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# Maritime Research Division

## Collaboration Between USC's Department of Geology and the Maritime Research Division

By Christopher Amer and Jeffery Morin

I was nestled tightly between a coring frame and a life raft two decks above the roiling sea pondering the meaning of life when the wave hit, drenching me out of my existential reverie (Figs. 1a and b). The ship that Jeffrey Morin of USC's Department of Geology, and I were on was the 185-foot research vessel *Endeavor*, a National Science Foundation vessel operated by the University of Rhode Island (Fig. 2). The occasion was the return trip to Charleston around Frying Pan Shoal off Cape Fear where myself along with SCIAA's Maritime Research Division (MRD) staffers, Lora Holland, Carl Naylor, and Jim Spirek had recovered three underwater instruments, nicknamed "Bigfoot 1 and 2" and "Mini-me."

The project was part of an ongoing collaboration between SCIAA's MRD and USC's Department of Geological Sciences that has spanned some five years.



Fig. 1b: A wave breaks over R/V *Endeavor*'s rail drenching the instruments lashed on the aft deck. (SCIAA photo)

In December of 2002, USC Department of Geological Sciences and SCIAA signed an Agreement of Cooperation designed to enable the two groups to assist each other on

applied marine research projects that would be mutually beneficial to the university, research, and scholarship in general. The collaboration makes perfect sense as many of our research interests overlap and much of our equipment can be shared. For example, a shipwreck site in the context of a barrier island may become alternately buried and exposed as the shore accretes and erodes due to natural physical forces like waves, currents, and storms. Understanding the causes and effects of these forces can greatly aid archaeologists in investigating and interpreting shipwreck sites, as well as planning strategies for long-term management of the sites. Already, partnerships with geologists and sedimentologists from both USC and Coastal Carolina University have helped archaeologists interpret the



Fig. 1a: A wave approaches R/V *Endeavor*'s rail. (SCIAA photo)



Fig. 2: R/V *Endeavor* taken from the significantly larger U. S. Navy Ship *Dahl* in Charleston. (SCIAA photo)

post depositional history of the *H. L. Hunley* site, prioritize areas to survey for the remains of Lucas Vazquez de Ayllon's lost Capitana, and survey for Confederate cannons in the waters of Charleston Harbor (Fig. 3).

This cooperation between SCIAA's MRD and USC's Department of Geological Sciences is having a much broader impact on the coastal regions of the state and the nation. Erosion of the coastlines of the continental United States is a serious national problem that poses a significant threat to human lives, property, and the environment. Locally, this is felt acutely in the rapidly developing coastal regions of South Carolina, which are plagued by severe ongoing erosion.

The Coastal Processes and Sediment Dynamics Lab (CPSD) at USC, under the direction of Dr. George Voulgaris, is currently involved in a number of investigations designed to determine the physical forces, eg. waves, currents, influencing the transport of sediment in coastal environments through continuous data collection at sites along the South Carolina and

North Carolina coasts. These projects include the South Carolina Coastal Erosion Study (SCCES) supported by the United States Geological Survey (USGS, Department of the Interior), monitoring associated with the South East U. S. Coastal Ocean Observing System (SEACOOS) funded through the Office of Naval Research (ONR), and a National Science Foundation (NSF) study designed to describe the

movement of sediments on the North Carolina shelf and how this transport defines the shape and structure of the bed forms observed. One way of visualizing sediment transport in coastal areas is through placement of instruments designed to measure concentration and particle velocity in the path of transfer. These instruments include a wide variety of acoustic devices deployed autonomously on observation platforms (SCCES, and the North Carolina bedform study) and current measuring acoustic systems connected to pier communication systems supplying real time measurements of wave features and current profile characteristics (SEACOOS).

The research projects require placement of instrumentation underwater in the regions of interest. To accomplish the goals of the projects, staff of SCIAA's MRD perform multiple invaluable tasks ensuring proper placement of observation platforms and continuous measurement systems. The coastal erosion and North



Fig. 3: Scott White, a researcher in USC's Department of Geological Sciences prepares a sub-bottom profiler for use aboard the Marine Research Division's *C-Hawk*. (SCIAA photo)

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Fig. 4: Two "Bigfoot" instrumentation platforms awaiting deployment aboard R/V *Endeavor*. (SCIAA photo)

Carolina bedform projects involve placement of sonar imaging and particle measuring instruments on observation tripods in specific types of sediment (Fig. 4). The divers assist in these efforts by conducting pre-deployment surveys of the intended sites, establishing the exact positions where the platforms will be placed for periods of months. When the platforms are recovered MRD staff enters the waters where the platforms are collecting data to locate them. A signaling device assists in the location of the platform by sending an acoustic ping to a diver operated receiver. Once the platforms are located the divers use recovery lines to attach the platforms to large inflatable buoys on the surface of the water (Fig. 5).

The continuous monitoring associated with the SEACOOS program requires placement of acoustic Doppler current profilers (ADCPs) in the vicinity of recreational piers on the coast of South Carolina (Fig. 6). These ADCPs are housed in large anti-trawl

devices manually lowered to the seafloor through diver assistance (Fig. 7). They are attached to computers on the pier, via cabling running on the seafloor, where wave and current data is sent to the CPSD lab in Columbia to be processed, archived, and posted on various web sites. Maintenance of the monitoring systems involves locating the ADCPs, disconnecting them and raising them to the surface for replacement. MRD staff rapidly locates and recovers the acoustic systems so that they can be maintained to insure continuous data collection. Data from the two ADCP units located off Springmaid and Folly piers can be accessed at



Fig 5: Dr. Paul Work, who worked with USC and USGS on the South Carolina Coastal Erosion Study, attaches a shackled lifting line to a "Bigfoot" off Myrtle Beach. (SCIAA photo)



Fig. 6: Staffs of the MRD and USC's Department of Geology recover an ADCP unit from the seabed 1,500 feet off Folly Pier. (*Department of Geological Sciences photo*)

<http://www.geol.sc.edu/gvoulgar/waves.html>.

Collaboration is the bedrock upon which successful research is built. While the coast of our state

may be as unstable as the pluff mud in its marshes and the sand of its barrier islands, the collaborative research of these two USC groups sits upon solid firmament.

## MRD's Website Recognized

By Christopher Amer

The Maritime Research Division (MRD) of SCIAA's website is now complete and on the University of South Carolina's server. Rich in content, the major themes of the website include current and past research projects, the Sport Diver Archaeology Management Program, Maritime Heritage Trails, special projects, and state legislation affecting submerged cultural resources. The website includes links to MRD research reports and newsletter articles, and includes slideshows highlighting each project. We hope the information presented will serve to inform website visitors about the diverse maritime archaeological legacy in South Carolina waters. The site can be reached via the SCIAA website

(<http://www.cas.sc.edu/sciaa/>) or by direct link ([http://www.cas.sc.edu/sciaa/mrd/mrd\\_index.html](http://www.cas.sc.edu/sciaa/mrd/mrd_index.html)). This month the MRD website became one of the top 10 notable South Carolina websites in SCIways Magazine.



Fig. 7: Marine Research Division's Carl Naylor lowers the now-replaced ADCP unit in its trawl-proof shell to the muddy seafloor off Folly Pier. (*SCIAA photo*)