

Project Title:

The Continued Development of the Northeastern Regional Coastal Ocean Observing System

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Recipient institution name and address:

Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)

Award Number:

NA11NOS0120034

Period of Performance:

December 1, 2014 – May 31, 2015

1) Project Summary

Long-term goals- The overarching intent of this award is to continue operation and further the development of the integrated ocean observing system for the Northeast and to expand the user base through consultation and outreach. The major goals of this award are to coordinate regional management, maintain the observing subsystem, maintain the DMAC subsystem, maintain the Modeling and Analysis subsystem, and maintain capacity with Education and Outreach activities.

Objectives- Objectives for years one through three for this award are included below and reported on herein. Details can be found in the original work plan of the proposal submitted in the fall of 2010.

1.0 Coordinated Regional Management

1.1 NERACOOS Office maintained at base capacity.

2.0 Observing Subsystem

- 2.1 Planning for future enhancement and National Synthesis of Regional Build Out Plans (Year 1).
- 2.2 The Gulf of Maine buoy array will be maintained at current capacity (6 buoys – UMaine).
- 2.3 The Long Island Sound buoy array will be maintained at current capacity (3 buoys – UConn).
- 2.4 The Great Bay Coastal Buoy and Coastal Marine Lab will be maintained at current capacity (UNH).
- 2.5 The Gulf of Maine HFR array will be maintained at current capacity (3 locations – UMaine).
- 2.6 Nutrient work will be maintained (URI and BIO).
- 2.7 Enhanced observing capacity will also be obtained with the real-time telemetry Narragansett Bay Fixed-Site Water Quality Monitoring Network (URI).
- 2.8 HAB monitoring in the Bay of Fundy and satellite work will be maintained at current capacity (BIO).
- 2.9 Expanded ESP monitoring of harmful algal blooms in the Gulf of Maine (WHOI).
- 2.10 Enhanced observing capacity will be achieved with continuing the deployment of Jeffrey's Ledge CDIP wave buoy (UNH).
- 2.11 Enhanced observing capacity will be achieved with continuing the deployment of the Ocean Acidification buoy in the Gulf of Maine (UNH).
- 2.12 Enhanced capacity for buoy (UMaine) and water level observations (NERACOOS)
- 2.13 Enhanced capacity for satellite remote sensing

3.0 DMAC Subsystem

3.1 DMAC coordination will be maintained at current capacity and for Year 2 only, include work on the IOOS Data Portal (GMRI).

4.0 Modeling and Analysis Subsystem

- 4.1 The Northeast Coastal Ocean Forecast System will be maintained at current capacity (UMassD).
- 4.2 Operate and refine inundation models (UMassD).
- 4.3 The WaveWatch III wave model will be maintained at current capacity (BIO).
- 4.4 National Search and Rescue Optimal Planning System Short-Term Predictive System (SAROPS – STPS) effort will be maintained (UConn).

5.0 Outreach and Education

5.1 Current capacity at NERACOOS office will be maintained.

2. PROGRESS AND ACCOMPLISHMENTS

Objective 1 – Coordinated Regional Management

1.1 The NERAOOS office was maintained.

NERACOOS continues to collaborate with MOU partner Northeast Regional Ocean Council (NROC). Through the joint planning initiatives of the merged NERACOOS and NROC Ocean and Coastal Ecosystem Health Working Group, the Integrated Sentinel Monitoring Network (ISMN) continued its work. NERACOOS hosted a workshop in April to develop the Science and Implementation Plan for monitoring ecosystem change which will be distributed for public review in July. NERACOOS also leads the Northeast Coastal Acidification Network (NECAN), which is further updated in section 5.1.3.

Since the launch of the Northeast Ocean Data Portal in June 2011, the *Northeast Ocean Data Portal Working Group* efforts have focused on continued advancement of NROC identified priorities, including the integration of key datasets for Ocean Planning and the development of functionality to access, visualize, and analyze those data. NERACOOS remains a key partner and participant in the working group's activities.

