THE CAROLINAS COASTAL OCEAN OBSERVING AND PREDICTION SYSTEM (CARO-COOPS)

NOAA Grant No. NA16RP2543

SEMI-ANNUAL PROGRESS REPORT
June 1, 2002 – November 30, 2002

I. INTRODUCTION

The Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS) is a NOAA funded partnership led by the University of South Carolina's Belle W. Baruch Institute (USC), with the North Carolina State University (NCSU) and the University of North Carolina at Wilmington (UNCW), to establish the capacity to monitor and model estuarine and coastal ocean conditions in the Carolinas. The goal of the project is to provide real-time predictions and ultimately forecasts to mitigate natural hazards, support management of living resources and marine ecosystems, and facilitate safe and efficient marine operations and support national security efforts.

Caro-COOPS is a wholly integrated system for coastal observations and their application to user-driven research, societal, and economic needs. Thus, Caro-COOPS consists of three related subsystems: (1) the observing instrumentation and platforms, (2) the data communications and management infrastructure, and (3) the modeling and applications elements. The approved Project Year (PY) 01 work plan for the grant includes a number of tasks related to establishing these capabilities. The work plan also calls for an initial pilot project focused on real-time prediction and analyses of storm surge and flooding before and during landfall of coastal storms to demonstrate Caro-COOPS' real-time interdisciplinary forecast concept. Finally, the work plan included a significant amount of effort to establish linkages with other state and federal observation and data networks nationally. A list of tasks and Milestone Schedule were provided in the original proposal to NOAA as Figure 8.

This report covers progress for work performed during the period June 1, 2002 to November 30, 2002, PY01 of the grant (Appendix A). It should be noted that although the grant's start date is June 1, 2002, the financial assistance award was not received by USC from NOAA Grants Management Division until July 3, 2002. As a result, the USC subawards to NCSU and UNCW were not in place until August 2002, and consequently, full implementation of the project was delayed approximately 2 months. The original Milestone Schedule was modified accordingly, as shown in Appendix B.

II. OCEAN OBSERVING SUBSYSTEM

The most significant milestones of this component of the project, deployment of the offshore moorings and installation of the coastal water level-meteorological stations, are approximately 4-6 months behind schedule. The delay was primarily due to: 1) modifications of the original sensor array to incorporate enhancements for real-time data transmission from all offshore stations and to meet NOAA requirements for the coastal water level-meteorological stations to be compatible with the NOAA National Water Level Observation Network (NWLON), and 2) identifying and scheduling a suitable vessel for offshore operations.

The Caro-COOPS observational network consists of a mix of fixed platforms, moorings, and sensors with real time telemetry. The original statement of work called for nine (9) offshore moorings, three (3) meteorological buoys, two (2) harbor stations, and six (6) water level-meteorological stations. As noted above, the original design of the array was modified primarily due to increases in instrumentation costs from the original cost estimates and upgrades to the network to enable real-time data transmission and to meet criteria required for consistency with NOAA observations. Regarding the latter, the Caro-COOPS water level stations will be fully compatible by PY02 with the NOAA NWLON, which is operated by the National Ocean Service (NOS) Centers for Operational Oceanographic Products and Services (CO-OPS). In addition, the Caro-COOPS modeling group ran development models to give further input on the actual array design needed for data assimilation into the storm surge prediction model for the pilot demonstration project. Sites and instrumentation were chosen to establish upstream, downstream, and offshore boundaries, as well as input and output through the air/sea interface, for model validation.

The initial array now will consist of:

- Three (3) offshore moorings at 10 m depth with bottom mounted Acoustic Doppler Current Profilers (ADCP's) and bottom pressure;
- Three (3) offshore moorings at 30 m depth with temperature, conductivity, and fluorescence at 10 m below the surface; bottom pressure; and bottom mounted ADCP's;
- One (1) mooring at approximately 225 m depth to monitor the inshore edge of the Gulf Stream with temperature, salinity, fluorescence, and nitrate at 10 m below the surface; temperature, salinity and pressure and an upward looking ADCP at 100 m depth; and bottom pressure, temperature and salinity.
- Two (2) meteorological buoys;
- Three (3) instrumented stations in Charleston Harbor; and
- Four (4) land-based coastal water level-meteorological stations.

