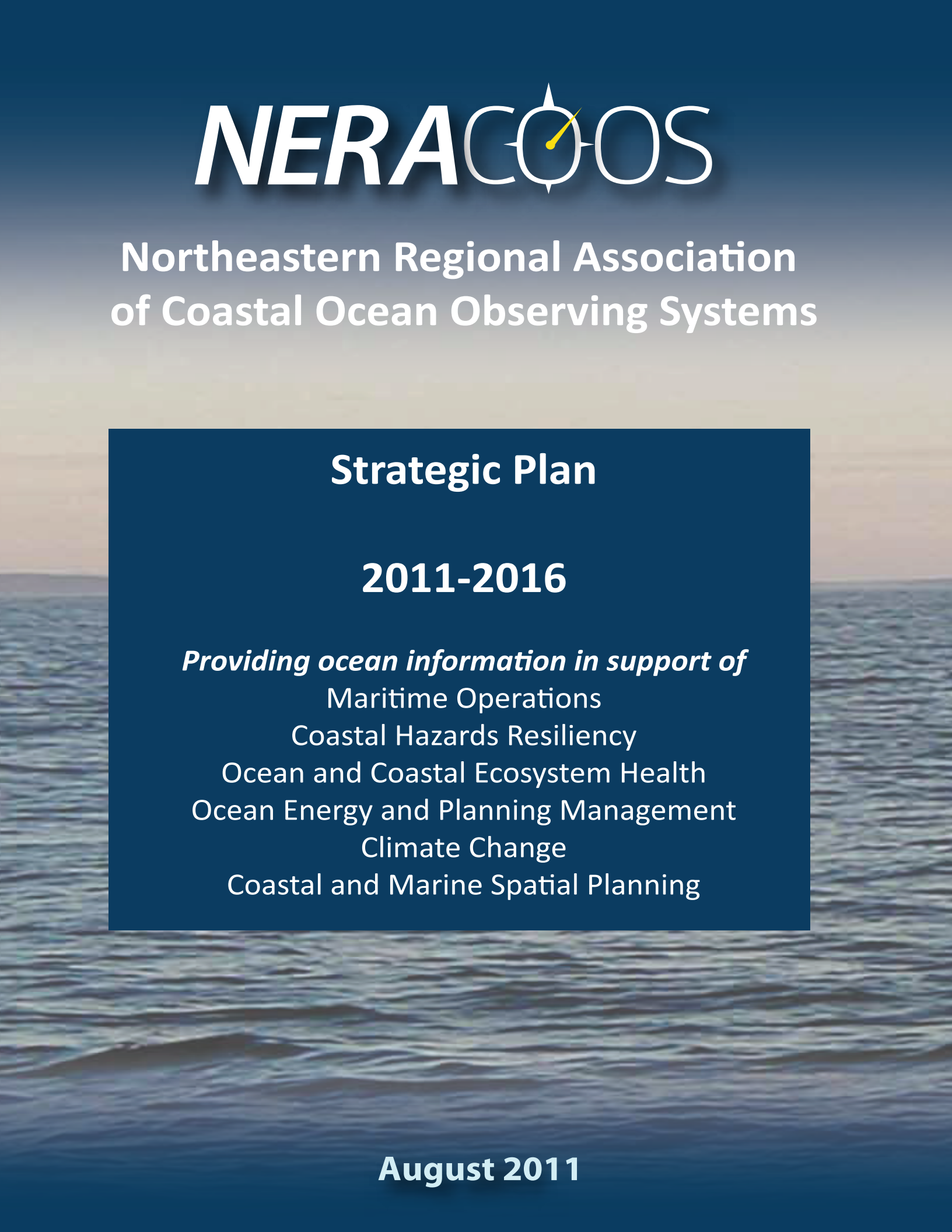

Northeastern Regional Association of Coastal Ocean Observing Systems

Strategic Plan

2011-2016

Providing ocean information in support of

Maritime Operations
Coastal Hazards Resiliency
Ocean and Coastal Ecosystem Health
Ocean Energy and Planning Management
Climate Change
Coastal and Marine Spatial Planning

August 2011

Contents

I. Executive Summary

Wise stewardship of the coastal ocean requires sustained monitoring of the characteristics of the water and the ecosystem. It is the mission of the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) to lead the development, implementation, operation, and evaluation of a sustained, regional coastal ocean observing system for the Northeast United States and Canadian Maritime Provinces of Nova Scotia and New Brunswick, as part of the United States Integrated Ocean Observing System (IOOS®); to promote the development and dissemination of data and data products that meet the needs of end users; and, to advocate for the regional, national, and global ocean observing system through education and outreach. This document outlines the strategy NERACOOS will follow during the next five years to develop systems and partnerships to fulfill its mission.

