continued quality control procedures will assure high integrity of data and access to real-time and archived data via appropriate IOOS approved Data Integration Framework standards with delivery of real-time products to mariners and the NWS via the NERACOOS website.

Informing Coast Guard Search and Rescue

When accidents occur in the coastal ocean the U.S. Coast Guard (USCG) is the agency that coordinates Search and Rescue (SAR) operations for ships and sailors at sea. Search planning is supported by an information management system (SAROPS) that uses measurements of ocean and atmosphere conditions to optimize the probability of successful rescues. Though the last known position and physical characteristics of the search target are crucial, SAR success is improved by knowledge of the wind and surface current velocities. The water temperature influences the survival duration of a person in the water and the sea state and visibility control the effectiveness with which targets can be located so these are also important variables in SAR.

The availability of surface current measurements from HF RADAR systems has recently been demonstrated to enhance search planning (O'Donnell et al., 2005) and the USCG has incorporated both observations and short term forecasts into SAROPS. However, the system is limited by the availability

of instrument systems. Currently, UMaine operates three long range HF RADAR systems in the GoM with the support of NERACOOS. UMassD operates a long range system on Cape Cod and UConn and URI operate five systems in the southern New England Sounds with the support of MACOORA. WHOI is planning the installation of another pair of systems near Martha's Vineyard. The Canadian CG has two operational systems in SW Nova Scotia and the combined array is being integrated into SAROPS. The NERACOOS HF RADAR Gap Analysis and the National HF RADAR plan outlines the regional infrastructure required to provide surface current observations and predictions throughout the region.

The proposed effort will maintain the UMaine operation of three long-range GoM HF RADAR systems and integrate the data into the national data base for USGC SAROPS. Together, UMaine and UConn will develop a Short Term Prediction System (STPS) and integrate these forecasts into the SAROPS. For this, a data system will routinely acquire current vectors from the HF RADARs in the GoM and produce a 24-hour-long prediction of the surface currents via the STPS where adequate data are available. A three-month evaluation of the predictions will check consistency, after which routine operation of the STPS will provide predictions to SAROPS for nine months. A final report of the STPS will make use of all USCG drifters deployed in the GoM and those deployed by the NERACOOS drifter program (see below) using the approach of Ullman et al. (2006). Additionally, forecast products from the Northeast Coastal Ocean Forecast System (NECOFS) will be provided for CG use (see next section).

Introducing new and enhancing existing weather forecast products

The NWS Weather Forecast Offices (WFOs) are responsible for issuing the regional marine forecasts which integrate information from a variety of sources including regional meteorological and oceanographic models. Icing Potential is an example of an additional product provided by regional models that can dramatically influence maritime safety. Icing on ship superstructures can and has led to loss of vessels and lives in the Northeast. With NERACOOS funding, the Marine Ecosystem Modeling Laboratory at UMassD has developed the NECOFS as part of a comprehensive regional marine environmental forecast system. NECOFS became operational in 2008 and continues to be improved as

new applications arise and computing power increases. The core system includes a NOAA/NCAR Weather Research and Forecast (WRF) weather model, a set of nested unstructured-grid Finite-Volume Coastal Ocean Models (FVCOMs), and an unstructured-grid surface wave model. Each day, three-day forecasts are produced of hourly surface weather, wave state, radiation stress, surface elevation, 3-D ocean currents, temperature, salinity, density, bottom stress, and turbulent mixing. Forecast fields are posted on the NECOFS and NERACOOS websites and made available via a THREDDS Data Server.

The proposed effort will maintain the NECOFS forecasts. The NWS Taunton (MA) WFO presently is using these forecasts of surface icing and other fields as part of their marine forecast operations. With internal NWS training and collaboration, the use of the NECOFS products will be expanded to the Gray (ME) WFO. Additionally, UMassD plans to add surface visibility and ceiling forecasts (derived from WRF) as requested by the NWS Taunton and Gray WFOs and 1st District USCG. UMassD is presently developing software to convert the unstructured-grid forecast fields into a uniform structured-grid format to facilitate use by the NWS, USCG, and other users who regularly handle gridded data solely. When completed, this advance should enable the USCG to upload the NECOFS surface wind, wave, current, temperature, visibility, and ceiling into their Environmental Data Server for use in SAROPS.

Ocean Energy

The increasing regional energy demand continues to raise interest in renewable and non-renewable ocean energy sources. Wind and in-stream tidal currents are potential sources of energy and have the potential of meeting state renewable energy goals, such as providing 15% of Rhode Island's 100 MW demand by 2015. States in the Northeast US have expressed a desire to consider the cumulative impact of offshore ocean energy structures at a regional scale. Currently, ME, MA and RI are drafting ocean management plans to help determine optimal siting of offshore wind farms, however, little consideration has been given to their cumulative effect, and what effects they as a whole may have on ecosystem dynamics as well as human use patterns. NROC is beginning to have these "energy build out" discussions at a regional scale, and NERACOOS observations, models, and data integration capacities

are well poised to support regional Marine Spatial Planning management decisions. Together with NROC and MOP, we have begun integrating the required information with a proof of concept on our website (www.neracoos.org/products/wms) which includes the WMS output from individual state planning efforts, relevant NECOFS modeled information, bathymetry, etc. Additionally, NERACOOS has the ability to provide baseline observations, to play a unique role in placing observation instruments on wind farm structures and to recommend monitoring protocols to be implemented on offshore platforms, as well as to develop modeling studies to develop an understanding of cumulative impact.

At the present time, two NERACOOS buoys are operating in Block Island Sound funded by the RI wind power initiative. In addition to the standard measurement suite, passive acoustics for monitoring marine mammals and bats were added to help evaluate the impact wind farms would have on these protected species. UMaine has recently received a major DOE grant (\$8M) for the establishment of a center for offshore wind technology testing and development. The suitability of Maine state waters for this center was established using wind, wave, and current climatologies constructed from the eight-plus years of operational IOOS data from the GoM array. As part of this project, a NERACOOS GoM-style monitoring buoy will be deployed in the test site for two years, and the standard data will be supplied in real-time to the public via the NERACOOS website. The ability to establish a “calibrated” test site was crucial to the success of the offshore wind technology center.

Ocean and Coastal Ecosystem Health

Improving Harmful Algal Bloom (HAB) monitoring and forecasting

The crucial role of the NERACOOS GoM buoy array in research and early warning of Paralytic Shellfish Poisoning (PSP) in the GoM is well-established. The mid-shelf region in the Eastern Maine Coastal Current (EMCC) is laden each summer with *Alexandrium fundyense* that causes PSP (Anderson et al., 2005). In extreme cases PSP can be fatal to humans and federal and state managers are responsible for ensuring that shellfish collected from their waters meet human consumption standards. Whether or not these HABs contaminate the shellfish beds depends in large part on the path of the current and the

direction and strength of the wind; information on both are provided by the GoM array (Pettigrew and Xue, 2006, Pettigrew et al., 2005). More recently, a detailed prognostic biophysical model of *Alexandrium* blooms in the GoM has been developed by researchers at WHOI (He et al., 2008) that assimilates winds and currents in real-time from NERACOOS GoM buoys. This model is presently used to track blooms, predict trajectories, and to guide regulators in charge of shellfish closures in both state and federal water in the south western GoM and south of Cape Cod (MA). Information from this model, state and other monitoring efforts, and closures are routinely shared with the region's managers and researchers via the [NortheastPSP] email distributions.

However, there are no continuous *A. fundyense* measurements in the offshore waters to specifically warn shellfish managers or to verify or update the model simulations. Results from past research and exchanges with managers, particularly during the intense blooms in 2005, 2006, 2008, and 2009 have highlighted the opportunities and need for HAB sensors in the offshore coastal waters of the GoM. One solution to this need is the Environmental Sample Processor (ESP), an instrument that uses molecular probe technology to enumerate target organisms and transmit the data to shore (see <http://www.mbari.org/ESP/>, Scholin et al. 2009). An ESP was purchased in 2009 by the US EPA for use in NERACOOS HAB activities. NOAA IOOS contributed supplies and deployment hardware. However, ESP deployment requires a highly stable environment with sufficient power and data telemetry capacity. The proposed effort will purchase a specialized mooring, the ADP-ESP mooring based on that designed for use in acoustic studies of cetaceans (Clark 2009), for deployment by WHOI of the ESP in the spring of 2011 near the GoM Buoy B.

In order to further assist in the prediction and diagnosis of HAB events, routine drifter deployments will be conducted at selected locations around the GoM coordinated by the NOAA NMFS. These student-built, lobstermen-deployed, GPS drifters were originally developed with eMOLT funding to track lobster larvae, and have now been used by more than 25 other groups in various applications (Manning et al, 2009). Monthly deployments will be made from both ferries and lobster boats in the

spring and summer. The drifters are crucial for assessing forecast and hindcast model skill and real-time web-served tracks of these drifters have been followed by state and local shellfish managers.

