Deep impact: New diving suit could increase undersea range of Navy divers

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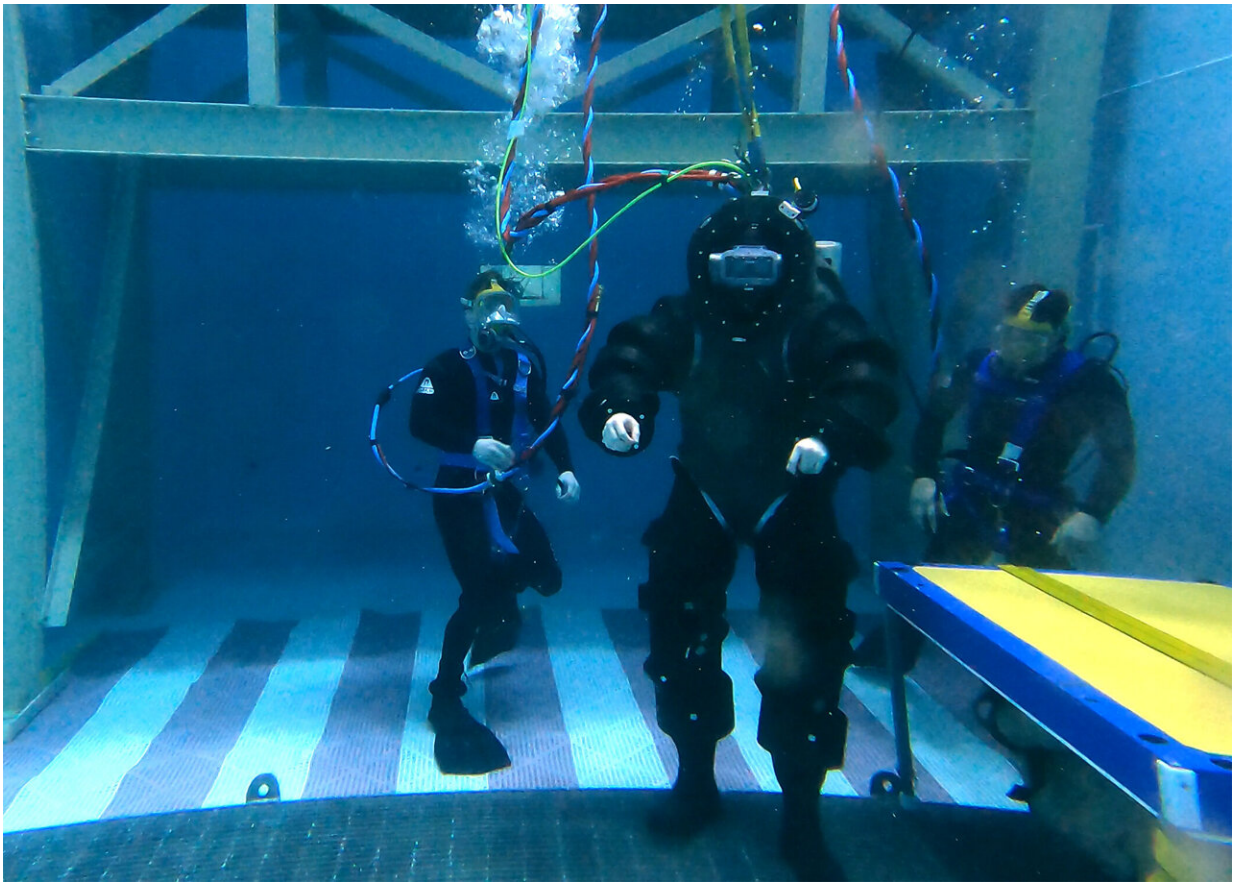

A U.S. Navy diver (center) tests the Office of Naval Research-sponsored Deep Sea Expeditionary with No Decompression (DSEND) system at the Navy Experimental Diving Unit in Florida. DSEND includes a hardened yet lightweight atmospheric dive suit featuring rotating, detachable joints allowing for greater dexterity, flexibility and maneuverability. Credit: U.S. Navy photo by Ronnie Newsome

The lights above the water's surface cast a ghostly glow on the bottom of the sprawling tank, as a U.S. Navy diver deftly swam through a sunken aircraft fuselage.

