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FEATURE

Investing in Submarines

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The UK's Atlantic Bastion 20

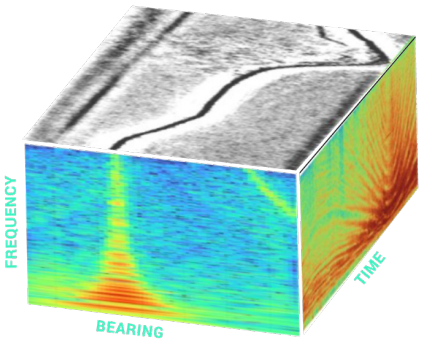
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UNDERSEA WARFARE

Winning the Undersea Fight:

Unmanned Acoustic Surveillance, Fielded Today



By John Russ

The next strategic surprise may come from beneath the surface.

Across the globe, the undersea domain is becoming more contested, more complex, and more consequential. Adversary submarines are becoming quieter, uncrewed underwater vehicles are proliferating, and critical maritime infrastructure is increasingly exposed. Ports, naval bases, strategic waterways, undersea cables, pipelines, offshore energy facilities, and high-value maritime assets all face growing risk from threats that are often difficult to detect and even harder to monitor continuously. The challenge is not theoretical. It is a present and expanding operational reality.

The requirement is clear, and the urgency is real. Submarines, destroyers, and maritime patrol aircraft remain indispensable, but these finite resources cannot cover the immense and expanding undersea battlespace. Building the requisite fleet of these exquisite assets to continuously monitor every harbor, chokepoint, maritime approach, and piece of critical infrastructure is neither practical nor economically viable.

At the same time, navies cannot add ships, aircraft, and trained personnel quickly enough to provide the persistent coverage required. The challenge is no longer simply identifying the problem. It is fielding practical capabilities that close the awareness gap today, before a crisis exposes it.

Distributed, unmanned acoustic surveillance helps meet that requirement. Positioned where awareness is needed most, these systems can maintain persistent watch, identify potential threats, and provide early warning that enables commanders to employ traditional ASW forces more effectively.

They do not replace the fleet. They extend its reach and multiply its effectiveness.

ThayerMahan's Outpost® system demonstrates that this approach has moved beyond experimentation. The Royal Australian Navy will field 40 ASW-capable Outpost payloads under SEA1200, establishing Outpost as a Program of Record mission system for unmanned ISR. Its selection reflects confidence in a capability proven through operational testing, multinational exercises, and real-world deployments.

Outpost combines advanced acoustic sensing with ThayerMahan's TransparenSea® software, which uses AI-enabled signal processing to detect and classify acoustic contacts and rapidly deliver actionable intelligence. By reducing analyst workload and improving cueing, the system helps commanders make more informed use of submarines, surface combatants, and maritime patrol aircraft.

No single system can address every undersea environment. ThayerMahan has developed a layered family of capabilities extending from the pier to the open ocean. The objective is straightforward: provide persistent awareness where it matters most and deliver actionable information to operational commanders without placing additional strain on scarce platforms and personnel.

The undersea fight is not a future challenge. It is unfolding today around critical infrastructure, strategic waterways, and high-value maritime assets. Nations that establish persistent awareness before a crisis will be better positioned to respond when one occurs. Distributed unmanned acoustic surveillance is no longer merely a concept or experiment. It is a proven, fielded capability available today.

Learn more at **thayermahan.com**

About the Author

CAPT John Russ, USN (Ret.), a former submarine squadron commander, serves as Chief Operating Officer at ThayerMahan. All views are his own.





One of Our Nation's Most Powerful Strategic Advantages

BY MCPON (RET.) MIKE STEVENS, NAVY LEAGUE CEO

America's strength at sea has always depended on our ability to operate where others cannot, to deter aggression before conflict begins, and, when necessary, to fight and win. Nowhere is that more evident or more consequential than beneath the surface.

Our submarine force remains one of our nation's most powerful strategic advantages. From ballistic-missile submarines that provide an indispensable leg of our nuclear deterrent to attack submarines that hunt adversary forces, collect intelligence, protect the fleet and hold targets at risk, undersea warfare is central to our national defense. But maintaining that advantage cannot be taken for granted.



Mike Stevens
CEO

Our competitors understand the value of the undersea domain and are investing heavily in submarines, unmanned systems, sensors, weapons and technologies designed to challenge our dominance. At the same time, the United States and our allies face the demanding work of strengthening shipbuilding capacity, expanding the industrial base, developing new technologies and, most importantly, recruiting, training and retaining the people who make it all work. This is a long-term national undertaking and the Navy League has an important role to play.

Across our organization, Navy League members are doing what they have done for more than 124 years: standing behind the men and women of our sea services. Through council programs, ship and unit adoptions, support to sea service members and their families, youth programs, legislative advocacy and engagement in communities across the country, our members help connect America with the sea services that protect it.

To our members, volunteers, council leaders, corporate partners and supporters: your service matters. Much of what you do happens quietly, without recognition or fanfare. Yet every scholarship awarded, family supported, service member recognized, elected official educated and young American introduced to our sea services strengthens the maritime foundation of this nation.

The same can be said of our undersea force. Much of its work occurs unseen, beneath the surface and far from public view. But its contribution to deterrence, national security and global stability is enormous.

As we look to the future, America must continue investing in ships, submarines, technology, industrial capacity and people required to preserve our advantage beneath the seas. And the Navy League must continue doing what it does best, supporting, educating and advocating on behalf of America's sea services.

Thank you for being part of that mission. Your commitment helps ensure America remains a maritime nation capable of defending its interests, supporting its allies and maintaining peace through strength. ■

A Deep Update on the Silent Service

BY BRETT DAVIS, EDITOR-IN-CHIEF



The submarine force is often called the "silent service" as it operates under the waves, mostly unseen. This is reinforced by fiction titles such as "Run Silent, Run Deep," the 1950s novel and movie. In this issue, however, themed around undersea warfare, we aren't being silent about submarines.

United Kingdom-based contributor Lee Willett brings us up to speed on the U.K. Royal Navy's new "Atlantic Bastion" concept for countering Russian submarine and underwater activity in the North Atlantic.

Contributor Theresa Goode highlights the lessons learned by a nearly calamitous dive and resurfacing conducted by the USS Chopper in 1969 after its power systems failed. Cool heads and good training helped prevent a tragedy. For her it would have been very personal, as her father, Eugene F. Goode, served aboard USS Chopper during the incident.

Frequent contributor Peter Ong outlines the planned next generation of submarine tenders, the surface ships that help keep the subs under the water and in the fight.

Elsewhere in this issue, regular contributor Dan Taylor takes a look at Navy efforts to expand submarine servicing to allies overseas to increase time on station, and gives an overview of the pending Combat Autonomous Maritime Platform (CAMP) program, intended to provide extra-large uncrewed undersea vehicles to move big payloads over long distances.

And, since you can't operate submarines if you don't have them, writer Erika Fitzpatrick takes a look at crucial actions the industry is taking to bolster the shipbuilding workforce and attract new workers.

I hope you enjoy this deep dive, and as always, thank you for reading *Seapower*. ■



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FEATURE: Submarine Builders Shore Up Manufacturing Base

By Erika Fitzpatrick

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ON THE COVER: Virginia-class fast-attack submarine USS Colorado (SSN 788) returns from sea trials during a maintenance period at Joint Base Pearl Harbor-Hickam, June 6, 2026. Commissioned March 17, 2018, at Naval Submarine Base New London, Colorado is the 15th Virginia-class fast-attack submarine and fifth Block III submarine of the class. Photo credit: U.S. Navy | Claudia LaMantia.

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Bare Shelves: Munitions Shortages Highlight Concerns About US Warfighting Capability

BY MATT REISENER



A U.S. Army air defense artilleryman inspects a Terminal High Altitude Area Defense (THAAD) launcher in the U.S. Central Command area of responsibility in May 2026. THAAD is an anti-ballistic missile system designed to intercept missiles in their terminal phase, and supplies are running low due to the conflict with Iran. Photo credit: U.S. Army.

Since the start of the Iran war in late February, American policymakers and defense experts have focused heavily on the conflict's operational tempo, Iran's geopolitical ambitions in the Strait of Hormuz and diplomatic efforts to end the fighting.

In recent weeks, however, Washington has become increasingly concerned about both the immediate and long-term implications of the conflict for U.S. munitions stockpiles. According to recent reporting, the United States expended virtually all its inventories of Army Tactical Missile Systems and Precision Strike Missiles available for the campaign by early August, while also running dangerously low on key defensive missile interceptors, including Patriot and Terminal High Altitude Area Defense (THAAD) interceptors.

Senior defense and acquisition officials reportedly held an emergency meeting on July 31 to address the worsening shortfall, and multiple news outlets have reported growing tensions between the White House and Pentagon over public reporting on the issue.

How significant is America's munitions shortage? While the U.S. produces an average of 700-800 Patriot missiles annually, its armed forces fired around 800 Patriots during the first day of strikes against Iran. In total, the U.S. had intercepted over 1,700 Iranian missiles and drones and struck over 13,000 targets in Iran by the time the ceasefire went into effect in early April. This heavy usage has taken its toll on America's arsenal. In July, the Center for Strategic International Studies reported America's Patriot Missile stockpile had been reduced to 700-800 missiles — down from roughly 2,300 prior to the conflict. Similarly, CNN reported in early August roughly 80% of America's 452 THAAD interceptors had been used during the war.

In response to this growing concern, President Trump invoked the Defense Production Act in June, calling on the Department of War to forge "voluntary agreements and plans of action to help provide for the national defense" and accelerate missile production. Similarly, Deputy Secretary of War Steve Feinberg wrote to defense industry leaders in August to urge "significantly faster, more aggressive delivery schedules and/or increased production for critical capabilities."

However, Admiral Samuel Paparo of U.S. Pacific Command warned Congress in April it could take one to two years to scale up the output of high-end missiles like the Tomahawk, and until 2031 to restore the U.S. Tomahawk stockpile to its pre-war level. Similarly, it could reportedly take up to eight years to replenish the supply of THAAD missiles used by the U.S. through the first month of the conflict alone. Even before the Iran War began, Lockheed Martin and the Department of War had agreed to quadruple THAAD interceptor production capacity. Although the Pentagon subsequently accelerated implementation of that plan through a seven-year, $35 billion procurement award and additional agreements to expand production of critical THAAD components, the resulting increase in output will take time to materialize and is unlikely to replenish the missiles expended during the current conflict.

If nothing else, America's missile shortage has revealed important vulnerabilities Washington must address to prepare America to deter and win future wars.

A Crisis Foretold

Washington should have seen this shortage coming. Such a crisis was predicted in part by the Pentagon's 2024 National Defense Industrial Strategy, which presciently identified "gaps in national stockpiles and challenges in replenishing existing ones." In 2023, the Biden administration actually delayed the shipment of long-range missiles to Ukraine precisely due to its desire to maintain enough munitions to preserve American military readiness.

Similarly, General Dan Cain, chairman of the Joint Chiefs of Staff, reportedly warned the White



An F/A-18E Super Hornet, attached to Strike Fighter Squadron (VFA) 14, launches from the flight deck of Nimitz-class aircraft carrier USS Abraham Lincoln (CVN 72) in support of Operation Epic Fury, March 25, 2026. Photo credit: U.S. Navy.

House prior to the conflict that a lengthy engagement against Iran could dangerously diminish America's missile stockpiles. The fact that Caine has reportedly been privately lobbying senior White House advisors in hopes of ending the conflict underscores the concerns many military leaders and experts feel over America's growing missile shortage and its potential national security implications.

Indeed, this munitions shortage imperils not only America's sea services, but its broader defense priorities, as well. As America's supply of missile interceptors dwindles, forward-deployed troops and naval vessels could become increasingly vulnerable to the Iranian missile and drone attacks, which could force the U.S. to either reduce its regional military footprint or rely on less sophisticated systems to defend against future Iranian attacks.

Similarly, such shortages could leave America's Middle Eastern allies increasingly exposed to Iranian projectiles, and several successful attacks against these states could greatly weaken global perception of the American security umbrella and undermine America's military relationships with important regional partners. Shortages might also risk weakening American deterrence in other theaters (the U.S. briefly moved THAAD missile interceptors from South Korea to the Middle East this spring), which could constrain American responses to naval conflicts that might break out in critically important regions throughout the globe, including the South China Sea.

If nothing else, America's missile shortage has revealed important vulnerabilities Washington must address to prepare America to deter and win future wars. The war with Iran has demonstrated the significant cost asymmetry inherent with America's reliance on exquisite defense systems, in which adversaries can mass-produce cheap drones that cost tens of thousands of dollars to build and can force the U.S. to expend multi-million dollar missiles to defend against this relatively cheap asset.

