Testimony before the United States Commission on Ocean Policy

By

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Need for better information

Thank you for the opportunity to speak to you today about partnership activities in this part of the Southeast. There is a pressing need for better information about the marine environment to address a dizzying array of societal and scientific issues that have been documented elsewhere (see of example NORLC, 1999). The rapid population growth of the southeast region adds to the urgency of developing better systems for delivering information.

There are a number of ways to address the need for information. I will focus my discussion on the development of regional-scale coastal ocean observing systems.

My experience with observing systems

For the past few years I have been the lead investigator of a project to develop an ocean observatory in the coastal ocean off Georgia. The South Atlantic Bight Synoptic Offshore Observational Network (SABSOON) has been funded through the National Oceanographic Partnership Program (NOPP) and therefore is required to be a partnering between academic, governmental and private entities. In SABSOON scientists from 3 universities have been working with state and federal resource agencies to utilize a set of offshore towers, owned and operated by the U.S Navy as a flight training facility, to conduct coastal ocean research. Prior to SABSOON the offshore towers had not been considered for environmental monitoring. Because of the very different missions that we were accustomed to pursuing, it took some time for the academics and the operational Navy personnel to develop a rapport but we now have a strong working relationship and spirit of cooperation that have permitted us to take advantage of the remarkable

infrastructure represented by these offshore towers. The meteorological and oceanographic measurements collected at the towers provide a real-time view of ocean conditions on the mid-continental shelf that are otherwise unavailable. In addition to developing a continuous record on shelf conditions of considerable scientific value, the observations are vital to the regional National Weather Service offices because they help fill a gaping hole in the existing observing system. They are also widely used by the offshore boating community who lets us know when the website is down (quite emphatically). We have already learned much about the shelf environment, from hurricane-strength winds during squalls and the seasonal variation in cross-shelf exchange events to avian predation on the benthic communities and extremely episodic atmospheric nutrient deposition events. It is, however, but one such window on the ocean.

Considerable interest and growth in observing systems

SABSOON is of course not the only observing system between Delaware and Georgia. Partnerships between universities and state agencies have built or are developing observing systems in Delaware Bay (DBOS), Chesapeake Bay (CBOS), Pamlico Sound (FerryMon) and the Neuse River, and federally funded long-term research efforts are underway off the Cape Fear River in North Carolina (CORMP), and in Long-term Ecological Research (LTER) sites near Oyster,Virginia and at Sapelo Island in Georgia. In all these efforts researchers are striving to collect information to address not only scientific issues but also to address societal issues. We all recognize that the information the observing systems collect can serve many purposes.

Also apparent is the need to knit the existing separate systems into a coordinated regional system. The potential benefits are many, by avoiding redundancy, by extending observations along the entire coastline (the ocean knows no bounds), and by sharing expertise. Considerable thought has gone into the design of such regional observing systems as has been articulated in reports of the U.S. GOOS steering committee (NORLC, 1999; NORLC, 2000) and the U.N. Coastal GOOS steering committee (UNESCO, 2000). Several efforts in the southesast that are following the GOOS model of a user-driven, end-to-end system have recently received congressional support. These include Caro-COOPs (Attachment 1), which will concentrate on the coasts of the Carolinas, and SEA-COOS (Attachment 2), which will provide coverage of the South Atlantic Bight and extend through the Florida Keys and to the NC/VA border. Another even larger scale program is SCOOP, which will link systems from Delaware south into the Gulf of Mexico to the Texas/Mexico border.

These regional systems will begin as university consortiums that establish the observing elements, data management systems, and modeling and product development components of an observing system. They are already, however, establishing partnerships with other data providers and data users in each region to help define the physical layout of the system and determine the ultimate business structure of the entities. Initial reliance on academic units to begin the regional systems is justified because many of the tools to be used are under development, but with time these tools will become operational and the observing systems will likely transition to non-academic entities. The many federal programs currently involved with ocean monitoring and regulation are natural and necessary partners in these programs. The federal programs have in place resources and infrastructure that would not be cost-effective to reproduce around the country (for example, high-resolution mapping capabilities). This organizational model of regional-scale observing systems is attractive because of its flexibility and ability to partner with any number of agencies and may be its greatest strength. It allows the systems to be built by integrating the many components that already exist and to tailor the system to address local user needs.

