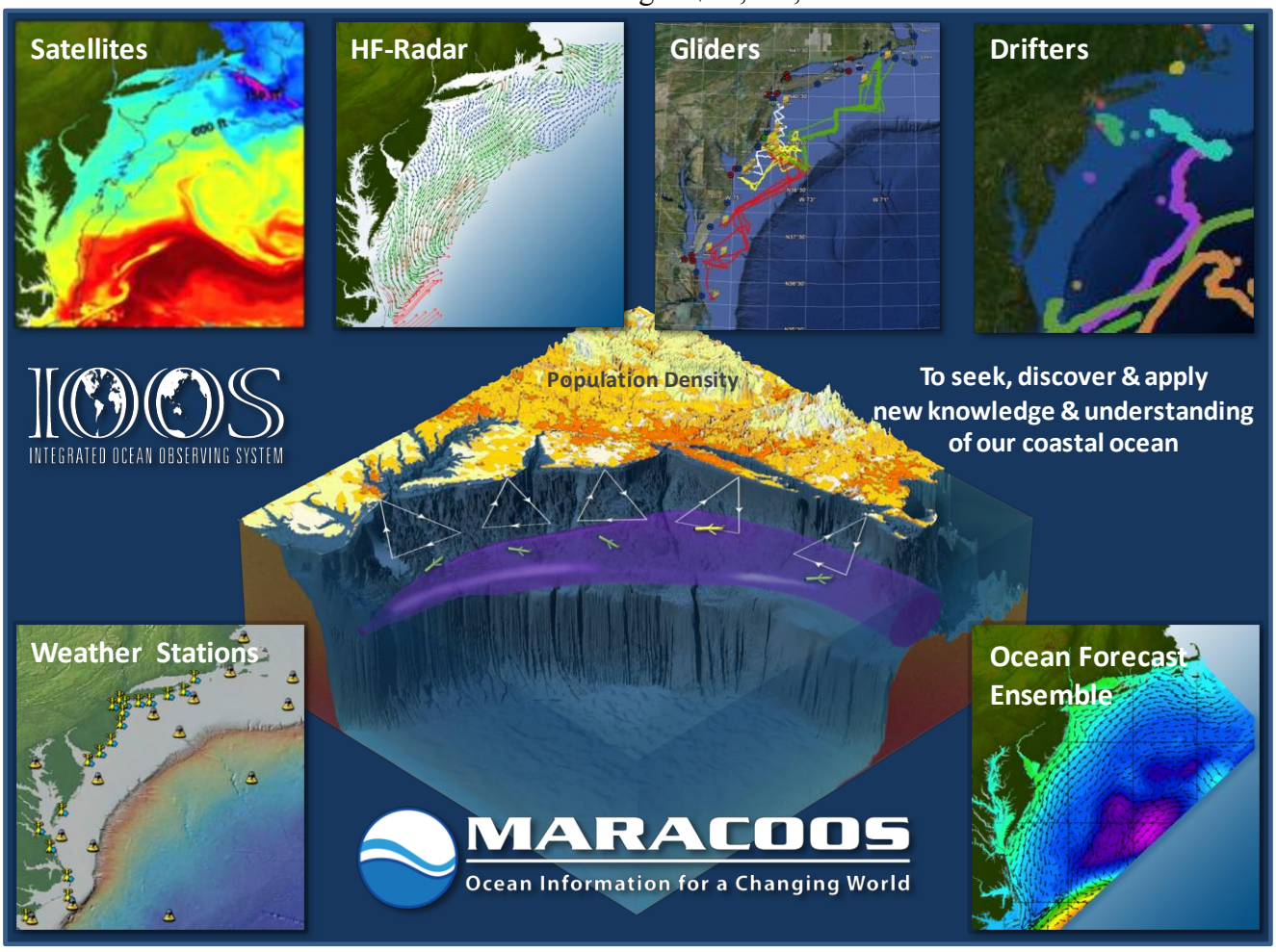
RUTGERS, The State University of New Jersey

"Towards a Comprehensive Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)"

Sponsor: National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA)
NOAA-NOS-IOOS-2011-2002515 / CFDA: 11.012, Integrated Ocean Observing System
Topic Area 1: Continued Development of Regional Coastal Ocean Observing Systems
June 1, 2011 – May 31, 2016
Total 5 Year Budget: $20,000,000



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1. PROJECT SUMMARY

Towards a Comprehensive
Mid-Atlantic Regional Association Coastal Ocean Observing System
MARACOOS

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Diverse Regional Needs: The **Mid-Atlantic Bight** (**MAB**) extends 1000 km alongshore, from Cape Cod, MA to Cape Hatteras, NC. It includes five major estuarine systems and a wide continental shelf cut by a deep cross-shelf valley and multiple shelf-break canyons. The footprint encompasses 10 states, the District of Columbia, and approximately 76 million people, or 25% of the US population. The nation's highest coastal population density makes increasingly competing demands for marine and coastal resources. Ports in the region handle 23% of the total U.S. waterborne commerce, and include the nation's largest petroleum product hub and the world's largest Naval base. The MAB is a dynamic boundary between cooler arctic waters and warmer tropical waters, with complex seasonal physical dynamics. These dynamics structure shellfish and migratory fish habitats that support both commercial and recreational fisheries. Developed watersheds and urban estuaries, impacted by a century of industrialization and growing coastal populations, degrade coastal water quality and diminish recreational economies. Inundation driven by tropical storms and northeasters are year-round threats to the large populations that live on the broad coastal plain. While the region's electrical power grid is the most congested in the nation, the high population density, reliable winds, and wide continental shelf combine to support the nation's first offshore wind energy development projects. To further compound these challenges, climate warming is altering fish and shellfish habitats in the MAB, and new rainfall patterns with more frequent extremes are impacting homes, farms and reservoirs.

Regional Progress: The **Mid-Atlantic Coastal Ocean Observing Regional Association** (**MACOORA**) was established in 2004 as the U.S. IOOS Regional Association (RA) for the MAB. Since then MACOORA, now a 501(c)(3) Non-Profit Corporation, created the framework in which the Mid-Atlantic's coastal ocean user community identified its five highest priority regional themes: *(1) Maritime Safety, (2) Ecosystem Based Management, (3) Water Quality, (4) Coastal Inundation,* and *(5) Offshore Energy*. Early user workshops were critical in identifying Maritime Safety and Ecological Decision Support as initial targets, first addressing a specific end-user need for surface current mapping to inform an advanced USCG Search And Rescue (SAR) capability, and then exploring a more general need to provide a missing layer of 3-D environmental information to fisheries resource managers, commercial and recreational fishers. MACOORA established the **Mid-Atlantic Regional Coastal Ocean Observing System** (**MARCOOS**) to provide the necessary ocean observing, data management, and forecasting capacity to systematically address the prioritized regional themes. MARCOOS, a NOPP-style, academic-industry-government partnership, has leveraged the region's distributed centers of critical expertise to form an interactive regional network. Operations include an industry-funded coastal weather network, primary and back-up satellite data acquisition centers, a triple-nested multistatic HF Radar network, an accelerating autonomous underwater glider capability, and mission-specific statistical and dynamical ocean forecast models. One of the most visible MARCOOS successes is the end-to-end demonstration of the nation's first operational HF Radar network supporting the USCG Search And Rescue Optimal Planning System (SAROPS).

A Plan for the Future: Building on accomplishments and lessons learned, the proposed effort over the next 5 years will (1) *unite and integrate the organizational activities of MACOORA and the operational activities of MARCOOS into a new corporate entity called the* **Mid-Atlantic Regional Association Coastal Ocean Observing System** (**MARACOOS**); (2) *maintain and expand the existing observing, data management and forecasting subsystems focused on the transition from data-generated to model-generated ensemble ocean forecast products that target multiple users*; and (3) *expand end-to-end operations across all five regional themes through* (a) *enhanced education and engagement activities,* (b) *the leveraging of resources beyond IOOS through expanded Users and Advisory Councils, and* (c) *the application of NFRA-endorsed metrics to measure and demonstrate success*. The new MARACOOS, bringing together over 40 investigators and partners from 20 institutions, will result in closer connectivity between ocean observatory data, model generators and the wide range of end users. The MARACOOS mission—to seek, discover and apply new knowledge and understanding of our coastal ocean—will be realized through scientific expertise, operational monitoring, and information product delivery in support of the wise use and management of the MAB's marine and coastal resources. The five regional themes will shape the work plans for the ocean observatory data and model information generation - outputs will be incorporated into appropriate stakeholder engagement, outreach, and education activities with targeted expansion. The continued evolution of MARACOOS towards its full potential depends on effective leveraging of partnerships supported by additional funding. While entrepreneurialism is a familiar approach in the MAB ocean observing community, sustained partnerships are required to enhance the capabilities and effectiveness of the System. To that end, newly intensified and focused efforts will be made to develop partnerships that tailor MARACOOS products to their specific needs.

3) PROJECT DESCRIPTION

A) BACKGROUND

In December 2005, the Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) incorporated as a 501c(3), non-profit entity. At the outset, MACOORA and its observing-system arm MARCOOS, embarked on an ambitious mission to provide sustained information products to key users in the coastal domain extending from Cape Cod to Cape Hatteras, a region encompassing 10 states, the District of Columbia, and 76 million people (25% of the US population). For the initial themes identified via user workshops—(1) Maritime Safety and (2) Ecological Decision Support—MARCOOS successfully moved from demonstrations to operational delivery of data and information products. Now, the U.S. Coast Guard's ability to save lives at sea is significantly enhanced by the real-time, operational incorporation of MARCOOS HF-Radar surface-current data and STPS statistical forecasts into its Search and Rescue Optimal Planning System (SAROPS). Information from MARCOOS robotic glider flights, satellite imagery, and data-assimilative modeling now helps inform NOAA Fisheries personnel in their quest to understand and manage heavily exploited Mid-Atlantic stocks.

As the delivery of real-time information from the MARCOOS network has evolved and matured, three additional themes have emerged from user workshops: Water Quality, Coastal Inundation, and Offshore Energy. Coastal managers throughout the region are partnering to monitor the oxygen-deprived dead zones that are becoming endemic in all MAB estuaries and along our coasts. A regional approach can harness the efforts of local monitoring programs toward a requirements-based, standardized, and sustained system. The success and lessons learned from local inundation forecasting such as the Chesapeake Inundation Prediction System (CIPS) can be extended and adapted for the entire Mid-Atlantic region for both storm surges and long-term sea-level rise. The Mid-Atlantic region contains the best match between offshore wind energy resources and public demand for power. Sustained monitoring and modeling will be necessary to support efforts to develop these resources in an environmentally sound manner.

MARCOOS has demonstrated that the core capabilities used to develop products for the first two themes can be efficiently leveraged to produce repurposed products supporting the additional themes; *investments in MARCOOS' capabilities serve multiple users* (Table 1). To further enable this evolution, a new, merged structure—MARACOOS (Mid-Atlantic Regional Association Coastal Ocean Observing System)—is proposed. This new streamlined organization

	MARCOOS Capabilities					
MACOORA Themes	**Weather Mesonet**	**HF Radar Network**	**Statistical STPS Forecast**	**Satellite Imagery**	**Glider Surveys**	**Dynamical Ocean Forecasts**
1. Maritime Safety	Operational input to USCG SAROPS	Operational input to USCG SAROPS	Operational input to USCG SAROPS			
2. Ecological Decision Support		Circulation and divergence maps for habitat		SST & Color for habitat	Subsurface T & S for habitat	3-D Fields of T, S, circulation for habitat
3. Water Quality	Winds for transport, river plumes, & upwelling	Surface currents for floatables, bacteria, spill response	Surface currents for floatables, bacteria, spill response	Ocean color for river plumes	Nearshore dissolved oxygen surveys	Surface currents for floatables, bacteria, spill response
4. Coastal Inundation	Weather forecast ensemble validation	Current forecast model validation				Nested forecast ensembles
5. Offshore Energy	Historical analysis & wind model validation	Historical current analysis & wind model validation		Historical analysis surface fronts & plumes for siting	Historical analysis subsurface fronts & plumes	Coupled ocean-atmosphere models for resource estimates

Table 1. MACOORA Themes/MARCOOS Capabilities Implementation Matrix

is configured to meet the challenges of providing valued information products in all of our priority sectors. The merged MARACOOS will enable ocean observing in the MAB to: 1) transition from delivery of data and data products to the production of operational ocean forecasts, 2) establish operational product lines for three additional high-priority, user-driven themes, 3) formalize structures for user interaction, science-based observing, and leveraging regional efforts, and 4) extend the observing perspective toward long-term, climate-change time scales. The following proposal provides a brief report on MARACOOS progress and a 5-year plan to both enhance our core themes and expand our ability to address the additional themes.

The MARACOOS activity has developed a collaborative network of some of the world's leading scientists and business leaders who are poised to expand their efforts to address priority regional user needs. Other federal agencies have recognized the combination of scientific expertise and operational capabilities in the Mid-Atlantic with their investments in this region. The NSF Ocean Observing Initiative (OOI) has chosen the MAB for its first 5-year deployment of the Pioneer Array. The OOI Cyber-Infrastructure Implementing Organization (CI IO) chose MARACOOS as its first test bed (Schofield et al. 2010). DHS formed a Center of Excellence for Port Security in the MAB to testbed new technologies for deployment around the country, while the Navy is using the MAB to testbed new technologies for forward deployed non-collaborative environments worldwide (e.g. SW06, ESPreSSO, LEAP). The lessons learned are being translated to other regions in the U.S. and other countries around the world. The procedures developed by the MAB HF Radar network to reach operational status in USCG SAROPS are now being expanded nationally as part of the developing National HF Radar Network. The web portals, Google Earth visualization interfaces, and the virtual community blog space developed to support Glider missions in the Mid-Atlantic have been used to coordinate the national IOOS response to the Deepwater Horizon Oil Spill in the Gulf of Mexico. Now, the MAB Region is serving as an international model for cooperative research and application partnerships, especially in Europe. The forging of partnerships has been facilitated, in large part, by the sustained presence of IOOS and the collaborative spirit that pervades the MAB.

B) GOALS AND OBJECTIVES

Three overarching goals have been established for the MARACOOS 5-year plan. The first establishes the new proposed Regional Management Subsystem and defines its activities. The second establishes a coordinated operations network consisting of the Observing, the DMAC, and the Modeling & Analysis Subsystems. The third defines the Education & Outreach Subsystem activities. Implementation paths are illustrated in the Subsystem Flowchart (Figure 1).

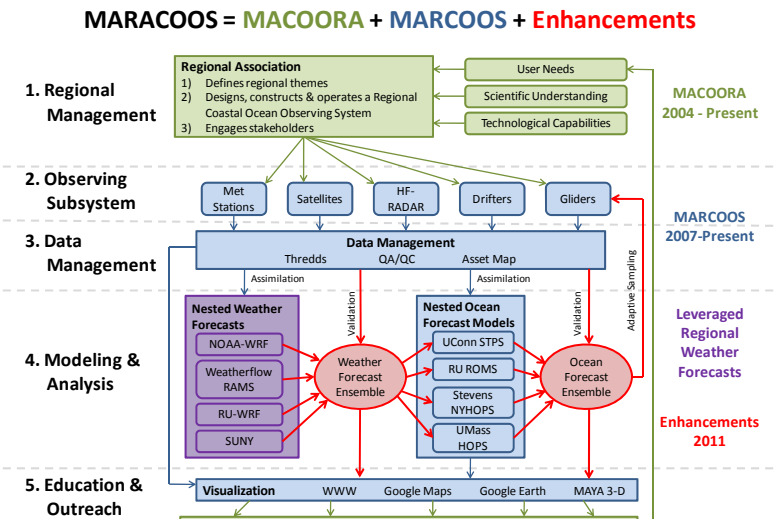


Figure 1. MARACOOS Subsystem Flowchart.

***Goal A**: Unite and integrate the organizational activities of MACOORA and the operational activities of MARCOOS into a new corporate entity, MARACOOS*. Objectives include:

1. Create MARACOOS as a 501 (c) (3) Non-Profit Corporation.
2. Establish two new MARACOOS Advisory Councils and charge the existing Users Council with formulating user feedback and market development procedures.
3. Conduct program evaluation with metrics; report accomplishments & outcomes.

***Goal B**: Maintain and expand the existing observing, data management and forecasting subsystems focused on the transition from data-generated to model-generated ensemble forecast products that can be repurposed for multiple users.* Existing system objectives are to:

1. Continue to (a) operate the regional satellite, HF-Radar and glider networks, (b) leverage the public/private meteorological stations and USCG drifters, and (c) expand the capabilities within the context of the 5 regional themes.
2. Continue to employ modern DMAC technologies to centralize the data distribution and storage system with tools based on IOOS standards that provide efficient, reliable data product delivery to its data-assimilative modelers, members, partners and the general public.
3. Continue to (a) operate a suite of 4 data-assimilative ocean forecast models, (b) assemble the weather and ocean forecast ensembles weighted by extensive validation resources and (c) develop the adaptive sampling feedback for applications that support the 5 regional themes.

***Goal C**: Expand end-to-end operations across all five regional themes through: (a) enhancing education and engagement activities, (b) leveraging resources beyond IOOS and (c) applying NFRA-endorsed metrics to measure and demonstrate success.* E & O objectives are to:

1. Establish a Stakeholder Liaison position to (a) expand information dissemination facilitated by technology, (b) facilitate synthesis, integration, and translation of MARACOOS products into appropriate end uses for stakeholders, and (c) formalize a system for stakeholder feedback.
2. Informed by data & model visualization needs assessment workshops, (a) develop visualization tools and lesson materials for beta-testing, (b) obtain feedback from MARACOOS teaching faculty, and (c) transition tools and materials to the Stakeholder Liaison, University Extension Agents, Sea Grant and NERRS to train new users.
3. Refine the "Beach Basics" outreach activity following user input obtained at the 2010 MACOORA annual meeting with the currently proposed annual focus on: (a) Alongshore currents from the HF Radar network for floatables, (b) nearshore waves from HF Radar, (c) cross-shore rip currents from the correlation between waves, alongshore currents and rips, (d) weather hazards (strong winds, rain, lightning) from the forecast ensemble, and (e) waterborne bacteria impacts from correlations with rainfall, alongshore currents and waves.

C) AUDIENCE AND BENEFITS

The MACOORA community, guided by targeted workshops and meetings, has identified its five high priority ocean observing themes: *(1) Maritime Safety, (2) Ecological Decision Support, (3) Water Quality, (4) Coastal Inundation, and (5) Offshore Energy*.

1. Maritime Safety: The U.S. Coast Guard (USCG), for its Search And Rescue (SAR) mission, responds to over 28,000 incidents with over 5,000 lives saved each year. The Search And Rescue Optimal Planning System (SAROPS) is the protocol used to respond to these incidents. The effectiveness of SAROPS to define search areas depends critically on the

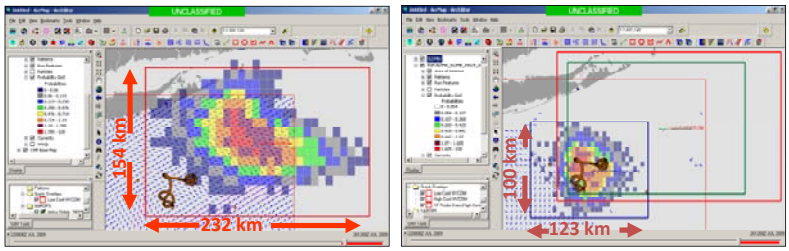


Figure 2: SAROPS search area using HYCOM model (left) and HF Radar data (right). The 4 day drifter path (brown inverted V) is shown.

observed real-time and forecast surface current data that is delivered through their Environmental Data Server (EDS). The USCG SAR operators are trained in SAROPS and educated in modern ocean observation and regional current conditions. Similarly, the U.S. Lifesaving Association (USLA), for its rip current safety mission, estimates that nearshore rip currents are responsible for over 100 deaths per year - the primary cause of drowning along U.S. coasts. Over 80% of the more than 12,000 annual lifeguard rescues are related to rip currents. The National Weather Service Weather Forecast Offices (NWS WFOs) provide daily rip current guidance to lifeguards' though a rip current warning system. The accuracy of NWS rip current forecasts depend critically on the observed nearshore waves and currents that go into their statistical models. The primary data need in this regard is the alongshore drift direction and nearshore waves.

Maritime Safety has been the highest priority RACOOS theme during its initial years. MARACOOS and recreational fishers jointly developed the broad support necessary to partner with NOAA's National Data Buoy Center (NDBC) to deploy a weather buoy that provides ocean/atmosphere environmental data at the seaward end of Hudson Canyon, improving fishing safety. Advances in port and harbor maritime safety continue through the execution of a preliminary data sharing agreement between Stevens and NOAA CO-OPS. Developed at the request of the NY USCG Harbor Ops committee, under the agreement, Stevens will deliver full water column current observations from 3 locations in NY Harbor to CO-OPS at the required NOS standards for integration into the PORTS system and use by harbor pilots. The agreement leverages instrumentation funded by the NJDOT OMR for integration into the NYHOPS/MARACOOS observing system and will serve as a prototype agreement for other harbors in the region.

The USCG Office of Search and Rescue and MARACOOS have jointly demonstrated that surface current maps improve the effectiveness of SAROPS. In a simulated search case, using a USCG surface drifter released south of Long Island, the USCG used surface currents from an operational HYCOM model and the MARACOOS high frequency radar (HFR) respectively with their SAROPS. The HFR surface current-derived search area (Figure 2, right) was (a) centered on the drifter and (b) 3 times smaller than that derived from the HYCOM simulation. Thus in spring 2009, HFR surface current data was installed on the USCG EDS for use as an operational component of SAROPS, an important first step toward a national capability. The USCG estimates that 50 additional lives will be saved each year after the national implementation of the HFR surface current network. The indirect benefit is that USCG assets, which are typically redirected to SAR missions, will spend more time on their law enforcement and homeland security missions.

2. Ecological Decision Support: Among the many issues requiring improved Ecological Decision Support, our region has focused its attention on fisheries, a track record MARACOOS will continue to build. Direct, indirect, and induced economic impacts of commercial and recreational fisheries in the MAB is substantial with commercial fish landing values averaging

close to $1.0 billion/year, and annual spending on recreational fishing estimated at $7.4 billion. MARACOOS has worked with the fisheries community to incorporate environmental observation and forecast fields to support more informed management of this valuable resource.

MARACOOS has already worked with sectors of the fisheries community to identify effective ways to utilize environmental observations and forecasts. These products enable offshore recreational fishers to fish more safely and commercial fishers to fish with reduced by-catch, less disruption of the environment, and more fuel-efficient operations. In the early '90s, daily real-time satellite Sea Surface Temperature (SST) maps were made available to MAB recreational and commercial fishing communities. More recently MARACOOS, with input from different sectors of the fishing community, has defined and built more useful satellite SST products and web-based interfaces. Leveraging IOOS supported regional ocean observing assets in the Mid-Atlantic Bight with research support from the Fisheries And The Environment (FATE) program, NOAA NEFSC and MARACOOS researchers were able to construct statistical models that linked fish abundance with observed pelagic habitat variables (Figure 3). Through direct interaction with the management community, these models are now being applied as a habitat based approach to reduce butterfish by-catch in the squid fishery throughout the MAB.

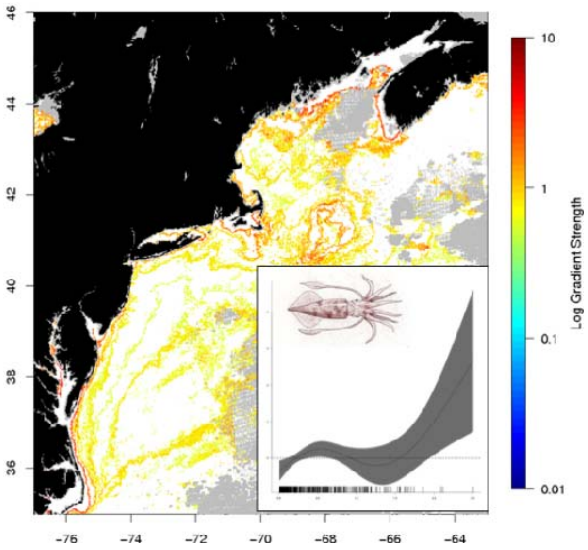


Figure 3. Map of satellite-derived frontal locations and strength. The inset shows the response of the longfin squid to this index. The combination of the two provides information where one may be more likely to encounter longfin inshore squid.

3. Water Quality: MARACOOS long-term support of water quality product delivery is expressed through a series of technical interactions with the water quality community across federal, regional, state, county and local agencies and governments. Since 2006, MARACOOS, in partnership with NOAA and others, have hosted three water-quality workshops to encourage the development of effective water quality products on all scales. At the federal level, the effectiveness of IOOS and National Water Quality Monitoring Network (NWQMN) interaction has been demonstrated through the initiation of the Delaware Bay Pilot Project. At the state level, the NJDEP and USEPA are funding dedicated glider deployments that leverage IOOS investments in the region. At the county level, the same MARACOOS HFR network that serves the USCG is used to monitor river plumes to warn of possible water quality impacts on recreational beaches. Leveraged data products such as these have been developed in response to specific needs of water quality professionals with local interests.

These interactions demonstrate the benefit of leveraging the regional assets for improved monitoring of the inner shelf and estuaries to support local water quality applications. MARACOOS has helped identify priority observations that could improve water quality in the MAB; through its collaboration with the NWQMN (via its USGS representative E. Vowinkle, Co-PI). The collaboration has enabled product development such as the U. Delaware MARACOOS satellite based chlorophyll product that was used in late August this year to detect

a large phytoplankton bloom off coastal New Jersey. A grant from USEPA Region 2, in cooperation with NJDEP Marine Monitoring, supported a glider deployment that provided critical subsurface data (Figure 4). The USEPA and NJDEP used MARACOOS modeling support from Stevens to build a 4-d representation of the bloom that identified potential water quality impacts throughout the water column. In another example, surface current observations, combined with regional ocean model forecasts, were used to successfully back-track the source of medical waste discovered off of an Atlantic County beach at the request of NJDEP. These serve as great examples of the quality of products and support that come from strong partnerships with the growing water quality user community throughout the MAB.

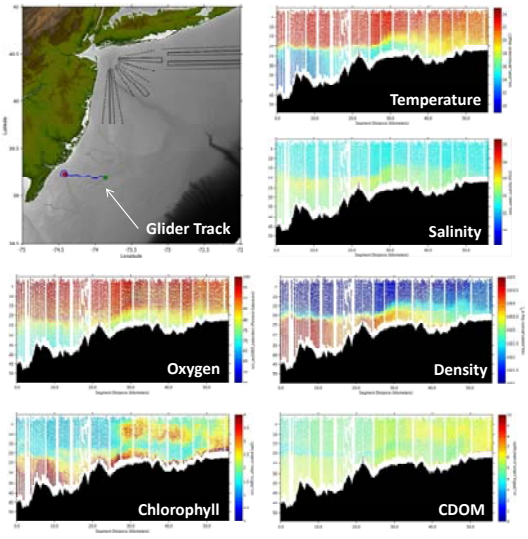


Figure 4. (top left) Glider (RU16) 10 September 2010 track along which were measured transects of: temperature, salinity, density, CDOM, oxygen and

4. Coastal Inundation: Following the 2005 IOOS/MARACOOS inundation workshop, the Chesapeake Inundation Prediction System (CIPS), in response to the needs of emergency managers, constructed a real-time forecasting system with storm-surge visualizations down to street-level spatial resolution. CIPS formed a government, academic, and private-sector partnership to produce the forecasts and deliver the information to the emergency managers to enhance their ability to respond to surges or sea-level rise. This partnership successfully used an ensemble approach that improved the accuracy of both atmospheric and water-level forecasts. One of the primary goals of CIPS was to take the lessons learned from the local Chesapeake case to expand inundation forecasting throughout the entire Mid-Atlantic Region. The inherently small space scales of inundation and the need to deal directly with the user community dictate that it will continue to be a fundamentally local process. However, significant improvements in accuracy and efficiency will accrue to these local efforts by addressing the issue from a regional perspective.

Coastal and estuarine inundation modelers will be able to improve their forecasts by exploiting MARACOOS ensembles for their offshore boundary conditions. These local models are inherently more accurate because they assimilate real-time MARACOOS observations to improve estimates of upper-ocean heat content and the thickness of the wind-driven layer. In addition, coastal and estuarine inundation modelers can reduce their forecast uncertainties by exploiting the full ensemble of MARACOOS atmospheric forcing products. All these resources will be readily available for delivery from the MARACOOS servers via OPeNDAP. CIPS showed that the delivery of these products to the emergency manager in a form that can be used is at least as important as accuracy of the forecasts. For this reason, MARACOOS will be able to facilitate local inundation efforts not only through delivery of regional modeling products, but also through transferring the lessons learned through the CIPS experience of working with local emergency managers to inundation efforts throughout the region. In addition, MARACOOS will be improving the accuracy of surface wind fields through the continuing collaboration of WeatherFlow and the regional NWS Weather Forecast Offices. WeatherFlow continues to collaborate with the NWS Forecast Offices within the MARACOOS domain to build an increased understanding of surface wind fields. The ultimate goal of this effort is to build high

resolution and accurate gridded wind fields for meteorological applications. This product will have a broad application with the overall IOOS community.

5. Offshore Energy: Academics and industry weather forecasters in the MAB have over a decade of experience collaborating with the land-based energy industry. These collaborations have provided forecasts of summertime sea-breezes used to estimate day-ahead power consumption for improved generation efficiency, and year-round forecasts of severe weather to reduce down time from electrical grid damage. Forecasts are typically delivered through a website with an on-call meteorologist during events. The collocation of large coastal populations with Class 4 winds offshore make the MAB the most viable U.S. location for offshore wind energy to succeed. Nearly all Mid-Atlantic States already have plans in place for offshore wind resource development, with some exceeding the national target of 20% renewables by 2030. MARACOOS has responded by hosting participants from the offshore wind industry at their 2008 and 2009 annual meetings as well as a dedicated stakeholder meeting to assess their ocean observing needs. MARACOOS PIs have been requested to serve on state implementation panels throughout the region. Through these needs assessments and service opportunities, MARACOOS has learned that developers and regulators need improved understanding of the wind resource derived from high-resolution sea-breeze resolving forecasts, delivered as maps, and used as input to state GIS systems for wind farm site planning. Additionally local estimates of the wind resource and environmental conditions must be delivered as time series for historical analyses, financing, permitting, construction and operations. Better data is also needed to assess the risk of waves, currents, salt spray, and biofouling on the offshore wind farm system. Companies are assessing the cost of operation and maintenance and require wave height information to determine the number of days per month they can be working onsite and how much scour to expect around power cables and structures. Once wind farms are operating, they will need detailed and accurate wind, boundary layer, wave and current observations, and, most importantly, accurate weather predictions to compete on the day-ahead market. The benefit to society are the improved estimates of the wind resource and environmental data for wind farm siting, improved construction/operation, and improved power generation forecasts.

