Semi-Annual Performance Report

March 1, 2007 – August 31, 2007

NOAA Award No. NA03NOS4730220

Coastal Observation IV – A Continuation of the OASIS Project

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Overview

Our goal is to develop a regional coastal ocean observing system along the Delmarva (Delaware/Maryland/Virginia) coast that will become a key component of the Mid-Atlantic Coastal Ocean Observing System Regional Association (MACOORA). We have completed the fourth year of this five-year NOAA-sponsored program. We have developed and are testing new sensors, platforms and applications to support NOAA and NASA coastal ocean remote sensing activities and products. Our CoastalObs system is comprised of the following major components: High Frequency Radar Systems (CODAR); Solar-powered surface autonomous vehicles (OASIS); a Coastal Ocean Bio-optical Buoy (COBY); a series of coastal ship surveys; and an education and outreach program. We have made progress through the development and deployment of several instrument platforms and the creation of a data archival and access portal that makes real-time observations available to the public. We continue to expand our observing program by establishing new collaborations.

We made substantial progress during the last six months:

- OASIS – OASIS I and OASIS II platforms are complete and operational. Both platforms were tested in coastal bays and open water environments. OASIS II has been completely instrumented and is obtaining measurements on air-sea fluxes of carbon dioxide in order to support carbon cycle science activities off the Delmarva coast. OASIS II has been deployed into Rhodamine dye spills to demonstrate long-range platform control and sampling programs that will be used on harmful algal bloom deployments. An additional platform, OASIS III, was procured, and delivery is scheduled for this October.

- High Frequency Radar Systems – Two of three long-range radar systems are fully operational and providing data to NOAA's National Data Buoy Center (NDBC) High Frequency Radar Network and Rutgers University. We encountered problems securing approvals for building and electrical installation with the third system, but we are finalizing plans for installation at Naval Air Station (NAS) Oceana, VA. The two standard-range radar systems are fully operational in the Chesapeake Bay. These are the only systems operating in the bay.

- Cross-Shelf and Seasonal Surveys – We completed eight COBY transit seasonal cruises during this reporting period, bringing the total to 30 cruises for the CoastalObs program. On these cruises, we obtained a time series of biological, physical and optical data along the COBY transect in order to calculate diversity indices for the region. Correlations to physical (salinity, currents, temperature and nutrients) and biological data (zooplankton community structure) are being investigated.

- COBY – The COBY buoy is complete and ready for deployment. We have been unable to obtain insurance coverage. We are working with Lloyd's of London to obtain coverage if the COBY is positioned closer to shore. This buoy will provide the oceanographic community with a coastal ocean observation platform for developing, testing, calibrating and comparing instruments.

- Data Archival Center - All Phase II hardware passed integration testing and is fully operational. CODAR data products are being delivered to Rutgers University and the National High Frequency Radar Network.

- Education and Outreach – The educational journal "Rising Tides" was completed and received approval from the NASA Communications Materials Review. The journal will be posted on the http://phytoplankton.gsfc.nasa.gov web site in October. A CoastalObs educational display is on view at the NASA Wallops Flight Facility (WFF) Visitor's Center.

- On July 9, we conducted a presentation for the Secretary of Technology and Secretary of Public Safety for the State of Virginia at Wallops Island, VA. On July 30, we participated in the Dewey Beach, DE natural disaster cross training initiative. We had an OASIS platform on static display, and we provided a CODAR demonstration to representatives from the Federal Emergency Management Agency (FEMA), the Delaware Emergency Management Agency (DEMA), the United States Coast Guard (USCG), the National Institutes of Health (NIH) and various local agencies.

The COBY buoy was completed during this reporting period. All required systems (electrical, solar, computer, winch and instrument) were successfully installed and tested. It is ready to deploy. We have obtained liability insurance coverage for the COBY, but we have been unable to obtain affordable property coverage. The one quote we received was for $40,000. We are negotiating with the carrier for a lower rate.

The data we are collecting are being widely distributed. The CODAAC web site, http://coastal.wff.nasa.gov, is providing access to CODAAC data and metadata. There is a link to this web site on our Coastal Observation web site, www.CoastalObs.US. We are delivering CODAR data products to Rutgers University and the National High Frequency Radar Network. We are working with Rutgers to produce a Delmarva-region surface current product.

We continue to foster and expand our regional partnerships with MACOORA members to establish a regional coastal ocean observing system. We recently partnered with MACOORA members on a winning proposal submitted to NOAA for the Regional Coastal Ocean Observing Systems (RCOOS) development. Our long-range and standard-range CODAR are an integral part of the MACOORA RCOOS. We have expanded the education and outreach component of this program. In addition to our educational magazine, we provided an opportunity for a student from Florida Institute of Technology to work with the OASIS

platform this summer as well as having students from Kutztown University and York College of Pennsylvania work alongside our research scientists at Wallops Island. Their work is being coordinated through the Marine Science Consortium on Wallops Island. Old Dominion University's Research Experience for Undergraduates program provided the opportunity for five interns to work on the CoastalObs project. We plan to continue this program next summer. As a result of our efforts on this project, the CoastalObs infrastructure will provide valuable long-term monitoring of the physical and ecosystem dynamics along the coastal ocean region of Virginia, Maryland and Delaware.

I. Program Management

The Center for Innovative Technology (CIT) provides management oversight and guidance to the Coastal Observation Project. Our CoastalObs team, consisting of NASA and NOAA experts and subcontractors who represent leading regional companies and universities, provides critical support and value to the program.

We are expanding our collaborations and partnerships in order to provide more regional products. We are collaborating with Maryland entities in order to expand our monitoring of the health of the Chesapeake Bay, which directly impacts the Delmarva coastal region.

We are effectively managing all of the equipment we have procured for this project through the property management system that we developed. All equipment is being maintained and calibrated to manufacturer specifications. Additionally, all equipment (with the exception of the COBY), has been insured for both property and liability insurance.

Although this program was approved for a fifth year, no additional funding was received for FY07 (Year V). In anticipation of this lack of funding, we reduced some of our current efforts in order to minimize the impact on Year V. We eliminated the purchase of two gliders, a second COBY and several field instruments. We also reduced the number of water samples to be processed and eliminated several field surveys (BIOME cruises). These reductions resulted in no loss of data streams or any other products/services available to the public, nor any loss of experienced personnel. In order to conserve funds, we made some very difficult decisions that affected the deployments of the third long-range CODAR and the COBY. After electromagnetic interference (EMI) problems were encountered at the original site, Fort Story, the third long-range CODAR was going to be installed at the Back Bay National Wildlife Refuge. Testing was completed and permits in hand, when the permanent power hook-up proved to be cost prohibitive. This system now will be installed at NAS Oceana Dam Neck Annex in Virginia Beach, VA next month. We waited to procure property insurance coverage for the COBY until just prior to deployment. None of the companies insuring other CoastalObs equipment would insure the COBY. We were able to obtain one quote from Lloyd's of London and that was for 40 percent of the total value of the buoy. We are trying to obtain a more affordable rate.

