

***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:***

June 1, 2012 – November 30, 2012

## 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.

**Objectives-** Since multiple awards were in place during the reporting period, objectives for years one and two for this award are combined below and reported on herein. Details can be found in the original work plan of the proposal submitted in the fall of 2010.

1. Coordinated Regional Management
  - 1.1. NERACOOS office at base capacity.
2. Observing Subsystem
  - 2.1. Year 1 only: Planning for future enhancement and National Synthesis of Regional Build Out Plans.
  - 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 will be maintained at current capacity (UNH).
  - 2.5. The Coastal Marine Lab will be maintained at current capacity (UNH).
  - 2.6. The Gulf of Maine HFR array will be maintained at current capacity (3 locations – UMaine).
  - 2.7. HAB monitoring in the Bay of Fundy work will be maintained at current capacity (BIO).
  - 2.8. MERIS satellite work will be maintained at current capacity (BIO).
  - 2.9. Nutrient work will be maintained at base capacity (URI).
  - 2.10. Enhanced observing capacity will also be obtained with the real-time telemetry Narragansett Bay Fixed-Site Water Quality Monitoring Network (NBFSMN, URI, SubChem).
  - 2.11. Maintain capacity of the AZMP program (BIO).
  - 2.12. Year 1 only: Enhanced observing capacity will be achieved with continuing the deployment of Jeffrey's Ledge CDIP wave buoy (UNH).
  - 2.13. Year 2 only: Enhanced observing capacity will be achieved with continuing the deployment of the Ocean Acidification buoy in the Gulf of Maine (UNH).
3. Data Management and Communications Subsystem
  - 3.1. DMAC coordination will be maintained at current capacity (GMRI).
  - 3.2. Year 2: Include work on the IOOS Data Portal (GMRI).
4. Modeling and Analysis Subsystem
  - 4.1. The Northeast Coastal Ocean Forecast System will be maintained at current capacity (UMassD).
  - 4.2. The WaveWatch III wave model will be maintained at current capacity (BIO).
  - 4.3. Year 2 only: National SAROPS – STPS effort will be maintained (UConn).
5. Outreach and Education
  - 5.1. Current capacity at the NERACOOS office will be maintained.

## 2. PROGRESS AND ACCOMPLISHMENTS

Two awards were in place during the reporting period to support the operations of the observing system for NERACOOS (#NA11NOS0120034 and #NA10NOS4730019) where there is a large amount of overlap in goals and objectives, and in work completed. Activities funded under award #NA11NOS0120034 are reported on herein to the best of our ability.

In October 2012, Hurricane Sandy passed through the region. NERACOOS provides nearly half the continuous near real-time at sea assets in the region from Long Island sound to Canada. In Long Island Sound NERACOOS provides all of the at sea near real-time assets, which proved to be very valuable

during and after Sandy. All buoys were operational during the storm with those in the Gulf of Maine reporting for the duration of the storm. The sensors in Long Island Sound operated successfully throughout the storm in conditions never observed before but went offline due to power outages on land. Coastal High Frequency Radars (HFR) from Long Island Sound to Maine were operating and reporting sea surface currents. Coastal wave and inundation forecasts (WWIII – BIO) were available throughout the storm, and coastal inundation forecasts (NeCOFS – UMassD) were available before the storm impacted the modeling facility. Damage was sustained to one surface current measuring HF Radar antenna from the University of Connecticut group. The national HFR data center at Rutgers University went down but data from the UMaine HFR was rerouted to the University of California San Diego. Data and the storm track were provided through the NERACOOS Real-Time Data Portal which included hourly information developed for marine operations. Web traffic for all three days of the storm (10/28 to 10/30) was up 300% with a peak of 800% on 10/29. There were over 13,300 page views for the three days with about 20% going to the real-time portal. More information can be found in the NOPP report submitted in November.