Additional effort on detecting *Alexandrium* will use remote sensing data in a pilot area of the outer Bay of Fundy, one of the source regions in the GoM with large *Alexandrium* blooms ($>50,000$ cell L^{-1}). BIO will perform continuous (weekly) shipboard sampling over a fixed array of five stations from May to October, and collect, analyze and validate high resolution ocean color imagery (MERIS) through direct measurements of optical properties in the surface layer. Field measurements to date clearly indicate *Alexandrium* blooms when the phytoplankton community is not dominated by diatoms, suggesting an inverse relationship exists between the two phytoplankton groups. The diatom algorithm of Sathyendranath et al. (2004) will form the basis of a “HABs warning” product that will be validated for the pilot region before expansion to the rest of the region.

Improving monitoring and modeling of Water Quality

Nitrogen enrichment of coastal waters is a major concern for both state and federal environmental managers since it leads to hypoxia in LIS and Narragansett Bay and eelgrass loss in Great Bay. NERACOOS has supported complementary observation, data sharing, and analyses activities, enhancing management efforts in both locations (e.g., Morrison et al., 2008, O'Donnell et al., 2008). Though on-going water quality survey programs conducted by ships are extremely valuable, it has become clear that these do not adequately resolve the inherent variability. High-frequency buoy records have revealed that the effect of wind on hypoxia was much more complex than previously thought (see O'Donnell et al., 2007) implying that regional climate changes may complicate the detection of the consequences of water quality regulations implemented in the last decade and that ship surveys which alias weather events will not reveal the critical scales of variation. The Massachusetts Water Resources Authority (MWRA) charged with monitoring the effects of the Boston sewage outfall in Massachusetts Bay, relies heavily on oceanographic and water quality measurements from NERACOOS Buoy A.

Since it is clear that high frequency water quality measurements are vital for the complete

understanding of these complex environments, NERACOOS will sustain the existing sensors in LIS and Great Bay and restore the support of the CLIS buoy. UConn has tested the Satlantic ISUS nitrate sensor on the CLIS mooring in LIS and on ship surveys. In partnership with EPA, NERACOOS has acquired four Envirotech Instruments EcoLab sensors for deployment in LIS to study mixing and nitrate variability. These sensors will be integrated with the NERACOOS LIS array instrument control and telemetry system and deployed for three months. To respond to the needs of States and municipalities to establish the true variability in estuaries in the region that are vulnerable to eutrophication and hypoxia NERACOOS will construct two low-cost buoys to deploy water quality sensors in sheltered estuaries and bays in the region. The systems will include salinity, temperature, and DO instruments and power and telemetry packages similar to those in the LIS array. Month-long deployments at test sites in the Thames River and Narragansett Bay are envisioned to establish the scales of variability which are essential to the development of the design for adequate monitoring systems which will be the end product. Sites will be selected by consultation with the regional Coastal Zone Managers.

Nutrient observations by NERACOOS will be supported by URI which will provide a central facility that will calibrate and prepare sensors for deployment as well as data processing and quality control. Additional real-time nutrient sensing activities in the Northeast are being developed, in part through leveraging NERACOOS activities. For example, both URI and UNH are part of a National Oceanographic Partnership Program (NOPP) effort to develop phosphate and ammonia sensors and URI is supporting a foundation-funded effort with WHOI at the Martha's Vineyard Coastal Observatory.

Regional scale integration of the many diverse data sources and modeling efforts has also been highlighted by the water quality management community both nationally and regionally. NERACOOS has supported the continuing partnership between the State of Connecticut DEP and UConn to provide access to the database of water quality measurements acquired in LIS in the last 20 years. The EPA has also funded the NeCODP Exchange Network program (ODPX) through NHDES to implement data sharing by multiple partners. To expand these capabilities and provide access to water quality data in all

the states, NERACOOS partners will contribute to a proof-of-concept project for utilizing web services to access and integrate watershed and coastal ocean data with common standards (WQX, ODPX, and IOOS DIF) using Open-Geospatial Consortium compliant tools to serve analysis results. For this project, to be coordinated for NERACOOS by GoMOOS, data and model results will be integrated from USGS, EPA, National Estuaries Programs (NEPs), states, provinces, NERRS, DFO, Environment Canada, and academia to provide a single point of access for regional nutrient information for water quality managers and researchers. This effort will help integrate IOOS and the National Water Quality Monitoring Network which, it is anticipated, will also provide funds for this. The integration effort will result in a region-wide indicator/estimator of land-based nutrient loads to coastal estuaries and embayments, and a simple estimator of median nitrogen concentrations for basins which have no data or sparse data.

Enabling Ecosystem Approaches to Management

Ecosystem Approaches to Management (EAM) of shelf seas involves meeting multiple goals based on objectives set within various management and legal regimes, and will require information on the status and trends of ecosystem elements at nested spatial and temporal scales. As a continuation of the IOOS-funded WHOI-led Northeast Benthic-Pelagic Observatory (NEBO), the time series for benthic habitat characterization with the towed Habcam optical imaging system will be extended at test sites (see Map in Appendix) containing epi-benthic communities critical to commercial fisheries along the Northeast coastal US. Integrated data products will continue to be developed and presented to ocean managers using advanced visualization tools so key fisheries target species and community responses to regulatory practices can be observed at multiple and relevant space and time scales and in relation to variations in seafloor habitat and boundary layer conditions. Further, data products are being produced so results can be incorporated into predictive community dynamics models for use in fisheries and sanctuary management. Data products are of direct utility to fishery and conservation scientists (e.g., government and academic scientists), fishery and sanctuary managers, and environmental policy makers (states' Departments of Natural Resources and the New England Fisheries Management Council).

Monitoring the effects and onset of Ocean Acidification

Secular increase in ocean acidification (OA) is occurring in New England waters, just as for the global oceans, as more than a third of the ever-increasing atmospheric CO₂ load is continually dissolving into the surface ocean. Acidic runoff by rivers into GoM, both in the present and historically, may also exacerbate pH decrease in nearshore waters. In the coming decades, spawning and recruitment success for economically important species, especially shellfish, may be adversely impacted by ocean acidification (Salisbury et al., 2008; Miller et al., 2009). A multi-phase approach will be used to bring OA observing into NERACOOS coordinated with the NOAA regional efforts currently being planned by the NOAA OA Implementation Team and the North Atlantic Regional Team. Existing state-of-the-art CO₂ measurement infrastructure established with NOAA IOOS COTS funds will be maintained and operated to deliver three ocean acidification monitoring time series, two offshore (climate impact) and one nearshore (watershed impact). These sites are the NH MAP-CO₂ buoy (2006-present), NERACOOS Buoy N-NE Channel (2008-present), and the UNH Coastal Marine Laboratory (2008-present). Observations to date have revealed natural seasonal variability as well as the year-to-year increases driving ocean acidification. Each site delivers hourly to daily sampling of pCO₂ and derived pH including data quality control and delivery to the DOE-CDIAC data center. Water sample data needed to validate and QA these observations will also be collected. As NOAA and other agencies begin to implement support for the FORAM Act, we will address the broader role that NERACOOS can play in supporting the region as well as other NOAA organizations including PMEL and NMFS. There is a clear regional interest to include OA monitoring in the nearshore water quality management programs.

Cross-Cutting Ferry Sampling Program

A pilot project is proposed to demonstrate standards-compliant real-time delivery of water quality indices and velocity profiles from existing ferry-based sampling systems in LIS and the GoM. URI will transition current profile measurements on the ferry in Eastern LIS to deliver a standards-compliant, QC/QA'd velocity profile data product to the NERACOOS and NDBC websites in near real-

time. Virtual stations along the transect will be established based on experience gained with real-time meteorological data on the central LIS ferry. The ferry traveling across Massachusetts Bay from Boston to Provincetown will be instrumented by WHOI with a basic sensor and real-time telemetry package (see description at <http://4dgeo.who.edu/ferries>). Additionally, a multiple sampling system will be added to collect 100 ml water samples along the ferry route every km. Although every sample will not necessarily be processed, during HAB events samples from the Boston to Provincetown ferry will be analyzed at WHOI to assess the extent of bloom transport. This will become an early warning system for detection of HABs entering Massachusetts and Cape Cod Bays. The importance of these pilot projects lies in the fact that they will generate real-time data products on water quality and transport. In addition to its utility to mariners, it is of high value to improve the skill of NERACOOS modeling products. It will develop a software capability that can be used with ADCPs on other ferries to generate the same data product in the future. This is a crucial step towards enabling NERACOOS to capitalize on the cost-effectiveness and unique sampling strengths of ferry-based velocity profile sampling.