A second major development concerned the availability and use of suitable ships for deployment and maintenance of the offshore moorings and buoys and for conducting seasonal hydrographic surveys. It originally had been proposed to use the UNCW *R/V Cape Fear* for deploying and maintaining the nearshore moorings and conducting the hydrographic cruises and to use the NOAA Ship *Ronald H. Brown* for deploying and maintaining the deeper water moorings. However, due to our misunderstanding of NOAA marine operations, no funds were allocated to support the requested time on the *Ronald H. Brown*. Also, we learned during preliminary work aboard the *R/V Cape Fear* that this ship was not suitable for handling the larger mooring configuration necessary for real-time data broadcast. Thus, it was necessary for us to find another primary ship for offshore mooring and survey operations. The ship of choice was the *R/V Palmetto*, a 110 ft long vessel operated by the South Carolina Department of Natural Resources (SC DNR), Marine Resources Research Institute (MRRI). Its home port is at the MRRI site at Ft. Johnson on James Island across the harbor from the City of Charleston, which is ideally located for Caro-COOPS purposes. Another advantage is cost, $3,100 per day, which is significantly less than the daily vessel charge for the *Ronald H. Brown* and equivalent to the daily rate for the *Cape Fear*. The only deficiency is that the *Palmetto* currently does not have an adequate heavy duty winch for the moorings and CTD winch with conducting cable. Dr. Marvin Moss, Caro-COOPS project coordinator for UNCW, agreed for funds to be transferred from the UNCW subaward to cover shiptime on the *Palmetto* and to procure the required winches.

A brief description of the work performed during this reporting period on each of the tasks related to establishing the ocean observing subsystem follows. The tasks are presented in the order that they appear on the Milestone Schedule.

Tasks 1-3. Order Equipment, Mooring Supplies, And Construct ADCP Housings.

These tasks are completed, albeit approximately 3 months behind schedule, due to the modifications to the original observing network and sensors, as described above, and a delay in hiring field technicians (see Task 4). Notable features of the work related to these tasks include:

- The original equipment inventory was modified, as described above.
- The primary design and construction of the moorings was completed in consultation with Mooring Systems. Inc., Cataumet, MA.
- All purchase orders for the observational equipment and mooring supplies will be placed with vendors by January 2003. Expected delivery time is March-April 2003. Additional supplies, such as batteries, etc., will be ordered closer to time of deployment.
- The order to construct the ADCP housings was submitted to the NCSU machine shop in November 2002. Construction should be complete in January-February 2003.
- Equipment for the Charleston Harbor stations will come from existing NCSU inventory.

Task 4. Hire Marine and Electronics Technicians.

This task was completed in October 2002. Specifically,

- NCSU hired Mr. Jeff Kinder as the Electronics Technician and Mr. Billy Sweet as the Marine Technician. The 2-month delay in hiring was due to NCSU policies that would not permit the positions to be advertised until the subaward from USC was in place.

Task 5. Arrange Ship Schedule

This task will be completed in December 2002. As noted above, the SC DNR *R/V Palmetto* replaced the UNCW *R/V Cape Fear* and the NOAA Ship *Ronald H. Brown* for Caro-COOPS marine operations. Further aspects of the work associated with shiptime scheduling are:

- The agreement between USC and SC DNR for use of the *R/V Palmetto* was made in September 2002.
- The schedule for the first phase of Caro-COOPS marine operations is dependent on delivery of the observational equipment and mooring supplies, which is expected to be during March-April 2003.
- The estimated amount of shiptime required for the first mooring deployment is 6-7 days. However, since the ship deck will be able to accommodate two full moorings at a time, the actual days at sea will not be concurrent. Therefore, the schedule includes a day trip for each of the three 10/30 meter depth moorings, one day for each of the two meteorological buoys, and one day for the deep mooring (225 meters depth).
- The ship schedule will be set up with SC DNR in December 2002. An initial cruise is planned for late April 2003 to examine ocean floor topography at each of the mooring and buoy sites. Actual deployment is scheduled for early May 2003, although a four-week window (April 28, – May 23, 2002) was established to take into consideration potential weather or equipment problems.