The remainder of this report is divided into the following sections: II. OASIS Platform; III. High Frequency (HF) Radar Systems; IV. Coastal Ocean Bio-optical Buoy (COBY); V. Cross-Shelf and Seasonal Field Surveys; VI. Data Archival Center; VII. Regional Partnerships and Outreach; VIII. Project Milestones and Schedule; IX. Budgetary Analysis; and X. Publications and Presentations. Each section will provide an update on the progress made during the semiannual performance period and a comparison of accomplishments with the goals and objectives for the period.

II. OASIS Platform

Goals and Objectives/Achievements:

> **Goals**: Continue testing and demonstration of OASIS I and OASIS II.
> **Achievements:** We demonstrated OASIS performance during long-term (100+ hour) continuous wet testing, and we continued to develop platform and instrument capabilities. We continued testing heat flux instrumentation, and remote mapping of Rhodamine dye (simulating harmful algal booms) was conducted on OASIS II. OASIS I was retrofitted to align it with the improvements installed on OASIS II.

During the past six months, successful field testing of the OASIS II platform continued to demonstrate the many capabilities of the OASIS platform concept. The OASIS II was deployed on day-long cruises at the Chesapeake Bay test site (Figure 1, Figure 2) and at the Saxis, VA and Chincoteague Bay site (Greenbackville, VA). Long-term testing was conducted in a pond (for safety reasons) in Laurel, DE. The OASIS onboard control system performed exceptionally well during all demonstration cruises. The in-line flow through system that supplies the *in situ* SeaBird CT sensor (measuring seawater temperature and salinity) and WetLabs fluorometers (measuring phytoplankton chlorophyll concentrations or rhodamine dye) performed to specifications on the deployments. All metrology and science instruments functioned as designed on these cruises.

The improvements in solar charging, the onboard control system and electrical system, and a new electrical motor demonstrated in OASIS II were retrofitted to OASIS I. A smaller electrical motor designed to improve efficiency was tested on OASIS I, but in-water testing revealed short motor life. So this system was replaced with the larger drive motor as installed on OASIS II. The OASIS I also was retrofitted with a flow through seawater sampling system identical to OASIS II.

Figure 1. *OASIS II mapping Rhodamine dye spill on Chesapeake Bay in support of HAB demonstration.*

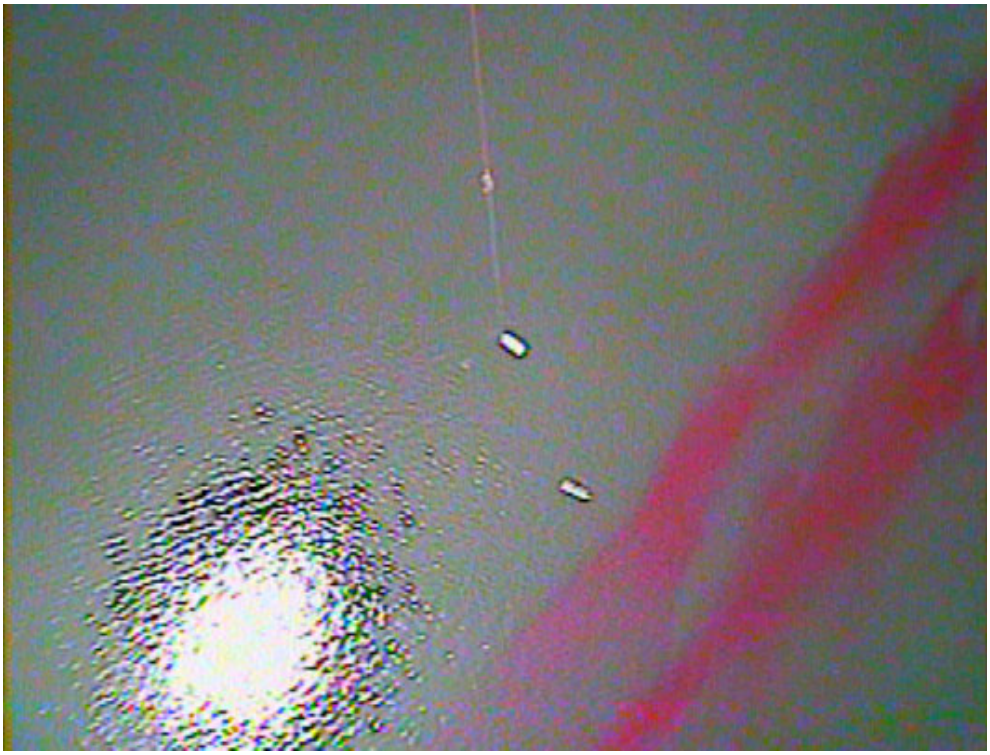

Figure 2. *OASIS II and support platform as seen from aerostat during HAB demonstration.*

The completed bow mast for carbon dioxide air-sea flux (Figure 3) instruments has been deployed, and it successfully collected data. The air-sea flux instrumentation is used to interface the air-sea gas and heat flux instruments of Wade McGillis (Columbia University) and the NOAA Environmental Technology Laboratory personnel (Fairall and Hare). This system will be used for planned field studies.

Figure 3. *OASIS II underway with bow mast near Greenbackville, Va.*

Both OASIS I and OASIS II platforms have undergone long-term (100+ hour) power tests (Figure 4) in water to demonstrate the robustness of the electrical and computer subsystems. We have demonstrated the ability of the OASIS electrical system to recover from consecutive multiple cloudy days as well as long-term continuous operation of the computer and communication systems.

Figure 4. *OASIS II platform during 100+ hour operational test near Laurel, DE.*

The OASIS platforms have met all performance goals and objectives for this reporting period.

III. High Frequency Radar Systems

Goals and Objectives/Achievements:

> **Goals**: Installation and maintenance of three long-range and two standard-range HF radar systems.
> **Achievements**: Both standard-range systems and two of the three long-range systems are operational and contributing data to the Rutgers University and National NOAA CODAR networks. The third long-range system will be operational in October.

The Assateague long-range CODAR site went online November 21, 2006, and the Cedar Island long-range CODAR site went online December 19, 2006. Both sites are fully operational and contributing data to the Rutgers University, East Coast and National NOAA CODAR networks. Since March 1, 2007, 4,256 radial files have been received from the Assateague site and 4,048 radial files from the Cedar Island site.

Both the Assateague and Cedar Island CODAR systems had issues requiring on-site visits to troubleshoot and correct problems. To resolve these problems, the team rebooted the on-site computers and modems and replaced receive antenna parts at Cedar Island. We are

continuing to upgrade the sites to perform autonomous self-checks and preventative maintenance and to automatically send e-mail notification when a problem is detected. These actions have lowered the number of on-site visits required to each CODAR site.

The final long-range system originally was going to be installed at Fort Story. However, as stated in the last performance report, we encountered EMI problems with the site's proximity to a U.S. Navy installation. The Back Bay National Wildlife Refuge site was tested and found suitable, but installation costs for power were prohibitive. An alternate site at the NAS Oceana Dam Neck Annex in Virginia Beach, VA was identified. This site has power and a structure suitable for sheltering the CODAR system. We anticipate the site being fully operational in October.

The two standard-range CODAR systems installed in the Chesapeake Bay are located on the fourth island of the Chesapeake Bay Bridge Tunnel and at Community Beach, Ocean View, VA. Both sites are fully operational and streaming data. They are the only CODAR systems operating in the Chesapeake Bay. Two NOAA-owned systems were removed due to lack of funding.

