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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.

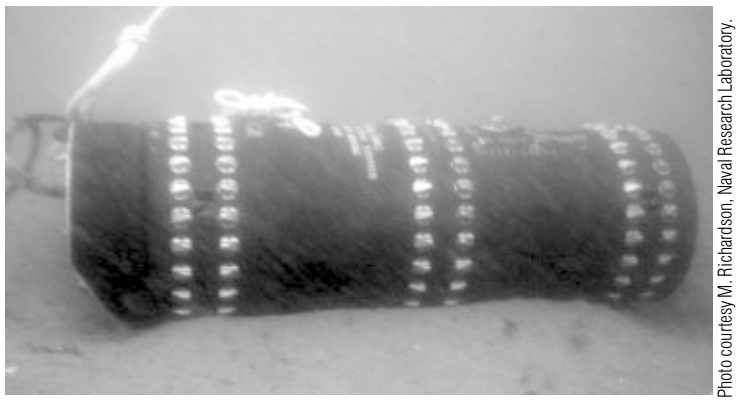

Photo courtesy M. Richardson, Naval Research Laboratory.
Researchers use inert instrumented mines to study mine burial.

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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five days previously," says Wilkens.

Sandy coastal areas dominated by waves, like many parts of the U.S. East Coast, are an area of particular strategic concern for the Navy. This is an environment that Friedrichs understands well. His research expertise lies in the physics and modeling of sediment erosion, transport, and deposition under exactly these types of highly energetic coastal conditions.

The specific role of Friedrichs' team in the MBP project is to develop 5-day forecasts of wave-generated bottom currents at MBP field sites off the Florida and Massachusetts coasts. Friedrichs then inputs the wave forecasts into a second model that predicts the rate at which scour processes are likely to mobilize sediments and bury the dummy mines used in their experiments.

Estimates of the probability of mine burial may determine whether a Navy fleet employs mine sweeping or mine hunting in a given area. Sweeping, which often involves use of a towed vehicle, seeks to activate mines across a large area by simulating the disturbances that a ship or other platform would produce if it traversed a route. In mine hunting, a remotely operated vehicle confirms the presence of an individual mine, then physically disarms or destroys it.

"Our field sites provide ideal laboratories for testing forecast models for mine burial by scour," says Friedrichs. During tests, the researchers deploy dummy mines on the sea floor in 10 to 40 meters of water. These mines have optical sensors that let them "see" whether and how fast they are being buried. At the same time, the scientists search for the mines with sonar. Comparing the optical and sonar results with concurrent model forecasts provides a good test of the model's predictive abilities.

For more information on the Mine Burial Program , visit www.vims.edu/physical/projects/CHSD/projects/MBP/