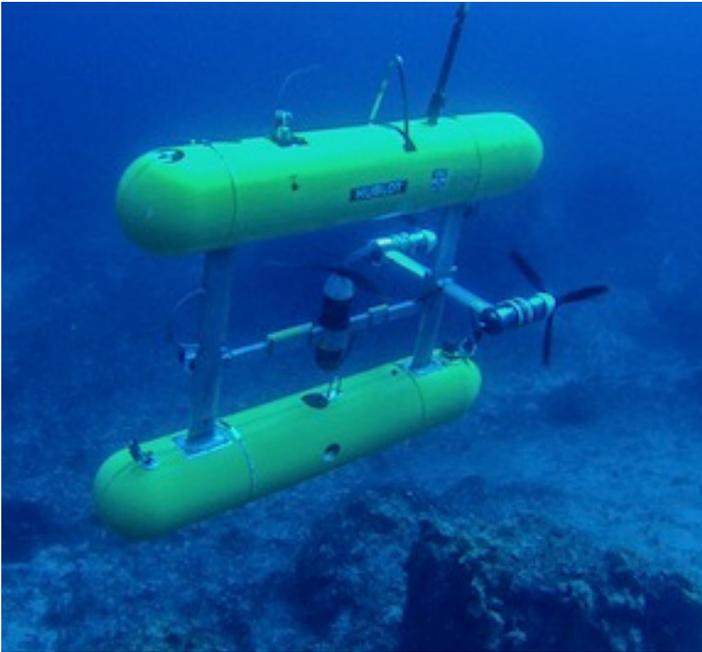




## Return to the Antikythera Shipwreck: Marine Archaeology Goes High-Tech



***Sirius descends to the seafloor near the Antikythera shipwreck to photograph the sunken boat and the surrounding site. (Photo courtesy of Phil Short, ARGO.)***

*Scientific America Editor's Note: Veteran science journalist Philip Hiltz is working with a team of archaeologists, engineers and divers off the shore of Antikythera, a remote Greek island, where a treasure ship by the same name sank in 70 B.C. New, high-tech gear is allowing the team for the first time to examine and excavate a wreck with the care and thoroughness of an archeological dig. This article is the first installment in a series Hiltz will write as the team explores the massive sunken boat and brings its bounty to the surface.*

Antikythera, Greece — The yellow, torpedo-shaped vehicles glided through the clear Mediterranean water just 10 feet above the 2,000-year-old shipwreck on the bottom. During the weekend of September 20 the autonomous underwater vehicles made 40 long passes over the area that is home to the most famous of all ancient wrecks, the Antikythera “treasure ship,” taking its picture in detail for the first time.

Researchers are now processing the data from about 50,000 photos to create a three-dimensional photo map of the site. Even though the wreck has been visited before, this is the first mapping of it and one of only a handful of 3D maps of ancient underwater sites ever developed.

The large, loaded vessel was caught in a storm some time around 70 B.C. and it crashed into a sheer rock wall along the island of Antikythera and sank. The ship carried a huge array of precious objects—the richest cache ever found in the Mediterranean—from life-sized bronze and marble statues to gem-encrusted gold jewelry, coins and the only example of an ancient analog computer, now called the “Antikythera mechanism.” (Scientific American published a feature about the computer in 2009.)

The wreck was first spotted by Greek sponge divers in 1900. Using diving suits and metal helmets of the time, the divers hauled up the first great batch of treasure. Then, in 1976, Jacques Cousteau and his team used standard scuba equipment to haul up more bounty. The wreck is between 135 and 185 feet deep, however, so divers could spend only a few minutes on the bottom before risking serious nitrogen sickness. During the foray in 1900 one of the divers was killed and two were permanently injured.

As a result, only a small part of the ship was ever examined, and no archeological work was done. Now the Greek government and the Woods Hole Oceanographic Institution have mounted a “Return to Antikythera” expedition that began in September and will continue until about October 12. I am staying with the team on the remote island throughout the operation, with access to all the divers, engineers and archeologists as they do their work. Only one other writer has similar access. The expedition is being led by Theotokis Theodoulou and Aggeliki Simossi of Greece’s Department of Underwater Antiquities, and Brendan Foley of Woods Hole.

The expedition is significant for marine archeology for two reasons. First, the spot is among the most famous of all marine sites, but it has never been properly searched, recorded and excavated. The team will correct that, and in addition, the researchers hope to find more ancient objects. On divers’ visits 114 years ago and 38 years ago, only a small portion of the wreck, perhaps 20 percent, was explored. Divers on the new team, such as Alexandros Sotiriou, will delve into the unexplored majority of the wreck.

In addition, Foley intends to demonstrate a new and efficient form of marine archeology that can explore many more sites, more effectively, to unearth the past. “Shipwrecks represent a completely different kind of information than historical records or land archeology can pro-



***The Antikythera Mechanism (fragment A) on display in the National Archaeological Museum, Athens, Greece. (Credit: Tilemahos Efthimiadis via Flickr)***

vide,” he says. They record thousands of years of culture and trade, as well as caches of objects from the everyday items to the extraordinary brass computer found at this location.

The Exosuit, developed and built in North Vancouver by Nuytco Research Ltd, allows divers to operate safely down to a depth of 1,000 feet. (Credit: Nuytco Research)

Sites can now be located by quick sonar scanning of wide areas, then photographed in detail using remote underwater robots, and then completely and accurately surveyed in a brief time. And divers can go deeper and stay far longer to excavate whatever they find on the bottom. Searching for and identifying thousands of wrecks, especially those completely unknown because of their depth, may become possible not only across the Mediterranean but in all seas.



The expedition is using an array of technologies that are relatively new to marine archeology, including robotic vehicles that can produce 3D visual maps of the bottom, and scuba “rebreathers” that allow divers to safely go deeper for longer periods. The team also is using drones to take pictures of the site from the air, and it will send down a human explorer in the latest of diving suits—the space-age-looking Exosuit that can bring a human down to 1,000 feet and stay on the bottom for up to 40 hours.

The expedition started with three days in which the survey team sent the “Sirius” autonomous underwater vehicle buzzing back and forth over the site, photographing the bottom with a pair of cameras in stereo. A team of three engineers from the University of Sydney’s Australian Centre for Field Robotics kicked off the expedition by launching the Sirius underwater vehicle, which photographed the sea bottom with a pair of cameras, in 40 overlapping lines, each about two and a half feet wide. The vehicle navigates on its own and then returns to the surface, capturing about 20,000 images in a run. The robot can sense its speed across the bottom, the movement of the water around it, its height above the bottom, and what lies ahead of it just in case it’s heading toward an obstacle. On one run Sirius encountered a huge boulder, but it slowed and tilted upward to glide safely over the rock and back to its row-on-row path.

Stefan Williams of the University of Sydney, a member of the survey team, says that a few years ago an underwater survey like this took a month to complete. Now it can be done in a couple of three-hour robot runs. Several marine archeology teams around the world are now using robot vehicles to obtain sound and visual images of targeted sites.

Williams says that as the vehicles get more compact and less expensive, and as their monitoring can be done remotely rather than having a multi-person team and a large vessel to watch over them, this kind of technology could open up many possibilities for marine archeology. In Australia scientists are already using the technology to monitor the ecology of underwater sites, year by year, to study changes over time.

This week the maps the team is producing will be used to guide divers as they begin to do a careful archeological dig on the Antikythera wreck for the first time.