Leveraging IOOS capabilities and expertise allows individual states to make cost effective investments in new observing system components to support the developing offshore energy industry. For example, the NJ Board of Public Utilities (NJ BPU) recommends state support for the RU-WRF weather forecasts and a nested high-resolution HF Radar network covering the inner shelf of southern NJ (see letter of support). The state funded enhancement of MARACOOS will provide a more detailed analysis of the wind resource for Marine Spatial Planning, and will develop a state-of-the-art forecasting capability for the day-ahead energy market that ultimately will reduce utility costs for the NJ rate-payer.

D. WORKPLAN

1. Regional Management Subsystem.

MARACOOS's success to this point has come from prioritizing user themes, establishing partnerships, and harnessing entrepreneurial energy and competitive opportunism to operationally deliver valued information. The leadership has intentionally not invested in a large administrative structure, but rather has relied on the matching investment of host universities to support the administrative conduct of business. The new MARACOOS structure will continue to benefit from the existing relationships at Rutgers and U. Delaware. The proposed matching investments from both institutions (see letters) represent substantial and sustained contributions

to the enterprise, greatly enhancing the effectiveness of direct IOOS funding. The MARACOOS governance structure reflects the key role of members, who elect the Board of Directors. The Board makeup deliberately represents a broad constituency, with members from industry, government, NGOs, and academia, and a broad geographic distribution throughout the MAB. The corporation bylaws provide for systematic renewal of the Board of Directors. MARACOOS currently has 40 full dues-paying members and over 4000 stakeholders who have identified themselves as being interested in one of the five priority themes.

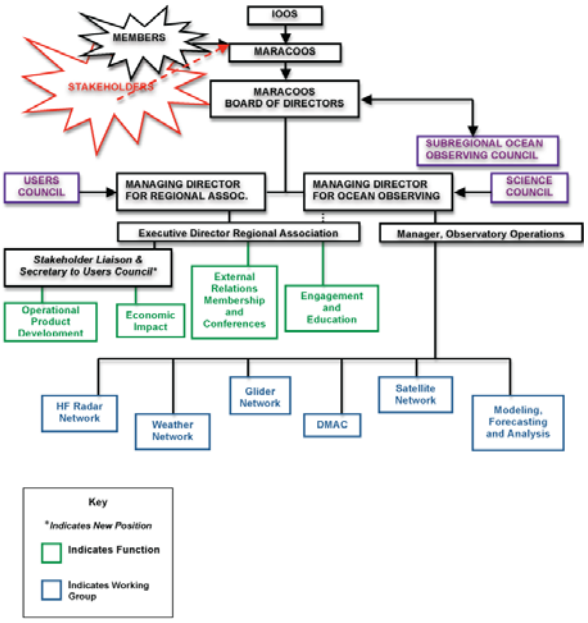


Figure 5. MARACOOS Organizational Chart.

The MARACOOS Board of Directors will retain an Advisory Council, and establish two new advisory councils. The existing Users Council will be charged with formalizing the feedback system between users and information providers and finding new markets for observing products. The Science Council will advise MARACOOS on research opportunities that leverage regional capabilities and feed back the latest scientific and technological developments on MARACOOS planning and implementation. The third group—Subregional Observing Council—will leverage and integrate successful sub-regional observing activities to address regional needs, forging partnerships with existing observing systems that are presently serving the large urban estuaries in the MAB.

The proposed MARACOOS management plan specifies 3 new positions (Figure 5). The Managing Director of the RA (C. Thoroughgood) is responsible for coordinating the business of the organization. The Managing Director of Ocean Observing Systems (S. Glenn) will coordinate the multi-institutional, distributed ocean observing collaboration. The Stakeholder Liaison is a high-priority position with the tasks of identifying new observing opportunities and invigorating the ongoing user network feedback loop, partially through serving as Secretary of the Users Council. In addition to overseeing RA functions, the Managing Director of the RA will lead an effort to increase MARACOOS membership in number and diversity and to implement a formal evaluation procedure based on performance metrics established by IOOS. This evaluation will facilitate an application for Regional Association Certification once the procedure is established and officially promulgated.

2a. Observing Subsystem: Satellites.

MARACOOS will continue to acquire satellite sea surface temperature and ocean color imagery from the ground station at Rutgers. This existing capability will be enhanced with a new satellite receive station at the U. Delaware which will be operational by the end of year 1. The addition of this station to the MARACOOS network will increase the number of satellites tracked and improve the resiliency of data collection and distribution in the MAB. With this dual station approach we will maintain the real-time de-clouded sea surface temperature and chlorophyll products delivered via OPeNDAP THREDDS, Google Earth, and standard web

pages to meet the needs of our broadest and most diverse user base (cover-page figure, upper left). In addition, two major new satellite products will be developed. One is a marine spatial planning product that will enable us to track the distribution of different water masses across the region and the strength of the boundaries between them (Oliver, Glenn et al. 2004; Oliver and Irwin 2008). The second will be a real-time coastal salinity product based on a locally-tuned algorithm that takes advantage of the optical properties of rivers (Geiger in prep).

2b. Observing Subsystem: HF Radar.

The proposed HF Radar workplan is described in terms of (1) operations and maintenance and (2) improvements and expansions. The continued operation and maintenance of the network, one of the highest MARACOOS priorities, is essential for delivering quality controlled data to the MARACOOS modeling group, National HF Radar Network, and U.S. Coast Guard SAROPS (cover-page figure, upper left center). This will require that we maintain efficient regional coordination of technical support, track resiliency statistics so as to prioritize gap-filling needs, implement gap-filling measures as resources allow, and incorporate new sites into the regional network. Our objective is to advance our HF Radar coverage statistics closer to the USCG target of 80% coverage, 80% of the time (Figure 6). This will require enhanced levels of funding for replacement spares and additional new sites. The second phase of the HF Radar workplan focuses on system improvements and enhancements to support products beyond the long-range current maps in support of USCG SAR. Specific improvement tasks are to implement Optimal Interpolation (OI) vector combination on our nested, high-resolution (25 MHz) networks, evaluate the uncertainties of radial currents as outlined in a plan co-developed with the manufacturer, and to evaluate the integration of a frequency specific bistatic vector capability.

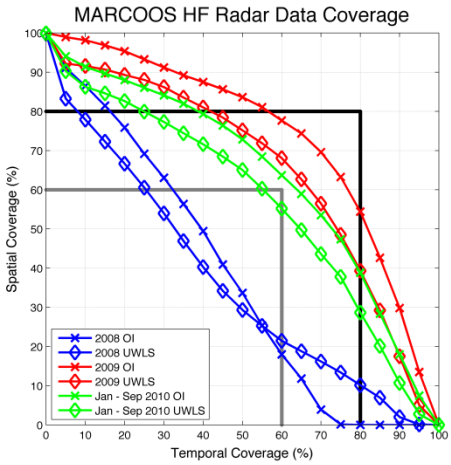


Figure 6. MARCOOS HF Radar coverage relative to NFRA endorsed metrics.

2c. Observing Subsystem: Gliders.

One of the most important subsurface physical features that structure ecological decision support in the MAB is the Cold Pool, a summertime strip of bottom trapped water stretching between Georges Bank and Cape Hatteras. Observing System Simulation Experiments (OSSEs) indicate that cross shore triangular sampling patterns are the most cost-effective glider strategy for sampling the Cold Pool. We propose to simultaneously sample 5 cross-shelf triangles twice a year, one in June after the Cold Pool has set up, and the other in late August/September just before the Cold Pool's stormy decay (cover-page figure, center). These glider sampling times are bracketed by and thus complement the spring and fall NEFSC Fisheries cruises. Region-wide sampling will require new gliders to complement the existing MARACOOS glider fleet. These gliders will be maintained by 3 Glider Technology Centers (U. Massachusetts, Rutgers, U. Maryland), local centers of critical expertise modeled after the trio of MARACOOS HFR Technology Centers. During the early years, while the MARACOOS IOOS glider fleet is being built, existing gliders at Rutgers, UNC, U. Delaware and U. Connecticut will be employed opportunistically to conduct the proposed sampling.

3. Data Management and Communication Subsystem.

The MARACOOS DMAC is responsible for (a) management of gridded satellite, HF radar, and model data; (b) management of glider and drifter data; (c) building data-model connections for assimilation and comparison; (d) publication of KML/Z data for use in Google Earth; (e) implementation of TDS/OPeNDAP/ncWMS and NetCDF conventions; (f) exploring the use of the Cloud for data storage and dissemination; (g) delivering data to operational users; and (h) data processing and storage within the RA.

Early-on we learned that it was difficult to monitor the system and enforce consistent processes and standards for our distributed data providers; each with different storage and distribution methods. Thus (a) MARACOOS will transition to a more centralized data aggregation approach in which the DMAC team can better manage data quality, distribution, and services. (b) The MARACOOS DMAC operational data management activities, including those for the USCG Environmental Data Server (EDS), U.S. Navy MDAS and commercial GIS web services, will be leveraged in the development of a robust services-oriented system that will build tools to auto-aggregate, quality-control, and monitor the data management system for transition to operations. (c) We have learned that using open standards encourage interoperability and thus their use can be important in mission-critical applications. For example, we used an SOS client, which was first evaluated for effectiveness for critical data management support of the Deepwater Horizon response, in terms of more timely delivery of results to the responders and scientists. Such stress-testing of data standards will be used to harden the IOOS system for transition to operational status. (d) MARACOOS scientists and the DMAC team work closely with Navy's Network-Centric Enterprise Services (NCES) and the NSF Ocean Observatories Initiative (OOI) Cyberinfrastructure Implementation Organization (CI IO), as one of the partners in the external observatories integration (EOI) task. We are following the lead of the OOI CI IO and NCES in exploring the use the revolutionary new Cloud computing for science data management. MARACOOS DMAC was involved in the federal GeoCloud initiative, is using the Amazon Cloud in a proof-of-concept demo project, and are evaluating use of the Cloud for a NOAA HPCC project. Thus MARACOOS is positioned to use the Cloud for centralized operational distribution of its data and products.

MARACOOS Data Centralization Plan: The DMAC team will employ an instance of the USCG EDS to centralize MARACOOS data. Thus data will be available via such web services as KML, WFS, SOS, NetCDF, WCS, WMS, as well as those for Android/iPhone applications. The proposed system will provide (via email, SMS, or Twitter) daily reports on data issues, such as availability; greatly enhancing the robustness of MARACOOS observation and model product delivery. This "one-stop shopping" will empower all researchers, using such tools as Matlab, ESRI ArcGIS, and web-based portals and provide access to federal data warehouses, such as NDBC and Ocean NOMADS, Synthesized data products will also be made available to support regional Coast and Marine Spatial Planning (CMSP). This centralized approach will enable us to implement and compliance-check standards such as SOS, OPeNDAP/TDS, and WMS; as well as maintain and publish the data catalog and associated metadata.

MARACOOS Cross-regional Collaboration Plans: The DMAC team developments will enable regional DIF coordination with interagency water quality working groups, federal and regional marine spatial planning activities, the Web Services and Data Encodings (WSDE) group, the DMAC ST, OGC, NSF OOI CI IO, and the federal Geocloud initiative.

4. Modeling and Analysis Subsystem:

Weather Forecast Ensemble Validation. WeatherFlow will manage the aggregation/validation of an ensemble gridded wind product that integrates available mesoscale model outputs from NOAA, SUNY, Rutgers, and WeatherFlow's own RAMS. Deliverables include at least two model runs per day. Additional products include: (1) a web-based map and time series viewer that displays wind vector contour plots and point location time series from each ensemble member plus the ensemble product itself; (2) a simple, but expandable gridded ensemble scheme (see ocean ensemble validation below); (3) a verification statistic tool that assesses model performance using a unique array of both terrestrial and littoral observations; and (4) a rolling archive directory of NetCDF binary data files that will be sent to a MARACOOS server, and made available for a variety of modeling uses including inundation. To accomplish this, Weather-Flow will provide spatial validation data that include publically available observations and over 100 of its own proprietary network of observing sites.

Table 2: MARCOOS Dynamic and Statistical Forecast Models

	UMass/HOPS Gangopadhyay	Stevens/NYHOPS Blumberg	Rutgers/ROMS Wilkin	UConn/STPS O'Donnell
resolution	15 km; 16 levels	50 m to 11 km; 10 levels	5 km; 36 s-levels	6 km; surface level
domain	Cape Hatteras - Grand Banks	MD to Nantucket; high res NY	Cape Hatteras - Nantucket	Cape Hatt. - Cape Cod
model home	mseas.mit.edu/HOPS	www.stevens.edu/maritimeforecast	myroms.org	lisicos.uconn.edu
meteorology	NCEP GFS 50 km 6-hr	NCEP NAM 12 km 3-hr	NCEP NAM 12 km 3-hr	no
rivers	no	NOAA AHPS 6-hr forecast	USGS daily observed	no
urban water	no	280 point sources	no	no
tides	no	EastCoast2001 ADCIRC	EastCoast2001 ADCIRC	CODAR 6-km MAB
open boundaries	GS SST ring/front feature model, dyn. adjustment	sea level NOAA ETSURGE; temp/salt WOA climatology	1/12° HyCOM/NCODA w/ SSH/SST/Argo assim	none
method	sequential optimal interp.	sequential optimal interp.	4D-VAR strong constraint	no
data used	AVHRR and REMSS blended SST; glider T/S; climatology	CODAR; T/S climatology; NY Harbor in situ ADCP & T/S	CODAR; AVHRR MODIS AMSR SST; altimeter SSH; glider T/S; XBT/CTD on GTS	CODAR
analysis every	7 days	1 day	1 day	1 hour
data to EDS	3-hourly for 5 days	10-min averages for 2 days	2-hourly for 3 days	1-hourly for 1 day
CF-compliant output server	aqua.smast.umassd.edu:8080/thredds	colossus.dl.stevens-tech.edu:8080/thredds	tinyurl.com/roms-maracoos	nopp.dms.uconn.edu:8080/thredds/catalog.html
online browse plots	www.smast.umassd.edu/modeling/RTF	www.stevens.edu/maritimeforecast	myroms.org/applications/espresso	lisicos.uconn.edu/map_viewer.php?site=6kmstps_ge
ncWMS inter-active plots	aqua.smast.umassd.edu:8080/ncWMS/godiva2.html	colossus.dl.stevens-tech.edu:8080/ncWMS/godiva2.html	tashtego.marine.rutgers.edu:8081/ncWMS/godiva2.html	nopp.dms.uconn.edu:8080/ncWMS/godiva2.html
google earth	-	hudson.dl.stevens-tech.edu/maritimeforecast/google	www.myroms.org/applications/espresso/kmz	nopp.dms.uconn.edu/google/6kmstps_ge.kmz

Ocean Forecast Generation, Ensemble Validation & Adaptive Sampling Feedback. Four systems forecasting MAB circulation were developed under MARACOOS: three dynamical data-assimilative models with different domain configurations, numerics, data inputs and assimilation methodologies, and one statistically-based surface current system using HF-RADAR velocity data (Table 2). In Nov 2009 these systems supported an OOI Cyber-Infrastructure Observing System Simulation Experiment (CI-OSSE) that demonstrated optimal control of gliders using forecast currents. Across variables (T/S, u&v), flow regimes (nearshore, shelf-break), and durations (hourly-weekly), no single model had consistently superior skill, indicating the value of multi-model ensembles (Schofield et al, 2010). The CI-OSSE ensemble mean gave all models equal weight, but with the expanding MARACOOS data archive we can quantitatively assess skill and formulate objective weights for each model and variable.

Base Level support will sustain these 4 efforts and their real-time delivery, further enhance model skill by transferring capabilities between groups, incorporate new data streams (NMFS EcoMon, OOI Pioneer) into the assimilation, and evaluate skill of each model to deliver quantitative forecast uncertainty estimates and thence an optimized multi-model ensemble prediction. Federal forecasts (NCOM & HYCOM) will be included in the multi-model ensemble. Skill assessment (year 1-2) will emphasize (i) USCG drifter data (QAQC by DMAC group) and (ii) MARACOOS glider T/S data that are not assimilated. Forecast skill with respect to not-yet-assimilated data will augment this analysis, leading to all-model space/time forecast skill assessments (year 3). Multiple meteorology forecasts will expand the ensemble set. By year 4, individual forecast error estimates and the multi-model ensemble forecast will be added to DMAC services. Retrospective ensemble "best estimate" re-analyses (year 5) will support end-user applications. Enhanced Capacity funding will support glider mission planning & adaptive

sampling, as well as enable applications pursued by individual groups on larval/disease dispersal, water-quality and DO (IOOS Super-regional Testbed), ocean-wave-atmosphere 2-way coupling, sediment transport, and inundation.

5. Education and Outreach Subsystem

The MARACOOS E&O team has decades of experience developing education programs, materials and software, has focused on resource development using data from ocean observatories, and includes the NSF Centers for Ocean Sciences Education Excellence – Networked Ocean World (COSEE-NOW). New product development for MARACOOS will initially target community college and university educators to engage the undergraduate community (diverse and rich audience, geographically accessible, and directly tied to the scientists with MARACOOS data) and rapidly develop beta data products that can be repurposed for a broad range of user groups. Our premise is that student use of these data products will help us create and interpret visual representations of multi-dimensional observational data that will inform or refine our approach with public user interfaces.

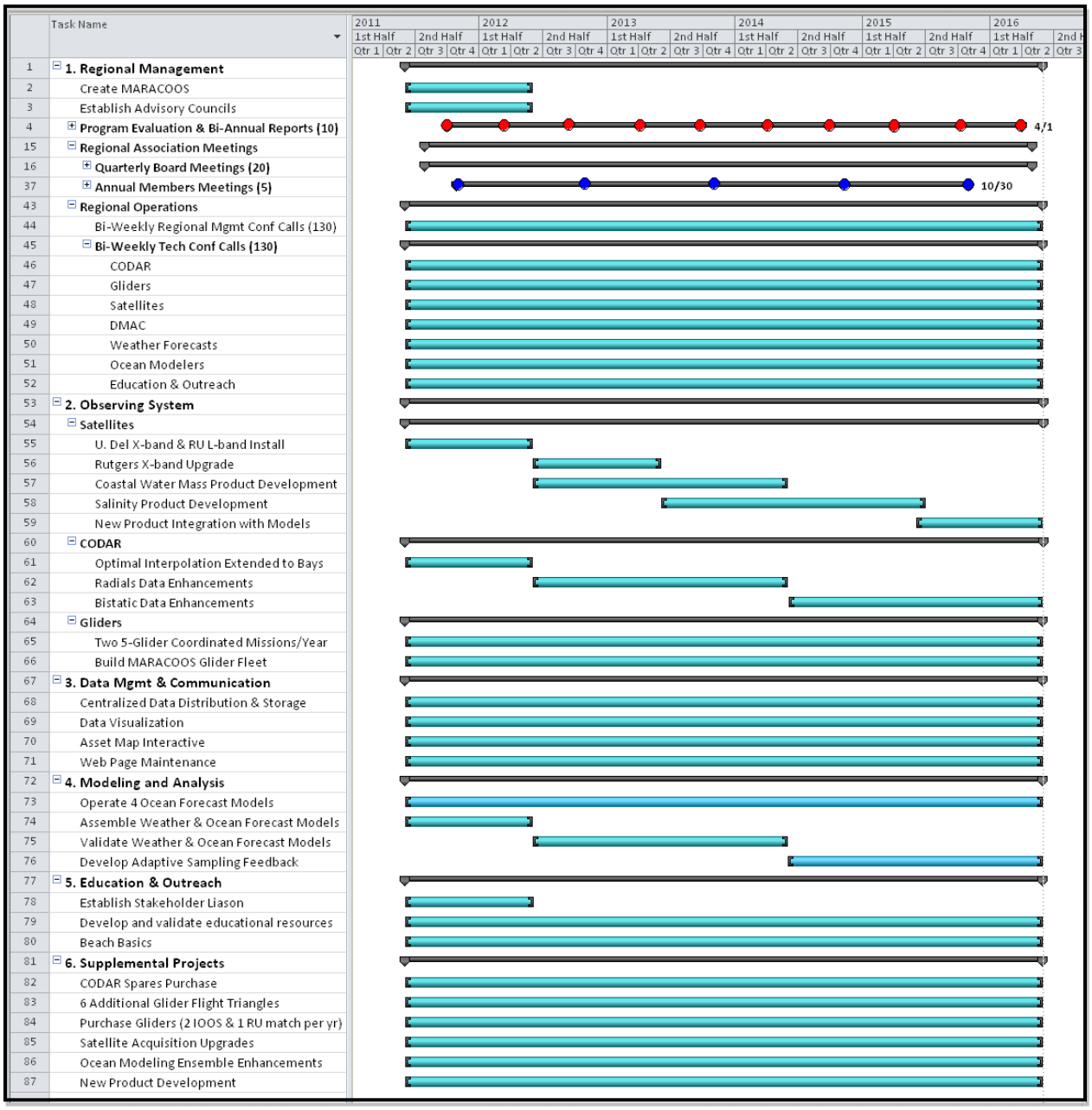
Stakeholder Engagement. The E&O team will be expanded to include a new Stakeholder Liaison position within the Regional Association. Working with the Executive Director, the expanded E&O team will continue the MARACOOS tradition of hosting an annual stakeholder workshop that informs implementation teams, rotating through each of the 5 regional themes. Follow-up by the E&O team will be through focus groups combining 5-8 key workshop participants with RA scientists to refine user needs with respect to RA datasets and forecasts. Our goal is to develop products that the RA Stakeholder Liaison, university extension agents, and Sea Grant personnel can promote with public audiences, and RA scientists can use in the classroom to engage the future workforce.

A New MARACOOS Product Line. "Beach Basics", our initial new product focus for years 1-5, will link strengthened observing and data management capabilities with new educational product development for improving beach safety – an issue that cross-cuts three existing regional themes including Maritime Safety, Water Quality, and Coastal Inundation. The E&O team will develop a series of data products including explanations of alongshore currents, waves, rip currents, weather (wind, rain & lighting) conditions, water quality (bacteria, floatables) and swimmer safety. Our production team consisting of a web & graphic designer, data translator, programmer, and educator will: 1) identify relevant data sets in collaboration with MARACOOS scientists, 2) develop middleware for on-demand data requests, 3) develop and test hand held apps with undergraduate students, 4) conduct needs assessments and usability testing with the User Council, and 5) revise and produce data apps for public user groups. E&O products may include but are not limited to: (a) educational data visualizations including applications for hand held devices, (b) supplemental content appropriate for end users, (c) instructor's guides and lesson plans to help Extension professionals distribute the apps, (d) production of educational and/or promo materials (workbooks, CDs, bookmarks, posters etc), and (e) development of complementary video and multimedia pieces.

Building National Synergies Among Regional E&O Efforts. COSEE-NOW is assisting NFRA leadership in creating and supporting participation from all 11 RAs in the NFRA Education and Outreach Committee. The MARACOOS E&O team will continue to work collaboratively on mutual projects including an evaluation metric development - all RAs have the need to determine if products and programs being offered are effectively engaging targeted audiences. The NFRA E&O Committee members propose to identify a common product or

program (following announcement of RA awards) and implement a standardized evaluation process. Results will help establish baseline metrics for determining the value of RA E&O programs and communication of information about the technologies used and the data collected as part of the Deep Water Horizon oil spill response. MARACOOS, SECOORA and GCOOS will work together to document communication strategies for rapid dissemination of information.

E) MILESTONE SCHEDULE



F) COST PROPOSAL

The MARACOOS budget target is $4M/year for 5 years, reflecting the existing targets of $500K/year for regional management and $3.5M/year for ocean observing. Budget allocation criteria prioritize activities in each of the 5 subsystems, followed by the allocation of funds to each activity, and finally assignment of responsible institutions and personnel. The annual budget template includes Base and Enhanced. Base support ($2.8M) reflects the cost of maintaining all the existing functions of the RA and RCOOS. Enhanced activities ($1.2 M) are in priority order. If cuts are required beyond the base level, maintaining the RA activities is our first priority, the time series of observations is second, and all other base-level functions are third. Budget cuts below $2.8M will be applied with 0 shares from Regional Management (RM), 1 share from Observing Subsystem (OS), and 2 shares from DMAC, M&A, and E&O Subsystems. A cut of $330K is achieved by a reduction of 0% for RM, 10% for OS ($130K), and 20% for DMAC ($60K), M&A ($100K) and E&O ($40K).

MARACOOS ANNUAL BUDGET TEMPLATE: YEARS 1 - 5			
DISTRIBUTION BY TASK (*Industry Partners)			
DESCRIPTION	**TOTAL**	**INSTITUTION**	**PI**
1. Regional Management Subsystem Base Support			
Regional Association Mgmt.	**$400,000**	U. Delaware	Thoroughgood
Regional Operations Mgmt.	**$100,000**	Rutgers U.	Glenn
Regional Management Subtotal	***$500,000***		
2. Observing Subsystem Base Support			
HF Radar Shore Site Support (35 x $10,000 / site)	**$350,000**	Rutgers (16 sites), CIT*(5 sites), U.Delaware (3 sites), U. Rhode Island (3 sites), U. Connecticut (2 sites), U. North Carolina (2 sites), Stevens Institute (1 site), U. Massachusetts (1 site), Rutgers Spares (2 sites).	
HF Radar Technology Centers (3 x $100,000 / center)	**$300,000**		
	$50,000	U. Massachusetts	Brown
	$50,000	U. Connecticut	O'Donnell
	$100,000	Rutgers U.	Kohut/Roarty
	$100,000	Old Dominion	Atkinson
HF Radar Regional Coordinator	**$50,000**	Rutgers U.	Kohut/Roarty
Satellite Technology Centers (2 x $50,000 / center)	**$100,000**		
	$50,000	Rutgers U.	Crowley
	$50,000	U. Delaware	Oliver
Glider Technology Centers (3 x $100,000 / center)	**$300,000**		
	$100,000	U. Massachusetts	Brown
	$100,000	Rutgers U.	Schofield
	$100,000	U. Maryland	Boicourt
Glider Flights (4 flights x $50,000 / flight)	**$200,000**		
	$50,000	U. Massachusetts	Brown
	$50,000	U. Maryland	Boicourt
	$50,000	Rutgers U.	Schofield
	$50,000	Rutgers U.	TBD
Observing Subtotal	***$1,300,000***		
3. Data Management & Communication Subsystem Base Support			
Data Management	**$200,000**		
	$175,000	Applied Science*	Howlett
	$25,000	Rutgers U.	Kerfoot
Web Site Management	**$100,000**		
	$25,000	Rutgers U.	Kerfoot
	$75,000	Rutgers U.	Crowley
Data Mgmt & Comm Subtotal	***$300,000***		
4. Modeling & Analysis Subsystem Base Support			
Weather Ensemble	**$100,000**	Weatherflow*	Titlow
Short Term Prediction System	**$100,000**	U. Connecticut	O'Donnell
Dynamical Modeling Forecast Centers (3 x $100,000 / center)	**$300,000**		
	$100,000	U. Massachusetts	Gongopadhyay
	$100,000	Stevens Inst Tech	Blumberg
	$100,000	Rutgers U.	Wilkin
Modeling & Analysis Subtotal	***$500,000***		
5. Education & Outreach Subsystem Base Support			
Education Center	**$100,000**	Rutgers U.	McDonnell
Outreach Center	**$100,000**	U. Delaware	Thoroughgood
Education & Outreach Subtotal	***$200,000***		
EXISTING BASE SUPPORT TOTAL	**$2,800,000**		

1. Regional Management Subsystem. The priority is to maintain the regional management at the present level ($500K/year). The management team includes the Managing Director, the Executive Director, the Stakeholder Liaison (see E&O) and partial support for Project Coordinators and Financial Assistants (from U. Delaware). The operations management team includes the Managing Director, an Operations Manager (from Rutgers), partial support for a Program Coordinator, and a Financial Manager (Rutgers).

2. Observing Subsystem. This maintains the existing IOOS-supported HF Radars, Satellites & Gliders. HF Radar site support is at the NOAA National HF Radar Network recommended annual level of $10K/site, including communications, utilities, general site maintenance, travel, and backup media. The current network of 33 shore sites is maintained by three (Northern, Central & Southern) HF Radar Technology Centers (HFRTCs) so that all sites are within a 1-day roundtrip. Each Center (Northern Center is shared) includes about .67 FTE funding for a HF Radar technician. Despite having less than 30% of the recommended 10 technicians to achieve

the USCG target of 80% spatial coverage 80% of the time, a viable network above the 60% coverage 60% of the time level of reliability is maintained. This success is supported by the HF Radar Coordination team at the level of $50K/year. Satellite Technology Centers (STCs) include data acquisition downlinks at Rutgers (L-Band, X-Band) and U. Delaware (X-Band). The STCs include about .33 FTE of a technician, data acquisition licensing and software support fees, and backup media. Glider Technology Centers (GTCs) are established following the HFRTC pattern of Northern, Central and Southern minimizing travel costs. GTCs include .67 FTE of a glider technician. Glider flight costs are based on >175 flights; the $50K/flight cost is all-inclusive.