Team members attended the CODAR Ocean Sensors training in May 2007 in Mountain View, CA. The training provided detailed information on maintaining and configuring the CODAR systems.

The CODAR status web page on the CODAAC website which shows the status and history of received radial files is located at the following URL:
http://coastal.wff.nasa.gov/index.php?module=static&file=/codar/radial_status

The high frequency radar systems (CODAR) have met all performance goals and objectives for this reporting period.

IV. Coastal Ocean Bio-optical Buoy (COBY)

Goals and Objectives/Achievements:

Goals: Deployment and maintenance of a Coastal Ocean Bio-optical Buoy.
Achievements: The COBY buoy has been completed and is ready for deployment.

The Gilman Corp. 3-meter COBY buoy system was completed and awaits deployment at Wallops Island, VA. The COBY design employs a surface-mounted profiling system designed by researchers at the University of Washington. (See Dunne, et al., J. Atmos. Oceanic Tech., 19, 1709-1721, 2002.) The winching system will lower a bio-optical cage designed by WetLabs. The OASIS-style command and control computer operates the winching system. Relative humidity, wind speed and direction, air temperature and atmospheric sensors were installed on the superstructure and integrated into the computer system. The WetLabs data handler (DH4) data stream has an interface into the data management software. All sensors

are integrated into the data management system, which utilizes the OASIS software. These data are available on the CODAAC web site, at the URL: http://coastal.wff.nasa.gov

Figure 5. *COBY Control Computer/Solar controller compartment on buoy deck without top cover.*

The command, control and communication aspects (Figure 5) will be the same as on the OASIS platforms (Iridium, Freewave and cellular modem communications). The only quote we received for property insurance for the COBY was cost prohibitive. We are negotiating with Lloyd's of London for a lower rate if we deploy the COBY closer to shore.

V. Cross Shelf Surveys

COBY transect cruises (Biweekly/Monthly)

Goals and Objectives/Achievements:

> **Goals:** Conduct biweekly cross-shelf transects to monitor short-term seasonal and long-term variability along the coastal ocean.
> **Achievements:** We conducted eight cross-shelf COBY cruises.

Cruise Logistics/Planning

Efforts have continued on a time series of biological, physical and optical data over the COBY transect, extending from Chincoteague Bay to approximately 40 km offshore of Wallops Island, VA. These cruises, conducted on the Marine Science Consortium's R/V Phillip N. Parker, continue to be collaborations between researchers at NASA Wallops Flight Facility, Goucher College, Kutztown University, Millersville University and York College of Pennsylvania.

Eight COBY transect cruises were completed during the previous six months, bringing the total number of transect cruises to 30 as of the end of August 2007. Weather conditions, mainly high seas, limited the number of cruises completed from March through May. However, the start of summer brought calmer seas that allowed for more cruises. All cruises consist of five standard stations (Figure 6).

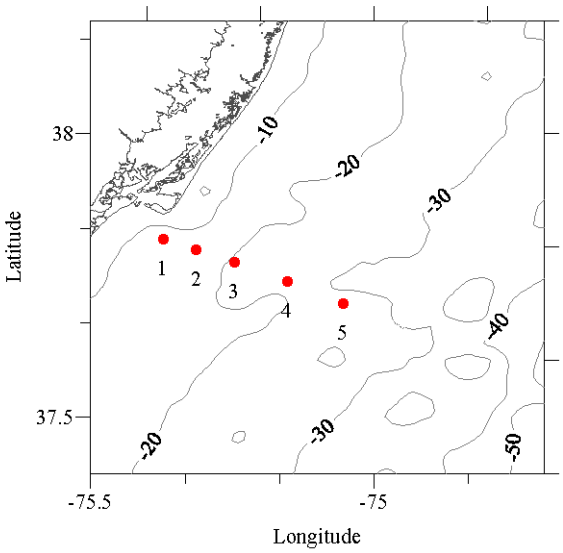

Figure 6. *COBY transect cruise stations.*

Data Collection

Cruises typically included marine technologists from EG&G Technical Services, students from Kutztown University and Millersville University, researchers from Goucher College and York College of Pennsylvania, a post doctoral fellow from Hampton University and interns from NASA who were participants in the Science Technology Engineering Pipeline for Underserved Populations (Step-Up) program. At the five continuously monitored cruise stations, researchers collected water samples for laboratory analyses, performed vertical phytoplankton and zooplankton tows, and deployed a free-falling radiometer, CTD system and IOP package. At the near shore stations, an epibenthic trawl was deployed to collect horizontal tows just above the benthos for zooplankton analysis. Measurements collected on the COBY transect cruise effort are indicated in Table 1.

The acoustic Doppler current profiler (ADCP), deployed in September 2006, was recovered in June of this year. The ADCP was continuously logging data on current profiles and scatter throughout the water column at Station 5. Due to technical difficulties, the trawl-resistant ADCP frame was not recovered from the bottom. Therefore, not only will the ADCP need to be cleaned, but also a new frame must be fabricated for the next deployment of the ADCP.

Table 1. *COBY Transect cruise measurements.*

Institution	Measurement	Instrumentation/Method
NASA/EG&G	Irradiance	Biospherical Instruments PRR-800
NASA/EG&G	Volume Scattering Function	WET Labs ECO-VSF
NASA/EG&G	a(total), a(particle), Backscatter	WET Labs ac-s
NASA/EG&G	a(CDOM)	WET Labs ac-9
NASA/EG&G	Fluorescence (CDOM, phycoerythrin, chlorophyll)	WET Labs ECO Triplet fluorometer
NASA/EG&G	Backscatter	HOBI Labs Hydroscat-2
NASA/EG&G	Nitrate Concentration	Satlantic ISUS Nitrate Sensor
NASA/EG&G	Conductivity, Temperature, Depth	Seabird 49 CTD
NASA/EG&G	Absorption (particulate, detrital, phytoplankton	Perkin-Elmer Lambda 800
NASA/EG&G	Chl a (by fluorescence)	Turner Fluorometer
NASA/EG&G	Pigments (HPLC)	Outside laboratory (Horn Point Lab)
NASA/EG&G	Physiology	Walz PAM fluorometer
NASA/EG&G	Abundance, Taxa	Olympus BX-51 microscope
NASA/EG&G	Abundance, Taxa	Olympus BX-51 microscope
NASA/EG&G	Nutrients (NH_4, NO_3, NO_2, PO_4, Si)	Outside laboratory (Horn Point Lab)
NASA/EG&G	Species Composition	Phytoplankton Net, 20µm
NASA/EG&G	Primary Productivity	Photosynthetron, Scintillation Counter
NASA/EG&G	POC/PON	Outside laboratory (Horn Point Lab)
NASA/EG&G	Current profiles	ADCP
Goucher College	Epibenthic zooplankton	Epibenthic sled
Millersville University	Zooplankton distribution, seasonality	Vertical tows
Kutztown University	Zooplankton distribution, seasonality	Vertical tows
York College	Picoplankton	Molecular techniques

Data Processing

In addition to completing eight COBY transect cruises, processing continues for samples collected on previous cruises. All cyanobacteria samples have been enumerated and sized from all BIOME and COBY cruises. Additionally, the cyanobacteria data have been plotted

to create depth profiles for each station sampled and contour plots for each transect sampled. Examples of these plots can be found below (Figure 7, Figure 8). Physical oceanographic data will be analyzed to determine if relationships exist between temperature, salinity or nutrient concentrations and cyanobacteria biomass and/or abundance.