NERACOOS continues to work together with other MOU partners the New England Ocean Science Education Collaborative (NEOSEC) and Stellwagen Bank National Marine Sanctuary (SBNMS) through participation in the SPI Team. Collaboration with a variety of other organizations in the region, such as the Gulf of Maine Council on the Marine Environment, was ongoing.

1.1.1 and 1.1.2 **Directors and SPI team continue to meet and update strategic priorities and products.** The NERACOOS Board of Directors continues to meet four times a year and met on December 4, February 24, and May 20. The strategic planning working group developed a new mission, vision, core values, and strategic priorities for NERACOOS and the Strategic Planning and Implementation (SPI) Team continues to hold monthly conference calls. A copy of the strategic priorities document for 2015 is available at neracoos.org/documents.

1.1.3 Ru Morrison **attended the regional coordination meeting** in March and continues as the Chair of IOOS Association.

1.1.4 **Progress reports to NOAA** have been submitted on time.

Objective 2- Observing Subsystem

2.1 The **Planning for future enhancement and National Synthesis of Regional Build Out Plans** was completed in year 1.

2.2, 2.2.1 The **Gulf of Maine buoy array was maintained** by the University of Maine (UMaine). Six buoys remained in operation for NERACOOS (B01, E01, F01, I01, M01 and N01). Buoy A01 was also in operation, see 2.12. Data from the active buoys were archived, processed, quality controlled, and made available in real-time on the web and sent to the Gulf of Maine Research Institute (GMRI) for dissemination to NERACOOS and the National Data Buoy Center (NDBC).

Winter storms caused temporary data loss and severe damage to several sensors on M, E, and F (all sensors have been recovered). Issues noted in the previous report on various other sensors like the wave direction sensors, continue to have problems and UMaine continues to work to resolve them. Buoy E0132 stopped reporting on April 21, just hours after receiving pictures from a fisherman showing the tower leaning over and only supported on two of the four legs. A trip was made to the buoy on April 30 but the tower was no longer attached. Preliminary indications are that the bolts may have worked

themselves loose during the winter storms. New buoy E (as others) will have nylox nuts with lock washers to protect against this in the future.

Preparations occurred during the reporting period for spring turnaround which was scheduled for the end of May on the NOAA ship RV Gordon Gunther but the cruise was cancelled. UMaine is now scheduling their turnaround for June with the RV Connecticut instead.

Old buoy N0116, which broke free from its anchor in January 2014, continues to drift. Acoustic telemetry receivers for NOAA/NMFS continue to be deployed on all buoys to track tagged fish.

2.3, 2.3.1 The **Long Island Sound buoy array was maintained** by the University of Connecticut (UConn). During the reporting period three axial buoy data streams (Central Long Island Sound, Western Long Island Sound, and Execution Rock) had limited transmission in real-time to the Long Island Sound Integrated Coastal Observing System (LISICOS), NDBC, and NERACOOS websites. Significant ice damage caused WLIS to break mooring and flip over. The buoy was recovered but is unreparable. UCONN will need to purchase a new buoy, and will do so with the next year of funding of this award. EXRX was also iced over and all sensors were damaged. A new EXRX was deployed, with assistance from the Sandy Supplemental funding, on May 20. The CLIS buoy also iced over and was damaged, and is currently in for repairs.

2.4 The University of New Hampshire (UNH) continued to maintain the **Great Bay Coastal Buoy and Coastal Marine Lab**.

2.4.1 UNH recovered the Great Bay Coastal Buoy on December 4 and deployed it for the season on April 23 (with new nutrient sensors through the Ocean Technology Transfer funded nutrient observatory).

2.4.2 The Coastal Marine Lab was also maintained by UNH and collected and served data but the meteorological station needs to be updated.