Task 6. Research Real Time Capability

This task was completed. Specifically,

- All offshore moorings will employ Low Earth Orbit (LEO) Iridium Cellular technology for data transmission (see Task 7).
- A similar commercial LEO system, Orbcomm, will be used for data transmission from the meteorological buoys, although plans are to convert these buoys to the Iridium technology in PY02.
- Data from the coastal water level-meteorological stations will be transmitted every three hours via GOES, NOAA's suit of Geostationary Operational Environmental Satellites.
- Funds available for upgrading the Caro-COOPS observing network to real-time data transmission were supplemented with funding ($90,000) awarded to USC through the Office of Naval Research sponsored program, Southeast Atlantic Coastal Ocean Observing System (SEA-COOS).

Task 7. Ocean.US Iridium Trials

This task is ongoing.

- Caro-COOPS was approved by Ocean.US in August 2002 to receive several Iridium L-Band Transceivers, i.e., Iridium data units, and accompanying satellite telemetry time as part of a demonstration project to evaluate this technology for distribution of data from offshore platforms in support of operational marine applications.
- To date, we have demonstrated the ability for our data loggers to dial up the satellite, transmit a data stream, and log off. Further experiments are focusing on optimizing the communications capability to save power aboard the mooring and on the ability to use the communications system to reprogram the data logger while it is deployed. Experiments include transmitting time, position, temperature, salinity, pressure, fluorescence, velocity profile, and bottom pressure data every 4 hours (the instruments on the mooring will be collecting data every 15 minutes and storing it for download upon recovery every 6 months) and examining the ability to reprogram data transmission to once every 15 minutes during a storm event.

Task 8. Expe rimental Real Time

This task will be undertaken after the moorings are deployed in May 2003.

Tasks 9-10. First and Second Mooring Deployment

The first mooring deployment was rescheduled from November 2002. Specifically,

- InterOcean S-4 Current Meter / TS Recorders from NCSU's existing oceanographic equipment inventory will be deployed at three sites in Charleston Harbor in January 2003. Permission to mount these instruments on navigation aides in the harbor has been requested to the Seventh U.S. Coast Guard District Aids to Navigation and Waterways Management Branch in Miami, FL.
- The first deployment of seven moorings and two meteorological buoys will occur in May 2003.

The second mooring deployment is scheduled for October 2003.

Task 11. Install Coastal Met Stations

The installation of the coastal water level-meteorological stations installment was rescheduled to March 2003.

- The stations will be installed at historical (inactive) NOS CO-OP NWLON water level station sites, which will allow for the use existing benchmarks for geo-leveling the Caro-COOPS stations.
- CO-OPS provided information on active and inactive NWLON sites in NC and SC in November 2002.

Task 12. Develop Data Products

This task is ongoing. A list of products being discussed includes:

- Real-time and historical information for marine operations, such as meteorological (air temperature, wind, relative humidity, etc.) and ocean conditions (water temperatures and salinity at various depths, wave height, currents, etc.).
- Satellite imagery for the Caro-COOPS region.
- Experimental forecasts.

Task 13. Satellite SST and Ocean Color

Preliminary work on this task includes:

- Collecting and archiving satellite SST data for the East Coast at NCSU.
- Evaluating the U.S. Navy's Real Time coastal 2km SST product for Caro-COOPS applications. The product is collected at the Naval Research Laboratory at Stennis Space Center, MS and distributed in near real time via the NASA JPL PODAAC.
- Exploring solutions for developing operational ocean color products. Ocean color data can be collected in real time from the NASA Sea-viewing Wide Field-of-view Sensor (SeaWiFS), but currently these data may only be used for scientific purposes. Also, NASA's contract with OrbImage expires on December 19, 2003.
- Dr. John Morrison, NCSU, will attend the NOAA Direct Readout Satellite Users Conference for the America's in Miami during December 2002.