What sets the regional observing systems apart from previous research activities is that their purpose is sustained observing, not a specific science topic. Basic ocean research will greatly benefit from the presence of the observing system by allowing scientists to nest their resources within the system, but the systems are intended to serve many other purposes. At issue is sustained funding – the federal agencies that are currently committed to supporting ocean research can not justify long-term support of regional observing systems. The result is considerable uncertainty about the fate of the systems being established.

What the Ocean Commission can do to help

What is needed is a simple, clear and effective mechanism to support a national ocean observing system. NOPP has put in place a structure to support sustained observing systems, but at present participation from the 14 federal agencies is essentially voluntary, and funding is minimal and tenuous. The essential concept of NOPP, that of coordinating the ocean-related activities of the many agencies involved, is ideally suited to creating the national observing system, as is the establishment of the Ocean.US office to oversee implementation. But the program almost certainly will not work over the long term if it must rely on voluntary funding through the present member agencies. I suggest the following issues be considered by the Commission:

1. Direct (line item) funding of the national ocean observing system must be established for a sustained program to exist. Funding one or several of the member

agencies of NOPP could lead to jurisdictional conflicts, and it therefore makes sense to consider appropriating funds directly to NOPP. This is not possible under the existing structure.

2. Ensure that support for the regional observing systems that will comprise the national system does not come at the expense of basic ocean research. The academic community will be an important contributor to the regional observing systems and can greatly benefit from the existence of the observing system, but they will not back the programs if doing so endangers their already tight funding base.

3. Provide incentives for federal agencies to be active participants in the regional systems. There is great potential cost savings associated with coordinating the many federal ocean activities, and encouraging agency participation, rather than strictly mandating it, will lead to much healthier partnerships.

In summary, there is considerable grass-roots support for the development of regional scale observing systems in this part of the country. With financial support from various agencies and congressional appropriations coastal ocean observing systems are being established. However, the regional systems will not survive in the long-term without stable sustained financial support, and national oversight and coordination, at the national level. Providing NOPP or a similar multi-agency program with direct line-item funding would be a simple and effective way to implement a national ocean observing system. Participation in the observing systems can be fostered by ensuring that the funds for the observing system do not diminish existing support for basic ocean research, and by providing incentives for federal agencies to be partners in the observing systems.

References

NORLC, "Toward a U.S. Plan for an Integrated, Sustained Ocean Observing System", April 1999.

NORLC, "An Integrated Ocean Observing System: A Strategy for Implementing the First Steps of a U.S. Plan", 2000.

UNESCO, "Strategic Design Plan for the Coastal Component of the Global Ocean Observing System (GOOS)", IOC/INF-1146, GOOS Report No. 90, 2000.

Attachment 1

CAROLINAS COASTAL OCEAN OBSERVING AND PREDICTION SYSTEM INITIATIVE

The coastal ocean of North and South Carolina is one of the most ecologically diverse and economically important systems in the Nation. With the Appalachian Mountains to the west and the Gulf Stream to the east, it also is an extraordinarily dynamic and complex air-land-sea interface system. However, despite the obvious requirements to understand and predict coastal ocean conditions in the region, the present observational network of routine in situ data is not adequate for most applications.

The Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS) initiative is a partnership between the University of South Carolina's Belle W. Baruch Institute, North Carolina State University, and the University of North Carolina at Wilmington to monitor and model estuarine and coastal ocean conditions in the Carolinas to establish a capability to provide real-time predictions and ultimately forecasts to coastal managers on:

- response to major storms.
- water quality and transport of pollutants,
- sediment transport and shoreline stability, and
- the state of the fisheries,

As examples, we expect outcomes and products such as the following to result from Caro-COOPS:

- Improved forecasts of natural hazards, so that they no longer become major disasters when appropriate measures are taken to anticipate and reduce their impact on life and property**.**
- Timely alerts or notices of anomalous ocean or estuarine water conditions, such as temperature and/or salinity extremes, eutrophication, hypoxia, anoxia, harmful algal blooms, and fish-kills.
- New information on the timing of critical environmental conditions for essential fisheries habitat, such as spawning and nursery grounds, and zones of retention and/or dispersal for fish eggs and larvae.

A fully operational Caro-COOPS will reduce the costs and risks to people, the economy, and natural resources from natural and human-induced hazards and increase coastal communities' ability to adapt to changing conditions, resulting in a balance of environmental and economic benefits.

WHY THE CAROLINAS?

