

Navy's NEPTUNE Program Accelerates Maritime Innovation Through University Partnerships

Stanford's Hacking for Defense Program Helps Drive Rapid Technology Transition from Lab to Fleet

From the Office of Naval Research

STANFORD, Calif., December 18, 2024 – The U.S. Navy's Office of Naval Research (ONR) is revolutionizing maritime technology development through its NEPTUNE program (Naval Enterprise Partnership Teaming with Universities for National Excellence), by demonstrating the vital role of academic-military collaboration in advancing national defense capabilities. Led by Dr. Corey Love, NEPTUNE has established strategic partnerships with leading institutions including Stanford University, MIT, Purdue University, UC Davis, Arizona State University, Old Dominion University, and the Naval Postgraduate School. These partnerships are proving instrumental in rapidly transitioning innovative technologies from laboratory concepts to operational naval assets. This initiative is not just about developing new technologies; it's about shaping the future of naval warfighting capabilities and ensuring the resilience of our forces in the face of evolving threats. This is particularly important given hostilities in Ukraine and the Middle East, as well as rising tensions with China, Iran, Russia and North Korea.

"The NEPTUNE program exemplifies the kind of innovative partnerships we need to accelerate defense technology development," says Dr. Jeff Decker, managing director of the Tech Transfer for Defense program at Stanford University's

Doerr School of Sustainability, and program director and co-instructor of Stanford University's Hacking for Defense® program, as well as author of "The Hacking for Defense Manual." "By connecting academic researchers directly with military end-users, we're seeing remarkable acceleration in the development and deployment of critical technologies."

A standout example of NEPTUNE's success comes from MIT, where Professor Steven Leeb's team has developed a groundbreaking Combat Power Monitor (CPM) system, using their research in energy management and monitoring to demonstrate progress in technology readiness in an area that is critical to the operational readiness, effectiveness and efficiency of naval vessels and U.S. Coast Guard (USCG) warships. The team's contributions, particularly in the development of technologies for supporting condition-based maintenance and energy economization, are proving to be invaluable assets to the U.S. Navy and U.S. Coast Guard. Active demonstrations have been conducted and are continuing on serving USN warships and U.S. Coast Guard cutters.

"We are now seeing game-changers flow through the innovation pipeline in less time," says Justin Fanelli, acting chief technology officer for the U.S. Department of Navy. "We have implemented and are looking for more ways to improve the time from concepts to outcomes; one thing is certain – great ideas and hustlers are essential for us to move at the speed of relevance. With Professor Leeb's work, the ability to monitor and manage energy usage on ships ensures that our vessels can operate longer, with greater endurance, and with reduced logistical footprints. This is particularly crucial in scenarios where resupply may be challenging or in stealth operations where minimizing energy signatures is vital."

The NEPTUNE program plays a pivotal role in advancing research from early-stage concepts to more mature, deployable technologies. By propelling basic scientific research (Technology Readiness Level, or TRL 2) towards prototype

demonstration in an operational environment (TRL 7), NEPTUNE ensures that innovative ideas are not left in the laboratory but are instead developed into practical solutions to naval challenges. This progression involves a systematic approach to technology development, where initial theoretical studies and proof-of-concept (TRLs 2-4) are followed by increasing levels of integration and testing in relevant environments (TRLs 5-6), culminating in prototype demonstrations that prove the technology's effectiveness in real-world naval settings (TRL 7). Through this structured pathway, NEPTUNE accelerates the transition of cutting-edge research into tangible assets that enhance the Navy's warfighting capabilities and operational resilience.

This initiative demonstrates how academic-military partnerships can yield transformative results, particularly vital given current global challenges including situations in Ukraine and the Middle East, as well as evolving maritime security needs.

NEPTUNE support made it possible for the MIT team to move from an advanced concept to a deployed prototype in 24 months. The NEPTUNE partnership between the Navy and academia is a powerful formula for innovation. By leveraging the expertise and creativity of university researchers, the Navy is able to accelerate the development of technologies that are essential for maintaining its edge in an increasingly competitive and complex global security environment.

"As we look to the future, the importance of programs like NEPTUNE cannot be overstated," noted Fanelli. "The challenges facing the Navy and the broader national security landscape are becoming more diverse and sophisticated. Adversaries are rapidly advancing their capabilities, and the technological gap is narrowing. In this context, the Navy's ability to innovate and adapt is not just a matter of maintaining superiority; it's a matter of national security."

The NEPTUNE program represents a strategic investment in the future of naval warfare. It is a model of how collaboration between the military and academia can yield transformative results. As we continue to navigate the uncertain waters of the 21st century, initiatives like NEPTUNE will be the beacon that guides the Navy toward a future where it remains the preeminent maritime force, capable of ensuring peace and security in an ever-changing world.

To learn more about the ONR Investment Horizons framework, visit onr.navy.mil; for more information on the Technology Transfer for Defense program at Stanford University, visit techtransferfordefense.stanford.edu.