2.5, 2.5.1 The **Gulf of Maine High Frequency (HF) Radar array was maintained** by UMaine. Scheduled maintenance was completed at each of the three sites and good data coverage was seen with only a small number of outages due to power outages during winter storms. Data from UMaine CODAR sites (Greens Island [GRNI], Grand Manan [GRMN], and Cape St Mary [CSTM]) were all processed and made available to the national data aggregation center during this period.

2.6 University of Rhode Island (URI) and Bedford Institute of Oceanography (BIO) continued **nutrient work**.

2.6.1 **Atlantic Zonal Monitoring Program (AZMP) program** work continued at the BIO. Nutrient samples from the fall (October) cruise were processed, analyzed, quality controlled, and sent to DFO. Discussions have begun to integrate this data into NERACOOS. The Spring sampling was conducted in April.

2.6.2 The new Universal Data Acquisition and Communication System (uDACS) that was developed at URI as an alternative technological approach to integrate nutrient sensors to the NBFSMN YSI Systems in Narragansett Bay will be deployed with the SUNA V1 Optical Nitrate sensor on the URI Graduate School of Oceanography pier once pier repairs are completed, most likely the end of July.

2.7, 2.7.1 URI continued to work to enhance capacity with **Narragansett Bay real-time telemetry**. The two Narragansett Bay Fixed Site Monitoring Network (NBFSMN) stations were deployed in May and work continues to resolve data flow issues to NERACOOS.

2.8 Bedford Institute of Oceanography (BIO) continued their work on **Harmful Algal Bloom (HAB) monitoring in the Bay of Fundy and satellite work.**

2.8.1 The weekly HAB sampling for the 2014 season occurred in the last period but the analysis (BIO) has been delayed due to capacity and cost issues. Jennifer Martin has retired from DFO and there is no longer a staff person available to take samples in the future. NERACOOS has been in discussion with DFO about resolving this for 2015.

2.8.2 Collection, analysis and validation of satellite data (BIO) in an attempt to relate densities of *in situ* Alexandrium and diatoms to satellite SST has been to develop a warning product based on that relationship. A manuscript describing that analysis has been resubmitted for publication and undergone one revision.

2.9 Work by Woods Hole Oceanographic Institution to expand Environmental Sample Processor (ESP) **monitoring of harmful algal blooms** in the Gulf of Maine continued. During the reporting period, two ESPs were successfully deployed in the western Gulf of Maine in May. ESP 3 is currently being prepared for deployment in June. Data from the ESPs are also now available through the WHOI server and NERACOOS ERDAPP (including cell counts, which will be added to NERACOOS during the next period).

2.10, 2.10.1 UNH continued the operation of the **Jeffrey's Ledge Datawell waverider buoy** after turnaround in May with a new mooring and sinker.

2.11 UNH continued the operation of the UNH Pacific Marine Environmental Laboratory (PMEL) **Ocean Acidification buoy** in the Gulf of Maine, measuring Carbon Dioxide, Oxygen, Temperature, and Salinity.

2.11.1 Ocean Acidification buoy deployment and turnaround- Data can be seen on the NERACOOS and PMEL websites. The buoy performed as expected and was visited for validation samples multiple times during the reporting period.

2.11.2 **Support graduate student for ocean acidification work** began in August. Student Melissa Melendez is making progress in her second semester.

2.12 **Enhanced capacity for buoy (UMaine) and water level observations (NERACOOS)**

2.12.1 Buoy A01 continued to report data along with the UMaine array, even though it moved approximately 100m during the blizzard in January. Brad Butman of USGS analyzed the data from the transmissometer which shows that winter storm Juno in January was a major event at buoy A. Spring turnaround will occur next month.

2.12.2 Tide gauges in Gloucester and Scituate remained in service with some downtime. Data is up to date and stored on site and on remote storage servers. Both instruments have functioned entirely on solar power and have provided tide level information with 1/10 of an inch accuracy.

2.13 **Enhanced capacity for satellite remote sensing.** NERACOOS provided funding for data acquisition and processing to the University of Maine's Satellite Oceanography Data Lab for regional satellite projects including Gulf of Maine and Long Island Sound. Satellite images for the entire NERACOOS region are available through December 2014.

