

How does a submarine work



**ASSIGN
BUSTER**

Submarines are ships that can operate both under and on top of the water. One of the first submersible vessels was built around 1620 by a Dutchman named Cornelius van Drebbel. We don't know that much about Drebbel's vessel, but diaries and books written at the time tell us his sub was really just a rowboat covered with a waterproof leather skin. Apparently 12 people with oars moved the vessel through the water. It could submerge to about 4.5 metres and go up to 8 kilometres before it needed to surface. It must have had some type of portholes to let in the light because one passenger wrote that people could see well enough underwater to read.

Submarines have changed a lot since Drebbel's day. Today some submarines are two football fields long (200 m) and carry a crew of over 150! Nuclear powered submarines can stay underwater for months at a time. How It Works Submarines are designed for use at great depths. Their rigid, double-walled hulls allow the crew to live and work normally underwater for as long as air and power supplies last. Submarines are steered by turning a rudder left and right. A propeller moves the sub through the water, pushing water backward so that the submarine moves forward. The crucial problem for a submarine is that it must either sink or float on command.

Most things either sink or float, but can't do both. Why? When an object is placed into water, it either sinks or floats according to its density. Objects denser than water (like metal) sink, while objects less dense than water (like air-filled balloons) float. What about a submarine? To descend, water is pumped into the ballast tanks. To rise, air is forced into the ballast tanks, pushing the water out. by David Garrison Submarines are a mixture of metal

(the hull), air, and water (the “ ballast”). The secret of a submarine’s ability to either sink or float lies in a special property of air.

Unlike water or metal, air can be squashed into a tiny space. While the submarine is sinking, its air is compressed. Water fills the compartments called the ballast tanks. The combination of water and metal, with just a little bit of air in the centre for the crew to breathe, is more dense than the surrounding ocean water, and so the submarine sinks. Once the submarine is underwater, air is pumped into the ballast tanks. The new combination of metal, water, and air is just as dense as the surrounding water, so the submarine hovers, neither sinking nor rising. This is called “ neutral buoyancy”, and allows the sub to maneuver underwater.

When it’s time to rise, even more air is pushed into the ballast tanks. This pushes water out, resulting in a mixture of air, metal, and water that is now less dense than the water surrounding the sub. Under these conditions, the sub rises to the surface. Submarine Facts A deep-diving submarine used to explore the ocean is called a submersible. Submersibles are usually smaller than submarines and may be connected (or tethered) to a support vessel on the surface. They are often equipped with external cameras, manipulating arms, and special lights. Submersibles are built to do specific jobs, not for long-distance travel.

We use them to help us recover “ black box” flight recorders from wrecked airplanes, bury cables in the sea floor, investigate ancient shipwrecks, map the ocean floor, look for signs of undersea earthquakes, study marine life, repair damaged offshore oil wells, take rock samples of the ocean floor, and

study ocean currents. A submersible called Alvin was used to recover a hydrogen bomb accidentally dropped from an air force bomber. Alvin has also explored the mysterious hydrothermal vents of the deep ocean, places where animals live not on sunshine but on heat and chemicals issuing from cracks in the Earth.

Kaiko was the first vehicle to sample sediment and microorganisms from the deepest place on Earth, the Mariana Trench. Japan once had an unmanned submersible called Kaiko that could dive over 10 kilometres. In 1995, Kaiko went down to the Mariana Trench — the deepest spot in the ocean! In 2003, Kaiko was lost when its tether to the surface was accidentally fractured in a typhoon. Probably the most famous submarine in history didn't even exist. Jules Verne created Captain Nemo's submarine Nautilus for his 1870 book *Twenty Thousand Leagues Under the Sea*.

Verne named his vessel after a real-life submarine invented by Robert Fulton. Food For Thought Some of the most impressive and exciting submersible vehicles don't have people on board at all. Remotely-operated vehicles (ROVs) have been used to explore shipwrecks such as the Titanic. Robotic subs are right now exploring the mysterious lakes of Antarctica, which have been buried under ice for thousands of years. Scientists and engineers are even designing robotic subs to explore the ice-covered ocean of faraway Europa, a moon orbiting the giant planet Jupiter.