Given the lengthy production times associated with the munitions America uses to support its air defenses, the country's potential adversaries will likely rely on the widely distributed production of cheap and easily built projectiles in hopes of winning a war of attrition against the US. America's adversaries are certainly taking note of this lesson, and the Iran



In June, 2026, U.S. forces carried out a maritime interdiction and right-of-visit boarding of the sanctioned stateless vessel MT Davina located in the Indian Ocean within the INDOPACOM area of responsibility, part of an effort to disrupt illicit networks and interdict vessels providing material support to Iran. Photo credit: U.S. Pacific Command.

war has raised important questions about America's ability to win protracted wars against countries like China with the industrial capacity to produce and maintain a larger arsenal than Iran has deployed in this conflict.

A report released by the Heritage Foundation in August warned a war with China could expend America's supply of missile interceptors within a matter of days, stressing the urgency with which this vulnerability must be addressed.

Boosting Procurement

Fortunately, the Pentagon is being increasingly proactive in hopes of reducing the risk of weapons shortages in the future. The Pentagon's FY 2027 budget request includes a nearly 200% increase in missile procurement funding, and the Navy's latest budget request calls for the procurement of enough torpedoes to support the service's simultaneous engagement in two major regional conflicts, a sign of the service's growing recognition of the need to shore up critical munition supplies.

Efforts by the Pentagon and White House to spur greater munition production may also result in improved production processes or instill a faster drumbeat of production that could help prevent future missile shortages.

However, broader reforms may ultimately be needed to address this vulnerability. Going forward, the military must strike a better balance between its more exquisite weapon systems and cheaper munitions which can be produced faster than much of America's current arsenal and can be deployed against some of the less sophisticated projectiles it may be forced to defend itself against in future conflicts.

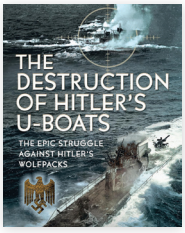
Similarly, the U.S. may need to move on from its "just-in-time" defense industrial model toward one capable of sustaining production that can support prolonged, large-scale conflicts. Such proposals will likely trigger intense debate in Congress and within the Pentagon, and policymakers will find few easy answers in their quest to shore up American munitions.

Continuing to neglect this vulnerability is no longer an option if America's sea services are to prevail in a future great power conflict. ■

Matt Reisener is the Senior National Security Advisor for the Center for Maritime Strategy.

ASW versus U-Boats, Mine Warfare, RN Sub in WWII, Soviet Nuclear Torpedoes, Submarine S-49, Grenada, Dunkirk

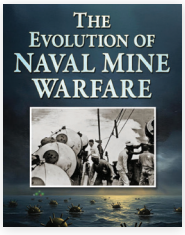
BY RICHARD R. BURGESS, SENIOR EDITOR



THE DESTRUCTION OF HITLER'S U-BOATS: The Epic Struggle Against Hitler's Wolfpacks

By Jak P. Mallmann Showell. Yorkshire and Philadelphia: Frontline Books (Pen & Sword), 2025. 268 pages. $59.95 ISBN: 978-1-03612-753-4

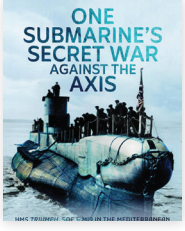
The Battle of the Atlantic in World War II was indeed an "epic struggle," as this book's title suggests. The German U-boat fleet threatened the United Kingdom's very survival and hindered U.S. efforts to build up its forces in the United Kingdom and supply it and the Soviet Union with war material, oil and food. This book's narrative and remarkable array of photos tell the story of the Sailors, weapons, sensor technology, convoy system and code-breaking that took a heavy toll of and eventually broke the U-boat fleet. Even readers familiar with the anti-submarine campaign in the Atlantic will find this book's presentation a welcome addition.



THE EVOLUTION OF NAVAL MINE WARFARE

By Jacob A. Mazurek. Jefferson, North Carolina: McFarland & Co. Inc., 2026. 236 pages. $49.95 ISBN: 978-1-47669-862-5

Most modern literature on mine warfare focuses on mine countermeasures, necessarily, a most difficult warfare domain. This book by a former U.S. Navy mineman focuses on the deployment of sea mines since 1776 in the various wars and crises since. He covers the types of mines developed and the pioneers who advanced the technology, and devotes chapters to mine use in the Crimean War, U.S. Civil War, Russo-Japanese War, World Wars I and II, Korean War, Vietnam War, the wars in the Middle East and even the current Russia-Ukraine War. The reader will find these accounts well-augmented by maps, tables and photos in this illuminating book.

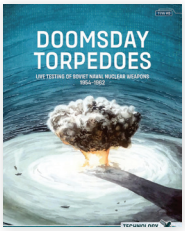


ONE SUBMARINE'S SECRET WAR AGAINST THE AXIS: HMS Triumph, SOE & MI9 in the Mediterranean 1941

By Gav Don. Yorkshire and Philadelphia: Pen & Sword Maritime, 2025. 242 pages. $39.95 ISBN: 978-1-03613-251-4

This book is a detailed history of the short career of Royal Navy T-class submarine HMS Triumph during World War II. Launched in 1938, Triumph survived a detonation of a German mine in December 1939 while operating in the North Sea. After repairs, the submarine deployed to the Mediterranean Sea in 1941, where it sank 13 Axis ships and an Italian submarine and where it landed and exfiltrated Allied agents in Greece and Crete. The submarine disappeared in January 1941, with a crew of 64 Sailors, probably a victim of a mine. The wreck was discovered in 2003 by Greek researcher.

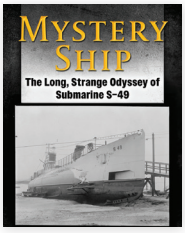
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DOOMSDAY TORPEDOES: Live Testing of Soviet Naval Nuclear Weapons 1954-1962

By Krzystof Dabrowski. Warwick, U.K., Poland: Helion & Co. Ltd., 2025. 56 pages. $29.95
ISBN: 978-1-084515-83-9

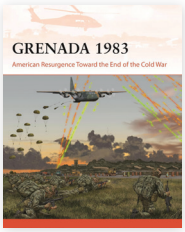
After successful development of nuclear weapons by 1949, the Soviet Union embarked on programs to arm its warships, submarines and long-range strike aircraft with nuclear weapons to counter the U.S. Navy's nuclear-armed carrier task forces and provide a sea-based nuclear deterrent. The Soviet navy armed its forces with nuclear-armed torpedoes, anti-ship cruise missiles and ballistic missiles, all of which required testing. This book features material new to Western readers about the test programs from 1954 to 1962 and covers the nuclear weapon use that almost came to pass in the Cuban Missile Crisis.



MYSTERY SHIP: The Long, Strange Odyssey of Submarine S-49

By Stephen R. Wilk. Jefferson, North Carolina: McFarland & Co. Inc., 2026. 241 pages. $39.95
ISBN: 978-1-4766-9835-9

This book is a detailed history of U.S. Navy submarine S-49 (SS 160), built in 1922 and which served a brief Navy career until 1927, mainly for sonar testing. The submarine was scrapped after two battery explosions in 1926, during which four Sailors died and eight were injured. S-49 returned to service but was decommissioned in 1927 in accordance with the London Treaty. S-49 enjoyed a second life, having been purchased by two entrepreneurs as a tourist attraction along the East Coast and at the Chicago World's Fair. However, the Navy reacquired the submarine hulk during World War II for naval mine warfare research.



GRENADA 1983: American Resurgence Toward the End of the Cold war

By Matthew A. Frakes. Oxford, United Kingdom: Osprey Publishing Ltd., 2026. 96 pages. $25.00
ISBN: 978-1-4728-6849-7

The United States launched Operation Urgent Fury, an invasion of Grenada, in October 1983, the first U.S. major combat operation since the Vietnam War. A joint force of Navy, Marine Corps, Army and Air Force units took part to attack the new Cuba-supported Marxist regime and rescue U.S. medical students on the Caribbean island. The U.S also was concerned about the construction of an airfield large enough to accommodate Soviet nuclear-armed bombers. The operation was subject to heavy international criticism but ultimately was successful. This well-illustrated book covers the forces involved, the operations, and the political context of the successful rollback of Communist influence.



WARSHIPS AT DUNKIRK 1940

By Angus Konstam. Oxford, United Kingdom: Osprey Publishing Ltd., 2025. 48 pages. $20.00
ISBN: 978-1-4728-7255-5

The 1940 evacuation of British Army forces from the beach at Dunkirk, France, is famous for its breathtaking accomplishment and the effort of British citizens in small boats and ships to aid in the rescue. This well-illustrated account covers the Royal Navy and French navy warships that participated in the operation, conducted under intense air attack by Luftwaffe Stuka dive bombers and other bombers. The Allied cost was heavy: approximately eight destroyers and 29 smaller warships and naval craft were sunk by German forces. The various ships are covered in detail to accompany the operational narrative.



Holland II, the "Fenian Ram," on display in the city of Paterson, New Jersey, as a memorial to pioneering submarine builder John P. Holland. Photo credit: U.S. Naval History and Heritage Command.

An Underwater Special Relationship

BY DAVID F. WINKLER

Arriving on foot to the Royal Navy Submarine Museum (recently rebranded as Royal Navy Museums: Submarines), across the channel from the main section of the National Museum of the Royal Navy at Portsmouth, U.K., one might notice the HMS Alliance dominates the left side of the museum approach.

As with many U.S. Navy Fleet Boats that served during World War II, Alliance underwent several upgrades that kept the submarine in service against the Soviet Union until the 1970s. The tall sleek conning tower is reminiscent of that of USS Becuna, a World War II vintage submarine that underwent GUPPY (Greater Underwater Propulsion Power Program) conversion after the war and is now on display next to Olympia in Philadelphia.

On the right side is a small building that holds a surprise for those appreciating the history of the American submarine service: Holland I. This is not the same craft as the original USS Holland that was acquired by the U.S. Navy on April 11, 1900 (the Submarine Service birthday). That submersible, dubbed Holland VI by its Irish émigré inventor John P. Holland, would be placed in commission on Oct. 12, 1900. Serving as a prototype, USS Holland remained commissioned for less than five years. Eventually, Holland VI would be placed on display in the Irish immigrant's adopted hometown of Paterson, New Jersey, only to be sold for scrap during the early years of the Great Depression. Happily, the Paterson Museum retains two of Holland's earlier submersibles: Holland I (1878) and Holland II (1881 – known as the Fenian Ram).



HMS Holland I, the first submarine commissioned by the U.K. Royal Navy, shown underway. Photo credit: Wikipedia.

Intrigued with USS Holland, the British contracted with Holland to build his submersibles in the United Kingdom. Work on HMS Holland I began at Barrow-in-Furness in Cumbria on Feb. 4, 1901. Completed eight months later, Holland I underwent sea trials the following spring and arrived at Portsmouth in September 1902 with other recently completed submersibles to form the first Royal Navy submarine squadron. That growing squadron nearly saw action in October 1904 as the Russian Baltic Fleet departing for the Far East to fight the Japanese fired on British fishing vessels in the belief that they were Japanese in what became known as the Dogger Bank incident. Having orders to attack the Russian flotilla, the British submarine squadron would be recalled as diplomacy saved the day.

The British Holland I almost suffered the same fate as America's first Holland. Technological advances made the submersible obsolete and, in 1913, the Royal Navy sold the boat to a Welsh scrapper. However, while in tow to Wales, Holland I took on water and made one final dive — to be lost to history until rediscovered in 1981. After a decade on outdoor display at the Royal Navy Submarine Museum, a realization of rapid deterioration due to 69 years of saltwater exposure led to a five-year conservation effort that placed the submersible in a tank filled with a solution of sodium carbonate to leach out the chloride salts. The museum then provided Holland I with a new climate-controlled indoor home. In doing so, the British preserved not only a piece of British submarine history but also an American one.

The Turtle Attacks

The Royal Navy Submarine Museum highlights "the special relationship" in other ways. A section tells the story of the Royal Navy's deterrence mission that was made possible with the transfer of American nuclear reactor and Polaris missile technology. However, the surprise exhibit with very American roots is the replica of the Turtle, marking the 250th anniversary of a different special relationship that had soured.

Perhaps the museum's willingness to place the replica on display stems from the fact the Royal Navy played a role in the Turtle story by providing a target for attack, and that target survived unscathed.