Objective 3- Data Management and Communications (DMAC) Subsystem

NERACOOS DMAC Lead Eric Bridger of GMRI continues with monthly Regional DMAC conference calls and webinars, and participation in the Annual DMAC Workshop in May.

3.1 The Gulf of Maine Research Institute (GMRI) continued to coordinate **the DMAC subsystem.**

3.1.1 GMRI has continued **implementation of the Regional Data Management Framework** by working with partners to incorporate their data which is the final step toward bringing the DMAC framework into full functionality.

3.1.2 GMRI continued with **SOS and TDS Implementation.** Eric Bridger continued to have conversations with IOOS on the resolution of the CF 1.6 compliance, specifically at the National DMAC workshop. The issues are with its limitations with sensors at multiple depths and parameters for continuous monitoring. Eric and Bob at UMaine made major progress this quarter. At the national level, other RAs experienced the same issues and raised the issue to IOOS and developers of the CF standard. They have acknowledged the issues and have indicated they will research and help with solutions. This has been a tremendous time sink for GMRI and our data providers.

The AWS system was upgraded so that THREDDS and ERDDAP have isolated instances with resources that better match the system's requirements.

3.1.3 There are no new updates on **NODC archival implementation** this period as work is on hold until all partners are producing standards compliant data. GMRI continues to be ready to achieve this milestone once all partners are producing standards compliant data (see issues described in 3.1.2).

3.1.4 GMRI continued to **maintain the NERACOOS DMAC System** by managing web presence, resolving issues, and maintaining products. As noted above, the AWS servers were upgraded but also put new contract in place. GMRI is working on a new model data viewer and an update to the home page design.

Objective 4- Modeling and Analysis Subsystem

4.1 During the reporting period the University of Massachusetts at Dartmouth (UMassD) **maintained the Northeast Coastal Ocean Forecast System (NECOFS).**

4.1.1 **UMassD maintained and improved NECOFS.** UMassD monitored performance daily of its 24/7 operation during the reporting period. Work continues to upgrade the NECOFS code to a global-regional nested system. UMassD continue to provide the GRIB2 output domain for the northeast National Weather Service offices.

4.1.2 UMassD continued operation of the **3-way fully coupled WRF/SWAVE/FVCOM system.**

4.1.3 UMassD is working on **adding annual hindcast to archive** for 2014.

4.2, 4.2.1 UMassD continues to **operate and refine inundation models** for Scituate, MA and Hampton/Seabrook, NH and both have been integrated into the NECOFS system. They have begun to develop Saco and Boston Harbor/Mass Bay FVCOM inundation models as well.

4.3, 4.3.1 The **Wavewatch III wave model was maintained** by BIO. Coding is being updated for time series comparisons of models and buoy data. BIO continues using v.4.18 and implementing and resolving bug fixes. Formulation for wave-ice interactions is being planned for implementation in WWII.

4.4, 4.4.1 UConn continued **national SAROPS – Short Term Prediction System (STPS)** efforts.

Objective 5- Education and Outreach

5.1 **Current capacity at NERACOOS office was maintained.** A major focus for the NERACOOS outreach and communications program continued to be staff participation in key meetings, symposia,

workshops, etc. that are attended by our stakeholders. This allowed us to frequently and efficiently inform our diverse stakeholders about our activities, data and products. Additionally, these meetings provided a valuable opportunity for us to hear from stakeholders about their data and product needs as well as learning about their use and value of NERACOOS information. Some of the meetings attended in the reporting period included; Maine NECAN Stakeholder workshop, Island Institute's Preparing for an Uncertain Fishing Future, Massachusetts Lobstermen's Association Annual Tradeshow, NEOSEC Annual retreat, Latitude 41 under Siege: Impact of Nutrient Pollution & OA on Coastal Waters, Estuaries and Marine Life, Citizen Science 2015, Marine and Oceanographic Technology Network (MOTN) Board of Directors Meeting, Maine Fishermen's Forum, Integrated Sentinel Monitoring spring workshop, Northeast Regional Ocean Council spring meeting, MERHAB Technical Advisory Committee, Long Island Sound Citizen Summit, Massachusetts State of the Bays Symposium, Massachusetts NECAN Stakeholder workshop, Great Bay Nutrient Observatory Stakeholder workshop.