PROGRAM ENHANCEMENTS: Distribution by Task			
Description	**Total**	**Institution**	**PI**
HF Radar Spares & Gap Filling	**$200,000**	Rutgers U.	Kohut/Roarty
Expanded Glider Operations (6 flights x $50k / flight)	**$300,000**		
	$50,000	U. Massachusetts	Brown
	$50,000	U. Maryland	Boicourt
	$50,000	Rutgers U.	Schofield
	$150,000	Rutgers U.	TBD
Glider Purchases ($150k each)	**$300,000**		
	$150,000	U. Massachusetts	Brown
	$150,000	U. Maryland	Boicourt
Expanded Satellite Operations (2 x $50k / center)	**$100,000**		
	$50,000	U. Delaware	Oliver
	$50,000	Rutgers U.	Crowley
Expanded Ocean Model Forecasts (4 x $50k / center)	**$200,000**		
	$50,000	U. Massachusetts	Gangopadhyay
	$50,000	U. Connecticut	O'Donnell
	$50,000	Stevens Inst Tech	Blumberg
	$50,000	Rutgers U.	Wilkin
New Product Development	**$100,000**	Rutgers U.	Glenn
ENHANCEMENTS TOTAL	**$1,200,000**		
TOTAL BUDGET REQUEST	**$4,000,000**		

3. DMAC Subsystem. The team includes a DMAC Coordinator, plus part time support for programmers at ASA and Rutgers. Based on the success of the IOOS Deepwater Horizon Oil Spill Portal, Rutgers has become the RA web designer and host. An advanced data visualization developer is established as the bridge between Data and Web groups.

4. Modeling and Analysis Subsystem. An atmospheric and 4 ocean Forecasting Technology Centers (FTCs) will develop the weather and ocean forecast ensembles. The atmospheric ensemble depends on leveraged weather forecasts supported by non-IOOS funds, but with validation data from WeatherFlow's meteorological network. The 4 ocean forecasts will be maintained by their FTC's and assembled into an ensemble with the DMAC team.

MARACOOS ANNUAL BUDGET TEMPLATE: YEARS 1 - 5				
DISTRIBUTION BY INSTITUTION & PI (*Industry Partners)				
Institution	**Base**	**Enhancement**	**Total**	**PI**
1. U. Delaware	***$580,000***	***$50,000***	***$630,000***	
	$500,000	$0	$500,000	Thoroughgood
	$50,000	$50,000	$100,000	Oliver
	$30,000	$0	$30,000	Lipphardt
2. Rutgers U.	***$1,005,000***	***$600,000***	***$1,605,000***	
	$100,000	$100,000	$200,000	Glenn
	$330,000	$200,000	$530,000	Kohut/Roarty
	$150,000	$50,000	$200,000	Schofield
	$50,000	$150,000	$200,000	TBD-Gliders
	$125,000	$50,000	$175,000	Crowley
	$50,000	$0	$50,000	Kerfoot
	$100,000	$50,000	$150,000	Wilkin
	$100,000	$0	$100,000	McDonnell
3. U. Massachusetts	***$310,000***	***$250,000***	***$560,000***	
	$210,000	$200,000	$410,000	Brown
	$100,000	$50,000	$150,000	Gangopadhyay
4. U. Maryland	***$150,000***	***$200,000***	***$350,000***	Boicourt
5. U. Connecticut	***$170,000***	***$50,000***	***$220,000***	O'Donnell
6. Applied Science*	***$175,000***	***$0***	***$175,000***	Howlett
7. Stevens Inst Tech	***$110,000***	***$50,000***	***$160,000***	
	$10,000	$0	$10,000	Bruno
	$100,000	$50,000	$150,000	Blumberg
8. Old Dominion U.	***$100,000***	***$0***	***$100,000***	Atkinson
9. Weatherflow*	***$100,000***	***$0***	***$100,000***	Titlow
10. CIT*	***$50,000***	***$0***	***$50,000***	Vorona
11. U. Rhode Island	***$30,000***	***$0***	***$30,000***	Ullman
12. U. North Carolina	***$20,000***	***$0***	***$20,000***	Seim
TOTAL BUDGET	***$2,800,000***	***$1,200,000***	***$4,000,000***	

5. Education & Outreach Subsystem. Funding is for one Regional Education Center (Rutgers) and one Regional Outreach Center (U. of Del). The Education effort leverages NSF COSEE-NOW and includes developers to produce Visualization tools. Outreach includes the Stakeholder Liaison that resides in the RA, and support for user identified products and workshops.

6. Priority Program Enhancements. (1) HF Radar spares to reduce downtime; (2) coordinated 5-glider mission, bringing base level mission up to 5 coordinated gliders; (3) purchase of dedicated instrumented gliders ($150K each); (4) satellite enhancements to access new satellite systems; (5) $50K for each of Ocean FTC's for adaptive sampling and theme-based coupled model development; (6) $100 K/year for new product development and "Beach Basics".

Appendix – 4.a *Detailed Budget Information*

Description	*Yr 1*	*Yr2*	*Yr3*	*Yr4*	*Yr5*	*Total*
Personnel-Staff						
Program Coordinator	$20,211	$19,811	$19,055	$18,260	$17,426	**$94,763**
CODAR Technician	$43,000	$44,000	$45,000	$46,000	$46,000	**$224,000**
CODAR Regional Coordinator	$11,181	$11,287	$10,947	$9,846	$9,471	**$52,732**
Satellite Technician	$36,000	$41,988	$41,988	$41,988	$41,988	**$203,952**
Glider Technicians	$80,276	$83,591	$85,448	$87,398	$89,446	**$426,159**
Glider Software Technician	$36,400	$40,504	$40,641	$40,857	$43,056	**$201,458**
Web Technician	$31,000	$33,000	$34,000	$34,000	$35,000	**$167,000**
Modeling Staff	$38,706	$39,480	$40,270	$41,075	$41,897	**$201,428**
Ed. Application Developer	$12,561	$12,937	$13,326	$13,725	$14,137	**$66,686**
Education Coordinator	$22,174	$20,763	$22,455	$20,926	$26,092	**$112,411**
Staff Fringe 34.6%	*$114,702*	*$120,190*	*$122,186*	*$122,513*	*$126,125*	***$560,717***
Hourly Student *	$5,000	$4,700	$4,700	$4,700	$4,700	**$23,100**
Faculty Summer Salary						
Scott Glenn (1 month)*	$19,393	$20,363	$21,381	$22,450	$23,572	**$107,159**
Josh Kohut (1 month)*	$8,729	$9,165	$9,624	$10,105	$10,610	**$48,233**
Oscar Schofield (1 month)*	$14,088	$14,792	$15,532	$16,309	$17,124	**$77,845**
John Wilkin (1 month)*	$10,763	$10,763	$10,763	$10,763	$10,763	**$53,815**
Graduate Student						
PhD Graduate Student	$14,228	$14,228	$10,671	$14,228	$14,228	**$67,583**
Grad Student Fringe 24.25%	*$3,450*	*$3,450*	*$2,588*	*$3,450*	*$3,450*	***$16,389***
Domestic Travel	*$44,222*	*$42,825*	*$41,533*	*$39,033*	*$33,697*	***$201,310***
Foreign Travel	*$8,781*	*$9,281*	*$9,281*	*$8,781*	*$8,781*	***$44,905***
Equipment*	*$226,596*	*$216,068*	*$219,720*	*$215,840*	*$214,901*	***$1,093,125***
Supplies	*$45,037*	*$40,587*	*$38,485*	*$32,923*	*$29,658*	***$186,690***
Contractual*	*$2,495,000*	*$2,495,000*	*$2,495,000*	*$2,495,000*	*$2,495,000*	***$12,475,000***
Other	*$248,755*	*$232,621*	*$227,290*	*$230,779*	*$224,385*	***$1,163,830***
Total Direct Charges	*$3,590,253*	*$3,581,405*	*$3,581,893*	*$3,580,960*	*$3,580,819*	***$17,915,330***
Indirect Charges – 54% yr 1, 55%	*$409,747*	*$418,595*	*$418,107*	*$419,040*	*$419,181*	***$2,084,670***
TOTAL	***$4,000,000***	***$4,000,000***	***$4,000,000***	***$4,000,000***	***$4,000,000***	***$20,000,000***

*No fringe charged to this salary. **No indirect charges to these items.

PERSONNEL: Salary is requested for the following: A program coordinator to manage daily logistical concerns for the project (3 mos/yr), a HF Radar (HFR) tech to set up and maintain 16 of the HFR sites (12 mos/yr), HFR Regional Coordinator who oversees the site network (2 mos/yr), a satellite technician who operates and processes dish systems (7 mos/yr), partial time for 2 glider technicians who repair, deploy and recover IOOS gliders, glider software technician that ensures delivery of data to the web and also works with the data management team (2.5 mos/yr each glider software & data management), a web technician to develop/maintain the MARACOOS web site (5.5 mos/yr), an ocean modeler to run operational models (4 mos/yr), an education application developer to develop web-based and/or handheld apps for education audiences (6 mos/yr) and an education coordinator to assist with application design/needs assessment/content development (3 mos/yr). Fringe on staff is charged at 34.6%. One month of summer salary is requested for Scott Glenn as the principal investigator of MARACOOS; Josh Kohut who chairs the CODAR data collection/synthesis efforts, Oscar Schofield who manages the glider deployments; and John Wilkin who leads the ocean modeling group. No fringe is applied to faculty summer salary. A 1/2 time graduate student is included to support the modeling teams efforts (24.25% fringe). Hourly students will participate in the daily activities of the lab with no fringe required.

TRAVEL: Travel funds are requested ($210k over 5 years). Funds are for 1) HFR and Glider deployments, 2) travel for the principal investigator to regional IOOS meeting (based on last proposal, 1 trip to Boston ($0.6k), 1 to Baltimore ($0.5k) and 1 to DC ($0.6k) (includes hotel, per diem, parking, transportation, mileage and train), 3) PI to attend a single Ocean Sciences meeting ($3.7k, including air, hotel 3 nights, mileage, parking, per diem), 3) regional travel for data management team, 4) education team members to attend the MARACOOS annual meeting, 5) 4

national IOOS meetings trips (NFRA/IOOS Education & Outreach Committee, IOOS Product Development, MTS, NMEA, Coastal Zone, Sea Grant, NERRS meetings) and 6) 8 people to travel to Rutgers (years 1-4) for a product development needs assessment focus groups.

FOREIGN: Travel funds are requested for the managing director of the ocean observing system and faculty to attend two international meetings at least one time per year ($9k/yr).

EQUIPMENT (>$5K): HFR system $200k per year is requested for a spare HFR system and associated parts. For the first three years, this includes a long-range SeaSonde ($120k), a Van ($30k), a transmitter ($35k), a transmit antenna ($8k), and a transponder ($7k). For years 4 and 5, this includes a Long-range SeaSonde ($120k), a receiver ($65k), a receive antenna ($11k) and lightening protection ($4k). $7k is requested by the data management team for a new data processor. HFR may require the replacement of broken equipment - $13k in year one and $12k each year thereafter. The modeling group has budgeted for partial payment of new processing computers for a total of $25k over five years.

SUPPLIES*:* To assist with the operation and facilitation of the HFR network, *computer supplies* are required which may include cables, peripherals, and other supplemental computer components of a system. ($2k each year). $1k over the 5-year period is requested for the CODAR technician to support the central operating site maintained in New Brunswick. The modeling group requests $1k over the project. To assist with project development, management, and product dissemination, the education team requests $2k over the 5 years. To assist with data management and web site maintenance $0.7k is requested. *Project supplies* are requested at $86k over the 5 years. These items include but are not limited to HFR site maintenance parts including new site sheds, glider wings and consumable glider parts, classroom kits for the education group, research supporting supplies including but not limited to printer/copy paper, toner supplies, other consumable supplies, and satellite backup tapes. An additional $86k for glider batteries, $17k/year - $1.9k per set of batteries for 6 deployments/year and 3 spares.

CONTRACTUAL: There are currently 12 designated subcontracts (includes $100k for beach basics), for a total of $2,495k/year. As part of the Rutgers in kind support, there is no indirect charges on these contracts.

OTHER: ***Computer Software***: Computer software is required for web development, data management, web site maintenance, research activities and yearly satellite software licenses at a cost of $5k each year. A total of $27k over 5 years is requested. ***Equipment less than $5k/unit****:* This includes but is not limited to computers, and is $98k over the 5 years. This includes costs for computers for HFR sites, processors, satellite tape drives, modeling computers, portable computers for field technicians, and the education group. ***Professional Services***: To augment the educational materials, we request funds ($3k each in years 2 and 4) for professional services for development of multimedia pieces (i.e. audio slideshows or podcasts). ***Other Services***: Funding is requested to support the 18 remote HFR sites which includes costs for communication services (cable, phone, internet and electricity) for a total of $373k. Other services also include Iridium and ARGOS satellite communications for the underwater gliders which is necessary to communicate with the robots while deployed at sea. ***Publication Services***: The group requests $2.7k in publication services. ***Cell Phone***: Cell phone funds are requested each year for the following: principal investigator to maintain communications with the HFR/glider team during deployments, as well as with all the staff supporting the regional network of technologies. Phone support is requested for a HFR and glider technician as well as software manager who responsible for 24:7 data delivery of MARACOOS ($25k). ***Copy Costs****:* $0.3k per year is requested for the management group for reporting group project coordination. ***Glider Shipping***: Freight shipping is required for gliders for repair to and from the manufacturer. This shipping is for freight and requires a specialty shipper given the issues associated with shipping equipment. ($15k for 5 years) ***Postage***: Charges ($15k) are included for carriers such as FedEx for shipping smaller parts (glider/HFR, etc.) for repair. $0.2k/yr is also

included for shipping subcontracts between partners. ***Conference Registrations***: Funds for meeting registrations are requested ($9.5k over 5 years) ***Business Meeting Expenses***: Expenses for business meetings are requested. For example the education group includes $1k for the four years funds to support workshops (food, etc). ***Telephone***: The central HFR site which receives the data from all the external HFR sites (New Brunswick, NJ) is comprised of two phone lines which cost an average of ~$0.3k/month for each line ($38k over 5 years). ***Equipment Rental – Ship Time***: Shiptime is required for the glider team (six deployments/year at $3.4k for deployment & recovery). Ship time is also required for pattern measurements in setting up HFR sites. Total ship time is $188k) ***Tuition***: Tuition is for the half-time graduate student ($14k over 5 years). ***Insurance*: (30500)** Insurance is required for each glider (~ $6.6k/glider/year), so for 6 gliders a total of $39.6k is required. ***Repair and Maintenance***: Funds are requested for repair work on both the HFR and gliders. Repairs are often upwards of $10k therefore a total $144k is requested over 5 years. The Rutgers University indirect rate is 54% for FY12 and 55% afterwards. Facilities and administration fees are not charged to equipment over $5,000, ship time, insurance, repair and maintenance or tuition.

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 20,000,000	$ 0	$ 20,000,000
2. Rutgers University						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2012	(2) 2013	(3) 2014	(4) 2015	(5)
a. Personnel	$ 403,710	$ 421,383	$ 425,811	$ 432,640	$
b. Fringe Benefits	118,152	123,641	124,774	125,964	
c. Travel	53,003	52,106	50,814	47,814	
d. Equipment	226,596	216,068	219,720	215,840	
e. Supplies	45,037	40,587	38,485	32,923	
f. Contractual	2,495,000	2,495,000	2,495,000	2,495,000	
g. Construction	0	0	0	0	
h. Other	248,755	232,621	227,290	230,779	
i. Total Direct Charges (sum of 6a-6h)	3,590,253	3,581,405	3,581,893	3,580,960	
j. Indirect Charges	409,747	418,595	418,107	419,040	
k. **Totals** (sum of 6i and 6j)	4,000,000	4,000,000	4,000,000	4,000,000	
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2. Rutgers University						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2016	(2)	(3)	(4)	(5)
a. Personnel	$ 444,822	$	$	$	$ 2,212,366
b. Fringe Benefits	129,576				622,107
c. Travel	42,478				246,215
d. Equipment	214,901				1,093,125
e. Supplies	29,658				186,690
f. Contractual	2,495,000				12,475,000
g. Construction	0				0
h. Other	224,385				1,163,830
i. Total Direct Charges (sum of 6a-6h)	3,580,819				17,915,330
j. Indirect Charges	419,181				2,084,670
k. **Totals** (sum of 6i and 6j)	4,000,000				20,000,000
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 4,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$	$	$	$	$

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. Rutgers University	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$	$	$	$

Section F - Other Budget Information

21. Direct Charges 17,915,331

22. Indirect Charges 2,084,670

23. Remarks

University of Delaware

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)
Towards a Comprehensive Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)

Project duration:	June 1, 2011 – May 30, 2016
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu
Subcontract Institution:	**University of Delaware**
Principal Investigator:	Dr. Carolyn A. Thoroughgood, (302) 831-7109; ctgood@udel.edu
Financial Representative:	Mark Dobbins, Contract and Grant Administrator Research Office University of Delaware 210D Hullihen Hall Newark, DE 19716 Telephone: (302) 831-7274; Fax: (302) 831-2828; email: dobbins@udel.edu
Requested Amount:	Year 1: $500,000 Year 4: $500,000 Year 2: $500,000 Year 5: $500,000 Year 3: $500,000 **TOTAL: $2,500,000**

Official Grant Administrator Signature:

CM Overby Date: 9/23/10

Cordell M. Overby, Associate Provost
University of Delaware
Research Office
208A Hullihen Hall
Newark, DE 19716
Phone: (302) 831-2383, Email: overbyc@udel.edu

STATEMENT OF WORK:

The primary activities of the MARACOOS Regional Association will focus on stakeholder and member engagement. For this proposal, particular attention is being given to strengthening the translation of ocean observing data and products to end-users. The User's Council and the Subregional Ocean Observing System Council will be actively engaged to develop a well-defined work plan with measurable performance standards for the Stakeholder Liaison new hire. In addition, an aggressive project of social networking will be undertaken to maximize the distribution of ocean observational data and products. This new initiative will be complemented by ongoing regional association activities, including aggressive pursuit of additional formal Strategic Alliances, the provision of regular communications via an up-to-date website and electronic newsletter, the close integration and support of ocean observing operations, and the conduct of at least one theme-related workshop per year for each of the five years. The MARACOOS Regional Association will also be responsible for day-to-day operations required to accomplish stated objectives, with re-doubled efforts to document and evaluate program accomplishments and impacts. The Regional Association will also assume the responsibility of Regional Association Certification, once the procedure has been officially promulgated.

BUDGET JUSTIFICATION:

Dr. Carolyn A. Thoroughgood will serve as project PI and Coordinator of the project. She requests 1.0 mm of salary support in Yr. 1 and 0.5 mm of salary support in Yrs. 2-5. Funds are requested for a full-time Executive Director and Stakeholder Liaison and a part-time communications person and secretary.

Domestic travel funds are requested and will be used to cover business travel of office staff throughout the regional footprint. Funds are requested to purchase general office supplies. Legal fees are budgeted to cover costs associated with changing the corporation's name as outlined in the proposal. NFRA dues of $5,000/yr. are also requested.

Funds are requested to support annual regional workshops as well as topic-specific workshops. The regional workshop budget has been designed to provide travel grants including overnight accommodations; approximately $15K/yr. of the funds requested for workshops will be used for travel grants. Remaining funds will be used to cover costs of conference rooms, meals, etc.

Project Evaluation costs and Stakeholder Initiative funds are requested. Project Evaluation funds will be used to retain an evaluation consultant who will analyze MARACOOS accomplishments opposite performance metric. The Stakeholder Initiative funds will be used to enhance the transfer of ocean data and decision models to diverse end users of coastal ocean and estuarine observations. The Stakeholder Initiative funds will also support demonstration projects and cost benefit analyses recommended by the User's Council that involve the translation and tailoring of MARACOOS data products to specific end user needs; valuation of demonstration project outcomes will be conducted throughout the project. The Stakeholder Initiative funds are decreased in Years 4 and 5 because of the expectation that shared cost projects will be funded by MARACOOS partner affiliates.

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
	Salary						
1	Carolyn A. Thoroughgood, PI	$25,568	$13,295	$13,827	$14,380	$14,955	$82,025
2	Executive Director	$106,424	$110,551	$114,973	$119,572	$124,355	$575,875
3	Stakeholder Liaison	$75,000	$77,909	$81,025	$84,266	$87,637	$405,837
4	Communications Person	$15,000	$15,581	$16,204	$16,853	$17,527	$81,165
5	Secretary	$20,000	$20,000	$20,000	$20,000	$20,000	$100,000
	Total Salary	$241,992	$237,336	$246,029	$255,071	$264,474	$1,244,902
	Fringe Benefits						
1	Faculty/Professionals, 32.3%	$71,703	$70,200	$73,007	$75,928	$78,965	$369,803
2	Misc. Wage Secretary, 7.9%	$1,580	$1,580	$1,580	$1,580	$1,580	$7,900
	Total Fringe Benefits	***$73,283***	***$71,780***	***$74,587***	***$77,508***	***$80,545***	***$377,703***
	Total Salary & Fringe	$315,275	$309,116	$320,616	$332,579	$345,019	$1,622,605
	Other Direct Costs						
	Domestic Travel	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000
	Supplies	$7,045	$8,204	$6,104	$6,241	$6,301	$33,895
	Workshops	$35,000	$40,000	$33,600	$35,000	$24,000	$167,600
	Project Evaluation Fees	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
	NFRA Dues	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
	Professional/Legal Fees	$3,000	$3,000	$0	$0	$0	$6,000
	Stakeholder Initiative Support	$15,000	$15,000	$15,000	$1,500	$0	$46,500
	Total Other Direct Costs	**$85,045**	**$91,204**	**$79,704**	**$67,741**	**$55,301**	**$378,995**
	Total Direct Costs	**$400,320**	**$400,320**	**$400,320**	**$400,320**	**$400,320**	**$2,001,600**
	Indirect Costs – 24.9% x MTDC	***$99,680***	***$99,680***	***$99,680***	***$99,680***	***$99,680***	***$498,400***
	TOTAL DIRECT & INDIRECT COSTS	**$500,000**	**$500,000**	**$500,000**	**$500,000**	**$500,000**	**$2,500,000**

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)

2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 30, 2016
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu
Subcontract Institution:	**University of Delaware**
Principal Investigator:	Dr. Matthew Oliver 302-645-4079, moliver@udel.edu
Co-Principal Investigator:	Dr. Bruce Lippardt 302-831-6836, brucel@udel.edu
Address:	College of Earth, Ocean and Environment School of Marine Science and Policy 104 Smith Laboratory Lewes, Delaware 19958

Requested Amount:	Year 1: $130,000	Year 4: $130,000
	Year 2: $130,000	Year 5: $130,000
	Year 3: $130,000	**TOTAL: $650,000**

Official Grant Administrator Signature

Sandra Anderson _____Date: 10/1/2010

Sandra Anderson, Contract and Grant Administrator
Research Office
210 Hullihen Hall
Newark, De 19716
302-831-2692, sanders@udel.edu

BUDGET JUSTIFICATION:

Research portion:

The ultimate goal is to provide satellite products for model assimilation and to provide MARACOOS users ecological decision products from orbital systems. The Orbital Platforms of General Interest to MARCOOS: SeaWiFS, MODIS-Aqua, NOAA-AVHRR, MERIS, FY1-D, OCEANSAT. These platforms are highest priority because of the following reasons.
1. MODIS-Aqua collects calibrated SST and ocean color daily.
2. The APS system is compatible with MODIS-Aqua
3. NASA Water Mass Algorithm is compatible with MODIS-Aqua
4. NOAA-AVHRR provides more than on SST pass per day
5. Sea-WiFS collects ocean color, but can be intermittent at times.

Transfer NOAA-AVHRR, APS and NASA Sea Surface Temperature, Ocean Color, Water Mass and Salinity products to a web server for general end-user use and for model assimilation. The data will have a THREDDS output, as well as a Google Earth/Google Maps output. Other satellite products will follow.
MODIS, NOAA-AVHRR, APS products are being collected, processed and stored at RUCOOL and at the University of Delaware. NASA water mass products have been tested and validated on a global scale. Coastal salinity algorithms have been tested and validated in the Mid-Atlantic. Marine spatial planning maps are under development with National Marine Fisheries Service.
Tasks to be accomplished and projected completion date**.**
1. Convert existing data from ncdf3 to ncdf4 for compression and easy integration in THREDDS

2. Make water mass and marine spatial planning maps real-time.
3. Make coastal ocean salinity algorithm real-time
4. Make real-time imagery available via Google Earth and Google Ma

To accomplish these goals, I am requesting 1.5 months of salary each year. I am requesting 6.12, 7.71, 7.29, 5.14, 6.51, in years 1-5 respectively for support technical staff that will handle daily operations of the cloud filtering, water mass and salinity algorithms, as well as archiving and distributing the satellite data. We are requesting 2K in travel for each year to go to regional observing meetings. We are also requesting 17K in year 1 and year 4 to purchase computing and storage dedicated to satellite processing and data distribution.

Delaware Bay HF radar network:

Funds are requested to operate and maintain three CODAR standard-range 25MHz SeaSondes at the mouth of the Delaware Bay. Sites are located at Cape Henlopen State Park (Delaware), Indian River Lifesaving Station (Delaware) and Saint Mary's convent in Cape May Point, NJ. We request $30,000 total per year for these three sites. Our spending plan is as follows:

Year 1: One combined transmit/receive antenna will be purchased as a troubleshooting aid and ready spare in the event of equipment failure. Other expenses: salary support for Dr. Lipphardt (0.06 man-months) and one technician (0.5 man-months); travel funds for eight site visits for one technician; funds for electricity and Internet communications at all sites; two days of small boat time for antenna calibrations; and supplies, including spare parts, consumables, tools, and manufacturer technical support by telephone or remote site login.

Years 2-5: A uniform spending plan over these four years is anticipated for these expenses:
salary support for Dr. Lipphardt (0.06 man-months per year) and one technician (one man-month per year); travel funds for eight site visits for one technician plus travel funds for one technician to attend a national working group meeting; funds for electricity and Internet communications at all sites; two days of small boat time for antenna calibrations; computer hardware for data storage and backup; and supplies, including spare parts, consumables, tools, and manufacturer technical support by telephone or remote site login.

University of Delaware's current fringe benefit rate for faculty and professionals is 32.3%. University of Delaware's current negotiated indirect cost rates are 53% for research on campus and 38.9% for service on campus. Both are calculated on modified total direct costs (MTDC).

BUDGET TABLE BREAKDOWN:

Description	Yr 1	Yr 2	Yr3	Yr4	Yr5	Total
Oliver, Matthew, PI	$13,425	$13,760	$14,312	$14,883	$15,479	$71,859
Lipphardt, Bruce, CO-PI	$544	$565	$588	$612	$636	$2,945
Technician	$28,106	$38,365	$37,984	$29,190	$37,175	$170,820
Fringe Benefits, 32.3%faculty/professionals	$13,590	$17,019	$17,082	$14,433	$17,213	$79,337
Total Salary and Fringe	$55,665	$69,709	$69,966	$59,118	$70,503	$324,961
Equipment*	$29,000			$17,000		$46,000
Domestic Travel	$4,000	$5,000	$5,000	$5,000	$5,000	$24,000
HF Radar Site Support(Comms & Power)	$6,000	$6,000	$6,000	$6,000	$6,000	$30,000
HF Radar Supplies	$822	$3,028	$2,772	$2,508	$2,234	$11,364
Computer Storage		$2,500	$2,500	$2,500	$2,500	$10,000
Small Boat Usage*	$1,000	$1,000	$1,000	$1,000	$1,000	$5,000
Total Direct Costs	$96,487	$87,237	$87,238	$93,126	$87,237	$451,325
MTDC Indirect, 53%	$28,752	$34,641	$34,640	$28,752	$34,641	$161,426
MTDC Indirect, 38.9%	$4,761	$8,122	$8,122	$8,122	$8,122	$37,249
Total Costs	$130,000	$130,000	$130,000	$130,000	$130,000	$650,000

*** excluded from IDC calculation**

University of Massachusetts, Dartmouth SUBCONTRACT

WORK STATEMENT & BUDGET: YEARS 1-5

Towards a Comprehensive
Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)

Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, chkohut@marine.rutgers.edu
Subcontract Institution:	University of Massachusetts, Dartmouth
Principal Investigator:	Dr. Wendell Brown 508-910-6390, wbrown@umassd.edu
Co-Principal Investigator:	Dr. Avijit Gangopadhyay 508-910-6330; agangopadhya@umassd.edu
Address:	School for Marine Science & Technology 736 S Rodney French Blvd New Bedford, MA 02744-1221
Total 5-year Amount:	$ 2,800,000

Task 1 – HF Radar Operations; MARACOOS Northern Domain Long Range CODARs

- Maintain the operational Northern Region Long-Range CODAR stations;
- Continue assessment of CODAR-derived surface current uncertainties;

Chris Jakubiak, the SMAST MARACOOS project engineer under the supervision of W. Brown, is responsible for maintaining the continuity in the operation of Long-Range CODAR HF-radar sites at Nauset, Nantucket, and Martha's Vineyard, MA; and Block Island, RI. Richard Arena, an Assistant Oceanographer and Phd. student under the supervision of W. Brown, will assist Jakubiak with field operations and continue our effort to refine the space-time-dependent uncertainty estimates of CODAR surface currents in the Northern Domain.

Task 2 - Northern MARACOOS Region Glider Operations

- Conduct northern MARACOOS-domain glider operations south of Massachusetts;
- Process available glider data for their assimilation into the real-time SMAST/HOPS water property nowcast and forecast runs (see Task 3).

Chris Jakubiak has operational responsibility for the proposed MARACOOS Northern Domain ocean glider deployments and tracking; as well as for setting up the Northern Domain Glider Technology Center. Richard Arena will assist Jakubiak with the Northern Domain glider preparation and deployments as well as the processing of Northern Domain glider data for HOPS assimilation and analysis. With the proposed acquisition of a new Webb ocean glider each year the Northern Domain glider operations will become more robust over the 5-year duration of the subcontract.

Task 3 – SMAST/HOPS Model 3-D Water Property and Velocity Fields

- Maintain the weekly web-served operational 3-D data assimilation SMAST-HOPS products; with continued accuracy and precision assessments;
- Enhanced model skill by validating against USCG drifter data and thus quantify uncertainty for ensemble forecasting with multiple weather forecasts.
- Assimilate CODAR and SSH data in a nested higher resolution (5km) model grid.

The SMAST operational Harvard Ocean Prediction System (HOPS) regularly assimilates satellite SST and, when available, MARACOOS glider-measured 4-D water properties, to produce weekly 3-D nowcast and forecast MARACOOS regional temperature, salinity and current maps (see http://www.smast.umassd.edu/modeling/RTF/marcoos). A. Schmidt, under the supervision of A. Gangopadhyay, continues the SMAST/HOPS implementation, maintenance and accuracy assessment of SMAST HOPS using comparisons between model and CODAR-derived surface maps, model and USCG drifter trajectories; and model and glider-measured water properties.