This past Sept. 7 marked the 250th anniversary of that attack. In 1776, the situation for the Americans was dire as General Washington had miraculously extracted his Army just over a week prior from Brooklyn after suffering defeats at the hands of British and Hessian troops, who had begun landing on Long Island following a month and a half buildup on Staten Island. Royal Navy ships flooded New York's harbor in preparation for an assault on Manhattan to finish off Washington. The American general, hoping to apply some asymmetric warfare to disrupt the British plans, turned to inventor David Bushnell, who had developed a method of detonating underwater explosives. To deliver those explosives, Bushnell also designed a self-propelled submersible that would be called the Turtle and worked with New Haven inventor Isaac Doolittle to construct the unique craft.

Successfully tested on the Connecticut River, the Turtle was transported over land from New Rochelle to the Hudson River and then towed downriver. Turtle's





A recreation of the Turtle built in 2002 by faculty and students from the Massachusetts College of Arts and Design is on display in the lobby of the Spy Museum in Washington, D.C. Photo credit: Brett Davis.

intended target, HMS Eagle, served as the flagship for the British blockade squadron. Destruction of Eagle not only would eliminate an important British naval asset but also would signal that the whole British flotilla was vulnerable — and perhaps factor into British planning considerations.

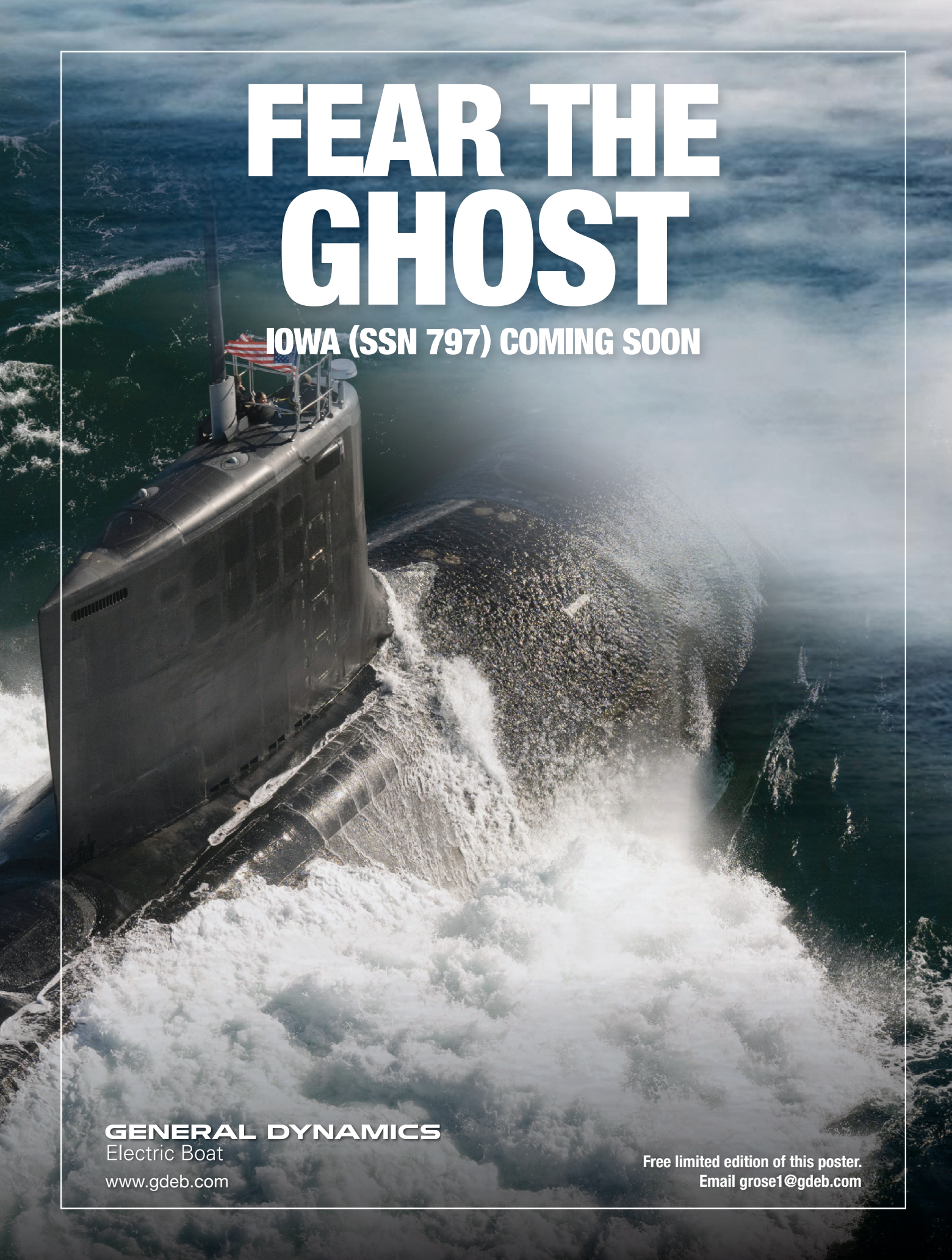
As it so happened, Sergeant Erza Lee's valiant effort to place a charge against the hull of Eagle failed. While failure to pierce the copper sheathing covering the hull is cited, Bushnell thought Lee had hit iron fittings that were in place to support the rudder. Attempts to attack other British warships with the submersible would also fail. Later in 1776, the British successfully sank Turtle's support vessel with the submersible on board. Bushnell claimed he recovered the submersible but, if so, its disposition is unknown. With the absence of any British records to mark the event, there have been naysayers challenging the notion that Turtle was capable of such a feat.

However, in 2002, faculty and students from the Massachusetts College of Arts and Design built a replica that would be tested at a tank at the U.S. Naval Academy, and during the testing the replica Turtle was able to drill and affix a device into a replica coppered hull. That replica of the submersible currently is on display at the International Spy Museum in Washington, D.C.

Another replica was built for the nation's bicentennial in Bushnell's home state of Connecticut where it is on display at the Connecticut River Museum. A third working model was produced in 2007 in an ambitious partnership between Old Saybrook High School in Connecticut and the Naval Undersea Warfare Center based in Newport, Rhode Island. There is a cutaway replica at the Naval Submarine Force Museum at Groton, Connecticut, and finally, the replica at the Royal Navy Submarine Museum is also a cutaway the museum received back in 1982.

Of course, the special relationship works both ways. Don't be surprised to see the ship's bell of the Royal Navy submarine HMS Trump recently presented to the 45th/47th president by King Charles on display at a future presidential library and museum slated for Miami. ■

Dr. Winkler is the Historian General of the Naval Order of the United States.


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Anduril Industries is fielding the Dive-XL, an all-electric vehicle the company says can travel more than 2,000 nautical miles without surfacing. Photo credit: Anduril.

Trucks Under the Sea

DIU Seeks Unmanned Subs to Haul Sensors, Mines, Other Payloads

BY DAN TAYLOR

In a hypothetical present day undersea battlefield, a U.S. Navy submarine commander faces a difficult choice: send a nuclear-powered attack sub and its crew into contested, shallow water to place a sensor, or hold that asset back due to the risk, despite the importance of the mission.

The Navy is hoping not to have to make that choice in the future as it turns its focus to the South China Sea and the surrounding region. That's why the service is developing an uncrewed vehicle it describes less like a warship and more like a truck.

The Defense Innovation Unit, working with the Navy's Program Executive Office for Unmanned and Small Combatants, has opened a solicitation for the Combat Autonomous Maritime Platform, an extra-large unmanned undersea vehicle designed to move big payloads over big distances with no one aboard. The requirement calls for a range beyond 1,000 nautical miles, an operating depth greater than 200 meters and a payload bay 21 feet long and 21 inches in diameter, matching the dimensions of the vertical launch tubes already built into Virginia-class submarines.

This could theoretically allow CAMP to carry Encapsulated Torpedo mines or clusters of smaller unmanned vehicles without years of separate weapons integration, since the payloads themselves are already mature and fielded.

While today's smaller unmanned undersea vehicles the Navy already operates are launched by hand or fired from a torpedo tube for reconnaissance and mine-countermeasure missions, CAMP is built for volume and range instead — pier-launched, sized to carry a mothership's worth of gear, and expected to transit entire ocean basins on its own.

Three industry teams are building prototypes under the program. Anduril Industries is fielding the Dive-XL, an all-electric vehicle the company says can carry up to three payload modules and travel more than 2,000 nautical miles without surfacing, double the Navy's baseline requirement, according to its published specifications; Anduril says the vehicle fits inside a standard 40-foot shipping container and is building it in Sydney, Australia, and Quonset Point, Rhode Island. A second team, led by Metron Inc. with Cellula Robotics, Integer Technologies and General Dynamics Applied Physical Sciences, is building the Lancet prototype around Cellula's Guardian vehicle, which the companies say can run on hydrogen fuel

cells for as long as 38 days and cover roughly 2,700 nautical miles on a single dive. A third team, Kongsberg and Oceaneering International, is drawing on decades of commercial offshore engineering, from deep-water oil field work to subsea cable repair, to develop its design.

Getting There

Building a vehicle that can travel a thousand miles underwater is only part of the challenge; getting it there without getting lost is the harder one. GPS signals do not penetrate seawater, so a vehicle running for days at depth cannot simply check its position the way a ship or aircraft can. The requirement for GPS-denied navigation is pushing contractors toward terrain-relative navigation and bathymetric mapping, in which a vehicle's sonar builds a three-dimensional picture of the seafloor and compares it against a preloaded map to correct its course, adapting techniques originally developed for cruise-missile guidance.

Forward-looking sonar and onboard processors handle obstacle avoidance in real time, steering the vehicle around seamounts and wrecks without a human at the controls. Powering all of that for weeks at a stretch is a massive engineering challenge that is driving varied approaches among contractors: some are using hydrogen fuel cells to maximize endurance, while others are proving that high-capacity battery architectures can indeed cross an ocean without compromising the payload volume the Navy requires. And because acoustic modems move data too slowly to offload it in bulk from depth, the Navy and its industry partners are also looking at subsea docking stations that could recharge a vehicle and relay its data to a surface drone acting as a gateway back to a command center — infrastructure that does not yet exist at any scale.

Asked whether CAMP is meant to become a formal program of record, a Navy official told Seapower the service "is proceeding with the prototyping phase to inform future program of record decisions," with initial prototype deliveries on track for the 3rd quarter of fiscal 2027 that will "accelerate operational evaluation, mature key technologies and mitigate technical risks ahead of formal transition decisions" — a timeline that puts CAMP roughly a year and a half from its first hardware in the water, which means operational capability is a bit further off.

CAMP is not meant to replace the Navy's other large unmanned undersea effort, the Orca extra-large UUV built by Boeing. "CAMP and Orca are separate prototyping efforts, designed to address distinct mission objectives through different technological approaches," the official said, and CAMP "is neither a component nor a sub-element of Orca; rather, it builds on lessons learned and technologies matured" through that earlier program.

The Navy also doesn't plan to pick a single winning design: "The Navy intends to field all successful prototypes that meet operational standards, leveraging the complementary strengths of multiple designs," the official said.

That approach fits a larger shift underway at the Pentagon, where uncrewed vehicles like CAMP are treated as attritable rather than exquisite.. A fleet of them scattered across the South China Sea, the Taiwan Strait or the Greenland-Iceland-United Kingdom gap would be cheap enough to lose and hard enough to distinguish from a crewed submarine, forcing an adversary to spend scarce sensors and weapons chasing all of them down.

Unmanned Undersea Vehicle Squadron 1, Surface Development Squadron 1 and Task Force 59 are already writing the doctrine and training pipelines for Sailors who will manage fleets of these vehicles from ashore, in some cases commanding more than a dozen at once. Whether CAMP becomes the vehicle that fills that role or simply teaches the Navy how to build the one that does, the solicitation marks a key milestone in the evolution of the unmanned undersea force from purely sensors to more key roles that were only theoretical years ago. ■

Dan Taylor has covered the U.S. Navy and the Pentagon since 2007 for a wide range of publications, focusing particularly on Pentagon acquisition and the latest in defense technology. Currently, he is technology editor for Military Embedded Systems.



USS Vermont (SSN 792) arrives at HMAS Stirling, Western Australia on Oct. 29, as part of a scheduled port visit before a planned submarine maintenance period. Photo credit: U.S. Navy | Ashley Calingo.

The Fifth Shipyard

Australia's HMAS Stirling Could be Key Future US Navy Maintenance Outpost

BY DAN TAYLOR

A Virginia-class attack submarine patrolling the South China Sea or standing watch near a Pacific chokepoint faces a hard arithmetic problem the moment something breaks. The nearest U.S. shipyard capable of fixing it sits in Hawaii or Washington state, weeks away at transit speed, and every day spent steaming home is a day the boat isn't tracking an adversary fleet or holding a chokepoint.