Coastal Hazards Resiliency

Enhancing and evaluating street-level inundation forecasting

With NERACOOS funding, UMassD has made significant progress on establishing an end-to-end capability for coastal inundation prediction at two NOAA pilot demonstration sites, Scituate (MA) and Saco (ME). Meetings with Scituate and Saco management and state personnel have identified the key areas of inundation, processes involved, and sources of recent detailed ocean bathymetric and land elevation data. Both sites feature wind and wave-induced setup, overflow of dikes and sea walls and low beaches, with resultant inland flooding. UMassD developed a FVCOM module to simulate dike and sea wall overflow (Ge et al, 2009). The Scituate FVCOM inundation grid, nested into the larger scaled model grids, is now completed and in testing. After testing, the Scituate inundation model will be added to the NECOFS operational cycle and the forecasts made available NWS Taunton WFO and Scituate management. The Saco model will be added to NECOFS by early 2010. Both Scituate and Saco

management are eager to see these projects come online. Two new pilot sites will be added in this next grant period to be chosen with user community engagement. UMassD will also hold a workshop on these model systems to acquaint other towns that experience severe inundation about NECOFS and the ability to develop FVCOM inundation model systems for their own areas. Also, given the NECOFS hindcast archive, investigators will be able to use these FVCOM inundation models to hindcast specific extreme events (e.g., the Patriots' Day storm, the "no-name" storm, etc.), as well as run future scenarios with changes in mean sea level, coastal modification, etc.

Expanding Coastal Flooding and Erosion Forecast for coastal inundation and damage

The Coastal Flooding and Erosion Forecast (CFaEF) is a prototype decision-support tool developed for NERACOOS by GoMOOS and the NWS. The tool is a nomogram plot, which displays the potential impact of the combined dynamical forces of storm tides and large battering waves. The predicted impact is based on empirical relationships produced from climatology (Bogden et al 2008). Model forecasts of water level and waves are then plotted on the nomogram to predict coastal storm damage. The tool increases meteorologists' confidence during the warning process, is used routinely at the Gray (ME) WFO, and assists emergency managers in mitigation preparedness. The original prototype was developed for the two pilot locations Saco (ME) with a second iteration added for Scituate (MA).

NERACOOS partners, the NWS, UMassD, BIO and GoMOOS will continue to maintain and evaluate the existing CFaEF capacity. This is dependent on the delivery of forecasts from the existing regional wave (Wave Watch III) and water level (FVCOM) models operated by BIO and UMassD, respectively, as well as buoy and water level observations. Furthermore, the tool will be extended to the additional locations identified for the street-level inundation above.

Supporting emergency spill response

Responding to the order of 120 incidents annually, NOAA's Office of Response and Restoration (OR&R) Emergency Response Division (ERD) provides scientific support for oil and chemical spills. The Spill of National Significance (SONS) exercise scheduled for March 2010 has provided a strong

focus for collaboration between NERACOOS, NOAA OR&R, and the USCG. Real-time buoy observations, essential for understanding oil weathering, are made available through the NERACOOS website and with IOOS Data Integration Standards. The NECOFS 3-day forecast surface fields are routinely provided to OR&R ERD Seattle Headquarters through the UMassD data server as input for GNOME software for detailed trajectory modeling. Through the proposed support of the buoy, drifter, and HF Radar arrays as well as the modeling efforts, NERACOOS will continue to provide the products and services necessary for regional emergency spill response.

Data Integration Framework (DIF)

A robust, scalable and cost effective regional Data Management and Communications (DMAC) infrastructure is a critical component of NERACOOS, enabling and supporting efficient development and delivery of a suite of sophisticated and interoperable decision support and analysis tools. Implementing and sustaining a successful DMAC system depends on the robustness of its components and the effective implementation of them throughout the region. NERACOOS DMAC efforts will be led by the NERACOOS DIF team and all NERACOOS observing and modeling partners will provide information via IOOS DIF compliant protocols. The NERACOOS DIF work will be integrated with the NeCODP. The NERACOOS/NeCODP collaboration will bring into NERACOOS the wide range of non-IOOS funded routine observations collected in the region, providing a broad spatial and temporal context for interpreting data and model assimilation.

The near-term goal for the DMAC system is to achieve 100% compliance in the implementation of IOOS-recommended DIF standards. The NERACOOS DIF team will provide assistance to partners to ensure we reach this goal. We propose to expand DIF-compliant data access across the region to diverse datasets by the continued development and deployment of easy-to-use software toolkits in a variety of implementation languages. These software toolkits will also help other regions and international partners deliver data via standards-based services, thus enabling integration on a national and international scale.

NERACOOS has demonstrated success in implementing a regional DIF Sensor Observation Service

(SOS) observation capability. Regional modelers and the DIF team will continue their implementation of CF compliant OpenDAP and THREDDS DIF standards. This will allow NERACOOS to efficiently develop model comparison products and support the efficient delivery of model output and integration of new models as they become available. NERACOOS will continue to actively participate in the national and regional DIF implementation team working groups to evaluate, test and enhance the existing standards. Additionally, we'll continue to participate in community efforts designed to advance DMAC efforts of the IOOS such as the Open Geospatial Interoperability Experiment II.

Education and Outreach

As described above, engagement with those who use ocean observing system information is essential for defining the scope of information required and framing its delivery. To better understand who the audience were and develop successful communication strategies with them, a survey developed during the Strategic Planning processes identified "Decision Makers," "R&D Partners," "Accountability Seekers," and "Ocean Literacy" as key target communities. A full-time Education & Communications Specialist (ECS) will be hired to promote internal communication within NERACOOS partners and to help them engage with target communities. Established collaborations with other regional experts (e.g., New England Ocean Sciences Education Collaborative, NEOSEC, and the Centers for Ocean Sciences Education Excellence, COSEE) will allow the ECS to leverage common goals and activities to help promote stewardship of the Northeast's watersheds and coastal waters.

Performance and Evaluation

A fundamental measure of performance for an observing system is the economic value it produces – the societal benefits generated by the use of its products, net of development, installation, and operating costs. Combined with information about how sensors, platforms, models, and data infrastructure contribute to each product, economic performance information can help NERACOOS prioritize investments to maximize the expected return. A second performance measure is the efficiency with which the system generates products – the extent to which system configuration and the effectiveness of

system components contribute to minimizing the “cost” part of the equation. While prior funding for NERACOOS economics work (Kite-Powell) has focused on development of estimates and tracking benefit delivery, we propose here to focus on the costs. We will develop a framework for carrying out a cost-based performance evaluation for ocean observing system components and for integrating this information into the observing system design and optimization process. This will likely involve a series of observing system simulation experiment (OSSE, e.g., Wei et al, 2009). We will illustrate the approach with a detailed performance evaluation of one or two major components of NERACOOS.

Benefits

Compiled below are the words of direct users of NERACOOS information much of which was obtained from letters of support included in the Appendix. The requirements for products and services are developed through direct engagement with those we provide information to and their representatives on the Working Groups and SPI Team. In developing the NERACOOS Strategic Plan 2009 in excess of 24 documents were consulted and the ongoing user engagement and planning activities ensure optimal delivery of NERACOOS information.

Maritime Safety and Security – Testimonials from **mariners** include: *"I trust the weather buoys with my life. Thank you."* - Maine Fisherman; *"Love your service...I believe your service is a lifesaver. Thanks!"* -Dave, Pilot; and *"I would like you to know that information you are providing us not only aids us in our work, it almost certainly has saved lives."* -Roy Atkinson, Fisherman. The **National Weather Service** wrote that they *"routinely integrate NERACOOS data into our forecasts and warning operations on an hourly basis."* and that *"Products derived from NERACOOS buoys are critical to protecting the lives and property of mariners and coastal residents alike."* The **USCG** wrote that NERACOOS provides *"information that we use routinely in planning our operations."* and that **HF RADAR** *"will directly improve our ability to locate mariners in distress."*

Ocean and Coastal Ecosystem Health – **Regional HAB managers** wrote that the proposed effort will *"directly benefit the regional HAB monitoring by continuing to provide the buoy observations ...*

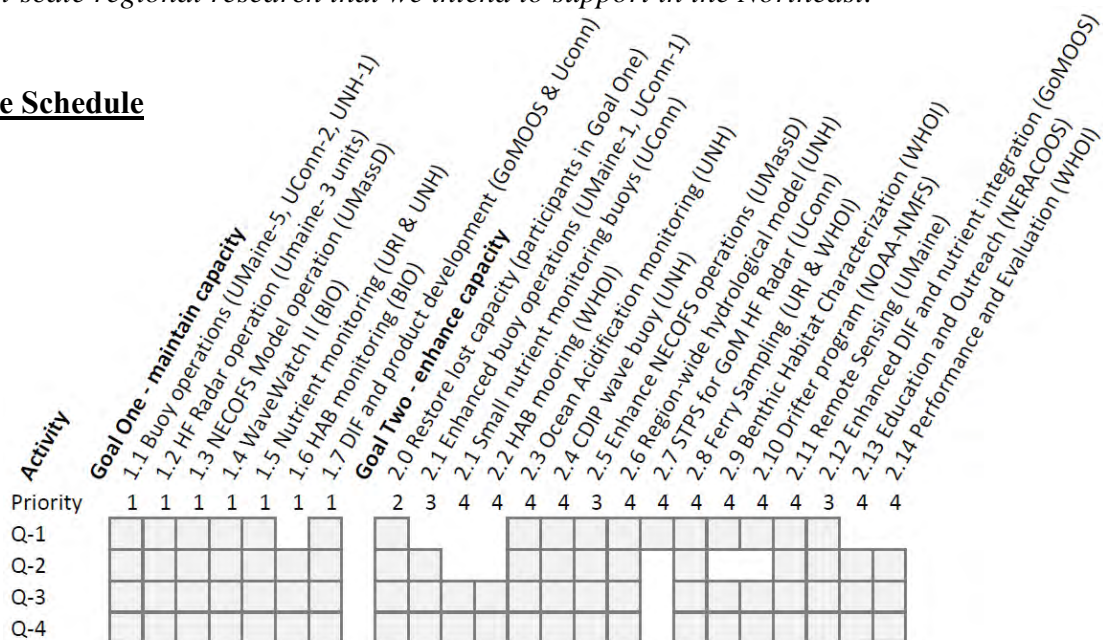
This work directly contributes to protecting the lives of those who enjoy harvesting and consuming the regions shellfish.” NOAA/NMFS/NEFSC wrote “the NERACOOS buoys are used in Ecosystem Assessment products that are being developed by the Center ... HabCam and the NEBO project represent critical technological developments.”