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
	Salary						
1	Wendell Brown, PI (1.91% Fringe)	$42,665	$42,665	$42,665	$42,665	$42,665	$213,326
2	A. Gangopahyay – PI (1.91% Fringe)	$18,833	$18,833	$18,833	$18,833	$18,833	$94,165
3	Engineer – CODAR & Glider (35.03%)	$81,018	$81,018	$81,018	$81,018	$81,018	$405,090
4	Research Associate – Modeling (35.03%)	$57,948	$57,948	$57,948	$57,948	$57,948	$289,739
5	Graduate Student (0% Fringe)	$12,500	$12,500	$12,500	$12,500	$12,500	$62,500
6	Graduate Student (0% Fringe)	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
	Health & Welfare (Full-time position)	$936	$936	$936	$936	$936	$4,680
	Total Salary & Fringe	**$223,900**	**$223,900**	**$223,900**	**$223,900**	**$223,900**	**$1,119,500**
1	Graduate Student Fees	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
	Other Direct Costs						
	TRAVEL	$12,838	$12,838	$12,838	$12,838	$12,838	$64,190
	SUPPLIES & MATERIALS	$16,082	$16,082	$16,082	$16,082	$16,082	$80,410
	EQUIPMENT (T. Webb Glider)	$150,000	$150,000	$150,000	$150,000	$150,000	$750,000
	Total Direct Costs	**$412,820**	**$412,820**	**$412,820**	**$412,820**	**$412,820**	**$2,064,100**
	Indirect Costs – 56%	***$147,180***	***$147,180***	***$147,180***	***$147,180***	***$147,180***	***$735,900***
	TOTAL DIRECT & INDIRECT COSTS	**$560,000**	**$560,000**	**$560,000**	**$560,000**	**$560,000**	**$2,800,000**

University of Maryland Center for Environmental Science

CFDA Number: 11.012, Integrated Ocean Observing System (IOOS)

2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 31, 2016
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu
Subcontract Institution:	**University of Maryland Center for Environmental Science**
Principal Investigator:	Dr. William Boicourt, 410-221-8426, boicourt@umces.edu
Financial Representative:	Erica Kropp, Vice President for Administration
Address:	UMCES PO Box 775 Cambridge, MD 21613
Congressional District:	First

Requested Amount:	Year 1: $350,000	Year 4: $350,000
	Year 2: $350,000	Year 5: $350,000
	Year 3: $350,000	**TOTAL: $1,750,000**

Official Grant Administrator:

for Erica Kropp Date: 9/30/10

Erica Kropp
P.O. Box 775
Cambridge, MD 21613
Phone: 410-221-2015; email: kropp@umces.edu

BUDGET JUSTIFICATION:

The primary goal of this component of the 5-year MARACOOS effort is to establish the Southern MARACOOS Glider Technology Center and to operate and maintain gliders in the southern portion of the Middle Atlantic Bight region to provide three-dimensional data for assimilation into ocean forecasts. This component will be carried out by W. Boicourt, who will direct the effort, and T. Wazniak and C. Derry, both Senior Faculty Research Associates. Boicourt will carry out the design and implementation of the Technology Center. All will participate in preparing gliders for operation, with Wazniak having primary responsibility for launch and recovery operations and Derry for preparation and data management. Salary support is requested for members of the 3-person team, with participation averaging 1 month/yr for Boicourt, 7 month/yr for Wazniak, and 2.5 month/yr for Derry. Fringe Benefits are determined at 30% of wages. Expendable supplies include batteries (at $1,900 per flight) and replaceable parts (such as anodes, wings, bladders) for 2 flights per year. Travel support is requested for launch and retrieval operations out of Ocean City, MD and Lewes, DE at 8 trips per year from Cambridge, MD (at $200 per person per 2-person trip). Travel is also requested for 3 MARACOOS meetings per year ($600 per trip) and attendance at a national meeting ($1,000). Primary communications costs are for Iridium Satellite communications with gliders at $2,600 per flight. Instrument maintenance and calibration costs are estimated at $10,000 per year. These costs include glider refurbishment activities performed by factory and sensor calibrations (at Seattle Regional Calibration Facility). Research Computer Support Service costs are for maintaining hardware and a data backup system. Machine shop support is estimated at an average of approximately $2,000 per year for

maintenance of instruments launch and recovery apparatus. Launch and recovery operations for the glider flights will be conducted from vessels in the UMCES small vessel fleet and on occasion, local charters in Ocean City and Lewes. Costs for these vessels are estimated at $1,000 per day for 12 days per year. UMCES vessels will be trailered to launch and recovery and $1,000 per year is included for a tow vehicle. To build the glider fleet at the Southern MARACOOS Glider Technology Center, a glider per year is requested for permanent equipment. The specified glider is a Webb Technologies Slocum Electric Glider, which is the workhorse vehicle of the MARACOOS fleet. The cost of $150,000 per unit reflects the cost of the glider and the added CTD and Optical sensing package. Indirect Costs for UMCES are determined at 50.5% of Modified Total Direct Costs (Direct Costs less permanent equipment).

University of Maryland Center for Environmental Science BUDGET TABLE BREAKDOWN:

	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
	Salary						
1	Boicourt William, PI	$13,391	$11,605	$12,069	$12,552	$13,054	$62,671
2	Derry Carole	$20,003	$20,803	$18,544	$16,072	$14,709	$90,131
3	Wazniak Thomas	$28,766	$29,917	$31,113	$32,358	$33,652	$155,806
	Total Salary	$62,160	$62, 325	$61,726	$60,982	$61,415	$308,608
	Fringe Benefits	$18,648	$18,698	$18,518	$18,295	$18,425	$92,584
	Total, Salary and Benefits	$80,808	$81,023	$80,244	$79,277	$79,840	$401,192
	Other Direct Costs						
	Expendable Supplies	$11,238	$12,000	$12,000	$12,000	$12,000	$59,238
	Travel	$4,500	$4,500	$4,500	$4,500	$4,500	$22,500
	Copying and Publication Fees	$1,000	$2,000	$2,000	$2,000	$2,000	$9,000
	Shipping	$2,000	$1,000	$1,000	$1,000	$1,000	$6,000
	Instrument Maintenance and Cal.	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
	Communication (Iridium & telecomm.)	$6,000	$6,000	$6,000	$6,000	$6,000	$30,000
	Research Computer Support Services	$1,864	$1,832	$1,824	$1,673	$1,625	$8,818
	Shop	$2,480	$1,536	$2,322	$2,440	$1,863	$10,641
	Vehicle	$1,000	$1,000	$1,000	$1,000	$1,063	$5,063
	Small Research Vessel (12 days per year)	$12,000	$12,000	$12,000	$13,000	$13,000	$62,000
	Equipment (Webb Slocum Glider with optics)	$150,000	$150,000	$150,000	$150,000	$150,000	$750,000
	Total UMCES Direct Costs	$282,890	$282,891	$282,890	$282,890	$282,891	$1,414,452
	Modified Total Direct Costs	$132,891	$132,890	$132,891	$132,891	$132,890	$664,453
	Indirect Costs – 50.5%	$67,110	$67,109	$67,110	$67,110	$67,109	$335,548
	TOTAL DIRECT & INDIRECT COSTS	**$350,000**	**$350,000**	**$350,000**	**$350,000**	**$350,000**	**$1,750,000**

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)
2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 30, 2016
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu
Subcontract Institution:	**University of Connecticut**
Principal Investigator:	Dr. James O'Donnell, (860)405-9171, james.odonnell@uconn.edu
Financial Representative:	Joanne Frederick, Financial Services Manager
Address:	Office for Sponsored Programs 438 Whitney Road Ext Unit 1133 Storrs, CT 06269-1133; Tel: (860)486-3893
Requested Amount:	Year 1: $219,638 Year 4: $219,453 Year 2: $219,977 Year 5: $220,601 Year 3: $220,012 **TOTAL: $1,099,681**

Official Grant Administrator Signature

Antje Harnisch Date: 9-29-10

Name: Antje Harnisch, Ph.D., Assistant Director, Office for Sponsored Programs
Tel: (860)486-3622; osp@uconn.edu

BUDGET JUSTIFICATION:

Salary, Wages & Fringe Benefits: PI James O'Donnell-1 month summer salary per year to supervise all aspect of program, prepare reports, and monitor data and forecast quality; Technician – 5,4,3.5,2.5,2 months in years 1-5 to maintain CODAR array in concert with a Graduate assistant.; Kay Howard Strobel - 1.76 months/year to monitor data and forecast quality and sustain the operational forecast system; Todd Fake – 1.8 months/year to assist in the comparison and evaluation of model forecasts and drifter data ; Graduate Assistant-we request funds for a graduate student to assist in the operation and evaluation of the STPS system. They will also be involved in supporting the maintenance of the CODAR infrastructure to expand the technical capacity of the region. Fringe rates have been calculated in accordance with the University's approved F&A rate agreement with DHHS
Travel: $2000/yr to cover travel to the 5 sites. Based on experience operating the system, we expect 10 trips per year at $200/trip.
Supplies: Operation of the CODAR sites requires power for air conditioning and system operation. Data transfer requires telecommunications (cell and phone) charges. Based on experience we request $2,000 per site per year for the 2 LIS sites (i.e. $4,000/yr). I n addition, the components of the equipment (cables, antennae, air handling, power supplies, etc.) have been aging and replacements are required. In keeping with request of other operators and our experience, we request $6500/site/yr ($13,000/yr) for replacement components. In support of the forecast model we estimate the computing supplies (data storage media, software upgrades and licenses etc) to be $3000/yr.
Publication costs: We request $1500/yr in years 1 & 2, and $300 in years 3 and 4 for preparation and dissemination of the results of our work.
Tuition: The University charges part of the cost of tuition for graduate students at a rate $6342, $6723, $7126, $7554, $8007 in years 1-5.

Shiptime: To calibrate the antennae in Block island Sound and Long Island Sound twice a year we request funds for the use of the RV Weicker for 18 hours at a cost of approximately $1000.
Indirect Costs: The University of Connecticut's federal indirect cost rate is 53% of modified total direct costs (total direct costs less equipment and tuition).

BUDGET TABLE BREAKDOWN:

						Year I	Year 2	Year 3	Year 4	Year 5	Total
A.	**Senior Personnel**	Salary	Appt	hs Effor	% Effort	6/1/2011-5/31/2012	6/1/2012-5/31/2013	6/1/2013-5/31/2014	6/1/2014-5/31/2015	6/1/2015-5/31/2016	
	James O'Donnell, PI	$40,622	3	1.00	33.34%	13,543	14,220	14,931	15,678	16,462	74,834
B.	**Other Personnel**						-	-	-	-	-
	Res. Assoc. (M Howard-Strobel)	$73,772	11	1.76	16.00%	11,804	12,394	13,014	13,665	14,348	65,225
	Comp Tech (T. Fake)	$75,600	12	1.80	15.00%	11,340	11,907	12,502	13,127	13,783	62,659
	TBN	$50,000	11	5.00	45.45%	22,725	19,091	17,540	13,155	11,050	83,561
1	Grad Asst (A/Y)	$20,702	9	9.00	100%	20,702	21,013	22,064	23,167	24,325	111,271
1	Grad Asst (Sumr)	$6,901	3	3.00	100%	6,901	7,005	7,355	7,723	8,109	37,093
	Undergraduate Students			-		2,000	3,000	1,000	1,000	1,000	8,000
					Total Salaries	89,015	88,630	88,406	87,515	89,077	442,643

C.	**Fringe Benefits** Current Fringe Rates	Yr 1 FY12	Yr 2 FY13	Yr 3 FY14	Yr 4 FY15	Yr 5 FY16					
	James O'Donnell, PI	22%	23%	24%	25%	26%	2,979	3,271	3,583	3,920	4,280	18,033
	Res. Assoc. (M Howard-Strobel)	57%	58%	59%	60%	61%	6,728	7,189	7,678	8,199	8,752	38,546
	Comp Tech (T. Fake)	36%	37%	38%	39%	40%	4,082	4,406	4,751	5,120	5,513	23,872
	TBN	36%	37%	38%	39%	40%	8,181	7,064	6,665	5,130	4,420	31,460
	Grad Asst (A/Y)	16%	17%	18%	19%	20%	3,312	3,572	3,972	4,402	4,865	20,123
	Grad Asst (Sumr)	8%	9%	10%	11%	12%	552	630	736	850	973	3,741
	Undergraduate Students	3%	4%	5%	6%	7%	60	120	50	60	70	360
						Total Fringe Benefits	25,894	26,252	27,435	27,681	28,873	136,135
	Total Salary, wages & fringe benefits						114,909	114,882	115,841	115,196	117,950	578,778
D.	**Equipment**	*										
E.	**Travel**	*Domestic*					2,000	2,000	2,000	2,000		8,000
		Foreign										-
F.	**Participant Support Costs**	*# of Participants: _____*										-
	Stipends											-
	Travel											-
						Total Participant Costs	-	-	-	-	-	-
G.	**Other Direct Costs**											-
	Materials & Supplies						20,000	20,000	20,000	20,000	20,000	100,000
	Publication Costs						1,500	1,500	300	300		3,600
	Other: R/V Weicker shiptime						1,000	1,000	1,000	1,000	1,000	5,000
	Tuition	*					6,342	6,723	7,126	7,554	8,007	35,752
	Tuition Calculator					**Total Other Direct Costs**	28,842	29,223	28,426	28,854	29,007	144,352
H.	**Total Direct Costs**						145,751	146,105	146,267	146,050	146,957	731,130
I.	**Indirect Cost base**						139,409	139,382	139,141	138,496	138,950	695,378
J.	**Indirect Costs (F&A) @**	*53%*	*53%*	*53%*	*53%*	*53%*	73,887	73,872	73,745	73,403	73,644	368,551
K.	**Total Costs**						$219,638	$219,977	$220,012	$219,453	$220,601	$1,099,681

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)

2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 30, 2016	
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu	
Subcontract Institution:	**Applied Science Associates, Inc.**	
Principal Investigator:	Eoin Howlett, 401-789-6224, ehowlett@asascience.com	
Financial Representative:	Linda Nolan, 401-789-6224, lnolan@asascience.com	
Address:	55 Village Square Drive, 2nd Floor South Kingstown RI 02879	
Requested Amount:	Year 1: $175,392.19	Year 4: $174,935.99
	Year 2: $174,851.99	Year 5: $175,098.89
	Year 3: $174,677.13	**TOTAL: $874,956.19**

Official Grant Administrator Signature

_____Date:_____

BUDGET JUSTIFICATION:

ASA will coordinate the Maracoos DMAC team and will focus on the following areas:

- Attend Marcoos planning meetings
- Liaise with the IOOS Program Office DIF team
- Connect observing systems for unified distribution of the disparate data and providers
- Publish Maracoos data (in-situ observations, gliders, HF Radar, Satellite) and models using IOOS standards and make them available for aggregation at national Data Aggregation Centers (DACs).
- Support the Maracoos web-based asset map with access to live observation data and model results
- Publish data so it is consumable by other applications such as Google Earth
- Provide guidance to data providers on DMAC issues
- Support the regional themes with access to the data in required formats
- Provide synthesized data for Coastal Marine Spatial Planning (CMSP) needs
- Provide Maracoos modelers access to the U.S Coast Guard SLDMB (drifter) database in a format useable by the modelers
- Coordinate with other federal activities to ensure that Maracoos data and processes are compatible with initiatives such as the NSF OOI, the US Coast Guard Environmental Data Server (EDS), and NOAA Hazmat.
- Continue to coordinate the federal Geocloud initiative to exploit use of the cloud for storage and distribution of data

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
	Salary						
1	Eoin Howlett, PI	$12,889.60	$11,673.20	$12,082.00	$11,790.31	$11,833.18	$60,268.29
2	Sr. Scientist	$19,921.20	$20,221.50	$19,694.40	$19,534.38	$19,778.56	$99,150.04
3	Scientist Level II	$13,093.60	$13,551.20	$13,490.00	$13,962.15	$15,028.86	$69,125.81
	Total Salary	**$45,904.40**	**$45,445.90**	**$45,266.40**	**$45,286.84**	**$46,640.60**	**$228,544.14**
	Fringe Benefits						
1	At 43%	$19,738.89	$19,541.74	$19,464.55	$19,473.34	$20,055.46	$98,273.98
	Total Fringe Benefits	***$19,738.89***	***$19,541.74***	***$19,464.55***	***$19,473.34***	***$20,055.46***	***$98,273.98***
	Total Salary & Fringe	**$65,643.29**	**$64,987.64**	**$64,730.95**	**$64,760.18**	**$66,696.06**	**$326,818.12**
	Other Direct Costs						
	Domestic Travel	$5,500.00	$5,500.00	$5,500.00	$5,500.00	$5,500.00	$27,500.00
	Total Other Direct Costs	**$5,500.00**	**$5,500.00**	**$5,500.00**	**$5,500.00**	**$5,500.00**	**$27,500.00**
	Total Direct Costs	**$5,500.00**	**$5,500.00**	**$5,500.00**	**$5,500.00**	**$5,500.00**	**$27,500.00**
	Indirect Costs – 118.50%	***$77,787.30***	***$77,010.35***	***$76,706.18***	***$76,740.81***	***$79,034.83***	***$387,279.47***
	Subcontractors	***$26,461.60***	***$27,354.00***	***$27,740.00***	***$27,935.00***	***$23,868.00***	***$133,358.60***
	TOTAL DIRECT & INDIRECT & SUBCONTRACTOR COSTS	**$175,392.19**	**$174,851.99**	**$174,677.13**	**$174,935.99**	**$175,098.89**	**$874,956.19**

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)

2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project Duration:	June 1, 2011 – May 30, 2016	
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu	
Subcontract Institution:	**Stevens Institute of Technology**	
Principal Investigator:	Dr. Alan Blumberg, 201-216-5289, alan.blumberg@stevens.edu	
Financial Representative:	Mr. David Schultz, 201-216-5371, dschult2@stevens.edu	
Address:	Stevens Institute of Technology One Castle Point on Hudson Hoboken, NJ 07030-5991	
Requested Amount:	Year 1: $160,000	Year 4: $160,000
	Year 2: $160,000	Year 5: $159,999
	Year 3: $160,000	**TOTAL: $799,999**

Official Grant Administrator Signature

Date: 10/01/2010

Chrissa Papaloannou
Manager, Pre-Award (Office of Sponsored Research)
Stevens Institute of Technology
One Castle Point on Hudson
Hoboken, NJ 07030-5991
Ph: 201-216-8051, Fax: 201-216-8909, Email: cpapaio1@stevens.edu

BUDGET JUSTIFICATION:

DIRECT COSTS:

A. Personnel

P.I. Alan Blumberg will devote 10% effort during the academic year to the research. The responsibility for the safe and ethical conduct of the research will fall to Professor Blumberg.

Senior Research Engineer, Nickitas Georgas will devote the following approximate effort during the proposed project period:

Yr 1: 2.4 months, **Yr 2:** 1.9 months, **Yr 3:** 1.8 months, **Yr 4:** 1.6 months, **Yr 5:** 1.3 months

Research Scientist/Associate will be recruited to devote the following approximate effort during the proposed project period:

Yr 1: 2.4 months, **Yr 2:** 1.9 months, **Yr 3:** 1.8 months, **Yr 4:** 1.6 months, **Yr 5:** 1.3 months

Graduate Students

Funding is requested for a partial stipend during the academic year (4.5 months) and a full summer stipend (3 months) for one graduate student.

B. Fringe Benefits

All salaries are based on actual amounts. The Stevens Institute of Technology's approved fringe benefit rate of 28.5% is used on the salary amounts. Salary amount requested is based on actual salary and includes a 4% annual cost of living increase.

C. Travel

Travel funds of $500 is requested to cover the cost of round trip mileage (50 cents per mile as per federal allowance), one night lodging and per-diem expenses is requested for the PI and/or one Co-PI to attend one regional IOOS meeting during the year.

D. Equipment

Funding is requested for the purchase of a computer system estimated at $5,000 which will be used by the project personnel for the conduct of this project.

E. Supplies

Computer Charges (Software)

Funding is requested to provide necessary software upgrades for use in modeling and other data collection/project activities. The cost estimates provided are based on conversations with vendors and on our experience.

HF Radar Ops

Funds are also requested in support of our HF Radar site operation of approximately $9,000 in Yr 1 with inflation expectation calculated for each year thereafter. These funds include communications, power, backup media, and supplies. The communication costs are estimated at $208/month ($2,500/year). The vendor and method vary from cellular modems to satellite links depending on site location and available infrastructure. This estimate includes two lines of communications to each site as available. Power costs are estimated at $100/month ($1,200/year). These include utility bills to run the HF Radar equipment, computer, and air conditioner. Additional supplies for each site include items needed for regular site maintenance excluding HF Radar system hardware (transmitters, receivers, antennas, etc.). Supplies will be site specific and include guide lines, stakes, electrical tape, back-up generators, etc.

H. Other

Funding is requested for tuition remission for the graduate student at $1218/credit x 9 credits per year commensurate to the AY stipend being requested. Tuition increases at a rate of 5% per year.

J. Indirect Cost

The Institute's current negotiated F&A (indirect) cost rate is 55.0% of the Modified Total Direct Cost. The Institute's cognizant agency is the Department of the Navy, Office of Naval Research. The indirect cost base includes all costs in this budget except tuition, equipment and subawards over $25,000.

BUDGET TABLE BREAKDOWN:

PI Name: Alan Blumberg							
Proposal for: NOAA/IOOS (Rutgers)							
DIRECT COST (Subject to O/H)		Year 1	Year 2	Year 3	Year 4	Year 5	Total
Salary & Wages							
Faculty/R Scientists		$49,343	$45,322	$46,246	$44,580	$42,831	$228,322
Benefits		$14,063	$12,917	$13,180	$12,705	$12,207	$65,072
Salary & Wages							
Graduate Students (academic year)		$11,151	$11,709	$12,294	$12,909	$13,554	$61,616
Graduate Students (summer)		$11,597	$12,177	$12,786	$13,425	$14,097	$64,082
Total Salaries, Wages & Benefits		**$86,154**	**$82,124**	**$84,506**	**$83,620**	**$82,689**	**$419,092**
OTHER Direct Expenses							
Computer charges, software& hardware		$500	$500	$500	$500	$500	$2,500
Travel (Domestic)		$500	$500	$500	$500	$500	$2,500
HF Radar Ops		$9,000	$9,450	$9,923	$10,419	$10,940	$49,732
Total Other Direct Expenses		***$10,000***	***$10,450***	***$10,923***	***$11,419***	***$11,940***	***$54,732***
TOTAL (takes O/H)		**$96,154**	**$92,574**	**$95,429**	**$95,039**	**$94,629**	**$473,824**
OTHER DIRECT COST (No O/H)							
Tuition Remission		$10,962	$11,510	$12,086	$12,690	$13,324	$60,572
Computer System		$0	$5,000	$0	$0	$0	$5,000
TOTAL DIRECT COST		**$107,116**	**$109,084**	**$107,514**	**$107,728**	**$107,953**	**$539,396**
Indirect Cost*	55.0%	$52,885	$50,916	$52,486	$52,271	$52,046	$260,603
TOTAL FROM SPONSOR		$160,000	$160,000	$160,000	$160,000	$159,999	$799,999
Cost Share by Stevens**		$0	$0	$0	$0	$0	$0
TOTAL BUDGET		**$160,000**	**$160,000**	**$160,000**	**$160,000**	**$159,999**	**$799,999**

Revised 3/17/2010

SUBCONTRACT YEAR 4 RENEWAL, ***University of Massachusetts, Dartmouth***

PROJECT TITLE: Phased Deployment and Operation of the Mid-Atlantic Regional Coastal Ocean Observing System (MARCOOS)

Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, chkohut@marine.rutgers.edu
Subcontract Institution:	Old Dominion University Research Foundation
Principal Investigator:	Dr. Larry P. Atkinson 757-683-4926, latkinso@odu.edu Center for Coastal Physical Oceanography
Address:	Old Dominion University Norfolk, VA 23529
Year 4 Renewal Request Amount:	$100,000

Official Grant Administrator Signature

Carole E McPhillips Date: 3/17/10

Carole E. McPhillips, Manager of Sponsored Programs
Old Dominion University Research Foundation
4111 Monarch Way, Suite 204
Norfolk, VA 23508
757-683-4293, rfawards@odu.edu

BUDGET JUSTIFICATION:

SALARIES & WAGES

Technician and Professional - Salary is requested to support 12 months of effort for Teresa Garner as a remote technician for the Southern sub-region. Specifically, she would 1) perform regular site hardware and software maintenance, (ii) maintain communications lines between radial and central sites, (iii) respond to site outages, and (iv) diagnose and repair hardware/software failures. The technician's salary is budgeted at $48,667 in year 1.

FRINGE BENEFITS (ONR negotiated rate dated June 18, 2009)

FICA, worker's compensation, unemployment insurance, health, dental, life, and disability insurance premiums, annual and sick leave earnings, tuition reimbursement, and a fringe benefit contribution in lieu of retirement have been budgeted for this position in accordance with current Old Dominion University Research Foundation policies.

TRAVEL

Funds are requested to support travel to the sites for regular and unexpected maintenance. We estimate a minimum of 24 trips per year. Additional funds are requested for travel related to developing wave products and coordinating the MARCOOS initiative in offshore wind power. All travel is domestic and minimized by our central location to the southern region sites.

OTHER DIRECT COSTS

Material and Supply Costs

Funds are requested to purchase miscellaneous supplies for both the surface current project and the wave and wind initiative.

INDIRECT COSTS

Our ONR negotiated agreement dated July 22, 2009 authorizes an on-campus indirect cost rate of 50% of modified total direct costs effective July 1, 2009 until amended. However, for this proposal recoverable indirect costs have been capped at 25% in accordance with sponsor policy.

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	YEAR 4
	Salary	
1	Teresa Garner	$48,667
	Total Salary	**$48,667**
	Fringe Benefits	
1	41.88% - please see above for details	$20,380
	Total Fringe Benefits	*$20,380*
	Total Salary & Fringe	**$69,047**
	Other Direct Costs	
	Domestic Travel	$5,477
	Supplies	$5,476
	Total Other Direct Costs	**$10,953**
	Total Direct Costs	**$80,000**
	Indirect Costs – 25%	*$20,000*
	TOTAL DIRECT & INDIRECT COSTS	**$100,000**

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)

2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 30, 2016	
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu	
Subcontract Institution:	**WeatherFlow Inc.**	
Principal Investigator:	Mr. James Titlow, 757-868-5362, jtitlow@weatherflow.com	
Financial Representative:	Ms. Lori Blomquist, 831-438-9740	
Address:	WeatherFlow Inc. 108 Whispering Pines Suite 245 Scotts Valley, CA 95066	
Requested Amount:	Year 1: $90,000	Year 4: $90,000
	Year 2: $90,000	Year 5: $90,000
	Year 3: $90,000	**TOTAL: $450,000**

Official Grant Administrator Signature

_____Date:_____

Name: Lori Blomquist
Address: 108 Whispering Pines, Suite 245
Scotts Valley, CA 95066
1-831-438-9742, lblomquist@weatherflow.com

BUDGET JUSTIFICATION:

For the MARCOOS domain: (36 to 43 N, and 78 to 69.5 W), WeatherFlow will manage the creation of an ensemble gridded wind product that is designed to integrate numerous mesoscale model outputs. Specifically, WeatherFlow is taking advantage of existing NOAA atmospheric models with the flexibility to also include any additional models run over all or a portion of the MARCOOS domain. Presently, this includes WeatherFlow's own RAMS model, with the ensembling system flexible so that other private, governmental, or academic institutions who wish to contribute output from their models may do so. Currently, the model outputs shown in the following table are targets for the ensemble.

NWS Office	Runs (UTC time)	resolution	West Lon	South Lat	East Lon	North Lat
Mt. Holly NJ	00, 12	3	-78.934	34.470	-69.189	42.391
Sterling VA	00 -21, every 3	4	-82.942	35.391	-73.057	41.818
Wakefield VA	00, 06, 12, 18	5	-84.081	32.812	-72.940	40.060
WFRAMS Ches	00, 06, 12, 18	2	-77.700	36.200	-74.910	39.890
WFRAMS2 CCod	00, 06, 12, 18	2	-71.600	40.800	-69.404	42.996
WFRAMS NE	00, 06, 12, 18	8	-78.900	34.200	-73.356	40.752

Deliverables will include the production of a sequence of files for at least two model runs per day, the 00 and 12 UTC. Depending on how many groups routinely produce run at 06 and 18 UTC, they may be included too. The new gridded product would be initially at 4km horizontal resolution with a goal of 2km targeted for year 2.