The core elements of the strategy are (1) a sustained successful regional observing system through strategic partnerships with States, academic institutions and other regional organizations; (2) integrate planning and prioritization of activities with the Northeast Regional Ocean Council (NROC) and other stakeholder groups through the development of a Strategic Operation Plan and strategic partnerships; (3) pursuit of certification under the Integrated Coastal and Ocean Observing System (ICOOS) Act of 2009; and (4) the refinement of a Regional Observing System Plan.

During the next five years, product priorities address national and regional themes:

a. marine operations
b. coastal hazards resiliency
c. ocean and coastal ecosystem health
d. ocean energy planning and management
e. regional climate change
f. coastal and marine spatial planning

Observations of the coast and ocean are the core business of NERACOOS. However, a robust, scalable and cost effective data management and communications system, and a forecast and analysis system are critical to the translation of observations to high value information. In the next five years NERACOOS will continue to implement and enhance a uniform, region-wide data system that is consistent with national IOOS® standards and protocols. Performance measures will be developed and monitored to guide the future development of the system and to quantify the range of uses and the impacts of NERACOOS products and services. NERACOOS will promote ocean literacy through support and collaboration with the New England Ocean Science Education Collaborative (NEOSEC) and the regional Centers for Ocean Sciences Education Excellence (COSEE).

II. Introduction

The Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) is one of eleven regional associations forming the coastal component of the United States Integrated Ocean Observing System (IOOS®). This stakeholder driven system was authorized in 2009 by the Integrated Coastal and Ocean Observing System (ICOOS) Act and establishes a national program office within the National Oceanic and Atmospheric Administration (NOAA).

The ICOOS Act establishes centralized coordination for development and maintenance of ocean observations in the US thus enabling a distributed national and regional implementation. The system consists of both federal and non-federal assets including Regional Information Coordination Entities (RICE[1]) such as NERACOOS to fulfill regional observation missions and priorities.

[1] RICE includes regional associations described in the IOOS Development Plan however the RICE is an entity that has been certified.

Sustained regional coastal ocean observing systems are needed to "understand weather, climate, and ocean conditions, to forecast key environmental processes, and to strengthen ocean management decision-making at all levels"[2]. The first IOOS® Development Plan[3] called for an integrated system of national and regional priorities, the latter to be determined by stakeholders at the local and regional level. The responsibility for such engagement was directed to IOOS® Regional Associations (RAs), charged with designing and implementing the observing system infrastructure that complement and contribute to national systems by providing observations at the regional scale.

Regional partnerships such as with the Northeast Regional Ocean Council (NROC) are important to developing and carrying out NERACOOS' mission. The mission of NROC is to assist the New England Governors to identify coastal and ocean management priorities that require a coordinated regional response and to foster collaboration that effectively addresses these issues. The Council provides a forum for the six New England states, federal agencies, and interested regional groups to address ocean and coastal issues that require a regional response. NROC was formed to augment the functions and authorities of existing regional entities. The council's current priority issue (Theme) areas are: coastal hazards resiliency, ocean and coastal ecosystem health, ocean energy planning and management and coastal marine spatial planning. The council recognized that ocean observations are a priority element within all the theme areas. NROC is a member of the Oceans Working Committee, which is a bi-national collaboration between the northeast U. S. and Atlantic Canada on regional coastal and ocean governance. Early in the planning process that led to formation of NERACOOS, the boundaries of the region (waters from the Canadian Maritime Provinces to the New York Bight) were chosen to be congruent with those of NROC to facilitate cooperation. NERACOOS adopted NROC's priority themes as ocean observing priorities. NERACOOS theme areas include the four NROC themes noted above and include Marine Operations and Climate Change, which creates an alignment with theme areas for all RAs. In addition, the national priority under the National Ocean Policy for Coastal and Marine Spatial Planning recognizes the Northeast Region as a planning sub-region of the Northeast Continental Shelf Large Marine Ecosystem.