Coastal Hazards Resiliency – Local town managers from Scituate and Saco wrote that the proposed effort would “greatly improve the ability of the Town staff to provide timely warnings and plan possible emergency responses as needed”. NOAA OR&R wrote that “This information significantly improves our ability to provide timely science based support for a spill in the Northeast US.”

Ocean Energy – The DeepCWind Consortium wrote “If the marine environment is not sufficiently characterized, developers will not risk starting offshore wind projects in the Gulf of Maine. These buoys will improve the viability of the Gulf of Maine as a strong candidate for offshore wind farm developments.” NROC wrote “The proposed effort will directly benefit NROC by applying the multi-institutional strengths of the NE community to our top priority issues: ocean energy, ecosystem health and hazard resilience.”

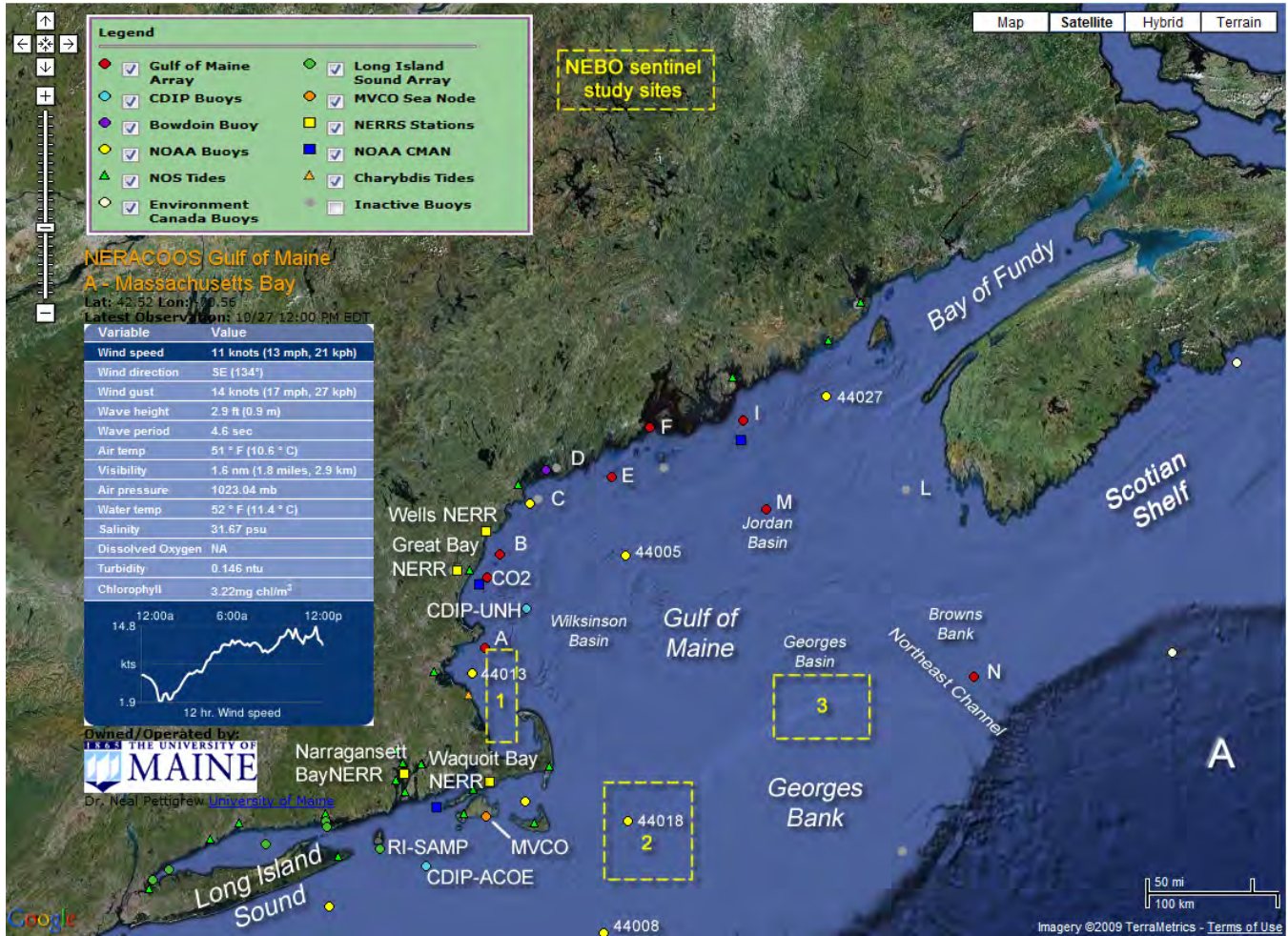
Researchers – NOAA/CSCOR wrote that “NERACOOS capabilities will benefit the kind of ecosystem-scale regional research that we intend to support in the Northeast.”

Milestone Schedule



Milestones activities and priorities, developed through a survey of the SPI Team, are provided above.

APPENDIX



Map 1. A) Map of the spatial extent of NERACOOS from the Canadian Maritimes to the waters off Connecticut, and B) detail of the Long Island Sound. These images were derived from those on the interactive NERACOOS website (www.neracoos.org) from which real-time and 12 hour historical data can be obtained. This is shown in the blue insert over the land to the left of A. The website integrates a wide range of information from

federal and non-federal sources as indicated by the key in the green square in A. The NECOFS model produces three-day meteorological and oceanographic forecasts for the whole region each day. Yellow dashed boxes show the locations of three of the NEBO sentinel benthic study sites (1 – Cape Cod Bay/Stellwagen Bank/Jeffreys Ledge, 2 – Great South Channel, 3 – Northeast Peak of George’s Bank).

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Science

Maritimes Region
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, NS B2Y 4A2

Sciences

Région des Maritimes
Institut océanographique de Bedford
C.P. 1006
Dartmouth (N-É) B2Y 4A2

October 16, 2009

Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870
U.S.A.

Dear Ru,

This letter is to confirm the Department of Fisheries and Oceans' (DFO) support for the participation of scientists from the Bedford Institute of Oceanography (BIO) and the St. Andrews Biological Station (SABS) in the application by NERACOOS to the FY 2010 Integrated Ocean Observing System Implementation funding opportunity. A total of nine researchers and support staff will conduct laboratory and field experiments in the lower Bay of Fundy, analyze and interpret satellite ocean colour imagery, and build an operational wave forecast model for the Gulf of Maine as a whole. The IOOS funds will help to leverage large amounts funds (>10:1) from Canadian agencies with similar interests.

The proposed work will directly benefit coastal managers and DFO regulators responsible for the health and safety of seafood gathered from the Fundy shores, as well as United States counterparts who track HABs from the Canadian source region to the northern New England coastline. Furthermore, the new wave forecast model will contribute to improved predictions storm and hurricane impacts, specifically in connection with the proven "spill-over" product in use by the United States National Weather Service.

Attached is a summary of the budget and the statement of work for DFO projects.

Sincerely yours,



Michael Sinclair
Regional Director, Science
Science Branch
Maritimes Region

PCS/spm

Att.

cc: P.C. Smith

S.E. McGladdery



Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

October 15, 2009

Dear Dr. Morrison,

This letter is to confirm the Department of Fisheries and Oceans' (DFO) support for the participation of scientists from the Bedford Institute of Oceanography (BIO) and the Saint-Andrews Biological Station (SABS) in the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. A total of nine researchers and support staff will conduct laboratory and field experiments in the lower Bay of Fundy, analyze and interpret satellite ocean colour imagery, and build an operational wave forecast model for the Gulf of Maine as a whole. The IOOS funds will help to leverage large amounts funds (>10:1) from Canadian agencies with similar interests.

