War Games

The center of excellence in undersea technology has the technology. Its mission? To create underwater devices that will defend us here and abroad.

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PHOTO BY ILLUSTRATION BY BRIAN STAUFFER

There are reminders of the country's wars all around the northwest side of Newport. There is the blue span of Narragansett Bay, finally held by the French during the Revolution; at the Bay's shore rest two decommissioned aircraft carriers, immense at their moorings. Overlooking this pair of Cold War survivors is the brick-and-glass campus of the Naval Undersea Warfare Center (NUWC), the Navy's headquarters of underwater engineering. In this time of terrorism and nuclear geopolitics, NUWC itself is a reminder of the military's modern truths: with so many battles to imagine, war is never simple, and technology is at the center of the fight.

Thanks to a new avenue of collaboration, though, NUWC's scientists have help in their endless mission to provide the Navy with the latest in undersea systems and hardware. The Center of Excellence in Undersea Technology (COEUT), a model managed by the University of Rhode Island (URI), is reshaping the way academic, defense, and industry researchers share ideas. But as military engineering begins to take new form in Rhode Island, scientific matchmaking isn't the only innovation crossing Narragansett Bay.

NUWC Division Newport is responsible for the development of the incredibly complex articles of undersea warfare—torpedoes, sonar systems, the myriad instruments of the subs themselves. With more than 1,900 scientists and an additional division in Keyport, Washington, NUWC's resources are extensive, but as Chief Technology Officer Dr. Pierre Corriveau says, collaborative advantages exist beyond the NUWC walls. "We'd been wanting to work more closely with academic communities that have similar interests in the ocean," says Corriveau. "What we really want is to be able to leverage our scientists with other scientists so that we can be sure that the science that gets done in undersea warfare is the best science."

The answer was the COEUT: a flexible model managed by a Ph.D.-granting institution that could gather the scientific talent needed to focus on problems of undersea engineering. Dr. Malcolm Spaulding, a professor of ocean engineering and a thirty-four year veteran of the University of Rhode Island, understood the potential right away. "The idea is that we'd have a place where we could bring together the various partners—the people from NUWC, the people from the academic community, and industry—to work on problems where we share a common interest," says Spaulding.

URI's Narragansett Bay campus, home of the renowned Graduate School of Oceanography (GSO), offers a breathtaking, eastward view of the bay. Its buildings are a combination of science buff and machine shop; downstairs from Spaulding's office sits a wide, light-green tank, several yards long, for testing the latest designs in ocean engineering. But brainpower is GSO's strongest asset. Intentionally "virtual" and structured around just two managers—Spaulding and GSO Associate Dean Dr. Kate Moran serve as director and associate director, respectively—URI's proposed model secured a NUWC contract to establish the Center.

Spaulding and Moran consider the financial demands and appropriate expertise needed on particular projects—a biologist here, a GSO fluid dynamics expert there — and get the right people cooperating on a matter. A graduate school marine research scientist has been working since the spring with NUWC researchers in a COEUT effort to test materials that can resist bio-fouling. The accumulation of marine life, from microscopic organisms to barnacles, on submerged surfaces, bio-fouling is a common occurrence in nature (think of a dock piling exposed at low-tide). It frustrates sailors to no end, interfering with periscopes and sonar and slowing their ships with drag. The International Maritime Organization recently enacted a worldwide ban last month on tributyltin, a toxic compound used in anti-fouling paints, so the need is great for affordable and environmentally friendly synthetics.

This is science, patient and unglamorous. Panels, coated with experimental materials developed by the NUWC researchers, are submerged in Narragansett Bay; once a month, a researcher records the number and species of organisms gathered on the panels as they're hauled out of the water. But as Cor-riveau explains, the project's success could have immense cost efficiencies for the military. "This is really exciting," he says. "In the Navy, we spend hundreds of millions of dollars on anti-fouling. The technology could translate into huge savings.

It's pretty basic, but it's very exciting, because if this succeeds, we're going to have a huge impact on the Navy."

As Corriveau says, such experiments are the near side of the future. The far side of the future sounds much more fantastic. The Navy needs a way to monitor enemy waterways without detection and without exorbitant cost.

So, faithful to the timeless military tradition of disguise, NUWC and area researchers have been discussing the creation of an acoustic sensing device that will look and move exactly like your everyday open-ocean jellyfish.

The research is at a theoretical level, but if realized, artificial jellyfish could be deployed by the hundreds off a coastline—dropped into the sea from a helicopter, for example—to send information back to systems and personnel off-site. The jellyfish might even be able to swim, resisting ocean currents and staying in position off an enemy port or naval installation for days. Again, theory, but realizing that the research fit well with the interests of the Center, Spaulding contacted Providence College biology professor Dr. Jack Costello after hearing about the PC academic from a colleague. Costello is a renowned expert in jellyfish. Since the spring, he's been working with URI and NUWC staff on the abstract challenges of jellyfish movement. Why jellyfish? "What we're looking for is a highly efficient, structurally simple model," says Costello. "Jellyfish are very simply constructed and are perhaps the easiest swimming animal to mimic. If you're looking for a vehicle that's high efficiency and easy to design, a jellyfish is an ideal model for that."

The jellyfish project is a leap into the realm of distributed network systems (DNS), a region of engineering that the COEUT was, in part, designed to explore. DNS involves the association of several parts, working to provide information to the most critical element, the commanding officer, in the area of operations, the “battlespace” in military terms.

A DNS-based COEUT research project currently being tested offers a good basis of the technology’s potential. It involves the use of a device called a profiler that monitors undersea characteristics—seawater oxygen levels, as in the project’s ongoing testing in Greenwich Bay, or, in theory, the traces of an explosive. Suppose a terrorist group, using divers, has welded a bomb to the bottom of a New York-bound freighter. The profiler, anchored a few miles outside the harbor, could detect

the traces of chemicals that the passing ship (and the explosive) would leak into the water. The system, responding to the chemical detection, could then send an autonomous underwater vehicle to approach the vessel and investigate. The submarine could communicate the data to nearby forces who could then formulate a response. The technology could allow personnel to monitor an entire stretch of coastline in real time, as the robot submarine and profilers could report data back to coastal imaging software.

Distributed network systems also offer advantages to the military in special operations, the realm of unconventional tactics used by well-equipped governments against irregular groups like Hezbollah, al-Qaeda, militia groups and guerillas. Billion-dollar submarines versus smuggled rifles? Besides entering a rebel-controlled area by helicopter or parachute jump, a commando team could swim to shore from the hatch of a submerged sub. As his vessel waits offshore, safe and unseen, a commander could review make-or-break information—say, the presence of boat traffic near shore—sent by sensors deployed in the area in the days preceding the mission. Distributed network systems have clear nonmilitary potential as well; sensors could monitor water quality and oil spills.

In its first year, the Center has been seen as a success by all parties, even beyond the world of research. John Riendeau, Defense Industry Manager for the state’s Economic Development Corporation, sees the Center as proof of the state’s economic promise. Defense is big business in Rhode Island. According to the economic development corporation’s research, the defense industry generates almost $63 million in state tax revenue and employs 22 percent of the state’s scientists. “We realize that to bring these three important players

[private sector, defense and academia] together was to acknowledge the Rhode Island global asset,” says Riendeau. “No one can do what we do. When the Economic Development Corporation refers to the twenty-first century innovation economy, this Center is a microcosm of that innovation economy.”