Last October, the Navy tested a different answer: it sent the USS Vermont (SSN 792) to HMAS Stirling in Western Australia and repaired it there instead of sailing it home.

That could be the norm in the future, which could be of tremendous benefit to the Navy. Every maintenance day Stirling can absorb is a day the Navy does not have to compete for at the four major public shipyards: Norfolk Naval Shipyard (NNSY), Portsmouth Naval Shipyard (PNSY), Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS&IMF), and Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility (PHNSY&IMF).

HMAS Stirling sits on Garden Island off Western Australia's coast, roughly 30 miles south of Perth on the Indian Ocean side of the country. It's the Royal Australian Navy's largest shore establishment, home port to the RAN's six Collins-class submarines and four Anzac-class frigates.

In March 2023, the United States, United Kingdom and Australia announced the Submarine Rotational Forces-West (SRF-W) initiative as part of the AUKUS trilateral security partnership between the countries. Under this initiative, the U.S. and U.K. would maintain a permanent presence of nuclear-powered submarines at the base.

The USS Vermont's maintenance period was the first intermediate-level work ever performed on a Virginia-class submarine outside the United States without a submarine tender alongside to support it, relying instead on a fly-away team from Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility blended with Australian personnel to complete more than 160 maintenance tasks over four weeks.

A Navy official told *Seapower* these initial maintenance activities "successfully demonstrated our foundational capabilities." However,

it's a far cry from building the capacity to do that kind of work routinely for a rotating fleet, rather than a one-off.

Persistent Presence?

The Navy is interested in finding out if it can be done. Submarine Rotational Force-West plans to station a persistent rotational presence of up to four U.S. Virginia-class submarines and a U.K. Astute-class boat at HMAS Stirling as early as 2027, although much work must be done between now and then.

"Key future capabilities at HMAS Stirling to support Submarine Rotational Force-West include expanded ability to repair shipboard components, enhanced pier services support to enable more efficient in-port maintenance execution, and ability to conduct all necessary pierside nuclear maintenance and repairs," the official said.

Those capabilities, the official added, "largely leverage minor outfitting of existing facilities, and in some cases include construction of new facilities." Construction and site preparation are underway and "scheduled to deliver the required capability in time for the commencement" of the rotational force in 2027, the official said.

Stirling does not need a submarine tender or a dry dock to do useful work today. "HMAS Stirling can currently support routine port visits and intermediate-level maintenance alongside the pier," the official said, including "waterborne repairs and component replacements."

Two homegrown fixes have expanded what pierside crews can handle without shipyard-scale infrastructure: a mobile pure water plant engineered by Western Australian industry to meet the exacting purity standards a nuclear reactor's cooling system demands, and a locally manufactured high-pressure air compressor system. Both, the official said, were "successfully used during recent submarine maintenance periods and provide even greater capacity to support SSN maintenance."

None of it works without people who can do the job, and that is where the Navy points to the most concrete number of the buildup: "Currently, more than 200 Australian civilian maintainers are receiving hands-on training at the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility," the official said, describing a program "designed to build a permanent, highly skilled Australian maintenance workforce at HMAS Stirling, reducing the reliance on fly-away teams over time."

The payoff extends past the rotational force: the official framed the training pipeline as a step toward a self-sufficient maintenance capability in Australia to support SRF-West. It could also support Australia's own sovereign fleet of conventionally armed, nuclear-powered submarines, the official added.

Still, Stirling has its limitations. Pierside crews can swap components and patch hulls, but a true depot-level overhaul — the kind that requires cutting into a submarine's pressure hull to replace massive internal machinery — still means sending the boat elsewhere. Australia is building a floating contingency dry dock nearby at the Henderson Defence Precinct, but its platform flexes with the tide in ways that make it unsuited to that precise work. A permanent, concrete graving dock capable of full depot-level maintenance is not expected in Western Australia until the late 2030s.

Asked whether the service is looking at additional forward maintenance or rearming sites in the Indo-Pacific beyond Stirling and Henderson, the official said the Western Australia investments are "part of a broader, distributed approach to maritime logistics," but declined to discuss the evaluation or selection of potential future operational nodes.

Taken together, the buildup at Stirling looks like the leading edge of a lasting change in how the U.S. Navy postures itself in the Western Pacific. As the Navy turns its focus to its rival, China, it is putting down deeper roots in the region. Sustaining a forward-deployed submarine force in the Pacific is no longer being treated as a problem to solve once a crisis emerges. It is being built now, on a published schedule, years ahead of when anyone expects to need it. ■

Dan Taylor has covered the U.S. Navy and the Pentagon since 2007 for a wide range of publications, focusing particularly on Pentagon acquisition and the latest in defense technology. Currently, he is technology editor for Military Embedded Systems.


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The crew of the Virginia-class nuclear-powered fast-attack submarine USS Idaho (SSN 799) stand at attention during Idaho's commissioning ceremony at Naval Submarine Base New London in Groton, Conn., April 25, 2026. Idaho is the newest fast-attack submarine and the fifth U.S. Navy vessel named for the Gem State. Photo credit: U.S. Navy | Chief Mass Communication Specialist Darren M. Moore.





Reasserting Dominance

A New North Atlantic Underwater Warfare Bastion

BY LEE WILLETT

In 2020, a Russian navy Oscar-class submarine was photographed by NATO forces sailing into the Baltic Sea. The U.K.'s Atlantic Bastion concept is designed to build integrated crewed-uncrewed surveillance and deterrence against the underwater threat. Photo credit: U.K. Ministry of Defence.

In the Cold War, the Soviet navy sought to use secure sea areas, especially in the Barents Sea, as "bastions" in which to hide its nuclear-powered ballistic missile submarines (SSBNs) out of reach of NATO's nuclear-powered fast-attack submarines (SSNs), bastions from where these boats could launch ballistic missiles across the North Atlantic toward the continental United States.

Today, the Russian navy's approach to deterring its adversaries is different. It retains the capacity to employ SSBNs and their payloads in the same manner. However, central to its deterrent activity is using its own SSNs — which carry dual-capable long-range Kalibr cruise missiles — to threaten targets across northern and central Europe from the Barents and Norwegian seas.

As NATO navies have responded to this changing threat, the role of the Greenland-Iceland-U.K. (GIUK) Gap maritime chokepoint has changed, too.

In the Cold War, the GIUK Gap was a gateway through which Soviet submarines sought access to roam more freely across the northern and western Atlantic. Today, the Russian navy may see the GIUK Gap more as a barrier, aiming to use submarines and other threats to keep NATO naval power — particularly U.S. Navy "heavy metal" — on the western side of the Gap. The net result would allow Russian submarines to slip more easily from the Barents Sea shallows into deeper Norwegian Sea waters and then roam freely again and threaten NATO European targets.

Consequently, NATO's major submarine-operating navies in the North Atlantic region are seeking to reassert underwater battlespace dominance eastward of the GIUK Gap, including to push Russian boats out of the Norwegian Sea, back into the Barents and out of Kalibr striking range of central European (and some northern) NATO targets.

SDR's strategic context is crucial here. Through a "NATO first" posture, the U.K. is committing to support its national and NATO security interests in the North Atlantic in an integrated manner. Moreover, SDR assigned three core roles for the U.K. armed forces. The second — enhancing North Atlantic deterrence and defense — explicitly demonstrates commitment to NATO interests. The other two — building national resilience and shaping global security, including against emerging threats — also have clear NATO North Atlantic deterrence relevance.

> **Atlantic Bastion is a groundbreaking concept revolutionizing how we protect the U.K. and its allies in the underwater environment.**
>
> *- General Sir Gwyn Jenkins, First Sea Lord, U.K. Royal Navy*

To support this naval operational-level aim, and its strategic-level deterrent impact, one of these NATO submarine forces, the U.K. Royal Navy, is establishing a new North Atlantic bastion concept.

Atlantic Bastion

In its 2025 Strategic Defense Review, the U.K.'s most recent defence policy update, the U.K. government announced the establishment of the Atlantic Bastion concept.

"Atlantic Bastion is the RN's plan to secure the North Atlantic for the U.K. and NATO against the persistent and growing underwater threat from a modernizing Russian submarine force," the SDR says.

Since around 2016, senior NATO naval officers have been underscoring the returning Russian underwater warfare threat, highlighting not only the enduring anti-submarine warfare challenge but the emerging threat to critical undersea infrastructure and the returning significance of naval mine warfare, the latter now as a strategic-level threat to Euro-Atlantic sea lines of communication security.

Recent events in the North Atlantic have underlined the threat is real.

The U.K. government reported that in April 2026, U.K. and NATO



A Royal Navy submarine sails off the coast of the U.K. with critical infrastructure assets in the background. Atlantic Bastion will see underwater assets deployed widely across the North Atlantic, including to deter threats to critical underwater infrastructure. Photo credit: U.K. Ministry of Defence.

forces, including anti-submarine warfare assets, had responded across Norwegian Sea waters to a two-pronged Russian underwater incursion.

The Russian activity included an Akula-class SSN deploying in a diversionary manner, while specialist Russian deep-submergence submarines moved against a critical undersea infrastructure network that was of interest to several NATO member states. Having tracked the Russian deployment for a month using air, surface and subsurface ASW surveillance capabilities, the NATO forces conducted overt messaging maneuvers to let Russia and its submarines know they had been located, identified and tracked. The Russian boats sailed for home.

This incident reflected what the U.K. sees as an increasing pattern of activity. In early 2026, the U.K. government stated Russian naval activity in and around U.K. waters had increased by 30% in two years. Much of this activity is located in the underwater environment. The April 2026 incident is an extremely rare example of covert, underwater operations being discussed so openly, but that in itself underlines the significant nature of the threat.

However, other underwater-related actions have been more overt. On several occasions in the last two years, the Royal Navy has driven away Russian intelligence-gathering vessels and "shadow fleet" ships with links to Russia which were loitering near critical underwater infrastructure sites. In one incident in November 2024 in the southwestern approaches, the Royal Navy surfaced one of its Astute-class SSNs near the Russian intelligence ship Yantar to show it was being monitored. Putting an SSN "on the roof" in a visible demonstration of deterrence, and then revealing this move publicly, was another unprecedented step that says much about the reality of the threat.

Hybrid Fleet

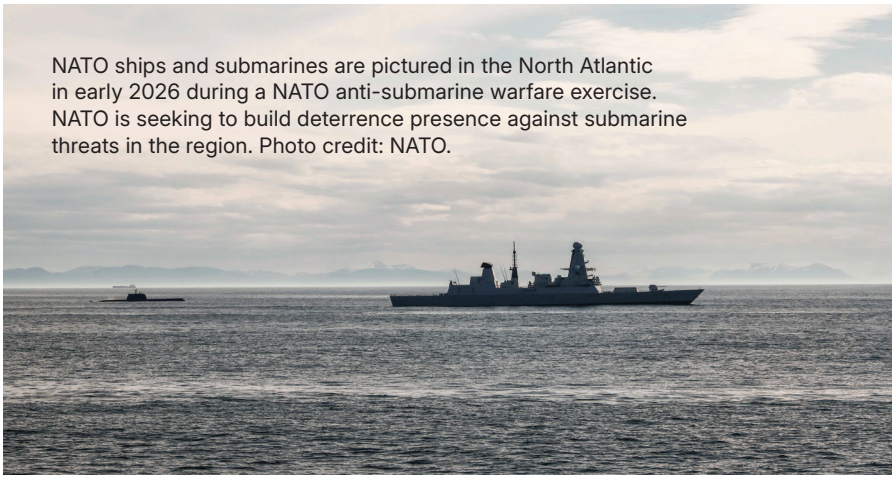
The Atlantic Bastion has been designed to deal with a real underwater warfare threat. There are several layers to its operational construct.

First, it is one part of a trilateral Atlantic Fleet series. This series is the centrepiece of the Royal Navy's transition to a hybrid navy construct, in which maritime uncrewed systems will bring mass in surveillance and strike outputs to complement crewed systems.

Atlantic Bastion deals with the underwater domain. Atlantic Shield is based around integrating large uncrewed surface vessels with crewed surface ships to build air-defence capability against integrated air and missile defence threats. Atlantic Strike harnesses long-range crewed and uncrewed capabilities — the latter including aircraft carrier-borne uncrewed fast jets — to threaten deep-strike operations as a response capability, designed to deter threats in the first place.

Under these three operational outputs, maritime uncrewed systems will deliver mass and persistence for protecting critical underwater infrastructure, the U.K.'s SSBN-based strategic nuclear deterrent and NATO North Atlantic security.