Two engagement highlights of the reporting period were the NERACOOS Annual Meeting and a NERACOOS sponsored cruise on Long Island Sound. On December 4th, over 90 stakeholders participated in the NERACOOS Annual Meeting, which included a series of breakout panel discussions and the premiere of an IOOS video featuring Captain David Gelinas of the Penobscot Bay and River Pilots Association. On May 19th, several staff members from the Connecticut congressional delegation, along with NERACOOS Board Members, Scientists and staff participated in a tour of the University of Connecticut's Avery Point Campus and a cruise on Long Island Sound. This event helped highlight the importance of NERACOOS' observations and modeling to industry, resource management, research and education in and around Long Island Sound.

NERACOOS continued its use of social media as a communications tool. This effort included regular Facebook posts that highlighted NERACOOS activities, data and products along with related activities and news. We also continued distribution of our stakeholder e-newsletter and our member e-newsletter. Through the IOOS E&O calls we worked with other Regional Associations to share best practices and lessons learned to help us all use social media more effectively.

NERACOOS continued its collaboration with the Gulf of Maine Climate Network and their communication activities, which includes a quarterly Climate Impacts and Outlook for the Gulf of Maine region. Each season, US and Canadian climatologists and meteorologists share data and collaboratively plan the Outlook, which offers an engaging two-page snapshot of the past season's events and anomalies; discusses impacts on the region's ecosystems and economy; and offers a forecast for the coming three months. NERACOOS and the University of Maine's School of Marine Sciences provide satellite-derived sea surface temperature maps for the Outlook.

NERACOOS continued to monitor and evaluate website use with google analytics and other tools. Visitors to the NERACOOS website from mobile devices continue to increase (see Figure 1). Our evaluation along with feedback from end users suggested that certain products were hard to find on the website and that NERACOOS was not ranked high in some web searches with key search terms closely related to NERACOOS data. Therefore, we have initiated an effort to update our home page and navigation with the goal of making it easier for stakeholders to find data and products when conducting web searches and when visiting the NERACOOS website. We will be launching a new website design at the 2015 annual meeting.

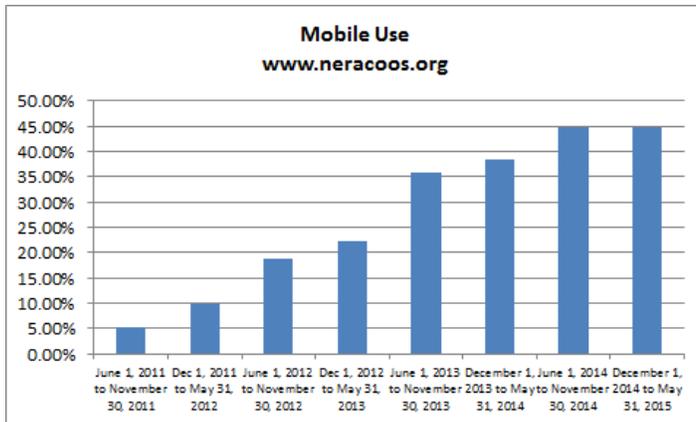


Figure 1. The percentage of people accessing the NERACOOS website from mobile devices. Since being optimized in 2013, mobile use has greatly increased.

NERACOOS continues to host and coordinate the Northeast Coastal Acidification Network (NECAN). The steering committee continues to work on the synthesis of the science into a technical document, and coordinating stakeholder workshops.