The history, geography and geomorphology of the NERACOOS region have led to the recognition of some differences between the needs of the Gulf of Maine and the nearshore complex of southern New England sounds. The fundamental challenge to regional management approaches is the lack of alignment between ecosystem and political boundaries. NERACOOS has adopted representative governance approaches to ensure that all regional needs are met.

III. Purpose – Making the Northeast Region Observation-Ready

The purpose of RAs is to gather "required System observation data, supporting and integrating all aspects of coastal and ocean observing and information programs within a region and that reflects the needs of" stakeholders and users (ICOOS Act, 2009). Like other RAs, NERACOOS evolved from a network of existing observing systems. This Strategic Plan will guide the evolution of NERACOOS into a fully integrated regional coastal and ocean observing system. The plan outlines actions to address the requirements of the ICOOS Act and make the Northeast Region observation-ready. The Deepwater Horizon Spill of 2010 was a stark reminder of how the nation and regions are dependent upon a fully operational observation system to effectively manage the protection of coastal resources. A central lesson from the disaster was the value of observational assets (or lack thereof) that can assist in response planning. In the Northeast, data from the NERACOOS buoys are collected by the National Weather Service to enhance marine forecasts and issue warnings. NERACOOS will embark on the development of the Regional Observing System Plan and then implement a strategy to finance the implementation of the plan.

[2] Final Recommendations of The Interagency Ocean Policy Task Force, July 19, 2010.
[3] This plan is referred to as the 'System Plan' in the ICOOS Act of 2009.

IV. Vision

In the next five years NERACOOS will sustain and expand an integrated coastal ocean observing system and modeling in the waters of New England and the Canadian Maritimes Provinces of Nova Scotia and New Brunswick. The system will contain an optimized array of instruments coordinated by a data management system that conveys measurements to archives, models and data-based information products and deliver them to users in support of wise ocean stewardship, efficient and safe human use of the ocean resources, and public education. To ensure efficiency and effectiveness, NERACOOS will monitor performance metrics, consult with users on needs, and adapt to changing user demands and technological developments.

V. Actions

In 1998, Congress called for the development of an Integrated Ocean Observing System (IOOS®) to serve as the US contribution to the Global Earth Observation System of Systems. In 2006, the IOOS® Development Plan called for an integrated system of observations to support national and regional priorities. Regional priorities would be determined by a comprehensive effort to engage stakeholders at the local and regional level and this process would be the responsibility of IOOS® RAs.

NERACOOS was established as an independent, non-profit organization in the fall of 2008 to:

1) lead the development, implementation, operation, and evaluation of a sustained, regional coastal ocean observing system for the Northeast Region[4] (coastal waters from the Canadian Maritimes to the New York Bight) as part of IOOS®,
2) promote the development, assessment, and dissemination of data and data products that meet the needs of stakeholders, and
3) advocate through education and outreach for the regional, national, and global ocean observing system and the application of scientific assessments using environmental data to meet societal needs.

The ICOOS Act of 2009 establishes a series of requirements that RAs must undertake or comply with including the IOOS® Development Plan. The following are key actions that NERACOOS will undertaken in the next five years to comply with the ICOOS Act, prepare for certification and devise a comprehensive plan of ocean observations.

a. Strategic Operation Plan

The ICOOS Act of 2009 requires RAs including NERACOOS to "develop and operate under a strategic operation plan that will ensure the efficient and effective administration of programs and assets to support daily data observations for integration into the System, pursuant to the standards approved by the Council[5]." The Strategic Plan Implementation (SPI) Team will assemble and refine information for the plan including but not limited to a description of:

- regional governance and management,
- the process for identifying regional needs and priorities through consultation with regional governing boards and stakeholder, and
- operations and maintenance of ocean observational assets.

[4] IOOS divides the east coast and the Atlantic Ocean into the following regions: Northeast Atlantic, Mid-Atlantic and Southeast Atlantic. Coastal waters include the nation's Exclusive Economic Zone, Great Lakes, and estuaries. NERACOOS will use the term Northeast Region.