The proposed work will directly benefit coastal managers and DFO regulators responsible for the health and safety of seafood gathered from the Fundy shores, as well as US counterparts who track HABs from the Canadian source region to the northern New England coastline. Furthermore, the new wave forecast model will contribute to improved predictions storm and hurricane impacts, specifically in connection with the proven "spill-over" product in use by the US National Weather Service.

A summary of the budget and the statement of work for DFO projects are attached.

Sincerely,

Dr. Sharon E. McGladdery
Director, St. Andrew's Biological Station
Fisheries and Oceans Canada

Encl.

Massachusetts Ocean Partnership

Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

October 23, 2009

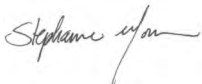
Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

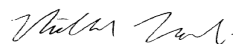
We are writing to express our support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. The Massachusetts Ocean Partnership (MOP) is a public-private partnership established in 2006 to advance the practice of integrated multi-use ocean management in the Commonwealth and broader region. The underlying premise of integrated ocean management is that it considers the entire ecosystem, including humans, and has the goal of maintaining the ocean ecosystem in a healthy, productive and resilient condition so that it can provide the goods and services humans want and need. MOP achieves its goal through its science integration and communications/stakeholder engagement programs.

This proposal is especially timely and pertinent to ocean science and management issues in Massachusetts. MOP has recently supported the integration of data from various providers in the coastal zone into the Commonwealth's database for use in the draft *Massachusetts Ocean Management Plan* (issued June 30, 2009; www.mass.gov/eea/mop). While this static data integration effort was necessary, it is MOP's goal to ensure that future ocean management planning will instead be supported by a dynamic coastal ocean data network. NERACOOS provides the framework and is an ideal partner in the development of such a data network. For example, MOP plans to fund the Marine Ecosystem Modeling Laboratory at UMass Dartmouth to develop hindcasts from 1990 to the present based on the FVCOM-GOM3 and FVCOM-SWAVE models. This investment leverages previous NERACOOS support of NECOFS, providing a database for research and ocean management planning in the region and demonstrating the value and leveraging opportunities associated with NERACOOS investments. MOP hopes to continue this partnership with NERACOOS, beginning with the opportunities identified in this proposal as they are essential to improve the accessibility and quality of the data that are necessary to advance integrated ecosystem based ocean management in the region.

Sincerely,



Stephanie Moura
Executive Director



Nicholas Napoli
Science Program Manager



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

20 October 2009

Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

Re: Support for FY2010 NERACOOS implementation proposal

Dear Dr. Morrison,

I am writing to express my support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity.

The Northeast Fisheries Science Center (NEFSC) continues to work with NERACOOS on a broad range of topics. Specifically, the NERACOOS buoys are used in Ecosystem Assessment products that are being developed by the Center. The Ocean Acidification efforts proposed by NERACOOS also are very important to the NEFSC and will form an important component of the Northeast Regional Ocean Acidification Science Plan. Finally, the development of HabCam and the NEBO project represent critical technological developments; continued support through NERACOOS for the development is an important part of transitioning this technology to operational use by the NEFSC.

In sum, the importance of NERACOOS to NEFSC operations steadily grows and FY2010 funding from NOAA IOOS will allow our collaborations to continue.

Sincerely,

A handwritten signature in black ink that reads "Nancy B. Thompson".

Nancy B. Thompson, Ph.D.
Science and Research Director





UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Coast Survey
Silver Spring, Maryland 20910-3282

Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

26 October 2009

Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

I am writing to express my support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity.

Our Coast Survey Development Laboratory, part of NOAA's National Ocean Service, develops model-based systems for operational coastal ocean circulation forecasting. As such, we are keenly interested in the Northeast Coastal Ocean Forecast System (NECOFS), developed by the Marine Ecosystem Modeling Laboratory at UMassD, as part of a comprehensive regional marine environmental forecast system. NECOFS, in part, relies on the unstructured-grid Finite-Volume Coastal Ocean Model (FVCOM) configured for this region (FVCOM-GOM3) with a nested higher resolution FVCOM grid configured for Massachusetts coastal waters (FVCOM-MASS). We are also applying FVCOM for numerical hydrodynamic model simulations and for Operational Forecast System development. The NECOFS effort is an important prototype, in the NERACOOS region, for FVCOM applications and will enhance the overall community effort to develop and operate coastal marine environmental forecast systems.

The proposed NECOFS effort should directly benefit maritime safety and security through its 3-day forecasts of surface weather, wave state, surface elevation, 3-D ocean currents, temperature, salinity, density, bottom stress, and turbulent mixing. In addition, NECOFS hindcasts will be useful in evaluating ocean energy extraction potential and environmental conditions which might influence facility siting. UMassD has also made significant progress on establishing a capability for coastal inundation prediction at the two NOAA pilot demonstration sites, Scituate (MA) and Saco (ME), which supports the other NERACOOS theme of coastal resiliency.

Again, I enthusiastically support the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity and the continued development of the NECOFS effort.

Sincerely,

Frank Aikman III, PhD
Chief, Marine Modeling and Analysis Program
Coast Survey Development Laboratory



Printed on Recycled Paper





National Oceanic and Atmospheric Administration
Office of Response & Restoration
Emergency Response Division
408 Atlantic Avenue
Boston, MA 02110

Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

October 23, 2009

Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

I am writing to express my support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. The NOAA Office of Response and Restoration (OR&R) Emergency Response Division (ERD) provide scientific support for approximately 120 oil and chemical spills in US coastal waters. As the Scientific Support Coordinator for the northeast I provide a direct link to local knowledge and infrastructure. Additionally, during a response the NOAA Scientific Support Team (SST) draws upon the expertise of the ERD Headquarters staff in Seattle to provide additional expertise which includes oceanographic modeling (including trajectory modeling). Such in-house expertise is often leveraged with local and regional scientific activity creating a synergy that provides highly reliable and useful advice to the spill response community.

The proposed effort will directly benefit NOAA OR&R ERD as the information from the NERACOOS buoy and High-Frequency Radar (HFR) arrays as well as NECOFS forecast products are extremely valuable to regional spill response. For example, water temperatures from buoys are vital for understanding oil weathering and buoy, HFR and NECOFS current observations and forecasts provide information necessary for predicting spill trajectories. This information significantly improves our ability to provide timely science based support for a spill in the Northeast US. The proposed effort will build upon our successful collaboration that has been developed prior to the Spill of National Significance (SONS) exercise scheduled for March, 2010, and I look forward to continuing to work with you and other NERACOOS partners in the future.

Again, I remain impressed with the quality of the data available through NERSCOOS and view it as an important regional asset not only during the occasional major pollution emergency in the northeast, but as a means for the local response community to be better prepared through such exercises as SONS 2010. Maintaining the viability of this program and, indeed is expansion, is important to ERD's ongoing effort to protect the habitat and economy of the coastal community.

Sincerely

Steve Lehmann
Scientific Support Coordinator, New England
NOAA Office of Response and Restoration, Emergency Response Division



WOODS HOLE OCEANOGRAPHIC INSTITUTION

Dr. Donald M. Anderson, *Senior Scientist, Biology Department and
Director, Cooperative Institute for the North Atlantic Region (CINAR)*

October 24, 2009

Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

Dear Ru,

I am writing to express my support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. I do this on behalf of CINAR, the Cooperative Institute for the North Atlantic Region. The mission of CINAR is to “*conduct and coordinate cutting-edge research engaging both NOAA and academic scientists to enable informed decisions by NOAA for sustainable and beneficial management of the northwestern Atlantic shelf ecosystem.*” As such, many of our goals overlap with those of NERACOOS, and thus we look forward to collaborating with you as both of our organizations develop.

The existing NERACOOS infrastructure provides operational capacity in several areas that are high priorities within CINAR, so we support the continued funding of these assets, as well as the expansion of new capabilities, as proposed in your funding application. For example, two of CINAR's main themes are to support NOAA programs in ecosystem-based management and climate change. To do this, we need the sustained operations of NERACOOS observing assets. Similarly, harmful algal bloom monitoring and forecasting will be improved through the deployment of specialized sensors, as will monitoring of water quality, and these again are priority areas within CINAR.

I therefore strongly support this specific application for funding. A number of the proposed activities will be of great value to CINAR investigators and programs, and therefore to our cooperating partners in NOAA.

Sincerely

A handwritten signature in dark ink, appearing to read "Don", is written in a cursive style.

Donald M. Anderson
Senior Scientist, Biology Department and
Director, Cooperative Institute for the North Atlantic Region (CINAR)

26 October 2009

Dr. Ru Morrison
Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)
Seacoast Science Center
570 Ocean Blvd.
Rye, NH 03870, USA.