Task 14. Seasonal Hydrographic Cruises

The first hydrographic cruise is scheduled for May 2003.

III. DATA COMMUNICATIONS AND MANAGEMENT SUBSYSTEM

All tasks related to establishing the basic infrastructure for Caro-COOPS data management and sharing are proceeding in accordance with the revised Milestone Schedule. The posting of real-time data from the Caro-COOPS observing subsystem has been delayed as a consequence of the rescheduling of the deployment of the observing network, as described above. In the interim, historical data sets and simulated model products are being used to develop and test the data acquisition and products dissemination systems.

Task 1. Identify data specifications

A data management group for Caro-COOPS has been established at USC. It began immediately to identify data specifications for sensors and measurements currently being obtained by UNC-W and projected by NCSU for new mooring instrumentation.

- Within the Caro-COOPS partnership, USC has identified a variety of hardware platforms, software preferences, data management practices, and client and participant expectations. This information is being incorporated in the development of a multi-participant database management program.
- The USC data management group met and discussed new mooring data specifications with both the modeling and research groups at NCSU. A similar meeting has taken place with CORMP personnel at UNC-W. These are ongoing discussions.
- Required data from outside sources were identified and include the NWS (National Weather Service), USGS (US Geological Survey), and DNR(Department of Natural Resources).

Task 2. Develop data collection protocol

By working with investigators at both NCSU and UNCW, the data management group at USC has identified the specifications (types of measurements, frequency, volume) for the data to be collected.

- USC has identified "primary" and "secondary" data sets. Primary data sets are those collected by Caro-COOPS maintained instrumentation in support of Caro-COOPS objectives. Protocols are being established to ensure consistency for these key variables. Secondary data sets are those for which the primary responsibility for collection and maintenance lies elsewhere but are relevant to Caro-COOPS efforts. USC has begun discussions with these external groups to standardize, to the extent possible, all data collection protocols.
- Documentation began with the UNCW CORMP program data, to familiarize the USC group with the types of data to be incorporated into the newly developed Caro-COOPS data management infrastructure.
- Documentation of data characteristics will continue as we approach deployment of the current array, plan for additional measurements, and establish linkages with partners who are also collecting observational data.
- Relevant datasets to be obtained from national and state agencies (NWS, USGS, SC DNR) have been identified and will be transformed to a common data format as soon as they are verified and made available to the public domain.
- We have identified data storage and transfer formats (e.g. NetCDF) and transfer tools (e.g. DODSs) in use within the oceanographic community and are ensuring that Caro-COOPS protocols include formatting and transport via these systems.

Task 3. Develop QA/QC procedures

This task is ongoing.

- We have identified that each partner has some level of QA/QC procedure documentation for instrument deployment and scheduled maintenance, which are being incorporated into on-line copy and referenced in metadata records. By doing so, we have also identified QA/QC procedure needs.
- We are identifying external groups involved in similar observation system data collection that have QA/QC procedures that can be incorporated or adapted to Caro-COOPS.

Task 4. Develop and maintain documentation

Documentation of program procedures and development of metadata guidelines are ongoing.

- Metadata, which provide information on the characteristics, lineage, and accessibility of a data set, must be documented in a way that facilitates retrieval and searching of the data. Guidelines for Caro-COOPS metadata are being developed, based the Automated Cast-Net Entry Tool (ACET) developed by the NSF-EPSCOR funded Cast-Net project. Enhancements of ACET required for Caro-COOPS and CORMP, and consistent with Ocean.US guidance, have been identified and are being developed.
- Other tools for metadata documentation (e.g. at NOAA Coastal Services Center and the NCDDC) are being assessed and elements incorporated where appropriate.