[5] National Ocean Research Leadership Council.

b. Strategic Partnerships

NERACOOS was founded after an extensive consultation process with an Advisory Committee to ensure representation of key partners. Members of the original Board of Directors were selected by NROC, the Sea Grant institutions within the region, and the Northeast Academic Consortium (NEAC) to ensure broad representation of diverse interests. The NEAC[6] is comprised of academic organizations that share a commitment to the States and Provinces of the region to provide sound scientific information for decision-making. NERACOOS has greatly benefited from significant in kind contributions from its partners, which have been essential to building and operating the current regional observing capacity. In order to continue to maintain and operate this critical capacity, it is essential that NERACOOS continue to leverage funds and other contributions from its broad public and private sector partnerships. To track and acknowledge these contributions in a consistent and equitable manner, NERACOOS requires all subawards to contribute a cost share equivalent to a minimum of 50% of their approved indirect costs[7].

A network of organizations involved in coastal ocean issues has emerged in the Northeast Region and NERACOOS has engaged them as strategic partners through Memoranda of Understanding (MOUs)[8]. Currently, the following regional organizations are partners:

- Northeast Regional Ocean Council – joint support for priorities of a mutual nature, source of regional priorities and sharing resources such as working groups.
- Northeast Coastal Ocean Data Partnership – advising on annual data integration priorities, serving as the Northeast Region representative to the national IOOS® Data Management and Communications (DMAC) Committee, and training regional partners in data management, integration and communications.
- New England Ocean Science Education Collaborative- developing joint communication strategies regarding ocean observations, project collaboration and NERACOOS participation at national education venues.

The National Federation of Regional Associations for Coastal and Ocean Observing (NFRA) is a significant partner for it represents all regional associations and assures that the needs of stakeholders are adequately addressed in national policy and helps to demonstrate the important role played by the regions in the US fulfilling its national and international observation obligations.

NERACOOS will continue to develop relationships with organizations in the Northeast Region to advance shared priorities through coordination and planning, proposal development and cost sharing.

[6] The Northeast Academic Consortium (NEAC) is comprised of the Universities of Connecticut, Maine, Massachusetts (Dartmouth), New Hampshire, Rhode Island, as well as the Woods Hole Oceanographic Institution and the Bedford Institute of Oceanography.

[7] The NERACOOS Cost Share Policy can be found at www.neracoos.org

[8] MOUs are available online at www.neracoos.org

c. Certification

The ICOOS Act of 2009 requires certification for all non-Federal assets, including the RICE, in order to establish eligibility for integration into IOOS® and to ensure compliance with all applicable standards and protocols. While guidelines are under development, the Act identifies the following minimum requirements for a RICE to be certified:

- Demonstrate an organizational structure capable of gathering required system observation data, supporting and integrating all aspects of coastal and ocean observing and information programs within a region and that reflects the needs of state and local governments, commercial interests, and other users and beneficiaries of the System;
- Identify gaps in observation coverage needs for capital improvements of Federal and non-Federal assets or other recommendations to assist in the development of the annual and long-term plans of IOOS®;
- Develop and operate under a strategic operation plan; and
- Work cooperatively with governmental and non-governmental entities at all levels to identify and provide information products of the system for multiple users.

NERACOOS will meet all certification requirements when final guidelines are released.

d. Northeast Region Observing System Plan

NERACOOS will develop a comprehensive Regional Observing System Plan building from the conceptual design that was developed in 2007 at the request of the IOOS® office. Guidelines for regional plans are being developed by the IOOS® program office and NFRA. All RAs will be undergoing a similar process allowing for a robust national synthesis of a full build out scenario as part of the Gaps Analysis required by the ICOOS Act. The NERACOOS SPI Team will develop a plan by mid 2012.

e. Coordination with Observing Programs

NERACOOS will work with observing system partners in the Northeast to provide seamless and integrated access to products and services within the region. At a national level, NERACOOS will coordinate with other RAs and the IOOS® Program Office to enhance information delivered to regional stakeholders. A robust nationally consistent DMAC system is a prerequisite to efficient development of products for implementation across a number of regions.

Federal observing programs such as the National Data Buoy Center (NDBC) not only access NERACOOS buoys for wave and weather data but also provide access to a subset of NERACOOS information. NERACOOS will review and identify where and how the federal observations systems might support the needs of the region.