Dear Dr. Morrison,

I enthusiastically support your proposal "Continued Development of the Northeastern Regional Coastal Ocean Observing System." As Chair of the Education and Outreach (EO) team during the Strategic Planning and Implementation process, I can confidently state that we were all impressed by your personal enthusiasm for delivering data and key messages of NERACOOS to broad audiences. The EO team – that included education and communications experts from five states -- collected and analyzed a set of survey-based data that provides a rich foundation for a NERACOOS “communications strategy.” Moreover, several members of the EO team (including myself) have expressed interest in serving on an external committee to provide guidance as you develop your future EO plans.

As Director of the Centers for Ocean Sciences Education Excellence (COSEE) – Ocean Systems (OS) program, I look forward to working closely with NERACOOS share effective practices for fostering effective scientist-educator partnerships. We welcome your interest in using COSEE-OS’s workshop model as a tool to support planning and design of materials that address the research topics of NERACOOS scientists. Evaluation data collected from participants show this model to be very effective in facilitating scientist-educator interactions. We are happy to share our experiences and expertise as you build your project team of scientists, educators, and other regional stakeholders.

We look forward to your success with this effort.

Regards,



Annette deCharon
Director, COSEE-Ocean Systems

advancing ocean sciences education

COSEE - Ocean Systems Office | University of Maine | School of Marine Sciences
Darling Marine Center | 193 Clark's Cove Road | Walpole, ME 04573
Tel: 207.563.3146 ext. 298 | Fax: 207.563.3119 | annette.decharon@maine.edu



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canadian
Coast Guard

Garde côtière
canadienne



Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

October 16, 2009

Dear Dr. Morrison,

This letter is to confirm the Canadian Coast Guard's (CCG) support for the participation of scientists from the Bedford Institute of Oceanography (BIO) in the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. A total of nine DFO researchers and support staff will conduct laboratory and field experiments in the lower Bay of Fundy, analyze and interpret satellite ocean colour imagery, and build an operational wave forecast model for the Gulf of Maine as a whole. This work will be closely coordinated with other US project components designed to build a CODAR surface current monitoring system that stretches from Long Island Sound to the Canadian border, and meshes seamlessly with a similar system maintained by the CCG. The IOOS funds will help to leverage large amounts funds (>10:1) from Canadian agencies with similar interests.

The proposed CODAR work will directly benefit maritime safety and search-and-rescue coordinators in the Maritimes region of Canada who are responsible for the security of marine operations and transportation in Canadian waters. Furthermore, the new wave forecast model will contribute to improved predictions storm and hurricane impacts that will be made available to various ocean stakeholders through DFO and Environment Canada, and through the GoMOOS organization in Maine.

A summary of the budget and the statement of work for DFO projects are attached.

Sincerely,

Paul Rudden
A/Superintendent, Search and Rescue
Canadian Coast Guard, Maritimes Region

Encl.



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5793 AEW Building
Orono, Maine 04469-5793
Tel: 207-581-2123
Fax: 207-581-2074
www.aewc.umaine.edu

October 21, 2009

Ru Morrison
Executive Director
Northeast Regional Association of
Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

I am writing to express my strong support for the application by the Northeast Regional Association Coastal Ocean Observing System (NERACOOS) to the FY2010 Integrated Ocean Observing System Implementation funding opportunity.

UMaine's AEW Advanced Structures and Composites Center (AEWC) has been recently awarded \$13 million from the Department of Energy and was named the DOE's national deepwater offshore wind research center. AEW has a strong track record of industry collaboration, and new composite products developed at the Center have won three national industry awards in the last two years. Our work on commercialization earned us the "Champion for Economic Development Award" by the Maine development foundation, as we spun off twelve new businesses in the past seven years, and assisted 70 others in developing new products or improving existing products.

The proposed effort will directly benefit the University of Maine's AEW, as well as the entire DeepCwind Consortium, a consortium of other universities, nonprofits, and industry leaders, by providing weather and ocean data that help our researchers characterize the marine environment. If the marine environment is not sufficiently characterized, developers will not risk starting offshore wind projects in the Gulf of Maine. These buoys will improve the viability of the Gulf of Maine as a strong candidate for offshore wind farm developments.

In parallel with this proposal, The UMaine-led DeepCwind Consortium has received \$13 million from the Department of Energy to fund validation of coupled aeroelastic/hydrodynamic models of floating offshore wind turbines, optimize floating platform designs by incorporating more durable and lighter hybrid composite materials, and integrate a deepwater offshore wind education mission. While these other efforts will advance the strategic objectives of Maine's offshore wind cluster, they would not be possible without the data collected by NERACOOS.

Sincerely,

Habib J. Dagher, Ph.D., P.E.
Director, AEW Advanced Structures and
Composites Center
Professor of Civil Engineering
BIW Professor of Structural Engineering



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MAINE'S LAND GRANT AND SEA GRANT UNIVERSITY
A Member of the University of Maine System



MASSACHUSETTS WATER RESOURCES AUTHORITY

Charlestown Navy Yard
100 First Avenue, Building 39
Boston, MA 02129

Frederick A. Laskey
Executive Director

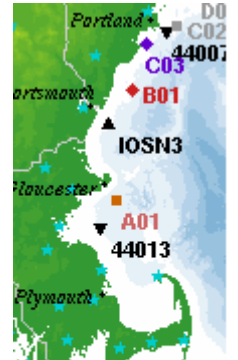
Telephone: (617) 242-6000
Fax: (617) 241-6070
TTY: 617 788-4971

October 28, 2009

Dr. Ru Morrison, Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

Dear Dr Morrison:

MWRA supports the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity.



MWRA provides water and sewer service to greater Boston. We discharge secondary-treated sewage effluent 15km offshore in Massachusetts Bay. Under our discharge permit, EPA, MADEP, and NMFS require us to protect the valued resources of the bay by monitoring and modeling for environmental effects of the outfall, the largest in the world. The cost of that comprehensive effort is \$3.2M per year, and much of it should be considered as match for regional ocean observing.

Three elements of the proposed and potential NERACOOS effort are critical to MWRA's permit-required monitoring and modeling program.

#	Activity	benefit to MWRA
2.1	UMaine buoy A	Indicates whether GoM currents are entering Mass Bay, and the quality of water approaching the outfall.
1.1	UMaine buoy B	Buoy B provides boundary conditions for Mass Bay hydrodynamic models.
1.3, 2.5	UMassD modeling	NECOFS provides the hydrodynamic component of our water quality model.

Other elements would benefit MWRA:

#	Activity	benefit to MWRA
1.6, 2.2, 2.10	HAB monitoring and mooring and drifter program	MWRA is required to measure <i>Alexandrium</i> abundance as part of the regional effort. MWRA focuses on detecting outfall nutrient enhancement of the bloom.
2.3, 2.8	UNH acidification; WHOI ferry to Provincetown	Provide context for our monitoring data, and data for modeling.
2.11	UMaine remote sensing	Regional and local context. UMaine adds value to the product.

Call me at 617 788-4951 if you need more information.

Michael J Mickelson, PhD
Program Manager, Outfall Monitoring

Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

Oct. 23, 2009

Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

I am writing to express my support for the activities proposed in the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. As you know, I have been working on a cross-NOAA team to explore how to integrate capabilities in research, observation, and modeling to provide ecological forecasts in a more routine and operational way. This will not be possible without the data streams and modeling capability provided by the regional observing systems. As we explore how to provide ecological forecasts in a regional context, I am hoping that the RAs can be active partners. In addition to providing observational data and modeling development, I could see the RAs serving as test beds for transitioning some of these research models to a more operational mode.

Specifically regarding the Northeast region, the proposed Coastal and Ecosystem Health objectives are directly in line with the research that is funded through my office, the Center for Sponsored Coastal Ocean Research. Our research efforts are developing predictive capabilities surrounding issues such as HABs, hypoxia, and coastal ecosystem-based management. In addition, we have interests in ocean acidification and its ecosystem effects. While our office can support directed research for the duration of the award period, many of these research endeavors depend on the kind of long-term data collection and integration that NERACOOS can provide. The maintenance and enhancement of NERACOOS capabilities will benefit the kind of ecosystem-scale regional research that we intend to support in the Northeast.

I will be very interested in NERACOOS activities as you go forward, and hope that your proposal will be successful.

Sincerely,
Beth

Elizabeth J. Turner
Oceanographer
NOAA Center for Sponsored Coastal Ocean Research



**U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration**

NATIONAL WEATHER SERVICE
FORECAST OFFICE
445 Myles Standish Boulevard
Taunton, MA 02780

1 Weather La., Box 1208
Gray, Maine 04039

October 31, 2009

Ru Morrison, Executive Director
Seacoast Science Center
570 Ocean Blvd.
Rye, NH 03870

Dear Dr. Morrison,

The National Weather Service (NWS) in Taunton, Massachusetts (BOX) and Gray, Maine (GYX), fully support the Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS) efforts to maintain their state of the art monitoring network in the Gulf of Maine and continue its new flagship website for serving data to customers. NERACOOS buoys remain uniquely suited to collect an array of environmental information, such as visibility and salinity data as well as high quality traditional wind and wave information. Their cross cutting ability to observe conditions over multiple disciplines serves those seeking to monitor, understand and preserve environmental ecosystems.

