

NAVY / MARINE CORPS / COAST GUARD / MERCHANT MARINE

SEAPOWERS



FEATURE

Navy Sees USVs as Critical to Fleet 60

*AI Improves
Disaster Response*
42

*The Little Missile
That Can*
56

April 2026 | \$5.00
Navy League of the United States
navyleague.org

AI AND AUTONOMOUS SYSTEMS



MARITIME DOMAIN AWARENESS OR DOMAIN DOMINANCE?

Spoofting detection that **protects your ports**.

Vessel targeting that **stops threats** at the boundary.

Zone-based intelligence that **alerts before arrival**.

Delivered **directly** into your systems.

Maritime domain dominance.

A successful mission, delivered.



PoleStarDefense.com

POLE STAR
DEFENSE



Mike Stevens
CEO

AI, Autonomy are Next Chapter of Advantage at Sea

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

Artificial intelligence and autonomous systems are no longer concepts confined to laboratories or strategy documents; they are operational realities shaping the way our sea services train, fight and win. Across the maritime domain, these technologies are enhancing decision-making, expanding reach and reducing risk to the Sailors, Marines and Coast Guardsmen who stand watch around the globe.

The U.S. Navy has deployed unmanned surface and undersea vessels to extend maritime awareness and operate in contested environments without placing crews directly in harm's way. Task forces employing unmanned platforms in the Middle East have demonstrated how autonomous systems can conduct persistent surveillance and integrate seamlessly with crewed ships. The Marine Corps is advancing its use of AI-enabled logistics and unmanned systems to support distributed operations, ensuring precision resupply and improved situational awareness in austere environments. Meanwhile, the Coast Guard is leveraging machine learning and autonomous surveillance tools to strengthen maritime domain awareness, counter illegal fishing and narcotics trafficking and improve search-and-rescue response times.

These advancements matter because the character of warfare and maritime security is evolving at pace. AI allows commanders to process vast amounts of data more rapidly and accurately, providing decision advantage. Autonomous systems expand operational flexibility, enabling distributed maritime operations and enhancing resilience across the force.

Looking ahead, AI integration will deepen, from predictive maintenance that increases fleet readiness to autonomous vessels operating alongside crewed ships to cyber defense systems protecting critical networks. To realize this future responsibly, we must continue investing in research and development, modernizing acquisition processes, strengthening partnerships with industry and academia and ensuring ethical frameworks guide implementation. Equally important is preparing our people, training a force that is technologically proficient and operationally agile.

Innovation at sea has always defined American maritime strength. Today, AI and autonomy represent the next chapter in that legacy.

As always, we thank our Navy Leaguers for their unwavering commitment to our sea services. Through your advocacy, outreach and steadfast support, you help ensure the Navy, Marine Corps, Coast Guard and U.S.-flag Merchant Marine have the tools, resources and public backing they need to remain ready, relevant and victorious. ■

AI and Autonomy are Transforming the Maritime World



BY BRETT DAVIS, EDITOR-IN-CHIEF

This super-sized issue of *Seapower* is largely devoted to a topic much in the news lately; artificial intelligence and the autonomous behavior it permits.

As it applies to the sea services, and particularly the U.S. Navy, that means autonomous ships, which could be built relatively quickly and could

augment the fleet at a time when Chinese shipbuilding is increasing rapidly.

We have several stories related to that. Frequent contributor Erika Fitzpatrick takes a look at the types of uncrewed surface vessels that could augment the U.S. fleet, and writer George Galdorisi gives us several ideas for what this "Navy After Next" could look like, depending on how the Navy chooses to deploy them.

Contributor Dan Taylor takes a look at the Navy's half-billion-dollar "Ship OS" plan scale AI and autonomy tools across the maritime industrial base, and I talk to a few companies who are pursuing that same effort on their own dimes.

AI and autonomy isn't just for military uses, of course, and writers Jamie Pfeiffer and Jim McClure show how autonomous maritime systems can help respond to natural disasters and improve forecasting for the storms that leave havoc in their wakes.

Senior Editor Rick Burgess shows how technology can impart precision strike capabilities on previous "dumb" rockets, adding new platform capabilities and new missions for the Advanced Precision Kill Weapon System II.

These uses for AI and autonomy, and many more, will be on display at Sea-Air-Space this year. We hope you enjoy this issue and the show. ■

