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The Crest

Current Issues in Coastal Ocean and Estuarine Science

VIMS Research Helps Protect Navy Ships from Mines

VIMS scientist Dr. Carl Friedrichs is working with an international group of collaborators on a multi-year program to improve the state of the art in mine-burial prediction. The program is funded by the U.S. Office of Naval Research (ONR).

The technology of naval mines has far surpassed the floating powder kegs depicted in old war movies. Many of today's mines lie in wait on the seafloor, then detonate when they sense acoustic or electromagnetic signals emitted by vessels passing far above.

The task of Friedrichs and other investigators in the Mine-Burial Prediction (MBP) program is to develop a computer model that can better predict the likelihood that a seafloor mine will be buried by sediments, and the rate and extent of burial. Mines that are more than 80% buried are difficult for mine hunters to detect.

"The Navy needs accurate models for mine burial to help plan and carry out military operations in coastal waters," says Friedrichs. "We're working to provide the Navy with a prototype model for forecasting mine burial in strategic areas." Friedrichs, along with Ph.D. candidate Art Trembanis and Dr. Patricia Wiberg of the University of Virginia, just gave an update on that work at the 3rd Annual ONR Mine Burial Prediction Workshop in St. Petersburg, Florida.

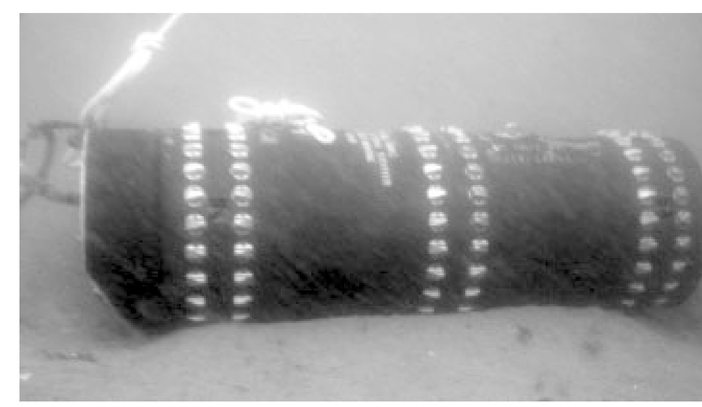

Photo courtesy M. Richardson, Naval Research Laboratory.

Researchers use inert instrumented mines to study mine burial.

Mine-burial models must be able to predict the behavior of mines in a variety of different environments. To do so, they must incorporate dynamic interactions among waves, currents, tides, gravity, and sediments, as well as the size, shape, and mass of the mine itself.

The University of Hawaii's Dr. Roy Wilkens notes that mine-burial models must also be able to forecast on many different time-scales. "Questions raised by the Fleet might range from the probability of objects burying along a particular coast during a particular season, to what might happen to objects deployed along a known beach

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Moore Goes with Flow to Monitor Water Quality and Seagrasses

A team of VIMS scientists led by Dr. Ken Moore is using new high-tech sensors to track Virginia's commitment to the water-quality standards of "Chesapeake 2000." This plan is the Chesapeake Bay Program's most recent blueprint for Bay restoration and protection, with standards designed to give Bay organisms the clear, clean water they need to thrive.

Moore's interest in water quality relates directly to his long-term interest in restoring the Bay's submerged aquatic vegetation, or SAV. These underwater grasses once covered about 600,000 acres of Bay floor, providing key habitat for numerous species of fish, invertebrates, and waterfowl. But by 1978, only 41,000 acres remained. The decline, which has been documented by VIMS researchers using historical aerial photographs, is largely due to shading of the grasses by increased levels of sediment, nutrients, and algae in the water.

"Suspended sediment and algal cells are of particular concern," says Moore. "They block light in the shallows and can severely hinder both natural recovery and efforts to trans-

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plant SAV to formerly vegetated areas."

Restoration of the Bay's submerged aquatic vegetation is a primary goal of *Chesapeake 2000*. The plan calls for a three-step approach. The first is to restore underwater grasses to 114,000 Bay acres, the area they occupied in the early 1970s. SAV coverage will then be expanded into all areas that historical aerial photographs show once had SAV. The final step is to vegetate potential habitats to a depth of one, then two meters.

Moore's Dataflow sensor is helping to identify areas in the James and York rivers where the water is consistently clear enough to support SAV growth at the depths defined in the *Chesapeake 2000* plan. This task is difficult if not impossible using present monitoring sites and methods.

"Although water quality is monitored at fixed stations in mid-channel areas of the James," says Moore, "we don't have a good understanding of conditions in the shallower areas where seagrasses grow, or how water-quality conditions vary with space and time."

The Dataflow system allows Moore's team to monitor large expanses of deep and shallow water relatively quickly, allowing them to better understand how water quality varies from place to place, top to bottom, and month to month.

Dataflow is a compact, self-contained system that is deployed during monthly cruises from a small boat operating at speeds up to 25 knots. It collects surface water through a pipe on the bottom of the vessel, pumps it through an array of water-quality sensors, then discharges the water overboard. The sensors record dissolved oxygen, salinity, temperature, turbidity, and chlorophyll—all parameters that relate to water clarity, algal abundance, and seagrass health. VIMS' dataflow system was fabricated in-house by technicians Todd Nelson and Wayne Reisner.

Britt Anderson and Ken Moore take the DATAFLOW system for a spin on the James River.

Dataflow collects one sample every 2-4 seconds, which at an average speed of 25 knots provides a data point every 40-60 yards. It sends these data to a laptop computer, along with information on location and depth provided by an integrated GPS sounder. VIMS researchers Britt Anderson, David Wilcox, and Betty Neikirk synthesize these data to produce detailed digital maps that show how water-quality varies across a study site. Bay managers use these maps to evaluate efforts to reduce pollution in Virginia's coastal waters, and to assess whether existing seagrass beds or designated restoration areas actually experience the conditions needed for seagrass survival.

To date, Moore's team has used Dataflow to produce surface maps of water quality in the tidal portions of the York and James Rivers. Funding for the York River work came from the Virginia Department of Environmental Quality. EPA funded the James River work.

The Acrobat, a torpedo-like vehicle that is towed behind a larger boat, is another newly developed instrument platform. It provides a means to sample water-quality in deeper portions of the Bay. Still in its testing phase, Acrobat can be programmed to sample along an undulating course between the surface and deeper waters, thus providing a three-dimensional view of water quality.

Moore and the other collaborators on this project, including Drs. Iris Anderson, Larry Haas, and Howard Kator, are particularly excited about Acrobat's ability to measure levels of dissolved oxygen in real time. "Deeper regions of the Bay often lack the levels of dissolved oxygen needed to support life," says Moore. "Acrobat will allow us to map these zones and to understand how they expand and contract in relation to temperature, salinity, and depth."

Dataflow data is available online through the Chesapeake Bay Program Office at www.chesapeakebay. net/data/index.htm