## **Objective 1 – Coordinated Regional Management**

1.1 The **NERAOOS office was maintained**. NERACOOS completed their annual audit in November and hired an Administrative Assistant in October. The NERACOOS Board of Directors continues to meet four times a year and met by webinar on August 22. A working group has been appointed to assess evolving funding opportunities and membership. During the meeting, the board approved the nomination of Marianne Molchan to replace Jack Ringelberg (through 2013), Steve Withrow as Cheryl Zimmerman’s alternate (through 2013), and Blaine Grimes joining the board (through 2013). The Strategic Planning and Implementation (SPI) Team continues to hold monthly conference calls and met on September 25. Currently the primary focus of the SPI team is long term planning of observing equipment. Assessments for equipment are being compiled by all the PIs to better understand the status of their aging equipment.

NERACOOS continues to partner with regional organizations on the *New England – Canadian Maritime Collaboration and Planning Initiative* where plans are being made for an update meeting in 2013. NERACOOS also continues to collaborate with partner Northeast Regional Ocean Council (NROC). NERACOOS PIs participated in the NROC hosted Northeast LiDAR & Sea Level Rise Mapping Workshop in July. NERACOOS and NROC working groups for Coastal Hazards and Ecosystem Health were merged, continuing to increase regional collaboration and efficiency. The Ocean and Coastal Ecosystem Health working group has begun work to develop a Northeast Integrated Sentinel Monitoring project plan.

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 Coastal and Marine Spatial 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, and provides ESRI licenses for the working group members.

Merger of the *Northeast Coastal and Ocean Data Partnership (NeCODP)* with NERACOOS was agreed upon at the September 26 NeCODP annual meeting. Member presentations from the meeting can be downloaded from the NERACOOS website. Tom Shyka will chair the partnership and NERACOOS will provide support for meetings and webinars. Partnership activities include: identification of common issues, webinars on data management efforts, meetings to share information, expand/re-populate the executive committee training/workshops, and to revisit technical guidance development.

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 was ongoing. NERACOOS representatives attended numerous meetings during the reporting period including those of the IOOS including the Summit held in November, National Federation of Regional Associations (NFRA, now IOOS Association), Gulf of Maine Council, Mid-Atlantic Regional Association for Coastal Ocean Observing Systems (MARACOOS), NROC, Regional Planning Body, Casco Bay Estuary Partnership. Other meetings included Gulf of Maine in A Changing Climate, National Marine Fisheries Service (NMFS) meeting, National Centers for Environmental Predictions (NCEP), Energy Ocean International, NASA Coastal and Inland Water Quality Remote Sensing Workshop, NMFS Climate Workshop, NMFS River Herring Workshop, and Woods Hole Oceanographic Institution's Laboratory for Ocean Sensors and Observing Systems dedication.

NERACOOS continues to make access easier to data and tools for users. NERACOOS staff worked closely with web development partners to have the new Climatologies product ready for release on Dec 4, 2012 and other products documented below and in the supplemental document. During this time period two NERACOOS newsletters were released.

## **Objective 2- Observing Subsystem**

2.2 The **Gulf of Maine buoy array** was maintained by the University of Maine (UMaine). During the reporting period, all work at UMaine was funded through this award (since April 2012). Six buoys remained in operation for NERACOOS (B01, E01, I01, M01, N01, and F01) during the reporting period, with data return of approximately 90%. Data from the active buoys are archived, processed, quality-controlled, and made available in real-time on the web and sent to GMRI for dissemination to NERACOOS and the National Data Buoy Center (NDBC). Data from other UMaine moorings, including A01 ((with funding through LNG mitigation and Massachusetts Water Resources Authority) and D02 (Bowdoin College with NASA funding), are being sent to Gulf of Maine Research Institute (GMRI) for dissemination to NERACOOS. The DeepCwind buoy E02 was recovered in June, and may be redeployed in 2013. All UMaine NERACOOS buoys continue to have fish tag telemetry receivers for NMFS. The UMaine buoy group assisted in the staging and logistics for the deployment and later recovery of the Wave glider and Fetch instruments by Liquid Robotics and Sonardyne personnel. The UMaine group continues working with the NERACOOS Products Team to develop climatologies. Gulf of Maine buoys that were redeployed in October all now have capacity to measure wave direction. During the reporting period, there were some data issues. Inductive modem (IM) instruments for A01 continue to be intermittent, the GPS failed in July (backup GPS okay), and the 50m dissolved oxygen sensor failed November 7 (values too low). Issues for I01 include failure of the Doppler current meter in July (battery failure), failure of 2m temperature in April, but current speed and directions still valid and failure of 20m IM in November. M01 failure of the secondary wind direction sensor in August, but primary sensor winds were fine. Issues for N01 included 20m IM stopped reporting on August 10, 100m IM stopped reporting June 21, and IMs becoming intermittent starting November 16. Issues for E01 include 20m/60m IMs became intermittent in October, last IM data received in November, and attempts to talk-through were unsuccessful. In September, 20m IM salinity failed for F01 (values too low).

