

# National Deep Submergence Facility



Many people know that 70% of the Earth's surface is covered with water. "What fewer people realize," says Woods Hole Oceanographic Institution (WHOI) Senior Scientist Chris German, "is that more than half of the entire planet is covered with sea water more than two miles deep."

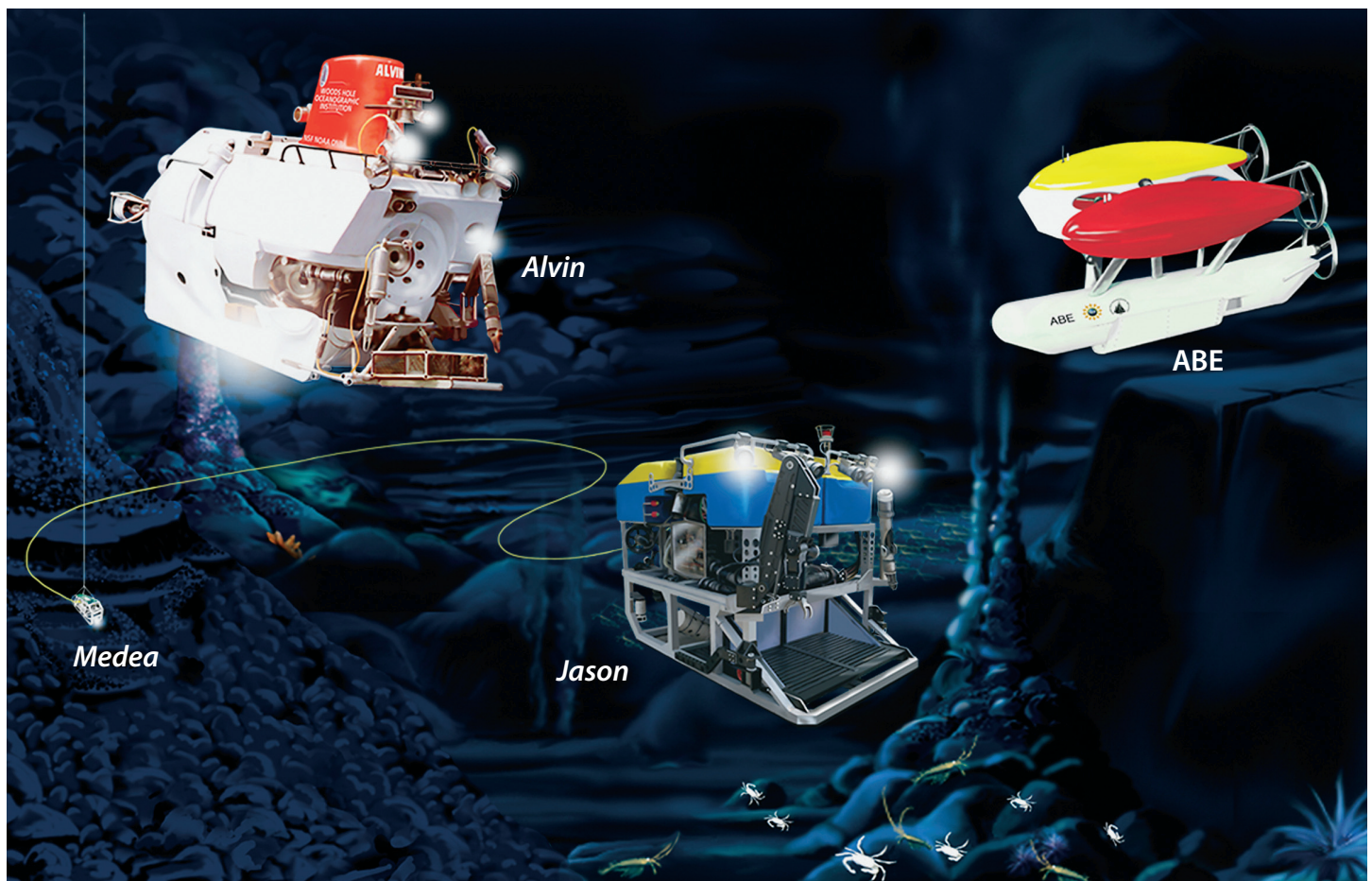
That is the reason for the existence of the National Deep Submergence Facility (NDSF), which is managed by WHOI. The NDSF, German says, enables scientists "to get down there (to extreme ocean depths). Right now, we have a better and more complete understanding of the surface of the Moon, Venus, and Mars than we have of our own ocean floor."

But that is changing because of NDSF. German, chief scientist of the facility, and researchers from all over the world are learning progressively more about the deep ocean by utilizing NDSF's three vehicles: human-occu-

ped submersible *Alvin*; the remotely-operated vehicle *Jason*; and the Autonomous Benthic Explorer, ABE. All three were developed by and are operated by WHOI for the NDSF, which was established in 1974 for the benefit of the U.S. oceanographic community.

The facility offers scientists an undersea presence down to 4,500 meters in *Alvin* or the capability of using robotic vehicles to depths reaching 6,500 meters that can remain submerged for several days. Each vehicle offers unique capabilities to explore the world far beneath the ocean's surface.