Products to accompany this effort will include:

Web-based map and time series viewer that displays wind vector contour plots and point location time series from each ensemble member plus the ensemble product itself. Second, a simple, but expandable gridded ensembling scheme. This scheme will use simple grid point averaging techniques among the various candidate model ensemble members to yield a resultant product. Since not all models are similar in resolution and domain, there will be some variance in forecast accuracy due to the number of and resolution of all members that can contribute to any individual grid point. Solving these non-meteorological varying domain size and resolution issues and well as the added knowledge of varying model behavior as a function of meteorology and varying model behaviors as systems traverse from the edge to core to edge of a domain are examples of the challenges that will result with the development of this system. Continued effort in follow-on years will focus on improved verification techniques such a spectral methods, assimilating with targeted oceanic and atmospheric

observations, employing ensemble weighting schemes, improved physics parameterizations to individual members, and post processing of results, of which all show promise to improve the overall forecast product.
Third, a verification statistic tool which will assess model performance using a unique array of both terrestrial and littoral observations. Verification of the ensemble using littoral observations is an important component of this project as numerical forecasts struggle to provide comparable levels of accuracy within coastal regions. WeatherFlow is providing this suite of observations which include a select set of publically available observations, and over 100 of its own proprietary network of observing sites within the MARCOOS domain. The data provision subtask allows for models to be compared to an independent, representative dataset.
Finally, the creation of a rolling archive directory of binary data files produced in NetCDF, that will be pushed/pulled to a MARCOOS server, and be made available for use in a variety of modeling uses including inundation, esturiary, and ecosystem. Aside from use as an input field to the applied modeling systems mentioned above, these products will have a broad application with the overall IOOS community as if they can become a single, high certainty solution with output tuned for each of its many derived uses.
SALARIES & WAGES
Principal Investigator
Support 10% of a 12 months/year salary for Jay Titlow. Specifically he will oversee progress of the tasks within WeatherFlow, and in addition, (i) prepare bi-annual progress reports to NOAA, (ii) prepare for and attend MACOORA meetings, (iii) prepare for and attend an annual MARCOOS PI's meeting, and (iv) Time for a regular monthly 1-hour conference call.
Data Analyst/Science Support
Support 15% of a data analyst's salary and 15% of a scientist time. The data analyst will be working on the analyzing the overall performance of the various models through verification studies and interaction with personnel at the various NWS offices.
IT Support
Support 10% time each for three IT specialists, a web developer, a middleware developer and a systems architect.
The web developer will be responsible for building dissemination tools such as the map viewer, as well as a time series viewing tool. The systems architect and middleware developer will work together to construct the model gathering, ensembling module, model verification statistics tool, and output archive structure.
FRINGE BENEFITS
FICA, worker's compensation, unemployment insurance, health, dental, life, and disability Insurance premiums, annual and sick leave earnings, and a fringe benefit contribution in lieu of retirement have been budgeted for this position.
TRAVEL
Support for personnel to travel to MARCOOS meetings to promote system and interact with oceanographers to understand atmospheric influences on oceanic processes . We estimate 3 trips per year, plus 1 trip to promote MACOORA missionFK.
SITE SUPPORT, SUPPLIES AND BACKUP MEDIA
Computer equipment to maintain an operational ensembling modeling system .

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	**YEAR 1**
	Salary	Task 1
1	Jay Titlow, PI	$5,000
2	Data Analyst/Science(modeling) Support	$7,000
3	Web Developer	$5,000
4	Systems Architect	$12,000
5	Middleware Developer	$12,000
	Total Salary	$41,000
	Fringe Benefits -18%	
	Total Fringe Benefits	***$7380***
	Total Salary & Fringe	***$48,380***
	Other Direct Costs	
	Domestic Travel	$4,000
	Supplies	$3,870
	Total Other Direct Costs	**$7,870**
	Total Direct Costs	**$56,250**
	Indirect Costs – 60%	***$33,750***
	TOTAL DIRECT & INDIRECT COSTS	**$90,000**

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)
2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 31, 2016	
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu	
Subcontract Institution:	**Center for Innovative Technology**	
Principal Investigator:	Nancy Vorona, 703 689 3043, nancy.vorona@cit.org	
Financial Representative:	Linda Gentry, 703 689 3035, linda.gentry@cit.org	
Address:	2214 Rock Hill Road, Suite 600 Herndon, Virginia 20170	
Requested Amount:	Year 1: $50,000	Year 4: $50,000
	Year 2: $50,000	Year 5: $50,000
	Year 3: $50,000	**TOTAL: $250,000**

Official Grant Administrator Signature

Linda Gentry Date: 9/24/10

Linda Gentry
2214 Rock Hill Road, Suite 600
Herndon, Virginia 20170
703 689 3006, linda.gentry@cit.org

BUDGET JUSTIFICATION:

PERSONNEL
Total Costs $5,473 – The CIT Principal Investigator (PI) Nancy Vorona will provide 80 hours of site support through provision and management of utilities, including power and communications, as well as insurance, backup media, and supplies and other requirements for routine maintenance. The PI will coordinate site support with the on site technician and will participate in regular monthly conference calls, provide input to semi-annual MARACOOS progress reports, and attend the annual MARACOOS meeting.

FRINGE BENEFITS
Total Costs $3,106 – Fringe benefits related to above personnel. The fringe benefit rate for CIT employees working on this project is based upon the Department of Defense (DOD) approved rate of 56.75% of total personnel costs. Fringe benefits include employer retirement account contribution, the cost of employer-paid health and life insurance, and employer payroll taxes.

OTHER DIRECT COSTS
TRAVEL
Total Costs $1,000 – This amount will cover travel for the PI to the MARACOOS annual meeting and two site-support related trips to HF radars owned by CIT. This amount includes mileage and hotel (if necessary).

SITE SUPPORT
Total Costs $19,520 – Funds are requested in support of site operation and minor maintenance. CIT will provide routine site support to the five CIT-owned HF Radar sites located on the Delmarva coastline. This does not include software maintenance support or support for significant repairs.

Site support includes communication costs, estimated at $45 per site or $2,700 per year. This is based on one line per site. Power costs average $100 per month per site, or $6,000 per year. These include utility bills to run the HF

Radar equipment, computer, and air conditioner. Insurance in the amount of $7,300 is required in case of catastrophic loss. Site support also includes $1,020 for boat trips to Cedar Island via a Virginia Institute of Marine Science-supplied boat and $2,500 for routine repairs and antenna pattern validation runs.

SUPPLIES

Total Costs $4,246 – Supplies for each site include those needed for regular site maintenance excluding HF Radar system hardware (transmitters, receivers, antennas, etc.) and software. Supplies will be site specific and include jacks, plugs, and other equipment components; guide lines, stakes, and electrical tape; compasses, computer file boxes, and other items required to maintain each site.

BACK-UP MEDIA

Total Costs $750 – Back up media, estimated at $750, include portable external hard drives and appropriate media for permanent back up of raw level data including range series and spectra.

INDIRECT COSTS

Total Costs $15,905 – Indirect Costs includes:

- Overhead rate of 82.96% is applied to $5,473 of personnel costs = $4,539.
- General and administrative rate of 29.42% is applied to total Direct Costs of $34,094 **plus** overhead costs of $4,540 = $38,634*29.42% = $11,366.

DOD rate approval letter and supporting material available upon request.

Year 1 Total Project Costs: $50,000
*** Year 2 Total Project Costs: $50,000**
*** Year 3 Total Project Costs: $50,000**
*** Year 4 Total Project Costs: $50,000**
*** Year 5 Total Project Costs: $50,000**

Total 5 Year Budget: $250,000

* We anticipate reductions in current indirect rates to absorb project cost fluctuations in outyears.

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	Year 1	Year 2 *	Year 3 *	Year 4 *	Year 5 *	TOTAL
	Salary						
	Nancy Vorona, PI	$5,473	$5,473	$5,473	$5,473	$5,473	$27,365
	Total Salary	**$5,473**	**$5,473**	**$5,473**	**$5,473**	**$5,473**	**$27,365**
	Fringe Benefits – 56.75%	***$3,106***	***$3,106***	***$3,106***	***$3,106***	***$3,106***	***$15,530***
	Total Salary & Fringe	**$8,579**	**$8,579**	**$8,579**	**$8,579**	**$8,579**	**$42,895**
	Other Direct Costs						
	Domestic Travel	$1,000	$1,000	$1,000	$1,000	$1,000	$5,000
	Site Support (Comms & Power)	$19,520	$19,520	$19,520	$19,520	$19,520	$97,600
	Supplies	$4,246	$4,246	$4,246	$4,246	$4,246	$21,230
	Back-up Media	$750	$750	$750	$750	$750	$3,750
	Total Other Direct Costs	**$25,516**	**$25,516**	**$25,516**	**$25,516**	**$25,516**	**$127,580**
	Total Direct Costs	**$34,094**	**$34,094**	**$34,094**	**$34,094**	**$34,094**	**$170,475**
	Indirect Costs						
	Overhead at 82.96%	$4,539	$4,539	$4,539	$4,539	$4,539	$22,695
	General & Administrative at 29.42%	$11,366	$11,366	$11,366	$11,366	$11,366	$56,830
	TOTAL DIRECT & INDIRECT COSTS	**$50,000**	**$50,000**	**$50,000**	**$50,000**	**$50,000**	**$250,000**

University of Rhode Island

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)
2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 31, 2016
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu
Subcontract Institution:	**University of Rhode Island**
Principal Investigator:	Dr. David Ullman, 401-874-6138, d.ullman@gso.uri.edu
Address:	Graduate School of Oceanography 215 South Ferry Road, Narragansett, RI 02882
Financial Representative:	Eileen Tobin Grant & Contract Accounting 70 Lower College Rd, Kingston RI 02881
Requested Amount:	Year 1: $29,990 Year 4: $29,994 Year 2: $29,990 Year 5: $29,994 Year 3: $29,988 **TOTAL: $149,956**

Official Grant Administrator Signature

Franca Cirelli Date: 9/23/10

Franca Cirelli, Asst. Director Sponsored Projects
70 Lower College Road
Kingston, RI 02881
401-874-5891, franca@uri.edu

BUDGET JUSTIFICATION:

Funds are requested in support of operation and minor maintenance of URI's 3 CODAR systems. These include communications, power, backup media, and supplies. The communication costs are estimated at $2,500/year per site. The vendor and method vary from cellular modems to satellite links depending on site location and available infrastructure. This estimate includes two lines of communications to each site as available. Power costs are estimated at $1,080/year per site. These include utility bills to run the HF Radar equipment, computer, and air conditioner. Back up media include portable external hard drives and appropriate media for permanent back up of raw level data including range series and spectra. Supplies for each site include those needed for regular site maintenance excluding HF Radar system hardware (transmitters, receivers, antennas, etc.). Supplies will be site specific and include guide lines, stakes, electrical tape, back-up generators, etc.

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	Other Direct Costs					
	Site Support (Communications)	$7,500	$7,500	$7,500	$7,500	$7,500
	Site Support (Power)	$3,240	$3,240	$3,240	$3,240	$3,240
	Supplies	$6,200	$6,200	$6,200	$6,200	$6,200
	Back-up Media	$2,790	$2,790	$2,660	$2,600	$2,600
	Total Other Direct Costs	**$19,730**	**$19,730**	**$19,600**	**$19,540**	**$19,540**
	Total Direct Costs	**$19,730**	**$19,730**	**$19,600**	**$19,540**	**$19,540**
	Indirect Costs – 52%	***$10,260***	***$10,260***	***$10,388***	***$10,454***	***$10,454***
	TOTAL DIRECT & INDIRECT COSTS	**$29,990**	**$29,990**	**$29,988**	**$29,994**	**$29,994**

CFDA Number: 11.012, Integration Ocean Observing System (IOOS)

2010 MARACOOS – Mid Atlantic Regional Association Coastal Ocean Observing System

Project duration:	June 1, 2011 – May 30, 2016
Lead Institution:	RUTGERS, the State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901 Attn: Courtney Kohut, courtney@marine.rutgers.edu
Subcontract Institution:	**University of North Carolina at Chapel Hill**
Principal Investigator:	Dr. Harvey Seim, 919-962-2083, hseim@email.unc.edu
Financial Representative:	Vanessa Peoples, Director Financial Reporting & Cash Management
Address:	Office of Sponsored Research 104 Airport Dr., Suite 2200, CB#1350 Chapel Hill, NC 2799-1350
Requested Amount:	Year 1: $20,000 Year 4: $20,000 Year 2: $20,000 Year 5: $20,000 Year 3: $20,000 **TOTAL: $100,000**

Official Grant Administrator Signature

Bruce H. Poole Date: 9/22/10

Barbara Entwisle, Ph.D.
Vice Chancellor for Research & Economic Development
Office of Sponsored Research
104 Airport Dr., Suite 2200, CB#1350
Chapel Hill, NC 2799-1350
Phone: 919-966-3411; Fax: 919-962-3352/5011,

BUDGET JUSTIFICATION and STATEMENT OF WORK:

Funds will provide for continued operations of HF radar systems on the Outer Banks. No salary is associated with this task (salary is provided through another source, SECOORA). All funds will go towards maintenance and upkeep of the 2 NC HF radar installations at Duck and Buxton, NC. For each year other direct costs include $5,000 for supplies, $7,500 for site support (power and communications) and $3,373 for travel to the sites for servicing and repairs and attendance of ROWG meetings if possible. Supplies use varies annually depending on needs; in the past they have gone toward cabling repairs, lightning protection replacement and system component repairs; there may be a need to purchase new computers that support the radar system, including computers at the 2 remotes sites, the central site, and for staff use for communications with the sites and offline processing because all of these systems are now quite dated (most were purchased in 2003). Communications includes home internet support for Michael Muglia, who lives on the Outer Banks, to enable him to communicate with the computing systems during evenings and weekends and allow him to plan off-hour trips to remotes sites as strategically as possible. An off-campus indirect rate of 26% is requested that totals $4,127, with the total request being $20,000.

BUDGET TABLE BREAKDOWN:

	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
	Salary						
1	Harvey Seim, PI						
	Total Salary	**$0**					**$0**
	Fringe Benefits						
1		$0					**$0**
	Total Fringe Benefits	***$0***					**$0**
	Total Salary & Fringe	**$0**					**$0**
	Other Direct Costs						
	Domestic Travel	$3,373	$3,373	$3,373	$3,373	$3,373	$16,865
	Site Support (Comms & Power)	$7,500	$7,500	$7,500	$7,500	$7,500	$37,500
	Supplies	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
	Total Other Direct Costs	**$15,873**	**$15,873**	**$15,873**	**$15,873**	**$15,873**	**$79,365**
	Total Direct Costs	**$15,873**	**$15,873**	**$15,873**	**$15,873**	**$15,873**	**$79,365**
	Indirect Costs – 26%	***$4,127***	***$4,127***	***$4,127***	***$4,127***	***$4,127***	***$20,635***
	TOTAL DIRECT & INDIRECT COSTS	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$100,000**

Appendix – 4.a.iii *Equipment Purchases*

The HFR site support budget includes costs of $200,000 for new HFR equipment each year. For years 1 through 3, these costs include a Long-Range Seasonde Remote Unit ($120,000), a van ($30,000), a transmitter ($35,000), a transmit antenna ($8,000) and a transponder ($7,000). For years 4 and 5, this includes a Long-Range Seasonde remote unit ($120,000), a receiver ($65,000), a receive antenna ($11,000), and lightening protection ($4,000). The HFR systems will be purchased for network resiliency to fill existing gaps for better coverage. The vans are to be purchased for continual site maintenance and transport of equipment and tools to and from each site. CODAR Ocean Sensors, Ltd., the manufacturer of Seasondes', does not lease systems as they are only offered on a purchase basis. As a state university, we do not pay tax on purchases, so purchasing a van outright is more economical than leasing over several years when you are still responsible for maintenance and upkeep. At the time of purchase, the request for a vehicle goes out to bid and the best offer is accepted by the university. Old Dominion will acquire one van and the Univ. of Massachusetts will acquire a second. Rutgers will acquire the third van.

Funds for equipment are also included to purchase replacement parts for the HF-Radar sites. Individual parts which degrade over time can run anywhere from $5,000 to $11,000 are included in the budget each year. This equipment is deployed along the coastline where they are exposed to high winds, salt water, sand and would be non-transferrable if ever taken down and would be in less than favorable condition if another user needed them – so their policy is to purchase outright. $7,000 is budgeted for the data management team to purchase a new server to house the web site. University purchases provide special pricing and do not offer a lease option.

The modeling group requests an average of $5,025 each year to expand an existing high performance computer cluster for operational modeling and assimilation tasks, and to expand network attached storage and tape backup for archiving and serving model output. We would purchase this equipment as vendors authorized for university purchases provide special pricing and do not offer a lease option. Once the grant ends, Rutgers will retain ownership of the SeaSonde's purchased for gap-filling. Any replacement parts purchased will remain with their operational HFR site in possession of Rutgers University. Computer equipment purchased will also remain with Rutgers to continue the operation and housing of any data collected and operation of the web site developed for MARACOOS.

Appendix – 4.a.iv *Complementary Funding & In-Kind Contributions*

Rutgers, the State University of New Jersey, will enhance this proposal by providing $500,000 per year for 5 years in seed funds to support regional coastal ocean observing and ocean literacy. These seed funds will include annual support for (a) an Operations Manager and a Financial Manager, (b) $300,000 per year in major equipment acquisition funds, and (c) $50,000 per year in infrastructure upgrades to the observatory operations center. The University, despite fiscal difficulties, will be contributing in a belief of the value added of the proposed IOOS array for the University community. *See the letter of support from Robert M. Goodman, Executive Dean for further details (see appendix).* IOOS efforts will bring outside support from the federal, state, and private foundations. For example in New Jersey, $2.2 million is going to be provided by Board of Public Utilities, New Jersey Department of Public Utilities, the Mushett Family Foundation as the next phase of MARACOOS is funded. Similar in-kind contributions are present for other partners in the throughout the MARACOOS consortium.

Appendix 4.b – Résumés

PRINCIPAL INVESTIGATORS:

Scott M. Glenn (lead)

Professor of Marine and Coastal Sciences, Rutgers Univ., Inst. Marine & Coastal Sci., 71 Dudley Road, New Brunswick, NJ, 08901; email glenn@marine.rutgers.edu; phone 732-932-6555 x506

Education: ScD (1983) MIT/WHOI Joint Program in Oceanography/Applied Ocean Science and Engineering, Cambridge & Woods Hole, MA; BS (1978) Geomechanics, U. Rochester.

IOOS-relevant qualifications and current synergistic activities: IOOS MACOORA Board of Directors and MARCOOS PI; DHS Center of Excellence for Port Security, Board of Directors, HF Radar PI and Director of Education; National HF Radar Network, Elected Steering Committee Member; ONR Slocum Glider Technology Center, PI; Navy Littoral Battlespace Sensing – Glider (LBS-G), Co-PI; Navy LEAP Program, Co-PI; NSF OOI Cyber-Infrastructure Implementing Organization, Project Scientist; NJ Wind Energy Consortium, Chair; ORRAP, Ocean Observing Subcommittee Member; NEPTUNE-Canada Regional Cabled Observatory, External Review Committee Member; The Oceanography Society Applied Observing Technologies Representative, Nominated; Journal of Atmospheric and Oceanic Technology, Editor; NSF Centers Ocean Sciences Education Excellence-Networked Ocean World (COSEE-NOW), Co-PI; NOAA Ocean Sciences Curriculum Sequence for Grades 3-5 and Grades 6-8, Science Advisor; NSF Communicating Ocean Sciences to Informal Audiences, Collaborating Scientist & Teacher; NSF Research Internships in Ocean Science & DHS Summer Research Institute, Undergraduate Mentor; *Atlantic Crossing* Documentary Film, Executive Producer.

Honors and Awards: (1) Rutgers University, *The Scholar-Teacher Award*, first recipient of the R.U. President's new award, 2000. (2) State of New Jersey *Assembly Resolution No. 209*, Commending Rutgers University (R.U.) Coastal Ocean Observation Lab (COOL), 2002. (3) Rutgers Cook College *Team Award* – R.U.COOL - Glenn, Schofield, Chant, Kohut & McDonnell, 2006. (4) Naval Research Lab *Collaboration Award*, for Helping to Focus Future Naval Oceanographic Research to Support the United States Navy Warfighter Operating in the Littoral Zone, - Glenn & Schofield, 2007. (5) Rutgers School of Environmental & Biological Sciences, *Outstanding Undergraduate Advisor*, 2008. (6) U.S. Secretary of Commerce Gary Locke, *Trans-Atlantic Glider Landing Video*, 2009. (7) NSF *Scientists Making an Impact in Ocean Sciences Education*, Featured Scientist (1 of 10 nationwide), 2010. (8) Smithsonian National Museum of Natural History, First Trans-Atlantic Underwater Robot, 2010. (9) Carnegie CASE U.S. Professors of the Year Awards Program, *New Jersey Professor of the Year*, 2010.

Relevant publications:

Glenn, S., O. Schofield & J. Kohut, 2010. International team completes first trans-Atlantic underwater glider flight, *Journal of Operational Oceanography,* Vol. 3, No. 1, p. 2.

Gong, D., J. Kohut and S. Glenn, 2010. Seasonal climatology of wind-driven circulation on the NJ shelf, Journal of Geophysical Research, doi:10.1029/2009JC005520, V. 115, pp. 25.

Glenn, S.M., and O. Schofield, 2009. Growing a Distributed Ocean Observatory: Our view from the COOLroom, Oceanography, Vol 22., No.2, 112-129.

Glenn, S.M., C. Jones, M. Twardowski, L. Bowers, J. Kerfoot, D. Webb, O. Schofield, 2008. Glider Observations of sediment resuspension in a Middle Atlantic Bight fall transition storm. Limnology and Oceanography. 53 (6): 2180-2196.

Glenn, S., +17 others, (submitted). The Trans-Atlantic Slocum glider expeditions: A catalyst for undergraduate participation in ocean science and technology, Marine Technology Society

Carolyn Thoroughgood

Professor of Marine Biosciences, University of Delaware, College of Earth, Ocean and Environment and Faculty Fellow, Delaware Environmental Institute, 15 Innovation Way, Newark, DE 19711; email ctgood@udel.edu; phone 302-831-7209

Education: PhD (1968); M.S. (1966) Nutritional Biochemistry, University of Maryland, College Park, MD; B.S. (1965) Dean's Scholar Program, Nutrition Sciences, University of Delaware, Newark, DE.

IOOS-relevant qualifications and current synergistic activities: Chair, IOOS MACOORA Board of Governors and MACOORA PI; President, The Oceanography Society; Faculty Fellow for Coastal Research; Southeastern University Research Association (SURA); Member, Ocean and Human Health Traineeship Review Panel, NOAA; Member, Ocean and Human Health Working Group, NOAA; Member, Census for Marine Life Working Group, NOAA; Member, National Advisory Committee, Centers for Ocean Science Excellence in Education, NSF; Member, Education Committee, ORRAP; Past Member, NOAA Science Advisory Board; Past Chair, Coastal and Environmental Research Committee, (SURA); Past Chair, Board of Governors and Acting President, Consortium for Oceanographic Research and Education; Science Advisory Panel, U.S. Commission on Ocean Policy; Administrative Positions Related to Organizational Management: Vice Provost for Research and Graduate Studies; President, UD Technology Corporation; Dean, Graduate College of Marine Studies; Director, University of Delaware Sea Grant College Program. Fundraising: As part of college administrative duties, generated in excess of $80 million via external grants and private fund raising. In addition, raised funding for the construction of UD's new 146-foot, acoustically quiet, $19 million research vessel, the R/V Hugh R. Sharp, now part of the nation's UNOLS fleet.

Honors and Awards: (1) Leadership Award, American Council on Education, Office of Women in Higher Education, 2007; (2) Gubernatorial Citation for Founding Marine Educator Award in Delaware, 2000; (3) State of Delaware General Assembly Citation for Founding Coast Day in Delaware, (1996): note: Coast Day now in 34th year; University of Delaware Excellence in Teaching Award (1974); Member, Sigma Xi, 1968-present.

Relevant publications:

Thoroughgood, C. 2010. Something to Celebrate, *Oceanography*, Vol. 23, No. 3, p. 7.

Thoroughgood, C. 2010. Marine Spatial Planning: A Call to Action, *Oceanography,* Vol. 23, No. 1, p. 9-10.

Thoroughgood, C. 2009. A Healthy Ocean Matters, *Oceanography,* Vol. 22, No. 4, p. 9.

Thoroughgood, C. 2009. The Answer is Engagement, *Oceanography,* Vol. 22, No. 3, pp. 8-9.

Thoroughgood, C. 2009. New Organizing Principle for Ocean Sciences, *Oceanography,* Vol. 22, No. 1, pp. 10-11.

Thoroughgood, C. 2009. Ocean Sciences and Its Role in the Knowledge Economy, *Oceanography*, Vol. 22, No. 1, p. 7.

William C. Boicourt

Professor of Oceanography, University of Maryland Center for Environmental Science, Horn Point Laboratory, 2020 Horns Pt. Rd, Cambridge, MD 21613; email: boicourt@umces.edu; phone: 410-221-8426

Education: PhD (1973) Physical Oceanography, The Johns Hopkins University; MA (1969) Physical Oceanography, The Johns Hopkins University; BA (1966) Amherst College.

IOOS-relevant qualifications and current synergistic activities: IOOS MACOORA Board of Directors and MARCOOS PI; Founder, Chesapeake Bay Observing System (CBOS), U.S.

National Committee for the International Union of Geodesy and Geophysics; U.S. Delegate, International Association for the Physical Study of the Ocean.

Honors and Awards: B.H. Ketchum Award, Woods Hole Oceanographic Institution, 1989.

Relevant publications:

Li, M., L. Zhong, W.C. Boicourt, S. Zhang, and D.-L. Zhang (2007) Hurricane-induced destratification and restratification in a partially mixed estuary. *Jour. Mar. Res*. **65**:169-192.

Li, M., L. Zhong, W.C. Boicourt, S. Zhang, and D.-L. Zhang (2006) Hurricane-induced storm surges, currents and destratification in a semi-enclosed bay. *Geo. Res. Let*. **33**:L02604, 4 pp.

Boicourt, W.C. (2005) Physical response of Chesapeake Bay to hurricanes moving to the wrong side. In: K.G. Sellner (ed.) *Hurricane Isabel in Perspective*. Chesapeake Bay Research Consortium, CRC Publication 05-160, Edgewater, MD. p. 39-48.

Li, M., L. Zhong, and W.C. Boicourt (2005) Simulations of Chesapeake Bay estuary: Sensitivity to turbulence mixing parameterizations and comparison with observations. *Jour. Geophys. Res.* 110:C12004, 22 pp.

Wendell S. Brown

Professor of Oceanography, University of Massachusetts Dartmouth (UMD), School for Marine Science and Technology (SMAST); 706 S. Rodney French Blvd., New Bedford MA 02744; email wbrown@umassd.edu; phone 508-910-6395

Education: Ph.D. in Oceanography (1971) Massachusetts Institute of Technology; Cambridge, MA; MS (1967) & B.S. in Engineering (1965) Brown University; Providence, RI.

IOOS-relevant Qualifications and Synergistic Activities: Led a series of research projects in combined use of ocean observation systems and numerical ocean circulation models to investigate coastal oceanographic processes (1975-present); Editor (1992-95) and Senior Editor (1995-99) of the *Journal of Geophys Res-Oceans*; Director of the OCEAN Observation Laboratory (OCEANOL) – UMD/SMAST (2000-present); MACOORA Board member (2004-present); MARCOOS participant (2007-present).

IOOS- Relevant Publications

Brown, W. S, A. Gangopadhyay, F. L. Bub, Z. Yu and G. Strout, and A. R. Robinson, 2007. An Operational Circulation Modeling System for the Gulf of Maine/Georges Bank Region, Part 1: The Basic Elements, *IEEE J. Oceanic Engineering,* 32(3), 807-822.

Brown, W. S., A. Gangopadhyay, and Z. Yu, 2007, An Operational Circulation Modeling System for the Gulf of Maine/Georges Bank Region, Part 2: Applications, *IEEE J. Oceanic Engineering,* 32(3), 823-838.

Erturk, S.N., A. Bilgili, M.R. Swift, W.S. Brown, B. Celikkol, J.T.C. Ip, and D.R. Lynch, 2002. Simulation of the Great Bay Estuarine System: Tides with Tidal Flats Wetting and Drying, *J. Geophys. Res.*, 107 (C5), doi:101029/2001JC000883.

Brown, W.S., 1998."Wind-Forced Pressure Response of the Gulf of Maine", *J. Geophys. Res.*, 103 (C13), 30, 661-30,678

Brown, W.S. and J.D. Irish, 1993."The Annual Variation of Water Mass Structure in the Gulf of Maine," *J. Mar. Res.,* 51, 53-107.

Larry P. Atkinson

Slover Professor of Oceanography, Old Dominion Univ., Norfolk VA 23529; email latkinso@odu.edu; phone 757 683 4926; fax 757 683 5550

Education: PhD (1972) Dalhousie Univ., Halifax, Nova Scotia; MS (1968) and BS (1966) Univ. of Washington, Seattle, Washington.

IOOS relevant qualifications and synergistic activities: Experience in ocean observing, large scale ocean experiments, coastal oceanography; NSF liason to Ocean.US office 2001-2004; Chair of American Meteorological Society working group on research requirements for offshore wind industry development; offshore wind resource and extreme events characterization and climatology; former editor JGR Oceans and Oceanography magazine; Fellow AAAS; offshore observations for alternative energy; mid-Atlantic Bight modeling for oil spill risk analysis.

Relevant Publications:

Atkinson, L. P., J. Huthnance, J. L. Blanco, 2005. Circulation, mixing and the distribution of remineralized nutrients. in The Seas v.13. Ed. by A. R. Robinson and K. H. Brink. Harvard Press. pp. 227-267.

Kumar, Ajoy, A. Valle-Levinson and L. P. Atkinson, 2006. Overrunning of shelf water in the southern Mid-Atlantic Bight. Prog. Ocean., 70. 213-232.

Liu, Kon-Kee, L Atkinson, R. Quinones and L Talaue-McManus (Editors), 2010. Carbon and nutrient fluxes in continental margins – a global synthesis. Springer. 741 pp.

CO-Principal Investigators/Partners:

Arthur A. Allen

Oceanographer, U.S. Coast Guard Headquarters' Office of Search and Rescue (CG-534), New London, CT, 06320; email Arthur.A.Allen@uscg.mil; phone 860-271-2747; fax 860-271-2773

Education: MS (1980) Dalhousie Univ., Halifax, Nova Scotia; BS (1975) Univ. of Massachusetts, Amherst, MA.

IOOS relevant qualifications and synergistic activities: Area of expertise includes the determination of the drift of common search objects, determination of environmental data sets for operational use by CG SAR planning tools, use of survival and hypothermic models in SAR planning. Liaison with oceanographic community to articulate USCG mission needs and provide assessment of environmental data products for USCG SAR mission. Member of government oversight team for development & use of the Coast Guard's SAR planning tool - SAROPS

Relevant Publications:

Breivik, Ø. and A. Allen, 2007. An operational search and rescue model for the Norwegian Sea and the North Sea, J. Marine Systems 69 (2008) 99-113.

Ullman, D.S., J. O'Donnell, J. Kohut, T. Fake, and A.Allen (2006) "Trajectory prediction using HF radar surface currents: Monte Carlo simulations of prediction uncertainties", J. Geophys. Res., 111, C12005,

Alan F. Blumberg

George Meade Bond Professor of Ocean Engineering, Center fopr Maritime Ststems, Stevens Institute of Technology, Hoboken, NJ; email ablumberg@stevens.edu; phone 201-216-5289; fax 201-216-8214

Education: Post Doctoral (1979) Princeton Univ., PhD (1976), MS (1973) The Johns Hopkins Univ.; and BS (1970) Fairleigh Dickinson Univ.