A high priority for NERACOOS is the coordination with the ocean observing programs of the Canadian Maritimes to the north and the Mid-Atlantic Regional Association Coastal and Ocean Observing System (MARACOOS) to the south. While regional collaboration is important, coordination with MARACOOS is particularly important given the boundary overlap, which includes all of southern New England. NERACOOS and MARACOOS will develop a strategy for how best to address the need of stakeholders to avoid duplication of effort.

VI. NERACOOS Products and Services

NERACOOS developed Strategic Priorities for 2011-2016 from stakeholders input at four regional meetings held in spring 2010 for the following theme areas: ocean observations, coastal hazards resiliency, ocean and coastal ecosystem health, and ocean energy planning and management. These meetings were part of a Regional Planning Initiative that involved thirteen regional scale organizations including NROC. Stakeholders were invited to review and advise on regional priorities identified by NERACOOS from the following sources:

- A directory (2009) of ocean observation priorities from past stakeholder surveys,
- Regional plans from organizations such as NROC, Gulf of Maine Council, Long Island Sound Study, and Regional Ocean Science Initiative for the Gulf of Maine

The Strategic Priorities and this plan are used to inform funding requests including the five year IOOS® implementation proposal submitted in the fall of 2010 and other grant applications. Applications are tailored for funding priorities and levels and contain more specific information[9].

a. Theme Areas

The priority issue areas called Theme Areas for NERACOOS are:

1. marine operations
2. coastal hazards resiliency
3. ocean and coastal ecosystem health
4. ocean energy planning and management
5. climate change
6. coastal and marine spatial planning

For each theme the areas of focus or emphasis are listed below.

1. Marine Operations

NERACOOS provides information, both real-time observations and model forecasts, for safe and efficient marine operations, including the U.S. Coast Guard search and rescue and Port Authorities. During the next five years, the product and services focus areas include:

- sustain and enhance the 24/7 delivery of hourly weather and ocean information to all mariners
- support and enhance search and rescue operations of the Coast Guard,
- survey port and harbor organizations to determine needs for products such as vessel tracking programs,
- identify potential products that support tourism and safe beaches (e.g., mobile applications that identify beach conditions such as riptides, surf, ultraviolet radiation, and
- collaborate with NOAA on the development of operational high-resolution models for inundation and oil spill risk locations.

NERACOOS will develop performance measures to assess success in the implementation of the Marine Operations products and services. Possible performance measures include:

- website user statistics to determine how real-time and model data is used by commercial and recreational mariners,
- value and use assessment of new AIS products at ports & harbors,
- utility of NERACOOS products in assisting the Coast Guard in reducing search area and successful rescue operations,
- value of offshore wind and wave climatologies derived by archived model data, and
- performance of new rip current and surf forecast models.

[9] Funding applications can be found at www.neracoos.org

2. Coastal Hazards Resiliency

NERACOOS supports NROC's hazards goal to "render New England a coastal hazards ready region by providing existing federal, state, and municipal programs with state-of-the-art data, tools and training to advance planning and response to storms, shoreline erosion, and coastal inundation due to projected sea-level rise from global warming." During the next five years, the product and services focus areas include:

- assist regional partners in the development of an online coastal hazards directory,
- complete the review of the draft coastal hazards observation plan developed jointly with the NROC Coastal Hazards Resiliency (CHR) workgroup and develop a strategy for implementation,
- identify strategic gaps in wave and tide observations and devise approaches to collect these data through the use of low technology methods, short-term deployment of wave buoys at strategic nearshore locations, and using models to generate virtual observations,
- integrate the latest digital geospatial information (LIDAR, digital bathymetry, digital aerial photography) into web-based mapping and modeling applications such as a regional inundation model, and
- assist regional partners in the conduct of technical meetings to determine approaches for standardizing surge forecasting/analysis, and shoreline change forecasting.

NERACOOS will develop performance measures to assess success in the implementation of the CHR products and services. Possible performance measures include:

- review of web statistics to determine how the products and services use changes before, during and after storm events,
- the number of climatologies developed,
- the number of new products or enhancement of existing products, and
- the results of a survey of coastal hazard managers to identify priority products and services.

