

# EXPLORING THE DEEP



Throughout history, scientists have relied on a number of specialized tools to measure, map, and view the ocean's depths. These are a few highlights.

One of the first instruments used to investigate the sea bottom was the *sounding weight*. Viking sailors took measurements of ocean depth and sampled seafloor sediments with this device, which consisted of a lead weight with a hollow bottom attached to a line. Once the weight reached

the ocean floor and collected a sample of the seabed, the line was hauled back aboard ship and measured in the distance between a sailor's outstretched arms — a 1.83-meter (6 ft) unit called a *fathom*. This term is still used today for nautical depth.

Cornelius van Drebel, a Dutch inventor, is credited by many historians with building the first submarine. His underwater vessel consisted of a wooden frame sheathed in leather. Oars extending out the sides propelled the craft through the water, at depths up to 4.6 meters (15 ft). The oar openings were sealed with tight-fitting leather flaps. Drebel tested the sub in the Thames River in England between 1620 and 1624. King James I is said to have taken a short ride in the craft.

From 1872 to 1876, a landmark ocean study was undertaken by British scientists aboard HMS *Challenger*, a sailing vessel

Divers do a final safety check of Alvin's hatch before the crew inside begins the descent to the seafloor.



On the deck of the 274-foot research vessel Atlantis, scientists examine a vent chimney sample collected by the submersible Alvin.

that was redesigned into a laboratory ship. The *Challenger* expedition covered 127,653 kilometers (68,890 nautical miles) and is credited with providing the first real view of major seafloor features such as the deep ocean basins. The researchers used wire-line soundings to determine depths and collected hundreds of water, sediment, and biological samples from all the oceans except the Arctic. They discovered more than 4,700 new species of marine life, including deep-sea organisms.

Deep-sea exploration advanced dramatically in the 1900s with a series of inventions, ranging from *sonar* — a system for detecting the presence of objects underwater through the use of sound — to manned submersibles such as *Alvin*.

Owned by the U.S. Navy and operated by the Woods Hole Oceanographic Institution, *Alvin* can carry a crew of one pilot and two scientists to a depth of 4,500 meters (14,764 ft). The sub is equipped with lights, cameras, computers, and highly maneuverable arms for collecting samples in the deep, dark ocean.

In the future, with the expanded use of fiber optics, high-tech sensors, and robotics, scientists hope to observe and monitor well-defined marine systems from the lab versus out of a porthole.

The Ocean Observatories Initiative, a program of the U.S. National Science Foundation, is focusing the science, technology, education, and outreach of an emerging network of science-driven ocean observing systems to forge a new era of discovery.

As these observatories evolve, they will give researchers new eyes into oceanic events and processes, from volcanic eruptions on the seafloor, to blooms of phytoplankton at the sea surface. We'll have a whole new way of looking at the largest ecosystem on the planet: the ocean!



## GETTING TO THE BOTTOM OF IT: THE OCEAN

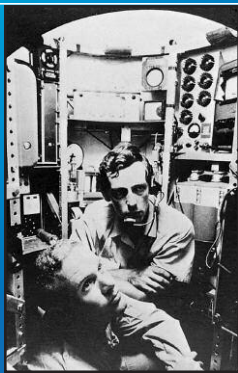
Because of the tremendous pressure, the depth to which a diver can descend without special equipment is very limited. The deepest recorded dive by a scuba diver is 318.25 m (1,044 ft).

Revolutionary new diving suits, such as the "Jim suit," enable divers to reach depths of about 600 meters (2,000 ft). Some suits feature thruster packs to boost a diver to different locations underwater.

To visit even greater depths, deep-sea explorers must rely on specially constructed steel chambers to protect them. In 1934, American oceanographer William Beebe and engineer Otis Barton were lowered to about 1,000 meters (3,280 ft) in a round steel chamber called a *bathysphere*, which was attached to a ship on the surface by a long cable. During the dive, Beebe peered out of a porthole and reported his observations by telephone to a colleague, Miss Hollister, on the surface.

In 1948, Swiss physicist Auguste Piccard began testing a much deeper-diving vessel he invented called the *bathyscaphe*. (This word is derived from the Greek words *bathos* — "deep" and *scaphos* — "ship.") On an unpiloted dive in the Cape Verde Islands, his invention, named *FNRS 2*, withstood the pressure on it at 1,402 meters (4,600 ft), but its float was severely damaged by heavy waves after the dive.

In the 1950s, Jacques Piccard joined his father in building new and improved bathyscaphes including *Trieste*, which dived to



In 1960, Jacques Piccard (top) and Donald Walsh made history when they descended in the bathyscaphe Trieste to the bottom of the Mariana Trench.

3,139 meters (10,300 ft) in field trials. The U.S. Navy acquired *Trieste* in 1958 and equipped it with a new cabin to enable it to reach deep ocean trenches. In 1960, Jacques Piccard and Navy Lieutenant Donald Walsh descended in it to the deepest known point on Earth — the Challenger Deep in the Mariana Trench. The two men made the deepest dive in history: 10,915 meters (35,810 ft).

Today, scientists are making exciting discoveries about the ocean floor, thanks to deep-sea submersibles such as *Alvin*. Owned by the U.S. Navy and operated by the Woods Hole Oceanographic Institution, this

three-person sub made its first dive in 1964. Since then, *Alvin* has taken more than 13,000 scientists, engineers, and observers to the deep sea. The sub can dive as deep as 4,500 m (2.8 miles), giving it access to about 62% of the ocean floor.

*Alvin* has conducted a wide variety of missions, from discovering giant tube worms in the Pacific Ocean near the Galápagos Islands, to surveying the wreck of HMS *Titanic* in the Atlantic Ocean. The sub once was attacked by a swordfish, which became trapped between two pieces of the sub's fiberglass skin. The fish was brought back to the surface and cooked for dinner!

A new *Alvin* is now being constructed. The new sub, to be completed in 2011, will descend to 6,500 m (over 4 miles), opening 99% of the ocean floor to potential study.