The Carolinas' coast is one of the most diverse, dynamic, and economically important regions of the Southeast US. During the past 10 years, the region has attracted tremendous residential and commercial investment. However, the decline of species, changes in biodiversity, and degradation of habitats are just a few indications that human activities can pose serious threats to coastal and marine ecosystems. Also, because of the rapid population growth and development in vulnerable coastal locations, the region is becoming increasingly vulnerable to extreme events. Midlatitude or extratropical cyclones develop rapidly off the coast of the Carolinas throughout the winter season, generating very high winds. Since fewer weather data are available in the region, detection may lag behind storm development, which shortens the time available for communities to respond.

Caro-COOPS

The Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS) is designed to integrate real-time monitoring of hydrologic and meteorological conditions with state-of-the-art computer models to characterize and predict complex coupled air-land-sea processes. At the heart of Caro-COOPS are a real-time instrumentation network, a sophisticated data acquisition and management system and a set of advanced numerical models.

The observational network will span the length of the Carolinas' coast and generally consist of a mix of platforms and sensors with real time telemetry, and making full use of existing operational observing systems in the region, such as:

- moored buoy stations (4) and C-MAN stations (5) operated by NOAA's National Data Buoy Center (NDBC) , which provide meteorological and oceanographic data in real time.
- the NOAA National Ocean Service (NOS) Water Level Observation Network, which includes two long-term continuously operating tide stations in South Carolina and five stations in North Carolina, which provide data and information on tidal datum and relative sea level trends.
- the NOAA Ships RONALD BROWN and FERREL, which are homeported in Charleston.
- South Carolina Department of Natural Resources surveys of ocean conditions and fisheries in the Charleston Bump area.
- Satellite datasets, such as sea surface temperature (SST) data from the Advanced Very High Resolution Radiometer (AVHRR) and ocean color data from SeaWiFS.

To facilitate open access and fast distribution of Caro-COOPS data, an integrated data management and analysis system will support customized search, retrieval, analysis and visualization of data through an intuitive web interface. It will be incorporated into the Virtual Network Information System (VNIS), a "virtual" Web-based data and information dissemination hub that is being established at the Geographic Information Processing Lab of the Baruch Institute for Marine Biology and Coastal Research. The VNIS system will provide a framework where a user can link via the Internet to the information hub and receive the requested data back on his or her own personal computer.

The Caro-COOPS modeling system consists of connected, fully three-dimensional, time dependent, continental margin and estuary coupled hydrodynamic model. The coastal atmosphere and ocean modeling group at North Carolina State University has developed an adaptable grid Coastal and Estuarine Modeling and Environmental Prediction System (CEMEPS), which will be used as the backbone model for the system.

An initial demonstration of the real-time interdisciplinary forecast concept for Caro-COOPS will focus on development of real-time analyses of storm surge and flooding before and during landfall of coastal storms, to improve warnings and provide local officials with the information needed to focus on mitigation, preparedness and prevention measures.

PARTNERS

The University of South Carolina's Belle W. Baruch Institute is the principal academic coastal research center of South Carolina. The Institute has one of the world's most comprehensive and continuous sets of biological, chemical, and physical measurements for a coastal ecosystem and employs state-of-the-art computing and communications technology and software to disseminate data and information.

North Carolina State University (NCSU), through its coastal atmosphere and ocean modeling group, has developed a three-dimensional coastal and estuarine modeling and environmental prediction system that was used for real-time flood forecast prior to numerous winter and tropical storm.

The University of North Carolina at Wilmington (UNCW) began in 1999 the Coastal Ocean Research and Monitoring program (CORMP), an extramural NOAA Research program that currently includes 17 offshore instrumentation-moorings in the Cape Fear River Plume and Onslow Bay. UNCW's Center for Marine Science houses the National Undersea Research Center (NURC) for the southeast U.S. region.

Caro-COOPS REQUIREMENTS

Demonstration of the Caro-COOPS concept is envisioned as a five-year, $8.25 million program. An appropriation of $2.25 million to the University of South Carolina's Belle W. Baruch Institute is requested for Fiscal Year 2002. Subsequent funding requests would be $2.25 for FY2003 and $1.25 million for each of the subsequent years. This funding will be leveraged with NOAA Research funding of the UNCW's Coastal Ocean Research and Monitoring program (CORMP), which is requested at $2 million for Fiscal Year 2002, and current funding from NOAA's Coastal Services Center and Office of Naval Research to support NCSU's Coastal and Estuarine Modeling and Environmental Prediction System (CEMEPS).