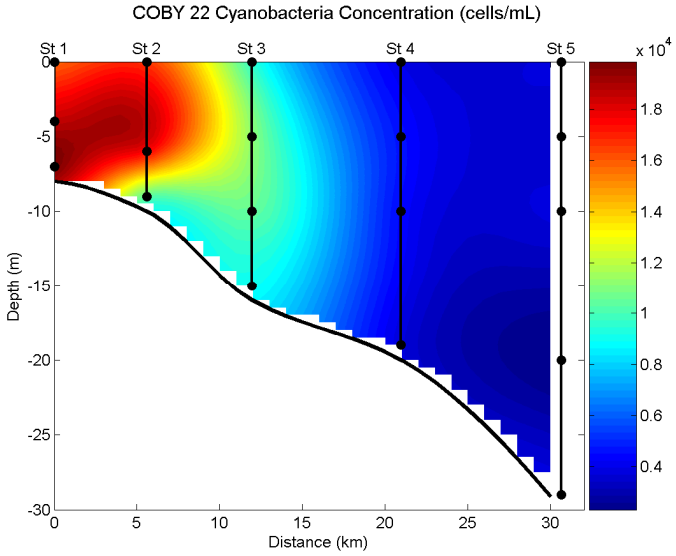

Figure 7. *A contour plot of cyanobacteria concentration from the COBY 22 transect.*

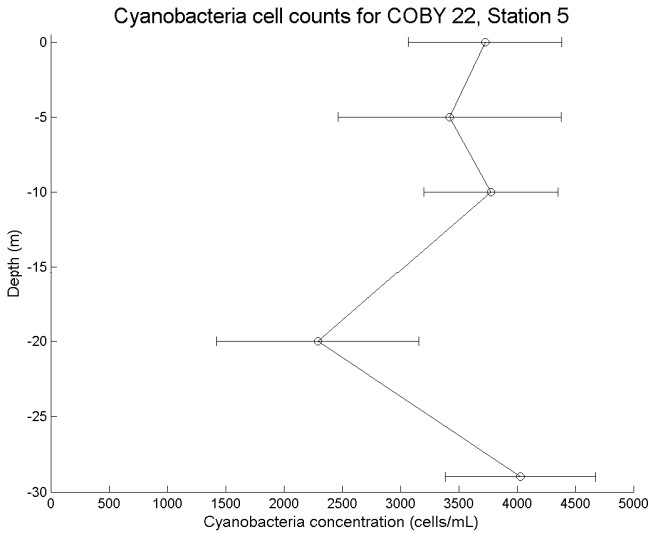

Figure 8. *A cyanobacteria concentration profile from COBY 22, Station 5.*

Nanoplankton samples are being processed to identify the phytoplankton community structure and diversity. BIOME 2 nanoplankton slides were counted and analyzed, and the remaining slides from other BIOME and COBY cruises are being processed. From these data, diversity indices for the region will be calculated and correlations to physical (salinity, currents, temperature and nutrients) and biological data (zooplankton community structure) will be investigated. Seasonal patterns also will be examined.

All fluorometric chlorophyll samples have been analyzed, and the data have been processed. Time series plots of chlorophyll data were created to study seasonal and annual variability. Data were organized into text files and incorporated onto the CODAAC web site for use by COBY collaborators at:

http://coastal.wff.nasa.gov/index.php?module=static&file=/coby_cruise/coby_chloro.txt

Most absorption samples were run through a Lambda 800 spectrophotometer.

Nutrient, POC/PON and HPLC samples from all BIOME cruises and most COBY cruises (except for the 50 most recent samples) have been processed at the University of Maryland, Horn Point Laboratory (HPL) analytical services facility. Surface contour plots for some stations have been created, and the remaining data will be analyzed in the coming months. Surface contours show higher nutrient concentrations in the Chesapeake Bay plume region, as expected (Figure 9).

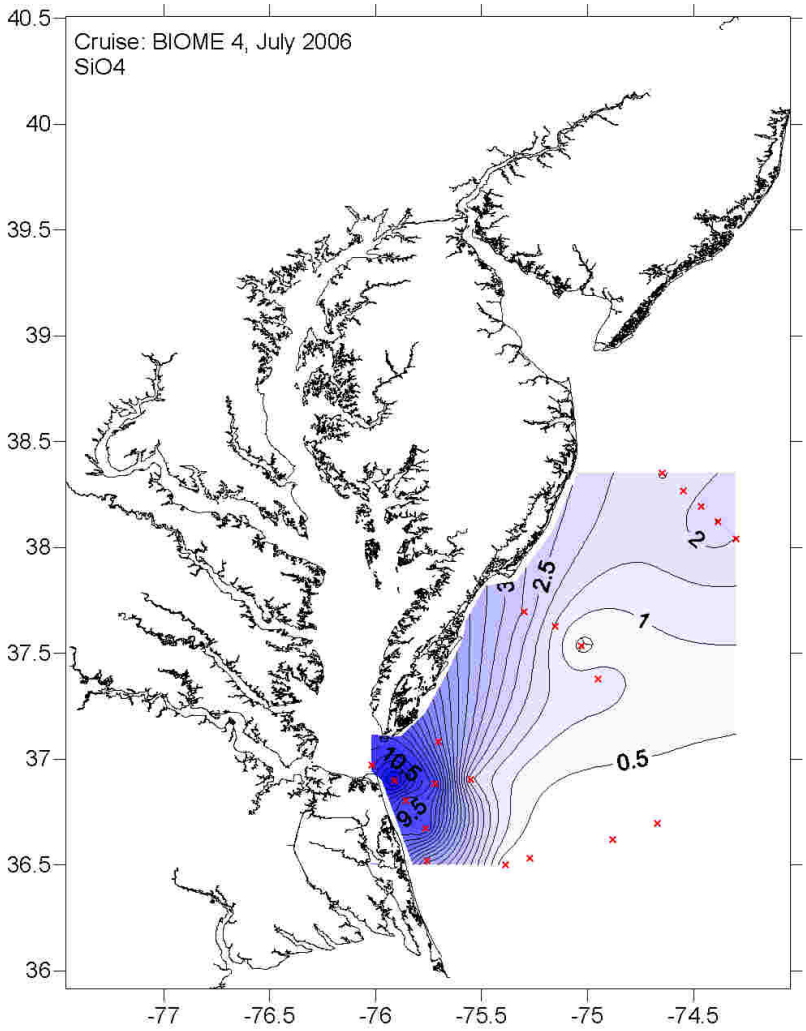

Figure 9. *Surface silicate concentrations from the BIOME 4 Cruise.*

All data from the CTD and IOP rack were downloaded and processed. Data from the radiometer have been preprocessed, but solutions to remove the effects of tilt and roll from the data are being investigated. Dr. Nobuaki Ohi, a postdoctoral fellow from Hampton University, correlated backscatter data from the BIOME cruises with other collected data. Figure 10 shows non-algal absorption and backscatter in the Chesapeake Bay plume region as well as offshore waters sampled during BIOME cruises. No relationships between chlorophyll a and particulate organic carbon have been detected with backscatter.

