Trans-Atlantic Glider Passes Spot Where Predecessor Sank

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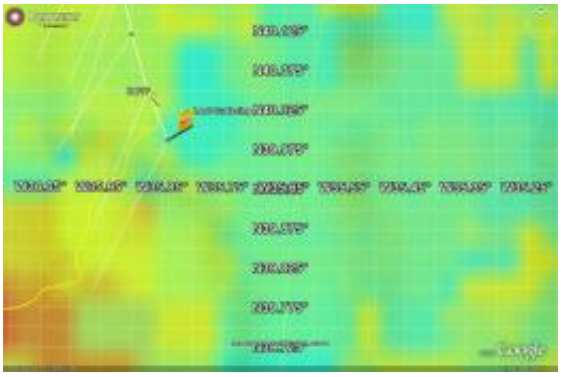

RU27 (white line and flag) has passed the final resting place of RU17 (yellow line and small flag).

(PhysOrg.com) -- On July 31, 2009, the submersible robot glider RU27, also known as the Scarlet Knight, passed east of the spot in the Atlantic Ocean where its predecessor, RU17, was lost on Oct. 28, 2008.

Scott Glenn, professor of marine science and director of the Coastal Ocean Observation Laboratory in Rutgers' Institute of Marine and Coastal Sciences, wrote in the mission blog: "Way back in April, we also started RU27 closer to shore than RU17. RU17, because of its indirect route, still has longer total distance flown. But with its more consistent speed and steering, and with the improved environmental guidance, has done much better in distance made good along a west-to-east line."

The cast of characters is the same, but much else has changed since Glenn, his colleagues and students attempted to launch a submersible robot glider across the Atlantic last year. The gliders - Slocum electric gliders, made by Teledyne-Webb Research of Falmouth, Mass. - carry sensors measuring the water's salinity, density, and temperature. The COOL crew controls them from the lab as they move very slowly from one "way point" to the next.

On May 21, 2008, Glenn, Oscar Schofield, Josh Kohut and their undergraduates in the ocean-observing class launched the first Scarlet Knight, RU17, into the water off Atlantic City. For five months and 5,700 kilometers, they rode the Gulf Stream, navigated eddies and meanders, solved numerous technical problems, and then lost the glider northwest of the Azores.

The new Scarlet Knight, RU27, was deployed off Atlantic City on April 27, 2009, and is now more than halfway to Vigo, in northwestern Spain. Like the RU17, the RU27 is modified especially for crossing the ocean - lithium batteries instead of alkaline for longer life, a longer body to accommodate a larger battery pack. But this year, the hull is coated with special paint intended to discourage aquatic critters, ranging from barnacles to remoras to squid, from hanging on to the hull. They've even practiced a new maneuver - flying backward - to help them shake off really persistent hitch-hikers. The COOL crew knows exactly how much battery life they have in the new glider - 300 days. There is an automatic on/off feature for the glider's sensors, so that the glider is not dependent on a human being in the lab physically typing in the command.

All these changes have been a help this time around, Kerfoot said. The satellite data supplied by the University of the Azores has also been valuable. But the two most important advantages may be changes in the movment of the Gulf Stream and lessons learned from last year's experience that help the COOL crew take advantage of those changes.

The Gulf Stream comes up the east coast of North America, and then starts trending east at about Cape Hatteras, Kerfoot said. But it meanders, and last year, it meandered north and south a good deal. This year, the flow pattern has been east and northeast.

"We've also learned a lot," Kerfoot said. "As long as we're watching very carefully where we are in the Gulf Stream, we have a very good feel for where we want to put the glider in relations to those high-velocity currents. It's a combination of being better at reading the data, and the shape of the Gulf Stream."

In 2008, the RU17 was beset with various critters -- "biota" in marine science lingo. Though the scientists couldn't be sure which animals were hitching a ride, they knew that some were, because the glider had trouble ascending to its pre-programed, submarine apogee. So far in 2009, the new hull paint seems to have discouraged the squid, remoras and barnacles that were a drag on the RU17's progress.

