OET/NAUTILUSLIVE

E/V Nautilus crew members used a remote-control vehicle to explore an undersea volcano off Hawaii.

Into the shadowy depths

Scientists believe exploring submerged volcanoes on Earth could help lead to the discovery of life on distant planets

By David Abel
GLOBE STAFF

NARRAGANSETT, R.I. — In the darkness of a sanctum known as the inner space center, a team of volcanologists, marine biologists, and other scientists whispered into microphones as they looked over their glowing monitors at a large projection screen, where a live feed showed a research vessel bobbing in heavy seas off Hawaii.

Atop the ship was one of the world's most advanced remotely operated vehicles, which the scientists were hoping to send some 4,000 feet below in search of signs of life along a massive underwater volcano, a dark, desolate place no human has ever explored.

The scientists, working from a University of Rhode Island chamber that looks like NASA's mission control center, were overseeing the E/V Nautilus on its 20-day expedition to survey the remote netherworld of the Pacific Ocean. The voyage was also a test for a much more ambitious goal — a potential future mission to explore oceans in distant planets where the sun's light barely reaches.

In recent years, NASA probes and other instruments have discovered these saltwater seas on Jupiter's moon Europa and Saturn's moon Enceladus, among a growing number of extraterrestrial bodies in the solar system found to have enough water to perhaps harbor life. And they believe the volcano deep in the Pacific offers a similar environment they might encounter beyond Earth.

"We're trying to understand how energy from this volcano can support life, and what that means for how life might be supported beyond Earth," said Julie Huber, a marine chemist at the Woods Hole

OCEAN VENTS, Page B6

JONATHAN WIGGS/GLOBE STAFF

OET/NAUTILUSLIVE

Bright yellow colors spotted near an underwater volcano may come from iron oxide vent deposits or iron-eating microbes.

Scientists search near underwater volcanoes

▶OCEAN VENTS
Continued from Page B1

Oceanographic Institution and one of the team's lead scientists. "The more we learn about how you get life without sunlight, the more it opens the possibilities of life in other places."

The multimillion-dollar expedition, financed mainly by NASA and the National Oceanic and Atmospheric Administration, has faced repeated delays from a succession of tropical storms and hurricanes. When the exploration vessel finally left port in Honolulu last month, Hurricane Lane whipped up heavy seas, leaving many of the scientists seasick.

When the conditions have calmed, the crew has managed to get the rover in the water and collect rocks, fluids, and other materials from vents near the summit of the submerged volcano, called Lo'ihi. The rover's cameras have also spotted the rare fish that plumb those depths, including a chimaera, also known as a ghost shark, and a grenadier, a fish that looks like a long rattail.

The scientists are mainly interested in what they find living below the sea floor, possibly single-cell organisms and other microbial life that can survive without the benefit of photosynthesis, which requires sunlight. Some of the material they have collected, once closely examined, could show organisms that were born — and survive — as a result of chemical reactions from the heat of the lava, saltwater, and iron-rich rock.

Life-forms that grow in such depths have been discovered elsewhere, most notably in ocean ridges where the collision of tectonic plates produces heat that gives rise to something called chemosynthesis. Unlike photosynthesis, that process can spark and sustain life through chemical reactions.

Scientists believe that such chemical reactions could be the building blocks of life in the oceans on Europa, Enceladus, and elsewhere in the solar system.

As the Nautilus recently took shelter from another storm behind the Big Island of Hawaii, the scientists onboard were still hoping to get in enough dives to learn whether a similar process can happen in a submerged volcano like Lo'ihi. They were also hoping to learn whether microbial life has arisen on submerged lava spewed from recent volcanic activity on the Big Island.

PHOTOS BY OET/NAUTILUSLIVE

Video manager Ed McNichol cleaned cameras that stream Nautilus's work to the world.

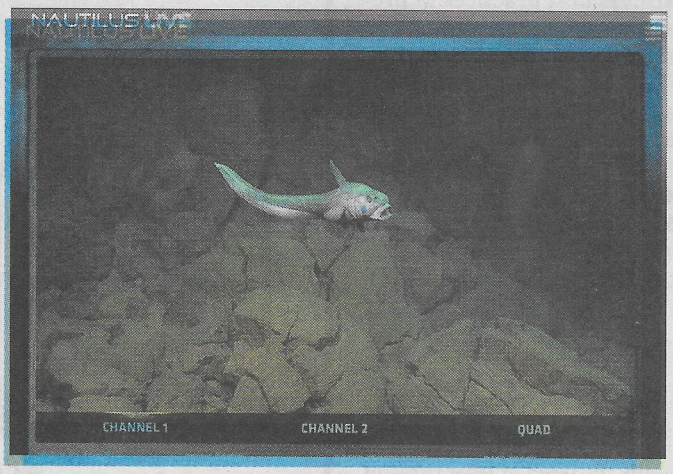
"We are on track to address our key questions," Chris German, a senior scientist at WHOI overseeing the mission on the Nautilus, wrote in an e-mail from the ship.

Those include how much heat can be produced by a volcanic eruption; how much of that heat can be converted into chemical energy; and how microbial life can grow out of those reactions.

"These are all critical to evaluating the probability to finding life on other ocean worlds," German wrote.

Inside the darkened chamber in Rhode Island, another part of the mission was unfolding: scientists studying their colleagues.

Part of the goal was to understand how different teams and remotely controlled probes work together when separated by vast distances and time zones. In a mission to another planet or moon, communications would be slow, delaying key decisions. An exchange between teams on Mars and Earth, for example, could take between eight and 40 minutes, depending on the alignment of the planets.



A rattail fish was spotted by the underwater rover's cameras, one of several unusual deep-sea species.

Matt Miller, a NASA research engineer, was inside the inner space center keeping tabs on how scientists in Rhode Island communicated with those on the ship off Hawaii.

With nearly instantaneous communication, there were no significant disruptions or epiphanies. On a similar mission planned for next year, the scientists intend to introduce a delay in their communications to see how that changes their ability to collaborate.

"If we plan to send people to deep space destinations, the ability to support them is going to be very different than today, such as how we support astronauts in low-Earth orbit," Miller said. "We need to learn how to work with long delays in communication."

At a seat beside Miller, Tamar Cohen, a computer scientist from NASA, was studying how the teams communicated online.

On Day 7 of the expedition, that collaboration looked familiar, even though one team sat comfortably in a climate-controlled building in Narragansett and the other was braving the high seas and heavy winds off Hawaii. The scientists exchanged instant messages in which both groups shared their frustrations about the weather.

"Looks like winds are up and swells are still swelling," wrote Darlene Lim, another lead scientist, to her shoreside colleagues in Rhode Island. "So we have to push launch."

"Bummer," Cohen responded.

A few days later, the team on the Nautilus was still waiting for the weather to clear.

David Abel can be reached at dabel@globe.com. Follow him on Twitter @davabel.