Building Them Tough and Bringing Them Back

WHOI celebrates the 50th anniversary of its pioneering Buoy Group

On Dec. 11, 1960, a group of scientists, engineers, and technicians from Woods Hole Oceanographic Institution set a doughnut-shaped buoy into the waters off Bermuda. Anchored by a line to a pair of old train wheels, the buoy remained in place for 79 days. No record was made of what scientific instruments, if any, were attached to the mooring line; but this modest endeavor, WHOI buoy station #001, marked the beginning of the WHOI Buoy Group—and a new era in physical oceanography.

In the 1950s, the renowned oceanographer John Swallow invented instruments to float in the depths and measure currents in the ocean's interior. In 1959, he set out six in one location. "He assumed he would have no problem tracking them because they would all go the same way," said Scott Worrilow, who joined the Buoy Group in 1978. "Well, the floats went this way, that way, that way, and that way," Worrilow said, pointing his arms in every direction. "It was an eye-opener, for him and everybody, who said, 'God, the ocean is much more complex than we thought.' "

Under the direction of physical oceanographer Bill Richardson, the Buoy Group set out to develop ways to discover what was happening far beneath the ocean surface and to explore the complex interactions between sea and air. Their tools of choice were anchored mooring lines, which carried current meters, thermometers, pressure gauges, and other instruments. Surface buoys kept the lines upright in the water, marked the lines' locations, and carried meteorological instruments such as rain and wind gauges.

The group quickly learned the hard way that, as George Tupper, a 43-year veteran of the group, put it, "The ocean is a tremendously hazardous place to put anything that you want to last for a while and do anything useful. The ocean wins most of the time."

Murphy's Law rules in the sea

Doing world-class oceanography requires more than world-class scientists. It also requires world-class technicians and engineers who can design instruments that will survive corrosion and pressure and battering by waves and figure out how to deploy those instruments on 3,000 meters of cable at sea and recover them months or years later.

"We were the facilitators," Worrilow said. "The scientists came up with the ideas, and we made it happen." But not that easily. The WHOI Buoy Group's "remarkable effort, which lasted over a decade, was a fundamentally experimental war against Murphy's Law," Russ Davis, an oceanographer at Scripps Institution of Oceanography, wrote in 2006.

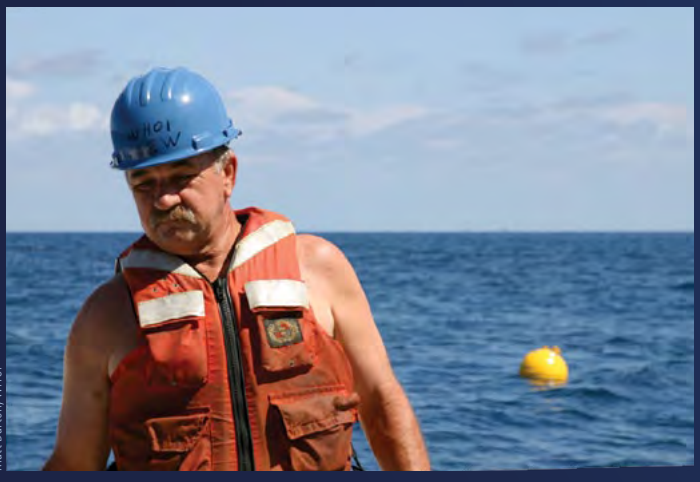
Courtesy of WHOI Buoy Project

In the early days, mooring line technicians switched from fiber ropes to wire ropes, which were stronger but prone to kinking into massive tangles called wuzzles.

At first, still learning how everything could go wrong in this punishing frontier of ocean exploration, the Buoy Group barely held its own against the ocean. In 1967, with the group losing almost as many moorings as it recovered, then-group leader Bob Heinmiller (above, right) called an "all stop," decreeing that WHOI researchers would not deploy another mooring until they figured out what wasn't working, and fixed it.

They succeeded. Within a few years, deployment times increased from two months to two years, and the mooring recovery rate jumped to 95 percent.

"For many years the WHOI Buoy Group was the leader in both technical and scientific areas," wrote Davis. "Other groups were formed around the country using methods and equipment developed by the Buoy Group and employing



Matt Barton, WHOI

Scott Worrilow began deploying buoys at WHOI in 1978 and now heads the Sub-Surface Mooring Operations Group. Above, he sets a mooring in the Gulf of Mexico in 2010.

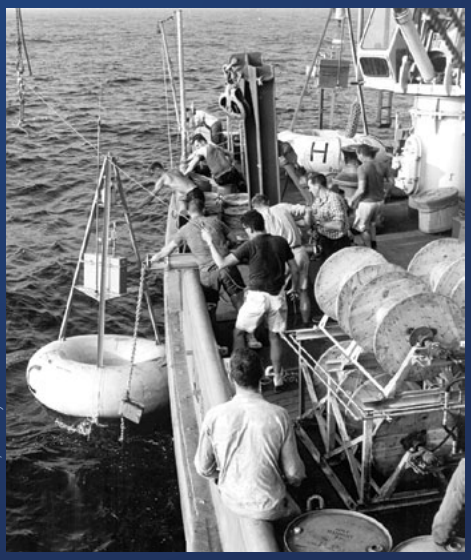
personnel trained there. At the same time, Buoy Group work motivated an interest in observations and technical developments that made new measurements possible. It was an exciting center of observational oceanography."