3. Ocean and Coastal Ecosystem Health

Improving water quality, achieving sustainable fisheries and maintaining healthy ocean and coastal ecosystems are priorities in the Northeast. During the next five years, the product and services focus areas include:

- provide support for sentinel monitoring program in the Northeast including data sharing and assets measuring water-column and benthic properties,
- develop regional model interoperability system for driving nested physical and ecosystem models,
- support the development of a Northeast Atlas, an online collection of key spatial data to support regional ocean management,
- enhance observation capacity by including HF RADAR surface current measuring systems, autonomous gliders, additional buoys, ferries and sensors such as those for nutrients, harmful algal blooms (HABs), waves, and CO_2/pH,
- expand data portal services in support of regional water quality and ecosystem health indicator priorities and identify priority datasets,
- create new or host online databases such as environmental event reporting tool and sediment elevation table database for regional marsh elevation reporting and analysis, and
- support integrated observation & forecasting tools for healthy beaches, shellfisheries, hypoxia and marine fisheries.

NERACOOS will develop performance measures to assess success in the implementation of the Ocean and Coastal Ecosystem Health products and services. Possible performance measures include:

- web-user statistic to determine how products and services are used by stakeholders,
- improved timeliness and resolution of beach and shellfish closures and openings,
- improved HAB forecasting, and
- improved indicator reporting such as the extent and duration of hypoxia

4. Ocean Energy Planning and Management

Ocean Energy Planning and Management (OEPM) is a new and rapidly evolving theme area for NROC. NERACOOS is working closely with NROC's OEPM working group to identify ocean observation needs and priorities. During the next five years, the product and services focus areas include:

- resource information and regional data products from observations and models in the Northeast Atlas/Ocean Data Portal,
- access to offshore energy facilities monitoring and platforms as part of the regional observing system, and
- adoption of standardized protocols for impact assessment of alternative energy including establishment of reference sites.

NERACOOS will develop performance measures to assess success in the implementation of OEPM products and services. Possible performance measures include:

- web-user statistics to determine use of resource information and regional data products,
- progress in developing protocols for selection of reference sites and monitoring resource change, and
- incorporation of facility monitoring data into region observing system.

5. Climate Change

NERACOOS observations are providing baseline data to better understand the effects of climate variability. In the next five years, the products and services focus areas include:

- determining how NERACOOS can support climate change activities of the New England Governors Conference,
- continue and expand support of regional indicator programs and provide data portal support for sentinel monitoring,
- coordinate with IOOS® and other RAs to devise a standard approach to delivering climatologies for key observation parameters such as temperature, weather, waves, salinity, and pH,
- develop an ecosystem monitoring and modeling system that will document and interpret change in the biological, physical and biogeochemical environments including species shifts and ocean acidification, and
- develop an online environmental events database to track events such as fish kills, algae blooms, and HABs to determine if there is a climate change signal in parameters such as these.

NERACOOS will develop performance measures to assess success in the implementation of the Climate Change products and services. Possible performance measures include:

- track the number of hits for data regarding climate change indicator trends,
- the number of climatologies developed, and
- the quantity of observation data that are incorporated indicator programs.

6. Coastal and Marine Spatial Planning

Coastal and Marine Spatial Planning (CMSP) is one of the nine national priority objectives in the Final Recommendations of the Interagency Ocean Policy Taskforce (2010). NROC will be central to the formation of the Regional Planning Body that will develop the region's plan. NERACOOS and other partners are developing a data portal and Atlas to support these planning efforts. During the next five years, the products and services focus areas include:

- development of the Northeast Atlas/Ocean Data Portal that will allow discovery, display, download, and analysis of geospatial and time-series information, and
- development of the ecosystem monitoring & modeling system that will facilitate adaptive management by documenting and interpreting change in biological, physical and biogeochemical environments, including species shifts and ocean acidification.

NERACOOS will develop performance measures to assess success in the implementation of the CMSP products and services. Possible performance measures include:

- number of geospatial layers delivered through the portal,

- contributions to the regional atlas, and
- number of products and services supporting ecosystem modeling and monitoring.

b. Cross-cutting Capacity

The development and implementation of DMAC, Education and Outreach, and Performance Evaluation programs will support all priority areas and will enhance the value and effectiveness of their products and services.

1. Data Management and Communication

A robust, scalable and cost effective DMAC system is a critical crosscutting component of NERACOOS. The DMAC system supports access to and archiving of observation and model data as well as information products. It will ensure that all NERACOOS data, services and information products are discoverable, accessible and implemented within a Service Oriented Architecture consistent with IOOS® recommendations.