Attachment 2

THE SOUTHEAST ATLANTIC COASTAL OCEAN OBSERVING SYSTEM
A REGIONAL REQUEST v1.8, 4/18/01

Abstract
A four-state, inter-institutional partnership will develop a regional coastal ocean observing system that will measure conditions in and above the coastal ocean and report the observations to a broad user base. The system will cover the region between the Virginia/North Carolina border and Dry Tortugas and provide information critical to many interests, including monitoring of natural hazards and coastal resource management.

The inter-institutional partnership is composed of (a) the University of North Carolina (including UNC-Chapel Hill, North Carolina State University and UNC-Wilmington), (b) the Baruch Institute of the University of South Carolina, (c) Skidaway Institute of Oceanography of the University System of Georgia, and (d) the University of Miami and University of South Florida.

The Need
In the next 25 years, the Southeast is expected to be the fastest growing region of the U.S. Its population is expected to increase by 23%, and 70% of that increase will occur within 100 miles of the coast. These projections indicate an increasing sensitivity of the region to natural hazards and an ever-growing impact of coastal development on the natural resources that make the coastline so attractive. There is an urgent need to better observe and understand the coastal environment.

As an example, hurricanes and winter storms can have devastating effects on our coastal regions; coastal areas between North Carolina and Florida have sustained tens of billions of dollars in damage over the last decade due to these storms. Naval interests are also severely impacted by extreme weather events. Our ability to forecast these events, and therefore prepare for them, is extremely limited because of a lack of real-time ocean measurements. Beach stability, fisheries management, waste disposal, and public health effects associated with shellfish and harmful algal blooms are all pressing issues in coastal regions that can best be addressed with a sustained coastal ocean observing system.

Development of a regional coastal ocean observing system will provide continuous, real-time information on conditions in offshore and estuarine waters. The proposed Southeast Atlantic Coastal Ocean Observing System (SEA-COOS) will cover the region between the Virginia/NC border and Dry Tortugas, an area known as the South Atlantic Bight (SAB). The system design will adhere to that developed by national committees, and the observing system will be part of a larger national effort to implement coastal ocean observing systems throughout U.S. territorial waters. The infrastructure will accommodate a broad range of measurements, establish a data management center, and develop computer models to provide nowcasts and forecasts of conditions in the coastal ocean.

The Project
The coastal ocean observing system will have three components:

- A distributed observing network that collects oceanographic and meteorological measurements and relays data to shore in real time;
- A data management system that makes observations available in a consistent fashion to a broad user group, including scientific researchers, educators, forecasters, resource managers, private and public interests;
- A numerical modeling nowcast/forecast system that extends the measurements in space and in time to provide full coverage of the coastal ocean.

There exist functioning aspects of each of these components in the Southeast, but at present they focus on localized parts of the entire region. The SEA-COOS project will maintain and enhance the existing systems and develop new capabilities that together will provide regional coverage. Funds received would be leveraged against those provided by state agencies, by the Southeastern University Research Association, and by federal agencies.

In the SAB, the only large-scale coastal observing system currently operating continuously is the South Atlantic Bight Synoptic Offshore Observational Network (SABSOON). This effort, initiated by the National Oceanographic Partnership Program, is continuously monitoring the coastal ocean at a range of Navy platforms off the Georgia coast and involves a partnering of a number of institutions. The Navy platforms are part of a flight training facility operated by the Marine Corps Air Station in Beaufort, SC. The *Skidaway Institute of Oceanography* in Savannah, GA has taken the lead role in developing and maintaining the oceanographic and meteorological instrumentation on the towers. Because SABSOON is located in the very center of the SAB, its continued operation and growth is essential to SEA-COOS.

Although SABSOON encompasses 6000 square kilometers of the continental shelf, it cannot provide the coverage needed for the entire SAB. The observing network of SEA-COOS will establish two additional major components and several smaller components. The first addition is the instrument-ation of another set of Navy platforms positioned off Oregon Inlet on the northeast North Carolina coast. The Oceana Naval Air Station in Norfolk, VA operates a flight training facility that uses these towers. The location of the towers, just north of Cape Hatteras, is in the pathway between the Mid-Atlantic and South Atlantic Bight coastal oceans. This is also a frequent location for development of wintertime storms that ravage the northeast corridor. As such, continuous information from this site is critical to accurately portray the coastal environment along the eastern seaboard. The existing and proposed marine science facilities of the *University of North Carolina* are ideally situated to support the offshore towers. Funding for a shallow-draft vessel capable of servicing the towers and working in the North Carolina estuaries and sounds will enhance the research capabilities of the facilities.

