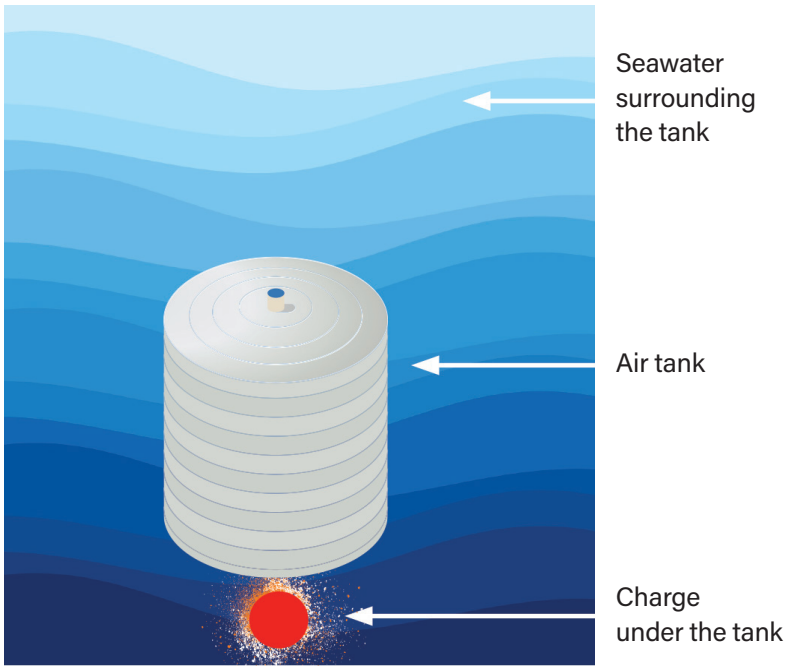
PROJECT ID:
592

Demonstration of the Robust Caisson Structure to Reduce Blast Effects from Underwater Blow-in-place



This NESDI project will field test the effectiveness of a robust caisson structure to reduce blast effects from underwater explosions. (Schematic Credit: Joey Trotsky)

OBJECTIVE

This project is field testing the effectiveness of a robust caisson structure to reduce blast effects from underwater explosions.

PROBLEM STATEMENT

Underwater munitions represent a significant threat due to potential incidental contact from recreational users. Current procedures, known as blow-in-place, detonate the underwater munition, which can result in blast pressures that are detrimental to nearby structures and marine life. Technologies are needed to cost effectively and safely recover munitions in the underwater environment.

DESCRIPTION

A caisson is a secure, watertight chamber usually used for underwater construction. The chamber is made waterproof through the addition of compressed air. The use of a caisson as a blast shield was studied under a Strategic Environmental Research and Development Program (SERDP) project MR-2648 "Modeling a Robust Caisson Structure to Resist Effects from Blow-In-Place of Underwater Unexploded Ordnance." Computer simulations found that the robust caisson structure (RCS) model developed by the SERDP team was able to significantly reduce the effects of underwater explosions.

The innovative design of the RCS splits the total blast wave energy into multiple smaller, weaker shock waves that travel at different times, resulting in much lower blast peak pressures and impulses. Computer software has proven that both peak blast pressures and impulses at the locations of interest may be dramatically reduced—up to 82 percent, with an average reduction of 48 percent and a median reduction of 52 percent, based on the amount of the air used in the RCS.

This project was formed to fabricate and demonstrate a full-scale RCS based on the original SERDP design, with explosive blast capability ranging from 1 to 20 pounds of explosive (equivalent to TNT). The size of the RCS is optimized for use against 20 pounds of explosives, which will approximate the majority of underwater munitions.

One RCS will be built for the demonstration. It will be a cylindrical air tank, approximately 8 feet in diameter by 6 feet tall, made of steel with a top and bottom welded at the ends to be airtight. It will be built with a 2-inch-thick steel plate, which modeling has determined to be more than sufficient to withstand multiple detonations. The RCS will be either built by a local steel/fabrication company or by personnel from the Naval Facilities Engineering and Expeditionary Warfare Center in Port Hueneme, CA.

The demonstration is tentatively scheduled to take place at the Naval Surface Warfare Center in Panama City, FL in water from 10 to 30 feet deep. The objective is to demonstrate that this technology will work at depth. The RCS will work in deeper water, but to simplify diving operations, a maximum depth of 30 feet is optimal. For shallower depths, the design of the RCS could be modified to simply vent the explosion to the atmosphere.

RETURN ON INVESTMENT

Terrestrial munition response sites are being assessed and managed by the Munitions Response Program (MRP), which is funded by the Naval Facilities Engineering Systems Command (NAVFAC). As the Navy's terrestrial MRP sites progress through the assessment and cleanup process, funding is becoming available to address the Navy's underwater MRP sites. The Navy has many underwater MR sites that may pose an explosive safety risk and NAVFAC Headquarters has plans to significantly increase funding for the underwater MRP sites to assess and manage these sites.

Although technologies are being developed to render underwater munitions safe, they are not yet mature and are currently unavailable. The current effort of using a remotely operated vehicle (ROV) coupled with water jet cutting is projected to be much more expensive and does not operate well in water less than 10 feet deep. A standard working class ROV can range from $600,000 to over 4 million dollars. The RCS will range from $10,000 to $14,000.

NAVY BENEFITS

The benefits of using a robust caisson structure to mitigate the blast effects from blow-in-place operations include significantly reducing the number of real estate/waterways requiring closure during an operation, a vast reduction of effects on nearby infrastructure and a significant decrease in the lethal blast dosing inflicted on nearby marine life. The RCS also offers cost savings over other remedial technologies.

TRANSITION DESCRIPTION

Modeling results from the SERDP project were discussed and presented to NAVFAC's Munition Response Workgroup. Members include both potential resource sponsors and end users. When the demonstration is complete, this workgroup will again be briefed.

A final report will be distributed to remedial program managers, and will include guidance and specifications on building and deploying an RCS. The demonstration RCS will likely be given to the team at the demonstration site.

CONTACT

For more specific information about this project, contact the Principal Investigator at 805-982-1258.

ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development, demonstration and validation (6.4) program, sponsored by the Chief of Naval Operations, Energy and Environmental Readiness Division (OPNAV N45) and managed by the Naval Facilities Engineering Systems Command (NAVFAC) out of the Engineering and Expeditionary Warfare Center (EXWC) in Port Hueneme, CA.

The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness and lethality. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at www.navfac.navy.mil/nesdi or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or ken.kaempffe@navy.mil.