In September 2025, at the DSEI defense exposition in London, the Royal Navy revealed further Atlantic Bastion details. General Sir Gwyn Jenkins, the Royal Navy's First Sea Lord and chief of naval staff, explained the bastion would be a networked system of systems, integrating crewed and uncrewed platforms to provide robust sensing posture and presence from the mid-Atlantic Ridge to the Norwegian Sea.



NATO ships and submarines are pictured in the North Atlantic in early 2026 during a NATO anti-submarine warfare exercise. NATO is seeking to build deterrence presence against submarine threats in the region. Photo credit: NATO.

This system of systems would generate capacity to find, track and act against underwater opponents. Moreover, maritime uncrewed systems use would add mass and lethality in this task to the navy's in-service crewed platforms, Jenkins said.

"Atlantic Bastion is a groundbreaking concept revolutionizing how we protect the U.K. and its allies in the underwater environment," Jenkins said. "It will provide a formidable underwater defense posture from the Mid-Atlantic Ridge to the Norwegian Sea."

To deliver on this requirement, Atlantic Bastion is split into two separate phases, both delivering capability development and operational deployment.

First, under what is called Atlantic Net, a large number of uncrewed underwater vehicles will be deployed in an around the GIUK Gap to build sensing presence there.

Second, under what is still called Atlantic Bastion itself, the initial capability and geostrategic structure established in Atlantic Net will be expanded, to include platforms like extra-large UUVs plus crewed assets like the Astute-class SSNs, the Royal Navy's new Type 26 ASW frigates, and NATO maritime patrol aircraft, all connected up across an expanded geostrategic mission scope covering the North Atlantic more broadly.

Procurement Process

In December 2025, the U.K. Ministry of Defence formally launched a procurement program for Atlantic Bastion.

This process includes two workstrands: first, securing an industry mission partner to deliver the Atlantic Net phase; second, launching a technology demonstrator process to identify sensing capabilities bringing the technology and scalability to be deployed en masse. Such technologies are intended to be in the water in 2026 and tested fully across the year; in 2027, the Royal Navy will seek to enhance technology functionality so Atlantic Net can go live by the end of that year. Phase two would follow in due course.

The next step is for the MoD to set out a budgetary and procurement approach for Atlantic Bastion to deliver on the Strategic Defense Review's strategic vision. This budgetary and procurement flesh on SDR's framework was set out in the Defense Investment Plan, published in June 2026.

The DIP reiterated the strategic significance of the Atlantic Bastion requirement, underscoring both the central role of submarine capabilities in meeting NATO deterrence needs and the role of cutting-edge uncrewed technologies as an integral part of a technological revolution in naval warfare. In the latter instance, the DIP referred to Atlantic Bastion as creating an "advanced hybrid naval force to defend the U.K. and NATO allies against evolving threats."

Most significantly, the DIP spelled out that Atlantic Bastion would receive additional funding of GBP 1.5 billion (more than $2 billion USD) over the next four years. This funding "will enable the U.K. to find, track and, if required, act against adversaries with unprecedented

effectiveness across vast areas of ocean," the DIP said.

Within this funding, two new uncrewed platforms will be developed to help deliver Atlantic Bastion: the Type 92 UUV for underwater sensing (a capability the technology demonstrator process is designed to support); and the Type 93 extra-large UUV to support the second phase outputs.

The DIP said the U.K. would also spend GBP 330 million over the next four years to secure critical underwater infrastructure, including investing in further capabilities and enhancements for the U.K.'s dedicated CUI security ship, RFA Proteus.

The DIP announced other underwater investment areas, including spending GBP 1.2 billion over the next four years as the headline figure to support underwater warfare capability developments; GBP 20 million on artificial intelligence to help enable underwater dominance through enhanced surveillance data gathering; and investing in sensors and other systems for UUVs as a signature project of the Australia-U.K.-U.S. (AUKUS) strategic partnership's Pillar 2, which looks to rapidly exploit emerging technologies.

These half-dozen separate programs will all integrate to deliver enhanced operational output but will require quick delivery to help deter the persisting underwater threat. ■

Dr. Lee Willett is an independent writer and analyst specializing in naval and maritime matters, with a 25-year professional background. He has spent time at sea, on submarines and aircraft carriers, among others.

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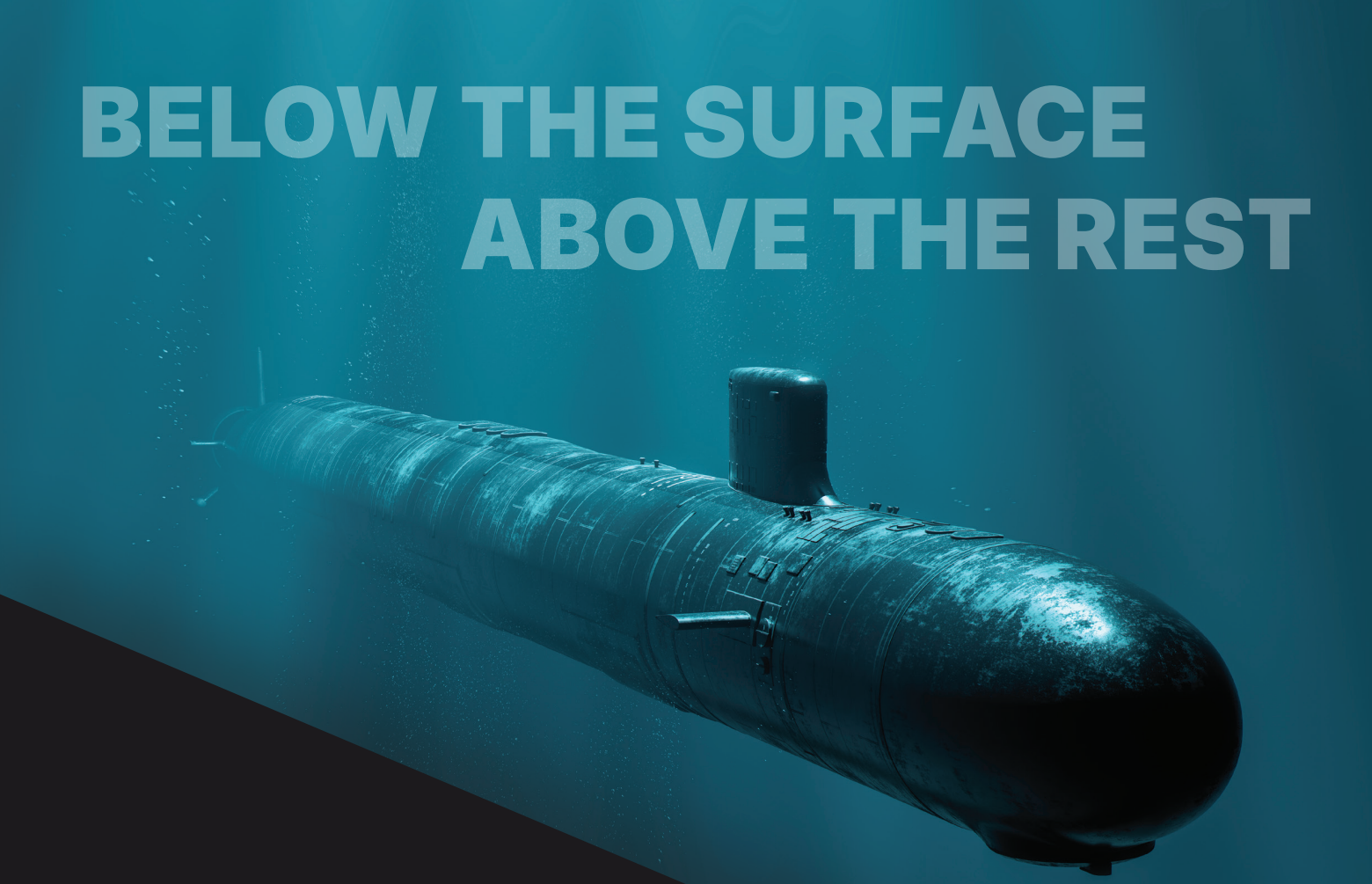
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Capt. Joseph Darcy, then commanding officer of Naval Surface Warfare Center Philadelphia Division, gives a keynote address during the Maritime Sustainment Technology and Innovation Consortium MSTIC-25-02 Collaboration Event at the Philadelphia Convention Center in March 2025. Photo credit: U.S. Navy | Gary Ell.

Delivering Capability Faster

Why Navy OTAs and Consortia Matter Now More Than Ever

BY TOM KEARNEY AND BILL DELIGNE

The U.S. Navy faces a clear operational reality: The pace of technology, threat evolution and fleet demand now exceeds the speed of traditional acquisition.

From autonomy and artificial intelligence to advanced manufacturing, cyber resilience and sustainment modernization, the fleet requires the development and deployment of new capabilities faster, and those capabilities must come from a broader and more innovative industrial base.

While these challenges are widely understood across the defense community, what is less widely appreciated is that one of the most effective acquisition tools available to address them remains underutilized: Other Transactions (OTs) and the collaborative consortium model that has developed around them through Other Transaction Agreements.

OTs themselves are not new and over the past decade have matured significantly across the Department of War. The Navy has established 10 warfare center–sponsored consortia, each aligned with the technical focus and mission outcomes of its respective center. They provide a proven and disciplined acquisition pathway for the Navy and industry to work together with greater speed, broader participation and more open communication, ultimately delivering better outcomes for Sailors, ships and naval systems.

Collectively, we have spent decades inside the Navy's acquisition and operational enterprise, including senior leadership roles within Naval Sea Systems Command (NAVSEA). During those years we saw firsthand how bureaucracy, onerous processes and risk aversion can slow the delivery of capability. Over the past several years, as the respective executive directors of Naval Surface Warfare Center Dahlgren's Naval Surface Technology & Innovation (NSTIC) and NSWC Philadelphia's Maritime Sustainment Technology and Innovation (MSTIC) Consortia, both managed by Advanced Technology International, we have also seen firsthand what becomes possible when government and industry collaborate with urgency, clarity and open communication.

Today, while OT-based consortia represent one of the most immediately available and effective tools for improving acquisition outcomes and accelerating capability delivery, their potential has not been fully realized.

Below we address some of the perceived challenges to utilizing OTs.

Understanding the Model: Tool vs. Team

First, it is important to distinguish between two related, but different, elements of this model. OTs are the tool. Consortia are the teams.

OTs, established under 10 U.S.C. 4021/4022, allow the Department of War to execute prototype and follow-on production agreements outside many of the traditional requirements of the Federal Acquisition Regulation (FAR). In practice, this enables the government to engage industry more easily and more flexibly in the development of innovative solutions. Within the Navy, these authorities are often executed by contracting offices at the Naval Warfare Centers.

Consortia, on the other hand, are structured communities of industry, academia and research organizations that participate under a common membership agreement. Companies formally join the consortium through a membership agreement and can then respond to project solicitations issued under the OT framework.

Each consortium is typically overseen by a Consortium Manager/Consortium Management Firm (CMF) selected by the warfare center that holds the OT authority. The CMF manages membership, facilities collaboration (business-to-business and business-to-government), provides training, administers solicitations, coordinates proposal submissions and handles the administrative aspects of project execution, including funding flow and reporting.

> **When government and industry collaborate effectively, the Navy delivers capability to the fleet faster and with greater mission relevance.**

For acquisition organizations facing workforce and contracting workload pressures, in this structure the CMF serves as a force multiplier allowing program offices to focus on technical evaluation and capability delivery to the fleet.

Just as importantly, the model allows the Navy to cast a significantly wider net for innovation, engaging hundreds of traditional and nontraditional companies that might otherwise find it difficult to participate in conventional government procurements. In parallel, the collaboration process allows the nontraditional companies to understand the mission and organization and to collaborate with traditional defense contractors where it makes sense. Overall, the consortia model further reduces barriers to entry for commercial technologies into the defense industry.

Understanding How to Use OTs

In conversations with Navy program managers and senior acquisition leaders, we often hear the same message: They recognize the general value of OTs but remain uncertain about how to initiate the process of utilizing them within existing acquisition workflows. The perception is often that accessing an OT requires a complicated or unfamiliar acquisition process.

The entry point is far simpler than many realize.

For most warfare center–sponsored consortia, the process can begin with something as straightforward as a clearly defined operational need. Program offices can work with their warfare center technical teams to translate that need into a statement of need that is included in the consortium's next request for prototype projects (RPP).