The second new component to SEA-COOS is the deployment of long-range, high-frequency radar units that measure ocean surface currents. These newly developed instruments can measure surface currents up to 200 km away and are currently in use in the Gulf of Maine and the New York Bight. An array of 12 antennas, 8 along the shore and 4 based at offshore platforms, will provide continuous maps of ocean currents from the shore to the seaward side of the Gulf Stream throughout the SAB on a grid of 7 km elements. This type of spatial coverage is unprecedented and will be of particular interest to shipping and fisheries interests. The *University of Miami* is a leader in this field and will spearhead this component.

The third new component to the observing network will implement several other monitoring systems. Moorings near NC inlets will interface with an estuarine system being administered by the C-MAST laboratories of *North Carolina State University* located in Morehead City. Existing CORMP moorings in Onslow Bay operated by *UNC-Wilmington* will be upgraded. Coastal ocean moorings offshore of Winyah Bay will be established by the *Baruch Institute of the University of South Carolina*, and the *University of Miami* and *University of South Florida* partnership will expand its observations further offshore and alongshore.

Communications to link all the observing sites are a vital component of the work. All real-time information collected both inshore and offshore of the coastline will be included. The *Baruch Institute* will take the lead in data management. The Institute is currently responsible for data management at the 25 National Estuarine Research Reserve sites and is supported by NSF and SURA to develop data management and archival tools.

The combined observations will be assimilated into model predictions of coastal conditions. The SABSOON observations are presently utilized in this manner by the *University of North Carolina at Chapel Hill* as part of a NOPP-funded program. The *University of Miami* is actively involved in modeling ocean circulation and satellite remote sensing of the ocean, and these two groups will team up to expand the scope of their existing modeling

efforts to the entire SAB. The SEA-COOS program will be coordinated by the *University of North Carolina at Chapel Hill*, which plays a leading role in existing observing and modeling efforts in the region.

Taken together, the regional collaboration will put into place a real-time data collection and dissemination system that will greatly improve our ability to observe and manage the coastal ocean. This information is vital to safe and sustained development of the Southeast, and the nation as a whole

SEA-COOS Budget

Funding of SEA-COOS will support development of an advanced regional coastal ocean observing system. Emphasis will be placed on developing the three component areas of the program listed above. The observing elements include instruments, personnel, ship time, and shop improvements necessary to deploy and maintain observing systems on the Navy towers and on offshore moorings. The high-frequency radar deployment and maintenance are part of these costs. All states will implement an in-state clearing house for observations with SC acting as the regional coordinator for data management, and funds will be used to purchase computer equipment and support staff. NC and FL groups will undertake computer-based circulation modeling of the entire region. They will engage a number of students, utilize regional super-computing facilities and collaborate with scientists nationwide. Communications between observational platforms and the various data centers is vital and will use recent advances in wireless communications technologies and dedicated communications links. Workshops to inform and involve regional interests will be held regularly, and SEA-COOS investigators will work closely with national offices and other regional observing systems to ensure nationwide compatibility.

DRAFT BUDGET (in millions)

	2002	**2003**	**2004**	**2005**	**TOTALS**
NC					
Observing elements	$2.845	$2.255	$2.015	$1.365	
Assimilative modeling	$0.48	$0.48	$0.4	$0.4	
Data management	$0.29	$0.29	$0.195	$0.145	
Information technology	$0.225	$0.625	$0.3	$0.35	
NC totals	**$3.84**	**$3.65**	**$2.91**	**$2.26**	**$12.66**
SC					
Observing elements	$0.4	$0.5	$0.5	$0.5	
Data management	$1.	$1	$1	$1	
Information technology	$0.4	$0.4	$0.4	$0.4	
SC totals	**$1.8**	**$1.9**	**$1.9**	**$1.9**	**$7.6**
GA					
Observing elements	$1.3	$1.1	$1.2	$1.2	
Data management	$0.2	$0.3	$0.3	$0.3	
Information technology	$0.4	$0.4	$0.4	$0.5	
GA totals	**$1.9**	**$1.8**	**$1.9**	**$2.0**	**$7.6**
FL					
Observing elements	$0.5	$0.75	$1.25	$1.75	
Assimilative modeling	$0.75	$0.75	$0.75	$0.75	
Data management	$0.25	$0.25	$0.3	$0.3	
Information technology	$0.4	$0.4	$0.4	$0.5	
FL totals	**$1.9**	**$2.15**	**$2.7**	**$3.3**	**$10.05**
GRAND TOTALS	**$9.44**	**$9.5**	**$9.41**	**$9.46**	**$37.81**

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