Task 5. Develop, implement and operate data hub

This task has been initiated:

- The Caro-COOPS website has been designed and activated (<www.carocoops.org>). Work is underway to develop the interfaces for data retrieval and integration, in preparation for a fully interactive web site, when the mooring instrumentation comes on line.
- A listserv and ftp server have been established for communication, data storage and transfer, and host user tools and documentation. A site usage application was established to profile system users so that we can better understand our users and their needs.
- The data management group has been familiarizing itself with a variety of existing data formats (e.g. ASCII, Matlab, netCDF, HDF, JGOFS and relational databases), as they relate to oceanographic data, as well as existing tools that are used in the search and retrieval of oceanographic data (DODS -Distributed Oceanographic Data System - and LAS - Live Access Server).
- Several of the storm surge datasets have been converted to a common netCDF format in an ongoing evaluation process of supporting the modeling groups data input needs.
- The Caro-Coops modeling team has assembled a comprehensive list of model input data on September 11, 2002. A CD-ROM containing the data set was made and delivered to USC at the September 2002 Caro-Coops meeting held in Charleston, SC. The South Carolina team (contact person: Jeremy Cothran) formatted the data set and will make the ftp connection available to NCSU on December 11, 2002. The NCSU modeling team will access the database maintained at USC and carry out the model test run on December 12, 2002. The NCSU modeling team made some suggestions to the USC team regarding several minor issues on data formatting.

IV. MODELING AND APPLICATIONS SUBSYSTEM

The NCSU Coastal and Estuarine Modeling and Environmental Prediction System (CEMEPS) provides the foundation for the Caro-COOPS modeling subsystem. The focus of the modeling effort during PY01 is to develop and calibrate, CEMEPS physics component. Tasks include modeling the atmospheric and oceanic mesoscale environment in the coastal region of the Carolinas to produce real-time atmospheric forcing and lateral oceanic open-boundary conditions for intensive (high-resolution) monitoring and prediction areas and developing a high-resolution ocean prediction system for the Caro-COOPS study area.

Task 1. Hire Post-Docs

Three Postdoctoral Associates were proposed to be hired in PY01:

- Dr. Machuan Peng was hired in July 2002 to work on the storm surge model for the Caro-COOPS region. He will be responsible for ocean mixed-layer model improvement; inundation scheme development/refinement, tidal forcing, and trajectory and dispersion modeling.
- Dr. Shaowu Bao will be hired in January 2003 to work on air-sea coupled model and application packages of the CEMEPS modeling system, the data display system; and graphics/internet support.

Task 2. Atmospheric and Oceanic Mesoscale Environment Modeling

This task consists of two subtasks:

Subtask 2a. Atmospheric and Lateral Boundary Conditions

- Xiaoming Liu, a graduate student, has been hired and will be responsible for the development of high-resolution, parallel ocean circulation models for North Atlantic (PMICOM). This model will provide lateral boundary conditions for the coastal modeling system (CEMEPS), and be used to study long-term changes of ocean circulation in the Caro-Coops region.
- Xiaoming has ported the PMICOM to the parallel SGI cluster at the North Carolina Supercomputing Center (NCSC). He is refining the model grids and generating corresponding atmospheric forcing fields. His next goal is to configure the model to run at twice the resolution (half grid size) of the standard PMICOM.

Subtask 2b. Wave and Tide Boundary Conditions

- Huiqing Liu, a graduate student, has been hired and is responsible for the development of a wave-current coupled modeling system for the entire coastal region of South Atlantic Bight, using WAM Cycle 4 and the Princeton Ocean Model (POM). Huiqing is reviewing literature on wave-current coupled modeling and will improve the wave-current coupled model developed by Xie et al. (2001, 2002) using an improved coupling formulation developed by Guan et al (2001).
- The Caro-COOPS modeling team began developing the 2km grid size model for the entire Caro-COOPS domain (31°N-35°N, and 75°W-82°W) following the first Caro-COOPS meeting held at NCSU on August 27, 2002. This task was completed in early October 2002. Model results and a PowerPoint file with animation were made available to the rest of the Caro-COOPS team on October 12, 2002. Dr. Earle Buckley presented the results at the Caro-COOPS briefing to NAVOCEANO and NRL at Stennis Space center, MS, in late October 2002.

