



Everything Jersey

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Technology opens wider 'window on the ocean'

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Like space, the Earth's oceans present a vast canvas for discovery. And for decades, oceanographers gathered their scientific information mostly through manned expeditions.

Now researchers believe ocean research is on the verge of a great transformation, due largely to advances in technology that provide an unprecedented "window to the sea."

The oceanographer's toolbox now includes coastal unmanned robots, radar, deep sea buoys, space satellites and sea floor sensors -- most transmitting data that can be downloaded into a laptop.

"When you have technology like this, it can literally change your whole view of the ocean," said Oscar Schofield, a biologist from California who has studied sea life in the Antarctic. "We are at the dawn of a new age."

Schofield is part of a small group of Rutgers University researchers from the school's Institute of Marine and Coastal Sciences who spent the past decade building a model system for the science of ocean observation.

"What New Jersey has done is an example for the whole country," said Richard Spinrad, an assistant administrator of the National Oceanic and Atmospheric Administration in the office of oceanic and atmospheric research. "That Rutgers crowd knows what it's talking about. The idea is to take what has been done there and expand it."

The government also is prepared to increase spending for marine science. President Bush's proposed budget for the next fiscal year would allocate \$309.5 million for the National Science Foundation to build the "backbone" of an ocean-observing system at key sites along the nation's coasts.

The funding, under the auspices of the NSF's Ocean Observing Initiative, would support three major projects:

- Expansion of Rutgers' undersea observatory network encompassing the East Coast.
- An ocean observatory in the deep ocean off California called MARS (Monterey Accelerated Research System), led by the Monterey Bay Aquarium Research Institute.
- Construction of an undersea grid of power and optical cables called NEPTUNE (North East Pacific Time-series Undersea Networked Experiments) near Washington state and British Columbia to view unusual seascapes, such as super-hot underwater vents.

As a host institution, Rutgers is expected to receive a sizable chunk of funding -- at least several million dollars. Beyond the scientific payback, experts see many practical benefits to the massive research project, from zeroing in on sources of pollution to rejuvenating and replenishing fish stocks.

'WINDOW FOR THE SEA'

Since man began studying Earth's vast oceanscape, it has been through contained expeditions at sea. Now it is a 24/7 analytical science with the technological ability to cast an expansive observational net into the oceans.

"We used to go out there, bobbing around, and take as many measurements as we could, knowing it was only a drop in the ocean of what was really going on," said Kevin Johnson, an assistant professor of oceanography at the Florida Institute of Technology in Melbourne. "The future of oceanography, though, is all about observation, prediction and tying it all to climate."

J. Frederick Grassle hatched the idea for "a permanent window for the sea" with his colleague Christopher van Alt on a barroom napkin in 1986. They were celebrating the 50th anniversary of the manned submersible craft called "Alvin."

Van Alt had been the chief engineer on the Alvin mission to find the Titanic.

Grassle, a renowned Woods Hole Oceanographic Institute scientist, left Massachusetts three years later to create and head Rutgers' Institute of Marine and Coastal Sciences.

The problem with oceanography, Grassle and van Alt agreed, was that the most interesting things happened when ships could not or should not be out. Known as "events" by scientists, these include storms, undersea volcanoes, river plumes and upwellings -- when cold water forces its way from the bottom to the top of the ocean, drawing fish for miles.

Unlike land, where change is constant because its surface is continually buffeted by winds and weather, the ocean is altered on a far slower scale. Oceanography, Grassle argued at the time, was taking snapshots when it should employ a 3-D movie camera. Somehow, scientists had to be inside the ocean at all times.

They needed to invent undersea sensors that could be linked.

When funds were allocated for the Institute of Marine and Coastal Sciences at Rutgers, Grassle made sure he had enough left over to install a satellite dish on the roof and to purchase a huge undersea coaxial cable, which he promptly stored. He knew he someday would need it.

Since the scientists still needed an at-sea presence, Rutgers in the early 1990s re-occupied an abandoned Coast Guard station in Tuckerton as its field station and an empty coastal area that had been the proposed site two decades earlier for an offshore floating nuclear power plant.

Working with Woods Hole scientists, the group installed its Long-Term Ecosystem Observatory, known as LEO, five miles from the shore and 48 feet below the surface on the soft sand in 1992. The cylindrical sensor, connected to the Tuckerton research facility by Grassle's coaxial cable, beamed back readings on salinity, oxygen, chlorophyll, pressure, temperature and currents. At the same time, the group was developing underwater, unmanned robots they eventually called gliders.

Gliders don't "swim," they decided. They "fly."

During this period of growth and invention, Grassle hired, among many talented young researchers, Scott Glenn, a physicist from Harvard, and Schofield, the California biologist. The pair started talking during Schofield's job interview at Rutgers. They have never stopped.

The scientists and their colleagues lived full-time at Tuckerton in the summer, boating along the coast, and "working seven days a week, 18 to 20 hours a day," Glenn said. "We said, 'There's got to be a better way.'"

Sitting recently in their coastal ocean observation laboratory in New Brunswick, known to faculty and students as the "COOL Room," Glenn and Schofield pointed to laptops containing data flowing in from instruments in or near the sea. "I can sit in my dining room and do this, too," Glenn said.

Rutgers University's marine scientists say they have found practical applications for their work. The U.S. Coast Guard is refining its search-and-rescue processes-based radar readings of currents compiled by Rutgers scientists, rather than relying on historic tidal charts.

Engineers at Public Service Electric & Gas Co. are improving their ability to predict peak energy demands during summers at the shore by using Rutgers' meteorological predictions of how intense the cooling sea breeze will be.

"It's an exciting time in the oceans," Grassle said.

Tomorrow: A high-tech experiment at sea with unmanned robotic gliders.

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