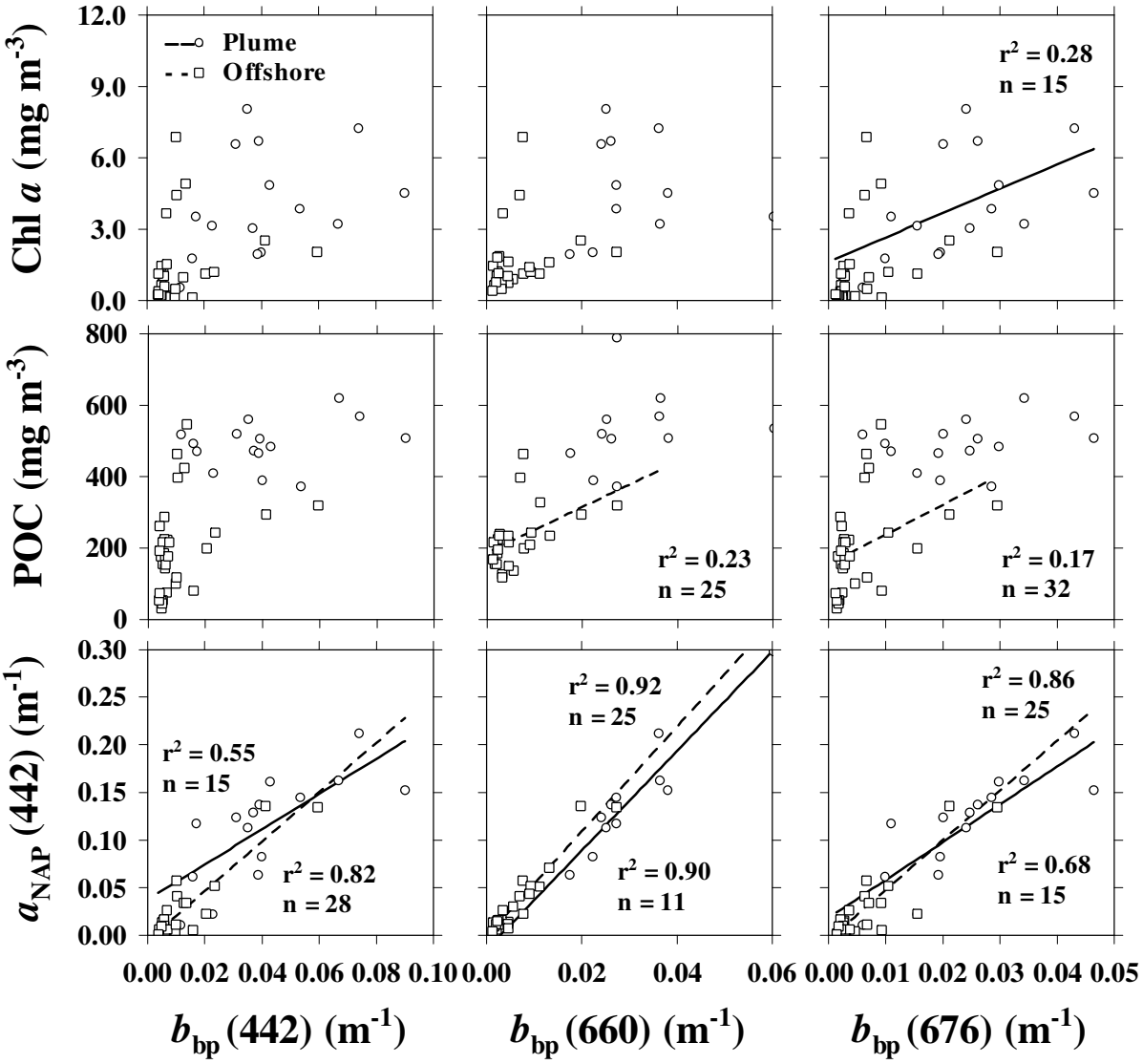

Figure 10. *Plots correlating backscatter data with Chl a, POC, and absorption data from BIOME 2, 3, and 5.*

Time series plots of CTD data were continuously updated throughout the COBY transect effort for Stations 3 and 5 to investigate seasonal and annual variability (Figure 11, Figure 12). Plots from both stations show definite stratification developing in the late spring/early summer and mixing beginning in October/November. In addition to these plots, data have been uploaded to the CODAAC website and are available as depth profiles for each station at:

http://coastal.wff.nasa.gov/index.php?module=static&file=/coby_cruise/ctd.html

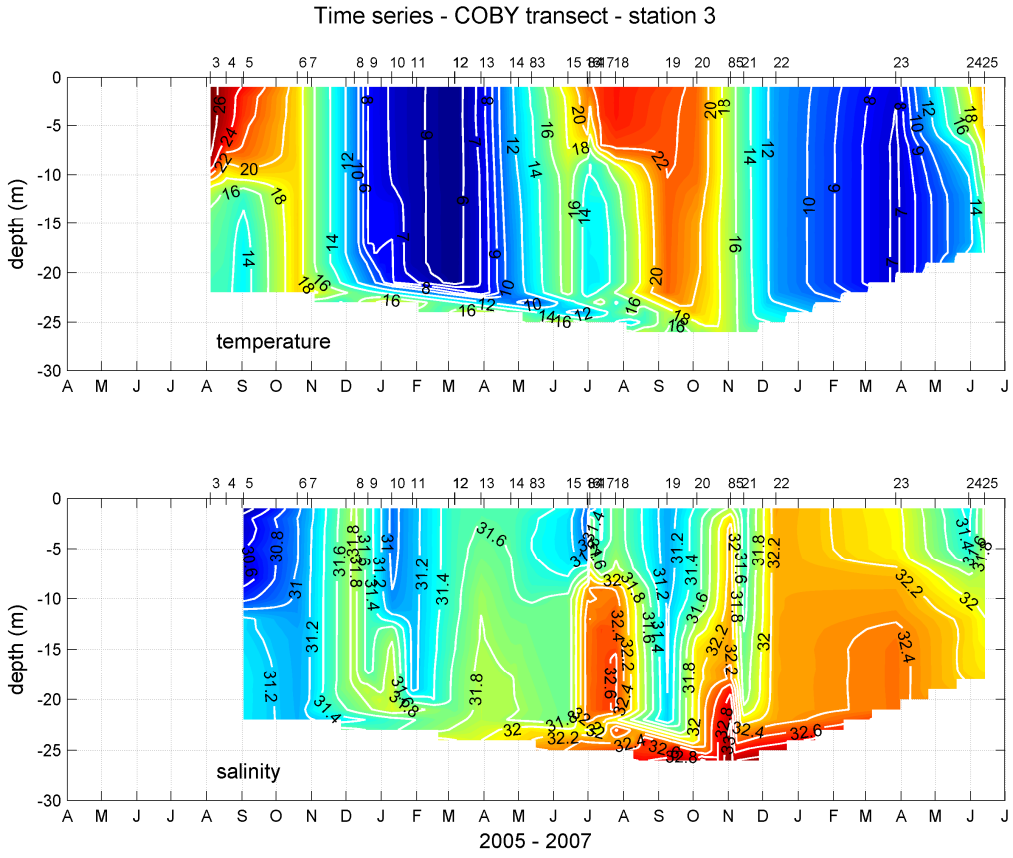

Figure 11. *Time series plot for temperature and salinity at COBY Transect Station 3. Cruise identification numbers are indicated on the top x-axis and months are indicated by first letter on the lower x-axis.*