Industry members of the consortium then respond with enhanced white papers, typically limited to about 15 pages, that describe potential solutions. These submissions are intentionally



On Oct. 19, 2022, Naval Surface Warfare Center Dahlgren Division hosted the Naval Surface Technology and Innovation Consortium Other Transaction Authority Industry Day event at the Fredericksburg Expo and Conference Center in Virginia. The goal of industry day is to increase collaboration to open more innovative solutions to benefit the warfighter in a flexible and faster way. Photo credit: NSWC Dahlgren Division | Stacia Courtney.

concise but provide enough technical detail for the government to evaluate ideas and select promising approaches without requiring the lengthy proposal packages associated with traditional acquisition programs.

The result is a process that is easier for both sides:

- Program offices receive a broad range of innovative solutions from both traditional and non-traditional companies
- Industry faces a lower barrier to participation, making it easier for new innovators to contribute
- Government evaluators are able to review proposals quickly, allowing prototype efforts to begin faster.

For program offices unfamiliar with the process, assistance is readily available. Warfare center OT program managers, consortium managers/CMFs and the executive directors of the individual consortia all work directly with government sponsors and industry to help guide them through the process.

The Real Value

At the center of the Navy's OT approach is a simple but powerful principle: Better government–industry communication produces better warfighting solutions, with capability for speed.

Under traditional FAR-based contracting, communications between government and industry becomes constrained once a solicitation is released. While those constraints exist for valid reasons, they often limit the ability of both sides to fully align technical solutions.

Under OT-based solicitations, communication and collaboration between government and industry can continue right up until proposal submission. This allows the government to clarify the need, industry to refine their technical approach, and both sides to ensure solutions are aligned with real operational requirements.

The result is better proposals, fewer misunderstandings and solutions that are more likely to deliver what the fleet actually needs.

This ability to sustain productive communication is not simply a procedural benefit, it is one of the most important practical advantages OTs offer. When government and industry collaborate effectively, the Navy delivers capability to the fleet faster and with greater mission relevance.

Two Examples: NSTIC and MSTIC

The Navy's 10 warfare center–sponsored consortia are each aligned to specific technical missions. The two consortia we respectively lead, NSTIC and MSTIC, illustrate how this model operates at scale.

NSTIC is the Naval Surface Technology and Innovation Consortium. Based at NSWC Dahlgren, Virginia, NSTIC focuses on surface warfare innovation across areas such as advanced

computing, Aegis and fire control systems, artificial intelligence and machine learning, directed energy, digital engineering, advanced manufacturing and other emerging technologies.

NSTIC currently includes more than 1,350 members, nearly 1,000 of which are nontraditional innovators. Over the past five years, NSTIC has executed more than $3 billion in prototype projects across approximately 130 efforts, with a majority of awards going to non-traditional defense contractors.

MSTIC is the Maritime Sustainment Technology and Innovation Consortium. Based at NSWC Philadelphia, MSTIC focuses on maritime sustainment technologies that enhance fleet readiness and long-term operational effectiveness. Its work spans propulsion systems, machinery control systems, cybersecurity, energy storage, data transformation and advanced manufacturing solutions that support lifecycle readiness of naval platforms.

MSTIC includes more than 750 industry members and continues to expand its portfolio of sustainment-focused innovation efforts supporting the fleet. To date, MSTIC has executed around 100 projects valued at $325 million. It covers seven Technology Topic Areas and 32 research and development focus areas.

These consortia are not theoretical constructs. They are active teams of government and industry partners delivering prototypes, solutions and transition pathways into real Navy programs. They bring forward innovative ideas from companies that may never have previously worked with the Navy while also enabling collaboration with established defense primes, creating a broader, more resilient industrial base.

An example benefit of the OT CMF model is the ability to concentrate on a particular capability focus area, such as additive manufacturing. When the MSTIC consortium was stood up in 2021, it included just over 50 companies that specialized in 3D printing/additive manufacturing. Since that time the Navy, mainly through the Maritime Industrial Base Program Office, has executed 26 prototype project awards. In response to urgent needs and through the recruiting efforts of the consortium manager, MSTIC now has 216 companies that possess advanced manufacturing as a key capability.

Moving Faster

As executive directors of NSTIC and MSTIC today, we firmly believe the Navy's OT consortium model represents one of the most effective ways to deliver increased value to the fleet, across research and development, procurement and sustainment.

Recent acquisition reforms, including the Department of War Warfighting Acquisition System, reinforce the same direction of travel: accelerating capability delivery, expanding industrial participation and leveraging flexible acquisition pathways such as OTs wherever appropriate.

The Navy is serious about moving faster. For that momentum to translate into lasting results, the broader acquisition community must better understand and more actively employ the OT–consortium model. For acquisition professionals across the defense ecosystem, we encourage the following three actions:

- Program offices should become OT-fluent and understand how these mechanisms can accelerate innovation
- Industry, especially non-traditional firms, should join relevant consortia and engage with warfare center technical leaders
- Navy leadership should treat government-industry collaboration as a strategic advantage.

OTs and their associated consortia are proven mechanisms for expanding the industrial base, accelerating innovation and delivering operational capability to the fleet.

That impact is magnified when OTs are supported by high-performing consortia teams that can rapidly connect government, industry and nontraditional partners around mission needs. In that environment, OTs become one of the Navy's most effective tools for delivering advanced naval power at the speed the mission demands. ■

Rear Admiral (retired) Tom Kearney is executive director of NSTIC OTA and Bill Deligne, SES (retired) is executive director of MSTIC OTA.



USS Chopper, photographed around 1963.
Photo credit: Naval History and Heritage Command.

Cold War Case Study

Near-Loss of Submarine Teaches Lessons on Readiness

THERESA GOODE

On Feb. 11, 1969, USS Chopper (SS 342) was operating submerged off Cuba with USS Hawkins (DD 873) when a routine exercise became a near-loss of the submarine and every man aboard.

At approximately 13:42, while submerged at about 150 feet and making seven to nine knots, Chopper lost AC power. Critical indications, communications, alarms and control references failed or became unavailable. With the stern planes at full dive, the boat entered a rapidly worsening down-angle descent. Within minutes, its bow reached approximately 1,011 feet before the submarine reversed, accelerated upward, broached in a near-vertical attitude, reentered the sea and surfaced again. All 81 men aboard survived.

The incident is dramatic, but its enduring value is not simply dramatic. USS Chopper offers a Cold War case study in submarine readiness, systems integration, casualty response and the human discipline required when machinery, information and time fail together.

Chopper was a Balao-class fleet submarine modernized under the GUPPY IA program, a Navy modernization effort to update World War II boats. Like many diesel-electric submarines of its generation, it represented both durability and adaptation. Its hull came from one era; its postwar service required new systems, new sensors and new operating demands. By 1969, it was no longer a new boat but remained a working part of the Navy's undersea force.

That combination matters. Submarines are not single machines. They are systems of systems: electrical, hydraulic, mechanical, procedural and human. A failure in one system can rapidly become a failure of awareness across the boat.



Eugene and Edna Goode with their children during his Navy service years. The family was part of the Navy community shaped by submarine duty and the long aftermath of USS Chopper's 1969 casualty. Photo credit: Theresa Goode.

The official findings summary makes the ordinariness of the opening conditions clear. At 13:40, Chopper was in trim, submerged at 150 feet, making seven to nine knots with bow and stern plane indicators functioning properly. The report states plainly there was "no unusual activity or events taking place aboard." Two minutes later, the casualty began.

The loss of AC power was not simply a loss of lights. The two online interior communications alternating-current motor generators tripped off without warning, disabling systems that supported alarms, MC speaker systems, motor-order telegraphs, hull and ballast tank indication, shaft revolutions, plane and rudder indication, sonar, radio and other equipment dependent on AC power. The same report states the stern planes were considered to be at full dive at the instant of AC power loss.

The crew was forced to operate inside partial knowledge. The boat's angle worsened. Normal references disappeared. Orders were attempted through communications pathways that did not reliably carry them. The men in Control, Maneuvering and other compartments had to act while still determining what had failed. That is one of the central truths of submarine casualty response: the crew may not receive a clean problem statement. They may have seconds to act before they fully understand the casualty.

One of the clearest examples occurred in Maneuvering. According to the findings, the senior controllerman attempted to communicate repeatedly with Control, then read the pressure gauge near his station, estimated a 40- to 45-degree down angle, and ordered the port controllerman to come to "All back full." Both men took the action immediately. In a casualty defined by partial information and degraded communications, that moment captures the operational lesson: survival depended on trained watchstanders acting correctly before the full picture could be restored.

The response aboard Chopper was distributed across the boat. Emergency blows were ordered. The planes were shifted. Men fought to interpret limited indications. Command decisions in Control had to become mechanical and electrical actions elsewhere. The submarine's descent slowed, stopped, and then became a violent ascent.

The findings record the maximum depth as approximately 1,011 feet at the bow and approximately 720 feet aft, with an angle greater than 75 degrees down. As the boat reversed, the up angle rapidly increased to at least 83 degrees. Loose material that had accumulated forward then fell aft through the air, striking bulkheads and equipment. The submarine broke the surface in a near-vertical attitude, settled stern-first back below the surface, then resurfaced at about 13:45.

Chopper returned to port under its own power but never dove again.

Rote Knowledge

It would be easy to tell the story as a miracle. It would be more accurate to call it a survival of systems under extreme stress. The hull held. The crew held. Training held long enough for action to matter.



Eugene F. Goode served aboard USS Chopper (SS342) during the submarine's Feb. 11, 1969 near loss off Cuba. Photo credit: Theresa Goode.

The official lessons from the casualty remain recognizable to anyone concerned with readiness. The report identified the need for watchstanders to understand the rated load capabilities of ship's service AC motor-generator sets. It warned the loss of one or more ACMG sets, or possibly all AC power, could be caused by transient voltages and current surges. It emphasized the need to think through the consequences of an AC power casualty before it occurred, particularly at speeds over about five knots.

Other lessons were just as practical. Deck plates in the forward torpedo room had not been bolted down and became dangerous at large angles. Auxiliary plane angle indicators required proper adjustment so plane position could be known. Internal communications with Maneuvering required attention, including ensuring E-call selectors were returned to Maneuvering after use. The report also found that watchstanders needed to know, by rote, the differences among loss of AC power, loss of DC power, loss of main hydraulic power, and loss of normal hydraulic power to the planes.

That phrase — "by rote" — is worth remembering. Rote knowledge can sound mechanical, but in a submarine casualty it is often what preserves time for judgment. A watchstander cannot wait for perfect understanding when the boat is taking a severe angle at depth. He must know the system, recognize the casualty, and act.

The Chopper incident also illustrates the enduring importance of human-system integration. Technology gives crews capability, but it also shapes dependency. When indicators fail, when communications are degraded, when the ship's senses go dark, trained people become the remaining control system. Their knowledge must extend beyond normal operations into degraded, confused, and physically disorienting conditions.

That lesson is not limited to diesel-electric submarines or Cold War boats. Today's sea services operate platforms of extraordinary complexity, with increasing dependence on networks, automation, sensors and integrated control systems. The specific technologies have changed, but the operational question remains familiar: what happens when a crew must fight through cascading failure faster than the system can explain itself?

USS Chopper reminds us readiness is not only equipment status. It is watchstander knowledge. It is common language. It is practiced response. It is the discipline of securing equipment before the casualty. It is the ability to keep working when certainty is unavailable.

There is also a reason to remember survival stories as part of naval history. Losses are rightly memorialized. Near-losses deserve attention as well, because they preserve hard-won lessons without the finality of disaster. They show what failed, what almost failed, and what held.

USS Chopper was a boat built for one war, adapted for another, and tested in a moment when training, steel and human action became the difference between survival and loss.

On Feb. 11, 1969, all 81 men came back.

The lesson should come back, too. ■

Theresa Goode is a Navy League member, published author and daughter of Eugene F. Goode, who served aboard USS Chopper during the 1969 incident. Her historical novel, "The Angle of Descent," is based on the near-loss of USS Chopper, official records, crew memory and the aftermath for the men and families connected to the boat.



The forward-deployed submarine tender USS Frank Cable (AS 40), departs Sasebo, Oct. 16, 2024. Photo credit: U.S. Navy | Mass Communication Specialist 1st Class Chase Stephens.

Time for Improvements

U.S. Navy Planning Two New Submarine Tenders After More Than 45 Years

BY PETER ONG

The two current U.S. Navy submarine tenders, both homeported in Apra Harbor, Guam, were also both commissioned in 1979: USS Emory S. Land on July 7 and USS Frank Cable on Oct. 14.

As of this summer, both ships are 47 years old and are expected to be retired in 2029 and 2030, respectively, replaced by a new AS(X) class of submarine tenders.

The new Auxiliary Submarine Tender (Experimental/Next-Generation), or AS(X), will be built as two ships, with the lead ship likely having the designation AS 42 (USS Emory S. Land is AS 39, USS Frank Cable is AS 40, and the long-decommissioned USS McKee is AS 41). Not much is known about the current and future submarine tenders because of their nuclear requirements, as all U.S. Navy submarines are now nuclear powered.