Task 3. High-Resolution Modeling System for Study Region

After the NCSU modeling group completed the 2km model development, they started to develop the high-resolution model for the Charleston subdomain.

- A 100m grid size for the region of 32.3°N-32.9°N and 79.3°W-80.1°W was designed, and the model development was completed on November 9, 2002.
- Dr. Lian Xie presented the results of the latest model development at the NCSU, Department of Marine, Earth and Atmospheric Sciences seminar on November 17, 2002. Xie's PowerPoint presentation, which includes descriptions of the 2km grid size model and the

100m grid size model, was made available to other Caro-COOPS team members after the seminar. It can also be downloaded from: http://dell01-112res3.meas.ncsu.edu/caro-COOPS/ppt/xie-seminar/

Task 4. Develop Data Inspection and Display

Work on this task is scheduled for the second half of PY01.

Task 5. Coupling to Ecological and Fisheries Models

Work on this task is scheduled to begin in April 2003.

V. CONCEPT DEMONSTRATION PROJECT: COASTAL AND INLAND FLOODING PREDICTION

The goal of this initial concept demonstration project is to develop a prognostic capability to accurately predict coastal and inland flooding in all of its aspects during the passages of high-energy atmospheric events such as Tropical Cyclones (TCs) and Extra-Tropical Cyclones (ETCs). Initial tasks include

Task 1. Examine requirements to expand the CEMEPS storm surge prediction system for South Carolina

This task has been mostly accomplished. Data requirements include bathymetry, land elevation, and time series for precipitation, tide, and river discharge.

Task 2. Gather elevation topographic data, in-situ tidal records, and precipitation data for SC

This task is in progress:

- For the 2-km grid domain, the bathymetry and land elevation data in the Caro-COOPS domain are assembled from two available datasets. One is ETOPO5, which was generated from a digital data base of land and sea-floor elevations on a 5-minute latitude/longitude grid; the other is GLOBE, which is a 1-kilometer-resolution land relief database.
- Times series data for precipitation and river discharge are available from the U.S. Geological Survey.
- Tidal records will be obtained from NOAA CO-OPS.

Task 3. Conduct model experiments in hindcasting mode

This task has not been completed, but the information needed to conduct hindcasts has been identified, as well as the data formats and coordination required with the USC data management team. The test of the 2km grid model for the SC domain, described above, was a necessary first step.

Task 4. Conduct model experiments in prediction mode

This task has been rescheduled to begin in May 2003.

VI. ESTABLISHMENT OF PARTNERSHIPS AND LINKAGES

The Caro-COOPS PIs have been working to identify productive interactions with federal agencies to ensure that the Caro-COOPS infrastructure is complementary with federal observing systems and Ocean.US plans, and provides strong and productive input to a large user community. A number of mutually supportive and promising linkages have been identified.

1. NOAA

One of the fundamental principles of Caro-COOPS is to supplement, enhance, and support existing NOAA coastal ocean observations and services. To that end, discussions of collaboration have been opened with the NOAA National Weather Service's (NWS) National Data Buoy Center (NDBC), the National Environmental Satellite, Data, and Information Service's (NESDIS) National Coastal Data Development Center (NCDDC), and the National Ocean Service's Coastal Services Center (CSC) and CO-OPS.