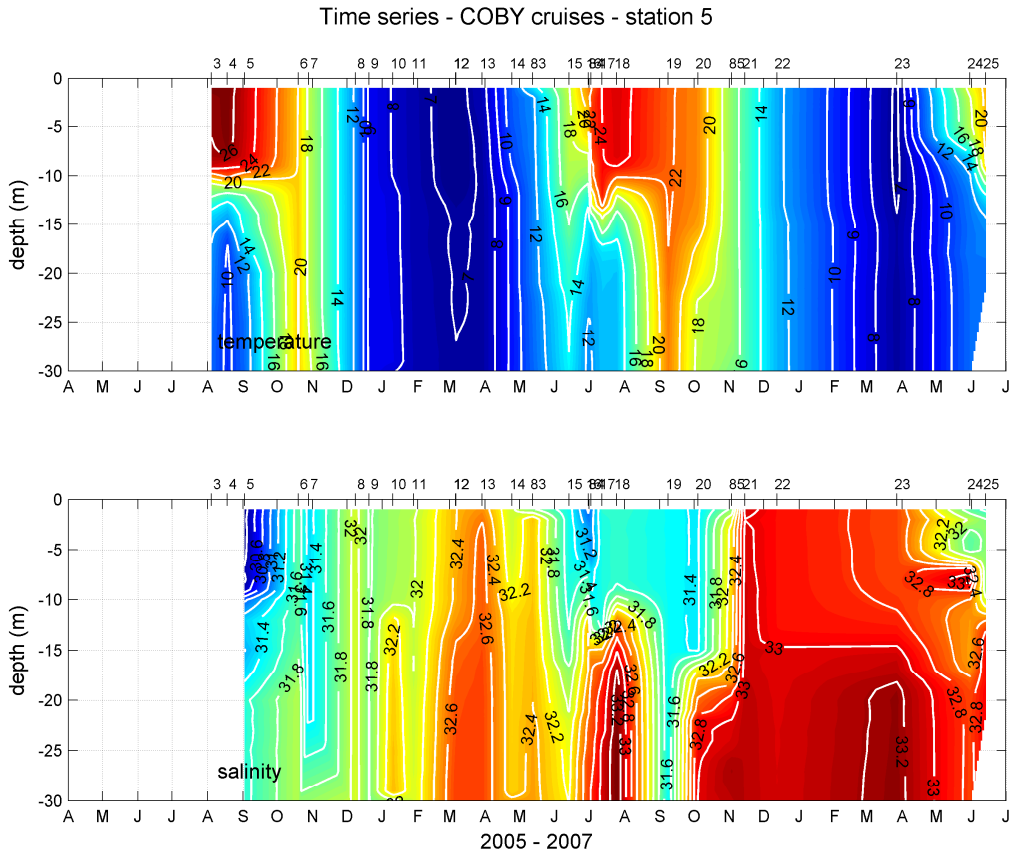

Figure 12. *Time series plot for temperature and salinity at COBY Transect Station 5. Cruise identification numbers are indicated on the top x-axis and months are indicated by first letter on the lower x-axis.*

ADCP data from both deployments (Deployment 1: January 25-July 28, 2007, Deployment 2: October 8, 2006-June 23, 2007) have been processed, and preliminary figures created (Figures 13 and 14). The data show significant events at various times of the year, most likely from storms passing through the area, as well as different water masses throughout the depths of the water column. This data will be correlated to other parameters measured on COBY cruises, including CTD data, community structure and nutrient data to determine whether these events brought in different water masses with higher nutrient concentrations, as is the case with cold-water upwelling.

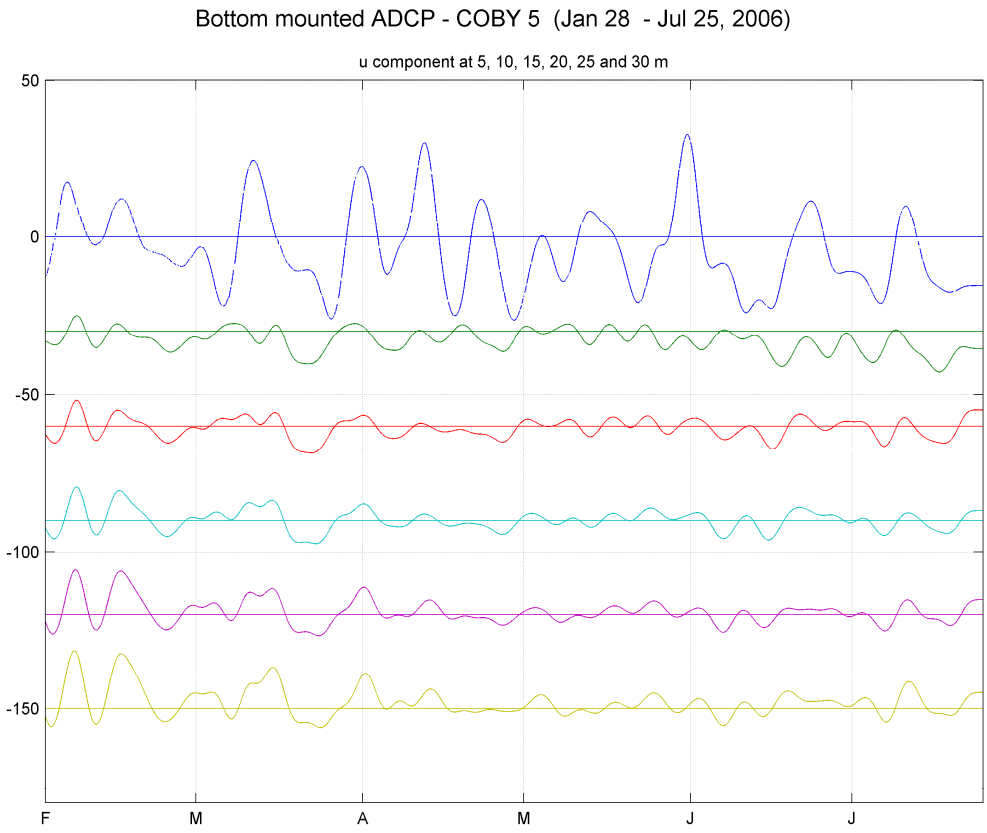

Figure 13. *U component (East-West) at Station 5 indicating stronger currents in surface waters.*