The words "nuclear" and "nuclear reactor" automatically shroud the submarines and their tenders with an air of secrecy because the U.S. Navy does not discuss secret submarine operations with the public and media. However, the U.S. Navy and General Dynamics National Steel and Shipbuilding Company (NASSCO) showcased the AS(X) model at the Sea-Air-Space conference and exposition in 2026 and the Navy has discussed some aspects of the planned ships.

Why New Tenders?

"Submarine tenders are very effective platforms designed to tend ships and submarines alongside at a pier or at anchor, with cranes, services and dedicated shop spaces and onboard planning capability enabling rapid and effective repairs," the Navy's Chief of Information Office (CHINFO) said in emailed responses to questions from *Seapower*.

"These repairs range from short voyage repairs to significant fleet intermediate-level maintenance availabilities. U.S. Navy conducted a thorough analysis of alternatives for replacements for the submarine tenders to include repurposing in service commercial and/or naval vessels. However, the U.S. Navy determined the most effective replacement for the in-service submarine tenders would be a new platform based on an in-service auxiliary ship hull form."

The two existing tenders are effective at their jobs but are reaching end of life, the Navy official said, and "only progressively more intrusive, expensive and extreme time-consuming measures would enable them to stay in service."

Also, "there are some limitations in their ability to work on some newer submarine class systems that were not factored into the original design of these vessels in the 1970s," the official said, although the tenders have regularly been modified with upgraded networks, command and control systems

and automated systems. "One example is the transition from hull penetrating optical periscopes [in submarines] to modern non-hull penetrating multi-spectral electronic photonics masts."

Key Features

The new AS(X) submarine tenders will have a displacement of about 23,000 tons and will be 650 feet long. They will have roughly the same layout features of the Emory S. Land class with 53 specialized workshops consisting of:

- Machine Shop: To make custom submarine replacement parts
- Welding and Pipefitting Shop: To repair hulls, pipes, plumbing and seawater systems
- Sheet Metal and Carpentry Shops: To repair ductwork, interior layouts and wood repairs
- Electrical Repair Shop: To repair electric motors, circuit breakers and battery systems
- Electronics and Instrument Repair Lab: Clean-room environments to repair communications, sonar, navigation and radar systems
- Optical Repair Shop: To repair the lenses and prisms on periscopes and optical masts
- Radiological Controls (RadCon) Lab: Supervised workshops to handle nuclear components safely and with environmental tracking
- Decontamination Facilities: Specialized washdown stations and containment areas that handle nuclear-contaminated tools and parts
- Nuclear Piping and Quality Assurance Shops: Laboratories that examine radioactive shielding and inspecting critical welds
- Torpedo Repair Shop: Workshops that examine and repair the Mark 48 Advanced Capability torpedoes
- Missile Tech Workshops: Workshops that examine and repair the Tomahawk missiles for a submarine's Tomahawk Vertical Launch Systems
- Medical and Dental Deep-Support Clinics: Includes surgery, pharmacy and dental clinics to serve the docked submarine crews
- Dive Locker: Workshop to examine and repair scuba gear, hyperbaric chambers and underwater hull inspection tools used by Navy divers
- 3D Printing and Gauge Calibration Labs: Workshop that tests the submarine valves and print temporary repair components quickly.

The two new submarine tenders, costing $2.2 billion each, will have a large helicopter flight deck for vertical replenishment and MH-60 embarkation and large OP-4 heavy-lift cranes amidships to handle ordnance and tend submarines.

Each AS(X) can accommodate and service three submarines moored alongside. The performance requirements are for 18 knots sustained and 10,000 nautical miles range, similar to the existing submarine tenders. The first hull's estimated delivery is in 2037.

"AS(X) is meant to recapitalize the two existing tenders and has similar requirements for equipment and organization, starting with a clean-sheet design to meet the requirements of the current and



The new AS(X) submarine tenders will have similar layouts and features to the current submarine tenders built in the 1970s but will incorporate technologies not possible decades ago. Image credit: General Dynamics NASSCO.

future submarine fleet," the Navy official said. "Additionally, the ships are being designed and built to American Bureau of Shipping standards and U.S. Coast Guard regulations with the intent to support a hybrid crew of uniformed Navy personnel and Military Sealift Command civilian mariners."

The U.S. Navy official declined to comment on if the AS(X) will have a helicopter hangar and be able to service and repair unmanned surface vessels and unmanned underwater vehicles, citing the AS(X) pre-decisional status.

The new tenders will be built to commercial standards and so "will leverage the latest technology available in commercial shipbuilding and will maximize the use of commercial off- the-shelf products," the Navy official said. "Only a few functions, such as the Nuclear Support Facility, are inherently governmental and will retain a MILSPEC [military specifications] design process."

Since 2024, the Navy has been working collaboratively with industry on cost trade studies, preliminary design, and contract design to improve AS(X) design definition and maturity, cost projection and affordability. The next design phase will occur as part of the fiscal 2027 detail design and construction award, with the design continuing to mature until details are finalized for the platform to support the start of construction, now estimated for fiscal 2030.

AS(X) will be designed with Computer Numerical Control, or CNC, machining technologies and will support additive manufacturing, sometimes known as 3D printing, for repair operations, the Navy official said.

Analyst's View

Brent Sadler, senior research fellow at the Heritage Foundation and a retired U.S. Navy captain, has some recommendations for the Navy on the submarine tenders. To start, he said the Navy should buy more than two, perhaps four or five.

"Base one in Australia, one in Diego Garcia, two in Guam," he said via email, and perhaps a fifth in the Atlantic, Western Hemisphere or Africa.

Also, "there are numerous new innovations that should be incorporated into the [next] generation of submarine tender: additive manufacturing for production of high-failure rate parts and damage repairs, [and] improved methods of torpedo and vertical launch cell reloading while at-sea," Sadler said.

If the AS(X) submarine tenders are to last 40-plus years or more, Sadler suggested, "focus on support for drydocking/ heavy lift, or conduct underwater hull repairs normally done in a drydock with new techniques and equipment deployed from the submarine tenders."

Defensive Weapons

"The AS(X) class is outfitted with an armament focused on self-defense similar to what one would find on other similarly-sized auxiliary vessels with the addition of two Mk 38 Machine Gun Systems per ship," the Navy official said.

Sadler noted the ships will operate in the rear areas of combat operations and should be escorted by air and submarine defense capable warships when moving from one protected anchorage to another.

If operating independently in wartime, which would likely be an unusual event, point defenses against small boat threats could be used, such as deck guns. Other systems that could be employed include point missile defense systems such as a close-in weapon system, drone defense systems and shoulder-fired air defense missiles such as Stinger short-range air defense missiles.

"Defense against torpedoes also can be provided by over-the-side countermeasures and decoys," Sadler said.

Sadler said there is a proven mission need for the tenders, as was demonstrated in the Pacific in World War II and during the Cold War.

"In a modern war with long-range ballistic missiles, the need to have mobile and mobile sustainment platforms like submarine tenders becomes highly valuable," he said. ■

Peter Ong is a freelance writer with U.S. and International Federation of Journalists media credentials who lives in California. He writes articles for defense, maritime and emergency vehicle publications.



Investing in Subs

Navy Submarine Builders Take Steps to Shore Up Manufacturing Base

BY ERIKA FITZPATRICK

A rendering of the future Columbia-class ballistic missile submarine. The 12 submarines of the Columbia class are a shipbuilding priority and will replace the Ohio-class submarines reaching maximum extended service life. Image credit: U.S. Navy.

In Connecticut, General Dynamics Electric Boat (GDEB) is converting a former mall into a training facility. In Virginia, HII-Newport News Shipbuilding (NNS) is expanding partnerships through its distributed shipbuilding program, which the company said increased shipbuilding throughput by 14% in 2025. In Mississippi, Bollinger Shipyards is opening a center for bootcamp classes in marine electrical and sheet metal mechanics.

The center of this effort is in Washington, D.C., where Capitol Hill lawmakers are sending the Pentagon billions of dollars to accelerate delayed submarine construction and revive the beleaguered maritime industrial base.

Another influx of funding was announced July 29, when the Navy awarded $76.6 billion for undersea warfighting to GDEB and NNS, the two main submarine makers that together have built 26 Virginia-class subs. The recently awarded funds are for construction of nine Columbia-class fleet ballistic missile submarines and five Virginia-class attack submarines. Money is also for "shipyard productivity," which includes wage increases, workforce development, modernization and other investments, the Navy said.

Slowing Construction

The Navy now takes almost 10 years to build a new submarine, up from about six years in the early 2000s. At the same time, the Navy is demanding more and bigger ships, including the Columbia, a new class of nuclear-powered submarine. Covid-era production constraints compounded the current delays. Adding to the demand is a 2023 agreement the United States and the United Kingdom made with Australia to help that country acquire nuclear-powered attack submarines.

> **The question becomes: Will all this time and attention, all this effort, produce the kind of results that we want?**
>
> *- Eric J. Labs, senior analyst for Naval Forces and Weapons, Congressional Budget Office*

It remains to be seen if the industry can keep up — especially as the growing AI tech sector siphons skilled trades workers like HVAC techs, pipefitters and electricians for its well-paid, less-gritty data center jobs.

"The question becomes: Will all this time and attention, all this effort, produce the kind of results that we want?" Eric J. Labs, senior analyst for Naval Forces and Weapons with the Congressional Budget Office, told *Seapower*, citing the need for faster production schedules, reduced construction backlogs and a more productive workforce.

"It's going to take a long time for that to work out," he said in an interview. "It's not going to happen in a year or two." He detailed these and other shipbuilding challenges in testimony provided April 22 to a House Armed Services subcommittee.

Expanding the Workforce

Defense contractors have taken steps to expand the number of skilled workers and production infrastructure, including at Groton-based GDEB, a division of General Dynamics, which has completed 99% of the Columbia's design and 71% of its construction.

General Dynamics said in a statement it has invested:

- More than $8 billion in the last decade in electric boat infrastructure, facilities modernization, manufacturing capacity and workforce development to accelerate the production of both the Columbia and Virginia submarines
- About $3 billion since 2015 in expanding facilities and next-generation engineering and manufacturing
- Another $1 billion since 2010 to hire, train and retrain shipbuilders.

The company is allocating $5 billion from the recent contract announcement for new tooling, more capacity, updated facilities, modern technology and improved work environments.

The investments are paying off, A.J. Harris, GDEB's vice president of Human Resources, told *Seapower*, assuring the Navy



A submarine in drydock in 2024.
Photo credit: General Dynamics Electric Boat.

it can deliver on the demand, including the first Columbia, which the company said is scheduled for completion in 2028.

Since 2017, the company added 11,000 workers for a total of 27,000 employees in 2026. This year, it plans to hire another 8,000 workers for shipyards in Groton, Connecticut, and Quonset, Rhode Island.

GDEB has done this by working with schools to shape the curriculum and grow the talent pipeline, fed from the population areas of eastern Connecticut, Rhode Island and Massachusetts. Harris said the company targets the roughly 10% of area high school graduates who want to work in a trade versus attend college.

"We're intimately involved with the schools," Harris said, "working with the counselors, the educators, helping build that curriculum."

Harris said trade schoolers now graduate with the minimum skills to work at the shipyards, where starting wages are about $25 or $26 an hour, with benefits.

Students come to GDEB from institutions like Ella T. Grasso Technical High School in Groton, which offers welding, metal fabrication and ship-fitting classes that prepare students for certifications in welding. Students at the school, including those being retrained for shipbuilding careers, even learn welding on a replica of a submarine at the facility, Harris said.

The company is also investing in the community by purchasing and remodeling the shuttered Crytal Mall in nearby Waterford to create a 500,000-square-foot learning center, with offices and training space. The company said a temporary training facility opens at the end of this year until the permanent space is ready in spring of 2027. The company also ensures shipyard workers have enough parking and food options and access to health and prescription drug care through an on-site wellness center.

"This is a huge investment we're making in the community," Harris said, "to truly, truly get our new employees trained up and make our current employees more proficient."

Distributing Production

The other main submarine shipbuilder NNS, a division of HII, is ramping up capacity to meet demand by subcontracting with smaller companies to produce modular submarine components that can be assembled at the prime's shipyards. The company said it plans to quadruple outsourced hours over the next two years for modular assembly of ships.



A crane operator with Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, assists with the undocking of Virginia-class fast-attack submarine USS Illinois (SSN 786) as Dry Dock 2 floods at PHNSY & IMF, June 23, 2026. Photo credit: U.S. Navy | Mike Wilson.