- We visited the NDBC offices at the Stennis Space Center in October 2002 to open discussions on working with them on collection and quality control of offshore real time meteorological. Our goal is to have these data collected via normal NDBC data channels using the GOES satellite.
- We also met with NCDDC staff in October 2002 to discuss sharing of Caro-COOPS data sets.
- We went to the CO-OPS offices in Silver Spring, MD in November 2002 to discuss making the Caro-COOPS coastal water level-meteorological stations fully NWLON compatible. As noted above, the original design for the Caro-COOPS stations would not have met NOAA standards. However, we decided to upgrade the Caro-COOPS stations to CO-OPS specifications as part of our efforts to be fully compatible with other components of the Coastal Ocean Observing System (COOS). The instrumentation that we now are purchasing for the Caro-COOPS stations meets NWLON criteria, although we will not purchase the redundant sensors necessary to become a certified NWLON station until June 2003. This reduced configuration is necessary at this point because of insufficient funds in the approved PY01 budget. Costs for a fully compatible NWLON station is considerably greater than the instrumentation originally proposed for the Caro-COOPS coastal stations. We plan to budget PY02 funds for upgrading of the equipment and for costs to geodetically level the stations. Once fully NWLON compatible, the data will be added to the normal CO-OPS data stream via GOES transponders. We will also be transmitting the real time data to the Caro-COOPS data center on the USC campus in Columbia, SC via cellular technology. We currently are preparing a Memorandum of Understanding between USC and CO-OPS for technical assistance and technology transfer to support operation and data sharing of the Caro-COOPS stations.
- We have continued to interact with the NOAA Coastal Services Center, primarily through participation in and contributions to the Coastal Observation Technology System (COTS) project.

2. Department of Defense

Discussions have been held with several branches of the US Navy to explore how Caro-COOPS products could support naval operations, including:

- Dr. Rick Spinrad, Technical Director to the Oceanographer of the Navy;

- Dr. Walt McKeown, Senior Scientist at the Naval Atlantic Meteorology and Oceanography Command, Norfolk, VA;
- Dr. Mitchell Shank and Dr. Ted Bennett, Naval Oceanographic Office, and Mr. Robert Rhodes, Naval Research Laboratory Ocean Dynamics and Prediction Branch, Stennis Space Center, MS; and
- Mr. Joe Ramirez and Mr. Dan Egge, SPAWAR, and Lt. Col. Reid Nichols, II Marine Expeditionary Force, Camp Lejeune, NC, specifically on collaboration with the Camp Lejeune Integrated Observation Network (CLION).

3. SC Department of Natural Resources

The SC DNR has been conducting long-term monitoring studies in tidal creeks, salt marshes, estuaries, and offshore areas in the South Atlantic Bight, particularly on fisheries and water.

- We have had numerous meeting with investigators and staff of the SC DNR to explore how Caro-COOPS might enhance SC DNR projects, such as the Southeast Area Monitoring and Assessment Program - South Atlantic (SEAMAP-SA) and the Marine Resources Monitoring Assessment and Prediction Program (MARMAP). There are considerable opportunities for collaboration and integration of data to expand the potential benefits and impact of the Caro-COOPS investment.
- The SC DNR has also worked with us to secure the ship support necessary for Caro-COOPS marine operations.

4. SC and NC Sea Grant College Programs

We initiated discussion with SC and NC Sea Grants to identify a way in which we could collaborate to enhance interaction with a broad user base for Caro-COOPS services and products. Specific activities, such as user workshops, may be implemented in PY02, dependent upon available funding.

VII. REFERENCES

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Appendix A. Caro-COOPS Semi-annual Progress Summary: June 1, 2002 to November 30, 2002