NERACOOS has established a formal relationship with the Northeast Coastal and Ocean Data Partnership (NeCODP) to collaborate on the design and implementation of a regional DMAC system. The NeCODP membership includes academic, state, federal and non profit partners involved in the collection and delivery of data about Northeast watersheds, coasts and ocean environments.

Key observations, products, services and expected results:

NERACOOS represents a consolidation of several sub regional observing systems and its current DMAC system is comprised of DMAC components from these systems. A key goal for NERACOOS DMAC is to implement a more integrated DMAC system that leverages the accomplishments of past efforts and also implements the guidance from IOOS® as well as utilizing recent advances in information technology capabilities.

NERACOOS will deliver in the next five years a DMAC implementation plan that describes overall architecture of the NERACOOS DMAC system along with a phased approach to implementing the architecture that can be scaled with various funding scenarios. The DMAC plan will also describe how NERACOOS DMAC will achieve IOOS® certification once those standards are defined. The plan will describe how NERACOOS will:

- ensure that all data from NERACOOS supported observing and modeling activities are delivered through IOOS® recommended standards and services,
- provide end users with access to real time and historical data through formats and services that support their needs,
- ensure that all NERACOOS data products are discoverable and accessible,
- support the cost effective and scalable development of products for all priority areas,
- ensure all partners aggregated real-time observations and regional model outputs are archived with NOAA's National Oceanographic Data Center,
- ensure that all data and products have essential metadata regarding information sources and quality,
- ensure that all NERACOOS data services are registered, cataloged and monitored,
- develop and implement performance measures and usage statistics, and
- ensure that the NERACOOS DMAC system becomes IOOS® certified.

NERACOOS will develop performance measures to assess success in the implementation of the DMAC system and its products and services. Possible performance measures include:

- achievement of IOOS® data certification standards,
- uptime of DMAC system,
- usage statistics of products and services,
- completion of metadata for all data sets and models, and
- user feedback surveys.

2. Education and Outreach

NERACOOS supports an education and outreach program to ensure that users and stakeholders participate in the development of priorities for the system and can provide input on the design of the observing system, and partners can incorporate high quality data and information into educational tools, programs, and curriculum resources.

NERACOOS has established a formal partnership with the New England Ocean Science Education Collaborative (NEOSEC), a joint effort to promote ocean literacy in the region. NERACOOS provides rich ocean scientific resources to the collaboration. The partnership reaches multiple audiences – from pre-schoolers and their families to teen-aged summer campers to college students – via a membership that includes informal science centers, universities, research institutions, government entities and formal education networks.

In the next five years NERACOOS will develop and implement an outreach and communications strategy that builds off of the recommendations developed by the NERACOOS Education and Outreach working group and specifically will:

- increase awareness, understanding and use of NERACOOS and its products and services among key audiences including decision makers, accountability seekers, research and development partners, and ocean literacy,
- improve Ocean Literacy through collaboration with NEOSEC and other regional education programs that can help expand the use of NERACOOS information and tools in formal and informal education,
- expand and improve the NERACOOS engagement process to ensure that stakeholders have input into the priorities, design and products and services of the regional observing system,
- improve coordination among other regional organizations involved in regional ocean research, management and education, and
- establish performance and evaluation metrics to help identify the effectiveness of our strategies and identify specific areas where we need to improve our outreach and education program.

3. Performance and Evaluation

Measuring performance and evaluation provides an understanding of the benefits of NERACOOS services and products, and identifies suggestions for improvement. A fundamental measure of performance for an observing system is the economic value it produces. NERACOOS will develop a comprehensive view of the links between all assets and economic benefits, including the value of the investments from partners and users. NERACOOS currently tracks metrics for elements such as instrument uptime and web use by stakeholders. To expand performance and evaluation in the next five years, in addition to performance measures previously mentioned, NERACOOS will:

- develop operation metrics for the valuation of observing and modeling assets,
- develop a comprehensive framework for economic performance evaluation,
- populate the framework by collecting data to assess the value of NERACOOS products and services,
- identify a small set of current assets for detailed economic analysis, and
- implement metrics distributed by the IOOS® Program Office.