WHOI-led advances in mooring technology made possible the multi-institution, multinational mooring projects of the 1970s and 1980s that revealed major current systems, such as the ocean conveyor in the North Atlantic, and the air-sea interactions in the central Pacific that produce El Niño and La Niña climate events.

An online history of WHOI buoys

The Buoy Group disbanded in 1989 into more specialized subunits. But the innovation has never ceased, with WHOI technicians continuing to deploy moorings around the world and to devise new moorings to work in ice-covered polar waters, listen for endangered whales in shipping lanes, and serve as platforms for launching free-roving underwater floats.

Despite advances in satellite technology, Worrilow doubted satellites would ever provide the penetration needed for deep-water-ocean measurements. "You're going to have to have some on-site instrument that you're going to have to put in the water."

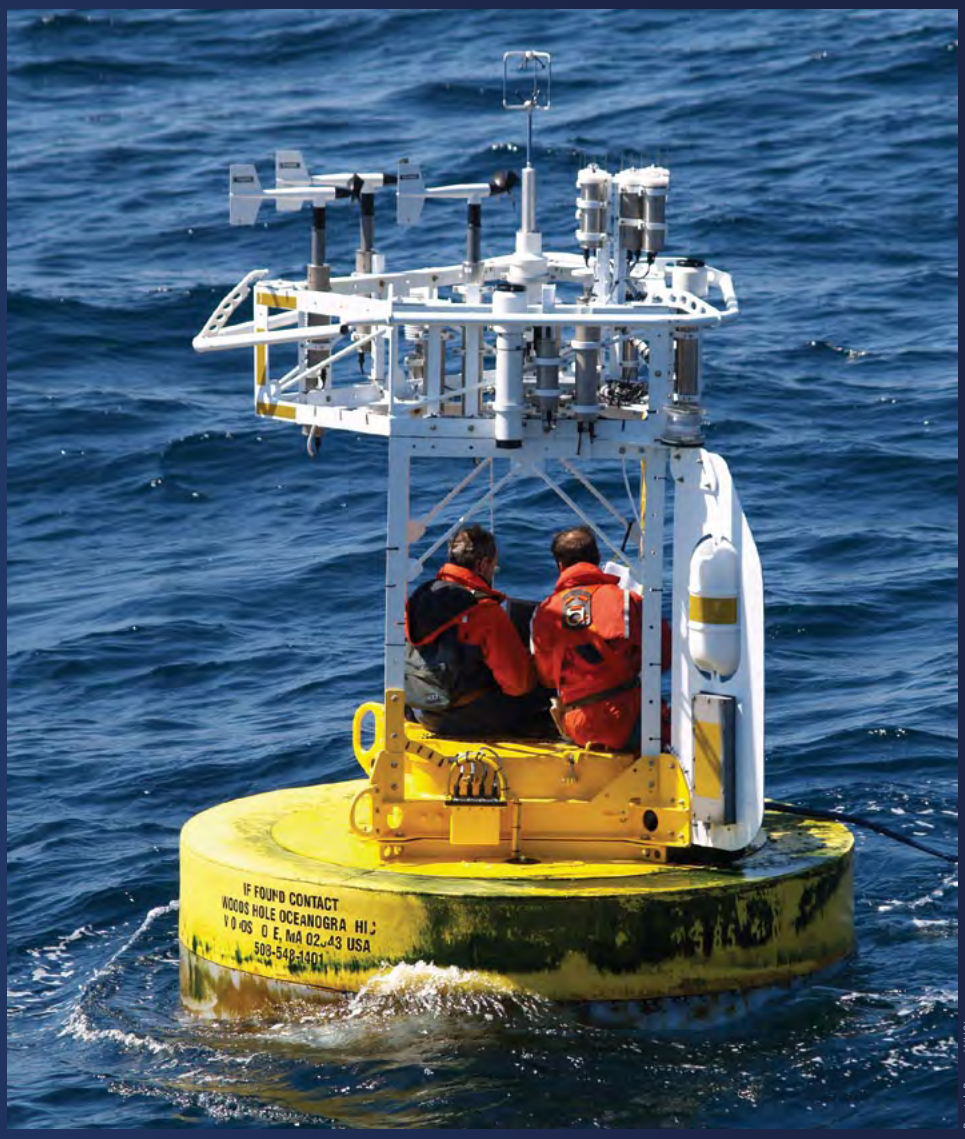


Robert G. Munns, Courtesy of WHOI Archives

And get it to work well. And make it last. And get it back. At this writing, Worrilow, who now heads the WHOI Sub-Surface Mooring Operations Group, was deploying WHOI moorings Nos. 1,239 and 1,240 off Hawaii.

Join us at *Oceanus* online as we celebrate the 50th anniversary of the formation of the WHOI Buoy Group. Go to www.whoi.edu/oceanus/buoytimeline to view an interactive timeline of the Buoy Group's adventures and accomplishments, and please check back often. We will be adding new stories and multimedia features in the coming months.

—Cherie Winner



Patrick Rowe, WHOI

Early buoys (left) were fragile-looking doughnut-shaped foam wrapped in fiberglass. Advances in design and materials produced much sturdier buoys capable of surviving months of deployment in the harshest seas. Today's buoys (above) are disc-shaped, made of epoxy-and-glass syntactic foam and sheathed in metal. They carry an array of meteorological sensors above the water and instruments on mooring lines below the surface. Above, WHOI researchers repair a buoy in the Gulf Stream that was probably damaged by a ship.

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