2.3 The **Long Island Sound buoy array** was maintained by the University of Connecticut (UConn). During the reporting period, all work at UConn was funded through this award (since April 2012). Three axial buoy data streams (Central Long Island Sound, Western Long Island Sound, and Execution Rocks) and two stationary (Ledge Light and Norwalk Aquarium) sites remained operational. These data streams were transmitted in real-time to the Long Island Sound Integrated Coastal Observing System (LISICOS), NDBC, and NERACOOS websites. An extensive red planktonic bloom was noted while servicing the buoys in September. Analysis by Dr. Senjie Lin at UConn, Marine Sciences revealed that the bloom was caused by the red ciliate *Mesodinium rubrum*, and it was hypothesized that the unusually

warm temperatures may have contributed to the large-scale nature of the bloom. UConn deployed a glider in July for two days with other secured funds. The UConn group continued working with the NERACOOS Products Team to develop climatologies. During Hurricane Sandy at the end of October, early November, power was lost on campus. Backup systems are now being considered. On June 6<sup>th</sup> the Central Long Island Sound buoy was hauled for maintenance and upgrades, including hull refurbishment, installation of new meteorological sensors, and the addition of a buoy-mounted acoustic Doppler current meter. The buoy was redeployed on July 12<sup>th</sup>. The surface YSI was serviced in August and October. The Western Sound buoy was serviced on June 21<sup>st</sup>, July 17<sup>th</sup>, August 8<sup>th</sup>, August 29<sup>th</sup> and September 24<sup>th</sup>. YSI's (surface, mid-depth and bottom) were swapped out during each servicing and the bottom SBE37 IDO visually examined and cleaned as needed by divers. The Execution Rocks buoy was serviced on June 21<sup>st</sup>, July 17<sup>th</sup>, August 8<sup>th</sup>, August 29<sup>th</sup> and September 24<sup>th</sup>. The SBE19's at mid and bottom were cleaned by divers during the June 21<sup>st</sup> servicing and the surface YSI swapped. The bottom SBE19 was removed on July 17<sup>th</sup> and replaced with a YSI as it had stopped transmitting. The unit was taken back to the lab for analysis. August 8<sup>th</sup>, the surface and bottom YSI's were swapped and the recently repaired SBE37 IDO was reinstalled as a redundant sensor near bottom. The mid-depth SBE19 sensor was removed on August 29<sup>th</sup> as it had stopped transmitting an YSI was installed in its place. September 24<sup>th</sup>, all three YSIs were serviced. The bottom SBE37 IDO visually examined and cleaned by divers.

2.4 During the reporting period, the University of New Hampshire (UNH) also worked with funds from award #NA10NOS4730019. The **Great Bay Coastal Buoy** was maintained by UNH for its eighth season of biogeochemical monitoring, beginning in June. However, there continues to be telemetry problems. The buoy was turned around in August. Beginning the 2<sup>nd</sup> week of November, the buoy no longer actively collected data. The buoy is not powering up on schedule and UNH cannot connect with a serial connection. The battery and charging system seem fine. Everything that can be tested with the buoy in the water has failed.