Wearing a special diving suit designed to protect against the crushing pressure of ocean depths, the diver found her target—a mannequin representing a human body. The exercise was part of a simulated crash recovery mission to test the capabilities of the Deep Sea Expeditionary with No Decompression (DSEND) system, which includes a hardened yet lightweight atmospheric dive suit featuring rotating, detachable joints allowing for greater dexterity, flexibility and maneuverability.

Sponsored by the Office of Naval Research (ONR)—in partnership with Naval Sea Systems Command (NAVSEA), Naval Undersea Warfare Center (NUWC) and Naval Surface Warfare Center (NSWC) Panama City—DSEND recently underwent demonstrations at NSWC Carderock Division in Maryland and at the Navy Experimental Diving Unit in Florida.

"DSEND is truly a game-changer because it's a self-contained environment that keeps internal pressure steady, as a diver descends to depths with increasing external pressure," said Dr. Sandra Chapman, a program officer in ONR's Warfighter Performance Department. "It increases diver safety, allows them to expand the operational envelope and would eliminate lengthy decompression times."

Navy diving missions include deep ocean salvage of vessels and aircraft, underwater rescues, explosive ordnance disposal, ship hull maintenance and recovery of sunken equipment.

The deeper divers descend, however, the greater the danger from increasing water pressure. In deep-water situations, Navy divers use a saturation system, or diving bell, that is pressurized with gas so the

pressure inside the bell matches outside pressure.

The drawback is that, when returning to the surface, divers must ascend slowly and stop at intervals so they don't suffer decompression sickness. This is a potentially lethal condition in which the inert gas dissolved in the blood and tissues by high pressure forms bubbles as pressure decreases. Although the time-consuming ascent safeguards divers, it limits the amount of hours they can spend at a site.

DSEND's one-atmosphere environment presents a solution to this challenge. Equipped with a self-contained life support system, the DSEND suit encloses a diver in a stabilized pressure cocoon during the entire dive. The diver can work at great depths for many hours and ascend without the drawn-out process of decompression.

"Because DSEND maintains one consistent pressure atmosphere, the diver is never exposed to the negative physiological effects associated with deep diving, such as decompression sickness, cold and wet exposure," said Paul McMurtrie, NAVSEA diving systems program manager. "A diver can work for long periods of time in deep water and rapidly return to the surface."

Although constructed from hard, durable material, DSEND is lightweight and enables users to swim and walk on the bottom easily. This improves on atmospheric diving suits traditionally used by the Navy in the past, which were more rigid and powered by attached thrusters, making it difficult to move around.

The suit also is easier to don and remove, and can be adjusted to diver size. In addition, DSEND features joints, grippers and hand attachments made from novel materials that are strong, lightweight and mirror the natural movements of human joints, reducing diver fatigue.

"DSEND will allow divers to conduct harder missions by going deeper, executing faster and operating longer," said Tom Hansen, a research engineer at NUWC Division Newport, "all while being protected by a sensorized suit of armor. It feels like we're developing the futuristic smart armor you see in movies."

During the Maryland and Florida demos, DSEND divers completed various exercises, including pulling a mannequin from an aircraft fuselage, rigging a piece of wreckage for salvage and traversing makeshift tunnels representing sunken vessels.

Within the next year, Chapman hopes to see DSEND undergo additional development, including at-sea demos in realistic operating environments.

Navy Master Chief Jericho Diego, a master diver and the senior enlisted leader at NUWC Division Keyport, said, "This system has the potential to be very advantageous to Navy divers. Eliminating the need for decompression increases safety, and the more flexible arm attachments allow us to retrieve targets and do our jobs more effectively."

Provided by Office of Naval Research

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