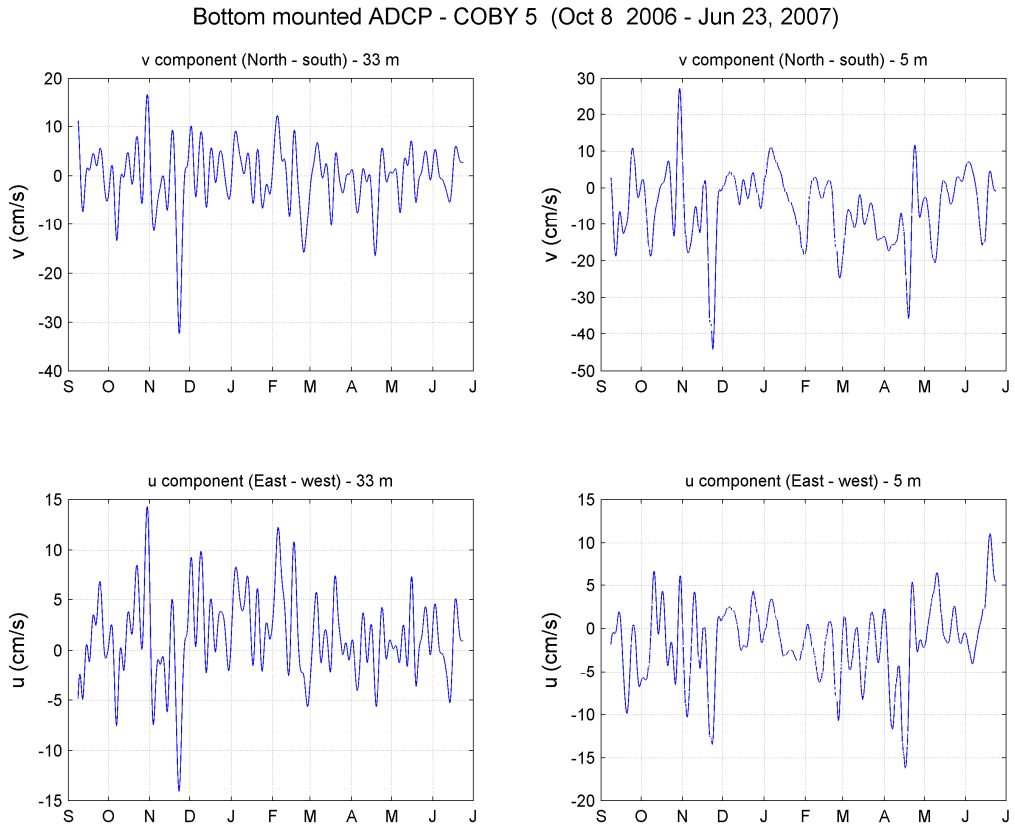

Figure 14. *Near-surface (5m) and bottom (33m) time series plots of the u- (East-West) and v-(North-South) components at COBY Station 5 throughout deployment 2.*

All cross-shelf cruise goals were met. Data assimilation from all collaborators is an ongoing process, and meetings are held periodically to discuss this effort. We have used data collected on the first 30 COBY cruises to establish a baseline, from which future data trends will be compared. Seasonal and yearly variations are better understood as a result of the current time series, and anomalies in community structure, stratification patterns or optical properties will be more apparent in future measurements,

VI. Data Archival Center

Goals and Objectives/Achievements:

Goals: Develop a standards-compliant data archival system to support open distribution of real-time observations and products.
Achievements: The data archival system ingested, archived, processed and distributed BIOME cruise data, CODAR data, COBY Cruise data, OASIS data, and the OASIS AIS data. The data archival system ingested, processed and distributed the Moderate

Resolution Imaging Spectroradiometer (MODIS) ocean color and sea surface temperature data for the Delmarva region.

Goals: Distribute CODAR observations to Rutgers University to produce the regional MACOORA surface product.
Achievements: We continue to submit the CODAR observations from the Assateague Island and Cedar Island sites to Rutgers for incorporation into the National NOAA CODAR network. Rutgers produces and sends back the Southern Mid-Atlantic raw velocity products, which are available on the Internet.

The CODAAC web site, at the URL: http://coastal.wff.nasa.gov, is providing access to CODAAC data and metadata. We made significant progress in providing updated status information and incorporating new datasets. We provide access to the following data: AIS; CODAR (in progress); MODIS sea surface temperature/chlorophyll; OASIS platform data/web cam; and BIOME cruise data (not yet public). The web site distributes U.S. fresh water flux via OpenDAP and serves as the backend for the Google Earth-based browser prototype.

The Phase 2 hardware for the CODAAC passed integration testing and is in operational use. The new hardware significantly increases CODAAC processing and storage capabilities and provides for redundancy. The Phase 2 hardware was specified with sufficient storage capacity to enable the CODAAC to serve as a backup archival site for the National High Frequency Radar Network. We are working with Rutgers University to incorporate the data archiving methodology.

The CODAAC Data Handling and Processing System (DHAPS) software was updated to ingest, archive and process the BIOME cruise nutrient data and the COBY cruise CTD data. Pending approval of the science team, we will make the raw data available for distribution. The BIOME cruise nutrient data are ingested and processed to generate plots of the individual nutrients at each station and a composite plot of all stations. The COBY cruise CTD data are ingested and processed to generate average data in one-meter bins. These data are plotted at each station by depth and temperature and are available on the web pages.

DHAPS continues to process and archive several datasets: OASIS AIS data; MODIS sea surface temperature and chlorophyll data; OASIS II platform data; and the COBY cruise CTD data. The AIS data are being transferred to the CODAAC in real time. The data are being captured and recorded in hourly datasets. The COBY cruise CTD data are ingested and processed as they become available from each cruise.

DHAPS is delivering CODAR data products to Rutgers University and the National High Frequency Radar Network. A Delmarva-region surface current product is being generated at Rutgers and is archived and displayed on the CODAAC website at the URL:
http://coastal.wff.nasa.gov/index.php?module=static&dir=/codar

Progress continues on the Google Earth-based data browser that allows users to develop their own views of the available regional ocean observing system data. From this browser, users

can view and download any of the available data. Viewable data includes: bathymetry; ocean color; ocean sea surface temperature (SST); NDBC buoy data; COBY cross-shelf and seasonal survey data; CODAR vectors; and larger-scale, courser resolution satellite data sets. Recent improvements include the integration of multi-resolution NOAA charts, multi-resolution bathometry, SST animations, and real-time weather radar. We are working to include additional observations from federal, state and academic groups collecting ocean observations in the region. We are working with MACOORA to coordinate our efforts so that each sub-regional association will be able to download the browsers that we are developing for local use. An example of this browser application is available on line at the URL: http://coastal.wff.nasa.gov.

All Data Archival Center objectives, goals and milestones are being fully met. The data archival system is in place, and it is processing the CODAR data and parsing them to Rutgers for use in the MACOORA surface product.

VII. Regional Partnerships and Outreach

Goals and Objectives/Achievements:

Goals: Develop additional educational and outreach components.
Achievements: We have expanded our educational and outreach components.

Partnerships with various agencies and universities for research and education have continued during the past six months.

We recently partnered with other MACOORA members on a winning proposal submitted to NOAA for the Regional Coastal Ocean Observing Systems (RCOOS) development. Our three long-range and two standard-range CODAR systems are an integral part of the MACOORA RCOOS. We look to build on this relationship in the future.

The collaboration with Dr. William Boicourt at the University of Maryland's Center for Environmental Science (UMCES) is expanding. We teamed with UMCES and other Chesapeake Bay Observing System (CBOS) partners to submit a Letter of Intent to NOAA in response to the FY2008 Implementation of Regional Integrated Ocean Observing Systems solicitation.

