Deep water search for jet could turn on robot subs

April 2 2014, by Adam Geller

An autonomous underwater vehicle (AUV) sits on the wharf at naval base HMAS Stirling in Perth, Australia, ready to be fitted to the Australian warship Ocean Shield to aid in the search for missing Malaysia Airlines Flight MH370, Sunday, March 30, 2014. The Australian Maritime Safety Authority, which oversees the search, said the ship will be equipped with a black box detector—the U.S. Navy's Towed Pinger Locator—and the AUV, as well as other acoustic detection equipment. (AP Photo/Rob Griffith)

Two miles down or more and darker than night, the ocean becomes a particularly challenging place for human searchers.

If the wreckage of a missing Malaysian airliner rests somewhere in the Indian Ocean's depths, then investigators will likely need to entrust the hunt at least partly to robot submarines and the scientists who deploy them to scan remote swaths of the seafloor.

Such unmanned subs, called autonomous underwater vehicles or AUVs, played a critical role in locating the carcass of a lost Air France jet in 2011, two years after it crashed in the middle of the south Atlantic. The find allowed searchers to recover the black boxes that revealed the malfunctions behind the tragedy.

That search keyed off critical information: The search area for the Air France jet was much smaller than that for Malaysia Airlines Flight 370, and the first pieces of wreckage were recovered within days of the crash. Even then, it required two years and four deep water search missions before a team from the Woods Hole Oceanographic Institution, using an AUV equipped with side-scan sonar, located the jet about 12,800 feet (3,900 meters) underwater.

"Air France 447 is a bit different from Malaysian Air 370 in that we had a few more clues to work with," said Dave Gallo, who led the search team from Woods Hole, located on Massachusetts' Cape Cod. The independent research institution has offered its services to investigators but has not been asked to join the current search effort.

Before unmanned subs can be sent down to look for the Malaysian jet, the search zone must be narrowed considerably. The size of the search area changes daily because of factors such as currents; on Wednesday it was 221,000 square kilometers (85,000 square miles).

But if investigators can zero in on an approximate crash location, they will likely turn to AUVs to begin the methodical task of tracking back and forth across miles of ocean floor in search of anomalies that might be wreckage.

"I like to think of it as mowing the lawn. You want to cover every bit of it," Gallo said.

"You need a little bit of luck and a lot of prayer that the oceans are going to cooperate, and then off you go."

The unmanned subs used by the Woods Hole team were developed as tools to research and monitor relatively shallow coastal waters, measuring variables like salinity and temperature over wide areas for hours on end. But AUVs are increasingly harnessed to perform some of the most demanding underwater jobs.

Australian Defense ship Ocean Shield is docked at naval base HMAS Stirling while being fitted with an autonomous underwater vehicle (AUV) and towed pinger locator to aid in the search for missing Malaysia Airlines Flight MH370, Sunday, March 30, 2014, in Perth, Australia. It will still take three to four days for the ship to reach the search zone—an area roughly the size of Poland about 1,850 kilometers (1,150 miles) to the west of Australia (AP Photo/Rob Griffith)

The U.S. Navy uses them to search for underwater mines because they can stay below the surface of even very cold water much longer than any diver, without the worry of exposing a human to danger. Energy companies employ unmanned subs to survey the floor at underwater drill sites.

In 2009, California's Waitt Institute sent down a pair of AUVs that surveyed more than 2,000 square miles of South Pacific ocean bottom over 72 days in an unsuccessful search for Amelia Earhart's plane.

The area off western Australia where search planes and aircraft are looking for the Malaysian jet slopes from about 2,600 feet (800 meters) to about 9,800 feet (3,000 meters) deep. But part of the zone drops into the narrow Diamantina trench, about 19,000 feet (5,800 meters) down.

"Let's hope the wreck debris has not landed over this escarpment. It's a long way to the bottom," said Robin Beaman, a marine geologist at Australia's James Cook University.

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The U.S. Navy last week sent a Bluefin-21 autonomous sub to Australia to prepare for an eventual deep water search. That sub can dive to about 14,800 feet (4,500 meters). The largest unmanned subs used by Woods Hole researchers are built to reach depths of about 19,700 feet (6,000 meters).

Searchers can also use tethered submersibles, towed by ships from cable that allows for real-time data transmission to the surface and a continuous supply of power to the vehicle. But it is a very slow process. AUVs can scan a larger area more quickly, without being affected by conditions on the surface. But they must be brought back to the surface

to recharge, and for researchers to download and analyze their data.

Even so, they are much better suited to the job of deep water search than any manned sub, whose descents are limited by air, light and power, as well as safety concerns, said William Sager, a professor of marine geophysics at the University of Houston.

Sager recalled that in 2000, when he climbed aboard a sub and ventured 5,600 feet (1,700 meters) down to the bottom of the Gulf of Mexico, all those factors limited time on the sea floor to just four hours, moving at a crawl. A researcher looking out a porthole into even the clearest water with a very bright light can't see beyond 100 feet, he said.

Unmanned subs are far more flexible. When Woods Hole engineers built their first REMUS 6000 sub a little more than a decade ago, they tested it off the Bahamas by driving it down a trench the scale of the Grand Canyon, said Chris von Alt, who led the team that developed the craft and then co-founded Hydroid Inc., the Massachusetts manufacturer of the subs.

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The REMUS sub—nearly 13 feet long, 1,900 pounds and mustard yellow—is equipped with sonar that can be programmed to capture images of vast stretches of seafloor and the objects resting there. Powered by a lithium battery, the unmanned subs stay below the surface for 20 to 24 hours. Scientists on the surface are now able to modify instructions to the sub via an acoustic link that allows them to look at bits of data gathered by the vehicle, von Alt said.

But they don't know what the sub has found until it surfaces and its data is fully downloaded to a computer.

The task requires patience and, for researchers whose livelihoods are focused on ocean life, a willingness to harness their expertise in a grim but necessary pursuit of answers.

"That's why you do it," von Alt said. "One of (the reasons) is, 'Why did it happen?' But the other is to get closure for the families who have suffered through the tragedy."