2.5 The **Coastal Marine Lab** was also maintained by UNH and actively collected and served data. The Carbon Dioxide (CO<sub>2</sub>) sensor and In-Situ Spectrophotometer (ac-9) were removed in the summer for NOAA and NASA sponsored cruises. The ac-9 was redeployed on November 17. The Sea Surface Salinity (SSS), Sea Surface Temperature (SST), Photosynthetically Active Radiation (PAR), and Oxygen met variable remained active. The met tower's temperature sensor is down. A new method of frying the sample CO<sub>2</sub> gas known as the reflux method was tested. This makes the system more efficient and robust because it no longer requires drying tanks.

2.6 The **Gulf of Maine High Frequency (HF) Radar** array was maintained by the University of Maine (UMaine). All intended work was completed at each of the three sites and good data coverage was seen. All data were sent to the national Coastal Ocean Dynamic Applications Radar (CODAR) backbone site in California. During the reporting period, UMaine upgraded the central CODAR site with a new Mac computer and software. UMaine also paired the production of elliptical files at Green Island to improve coverage in the Gulf of Maine (multi-static processing upgrade).

2.7 During the reporting period, Bedford Institute of Oceanography (BIO) efforts were all funded under this award (since October 2011). **Harmful Algal Bloom (HAB) monitoring in the Bay of Fundy** continued at BIO. BIO continued its work detecting *Alexandrium* using remote sensing data in the pilot area of the outer Bay of Fundy. The 2011 results of the new prototype HABs warning product, based on the inverse correlation between diatom and dinoflagellate (*Alexandrium*) concentrations, have been sent SABS for comparison with the field counts data, and independent radiation and SST measurements are being compared to those from remote sensing. The overall success rate for the 2011 field season will be assessed and discrepancies used to improve the algorithm. Results of the (potentially) revised algorithm will be compared to the 2010 field data, which await analysis. In addition, broad biweekly surveys of the

Bay of Fundy were initiated in early June to determine spatial and temporal distributions of *A. fundyense*. The 2012 HABs sampling season was completed in September. Weekly samples were collected from 7 sites as well as broader Bay of Fundy samplings in early, mid and late June and July. All samples have been analyzed for *A. fundyense* cell abundance. With completion of the 2012 HABs sampling season at SABS in September (including broader Bay of Fundy samplings in June and July), and their analyses for *A. fundyense* cell abundance, and completion of the microscopic counts of cell concentrations, the next step is ground truthing of algorithms determined from satellite imagery.

2.8 **MERIS satellite work** was continued (BIO). The MERIS satellite-based detection algorithm was tested and refined using additional data from 2011 and 2012 and some promising results were indicated. A manuscript describing the method and results is being prepared for publication. Unfortunately communication with the satellite which houses MERIS was lost in April, and while waiting for the launch and data availability of OLCI on Sentinel-3, the suitability of MODIS Aqua data as a replacement for MERIS will be investigated. This requires considerable additional work to transport the algorithms to MODIS data, adapt it to the waveband specifications of MODIS, which are different from MERIS, and additional tests are required to establish the validity of the algorithm as implemented for MODIS data.

2.9 University of Rhode Island (URI) efforts were all funded under this award (since October 2011) and **nutrient work** was continued. During the reporting period, sensors from the URI Graduate School of Oceanography (GSO) pier remained out of the water for service and repair. One of the nutrient sensors from Sensor Array 2 remains with the manufacturers for diagnosis and repair. A second sensor was repaired and returned in September by the vendor, after agreeing to a discount for the repair costs. These sensors will be redeployed on the URI GSO pier once repaired.

2.10 URI continued to enhance capacity with **Narragansett Bay real-time telemetry**. Field testing with newly improved ChemFIN Nitrate sensor has been delayed because it also needs to be repaired by SubChem. It is intended to be deployed on one of the YSI buoys in Narragansett Bay, once the network connections to the NERACOOS portal are completed. Engineering work is in progress by SubChem, URI and Rhode Island Department of Environmental Management (RI DEM) to develop and demonstrate the capability to have nutrient sensors coupled to some of the Narragansett Bay Fixed Site Monitoring Network (NBSFMN) stations, and will report nutrient data to the NBSFMN and NERACOOS in real time.

