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The little robot submersible that could

Rutgers' device glides through the Southern Ocean, keeping its cool, transmitting data home.

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NEW BRUNSWICK, N.J. - Shortly after dawn yesterday, as Rutgers University oceanographer Josh Kohut took a final bite of doughnut, a nearby computer made a sound like a phone ringing.

It was his ocean-going robot calling.

Floating 7,187 miles away in the vast waters off the Antarctic Peninsula, backed by massive snow-covered mountains, was a 6-foot-long, 115-pound yellow submersible.

Just by proving it could survive in the remotest, wildest, most hostile place a submersible robot like this has ever been deployed, it would make oceanographic history.

Beyond that, the data it and others like it could collect - even relatively simple data like temperature and salinity - will help researchers answer large questions about the ocean and global climate change. The poles are where they expect to see global warming first, and most dramatically.

A successful mission for the $100,000 robot - one of several Rutgers has in its fleet - would be another coup for a school already known for its oceanographic study.

The robot had been flown from New Jersey to California to Chile, where it was loaded onto a research vessel that traversed the Straits of Magellan into the Atlantic Ocean and got tossed by a storm as it crossed the Drake Passage.

Just off shore from the Palmer research station, one of three in the Antarctic operated by the National Science Foundation's Office of Polar Programs, a researcher slid it from an inflatable boat into the 34-degree ocean and ran it through a few tests.

Now the robot was asking Kohut what to do next.

Kohut, director of Rutgers' Coastal Ocean Observation Lab - R.U. COOL - typed a few commands into his computer. Rows of data scrolled across the screen, then stopped.

The link was dead. The robot, ru05, was submerging.

It was 7:34 a.m. at Rutgers, two hours later in what some geographers and mariners now call the Southern Ocean, the southernmost merging of the Atlantic, Pacific and Indian Oceans.

Could the robot's aluminum shell and onboard computer withstand the thrashing it would get as massive waves, unimpeded by continents, hurl themselves around the globe?

Would the intense cold drain its batteries? Would it hit an iceberg and sink forever?

Or would it keep diving and coming back up to phone home via satellite and transmit data that oceanographers have never seen from these lonely waters?

Submersibles like this are transforming conventional oceanography, said Oscar Schofield, associate professor of marine science at Rutgers. "It's a complete change in how we go to sea."

The traditional way is to get a bunch of researchers onto a vessel and take off for the horizon, moving across the surface, "trying to describe this soup that's being stirred every time the wind changes direction."

But the information they can gather from the water itself is limited by the number of times they can lower an instrument, log the data, haul it up and move to a new location. Besides, vessels are expensive and vulnerable to weather.

Over the last few decades, a technical revolution has occurred. First, satellites began to beam back pictures of the oceans. But they could see only the surface. Then researchers began to deploy buoyed underwater sensors. But those could describe only one place.

"How do you describe all the variability if you only have one point?" Schofield said.

The Rutgers submersible - a few other labs have other types - is the brainchild of inventor Douglas Webb of Webb Research in Massachusetts.

Dubbed the Slocum, after Joshua Slocum, the first man to sail single-handedly around the world, it is the first such device that doesn't need a power-hungry propeller. It's a glider.

When Kohut's computer instructs it to submerge, an onboard piston in the nose draws back, bringing in just enough water to make the nose of the glider sink. As the glider descends, wings on each side transfer the downward motion into a forward glide. At the bottom of the glider's dive, the water is pushed out and everything happens in reverse.

And so it moves, porpoise-style, through the water.

Powered by 240 common C-cell batteries - enough for about 40 boom boxes - it can stay in the water for about 30 days, changing course and calling back to download data as often as a land-bound computer directs.

Rutgers has run them in the Baltic Sea, the Irish Sea, and the Mediterranean. It has run them off Bermuda, off the Bahamas, off Hawaii and off New Jersey - "a lot," Kohut said.

Now 31, Kohut grew up near Freehold, N.J., racing sailboats along the coast, and became an oceanographer so he could stay connected to the water. He was at the launch of Rutgers' first glider, in 1998, in the ocean off Tuckerton. They had a line tied to it because they weren't certain it would come back.

Moving through the water, gulping in data, the amount of information a glider can send back is "mammoth," Schofield said.

Plus, a month of glider use might cost only $3,000, and the device itself runs about $100,000. Research vessels cost $15,000 a day to operate.

While ocean-going vessels have to run from storms, the glider can fly through them.

Rutgers has sent its gliders into the teeth of Atlantic Ocean tropical storms, into Pacific typhoons. They not only survived, but also captured valuable data.

And gliders don't get seasick.

With gliders that send data back in real time, "I can go to sea many different places at one time," said Scott Glenn, professor of marine science at Rutgers. In effect, "I can be at sea and still be with my family. I can take my children to sea."

Kohut has even communicated with Rutgers' gliders from the recliner in his living room.

Because of its mostly passive design, the glider moves, almost literally, at a snail's pace - less than one mile an hour. A side benefit is that it's not a threat to marine life, if you don't count the turtle that once tried to mate with one.

With this mission, "we're seeing the future of the Antarctic ocean observatory," Glenn said. "This is the first step in building that. How do we maintain ourselves down there? How do we have a continuous presence? It's really hard with ships. But with robots..."

At 8:23 a.m., ru05 was back up on the surface and Kohut watched data stream in.

Many of today's sensors are barely bigger than a pen, so the data collected on each glider voyage can be customized.

A thermometer on the side of ru05 showed the water temperature was 34 degrees Fahrenheit. Two more sensors measured salinity and density.

Hockey-puck-size optical sensors underneath the glider characterized the clarity of the water - clear for the most part, which told Kohut there was not much sediment. The light that bounces back to a sensor can also indicate the presence of plant life, which may also indicate the presence of pollutants.

But within two hours, reflected light coming back into another sensor showed the presence of phytoplankton in a subsurface band of water where the temperature decreased and the salinity increased.

Kohut was pleased. "The cool story is we're already seeing a gradient."

Schofield and Glenn, on a trip to China, called from Beijing and booted up their laptops to have a look.

Kohut decided to step out of the way, letting the computer take over the glider's guidance. It will parallel the coast of the peninsula, covering about 310 miles in 30 days. If it runs into ice when it tries to surface, it will submerge again and try later.

Finally, on about Jan. 31, it will be picked up by another research vessel heading to Palmer.

Shortly before noon, Kohut shouldered his backpack and headed home.

Ru05 was headed southwest.

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