The operation is overseen by the University-National Oceanographic Laboratory System, a body of 62 academic institutions and national laboratories engaged in marine research. The NDSF is funded by the National Science Foundation, the Office of Naval Research and the National Oceanic and Atmospheric Administration.



# JASON



The remotely operated vehicle (ROV) *Jason* provides scientists with access to the deep sea without their having to leave the deck of a ship. With a depth rating of 6,500 meters, *Jason* is recognized as one of the world's most capable research ROVs.

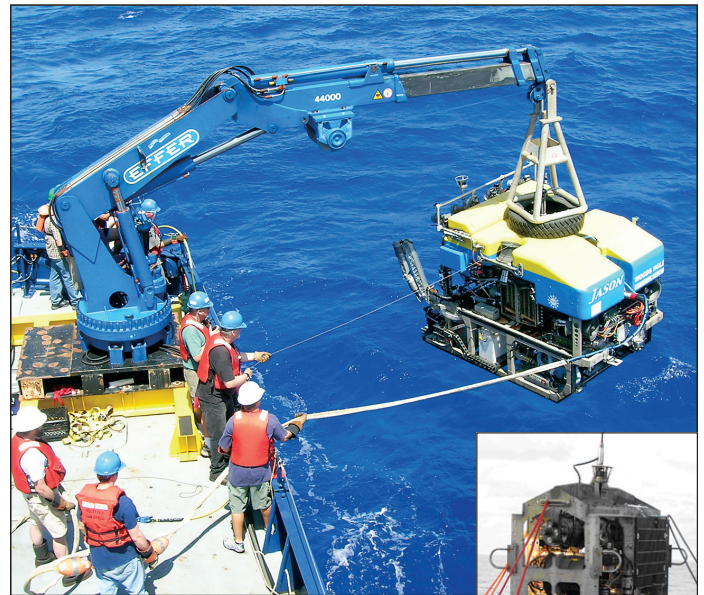
Approximately seven feet high and nearly eight feet wide, *Jason* is larger than most SUVs. Though it weighs 9,000 lbs in air, the vehicle is neutrally buoyant in the water. A pilot working from a control room on the ship uses a joystick to "fly" *Jason* over the seafloor. The pilot's commands, as well as the vehicle's electric power, are sent through a fiber-optic cable, which then returns data and live video imagery. *Jason* is equipped with sonar imagers, water samplers, video and still cameras, and lighting gear. *Jason's* robotic manipulator arms collect samples of rock, sediment or marine life and places them in the vehicle's basket or on "elevator" platforms that float heavier loads to the surface.

First launched in 1988, the system has been used for hundreds of dives to hydrothermal vents in the Pacific, Atlantic and Indian Oceans. A sturdier, more advanced version of ROV *Jason* was launched in 2002. Since then, *Jason* has conducted 485 dives, with an average bottom time of more than 21 hours per dive. The longest dive to date exceeded 100 hours.

"*Jason* has enormously expanded our reach in the ocean science community," says WHOI Senior Scientist Dan Fornari, "not only because of its depth capability, but because it doesn't require a dedicated support vessel. It can be transported anywhere in the world and launched from any global-class ship."

Fornari was among a group of scientists that used the ROV during a field program in May 2007 at the East Pacific Rise. There, *Jason* was used to recover equipment—ocean bottom seismometers—that had been buried by a volcanic eruption. A pilot operating the ROV directed *Jason's* two manipulator arms—one is very strong and the other very dexterous—to retrieve the lost equipment.

In its lifespan, the ROV has had some close encounters with volcanoes. The first was a 2006 NOAA-funded expedition that marked the first time researchers witnessed an actively erupting seafloor volcano. During that mission, to the Brimstone Pit at the NW Rota volcano in the Pacific Ocean, the scientists used *Jason* to collect rock and water samples and to film the glowing



*Jason* and *Medea* (inset)



red lava jetting out of the volcano's vent.

"There were some scary moments," says Will Sellers, the *Jason* pilot who maneuvered the ROV from a van aboard the support ship. "The common reaction was, 'Are you sure we should be here?' [The volcano] is sitting there violently erupting away, and really, you got the impression that this thing is so unpredictable".

In the spring of 2009, scientists returned to NW Rota with *Jason* to continue the study of this continuously erupting volcano, again capturing remarkable footage. On the heels of that expedition, in May 2009, researchers using *Jason* discovered the deepest erupting seafloor volcano yet at West Mata. There, *Jason*, equipped with a high-definition camera system provided by WHOI's Advanced Imaging and Visualization Lab, captured never-before-seen images of molten lava flowing across the deep ocean seafloor.

## Vehicle Specifications

Depth Capability: 6,500 meters (4.04 miles)

Tether: 50 meters (164 feet) long, 20 millimeters (0.8 inch) diameter, neutrally buoyant

Size: 3.4 meters (11.2 feet) long, 2.4 meters (7.9 feet) high, 2.2 meters (7.2 feet) wide

Weight: 4,082 kilograms (9,000 pounds) in air (approx.)