Collaboration continued with the Marine Science Consortium (MSC) at Wallops Island, VA. The MSC is coordinating the work of several undergraduate students and their professors on the CoastalObs project. Additionally, we are chartering their research vessel, the R/V Phillip N. Parker, for our COBY transect cruises.

The COBY transect cruises continue to demonstrate strong collaborative relationships between Dr. Moisan and various universities, including Millersville University, Kutztown University, Goucher College and York College of Pennsylvania. Drs. Julie Ambler

(Millersville University) and Nancy Butler (Kutztown University) have collected zooplankton samples on all COBY transect cruises and have students researching zooplankton community structure and distribution. Dr. William Johnson (Goucher College) continues to collect epibenthic zooplankton samples on the cruises to investigate the temporal changes in epibenthic community structure. The Coastal Observation group met at NASA Wallops on June 7, 2007 to discuss data progress and future plans.

Phillip Orton, a graduate student of Dr. Wade McGillis from Columbia University, has been at NASA WFF for most of the summer incorporating an air-sea flux system onto one of the OASIS platforms for testing with Dr. John Moisan and the OASIS team.

Hampton University's Dr. Nobuaki Ohi has been performing field experiments related to improving the relationship between optical and biogeochemical properties in the Delmarva coastal water. He continues to participate in all Coastal Obs cruises and perform additional testing on optical instrumentation in the laboratory as well as analysis of our POC and backscatter data.

On April 2, Coastal Obs personnel attended a Harmful Algal Bloom workshop sponsored by the Maryland Department of Health and Mental Hygiene that was hosted at Horn Point Laboratory in Cambridge, MD. The purpose of the workshop was to review current research on harmful algal blooms, discuss policy issues related to surveillance programs in the state, and discuss future directions for the program. Dr. Tiffany Moisan (NASA GSFC) and John Higinbotham (Emergent Space Technologies) gave presentations on the capabilities of OASIS in tracking these harmful algal blooms.

On July 30, 2007, the town of Dewey Beach, DE, conducted a natural disaster (hurricane) cross training initiative. We had one OASIS platform on static display, and we demonstrated our CODAR capabilities in the Monmouth County University Mobile Command Vehicle. Representatives from FEMA, DEMA and State Police, the Fish and Wildlife Service, the USCG, NIH and various local agencies received our briefing and demonstration.

We are developing additional products for the user community. Meetings are being planned with various public, commercial, private and recreational users to prioritize their needs.

Education Component

For broader public outreach, an educational display has been set up at the NASA Wallops Flight Facility Visitor Center. The display was moved from its temporary location to a permanent location with other Earth Sciences displays (Figure 15). Families and educational groups tour the Visitor Center throughout the year, particularly during the summer when the Visitor Center schedules special programs. The display is updated on a regular basis.

Figure 15. *The completed visitor's center display in its permanent location.*

ODU's Research Experience for Undergraduates program was conducted this past summer. Five interns were selected to work in the laboratories of six ODU faculty members. The students gained valuable experience to help them become decision makers in marine science. Several publications are being prepared describing results of their field work. We plan to continue this very successful program next summer.

In addition, this summer three interns from the Step-Up program were hosted at NASA WFF from June until August. They participated on COBY cruises and assisted with research in the laboratory and on the computer. The Step-Up program is a collaborative effort between NASA, Worcester County, MD, and the Lower Shore Workforce Alliance.

In March, Brian Campbell, the CoastalObs education specialist, attended the National Science Teachers Association Annual Conference in St. Louis, MO. At an informal discussion period, he presented "Coastal Observations and NASA Oceanography in the Classroom" to 36 teachers. This discussion period informed the K-12 science teachers about the CoastalObs program and available student programs and educational materials.

The educational journal "Rising Tides" was completed and received approval from the NASA Communications Materials Review. Although the NASA review process took much longer than anticipated, the journal will be uploaded to the http://phytoplankton.gsfc.nasa.gov and www.coastalobs.us web sites and copies will be distributed to area schools.

Our goal of fostering new collaborations with regional partners and developing strong educational and outreach efforts has been met for this reporting period.

VIII. Project Milestones and Schedule

Task	Milestone Date	Status
HF Radar System Design	May 2005	Completed
HF Radar System Delivery and Testing	May 2005	Completed
HF Radar System Deployment	December 2006 (Rev – October 2007)	In progress, 2 of 3 long-range and 2 standard range systems operational
HF Radar Archival System	April 2006	Completed
HF Radar System Operational	December 2006 (Rev – October 2007)	In progress
OASIS Simulator Software Completion	January 2005	Completed
OASIS Platform Sea Trials	August 2007	Ongoing
OASIS Remote Radio-Control	February 2005	Completed
OASIS GNC Test	August 2007	Ongoing
OASIS Open Ocean Field Trials	August 2007	Ongoing
Begin Additional OASIS Platform Fabrications	August 2005	Ongoing
OASIS HAB Inst. Field Tests	August 2007	Ongoing
Design of COBY	September 2005	Completed
Fabrication of COBY	December 2006	Completed
Instrumentation of COBY	January 2007	Completed
Deployment of COBY	May 2006 (Rev – October 2007)	Ongoing
Develop COBY line instrument system	May 2005	Completed
Bi-weekly COBY lines	June 2005	Ongoing
Complete Data Archival System Design for CODAR	June 2005	Completed
Carry out seasonal field surveys	March 2005	Ongoing
Deploy ADCPs for CODAR validations	January 2006	Ongoing

IX. Budgetary Analysis

The following figures are for the period 9/1/2006 – 08/31/07 (Year IV):

	Approved Funding	Expenditures to 8/31/07
Personnel	$91,556	$84,330
Fringe	$47,610	$48,561
Travel	$6,956	$1,974
Equipment	$219,682	$176,924
Subcontract	$1,250,603	$1,670,561
Other	$125,000	$26,264
Indirect	$71,830	$97,218

Our expenditures are where we anticipated they would be.

All major equipment has been procured.

The "Subcontract" expenditures include the Hampton Post-Doc. This position was originally to be funded with "Other" funds.

"Other" funds are being used to pay for the required CoastalObs property and liability insurance. We will request a reprogramming of the remaining "Other" funds in the future.

Our expenditures are on track. As of August 31, we have carry-over funds from lower than anticipated spending rates in the first three years of the project. These funds will be used to insure that all of the items in our application are completed in Year V.

X. Publications and Presentations

2007. Ambler, J.W., E. McLenegan, T.A. Moisan, J.L. Blanco, C.P. Makinen and K.VanSant. Relationship of summer cladoceran-pelagic tunicate assemblages to temperature, salinity and chlorophyll a in the Mid-Atlantic Bight. Atlantic Estuarine Research Society and Southeastern Estuarine Research Society Spring Meeting, March 15-17, 2007, Pine Knoll Shores, North Carolina.

2007. Saville-Andree, A.G., C.M. Spotts and N. M. Butler. Spatial and temporal variation of the winter zooplankton communities of the coastal waters of Chincoteague, Virginia. Poster presented at the Commonwealth of Pennsylvania University Biologists 38th Annual Meeting, Edinboro University, PA, April 13-15, 2007.

2007. Brian Campbell. Science: A River of Connections. National Science Teachers Association Annual Conference, St. Louis, Missouri, March 29-31, 2007.