The Scarlet Knight is one of 23 gliders in the Rutgers fleet. They are ocean-observing systems, carrying various sensors in their science bays. Those sensors measure physical properties like water temperature and salinity. While the Scarlet Knight is traveling alone, her 22 sisters usually are deployed simultaneously with other ocean-observing systems, such as high-frequency radar and satellite data, to form a holistic picture of a given piece of the ocean. Satellite data might show sea-surface

temperature, for instance, and radars would show the direction and speed of surface currents. All these pieces of the puzzle are necessary, Glenn said, to understand a constantly changing ocean environment.

“The nice thing about the gliders is that they can go to extreme environments that scientists can’t go to,” Glenn said. “They can stay at sea for longer than scientists can. And they can be in more than one place at once."

The gliders move by by changing buoyancy. A small electric motor operates a pump, which sucks in water through tiny holes in the nose. The nose dips, the glider sinks, and its delta wings turn the downward motion into forward motion. At its preprogrammed depth, the pump spits out the water. The nose rises, the glider ascends, and the wings turn the upward motion into forward motion.

The glider “roller-coasters” through the water at speeds measured in centimeters per second. Every few hours, the glider pops out of the water and calls the lab with a satellite phone in its tail. It sends email, telling the lab its position and uploading data it has gathered, and then waits for instructions. The motor controlling the pump, the satellite phone in the tail that allows the lab to communicate with the glider, the movement of the rudder, even the angle of glide - all those functions rely on the batteries. Glenn is fond of holding up a plastic bag containing six Christmas tree lights to illustrate how efficient he and his students and colleagues have made the Scarlet Knight. "This is how much power the glider draws - enough to light six Christmas tree lights," he says.

Some time in August 2009, faculty and some undergraduates will go to the Azores to look at the Scarlet Knight on the surface. "We want to see it, to take pictures of it, to find out what, if anything, is growing on it," Kerfoot said.

One other new aspect to this year's attempt is that Dena Seidel, a documentary film maker and instructor in the English department's Writers' House, is working with her students to make a documentary about the project. They've been shooting in class, in the lab, on various practice deployments, and they were there on April 27 - aboard the R/V Arabella with the glider and on a commercial launch, as well.

Glider deployments depend upon the weather, and this one was delayed because of storms. But on Monday, April 27, conditions were very close to perfect as Glenn and marine technicians Dave Aragon and Tina Haskin loaded the glider aboard the R/V Arabella at the Rutgers University Marine Field Station in Little Egg Harbor Township, N.J.

They were joined by Seidel and one of her students, Alex Prister. Two more of Seidel's student documentarians, Amanda Bullis and Steve Beeston, were aboard a commercial launch. George H. Cook Campus Dean Richard Ludescher, professor of food science and executive producer of Seidel's documentary, was also aboard.

When the glider and its wheeled carriage were lashed to the deck, and the Arabella began her slow chug toward the Little Egg Inlet and the open sea, Glenn, perhaps for the first time in a long time, had absolutely nothing to do. "That's it," he said as he stood on deck watching the dock slide by. "Everything that can be done, has been done."

About three hours later, the glider slipped into the water and under the waves -- and began to fly backwards. Ludescher, who used a satellite phone to provide the play-by-play for Schofield, Kohut, their students, various staff, journalists and more of Seidel's crew back in the COOL room, stopped his commentary. "Is Scott's head exploding yet?" Schofield asked Ludescher.

As it turned out, a typo in an instruction to the glider told it to fly

backwards. The instruction was revised, and the glider flew as it should. There was applause in the COOL room, and on the Arabella, Ludescher called out, "Group hug! Let's have a group hug!" About 90 minutes later, control was passed from the technicians on the boat to the COOL room. Late on Friday, May 1, the Scarlet Knight passed over the edge of the continental shelf, having dodged fishing nets and large ships, and her pilots faced the new challenge of finding their way into the Gulf Stream.

More information: Follow the Scarlet Knight: rucool.marine.rutgers.edu/atlantic/

Provided by Rutgers University (news : web)