IOOS relevant qualifications and synergistic activities: Estuarine and coastal ocean forecast model development, experience in urban ocean observing, data assimilation technology, HF Radar utilization, uncertainty quantification, created NY Harbor Observing and Prediction System; EPA Science Advisory Board 2006-2007; former associate editor Estuaries; Fellow Am Soc of Civil Engineers (ASCE); recipient 2001 ASCE Hilgard Hydraulic Prize and 2007 Denny Medal from Institute of Marine Engineering, Science and Technology.

Relevant Publications:

2008 Kerman, M. C., W. Jiang, A. F. Blumberg, and S. E. Buttrey. A comparison of robust meta

models for the uncertainty quantification of New York Harbor oceanographic data. . Journal of Operational Oceanography, 1, 2, 4-13.
2008 Blumberg, A. F., N. Georgas. Quantifying Uncertainty in Estuarine and Coastal Ocean Circulation Modeling", J. Hydraulic Engineering, 134, 403-415.
2008 Hoffman, R., R. Ponte, E. Kostelich, A. F. Blumberg, I. Szunyogh, S. Vinogradov and J.M. Henderson. A Simulation Study Using a Local Ensemble Transform Kalman Filter for Data Assimilation in New York Harbor, J. Atmospheric and Oceanic Technology, 25, 1648-1656.

Michael S. Bruno

Dean, School of Engineering, Stevens Institute of Technology, Hoboken, NJ 07030; phone: (201) 216-5338; email: michael.bruno@stevens.edu

Education: Sc.D. (1986) Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program. M.S. (1981) Univ. of California at Berkeley, B.S. 1980 NJIT.

IOOS-relevant qualifications and synergistic activities: Dr. Bruno is the Director of the DHS Center of Excellence for Port Security. He has been involved in the development, installation, and utilization of coastal ocean observation systems for more than 20 years. His work has been sponsored by the Office of Naval Research, NOAA, FEMA, and the States of New York and NJ. He is active in numerous committees and advisory boards that seek better coordination and utilization of ocean and weather observing systems, including the New York/NJ Harbor Safety, Navigation & Operations Committee and NJ Coastal Protection Technical Assistance Service.

Related Publications:

Bruno, M.S., A.F. Blumberg and T.O. Herrington. 2006. The Urban Ocean Observatory - Coastal Ocean Observations and Forecasting in the New York Bight. Journal of Marine Science and Environment, No C4, IMarEST, 1-9.
Bruno, M.S., B. J. Fullerton, R. Datla, and P. Rogowski. (2004). "Field and Laboratory Investigation of High-Speed Ferry Wake Impacts in New York Harbor", High Speed Performance Vehicles, 277- 286. Springer.
Herrington, T.O., K.L. Rankin, and M.S. Bruno. 2002. "Frequency of Sediment Suspension Events in Newark Bay. Proceedings, Protection and Restoration of the Environment VI, Skiathos, Greece, 1-5 July 2002.

Alan M. Cope

Science and Operations Officer, National Weather Service, Mount Holly, NJ 08060; email alan.cope@noaa.gov; phone 609 261 6602; fax 609 261 6614

Education: MS (1980) State Univ. of New York at Albany and BS (1977) NCSU

IOOS relevant qualifications and synergistic activities: Experience in operational weather and marine forecasting and related research; interpretation of numerical weather prediction
model output and running high-resolution models. Member, American Meteorological Society and National Weather Association.

Relevant Publications:

Croft, Paul J., A.M. Cope and T. Skic, 2009: Convective Research for Operational Forecasting and Training: A Verification of Operational Research Trial Simulations. 34th National Weather Association Annual Meeting, Norfolk, VA.
Blumberg, A, S. Fan, T. Herrington, M. Bruno, A. M. Cope, Q. Ahsan, and H. Li, 2005, A Coastal Wave Forecasting System for NJ and Long Island Waters, 6th Conference on Coastal Atmospheric and Oceanic Prediction and Processes, San Diego.
Gorse, M. and A.M. Cope, 2005: The flash flood of 12 July 2004 in Burlington County, NJ: A

case study. 21st Conference on Weather Analysis and Forecasting, Washington, D.C.

Michael Crowley

Program Manager, Rutgers Univ., Inst. Marine & Coastal Sci., 71 Dudley Road, New Brunswick, NJ, 08901; email: crowley@marine.rutgers.edu; phone 732-932-6555 x543.

Education: 1993 M.S. Oceanography/Geography (Remote Sensing), Rutgers University, New Brunswick, NJ. 1991 B.A. Geography (Remote Sensing & GIS), Rutgers University, NJ.

IOOS relevant qualifications and synergistic activities: Experience in technical program management; land, ocean and atmospheric remote sensing experience using both satellites and airborne sensors; worked with numerous types of ocean sensors and satellites including but not limited to AVHRR, Geosat, MODIS, SeaWiFS, OceanSat, GOES, Radarsat, ERS-2, CODAR, ADCP/ADP/CTD, and AUV Glider bio-optical data; multi-spectral image processing and algorithm development; conducted public outreach including K-12 education, television, magazine, newspaper and radio interviews to expand awareness of NJ ocean research activities and relevance to the community; TS Clearance.

Relevant Publications:

Crowley, M., O. Schofield, S. Glenn, J. Kohut, 2002. Development of Coastal Ocean Observatories for Synoptic Oceanography, PICES North Pacific Marine Science Organization, 11th Annual Meeting, Qingdao, China.

Crowley, M., R. Bernstein, K. Prasad, S. Glenn, E. Terrill, M. Otero, 2003. Oceansat's Ocean Color Monitor: Overview and Applications, Oceans Conference, San Diego, CA.

Richard Dunk

Institute of Marine and Coastal Sciences, Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901-8521, 732-932-6555, 732-932-1821 (fax), dunk@marine.rutgers.edu

Education: Ph.D. (1993): Environmental Science/Meteorology, Rutgers University. M.S. (1976): Meteorology, Rutgers. B.S. (1972): Environmental Science (Meteorology), Rutgers. B.A. (1967): Science Education, Glassboro State College (Rowan University).

IOOS-relevant qualifications and synergistic activities: Dr. Dunk has over 25 years of industrial and academic experience working in the fields of applied meteorology, environmental monitoring, modeling, and statistical analyses with projects related to energy and environmental management. Studied and evaluated the interaction of the ocean and atmosphere and associated coastal processes, such as the NJ *Sea Breeze,* to determine cause and affect relationships regarding wind/temperature gradient and vertical profile dynamics and configurations. Severed on various EPRI committees and task force groups concerned with power plant development, operational issues associated with atmospheric transport/dispersion modeling and meteorological monitoring, including flux and turbulence monitoring within the surface boundary layer. Enhanced the accuracy and precision of regional numerical /probabilistic atmospheric modeling systems by statistically evaluating area- and site-specific forecasts as compared to actual (monitored) data acquired for selected locations, especially coastal and inland coastal areas, in NJ and adjacent states.

Charles N. Flagg

Research Professor, School of Marine and Atmospheric Sciences, Stony Brook Univ., Stony Brook, NY 11794, (631) 632-3184, cflagg@ms.cc.sunysb.edu

Education: PhD, 1977, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program; MS, 1971, Massachusetts Institute of Technology; BS, 1969, Cornell.

IOOS relevant qualifications and synergistic activities: Experience in field programs in the Mid-Atlantic Bight, NESDE, BLM Georges Bank, SEEP-I, -II, OMP, GLOBEC and Oleander

Relevant Publications:

Rossby, H.T., C.N. Flagg, K. Donohue, 2010. On the Variability of Gulf Stream Transport 1 from Seasonal to Decadal Timescales, Journal of Marine Research, Accepted.

Flagg, C. N., M. Dunn, D. Wang, H. T. Rossby, and R. L. Benway (2006), A study of the currents of the outer shelf and upper slope from a decade of shipboard ADCP observations in the Middle Atlantic Bight, J. Geophys. Res., 111, C06003, doi:10.1029/2005JC003116.

Flagg, C.N., L.J.Pietrafesa, and G.L. Weatherly, 2002. Springtime hydrography of the southern Middle Atlantic Bight and the onset of seasonal stratification. Deep-Sea Research II, 49/20, pp 4297-4329.

Avijit Gangopadhyay

Professor and Associate Dean, SMAST, UMass Dartmouth, 200 Mill Road, Fairhaven, MA 02179; email: Avijit@umassd.edu; phone: 508-910-6330; fax: 508-910-6374; website: http://www.smast.umassd.edu/modeling/RTF.

Education: PhD (1990) University of Rhode Island; M.Tech. (1981) IIT Delhi; B.Tech. (1979) IIT Kharagpur.

IOOS-relevant qualification and synergistic activities: Expertise in feature oriented regional modeling system for initialization and assimilation of synoptic ocean forecasting; dynamical understanding of the Gulf Stream separation problem; developed synoptic feature-based models for Gulf Stream, Gulf of Maine, California Current System, Brazil Current System, North Brazil Current Rings and many other regions of the world ocean. Member of the AGU, TOS and AAAS. Work with industry partners in developing forecast systems.

Relevant publications:

Brown, W.S., A. Gangopadhyay, F. L. Bub, Z. Yu and G. Strout, and A.R. Robinson, 2007: An Operational Circulation Modeling System for the Gulf of Maine/Georges Bank Region, Part 1: The Basic Elements, *IEEE J. Oceanic Eng. 32* (4), 807-822.

Brown, W.S., A. Gangopadhyay, and Z. Yu, 2007: An Operational Circulation Modeling System for the Gulf of Maine/Georges Bank Region, Part 2: Applications, *IEEE J. Oceanic Eng. 32* (4), 823-838.

Gangopadhyay, A., A.R. Robinson, P.J. Haley, W.J. Leslie, C.J. Lozano, J.J. Bisagni, and Z. Yu, 2003: Feature Oriented Regional Modeling and Simulation (FORMS) in the Gulf of Maine and Georges Bank, *Cont. Shelf Res. 23*(3-4), pp 317-353.

Thomas Herrington

Assistant Director, Center for Maritime Systems, Associate Professor, Department of Civil, Environmental and Ocean Engineering, Stevens Institute of Technology, Hoboken, NJ; phone: 201.216.5320; email: Thomas.Herrington@stevens.edu

Education: Ph.D. (1996), M.E. (1992) and B.E. (1989) Stevens Institute of Technology

IOOS-relevant qualifications and synergistic activities Dr. Tom Herrington is a Associate professor at the Stevens Institute of Technology and is the Coastal Process Specialist for the NJMSC/NJ Sea Grant Marine Extension Program. He is the Assistant director of the center of Marine Systems. He is also the Director NJ Coastal Protection Technical Assistance Service.

Related Publications:

Bruno, M.S., A.F. Blumberg & T.O. Herrington (2006). The urban ocean observatory – coastal ocean observations and forecasting in the New York Bight, J. Marine Sci and Envirn., No. C4, 31-39.

Herrington, T.O., M. Mossler, E. Zagrai, B.J. Fullerton, A.F. Blumberg and M.S. Bruno (2005). Development of an automated coastal storm surge warning system. Presented at the 2005 Conference of Flood Warning System Technologies and Preparedness, 6TH National Conference and Exposition of the National Hydrologic Warning Council, May 16-20, 2005, Sacramento, CA.

Blumberg, A., S. Fan, T.O. Herrington, M. Bruno, A.M. Cope, Q. Ahsan, and H. Li, (2005). A coastal wave forecasting system for NJ and Long Island waters. Sixth Conference on Coastal Atmospheric and Oceanic Prediction and Processes, 85th AMS Annual Meeting, 9-13 January 2005, San Diego, CA.

Eoin Howlett

CEO, Applied Science Associates, Inc., South Kingstown, RI 02879; email ehowlett@asascience.com; phone 401 789 6224; fax 401 789 1942.

Education: MBA (2002) Univ. of Rhode Island; Kingston, RI; BEE Hons. (1988) Univ. College, Dublin, Ireland.

IOOS relevant qualifications and synergistic activities: Mr. Howlett was a member of the Ocean.us Modeling and Analysis Steering Team, and is a member of the Ocean.us DMAC (Data management and communications) modeling sub-committee, a member of the IOOS Program Office Web Services and Data Encodings committee for Data Integration Framework, and a member on the Ocean Research & Resources Advisory Panel Ocean Observing Sub-Panel. He is the DMAC Principal Investigator for Marcoos (Mid-Atlantic Regional Coastal Ocean Observing System), and is a member of the Data Management and Strategic Planning teams for NERACOOS. Mr. Howlett is the Cyberinfrastructure (CI) principal investigator for the SURA NOAA Model Testbed project and also coordinates closely with the NSF OOI-CI project.

Relevant Publications:

Jeff de La Beaujardière, Eoin Howlett, et al : Coastal Data Management, presented at OceanOBS, Venice, Italy, 2009

Steve Hankin, Eoin Howlett et al : Ocean Data Management: The Way Forward, plenary session at OceanOBS, Venice, Italy, 2009

Eoin Howlett et al: An Integrated Statewide Ocean Data Network to Provide Data Analysis Necessary for Integrated Multi-use Ocean Management in Massachusetts, prepared for the Massachusetts Ocean Partnership, 2009.

John Kerfoot

Research Computing Specialist, Rutgers Univ., Inst. Marine & Coastal Sci., 71 Dudley Road, New Brunswick, NJ, 08901; email: kerfoot@marine.rutgers.edu; phone 732-932-6555 x527.

Education: 1998 M.S. Biological Oceanography, University of California, Santa Barbara, CA.

IOOS relevant qualifications and synergistic activities: Significant experience with a wide variety of oceanographic sampling platforms (AVHRR, MODIS, gliders, CODAR) and the technologies used to acquire, process and display them in real-time (Matlab, perl, javascript, php, SQL, shell scripting, OPeNDAP, THREDDS). Interacts with government agencies (NOAA, NAVOCEANO, NATO) to facilitate the acquisition and sharing of datasets.

Relevant Publications:

Kerfoot, J., K. Mahoney, G. Kirkpatrick, S. Lohrenz, M. Moline and O. Schofield. Vertical Migration of a Toxic Karenia brevis Red Tide and the Impact on Remote Sensing Reflectance. Ocean Sciences Meeting, American Geophysical Union, Honolulu, 2002.

Kerfoot, J., Glenn, S., Schofield, O., Kohut, J., Chant, R., Wilkin, J., Roarty, H (2008). The View from the COOL Room: 15 Years in the Rutgers University Coastal Ocean Observation

Lab. Ocean Sciences Meeting, American Society of Limnology & Oceanography 2008.

Dennis M. King

Research Professor, Univ. of Maryland, Center for Environmental Science; email dking@umces.edu; phone 410 326-7212; fax 410 326-7419.

Education: PhD (1977) Univ. of Rhode Island, S. Kingston, RI; MS (1973) and BBA(1970) Univ. of Massachusetts, Amherst, MA

IOOS relevant qualifications and synergistic activities: Experience with economic aspects and uses of data in decision-making in ocean-related industries and coastal and ocean management, fisheries management, and emergency management. Involved in all aspects of market and non-market valuation methods, including methods of assessing the value of information. Past research dealing with the effects of ocean conditions on fish stocks and fishing success.

Relevant Publications:

The Economic Structure of California's Commercial Fisheries, with Elizabeth Price, Steven C. Hackett, and M. Doreen Hansen, A Report to California Department of Fish and Game, June 3, 2009 (PDF file at: http://www.dfg.ca.gov/marine/economicstructure.asp)

Rational noncompliance and the liquidation of Northeast groundfish resources, with Jon G. Sutinen, Marine Policy (2009), doi:10.1016/j.marpol.2009.04.023 (PDF file at: http://lenfestocean.org/publications/NEGFenforcement.html)

Linking optimization and ecological models in a decision support tool for oyster restoration and management, with E.W. North, J. Xu, R.R. Hood, R.I.E. Newell, K.T. Painter, M.L. Kellogg, M.K. Liddel, and D. Boesch, submitted to Ecological Applications; May, 2009

Josh T. Kohut

Assistant Professor of Marine and Coastal Sciences, Rutgers Univ., Institute of Marine & Coastal Sciences, 71 Dudley Road, New Brunswick, NJ, 08901; email: kohut@marine.rutgers.edu; phone: 732-932-6555 x542

Education: PhD (2002) Physical Oceanography, Rutgers Univ., New Brunswick, NJ, USA; B.S. (1997) Physics, College of Charleston, Charleston, SC, USA (Cum Laude)

IOOS-relevant qualifications and synergistic activities: Experience working with MARCOOS observing technologies, particularly HF radar and gliders. I participated on the panel to draft a document describing a national HF radar network. Over the past 3 years I have been a co-PI on the MARCOOS project focused mainly on the HF radar evaluation for Coast Guard Search and Rescue and working with ocean observing and fisheries scientists to help define IOOS based habitat indicators appropriate for critical fish species of the Mid-Atlantic Bight.

Relevant publications:

Kohut, J. T., S. M. Glenn, and J. D. Paduan. 2006, Inner shelf response to Tropical Storm Floyd, J. Geophys. Res., 111, C09S91,doi:10.1029/2003JC002173

Kohut, J.T., H.J. Roarty and S.M. Glenn (2006) Characterizing Observed Environmental Variability with HF Doppler Radar Surface Current Mappers and Acoustic Doppler Current Profilers: Environmental Variability in the Coastal Ocean, IEEE Journal of Oceanic Engineering, Vol. 31, No. 4, pp. 876-884.

Gong, D., J. T. Kohut, and S. M. Glenn (2010), Seasonal Climatology of Wind-Driven Circulation on the New Jersey Shelf, J. Geophys. Res. doi:10.1029/2009JC005520

Judith T. Krauthamer

Executive Director, MACOORA, the Mid-Atlantic Coastal Ocean Observing Regional Assoc. Box 6879, Ellicott City MD, 21042. 410-462-5017. judith.krauthamer@macoora.org

Education: MS (1984) Texas A&M Univ., College Station, TX

IOOS relevant qualifications and synergistic activities: Industry Sub-Committee, Ocean Research and Resources Advisory Panel; Executive Director, Marine Technology Society (1999-2007), Reviewer for: Marine Technology Society Journal, 2000-2007.

Relevant Publications:

Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2004-2007; Guiding National Ocean Research Investment: The Development of the Ocean Research Priorities Plan, 2006; An Ocean Blueprint for the 21st Century Final Report, U.S. Commission on Ocean Policy, ISBN#0-9759462-0-X

Bruce L. Lipphardt, Jr.

Research Assistant Professor, College of Earth, Ocean and Environment, Univ. of Delaware, Newark, DE 19716; email brucel@udel.edu; phone 302 831 6836; fax 302 831 6521

Education: PhD (1995) Old Dominion Univ.; BS (1984) US Naval Academy, Annapolis.

IOOS relevant qualifications and synergistic activities: Experience in objective mapping and Lagrangian analysis of HF radar current measurements, experience in operating and evaluating HF radars, lead investigator for the Delaware Bay HF radar network.

Relevant Publications:

Dzwonkowski, B., B. L. Lipphardt, Jr., J. T. Kohut, X.-H. Yan, and R. W. Garvine. 2010. Synoptic measurements of episodic offshore flow events in the central mid-Atlantic Bight. *Cont. Shelf Res.*, 30: 1373-1386.

Carlson, D. F., P. A. Muscarella, H. Gildor, B. L. Lipphardt, Jr. and E. Fredj. 2010. How useful are progressive vector diagrams for studying coastal ocean transport? *Limnol. Oceanogr.: Methods*. 8: 98-106.

Lipphardt, B. L., Jr., A. D. Kirwan, Jr., C. E. Grosch, J. K. Lewis and J. D. Paduan. 2006. Synoptic Lagrangian maps: Application to surface transport in Monterey Bay, J. Mar. Res., 64: 221-247.

Tony MacDonald

Director, Monmouth Univ. Urban Coast Institute, West Long Branch, NJ 07764; email – amacdona@monmouth.edu; phone-732-263-5392; fax-732-263-5723

Education: JD (1979) Fordham Univ., New York, NY; BA (1975) Middlebury College, Middlebury, VT.

IOOS relevant qualification and synergistic activities: Experience in coastal and ocean management programs and policy; Executive Director, Coastal States Organization; Director of Environmental Affairs, American Association of Port Authorities; member NOAA Oceans and Human Health National Advisory Committee.

Relevant Publications:

MacDonald (2009) A Time for a New Approach: Regional Marine Spatial Planning for the Mid-Atlantic, The Jersey Shoreline.

John P. Manderson

Research Fisheries Biologist, Behavioral Ecology Branch NEFC/NOAA/NMFS, James J. Howard Marine Sciences Laboratory, 74 Magruder Rd, Highlands, NJ 07732; email: john.manderson@noaa.gov ; Phone: +1 732 872 3057, Fax : 732 872 3128

Education: PhD (2005) Univ. of Massachusetts, Amherst , Massachusetts; BS (1983) Connecticut College, New London Connecticut.

IOOS relevant qualifications and synergistic activities: Development and implementation IOOS applications in fisheries science. The use of IOOS data in retrospective analysis of fish stock assessment data as well as application of near real time IOOS data to investigate

biophysical processes affecting fish recruitment. 2009 recipient of Judith Brennan Hoskins Memorial Award for outstanding performance in the NOAA/NEFSC science program. Steering Committee in ICES working group on the Northwest Atlantic Regional Sea co-responsible for habitat and spatial management.

Relevant Publications:

P. Manderson, J. Kohut, L. Palamara, and B. Phelan. Fish and Physics: Assessment of the power of Ocean Observing System data streams to explain habitat specific distributions of resource species in the coastal ocean. International Council for the Exploration of the Sea. Proceedings of the 2009 ICES Science Conference, Berlin Germany. K_11. 26pp

P. Manderson. The spatial scale of phase synchrony in winter flounder (Pseudopleuronectes americanus) production increased among southern New England nurseries in the 1990's. Canadian Journal of Fisheries and Aquatic Sciences 65:340-351.

Janice McDonnell

Science Engineering & Technology (SET) 4-H Agent, Associate Professor, Department of Youth Development, Rutgers Univ., 71 Dudley Road, New Brunswick, NJ 08901; phone: (732) 932 6555 x521; email: mcdonnel@marine.rutgers.edu.

Education: BS (1988) Univ. of Connecticut, MS (1994) Old Dominion Univ..

IOOS relevant qualifications and synergistic activities: Janice is the Director of the Centers for Ocean Science Education Excellence Networked Ocean World (COSEE NOW) which is focused on encouraging an online network of scientists and educators involved in ocean observing systems.

Relevant Publications:

McDonnell, J. A. deCharon, and C. Peach. 2010. Earth Science Teacher. Vol. 26. 1. P.25-28.

McDonnell, J. S. Franks, A. Thorrold, C. Peach, and E. Simms. 2007. Strategies for Engaging Scientists in Ocean Sciences Education. Currents: The Journal of Marine Education. Vol. 23. No. 1 p. 10-11.

James O'Donnell

Professor of Marine Sciences and Joint Professor of Physics, University of Connecticut. 1084 Shennecossett Road, Groton, CT 06340. Telephone: 860 405 9171. Email: James.ODonnell@uconn.edu.

Education: Ph.D. Oceanography, 1986, University of Delaware, College of Marine Studies, Newark, DE; M.S. Marine Studies, 1981, University of Delaware, Newark, DE; B.Sc. (hons) Applied Physics, 1979, University of Strathclyde, Glasgow, Scotland..

IOOS-relevant qualifications and synergistic activities: IOOS MACOORA Board of Directors (2006-2009); NERACOOS Board of Directors (2007-2010); Chair, Gordon Research Conference in Coastal Circulation (2005-9); Long Island Sound Science Advisory Committee;

Relevant publications:

O'Donnell, J. (2009). The Dynamics of Estuary Plumes and Fronts. In "*Contemporary Issues in Estuarine Physics,* A. Valle Levinson, edt. Cambridge University Press..

O'Donnell, J., H. G. Dam, W. F. Bohlen, W. Fitzgerald, P. S. Gay, A. E. Houk, D. C. Cohen, and M. M. Howard-Strobel (2008). Intermittent Ventilation in the Hypoxic Zone of Western Long Island Sound During the Summer of 2004. J. Geophys. Res. V113, C09025, doi:10.1029/2007JC004716

Matthew J. Oliver

Assistant Professor, College of Earth Ocean and Environment, Univ. of Delaware; email moliver@udel.edu; phone 302 645 4079; fax 302 645 4028.

Education: PhD (2006) Rutgers Univ., New Brunswick, NJ; MS (2001) and BS (1999) California Polytechnic State Univ., San Luis Obispo, CA

IOOS relevant qualifications and synergistic activities: Experience in remote sensing algorithm development for MAB ocean observing; More than 200 days at sea in MAB related to ocean observing; Linking fisheries catch to remote sensing products in the MAB through the NOAA FATE program; Developed web-based and Google Earth interfaces for display of IOOS products in K-12 classrooms.

Relevant Publications:

Irwin, A. J., Oliver, M. J., 2009. Are ocean deserts getting larger? Geophysical Research Letters, Vol .36, L18706, doi:10.1029/2009GL039414

Oliver, M. J., Irwin, A. J. 2008. Objective Global Ocean Biogeographic Provinces. Geophysical Research Letters, Vol. 35, L15601, doi:10.1029/2008GL034238.

Oliver, M. J., et al. Bioinformatic Approaches for Objective Detection of Water Masses on Continental Shelves. 2004. Journal of Geophysical Research 109, C07S04, doi:10.1029/2003JC002072

Hugh Roarty

Research Project Manager, Coastal Ocean Observation Laboratory, Rutgers University, Institute of Marine & Coastal Sciences, 71 Dudley Road, New Brunswick, NJ, 08901; email: hroarty@marine.rutgers.edu; phone: 732-932-6555 x543

Education: PhD (2001) Ocean Engineering, Stevens Institute of Technology, Hoboken, New Jersey, USA; B.S. (1995) Civil Engineering, Rutgers University, New Brunswick, New Jersey, USA (Cum Laude)

IOOS-relevant qualifications and synergistic activities: Experience working with MARCOOS observing technologies, particularly HF radar and gliders. For the past three years I have served as regional coordinator for the HF radar network. My duties have included managing the efforts of the four HF radar operators assigned to the three regions within the MARCOOS HF radar network and developing the network to be consistent with national standards. I have participated in each of the Radiowave Operators Working Group meetings.

Relevant publications:

Roarty et al. (2010) "Operation and Application of a Regional HF Radar Network in the Mid-Atlantic Bight" submitted Marine Technology Society Journal

Roarty, Barrick, Kohut, Glenn (2010) "Dual-Use of Compact HF Radars for the Detection of Mid and Large Size Vessels" Turkish Journal of Electrical Engineering & Computer Sciences, Vol. 18, No. 3, 373-388

Roarty, Kohut, Glenn (2008) "The Mid-Atlantic Regional Coastal Ocean Observing System: Serving Coast Guard and Fisheries needs in the Mid-Atlantic Bight", Proceedings of the IEEE/OES/CMTC Ninth Working Conf. on Current Measurement Technology , 151-155

Oscar Schofield

Professor of Oceanography, Rutgers of Oceanography, New Brunswick, NJ 08901 Email: oscar@marine.rutgers.edu phone: 732 932 6555; fax 732 932 8578

Education: 1993 PhD UCSB, 1994-1995 Postdoctoral Researcher USDA, 1995-present Rutgers Assistant/Associate/Full Professor

IOOS relavant qualifications and synergistic activities: Project Scientist NSF OOI Cyberinfrastructure Implementing Organization, National Research Council Member for the Committee of "Ocean Infrastructure for the year 2030", Science Advisory Board for Alliance of Coastal Technologies, Board of Directors Canadian "Ocean Entity Society"

Relevant Publications

Schofield, O., Glenn, S., Orcutt, J., Arrott, M., Brown, W., Signell, R., Moline, M. A., Chao, Y., Chien, S., Thompson, D., Balasuriya, A., Oliver, M. Developing and deploying automated sensor networks to advance ocean science. EOS (In Press)

Schofield, O., Ducklow, H. W., Martinson, D. G., Meredith, M. P., Moline, M. A., Fraser, W. R. 2010. How do polar marine ecosystems respond to rapid climate change? Science 328, 1520 DOI: 10.1126/science.1185779

Schofield, O., Chant, R., Cahill, B., Castelao, R., Gong, D., Kahl, A., Kohut, J., Montes-Hugo, M., Ramadurai, R., Ramey, P., Xu, Y., Glenn, S. M. 2008. Seasonal forcing of primary productivity on broad continental shelves. Oceanography 21(4): 104-117.

Harvey E. Seim

Professor of Marine Sciences, Univ. of North Carolina at Chapel Hill; email hseim@email.unc.edu; phone 919 962 2083; fax 919 962 1254.

Education: PhD (1993) Univ. of Washington, Seattle, Washington; MS (1985) and BS (1981) Univ. of South Carolina, Columbia, South Carolina.

IOOS relevant qualifications and synergistic activities: Experience in ocean observing,estuarine and coastal oceanography; Chief Operating Officer of SEACOOS, 2003-2008; Chair of the Board of SECOORA, 2009-present; editor JGR Oceans; co-led offshore wind power study for NC, 2009.

Relevant Publications:

Seim, H., H. Dahlin, G. Meyers, R. Shuford and R. Proctor, 2009. Development of delivery of services from ocean observing systems – an opportunity to promote common approaches for a Global Ocean Observing System, Community White Paper, OceanObs'09 conference, Venice, IT.

Shay, L., H. Seim, D. Savidge, R. Styles and R. Weisberg, 2008. High frequency radar observing systems in SEACOOS. MTS Journal, 42(3), 55-67.

Seim,. H., C. Mooers, J. Nelson, R. Weisberg and M. Flectcher, 2009. Towards a regional coastal ocean observing system design for the southeast coastal ocean observing regional association, Journal of Marine Systems, 77, 261-277, doi: 10.1016/j.jmarsys.2007.12.016.

James Titlow

Senior Meteorologist, WeatherFlow Inc. Poquoson VA 23662; email jtitlow@weatherflow.com; phone 757 868 5362; fax 757 868 5362.

