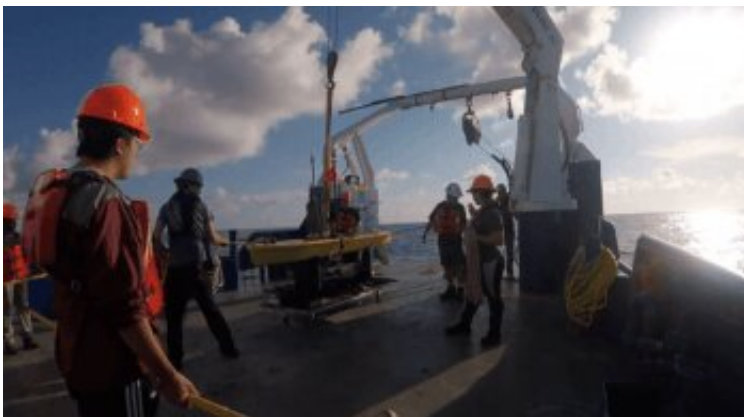


Autonomous glider withstands two hurricanes while transmitting continuous ocean data

September 28 2021, by Leslie Lee



The Texas A&M Liquid Robotics WaveGlider SV3 was deployed Aug. 13, 2021. Credit: Steve DiMarco

Today, 100 miles off the coast of Texas, a 10-foot-long yellow autonomous glider is riding waves as it patrols the perimeter above the NOAA Flower Garden Banks National Marine Sanctuary.

It is collecting water quality data related to ocean acidification, which is essential to monitoring the long-term survival of the sanctuary's unique coral reef ecosystem, and transmitting it to a research team that includes Texas A&M University System scientists.

The Texas A&M Liquid Robotics WaveGlider SV3's 90-day

deployment—the first of its kind in the U.S.—is part of a multi-institutional collaborative project funded by NOAA's Oceanic and Atmospheric Research Office Ocean Acidification Program (OAP). Project partners include the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi, Texas A&M University's Geochemical and Environmental Research Group (GERG), the Gulf of Mexico Coastal Ocean Observing System (GCOOS), Liquid Robotics, and the Flower Garden Banks National Marine Sanctuary.

But the WaveGlider's mission has been bumpier than expected. It has survived two named hurricanes—Ida and Nicholas—since Texas A&M GERG scientists deployed it Aug. 13 into the Gulf of Mexico.

"The WaveGlider was riding 16-foot swells after Hurricane Nicholas," said Steve DiMarco, professor of oceanography at Texas A&M and team leader for ocean observing at Texas A&M GERG. "Those are not seas where we want to put a research vessel loaded with scientists and students. So, that's one reason why this autonomous glider is perfect for this mission. It's the first long-term operational monitoring of a coral reef in U.S. waters using an autonomous surface vehicle (ASV)."

This feat shows the important role that autonomous systems can play in collecting invaluable ocean data—even in the face of extreme weather events, the research team said.

The principal investigator leading the project is Xinping Hu, chair for ecosystem science and modeling at the Harte Research Institute and associate professor in the Department of Physical and Environmental Sciences at Texas A&M University-Corpus Christi.

"Our lab has been working with the Flower Garden Banks National Marine Sanctuary since 2013 collecting seawater carbonate data," Hu said. "But sample collections have been mostly on a seasonal basis and

rely on the sanctuary's research vessel, the R/V Manta. The WaveGlider offers an excellent opportunity for us to continuously monitor this area for an extended period of time with unprecedented temporal resolution. We can't wait to see what the on-board sensors will reveal for the entire deployment."

Researchers work together to protect marine sanctuary

The groundbreaking work is being made possible through collaborations with several partners. DiMarco is co-leading the research, while Kerri Whilden, GERG assistant research scientist and GCOOS oceanographer, is leading at-sea logistics, sensor integration, deployment and recovery operations. Liquid Robotics technicians are remotely piloting the ASV.

The WaveGlider mission support is provided by the GCOOS glider-piloting dashboard and data portal known as GANDALF. In addition to providing real-time vehicle positioning information, GANDALF can show data layers that can be individually displayed on the base map, including visible and infrared satellite images, sea surface temperature and chlorophyll images, sea surface heights and navigational charts.

"The Flower Garden Banks is a stunningly beautiful coral reef, and it's just off the Texas coast," said Anthony Knap, director of GERG. "Not many people know about it, but it is very well known in the diving community. We're interested in it scientifically because it's vulnerable to the harmful effects of ocean acidification, which can cause bleaching and death to corals, and if the building blocks of a reef, corals, start to die, then all the rest of that ecosystem—the fish, the turtles, the whale sharks, all the life that depends upon that coral reef—could also be in danger."

DiMarco said there has been recent history of mortality events at this location.

"In 2016 there was a really bad die-off of the coral, and it was attributed to low oxygen water that bathed that coral reef and caused bleaching of the coral heads," DiMarco said. "This type of monitoring provides resource managers timely information so they can respond to future threats."

Autonomous glider gives continual data, reduces costs and risks

The WaveGlider's 90-day solo voyage is an important test run for ocean science.

If it can successfully patrol above the marine sanctuary, regularly measuring and transmitting water quality data, then a whole new set of possibilities will open up for oceanographers: remote, continual data collection that is not dependent on a stable sea-state, as research vessel voyages are.

"Our job here is to create an autonomous vehicle that we could send out on patrol instead of relying on an expensive, weather-dependent ship-based team to monitor this important reef," DiMarco said. "And since Aug. 13, our ASV team has demonstrated the operational capability to put a data-collecting system like this out there and have it patrol around."

The WaveGlider deployment from the R/V Pelican included a diverse team of scientists, technicians and students. On board from Texas A&M were chief scientist DiMarco, chemist Piers Chapman, ASV operations leader Whilden, and students Ellen Laaker, Samantha Longridge, Reshmi Joseph, Sakib Mahmud and Xiao Ge. The Texas A&M Corpus

Christi team included Hu, postdoctoral researcher Hang Yin, technician Cory Staryk, and students Molly Brzezinski, Nicole Kumbula and Kenzie Merrill.

The deployment was a one-of-a-kind experience for those students and graduate students, and the importance of their work is clear, the scientists said: if the Flower Garden Banks sanctuary is not protected from [ocean acidification](#), its corals and entire ecosystem are in danger.

Provided by Texas A&M University

Citation: Autonomous glider withstands two hurricanes while transmitting continuous ocean data (2021, September 28) retrieved 9 April 2024 from <https://techxplore.com/news/2021-09-autonomous-glider-hurricanes-transmitting-ocean.html>

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