Task No.	Description	Status	Comments
Observing Subsystem			
1	Order Equipment	Delayed	To be completed in January 2003
2	Construct ADCP Housings	Delayed	To be completed in January 2003
3	Order Mooring Supplies	Delayed	To be completed in December 2002
4	Hire Marine and Electronic Tech	Completed	October 2002
5	Arrange Ship Schedule	Delayed	To be completed in December 2002
6	Research Real Time Capability	Completed	November 2002
7	Ocean.US Iridium Trials	Ongoing	On schedule
8	Experimental Real Time	Delayed	To be initiated in May 2003
9	First Mooring Deployment	Delayed	To be completed in May 2003
10	Second Mooring Deployment	Delayed	To be completed in October 2003
11	Install Coastal Met Stations	Delayed	To be completed in March 2003
12	Develop Data Products	Ongoing	On schedule
13	Real Time Coastal Met Data	Delayed	To be initiated in March 2003
14	Satellite SST and Color	Ongoing	On schedule
15	Seasonal Hydrographic Cruises	Delayed	To be initiated in May 2003
Data Communications & Management Subsystem			
1	Identify data specifications	Ongoing	On schedule
2	Develop data collection protocol	Ongoing	On schedule
3	Develop QA/QC procedures	Ongoing	On schedule
4	Develop & maintain documentation	Ongoing	On schedule
5	Develop, implement, & operate data hub	Ongoing	On schedule
Modeling and Applications Subsystem			
1	Hire Post-Docs	Ongoing	First position filled in July 2002; second to be hired in January 2003; third postponed to PY02
2	Atmospheric and Oceanic Mesoscale Environment		
2a	*Atmospheric and Lateral Boundary Conditions	Ongoing	On schedule
2b	* Wave and Tide Boundary Conditions	Ongoing	On schedule
3	High-Resolution Modeling System for Study Region		
3a	*Atmospheric and Lateral Boundary Conditions	Ongoing	On schedule
3b	* Wave and Tide Boundary Conditions	Ongoing	On schedule
4	Develop Data inspection and display	Next reporting period	On schedule
5	Coupling to Ecological and Fisheries Models	Next reporting period	On schedule

Task No.	Description	Status	Comments
Concept Demonstration Project: Coastal and Inland Flooding Prediction			
1	Examine requirements to expand the CEMEPS storm surge prediction system for South Carolina	Completed	September 2002
2	Gather elevation topographic data, in-situ tidal records, and precipitation data for SC	Ongoing	On schedule
3	Conduct model experiments in hindcasting mode	Ongoing	On schedule
4	Conduct model experiments in prediction mode	Next reporting period	On schedule
Establishment of Partnerships and Linkages			
1	Federal programs	Ongoing	NOAA, DOD
2	State programs	Ongoing	SC DNR, NC and SC Sea Grant College Programs

APPENDIX B. Revised Caro-COOPS Milestone Schedule

TASKS	M02[a]	J02[b]	J02[c]	A02[d]	S02	O02	N02	D02	J 03	F03	M03	A03	M03	J03	J03
Order Equipment		→													
Construct ADCP Housings	→														
Order Mooring Supplies		→													
Hire Marine and Electronic Tech	→														
Arrange Ship Schedule		→													
Research Real Time Capability	→														
Ocean.US Iridium Trials	→														
Experimental Real Time							→								
First Mooring Deployment							→								
Second Mooring Deployment												→			
Install Coastal Met Stations			→												
Develop Data Products			→												
Real Time Coastal Met Data							→								
Satellite SST and Color	→														
Hydrographic Cruises															
Seasonal Cruises								→			→				
Data Communications and Management Subsystem															
Identify data specifications (in progress)	→														
Develop data collection protocol	→														
Develop QA/QC procedures	→														
Develop & maintain documentation	→														
Develop, implement, & operate data hub				→											
Modeling and Applications Subsystem															
Hire Post-Docs	→														
Development CEMEPS Physics		→													
Atmospheric and Oceanic Mesoscale Environment		→													
*Atmospheric and Lateral Boundary Conditions		→													
* Wave and Tide Boundary Conditions		→													
High-Resolution Modeling System for Study Region		→													
*Atmospheric and Lateral Boundary Conditions		→													
* Wave and Tide Boundary Conditions		→													
Develop Data inspection and display									→						
Coupling to Ecological and Fisheries Models												→			
Concept Demonstration Project: Coastal and Inland Flooding Prediction															
Examine requirements to expand the CEMEPS storm surge prediction system for South Carolina		→													
Gather elevation topographic data, in-situ tidal records, and precipitation data for SC		→													
Conduct model experiments in hindcasting mode						→									
Conduct model experiments in prediction mode											→				

a/ Proposed start date
b/ Grant start date
c/ Award received
d/ Project implementation begins

→ indicates original date revised