Education: MS (1987) University of Delaware, Newark, Delaware; BS North Carolina State University Raleigh, NC.

IOOS relavant qualifications and synergistic activities: Jay Titlow is a Senior Meteorologist with WeatherFlow Inc., and their Poquoson VA office. Jay is involved with several business development projects, as well as serving in an advisory mode for WeatherFlow coastal forecasting operations. Jay also continues to lead numerous meteorological research efforts, including the development of an AI-based intelligence system to facilitate operational forecasting. Other responsibilities include mesonet engineering (siting, installation, data qc, and maintenance), mesoscale modeling via WeatherFlow's own system, product development, and special projects. Other efforts include working with other groups such as the National Weather Service, Department of Defense, and the USCG to facilitate operations through the use of WeatherFlow's coastal mesonet.

Relevant Publications

Titlow, J.K. and M. Willis, 2010. On the Use of a Coastal Mesonet to Improve Operations at an

NWS Forecast Office. Proceedings of the 26th Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, Atlanta GA, January 20, 2010.

Titlow, J.K. and S.C. Woll, 2009. Challenges of Coastal Wind Forecasting. Proceedings of the American Wind Energy Association Windpower 2009, Chicago IL, May 6, 2009.

Titlow, J.K., 2005: An Operational Coastal Mesoscale Forecast System. *Proceedings of the AMS Sixth Conference on Coastal Atmospheric and Oceanic Prediction and Processes*, San Diego, CA, January 9-13, 2005.

David S. Ullman

Associate Marine Research Scientist, Univ. of Rhode Island, Narragansett, RI 02882; email d.ullman@gso.uri.edu; phone 401 874 6138

Education: PhD (1996) State Univ. of New York, Stony Brook, NY; MS (1984) State Univ. of New York, Stony Brook, NY; BE (1981) Stevens Institute of Tech., Hoboken, NJ.

IOOS relevant qualifications and synergistic activities: Experience in observational coastal oceanography; Operated a 3-site surface current mapping radar (CODAR) system in the Block Island Sound region for the past 10 years; Developed methodology for prediction of the uncertainties in drifter trajectories using HF radar derived surface currents; Developed data model for HF radar wave data to facilitate access to these data.

Relevant Publications:

Ullman, D. S., J. O'Donnell, J. Kohut, T. Fake, and A. Allen, 2006. Trajectory prediction using HF radar surface currents: Monte carlo simulations of prediction uncertainties, J. Geophys. Res., 111, C12005, doi: 10.1029/2006JC003715.

Ullman, D. S. and D. L. Codiga, 2004. Seasonal variation of a coastal jet in the Long Island Sound outflow region based on HF radar and Doppler current observations, J. Geophys. Res., 109, C07S06, doi: 10.1029/2002JC001660.

Nancy Vorona

Vice President, Research Investment, Center for Innovative Technology (CIT), Herndon, Virginia 20170; email nancy.vorona@cit.org; phone 703-689-3043; fax 703-689-3041.

Education – MBA, Thunderbird School of Global Management, Glendale, Arizona, 1981; BA University of North Carolina, Chapel Hill, North Carolina (1979).

IOOS relevant qualifications and synergistic activities – Experience managing large scale ocean observing and other federal research and technology development and deployment projects; experience in federal and state policy initiatives; experience in developing and implementing export control policies and programs. Research and technology development and deployment projects include those with multi-site data collection and integration and analysis by different end users, and those that must conform to federal technology standards.

Eric. F. Vowinkel

Hydrologist, U.S. Geological Survey NJ Water Science Center 1978-present, 810 Bear Tavern Road Suite 206 West Trenton, NJ 08628; vowinkel@usgs.gov; 609-771-3931; fax 609-771-3915

Education: Ph.D. (1997), M.S. (1978), and B.S. (1975) Environmental Sciences, Rutgers University, New Brunswick, NJ

IOOS Relevant qualifications and synergistic activities: At-Large Board of Directors position of MACOORA for 2010-11. Named a Co-PI of the MARCOORA/ MARCOOS monitoring plan for FY2009-11. Helped coordinate: (1) water-quality workshop for the 3-East Coast IOOS Regional Associations (MACOORA, SECOORA, NERACOOS) with Univ., NOAA, USGS, and USEPA scientists and managers in January 2010; (2) the MACOORA Water Quality Workshop

in Philadelphia in 03/08 and (3) the IOOS/NOOA National Water Quality Monitoring Network Workshop at Rutgers Univ. in 09/06. Assisted in the design of the National Water Quality Monitoring Council's National Monitoring Network for Coastal Waters and Their Tributaries linking monitoring in watersheds with estuaries and coasts. Project chief of the Delaware River Basin Demonstration Project of the National Network. USGS Co-Chair of the National Water Quality Monitoring Council's Methods Data Comparability Board 2004-2010.

Relevant Publications:

Hamilton, P.A., Hancock, T.L., Vowinkel, E.F., 2010: The National Water Quality Monitoring Network-now and into the future, Proceedings of the National Water Quality Monitoring Council Conference, Denver, CO, April 25-29, 2010, p. 79-80.

Vowinkel, E.F., and Tudor, R.J., 2010: Progress of the Delaware River Basin Demonstration Project of the National Water Quality Monitoring Network, Proceedings of the National Water Quality Monitoring Council Conference, Denver, CO, April 25-29, 2010, p. 79-80.

John L. Wilkin

Associate Professor of Marine and Coastal Sciences, Rutgers Univ., New Brunswick NJ 08901; email jwilkin@rutgers.edu; phone 732 932 6555; http://marine.rutgers.edu/~wilkin

Education: PhD (1988) MIT/WHOI, Woods Hole, Mass.; SM (1985) MIT, Cambridge, Mass.; BE Hons. (1982) Univ. of Auckland, New Zealand.

IOOS relevant qualifications and synergistic activities: 20 years experience with model-based analysis systems for coastal ocean forecasting and data assimilation, observing system design, nutrient and carbon cycling, and larval dispersal. Modeling Subcommittee, National Federation of Regional Associations (NFRA); IOOS Modelers Caucus for Data Management and Communications (DMAC) and Modeling and Analysis Steering Team (MAST); Science Working Team NASA Ocean Surface Topography Mission. Assoc-Editor Ocean Dynamics.

Recent Relevant Publications:

Zhang, W., J. Wilkin and J. Levin, 2010: Towards an integrated observation and modeling system in the New York Bight using variational methods, Part II: Representer-based observing system design, Ocean Modelling, doi: 10.1016/j.ocemod.2010.06.006.

Zhang, W., J. Wilkin and H. Arango, 2010: Towards an integrated observation and modeling system in the New York Bight using variational methods, Part I: 4DVAR data assimilation, Ocean Modelling, doi: 10.1016/j.ocemod.2010.08.003.

Zhang, W., J. Wilkin and R. Chant, 2009: Modeling the pathways and mean dynamics of river plume dispersal in New York Bight, J. Phys. Oceanogr., 10.1175/2008JPO4082.1.

Robert E. Wilson

Associate Professor, Marine Sciences Research Center, Stony Brook Univ./SUNY, Stony Brook, NY 11794-5000; phone: (631) 632-8689; rwilson@notes.cc.sunysb.edu

Education: Ph.D. (1974), M.A. (1970), and BA (1967) Johns Hopkins Univ.

Relevant Publications:

Cheng, P., R.E. Wilson, R.J. Chant, D. Fugate and R. Flood. 2009. Modeling the influences of stratification on lateral circulation in a partially mixed estuary. Journal of Physical Oceanography, 39:2324-2337.

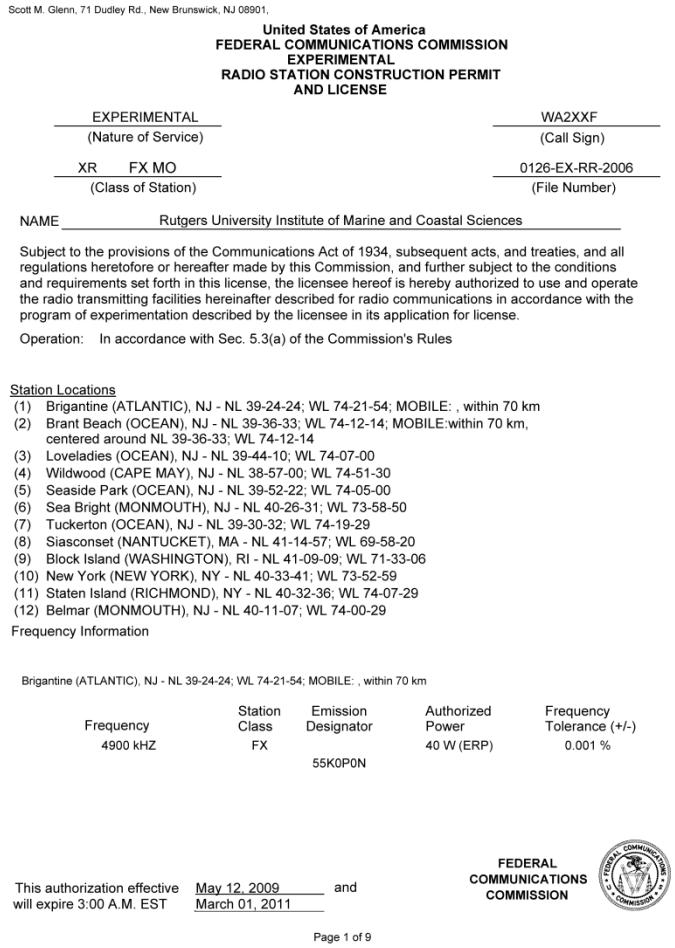
Wilson, R.E., R.L. Swanson and H.A. Crowley. 2008. Perspectives on long-term variations in hypoxic conditions in Western Long Island Sound. Journal of Geophysical Research, 113, C12011, doi:10.1029/2007JC004693.

Swanson, R.L. and R.E. Wilson. 2008. Increased tidal ranges coinciding with Jamaica Bay development contribute to marsh flooding. Journal of Coastal Research, 24: 1565- 1569.

B. National Environmental Policy Act (NEPA)

C1: NOAA is the funding agency for the proposed activity. NOAA oversight is provided by the NOAA IOOS Program Office. The project will be conducted in partnership with NOAA scientists listed on page 1 of the Project Summary under Co-PI's. They include scientists from NOAA National Weather Service and NOAA National Marine Fisheries Service. NOAA scientists are participating as partners at no cost to this proposal.

C2: The proposal does involve scientists from other federal agencies, in particular, U.S. Coast Guard and U.S. Geological Survey. As with NOAA, the project is being conducted in partnership with the federal agency scientists listed on page 1 of the Project Summary. Similar to the NOAA scientists, all other federal scientists are participating as partners at no cost to this proposal.



Scott M. Glenn, 71 Dudley Rd., New Brunswick, NJ 08901,

United States of America
FEDERAL COMMUNICATIONS COMMISSION
EXPERIMENTAL
RADIO STATION CONSTRUCTION PERMIT
AND LICENSE

EXPERIMENTAL	WA2XXF
(Nature of Service)	(Call Sign)
XR FX MO	0126-EX-RR-2006
(Class of Station)	(File Number)

NAME Rutgers University Institute of Marine and Coastal Sciences

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications in accordance with the program of experimentation described by the licensee in its application for license.

Operation: In accordance with Sec. 5.3(a) of the Commission's Rules

Station Locations
(1) Brigantine (ATLANTIC), NJ - NL 39-24-24; WL 74-21-54; MOBILE: , within 70 km
(2) Brant Beach (OCEAN), NJ - NL 39-36-33; WL 74-12-14; MOBILE:within 70 km, centered around NL 39-36-33; WL 74-12-14
(3) Loveladies (OCEAN), NJ - NL 39-44-10; WL 74-07-00
(4) Wildwood (CAPE MAY), NJ - NL 38-57-00; WL 74-51-30
(5) Seaside Park (OCEAN), NJ - NL 39-52-22; WL 74-05-00
(6) Sea Bright (MONMOUTH), NJ - NL 40-26-31; WL 73-58-50
(7) Tuckerton (OCEAN), NJ - NL 39-30-32; WL 74-19-29
(8) Siasconset (NANTUCKET), MA - NL 41-14-57; WL 69-58-20
(9) Block Island (WASHINGTON), RI - NL 41-09-09; WL 71-33-06
(10) New York (NEW YORK), NY - NL 40-33-41; WL 73-52-59
(11) Staten Island (RICHMOND), NY - NL 40-32-36; WL 74-07-29
(12) Belmar (MONMOUTH), NJ - NL 40-11-07; WL 74-00-29

Frequency Information

Brigantine (ATLANTIC), NJ - NL 39-24-24; WL 74-21-54; MOBILE: , within 70 km

Frequency	Station Class	Emission Designator	Authorized Power	Frequency Tolerance (+/-)
4900 kHZ	FX	55K0P0N	40 W (ERP)	0.001 %

This authorization effective May 12, 2009 and
will expire 3:00 A.M. EST March 01, 2011

FEDERAL COMMUNICATIONS COMMISSION

Page 1 of 9

D1: The proposed activity will take place in the Middle Atlantic Bight of North America. The region is approximately 1000 km in the alongshore direction, running from Cape Cod to Cape Hatteras. It includes 10 states: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia and North Carolina. The cross-shore extent runs from the watersheds, across the estuaries, bays and waters of the continental shelf to the outer edge of the U.S. Exclusive Economic Zone.

E1: Every HF Radar operating in the U.S. (over 100) require an FCC permit to broadcast. Most HF radars in the MARCOOS network were operated by individual universities before MARCOOS was formed. As such, each university had to acquire a FCC broadcast license for every HF Radar system it operates before it could be turned on. No NEPA permit is required for a FCC broadcast license. As an example of a FCC permit, page 1 from the Rutgers permit, the largest HF radar operator in the Middle Atlantic, is reproduced here.

F1: There is no potential for the proposed activity to alter the environment from ambient conditions. There are no acoustic arrays, and all the measurements are passive observing systems. Given this there are no possible changes to the ambient environment.

RUTGERS
School of Environmental and Biological Sciences

Robert M. Goodman
Executive Dean of Agriculture & Natural Resources
Rutgers, The State University of New Jersey
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July 12, 2010

Professor Scott Glenn
Institute of Marine and Coastal Sciences
School of Environmental and Biological Sciences
Rutgers, The State University of New Jersey

Dear Scott:

Rutgers welcomes the opportunity to contribute to the continuing success of your 20 years of leadership in ocean observing and ocean literacy.

Two opportunities are afforded by recent federal calls for proposals. One is a NSF Ocean Observing Initiative (OOI) Education and Public Engagement (EPE) Implementing Organization (IO) proposal that will be led by Francisco Werner, the Director of IMCS. The second is a NOAA Integrated Ocean Observing System (IOOS) combined Middle Atlantic Coastal Ocean Observing Regional Association (MACOORA)/ Middle Atlantic Regional Coastal Ocean Observing System (MARCOOS) proposal. We believe Rutgers is well situated to provide a long-term home for both of these initiatives.

Rutgers has demonstrated its commitment to building regional-scale ocean observing partnerships through your leadership of the Middle Atlantic Regional Coastal Ocean Observing System (MARCOOS). We have experience growing our regional capabilities by leveraging the contributions of both international and local partners. Our participation in national ocean observing programs such as the NSF Ocean Observing Initiative, the DHS Centers of Excellence, the NOAA National HF Radar Network, and ONR Slocum Glider Technology Center further ensures that national developments are leveraged at the regional scale. Rutgers continued long-term commitment to regional-scale ocean observing is demonstrated through our Coastal Climate Collaboratory (C^3), a proposed new facility that will serve as a catalyst for partnerships advancing our understanding of urbanized Large Marine Ecosystems.

Rutgers commitment to improved ocean literacy is demonstrated through its leadership of two multi-institutional NSF Centers for Ocean Sciences Education Excellence (COSEE) 5-year programs, the first for the Middle Atlantic Bight (COSEE-MAB), and the second for the Networked Ocean World (COSEE-NOW). Both COSEE's focus on the use of ocean observing data to improve ocean literacy across the full K-undergraduate educational spectrum and within the general public.

Given the opportunity to lead the combined MACOORA/MARCOOS proposal, Rutgers is committed to preserving MACOORA's existing strengths while enhancing its present capabilities. For example, Rutgers contributed to the success of the original MARCOOS program by waiving the indirect cost on subcontracts. Rutgers will preserve this contribution by again waiving the indirect costs on subcontracts for a combined MACOORA/MARCOOS proposal. In addition, Rutgers will enhance this contribution by providing $500,000 per year for 5 years in seed funds to support regional coastal ocean observing and ocean literacy. This match will include annual support for both an Operations Manager and a Financial Manager, $300,000 per year in major equipment acquisition funds, and $50,000 per year in infrastructure upgrades to the observatory operations center.

We thank you for your continued leadership in these important projects for our university, state, region and nation. Best of luck on your combined MACOORA/MARCOOS proposal.

Sincerely,

Robert M. Goodman
Executive Dean
School of Environmental and Biological Sciences

NOAA IOOS MARACOOS & NSF OOI EPE IO Reinvestment Timeline					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Personnel					
Financial Manager	$65 K +Fringe	$65 K +Fringe	$65 K +Fringe	$65 K +Fringe	$65 K +Fringe
Observatory Operations Manager	$85 K + Fringe	$85 K + Fringe	$85 K + Fringe	$85 K + Fringe	$85 K + Fringe
Subtotal Personnel	***$150 K + Fringe***	***$150 K + Fringe***	***$150 K + Fringe***	***$150 K + Fringe***	***$150 K + Fringe***
Major Equipment					
Server & Disk Archive	$50 K	$50 K			
Slocum Glider w/Sensors	$150 K	$150 K	$150 K	$150 K	$150 K
L-Band Satellite Receiver, X-Band International Upgrade	$100 K	$100 K			
Long-Range CODAR			$150 K	$150 K	$150 K
Subtotal Equipment	***$300 K***	***$300 K***	***$300 K***	***$300 K***	***$300 K***
Infrastructure Upgrades					
Glider Lab Beam & Hoist	$20 K				
Van		$25 K		$25 K	
Video Wall			$20 K		$20 K
Video Conferencing	$20 K		$20 K		
Visualization Computer		$20 K		$20 K	
Video Broadcasting					$20 K
Lab Computers	$5 K		$5 K		$5 K
Student Computers	$5 K	$5K	$5 K	$5 K	$5 K
Subtotal Infrastructure	***$50 K***	***$50 K***	***$50 K***	***$50 K***	***$50 K***
Total	**$500 K**	**$500 K**	**$500 K**	**$500 K**	**$500 K**

U.S. Department of Homeland Security
United States Coast Guard

Commandant
United States Coast Guard

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28 October2010

Scott Glenn, Sc.D.
Coastal Ocean Observation Lab
Department & Institute of Marine and Coastal Sciences
School of Environmental and Biological Sciences
Rutgers University
71 Dudley Road
New Brunswick, New Jersey 08901-8521

Dear Dr. Glenn,

The U.S. Coast Guard (USCG) Office of Search and Rescue supports your proposal to seek funding through the FY2011 Integrated Ocean Observing System Implementation. As you know, we are committed to working with the scientific community to develop ways to improve modeling and predictive tools in U.S. waters, especially those that can improve our abilities to predict search and rescue trajectories. In particular, we are interested in seeing the continued delivery of observational HF radar data and STPS predictions based upon these data into the USCG's Search And Rescue Optimal Planning System (SAROPS). SAROPS has now been operational since January of 2007. SAROPS is supported by the Environmental Data Sever (EDS) run operationally at the USCG's Operations System Center in Martinsburg, WV.

The initial feedback from USCG search planning personnel on SAROPS has been overwhelmingly positive; however there is room for improvement in the areas of: 1) availability of additional surface current products and other parameters in the EDS; 2) use of SAROPS in bays, harbors and rivers and into the near-shore environment; and 3) higher confidence in all the surface current products. The continued operational level support of the HF radar network is a critical input into SAROPS for the mid-Atlantic shelf region. The potential assimilation of HF radar data in numerical models and into rip-current predictions will further extend the usefulness of this data set to USCG SAR operations. My point of contact is Arthur Allen, Oceanographer.

The USCG Search and Rescue program looks forward to using the achievements gained from this work conducted under this proposal.

Sincerely,

Kenneth "Max" Moser
Commander
U.S. Coast Guard Office of Search and Rescue

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

Richard B. Robins, Jr.
Chairman

Lee G. Anderson
Vice Chairman

800 North State Street, Suite 201
Dover, Delaware 19901-3910
Tel: 302-674-2331
Toll Free: 877-446-2362
FAX: 302-674-5399
www.mafmc.org

Christopher M. Moore, Ph.D.
Executive Director

September 28, 2010

Dr. Scott Glenn
Coastal Ocean Observation Lab
Department & Institute of Marine and Coastal Sciences
School of Environmental and Biological Sciences
Rutgers University
71 Dudley Road
New Brunswick, New Jersey 08901-8521

Dear Dr. Glenn:

This letter expresses our support for your proposal submitted to the National Ocean Partnership Program that was entitled "*Towards a Comprehensive Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)*".

The Mid-Atlantic Fishery Management Council is responsible for management of fisheries in federal waters off the mid-Atlantic coast. States with voting representation on the Council include New York, New Jersey, Pennsylvania, Delaware, Maryland Virginia, and North Carolina. These states and the Council are looking for ways to incorporate environmental data into fisheries resource management and in particular how ocean observations and forecasts might be used to guide decision-making related to the fisheries resources in the Mid-Atlantic Bight. For example, MARACOOS, if funded, could provide spatially and temporally comprehensive descriptions of pelagic features and processes required to understand the ways in which pelagic habitat dynamics affect fish recruitment. As such, we believe that the observations, forecasts, expertise, and partnerships provided by MARACOOS are critical to the proper incorporation of this kind of dynamic environmental information into regional fisheries management.

If you have any questions, please contact me or Dr. Tom Hoff of my staff.

Sincerely,

Christopher M. Moore, Ph.D.
Executive Director

cc: Robins, Anderson, Kray, Hoff, Kohut

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
James J. Howard Marine Sciences Laboratory
74 Magruder Road
Highlands, New Jersey 07732

Wednesday, September 22, 2010

To:
Judith T. Krauthamer, Executive Director
Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA)
Mid-Atlantic Regional Coastal Ocean Observing System (MARCOOS)
Box 6879
Ellicott city MD 21042

Subject: Support of the Mid-Atlantic Coastal Ocean Observing Regional Association and Ocean Observing System proposal

Dear Dr. Krauthamer,

Please accept our support of your proposal to continue and improve the operations of MACOORA. We strongly endorse the Mid-Atlantic Coastal Ocean Observing Regional Association and Ocean Observing System proposal to the funding grant, FY 2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS). MACOORA and MARCOOS provide valuable data and tools to support numerous regional research and management actions including many of our own.

Currently our research efforts at the NOAA Northeast Fisheries Science Center and in particular at the NOAA Laboratory in Sandy Hook, NJ benefit significantly from the services and products provided by MARCOOS and MACOORA. Our primary mission is to understand the effects of environmental variability and human disturbances on fish and shellfish productivity relative to habitat and ecosystem processes. Your network of scientists and managers along with the observing system enables our scientists to upscale results from the laboratory and field surveys to broader regional applications in support of responsible ocean management.

The implementation of a fully-developed observing system would greatly improve our ability to apply our science to management issues. In particular, if your proposal is successful, we expect that MACOORA and MARCOOS will enhance our ability to evaluate the effects of ocean acidification and other climate-related changes on living marine resources, and will help us to perform the integrated habitat and ecosystem assessments needed for responsible coastal and marine spatial management and improved fisheries management.

Sincerely,

Thomas T. Noji, Director
James J. Howard Marine Sciences Laboratory
NOAA Northeast Fisheries Science Center

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Narragansett Laboratory
28 Tarzwell Drive
Narragansett, Rhode Island 02882

27 September 2010

Scott Glenn
Department & Institute of Marine and Coastal Sciences
School of Environmental and Biological Sciences
Rutgers University
71 Dudley Road
New Brunswick, New Jersey 08901-8521

Dear Dr. Glenn,

I am very supportive of the MACOORA/MARCOOS (newly-renamed MARACOOS) proposal to the FY2011 Integrated Ocean Observing System Federal Funding Opportunity.

The Northeast Fisheries Science Center (NEFSC) has been collaborating with MARCOOS over the past few years on several important projects. Continued funding for MARACOOS would allow continuation of these valuable collaborations.

First, our group is keenly interested in collaborating with MARACOOS in the monitoring and understanding the cold-pool on the Mid-Atlantic Bight shelf. We are working to include indicators of the cold-pool distribution and magnitude into stock assessments and the MARACOOS proposal would provide an excellent operational platform from which to derive the oceanographic indicators to include in future stock assessments.

Second, MARACOOS has been deploying gliders during the NEFSC groundfish trawl surveys. These deployments are assisting in efforts to define the factors that control fish distribution on the shelf.

Third, NEFSC scientists also have collaborated with MARACOOS researchers to examine in more detail the relationship between fish distributions and oceanographic properties in the New York Bight. This latter project has been partially funded by the NMFS Fisheries and the Environment Program.

These three efforts are critical to developing the capability of forecasting fish distribution and abundance under different environmental conditions and a fully funded MARACOOS would provide tremendous support to our operational programs.

Sincerely

Jonathan A. Hare
Oceanography Branch Chief, NEFSC

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER MONITORING AND STANDARDS
P.O. Box 409
Trenton, NJ 08625-0409
TEL # (609) 292-1623
FAX # (609) 633-1276

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

September 30, 2010

Scott Glenn, Ph.D.
Institute of Marine and Coastal Science
Rutgers University
71 Dudley Road
New Brunswick, NJ 08901

Re: Letter of Support for the proposal entitled *Towards a Comprehensive Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)*

Dear Dr. Glenn:

I am writing in support of your proposal to the National Oceanographic Partnership Program (NOPP) entitled *Towards a Comprehensive Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)*. This proposal is seeking funding in FY 2011 from NOPP, the National Oceanic and Atmospheric Administration (NOAA) and its partner agencies – the National Aeronautics and Space Administration (NASA), the Office of Naval Research (ONR), and the U.S. Department of Energy (DOE) - for a coordinated regional effort that furthers the U.S. Integrated Ocean Observing System (IOOS). Its goal is to provide timely and appropriate information to public mission agencies at the national, regional, state, local, and tribal levels, and that address integration across regional and national agency priorities.

I would also like to express the New Jersey Department of Environmental Protection's interest in working with you and the project team to ensure that end-users such as NJDEP are engaged throughout the process of concept development and application. NJDEP has been a supporter of the Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) since its inception and has supported MACOORA's goal of providing the mid-Atlantic region with state-of-the-art sensors, data management and modeling for five priority areas identified by MACOORA members. These include:

The project will enhance an existing high-resolution coastal ocean observation and modeling system in the New York Bight and New York Harbor. Harbor and coastal bay dissolved oxygen, turbidity and chlorophyll a measurements will be integrated with high-resolution surface current observations to forecast water quality parameters in 3-dimensions in the coastal waters, harbor and bays. Key outputs will include high-resolution forecasts of the spatial extent and duration of degraded water quality. These products will significantly enhance the information available to the New Jersey Department of Environmental Protection and other coastal stakeholders to understand and address coastal water quality issues relating to public health (recreational bathing and shellfish harvesting) and ecosystem health (oxygen levels, fish kills and algal blooms).

We look forward to collaborating with you and your team to improve our region's coastal water monitoring and forecasting capabilities.

Sincerely,

Leslie J. McGeorge

Leslie J. McGeorge, M.S.P.H., Administrator

Scott Glenn, Professor
Institute of Marine and Coastal Sciences
Rutgers University
71 Dudley Road
New Brunswick, NJ 08901-8521
glenn@marine.rutgers.edu

September 27, 2010

Dear Dr. Glenn:

The Massachusetts Department of Environmental Protection (MassDEP) strongly supports the Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS) 2010 proposal to NOAA's Integrated Ocean Observing System (IOOS) to proved funding support for the continued development of Regional Coastal Ocean Observing Systems.

One of the MassDEP's missions includes maintaining and enhancing the Commonwealth's ability to prevent and respond to oil spills into the state's marine environment. Recently MassDEP and the USCG collaborated in monitoring the possibility of oil from the Deep Water Horizon oil spill in the Gulf of Mexico migrating to and impacting coastal areas of Massachusetts. This effort to monitor and inform the citizens of Massachusetts regarding the threat of oil impacts from the Gulf spill was greatly assisted by the ocean observing work of MARCOOS/NERACOOS and specifically by Dr. Wendell Brown, UMass, Dartmouth's, School of Marine Science & Technology.

MassDEP recognizes the value of the ocean observing and forecasting capabilities that are being developed by MACOORA/MARCOOS for our regional waters. We also expect to derive future benefits for Massachusetts from ongoing MARACOOS efforts to produce ocean data and information such as:

1) The real-time MARACOOS HF Radar network's ability to provide an hourly surface current map that could assist the Mass DEP's ability to respond to releases of oil and hazardous materials offshore and will undoubtedly improve the effectiveness of USCG's search and rescue mission.
2) We are especially interested in encouraging continued MARACOOS efforts in the area of real time data collection and development models that can improve forecasts of marine oil spill fate and transport.

We look forward to working with MARACOOS on the development new information products that will assist in the environmental decision-making for Massachusetts and the region.

Sincerely,

Richard F. Packard

Richard F. Packard
MassDEP
Oil Spill Prevention and Response Program
1 Winter Street
Boston, MA. 02108

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

Delaware River Basin Commission
25 State Police Drive
PO Box 7360
West Trenton, New Jersey
08628-0360
Phone: (609) 883-9500 Fax: (609) 883-9522
Web Site: http://www.drbc.net

Carol R. Collier
Executive Director

Robert Tudor
Deputy Executive Director

August 23, 2010

Judith T. Krauthamer, Executive Director
Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA)
Mid-Atlantic Regional Coastal Ocean Observing System (MARCOOS)
P.O. Box 6879
Ellicott City, MD 21042

Dear Judith,

I am writing to express support for the Mid-Atlantic Coastal Ocean Observing Regional Association and Ocean Observing System proposal to the funding grant, FY 2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS). We believe MARCOORA/MARCOOS will continue to provide a vital, regional backbone for many sub-regional and local efforts being conducted from Massachusetts through North Carolina. The association and its operating arm combined provide vital products and services in Maritime Safety, Ecosystem-Based Management, Water Quality, Coastal Inundation and Offshore Energy from which we benefit.