Our marine desks routinely integrate NERACOOS data into our forecasts and warning operations on an hourly basis. The observational data is plotted and analyzed in our computer systems and is a prime source of in-situ data for ingest into mesoscale models. The reliable flow of information is then aired for public interests over NOAA Weather Radio.

Products derived from NERACOOS buoys are critical to protecting the lives and property of mariners and coastal residents alike. Collaborative research efforts leveraging the extensive archives of network data have led to locally produced advances in modeling techniques, coastal inundation studies, web portals, splash-over and beach erosion efforts as well as a local wind and visibility climatology. Flexibility, ingenuity and passion within the NERACOOS organization are outstanding characteristics which result in this successful transfer of research into forecast operations.

NWS BOX and GYX have enjoyed an excellent rapport with NERACOOS. NERACOOS rapid responsiveness to the needs of its users is truly remarkable and refreshing. Our partnership demonstrates the value of working together to provide the marine community with high quality observation and forecast services. In summary, the NWS wholeheartedly supports the NERACOOS mission.

Sincerely,

Robert Thompson,
Meteorologist in Charge, NWS Taunton, MA

John Cannon
Senior Meteorologist, NWS Gray, ME





U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE

175 Brookhaven Ave.
Upton, NY 11973

October 28, 2009

J. Ru Morrison, Ph.D.
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)
Seacoast Science Center
570 Ocean Blvd.
Rye, NH 03870

Dr. Morrison:

I am writing in support of the University of Connecticut's (UConn) MySound Project and the Long Island Sound Integrated Coastal Observing System (LISICOS). The real time meteorological and maritime observations that LISICOS provides are critical to NOAA's National Weather Service (NWS) mission. In addition, LISICOS data are disseminated to the National Data Buoy Center, placed on public web servers, and also broadcast on NOAA's All Hazards Weather Radio. These observations, if discontinued, would significantly decrease the quality of the NWS forecast and warning information for users of Long Island Sound.

NWS meteorologists utilize UConn's LISICOS data on a continuous basis every day as part of our mission of maritime safety. The data are the only in-situ measurements of waves and are the only true measurements of wind on the Sound. These in-situ measurements are critical for validation of the forecasts by users and for verification of forecasts internally. In addition, these data support various modeling efforts at universities, specifically Stevens Institute and Stony Brook University, that the NWS collaborates with. In addition to the NWS, other NOAA agencies make use of the LISOCOS data to observe and predict the Earth's atmosphere, ocean and biosphere.

Our past collaborations with the University of Connecticut (UConn) have instilled confidence in the value and quality of LISICOS data. It's our opinion that UConn's MySound project has been an outstanding success and paid dividends many times over and over again. We completely endorse the LISICOS effort and must emphasize the importance of maritime safety that these data provide.

We sincerely hope that NERACOOS continues to support the LISICOS's value in serving the needs of maritime safety.

Jeffrey S. Tongue
Acting Meteorologist-in-Charge

cc: W/ER3 (Dr. Kenneth W. Johnson)
W/ER1x3 (Donald J. Miller)
WFO/BOX (Robert Thompson)



To: J. Ru Morrison, PhD
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)
Seacoast Science Center
570 Ocean Blvd.
Rye, NH 03870, USA

Tuesday, October 27, 2009

Re: NERACOOS buoys funding renewal

Dear Dr. Morrison,

I am writing to you with regard to the funding renewal for the instrumentation on the NERACOOS EXRK, WLIS, and CLIS buoys. At Stevens Institute of Technology, we are using the meteorological and water data from these buoys, such as winds, water temperature, and surface waves, to assess daily the hydrodynamic forecasts of our operational New York Harbor Observing and Prediction System (NYHOPS, www.stevens.edu/maritimeforecast). The Long Island Sound region is a focus region for NYHOPS: NYHOPS forecasts are used daily by a diverse user group, ranging from federal and state agencies (FEMA, NTSB, USACE, NJDOT, NWS, *etal.*) to recreational boaters and commercial fishermen interested in marine conditions from the coast of Delaware to Nantucket, MA. NYHOPS personnel work continuously with the Sound's regional National Weather Service (NWS) hydrologic forecast center at Taunton, MA, providing forecasts of water levels to NWS at several locations used for flooding alert guidance. These forecast exchanges include areas in the Sound, especially areas around the Connecticut River outlet, which are of particular significance to NWS.

Due to the real scarcity of real-time observations in the Sound, the NERACOOS buoys have been a tremendous asset to the scientific and marine-forecast user community that NYHOPS serves. With regard to surface waves in particular, these are the only real time instruments collecting wave data in the Sound that we are aware of, and thus the only source of information we have to assess how good our daily forecasts are for that region.

With the help of the NERACOOS observations, we have learned that the NYHOPS model does a great job in accurately forecasting surface wave conditions in the eastern part of the Sound, but does not do as well in the western part. Comparisons of NWS wind forecasts to wind observations at the WLIS and the [now defunct] CLIS buoys show that National Weather Service wind forecasts in the central and, especially, western Sound appear to be poorer than elsewhere, possibly due to low resolution of the NWS meteorological models. As our NYHOPS and the NWS forecasts evolve, we need to continue investigating the causes of such forecasting inadequacies, with continuous real-time observations from these buoys. Finally, real-time water quality observations from these sensors (e.g. dissolved oxygen) will be used to validate ongoing water quality forecasting products developed at Stevens and other institutes of higher education.

Thank you for considering renewal of the funding for the presently operating NERACOOS buoys (EXRK and WLIS). Based on the above, we would urge you to consider resumption of funding for the CLIS buoy as well.

Sincerely yours,

Dr. Alan F. Blumberg, Director, and
Nickitas Georgas, Senior Research Engineer
Stevens Institute of Technology
Center for Maritime Systems
Davidson Laboratory
711 Hudson Street
Hoboken, NJ, 07030
(201) 216-8218
www.stevens.edu/maritimeforecast www.stevens.edu/SSWS

16 October 2009

Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.
Rye, NH 03870

Re: Support for FY2010 NERACOOS implementation proposal

Dear Dr. Morrison:

I am writing to express my support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. As the primary industrial partner in the Canadian initiative that implemented and now operates a network of CODAR HF radars off Southwest Nova Scotia, OEA Technologies is acutely aware of the critical supporting role played by ocean observing infrastructure operated by the University of Maine within the waters of the Gulf of Maine. Canadian and American operational interests overlap within these waters, through various cooperative initiatives and programs, with the result that at times we depend upon each other for data, information and logistical support.

In 2007, the government of Canada provided funding to the Canadian Coast Guard to purchase and install CODAR HF radars in Nova Scotia, primarily in support of Search and Rescue operations but also in support of perceived homeland security applications. Among others, critical factors in the success of this initiative included the fact that the University of Maine already operated a network of radars within the region, that the University was a founding partner of the initiative, and that the Canadian system would integrate seamlessly with this American-owned network. Collectively, the two networks result in cost-effective coverage from an operations perspective.

The proposed effort will directly benefit this Canada / US cooperation by providing funds required to continue the U.S. component of the network. As search and rescue is a joint coast guard / armed forces mandate in Canada, continued operation of University of Maine's CODAR HF radars will benefit Canada's Joint Rescue Coordination Centre. Resulting data are also envisioned to be used as ground truth data in support of Canadian security-related R&D initiatives involving spaceborne synthetic aperture radar.

Sincerely,

Brian G. Whitehouse, PhD
President
c. LCdr. D. Williams, SSO MetOc, MARLANT, Halifax



CITY OF SACO

OFFICE OF THE CITY ADMINISTRATOR

Saco City Hall
300 Main Street, Saco, Maine 04072-1538

Richard R. Michaud
City Administrator

Telephone: (207) 282-4191

Fax #: (207) 282-8209

www.cityadmin@sacomaine.org

October 22, 2009

Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

Re: Support for FY2010 NERACOOS implementation proposal

Dear Dr. Morrison,

I am writing to express my support for the application by Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. The City of Saco experiences significant coastal flooding each winter during strong storm and wave events, so advance warning of potential flooding would greatly improve the ability of the city staff to provide timely warnings and plan possible emergency responses as needed. Thus the city welcomes the development and continued evaluation and improvement of a high-resolution coastal inundation forecast model system for Saco as part of NERACOOS.

The proposed effort will directly benefit Saco by producing 3-day hourly forecasts the surface weather, waves, 3D currents, and surface elevation in the Saco FVCOM inundation model domain. These forecasts will be sent directly to both the NWS Grey (ME) Weather Forecast Office and Saco town officials for their use.