2.11 **Atlantic Zonal Monitoring Program (AZMP) program** work continued at BIO. The ongoing AZMP regular, semi-annual sampling of nutrients and hydrographic properties did not happen in the spring due to a cruise cancellation, but the fall version was completed in October. Processing of data will take place at BIO, and results will be made available online through the BIO hydrographic database. Nutrient sections continue to be used in conjunction with current data to estimate nutrient fluxes into the Gulf of Maine.

2.12 UNH continued operation of the buoy on **Jeffrey's Ledge Datawell waverider buoy**. Although this was only an objective for year 1, the buoy remains deployed with data feeding into the NERACOOS system. This effort complements the other CDIP buoy in the region operated by the US Army Corps of Engineers off Block Island that is also already integrated into NERACOOS and contributes to the National Wave Plan.

2.13 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, Salinity, Chlorophyll, dissolved organic matter, and turbidity at the surface. The data can be seen on the NERACOOS and PMEL websites.

### **Objective 3- Data Management and Communications (DMAC) Subsystem**

3.1 Ru Morrison continued his work on the Interagency Ocean Observation Committee DMAC Steering Team by attending the September 5 and 6 meeting. During the reporting period, all Gulf of Maine Research Institute (GMRI) **DMAC coordination** efforts were funded under this award (since December 2011). GMRI contributed a DMAC component to sentinel observing white paper for the IOOS Summit. GMRI began development of ncSOS implementation plan, and developed NERACOOS data streams spreadsheet for NFRA. Work is underway to integrate URI efforts including the in-situ nutrient measurements and the Narragansett Bay Fixed Site Monitoring Network. Cloud server work included migration of the dependent buoy database as well as solving FTP and backup issues. United States Geological Survey tide stations were also included into the NERACOOS data stream and available through the real-time portal. Routine activities included web and aggregation database maintenance, daily checks, trouble shooting, and bug fixes. GMRI also participated in bi-weekly Regional DMAC Conference calls and SOS reference team calls. GMRI developed Real Simple Syndication (RSS) feeds for individual buoys and preliminary text-a-buoy services using Twitter and RSS. GMRI leads the Product Team with creating and implementing products like climatologies, bringing drifter data into NERACOOS, and scoping a regional portal to improve data access. GMRI helped develop a customized forecast for the Newport America's Cup in July. GMRI is developing a Regional Data Management Plan and continues work with NeCODP Executive Committee with developing work plans, and helped hold the NECODP workshop on September 26.

3.2 GMRI also started work on the IOOS Data Portal.

### **Objective 4- Modeling and Analysis Subsystem**

4.1 During the reporting period, University of Massachusetts at Dartmouth (UMassD) work was also funded under award # NA10NOS4730019. The UMassD maintained the **Northeast Coastal Ocean Forecast System (NECOFS)** and monitored system performance daily. Recently NECOFS was updated by assimilating the current meter data recorded on the NERACOOS buoy network into NECOFS to reduce the uncertainty of the forecast field for water currents in the Gulf of Maine, particularly along the coastal region. UMassD spent significant time on upgrading the Gulf of Maine Finite Volume Coastal Ocean Model (FVCOM) by integrating it to the global-ocean models. UMassD set up the graphical user interface to auto-download the real time meteorological forcing and river discharge data over the world scale. These data are required to drive the global ocean FVCOM. The daily river discharge can be auto-downloaded, but real-time data from the Canadian Rivers are unavailable. UMassD is working with scientists at BIO to find a way to get a real time data. Work also continues to place the global-FVCOM into the forecast operation. UMassD developed a new Web Mapping Services (WMS)-based NECOFS website display system, which includes both the Google-based displays of forecast and hindcast results. The WMS website has been continuously improved by 1) uploading all hindcast results of GOM3-FVCOM from 1978-2010; 2) adding the model-data comparison for the NECOFS forecast fields; 3) making it easy to view the 3-D fields of water currents, temperature and salinity, etc. The sub-grid FVCOM configuration was completed for Hampton, New Hampshire. The GOM3-FVCOM grid was modified to enable auto-nesting with the Hampton inundation model. UMassD completed revising a manuscript for Hurricane Bob simulation, and are working on two manuscripts for Scituate inundation simulation occurred in 2005, 2007 and 2010. UMassD continues to work on synthesis of global-FVCOM results from 1978 to 2010 for studying climate change in the Gulf of Maine ecosystem change, particularly the physical mechanism of the salinity anomaly. Plans are underway to upgrade the Weather Research and Forecasting Model (WRF) to extend its capability for predicting hurricanes. NECOFS had to be shut down during Hurricane Sandy due to closure at the university and options to assure uninterrupted operations during storms are being reviewed.