The Delaware River Basin Commission (DRBC) is a federal-interstate government agency responsible for managing the water resources within the 13,539 square-mile Delaware River Basin without regard to political boundaries. Its ex-officio members are the governors of the four basin states (Delaware, New Jersey, New York, and Pennsylvania) and the Division Engineer, North Atlantic Division, U.S. Army Corps of Engineers, who serves as the federal representative. The 1961 compact creating the commission provides for the joint exercise of sovereign powers over the water resources of the basin and the DRBC is one of only two federal-interstate compact commissions in the nation. The Delaware is the only river basin with both a federal-interstate commission and a national estuary program in place. Our institutional arrangement facilitates coordination among federal and state agencies concerned with water management, and as a result conserves scarce resources, avoids duplication of effort, enables complementary programs to be developed, and maximizes efficiencies.

DRBC uses information products that enhance water quality decision support systems. These relate to the National Water Quality Monitoring Network Design, Early Warning Systems, Spill Response and anomalous water quality events. DRBC is also interested in natural hazard preparedness and work products focused on Coastal Inundation--- particularly products that link real time weather information to models to warning systems for emergency managers.

I strongly endorse the support for a fully-developed MACOORA/MARCOOS observing system that builds on the existing federal-regional partnerships. A signature feature of MACOORA relative to the other 12 Regional Associations involves its attention and service to Sub-basins and recognitions from a "systems management" perspective of the connection between watersheds, estuaries and ocean environments.

Sincerely,

Robert Tudor
Deputy Executive Director

Jacques Cousteau National Estuarine Research Reserve
Coastal Education Center
130 Great Bay Blvd • Tuckerton, NJ 08087
Phone: 609-812-0649 Fax: 609-294-8597
www.jcnerr.org

September 8, 2010

Judith T. Krauthamer, Executive Director
Mid-Atlantic Coastal Ocean Observing regional Association
Mid-Atlantic Regional Coastal Ocean Observing System
Box 6879
Ellicott City, Maryland 21042

Dear Judith,

As a science manager at a marine research institution, and manager of a marine protected area--the Jacques Cousteau National Estuarine Research Reserve, I strongly endorse continued support for MACOORA and MARCOOS. These organizations provide timely, relevant science-based information that is being used to inform environmental decision-making. MACOORA and its associated operating association, MARCOOS, contribute data products and services that have helped communities prepare for and respond to storm events, helped government agencies address problems associated with water quality, and improved safety of maritime operations. From my own perspective, information from MACOORA/MARCOOS has been used to forecast storm impacts, informed several initiatives aimed at helping coastal communities develop adaptation strategies in response to rising sea level, and has aided decision-making associated with future sites for offshore energy facilities.

I strongly support continued funding for MACOORA/MARCOOS at full operations. Such support is essential to leverage the capacity of existing federal-regional partnerships on behalf of user needs in the Mid-Atlantic region.

Sincerely,

Michael P. De Luca
Senior Associate Director, IMCS
Manager, Jacques Cousteau NERR

Lee A. Solomon
President

State of New Jersey
Board of Public Utilities
Two Gateway Center
Newark, NJ 07102

Michael Winka, Director
Office of Clean Energy

Tel. # (609) 777-3312
Fax # (609) 777-3336

September 27, 2010

Scott Glenn, Professor
Institute of Marine and Coastal Sciences
Rutgers University
71 Dudley Road
New Brunswick, NJ 08901-8521

Dear Dr. Glenn:

The New Jersey Board of Public Utilities (NJBPU) Office of Clean Energy is a strong supporter of your Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS) proposal to the Integrated Ocean Observing System (IOOS) Federal Funding Opportunity for the Continued Development of Regional Coastal Ocean Observing Systems.

The Mission of the NJBPU includes ensuring the provision of safe, adequate and proper utility service at reasonable rates, while enhancing the quality of life for the citizens of New Jersey. This includes implementation of the "Offshore Wind Economic Development Act" signed by the Governor of New Jersey on August 19, 2010 which established an Offshore Wind Renewable Energy Certificate Program in order to support at least 1100 megawatts of generation from qualified wind projects. Towards this end, we have recommended funding of your NJBPU proposal entitled "An Advanced Atmospheric/Ocean Assessment Program Designed to Reduce the Risks Associated with Offshore Wind Energy Development Defined by the NJ Energy Master Plan". This is expected to include funding for the operation of the Rutgers University - Weather Research and Forecasting" (RU-WRF) atmospheric model and its validation using spatial data from a nearshore High Frequency Radar (CODAR) network and with available offshore wind measurements. The ability to share the benefits of participation MACOORA/ MARCOOS, and now the combined MARACOOS, weighed significantly in our decision to fund your NJBPU proposal.

We see the following specific benefits of participation:

1. The RU-WRF model forecasts are public domain, so they can be shared through MARACOOS and contribute to the proposed atmospheric forecast ensemble. MARACOOS will receive the benefit of another forecast model, and NJBPU will receive the benefit of the ensemble and its validation.
2. NJBPU is funding the installation of 4 HF Radar sites for the NJ inner shelf that cover the south Jersey offshore wind development area. By contributing this data to the National HF Radar network through MARACOOS, we will be able to combine our 4 south Jersey sites with 2 north Jersey Department of Defense sites to cover the full NJ coast. The data will then be used to improve our forecast model and, through MARACOOS, enhance the quality of life for the citizens of NJ through improved Search and Rescue and beach water quality.
3. We are especially interested in encouraging the continuing MARACOOS efforts to couple their ocean models with RU-WRF to further study the impact of coastal upwelling on the nearshore winds in the vicinity of our proposed windfarms.

Good luck with your proposal. We look forward to working with you on both your NJBPU grant and MARACOOS.

Sincerely,

Michael Winka

Michael Winka
Director
Office of Clean Energy

FUGRO ATLANTIC

World Trade Center
101 West Main Street, Suite 350
Norfolk, Virginia 23510
Tel: (757) 625-3350

September 27, 2010

Rutgers University
71 Dudley Road
New Brunswick, NJ 08901

Attention: Dr. Scott Glenn, Professor (glenn@marine.rutgers.edu)

Subject: **MACOORA**

Dear Scott:

I would like to express Fugro's support for your upcoming proposal requesting continuation of the mid-Atlantic region ocean observing system within the Integrated Ocean Observing System program. Fugro joined MACOORA because we understand that better observations and, in many cases, research is needed to develop, implement and install appropriately-designed ocean observing systems.

The continuation of the program is important for the ultimate development of renewable energy offshore the mid Atlantic. Fugro has significant involvement in offshore wind energy development both offshore northern Europe and in the mid-Atlantic. The European experience documents the critical need for continuous and adequately-detailed met/ocean observational data. Better wind and wave observations and predictions are required tor optimize offshore wind facility design and to ensure safe and efficient wind farm installation and operation. We in particular have found a need for wave, current, and bathymetry measurements as part of sand scour studies that are required prior to wind farm development.

We look forward to more years of collaboration with MACOORA and its many partners in this endeavor.

Sincerely,

FUGRO ATLANTIC

Thomas W. McNeilan, P.E.
Vice President

CC: Dr. Larry Atkinson, Old Dominion University (latkinso@odu.edu)

D. References

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Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 2,500,000	$	$ 2,500,000
2.						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	(5)
a. Personnel	$ 241,992	$ 237,336	$ 246,029	$ 255,071	$
b. Fringe Benefits	73,283	71,780	74,587	77,508	
c. Travel	15,000	15,000	15,000	15,000	
d. Equipment	0	0	0	0	
e. Supplies	7,045	8,204	6,104	6,241	
f. Contractual	0	0	0	0	
g. Construction	0	0	0	0	
h. Other	63,000	68,000	58,600	46,500	
i. Total Direct Charges (sum of 6a-6h)	400,320	400,320	400,320	400,320	
j. Indirect Charges	99,680	99,680	99,680	99,680	
k. **Totals** (sum of 6i and 6j)	500,000	500,000	500,000	500,000	
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2.						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2015	(2)	(3)	(4)	(5)
a. Personnel	$ 264,474	$	$	$	$ 1,244,902
b. Fringe Benefits	80,545				377,703
c. Travel	15,000				75,000
d. Equipment	0				0
e. Supplies	6,301				33,895
f. Contractual	0				0
g. Construction	0				0
h. Other	34,000				270,100
i. Total Direct Charges (sum of 6a-6h)	400,320				2,001,600
j. Indirect Charges	99,680				498,400
k. **Totals** (sum of 6i and 6j)	500,000				2,500,000
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 500,000	$ 125,000	$ 125,000	$ 125,000	$ 125,000
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$ 500,000	$ 125,000	$ 125,000	$ 125,000	$ 125,000

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

	Future Funding Periods (Years)			
(a) Grant Program	(b) First	(c) Second	(d) Third	(e) Fourth
16. University of Delaware	$ 500,000	$ 500,000	$ 500,000	$ 500,000
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$	$	$	$

Section F - Other Budget Information

21. Direct Charges	22. Indirect Charges	24.9% x MDTC

23. Remarks

Applicant Name: University of Delaware - Lippardt Award Number:

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012			$150,000	$0	$150,000
2. University of Delaware - Lippardt						$0
3.						$0
4.						$0
5. Totals		$0	$0	$150,000	$0	$150,000

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total (5)
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	
a. Personnel	$2,583	$4,800	$4,993	$5,193	
b. Fringe Benefits	$834	$1,550	$1,613	$1,677	
c. Travel	$2,000	$3,000	$3,000	$3,000	
d. Equipment	$12,000				
e. Supplies	$822	$3,028	$2,772	$2,508	
f. Contractual					
g. Construction					
h. Other	$7,000	$9,500	$9,500	$9,500	
i. Total Direct Charges (sum of 6a-6h)	$25,239	$21,878	$21,878	$21,878	
j. Indirect Charges	$4,761	$8,122	$8,122	$8,122	
k. **Totals** (sum of 6i-6j)	$30,000	$30,000	$30,000	$30,000	
7. Program Income					

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012					$0
2. University of Delaware - Lippardt						$0
3.						$0
4.						$0
5. Totals		$0	$0	$0	$0	$0

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total (5)
	(1) 2015	(2)	(3)	(4)	
a. Personnel	$5,400				$22,969
b. Fringe Benefits	$1,744				$7,418
c. Travel	$3,000				$3,000
d. Equipment					$0
e. Supplies	$2,234				$2,234
f. Contractual					$0
g. Construction					$0
h. Other	$9,500				$9,500
i. Total Direct Charges (sum of 6a-6h)	$21,878	$0	$0	$0	$112,751
j. Indirect Charges	$8,122				$37,249
k. **Totals** (sum of 6i-6j)	$30,000	$0	$0	$0	$150,000
7. Program Income					$0

Section C - Non-Federal Resources					
(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.					$0
9.					$0
10.					$0
11.					$0
12. **Total** (sum of lines 8 - 11)		$0	$0	$0	$0
Section D - Forecasted Cash Needs					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th quarter
13. Federal	$30,000	$16,500	$4,500	$4,500	$4,500
14. Non-Federal	$0				
15. **Total** (sum of lines 13 and 14)	$30,000	$16,500	$4,500	$4,500	$4,500
Section E - Budget Estimates of Federal Funds Needed for Balance of the Project					
		Future Funding Periods (Years)			
(a) Grant Program		(b) First	(c) Second	(d) Third	(e) Fourth
16. University of Delaware - Lippardt		$30,000	$30,000	$30,000	$30,000
17.					
18.					
19.					
20. **Total** (sum of lines 16-19)		$30,000	$30,000	$30,000	$30,000
Section F - Other Budget Information					
21. Direct Charges		22. Indirect Charges MTDC Service rate 38.9%			
23. Remarks					

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Applicant Name: University of Delaware - Oliver Award Number:

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012			$500,000	$0	$500,000
2. University of Delaware - Oliver						$0
3.						$0
4.						$0
5. Totals		$0	$0	$500,000	$0	$500,000

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total (5)
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	
a. Personnel	$39,492	$47,890	$47,890	$39,492	
b. Fringe Benefits	$12,756	$15,469	$15,469	$12,756	
c. Travel	$2,000	$2,000	$2,000	$2,000	
d. Equipment	$17,000			$17,000	
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)	$71,248	$65,359	$65,359	$71,248	
j. Indirect Charges	$28,752	$34,641	$34,641	$28,752	
k. **Totals** (sum of 6i-6j)	$100,000	$100,000	$100,000	$100,000	
7. Program Income					

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012					$0
2. University of Delaware - Oliver						$0
3.						$0
4.						$0
5. Totals		$0	$0	$0	$0	$0

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total (5)
	(1) 2015	(2)	(3)	(4)	
a. Personnel	$47,890				$222,654
b. Fringe Benefits	$15,469				$71,919
c. Travel	$2,000				$2,000
d. Equipment					$0
e. Supplies					$0
f. Contractual					$0
g. Construction					$0
h. Other					$0
i. Total Direct Charges (sum of 6a-6h)	$65,359	$0	$0	$0	$338,573
j. Indirect Charges	$34,641				$161,427
k. **Totals** (sum of 6i-6j)	$100,000	$0	$0	$0	$500,000
7. Program Income					$0

Section C - Non-Federal Resources					
(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.					$0
9.					$0
10.					$0
11.					$0
12. **Total** (sum of lines 8 - 11)		$0	$0	$0	$0
Section D - Forecasted Cash Needs					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th quarter
13. Federal	$100,000	$37,750	$20,750	$20,750	$20,750
14. Non-Federal	$0				
15. **Total** (sum of lines 13 and 14)	$100,000	$37,750	$20,750	$20,750	$20,750
Section E - Budget Estimates of Federal Funds Needed for Balance of the Project					
		Future Funding Periods (Years)			
(a) Grant Program		(b) First	(c) Second	(d) Third	(e) Fourth
16. University of Delaware - Oliver		$100,000	$100,000	$100,000	$100,000
17.					
18.					
19.					
20. **Total** (sum of lines 16-19)		$100,000	$100,000	$100,000	$100,000
Section F - Other Budget Information					
21. Direct Charges		22. Indirect Charges MTDC 53%			
23. Remarks					

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Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 2,800,000	$	$ 2,800,000
2. University of Massachusetts,						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2012	(2) 2013	(3) 2014	(4) 2015	(5)
a. Personnel	$ 185,760	$ 185,760	$ 185,760	$ 185,760	$
b. Fringe Benefits	38,140	38,140	38,140	38,140	
c. Travel	12,838	12,838	12,838	12,838	
d. Equipment	150,000	150,000	150,000	150,000	
e. Supplies	16,082	16,082	16,082	16,082	
f. Contractual	0	0	0	0	
g. Construction	0	0	0	0	
h. Other	10,000	10,000	10,000	10,000	
i. Total Direct Charges (sum of 6a-6h)	412,820	412,820	412,820	412,820	
j. Indirect Charges	147,180	147,180	147,180	147,180	
k. **Totals** (sum of 6i and 6j)	560,000	560,000	560,000	560,000	
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2. University of Massachusetts,						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2012	(2) 2013	(3) 2014	(4) 2015	(5)
a. Personnel	$ 185,760	$	$	$	$ 928,800
b. Fringe Benefits	38,140				190,700
c. Travel	12,838				64,190
d. Equipment	150,000				750,000
e. Supplies	16,082				80,410
f. Contractual	0				0
g. Construction	0				0
h. Other	10,000				50,000
i. Total Direct Charges (sum of 6a-6h)	412,820				2,064,100
j. Indirect Charges	147,180				735,900
k. **Totals** (sum of 6i and 6j)	560,000				2,800,000
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 560,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$	$	$	$	$

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. University of Massachusetts, Darmouth	$ 560,000	$ 560,000	$ 560,000	$ 560,000
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$	$	$	$

Section F - Other Budget Information

21. Direct Charges 2,064,100

22. Indirect Charges 735,901

23. Remarks

This is a five year project.

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 1,099,681.00	$	$ 1,099,681.00
2. University of Connec						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 1,099,681.00	$ 0.00	$ 1,099,681.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1)	(2)	(3)		(5)
a. Personnel	$ 89,015.00	$ 88,630.00	$ 88,406.00	$ 87,515.00	$ 353,566.00
b. Fringe Benefits	25,894.00	26,252.00	27,435.00	27,681.00	107,262.00
c. Travel	2,000.00	2,000.00	2,000.00	2,000.00	8,000.00
d. Equipment					0.00
e. Supplies	20,000.00	20,000.00	20,000.00	20,000.00	80,000.00
f. Contractual					0.00
g. Construction					0.00
h. Other	8,842.00	9,223.00	8,426.00	8,854.00	35,345.00
i. Total Direct Charges *(sum of 6a-6h)*	145,751.00	146,105.00	146,267.00	146,050.00	584,173.00
j. Indirect Charges	73,887.00	73,872.00	73,745.00	73,403.00	294,907.00
k. TOTALS *(sum of 6i and 6j)*	$ 219,638.00	$ 219,977.00	$ 220,012.00	$ 219,453.00	$ 879,080.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 219,638.00	$ 54,910.00	$ 54,910.00	$ 54,909.00	$ 54,909.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 219,638.00	$ 54,910.00	$ 54,910.00	$ 54,909.00	$ 54,909.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	$ 219,977.00	$ 220,012.00	$ 219,453.00	$ 220,601.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 219,977.00	$ 220,012.00	$ 219,453.00	$ 220,601.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges:	22. Indirect Charges:
23. Remarks:	

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 874956.19	$	$ 874956.19
2. Applied Science Associates						
3.						
4.						
5. Totals		$	$	$ 874956.19	$	$ 874956.19

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	(5)
a. Personnel	$ 45904.40	$ 45445.90	$ 45266.40	$ 45286.84	$
b. Fringe Benefits	19738.89	19541.74	19464.55	19473.34	
c. Travel	5500	5500	5500	5500	
d. Equipment					
e. Supplies					
f. Contractual	26461.60	27354.00	27740.00	27935.00	
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)	97604.89	97841.64	97970.95	98195.18	
j. Indirect Charges	77787.30	77010.35	76706.18	76740.81	
k. **Totals** (sum of 6i and 6j)	175392.19	174851.99	174677.13	174935.99	
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 175392.19	$ 43848.19	$ 43848.00	$ 43848.00	$ 43848.00
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$	$	$	$	$

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. Applied Science Associates	$ 174851.99	$ 174677.13	$ 174935.99	$ 175098.89
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$ 174851.99	$ 174677.13	$ 174935.99	$ 175098.89

Section F - Other Budget Information

21. Direct Charges

22. Indirect Charges 118.50% Fixed

23. Remarks

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2. Applied Science Associates						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2015	(2)	(3)	(4)	(5)
a. Personnel	$ 46640.60	$	$	$	$ 228544.14
b. Fringe Benefits	20055.46				98273.98
c. Travel	5500.00				27500.00
d. Equipment					
e. Supplies					
f. Contractual	23868.00				133358.60
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)	96064.06				487676.72
j. Indirect Charges	79034.83				387279.47
k. **Totals** (sum of 6i and 6j)	175098.89				874956.19
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 799999	$	$ 799999
2. Stevens Inst. of Technology						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	(5)
a. Personnel	$ 72091	$ 69208	$ 71326	$ 70914	$
b. Fringe Benefits	14063	12917	13180	12705	
c. Travel	500	500	500	500	
d. Equipment	0	5000	0	0	
e. Supplies	9500	9950	10423	10919	
f. Contractual	0	0	0	0	
g. Construction	0	0	0	0	
h. Other	10962	11510	12086	12690	
i. Total Direct Charges (sum of 6a-6h)	107116	109084	107514	107728	
j. Indirect Charges	52884	50916	52486	52271	
k. **Totals** (sum of 6i and 6j)	160000	160000	160000	160000	
7. Program Income	$ 0	$ 0	$ 0	$ 0	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2. Stevens Inst. of Technology						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2015	(2)	(3)	(4)	(5)
a. Personnel	$ 70482	$	$	$	$ 354021
b. Fringe Benefits	12207				65072
c. Travel	500				2500
d. Equipment	0				5000
e. Supplies	11440				52232
f. Contractual	0				0
g. Construction	0				0
h. Other	13324				60572
i. Total Direct Charges (sum of 6a-6h)	107953				539396
j. Indirect Charges	52046				260603
k. **Totals** (sum of 6i and 6j)	159999				799999
7. Program Income	$ 0	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 160000	$ 40000	$ 40000	$ 40000	$ 40000
14. Non-Federal	0	0	0	0	0
15. **Total** (sum of lines 13 and 14)	$ 160000	$ 40000	$ 40000	$ 40000	$ 40000

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. Stevens Inst. of Technology	$ 160000	$ 160000	$ 160000	$ 159999
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$	$	$	$

Section F - Other Budget Information

21. Direct Charges

22. Indirect Charges ONR Rate-55%

23. Remarks

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. MARACOOS	11.012	$	$	$ 500,000	$ 0	$ 500,000
2. Old Dominion University Res						
3.						
4.						
5. Totals		$	$	$ 500,000	$ 0	$ 500,000

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	(5)
a. Personnel	$ 43,982	$ 43,982	$ 43,982	$ 43,982	$
b. Fringe Benefits	17,685	17,685	17,685	17,685	
c. Travel	4,000	4,000	4,000	4,000	
d. Equipment	1,000	1,000	1,000	1,000	
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)	66,667	66,667	66,667	66,667	
j. Indirect Charges	33,333	33,333	33,333	33,333	
k. **Totals** (sum of 6i and 6j)	100,000	100,000	100,000	100,000	
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. MARACOOS	11.012	$	$	$ 500,000	$ 0	$ 500,000
2. Old Dominion University Res						
3.						
4.						
5. Totals		$	$	$ 500,000	$ 0	$ 500,000

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2015	(2)	(3)	(4)	(5)
a. Personnel	$ 43,982	$	$	$	$ 219,909
b. Fringe Benefits	17,685				88,424
c. Travel	4,000				20,000
d. Equipment	1,000				5,000
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)	66,667				333,333
j. Indirect Charges	33,333				166,667
k. **Totals** (sum of 6i and 6j)	100,000				500,000
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 100,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$ 100,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. Old Dominion University Research Foundation	$ 100,000	$ 100,000	$ 100,000	$ 100,000
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$ 100,000	$ 100,000	$ 100,000	$ 100,000

Section F - Other Budget Information

21. Direct Charges

22. Indirect Charges

23. Remarks

757-868-5362

James Titlow

OMB Approval No. 0348-0044

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 450,000.00	$ 0.00	$ 450,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 450,000.00	$ 0.00	$ 450,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) 2011	(2) 2012	(3) 2014	2014	Total (5)
a. Personnel	$ 36,000.00	$ 36,000.00	$ 36,000.00	$ 36,000.00	$ 144,000.00
b. Fringe Benefits	5,400.00	5,400.00	5,400.00	5,400.00	21,600.00
c. Travel					0.00
d. Equipment					0.00
e. Supplies					0.00
f. Contractual	30,000.00	30,000.00	30,000.00	30,000.00	120,000.00
g. Construction					0.00
h. Other	600.00	600.00	600.00	600.00	2,400.00
i. Total Direct Charges *(sum of 6a-6h)*	72,000.00	72,000.00	72,000.00	72,000.00	288,000.00
j. Indirect Charges	18,000.00	18,000.00	18,000.00	18,000.00	72,000.00
k. TOTALS *(sum of 6i and 6j)*	$ 90,000.00	$ 90,000.00	$ 90,000.00	$ 90,000.00	$ 360,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. Weatherflow Inc.	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 90,000.00	$ 22,500.00	$ 22,500.00	$ 22,500.00	$ 22,500.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 90,000.00	$ 22,500.00	$ 22,500.00	$ 22,500.00	$ 22,500.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.Weatherflow Inc.	$	$	$	$
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	22. Indirect Charges: provisional 25%

23. Remarks:

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. Weatherflow Inc.	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 90,000.00	$ 22,500.00	$ 22,500.00	$ 22,500.00	$ 22,500.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 90,000.00	$ 22,500.00	$ 22,500.00	$ 22,500.00	$ 22,500.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.Weatherflow Inc.	$	$	$	$
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	22. Indirect Charges: provisional 25%
23. Remarks:	

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 250,000.00	$	$ 250,000.00
2. CIT - Center for Inno						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 250,000.00	$ 0.00	$ 250,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) 2011	(2) 2012	(3) 2014	2014	(5)
a. Personnel	$ 5,473.00	$ 5,473.00	$ 5,473.00	$ 5,473.00	$ 21,892.00
b. Fringe Benefits	3,106.00	3,106.00	3,106.00	3,106.00	12,424.00
c. Travel	1,000.00	1,000.00	1,000.00	1,000.00	4,000.00
d. Equipment					0.00
e. Supplies	4,246.00	4,246.00	4,246.00	4,246.00	16,984.00
f. Contractual					0.00
g. Construction					0.00
h. Other	20,270.00	20,270.00	20,270.00	20,270.00	81,080.00
i. Total Direct Charges *(sum of 6a-6h)*	34,095.00	34,095.00	34,095.00	34,095.00	136,380.00
j. Indirect Charges	15,905.00	15,905.00	15,905.00	15,905.00	63,620.00
k. TOTALS *(sum of 6i and 6j)*	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 200,000.00
7. Program Income	$	$	$	$	$ 0.00

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BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$ 0.00
2. CIT - Center for Inno						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) 2015	(2)	(3)		Total (5)
a. Personnel	$ 5,473.00	$	$	$	$ 27,365
b. Fringe Benefits	3,106.00				15,530
c. Travel	1,000.00				5,000
d. Equipment					0.00
e. Supplies	4,246.00				21,230
f. Contractual					0.00
g. Construction					0.00
h. Other	20,270.00				101,350
i. Total Direct Charges *(sum of 6a-6h)*	34,095.00	0.00	0.00	0.00	170,475
j. Indirect Charges	15,905.00				79,525
k. TOTALS *(sum of 6i and 6j)*	$ 50,000.00	$ 0.00	$ 0.00	$ 0.00	$ 250,000
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. Center for Innovative Technology	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 50,000.00	$ 12,500.00	$ 12,500.00	$ 12,500.00	$ 12,500.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 50,000.00	$ 12,500.00	$ 12,500.00	$ 12,500.00	$ 12,500.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.Center for Innovative Technology	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges:	22. Indirect Charges: OH 82.96% G&A 29.42%
23. Remarks:	

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 149,956	$	$ 149,956
2. CODAR systems URI/GSO						
3.						
4.						
5. Totals		$	$	$ 149,956	$	$ 149,956

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2011	(2) 2012	(3) 2013	(4) 2014	(5)
a. Personnel	$	$	$	$	$
b. Fringe Benefits					
c. Travel					
d. Equipment					
e. Supplies	6,200	6,200	6,200	6,200	
f. Contractual					
g. Construction					
h. Other	13,530	13,530	13,400	13,340	
i. Total Direct Charges (sum of 6a-6h)	19,730	19,730	19,600	19,540	
j. Indirect Charges	10,260	10,260	10,388	10,454	
k. **Totals** (sum of 6i and 6j)	29,990	29,990	29,988	29,994	
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2. CODAR systems URI/GSO						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2015	(2)	(3)	(4)	(5)
a. Personnel	$	$	$	$	$
b. Fringe Benefits					
c. Travel					
d. Equipment					
e. Supplies	6,200				31,000
f. Contractual					
g. Construction					
h. Other	13,340				67,140
i. Total Direct Charges (sum of 6a-6h)	19,540				98,140
j. Indirect Charges	10,454				51,815
k. **Totals** (sum of 6i and 6j)	29,994				149,656
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 29,990	$ 7,500	$ 7,500	$ 7,500	$ 7,490
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$ 29,990	$ 7,500	$ 7,500	$ 7,500	$ 7,490

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. CODAR systems URI/GSO	$ 29,990	$ 29,988	$ 29,994	$ 29,994
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$ 29,990	$ 29,988	$ 29,994	$ 29,994

Section F - Other Budget Information

21. Direct Charges	22. Indirect Charges
	Varies

23. Remarks

Indirect: Year 1-2, 52%, Year 3, 53%, Year 4-5, 53.5%

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$ 100,000	$	$ 100,000
2. University of North Carolina,						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2012	(2) 2013	(3) 2014	(4) 2015	(5)
a. Personnel	$ 0	$ 0	$ 0	$ 0	$ 0
b. Fringe Benefits	0	0	0	0	0
c. Travel	3,373	3,373	3,373	3,373	13,492
d. Equipment	0	0	0	0	0
e. Supplies	5,000	5,000	5,000	5,000	20,000
f. Contractual	0	0	0	0	0
g. Construction	0	0	0	0	0
h. Other	7,500	7,500	7,500	7,500	30,000
i. Total Direct Charges (sum of 6a-6h)	15,873	15,873	15,873	15,873	63,492
j. Indirect Charges	4,127	4,127	4,127	4,127	16,508
k. **Totals** (sum of 6i and 6j)	20,000	20,000	20,000	20,000	80,000
7. Program Income	$	$	$	$	$

Budget Information — Non-Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. IOOS	11.012	$	$	$	$	$
2. University of North Carolina,						
3.						
4.						
5. Totals		$	$	$	$	$

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total
	(1) 2016	(2)	(3)	(4)	(5)
a. Personnel	$ 0	$	$	$	$ 0
b. Fringe Benefits	0				0
c. Travel	3,373				16,865
d. Equipment	0				0
e. Supplies	5,000				25,000
f. Contractual	0				0
g. Construction	0				0
h. Other	7,500				37,500
i. Total Direct Charges (sum of 6a-6h)	15,873				79,365
j. Indirect Charges	4,127				20,635
k. **Totals** (sum of 6i and 6j)	20,000				100,000
7. Program Income	$	$	$	$	$

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8.	$	$	$	$
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)	$	$	$	$

Section D - Forcasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 20,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)	$	$	$	$	$

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	**Future Funding Periods (Years)** (b) First	(c) Second	(d) Third	(e) Fourth
16. University of North Carolina, Chapel Hill	$ 20,000	$ 20,000	$ 20,000	$ 20,000
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$	$	$	$

Section F - Other Budget Information

21. Direct Charges 79,365

22. Indirect Charges 20,635 - 26%

23. Remarks

Five year project - $20,000 each year.