Sincerely,

Richard R. Michaud,
City Administrator

Town of Scituate

TOWN HALL
600 Chief Justice Cushing Highway
Scituate, MA 02066



Conservation Commission

Telephone: (781) 545-8721
Fax: (781) 545-8704
Web Site: www.town.scituate.ma.us

Dr. Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

October 22, 2009

Re: Support for FY2010 NERACOOS implementation proposal

Dear Dr. Morrison

We are writing to express our support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. The Town of Scituate experiences significant coastal flooding each winter during strong storm and wave events, so advance warning of potential flooding would greatly improve the ability of the Town staff to provide timely warnings and plan possible emergency responses as needed. Thus the Town welcomes the development and continued evaluation and improvement of a high-resolution coastal inundation forecast model system for Scituate, Ma. as part of NERACOOS.

The proposed effort will directly benefit The Town of Scituate by producing 3-day hourly forecasts related to the surface conditions, wave heights, currents, and there interaction with ground elevation in the Scituate FVCOM inundation model domain. These forecasts will be sent directly to both the NWS Taunton (MA) Weather Forecast Office and Scituate town flood plain managers for their use.

Sincerely

Vincent J. Kalishes, III
Conservation Agent, FEMA Coordinator

Albert Bangert
Superintendent of Public Works

Mark Patterson
Habormaster

GULF OF MAINE LOBSTER FOUNDATION



ATLANTIC OFFSHORE
LOBSTERMEN'S ASSOCIATION



Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

20 Oct 2009

Dear Ru,

We are writing to express our support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. With hundreds of members in our lobstermen associations, there is a network of fishermen that are ready and willing to help with your efforts. Their vessels sail from dozens of ports along the New England coast on a near-daily basis and some individuals do so year-round. Many of these individuals have been involved with the Environmental Monitors on Lobster Traps project for several years and are interested in the results of long-term monitoring. They are obviously curious about variability in water quality in both time and space and how the changes may affect their catch.

The proposed effort will directly benefit our lobstermen's association by providing real-time observations of temperature, wind, and waves. We often make daily safety decisions based on readings from offshore moorings. We also benefit from having continuous a time series of near-bottom temperatures. We can look back on archived data to help diagnose certain oceanographic events that may have affected our catch. We hope you are well funded and we look forward to collaborating with you in the future.

Sincerely,

Patrice McCarron
Maine Lobstermen
Lobstermen

Bonnie Spinazzola
Atlantic Offshore Lobstermen

Dave Casoni
Massachusetts

Sheila Dassatt
Downeast Lobstermen

Erin Pelletier
Gulf of Maine Lobster Foundation



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

October 21, 2009

Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

We are writing to express our support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. As the parties responsible for ensuring that shellfish in our States' waters meet standards for human consumption we are particularly interested in efforts dedicated to monitoring and understanding Harmful Algal Blooms (HABs). In the spring, summer, and autumn, HABs can contaminate the region's extensive shellfish resources with Paralytic Shellfish Poisoning (PSP) toxins that, in extreme cases, can be fatal to humans. In 2005, an HAB outbreak caused significant economic impact with estimated losses of \$12 to \$20 million dollars in the shellfish industry of Massachusetts alone.

The proposed effort will directly benefit the regional HAB monitoring by continuing to provide the buoy observations which provide information of current weather and oceanographic conditions as well as contributing to modeling efforts. Upstream HAB cell numbers in the Bay of Fundy also provide valuable information to the Shellfish programs in our region. The additional support of a moored Environmental Sample Processor (ESP) is an exciting addition to the monitoring efforts that will bring state of the art technology to bear providing near real-time alerts and better validation of models. We expect this work will enhance our ability to detect and manage the adverse effects of HAB events, and look forward to continue working with you and the regional efforts in HAB assessment.

Sincerely,

Chris Nash,
Shellfish Program Manager, New Hampshire Department of Environmental Services

Darcie Couture
Director, Marine Biotoxin Monitoring Program, Maine Department of Marine Resources

Michael Hickey
Massachusetts Division of Marine Fisheries



Ru Morrison
Executive Director
Northeastern Regional Association of Coastal Ocean Observing Systems
570 Ocean Blvd.,
Rye, NH 03870

October 22, 2009

Re: Support for FY2010 NERACOOS implementation proposal

Dear Ru,

We are writing to express our support for the application by NERACOOS to the FY2010 Integrated Ocean Observing System Implementation funding opportunity. The Northeast Regional Ocean Council (NROC) was initiated in 2005 to facilitate a coordinated regional approach for addressing New England's priority coastal and ocean management issues. The Council is comprised of representatives from the six New England states as well as from the National Oceanic & Atmospheric Administration, Department of Interior, Environmental Protection Agency, Natural Resource Conservation Service, U.S. Coast Guard, and the U.S. Army Corps of Engineers. Our role is to identify and work to resolve management issues that require a regional solution, and for this reason look to regional enterprises like NERACOOS for leadership in listening to the management need and helping to address these challenges through applied research, observations, and product development.

The proposed effort will directly benefit NROC by applying the multi-institutional strengths of the NE community to our top priority issues: ocean energy, ecosystem health and hazard resilience. With ocean energy driving so many of our ocean planning efforts, we are particularly interested in NERACOOS exploring the cumulative impact of offshore ocean energy structures at a regional scale (New England waters). Currently, several states are drafting ocean management plans to help determine optimal siting of offshore wind farms, however, little consideration has been given to the multiplied effect of this proposed infrastructure, and what effects it may have as a whole on ecosystem dynamics as well as human use patterns.

On issues such as hazard resilience, it is important for NERACOOS to respond to management needs common to NE states. For instance, frequent Nor'easters have required a real-time response for predicting and visualizing coastal inundation impacts on communities. Products are needed to assist communities in understanding these impacts and visualize how they will be exacerbated with sea level rise.

NERACOOS can play a critical and unique role in supporting governance bodies, such as NROC, in making informed decisions on all of its priority issue areas. This partnership between these two entities was the first to be codified in an MOU, and as such, we consider NERACOOS a full partner in moving the Northeast forward towards effective collaboration and problem solving.

Respectfully,

Kathleen Leyden, Maine Coastal Program
2009 State Co-Chair

Mel Coté, EPA Region 1
2009 Federal Co-Chair

National Environmental Policy Act (NEPA)

Answer to Question C1: It is anticipated that the NOAA IOOS Program Office will agree to be substantially involved by, for example, acquiring, increasing access to, and enhancing capacity to use data and tools; convening partners and building diverse teams to accomplish work; providing meeting planning and facilitation; assisting with instructional design; developing spatial databases, models, and analyses to address the identified management needs; guiding in the development of social, economic and other human dimension information and analyses; coordinate with other Federal agencies towards regional and national IOOS objectives, and/or designing of Geographic Information System (GIS), Internet products, and system architectures.

Answer to Question C2: It is anticipated that other federal agencies will be involved in the effort but without a specific partnership arrangement apart from through the MOU with NROC.

Answer to Question D1: The proposed activity will take place in the states and waters of the northeast of the U.S. and the adjacent Canadian Maritime provinces of New Brunswick and Nova Scotia.

Answer to Question E1: No NEPA analysis was required for approval of any of the buoy and HF RADAR

Buoys in Northeast US waters require a approval from the USCG 1st District Aids to Navigation office in Boston Massachusetts, and a letter from the USACE. All of these permissions for the NERACOOS GoM buoy array are on file with the USCG and do not expire until unless the buoy is removed from service. We currently have buoys the following buoys in service and on file:

Buoy A- Latitude: 42° 31.34'N: Longitude: 70° 33.89'W. Approved June 2001.

Buoy B- Latitude: 43° 10.88'N: Longitude: 70° 25.65'W. Approved June 2001.

Buoy E- Latitude: 43° 42.81'N: Longitude: 69° 21.41'W. Approved June 2001.

Buoy F- Latitude: 44° 3.25'N: Longitude: 68° 59.87'W. Approved May 1997.

Buoy I- Latitude: 44° 6.31'N: Longitude: 68° 6.58'W. Approved June 2001.

Buoy M- Latitude: 43° 29.36'N: Longitude: 67° 52.27'W. Approved June 2001.

Great Bay Coastal Buoy- Latitude: 43.0716° N and 70.8679° W. Approved April 2005.

In Canadian Waters:

Buoys in Canadian waters are approved by the Canadian Dept. of Fisheries and Oceans, Aids to Navigation Superintendent, Atlantic Canada.

Buoy N- Latitude: 42° 19.57'N: Longitude: 065° 54.43'W. Approved April 2004.

When servicing oceanographic buoys in Canadian waters, the ship needs US and Canadian state Department approvals. These permissions are renewed annually for Buoy N. We file for the required Canadian fishing license annually in December.

HF RADAR Radio Licenses:

We currently have three HF RADAR sites in the NERACOOS GoM region. Those in Canada require a radio license from Industry Canada, spectrum management. Our license for Cape St. Mary NS was granted in December, 2002, and is renewed in March every year. The license for Grand Manan Island, NB was granted March 2007 and was taken over by the Canadian Coast Guard in March 2009.

US sites require FCC radio spectrum licenses. We received our approval in May 2001 for the site in Vinalhaven ME in 2001. We also received approval from the Vanalhaven town planning board that same year.

Answer to Question F1: No.