# Thermal Power Helps Plumb Ocean's Depths

The ocean is full of secrets. Knowledge of its movement can help scientists and researchers predict when there's going to be a drought in California, excessive rainfall on the East Coast or when crops might not make it through a season in Africa. Since the 1970s, scientists have utilized autonomous underwater vehicles (AUVs) to study coastlines, currents and ocean circulation in order to get a better understanding of climate change, pollution and marine life.

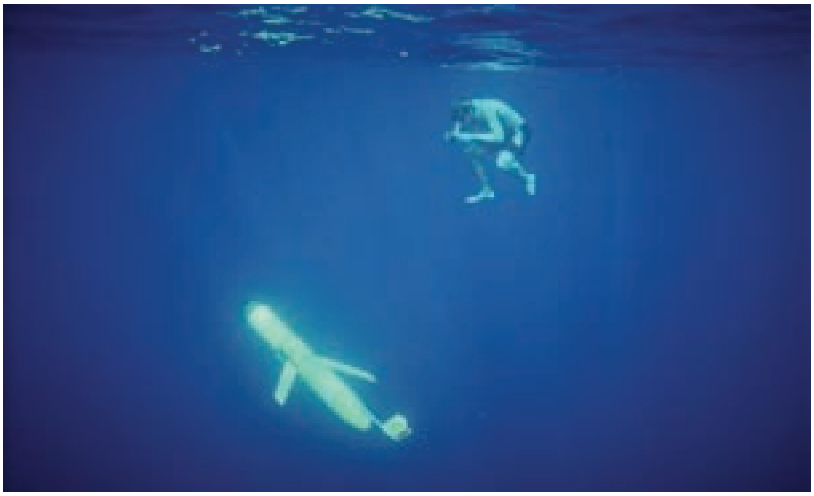
While most of these vehicles use battery-powered motors and mechanical pumps for power transmission, the Slocum thermal glider is the only one powered by the ocean itself. Named after Joshua Slocum, the first man to single-handedly sail around the world, these gliders have been used for military surveillance, oceanic research and underwater communication networks for organizations like the Woods Hole Oceanographic Institution (WHOI) and Rutgers University.

"Doug Webb retired from Woods Hole in 1982 and started Webb Research to better enable us to see into the world's oceans," says Clayton Jones, senior director at Teledyne Webb Research in Falmouth, Massachusetts. "In 1986, he sketched a drawing in his lab notebook for a thermal engine that harvests energy from the thermocline of the ocean."

Typically AUVs are motorized, propeller-driven vehicles that can only be counted on for short, aquatic trips. The Slocum gliders can endure months of rigorous testing. So much so, that the team at Teledyne Webb would eventually like to see a thermal glider travel uninterrupted around the world.

"In the early days, people didn't believe a thermal glider could work," Jones says. "Today, you might find a fleet of gliders moving through a hurricane or typhoon in a coordinated fashion."

**WHOI scientist Dave Fratantoni and postdoctoral scholar Benjamin Hodges prepare to lower the thermal glider into the ocean in December 2007.**



**David Sutherland, a student in the Physical Oceanography Department, joins an ascending glider during a test run in the Bahamas.**

In order to move through the ocean, the Slocum thermal glider relies on thermal stratification between warm and cold water temperatures. According to Jones, as the glider dives to 1,200 m, a wax-like substance freezes, making room for some oil in a flexible tube. At the inflection depth, the glider uses the accumulator-stored oil to change buoyancy and begin to rise back to warmer waters. The wax then thaws and expands, forcing the oil in the flexible tube back into the accumulator for the next dive cycle.

Slocum gliders follow a saw-tooth pattern, surfacing once in awhile in order for the data to be sent by satellite feed back to the lab. "The glider is really just a data truck," Jones says. "We're building and designing the equipment so science institutions and universities can go out there and conduct the necessary fieldwork."

Rutgers, for example, is currently "flying" a glider non-stop across the Atlantic. Jones notes that technology allows anyone with a computer to track its progress. "This moves away from traditional science as the information is available to the public in real time," Jones says. "It used to take weeks or months to get the information and write the technical papers. Technology has changed the way we look at the ocean."

With 120 gliders delivered to more than 13 countries and 40 different organizations, it seems the thermal glider sketch in Doug Webb's notebook in 1986 paved the way for some interesting innovations in oceanic research.

"Doug dreams up the ideas," Jones says, "and it's my job to help whittle them down into some form of reality and get them into the water."

For more information on the Slocum glider, visit *www.webbresearch.com*. To view the active deployments at Rutgers University, visit *www.marine.rutgers.edu/cool/auvs*.