4.2 The **Wavewatch III model** was implemented on a new computer platform at BIO, and plotting programs to display the field outputs from model runs have been revised and tested. A new version of the model has been brought online, and is being tested. Some bugs were discovered related to the specification of ice floes, which is important for model forecasts over the Grand Banks in late winter. These are being corrected by implementing patches suggested by the model developers in NOAA.

4.3 UConn continued **national SAROPS – Short Term Prediction System (STPS)** efforts. UConn operated the computer system to automatically retrieve data from the national HF Radar database hourly for the national grid and compute the STPS forecasts for 24 hours and share the results with the United States Coast Guard’s Environmental Data Server. The Gulf of Mexico, Florida and Hawaii, and West Coast are also operational and streaming on the web.

## **Objective 5- Education and Outreach**

5.1 NERACOOS continues to collaborate with the New England Ocean Science Education Collaborative (NEOSEC) for its educational efforts. During the reporting period, NERACOOS was busy planning and co-sponsoring the 2012 NEOSEC Ocean Literacy Summit held in November at the University of Rhode Island. The Summit was a great success, highlighting ocean exploration. This unique event brought together approximately 180 people from around New England that are involved and interested in formal and informal ocean education. Highlights of the two day event included a “Gallery of Exploration” and speech by NOAA Deputy Administrator Dr. Kathryn Sullivan, keynote address by ocean explorer Dr. Robert Ballard, and a multi-disciplinary panel of explorers focused on the question “why should we explore”. Attendees chose from 15 concurrent sessions, each of which featured a scientist and educator as co-presenter. Many NERACOOS partners were speakers and/or attendees, including NERACOOS staff who had an exhibit table and hosted three sessions: Ocean Observing Information for Everyone, Predicting Hazards Using Scientific Models, and Mapping the Ocean for Energy Resources. The summit provided a great opportunity to share with educators how NERACOOS could be used in the classroom to engage students about the ocean. One attendee noted the summit as a “truly useful and energizing event”. NERACOOS will host the presentations and resources from the event at [neracoos.org/education](http://neracoos.org/education).

A one pager of resources for educators was created prior to the summit and shared with the attendees. The education section of the website was also updated with these resources. Educational efforts also included improved data access for educators by integrating drifter data from the Northeast Fisheries Science Center, provided content for exhibit at Marine Science Magnet High School in Southeastern Connecticut, continued work as science and technology partner to Families by the Seaside grant, and continued participation in National Federation of Regional Associations (NFRA, now IOOS Association) Education and Outreach Committee monthly calls. Work continues on the development of an exhibit at the Seacoast Science Center in Rye, NH to highlight Right Whale research in Stellwagen Bank National Marine Sanctuary. Staff provided materials for the IOOS booth at National Marine Educators Association in Alaska, attended the Boston Harbor Educator Conference, and taught a co-taught course on Ocean Optics and observing networks in Scotland.

NERACOOS continued to use a variety of outreach channels to reach its stakeholders including the release of the fall quarterly e-newsletter, adding website features, posting weekly Facebook updates, hosting focus group at the ME/NH Port Safety Forum, and collaboration with the Mid Atlantic Regional Association for Coastal Ocean Observing Systems (MARACOOS) and the Southeast Coastal Ocean Observing Regional Association (SECOORA) on an East Coast Ocean Energy Working Group. Outreach efforts also continued with participation in a Metrics Webinar, Newport America’s Cup, Oceans 12 MTS/IEEE, and presenting to the Public Service of New Hampshire.