In news released April 20, at 2026's Sea-Air-Space conference, HII celebrated plans to outsource more than 2.5 million hours of shipbuilding work, a 30% increase from 2025. It also said it would expand its network of assembly partner companies so that more work could be completed outside the shipyard, before final assembly.

It's also acquiring facilities to build capacity beyond its shipyards in Newport News and Pascagoula, Mississippi, such as a manufacturing plant in Goose Creek, South Carolina.

"Shipbuilding is a broad-based team effort in support of our customers' mission to protect peace and freedom across the globe," HII CEO and President Chris Kastner said April 20, in a story posted on the HII website. "I am proud that, in partnership with the U.S. Navy, HII has expanded the team of companies and states that actively participate in the critical work of shipbuilding. Early indications are that this strategy is working to improve schedule performance, as our Navy customer expects."

Adding Training Facilities

Gulfport-based Bollinger, another major shipbuilding firm, this summer opened a new, 7,200-square-foot workforce training center to provide hands-on skills training in shipbuilding.

The program, developed in partnership with the Submarine Industrial Base Program Office and Mississippi Gulf Coast Community College, aims to create "a direct pipeline of qualified talent that will strengthen not just our operations in Gulfport, but the broader national shipbuilding workforce."

The center builds on Bollinger's existing bootcamp program, which the company said attracted more than 4,000 applicants from 22 states since 2024.

Labs said despite Congress investing some $15 billion to $20 billion in the shipbuilding industrial base in recent years, the Navy's added demands for more submarines with greater tonnage



The Virginia class is the first U.S. Navy warship designed from the keel up for the full range of mission requirements in the post-Cold War era. Optimized for maximum technological and operational flexibility, these submarines will play a key role in the nation's defense with their stealth, firepower and unlimited endurance. Photo credit: General Dynamics Electric Boat.

will further constrain the industry. The Navy plans are for the five Virginia-class submarines, up from one, and the nine Columbia-class ships, which are 2.5 times the size of Virginia-class boats. And the U.S. has pledged to sell in-service submarines to Australia in the coming years.

All of this requires the industry to produce two subs per year, up from the current annual production pace of about 1.2 submarines, Labs said.

"That's an enormous ramp up for the industrial base to have to do," he said. "And even though we saw this coming, it either wasn't planned for as well as it could have been or people didn't fully appreciate the scope or the magnitude of what that problem was going to be."

"We're intimately involved with the schools, working with the counselors, the educators, helping build that curriculum."

- A.J. Harris, vice president of Human Resources, General Dyamics Electric Boat

Beyond the need for a better trained shipbuilding workforce, more modernized plants and tactics like outsourcing, the submarine supplier base is still prone to bottlenecks. For instance, Labs estimates 70% of critical components for submarines are provided by one manufacturer, often a small mom-and-pop shop.

"The Navy is on the receiving end of that one way or the other, which could mean either slower parts, or fewer parts, or no parts at all until they can find some sort of alternative," he said. ■

Erika Fitzpatrick is an award-winning writer living in Washington, D.C. With more than 20 years of experience in public policy journalism and communications, she specializes in covering issues affecting service members, veterans, and military families.

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San Diego Council members welcome home the Sailors on USS Lake Eerie. Photo credit: San Diego Council.

San Diego Council Participates In Naval Base Coronado NASCAR Race

The San Diego Council participated in the first Naval Base Coronado NASCAR Race, held June 18-21.

This event celebrated America's 250th Birthday and NASCAR at Naval Air Station North Island with the collaboration of the U.S. Navy, NASCAR, community leaders, industry partners and supporters in highlighting the strength of partnerships that connect military and civilians in the communities they serve across the country.



One of the race cars that participated in the Naval Base Coronado NASCAR race. Photo credit: San Diego Council.

Thank you Commander, Naval Air Force U.S. Pacific Fleet and NASCAR for its partnership and USS Carl Vinson (CVN 70) and the InterContinental Hotels Group in hosting council members.

The council's Homecoming Committee also joined proud families and friends to welcome home more than 400 Sailors aboard USS Lake Erie (CG 70) as the ship returned to homeport at Naval Base San Diego, capping an 11-month deployment with the U.S. 4th Fleet.

USS Lake Erie is a Ticonderoga-class guided missile cruiser equipped with the MK41 Vertical Launch Missile System.

Former Sea Cadet Awarded Achievement Medal

The Atlanta Metropolitan Council is happy to announce that EMN1 (SW) Jeff Alexander Jr., USN, a former Sea Cadet with the NAR B1 unit, was recently awarded his third Navy Achievement Medal.

Alexander enlisted in the Navy and, following basic training, graduated as a nuclear power electrician's mate (EMN) from the Navy Nuclear Power Training command.

He has completed multiple deployments as a member of reactor departments on several different carriers in support of the Global War on Terrorism.



The Commanding Officer of the USS George H.W. Bush presents the Navy Achievement Medal to Jeff Alexander Jr.. Photo credit: U.S. Navy.

Alexander currently serves as an assistant leading petty officer in the reactor department of a forward-deployed aircraft carrier. He is also an active-duty Navy League member.

Bay County Council Presents STEM Donation

The Bay County Council presented a $3,000 donation to the Gulf Coast State College STEM Program to help provide scholarships for students attending its one-week STEM camps, as well as support the purchase of supplies used in building 3D-printed underwater robots.

These hands-on programs give youth the opportunity to learn valuable skills like 3D printing, engineering, coding and building underwater robots, sparking curiosity and preparing the next generation for careers in science, technology and our region's growing maritime and defense industries. The council is proud to support a program that's investing in the future of their community.

Bravo Zulu to both the Bay County Council and Gulf Coast State College for creating opportunities that inspire students to discover future passions. ■



The Bay County Council's donation will help students learn valuable STEM skills. Photo credit: Bay County Council.

Council Awards Presented at Navy League National Convention

At the National Convention of the Navy League in June in Norfolk, Virginia, individuals and councils were presented awards honoring their performance in carrying out the league goals of educating, advocating and supporting the sea services. The awards were presented by National President Larry Salter and Navy League CEO Mike Stevens.

Council Performance Award Winners

OUTSTANDING

Bremerton-Olympic Peninsula
Honolulu
New York
Portland-Blueback
San Diego
Savannah
Treasure Coast
Key West
Placer County
Mayport
National Capital

MERITORIOUS

Greater Kansas City
Lake Merritt
Alameda
Fort Lauderdale
Sarasota-Manatee
Atlanta Metropolitan
Richmond
Anchorage

HONORABLE MENTION

Newport County
Cape Canaveral
Greater Cincinnati
Central Florida
Inland Empire
Upper South Carolina
Hampton Roads

Mackie Winners

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South Dakota
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2025 Sea Service Unit Adoption Excellence Awards

EXTRA LARGE
Honolulu
National Capital
New York
San Diego

LARGE
Bremerton-Olympic Peninsula
Central Florida
Dallas
Greater Cincinnati
Portland-Blueback

MEDIUM
Atlanta Metropolitan
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Fort Lauderdale
Greater Kansas City
Newport County
Placer County
Richmond
Sarasota-Manatee
Savannah

SMALL
Cape Canaveral
Alameda
New Mexico

VERY SMALL
Lake Merritt

Retention Awards

South Dakota
Coastal Carolina
North Dakota
Broward County
Tri-County

Recruitment Awards

Jane Ferreira – Honolulu
James Spear - New York
Norma Milio - New York

Certificates of Appreciation

Mark Harden
Charles McCleskey
Lawrence Osborn
Steve Westover

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Percent Paid	98.5	98.8
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Total Paid Print Distribution + Paid Electronic Copies	21,407	19,725
Percent Paid	94.1	96.2

I certify that all information is true and complete – Brett Davis, Editor-in-Chief

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■ We of the Navy League of the United States stand for a strong America — a nation morally, economically, and internally strong.

■ We believe that the security of our nation and of the people of the world demands a well-balanced, integrated, mobile American defense team, of which a strong Navy, Marine Corps, Coast Guard, and Merchant Marine are indispensable parts.

■ We support all Armed Services to the end that each may make its appropriate contribution to the national security.

■ We know that in a free nation an informed public is indispensable to national security and, therefore, we will strive to keep the nation alert to dangers which threaten — both from without and within.

■ We favor appropriations for each of the Armed Services, adequate for national security, economically administered.

■ We oppose any usurpation of the Congress's constitutional authority over the Armed Services.

■ We urge that our country maintain world leadership in scientific research and development.

■ We support industrial preparedness, planning, production.

■ We support efforts of our government to achieve worldwide peace through international cooperation.

■ We advocate a foreign policy which will avoid wars — if possible

if not, win them!

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2026 September Top Recruiters

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Bonnie Potter	Placer County	1
Roger Olsen	Tacoma	1

2026 September Top Recruiting Councils

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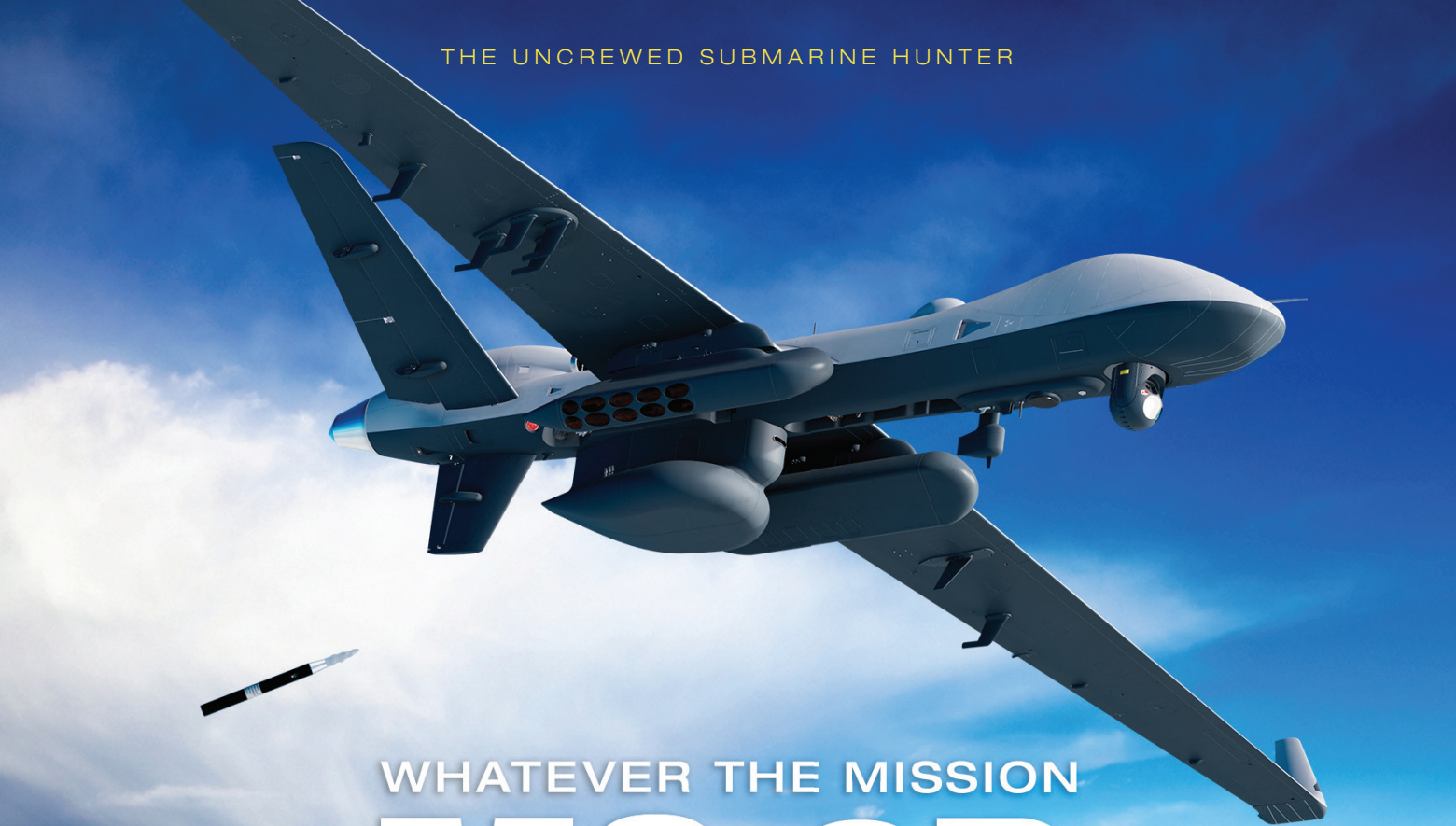
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