NERACOOS continues its education efforts including the promotion of the Northeast Fisheries Science Center Drifter Program by hosting school webpages at www.neracoos.org/drifters, participation in IOOS Association Outreach Committee monthly calls, and engagement through the Board of Directors for the Gulf of Maine Marine Education Association (GOMMEA). NERACOOS also continues to collaborate with the New England Ocean Science Education Collaborative (NEOSEC) for its educational efforts in addition to Summit planning (see below), by participating in the Governing Council, and Cassie Stymiest is currently the Chair Elect.

Working closely with Amanda Sobel, a Teaching Assistant at the University of New Hampshire, Cassie assisted with a class of marine biology students on independent projects. They all focused on using buoy data, and presented their results at the Annual Meeting in December.

NERACOOS also successfully established an internship program with support from New Hampshire EPSCOR. Both interns started at the end of May and will be helping with ISMN and NECAN.

5.1.1 NERACOOS helped to **sponsor the NEOSEC summit** during the last reporting period. The next summit will be in 2016 and planning has already begun.

5.1.2 NERACOOS provided **travel support for the Northeast Regional Planning Body Meeting** held on June 3-4.

5.1.3 NERACOOS **supported the Northeast Coastal Acidification Network (NECAN) Stakeholder Engagement** via coordinating stakeholder engagement workshops in Maine in December, Cape Cod in April, Rhode Island in June, and Gloucester in June as well. Subsequent workshops are being planned for Connecticut in November and Canada in October. These workshops will be integral to the development of an implementation plan to be developed this summer.

3. SCOPE OF WORK

During the next reporting period similar activities will be undertaken to keep all aspects of the program moving forward.

4. PERSONNEL AND ORGANIZATIONAL STRUCTURE

In December, elections occurred and the following officers were approved for terms of 2014-2016: Steve Lohrenz (President), Peter Smith (Vice President), Matthew Lyman (Treasurer), and Anthony

Kirincich (Secretary). At the same meeting, elections occurred and the following directors were approved for terms of 2014-2017: Alfred Hanson, Joe Salisbury, Ames Colt and Matthew Lyman. Andy Pershing will be completing the rest of Blaine Grimes term through 2015. Dave Hebert was approved as the alternate for Peter Smith and Blaine Grimes was approved as the alternate for Andy Pershing. In February, Matt Liebman was approved as a non-voting alternate for Mel Cote. In February Dave Casoni stepped down from the board and Arthur Sawyer was approved as a Director and for Beth Casoni to be his alternate. Individuals that have stepped down from the board during the period include: Malcolm Spaulding, Linda Mercer, Christine Tilburg, Ames Colt, and Jon Pennock.

5. BUDGET ANALYSIS

Expenditures during the reporting period were \$1,031,430 including those at the NERACOOS office and for contracts and subawards (\$804,418). The expenditures should match ASAP draw downs.

Table 1: Breakdown of expenditures to date

NOAA FY11 Award NA11NOS0120034			Budget (June 1, 2014 to May 31, 2015)	Performance Period
				Dec 1, 2014 to May 31, 2015
Expense - NA11NOA0120034				
Direct Expenses				
	6.a. · Payroll		194,151	107,483
	6.b. · Fringe		70,535	39,048
	6.c. · Travel		38,622	12,000
	6.e. · Supplies		8,263	0
	6.f. · Contractual			
		UConn (A002-001)	329,999	249,908
		UMaine (A002 -002)	794,999	202,450
		URI (A002-003)	60,000	9,410
		UNH (A002-004)	254,661	124,264
		UMass Dart (A002-005)	90,000	49,950
		GMRI (A002-006)	90,000	60,264
		Bed Inst Ocean (A002-007)	30,000	0
		WHOI (A002-008)		108,172
	Total 6.f. · Contractual		1,674,659	804,418
	6.h. · Other		57,350	26,000
	Total Direct Expenses		2,043,580	988,949
	6.j · Indirect Expense*		90,681	42,481
			2,134,261	1,031,430

* Indirect expenses reflect those charged and not a given rate. Future adjustments of these amounts are anticipated.