SEAPOWER

THE OFFICIAL PUBLICATION OF THE
NAVY LEAGUE OF THE UNITED STATES
Volume 69, Number 3, April 2026

PUBLISHER

Mike Stevens

EDITOR-IN-CHIEF

Brett Davis

bdavis@navyleague.org

SENIOR EDITOR

Richard R. Burgess

rburgess@navyleague.org

SENIOR ART DIRECTOR

Victoria Motsay

vmotsay@navyleague.org

SENIOR MARKETING DIRECTOR

Evan Clarke

eclarke@navyleague.org

SENIOR COMMUNICATIONS MANAGER

James Peterson

jpeterson@navyleague.org

CONTRIBUTING WRITERS

Anthony Basenese

Nolan Bowlus

Ross Brown

Erin Edwards

Erika Fitzpatrick

George Galdorisi

Jim McClure

Jamie L. Pfeiffer

Dan Taylor

David F. Winkler

WASHINGTON CORRESPONDENT

Matthew Reisener

SEAPOWER

2300 Wilson Blvd., Suite 200

Arlington, VA 22201-5424

TEL: 703-528-1775

EMAIL: seapowermail@navyleague.org

WEBSITE: www.seapowermagazine.org

X: @Seapowermag

FACEBOOK: www.facebook.com/SeapowerMagazine



NAVY LEAGUE of the UNITED STATES

SEAPOWER

VOLUME 69 / NUMBER 3 / APRIL 2026



42

FEATURE:
*AI Helping Improve
Disaster Response*

By Jamie L. Pfeiffer



60

FEATURE:
*Navy Sees USVs as
Critical to Future Fleet*

By Erika Fitzpatrick

20

IN THE NEWS: Drone Swarms at Sea

By Dan Taylor

24

IN THE NEWS: Shipbuilding's AI Moment

By Dan Taylor

DEPARTMENTS

- 6 Washington Report
- 12 Ship's Library
- 10 Historical Perspective
- 34 Sea Services in Action
- 70 Cadet Corner
- 72 In My Own Words

28

IN THE NEWS: HII Adds AI Welding to Portfolio

By Brett Davis

30

IN THE NEWS: Autonomous Ships Prepare to Hit the Water

By Brett Davis

34

IN THE NEWS: Navy USV Push Drives Partnerships

By Brett Davis

36

IN THE NEWS: Additive Manufacturing and Sea Power

By Anthony Basenese and Ross Brown

48

FEATURE: Autonomous Weapons in Maritime Theater

By Nolan Bowlus

52

FEATURE: NOAA Trials Mini-Robots for Tracking Hurricanes

By Jim McClure

56

FEATURE: APKWS II: The Little Missile that Can

By Richard R. Burgess

66

FEATURE: Building the Navy-After-Next

By George Galdorisi



ON THE COVER:

U.S. Marine Corps Lance Cpl. Giancarlos Maldonado, a drone operator with Headquarters Company, 6th Marine Regiment, 2nd Marine Division, poses for a portrait with a Skydio X2D on Marine Corps Base Camp Lejeune, North Carolina, Nov. 21, 2025. Photo credit: U.S. Marine Corps | Staff Sgt. Armando Elizalde.



Modernizing the CMV-22B: A Navy Readiness Imperative

By Christopher Misner

Naval power is often judged by the capabilities of the platforms at the tip of the spear, such as surface vessels, submarines, and combat aircraft. Those assets enable the United States to project power in the maritime domain, but to bring their full capabilities to bear requires readiness – a key priority for Pentagon leadership.

The CMV-22B Osprey plays a vital logistics role in carrying out its Carrier Onboard Delivery (COD) mission, where its speed, range, and runway independence are essential capabilities, particularly in the vastness of the

Indo-Pacific area of operations. Keeping the Carrier Strike Group supplied, connected, and fully operational is the mission of this tiltrotor aircraft.

To keep the tiltrotor aircraft ready, it is important to modernize the CMV-22B, specifically through the Nacelle Improvement program.

The Nacelle Improvement program is a modernization effort that overhauls and simplifies the internal workings of the Osprey's nacelles. Each nacelle houses a rotating engine, which allows the aircraft to transition between vertical and horizontal flight.

A CMV-22B Osprey operates from the flight deck of the USS George Washington (CVN 73) while underway in the Pacific Ocean, Sep. 19, 2024. Photo credit: U.S. Navy | Mass Communication Specialist 3rd Class August Clawson.

The appearance of U.S. Department of War (DoW) visual information does not imply or constitute DoW endorsement.

The condition of those nacelles directly affects the aircraft's reliability, maintenance cycles, and availability. According to estimates by the V-22 Joint Program Office (PMA-275), approximately 60 percent of maintenance work on V-22 Ospreys is related to the nacelle area. The 1980s-era design of the Osprey's nacelles is anything but simple, which accounts for why they are so maintenance-intensive. With today's technology, however, nacelle improvement results in dramatic simplification of the inner workings.

For comparison, imagine looking under the hood of an old sports car, featuring a complicated tightly packed combination of wires,

hydraulic lines and belts. Then look at the very clean lines of a modern engine assembly of a brand-new sports car of today. That's the difference between a legacy nacelle of a 1980s-era design, and a modernized one that has undergone Nacelle Improvement. More specifically, the modernization of the nacelles replaces the original wiring and junction boxes with a more efficient point-to-point wiring system.

The Nacelle Improvement program is a proven solution that has already brought dramatic improvements to the Air Force fleet of CV-22 Ospreys. Air Force Special Operations Command (AFSOC) Commander, Lt. Gen. Michael Conoly has said, "We've got 31 of the 51 aircraft that have had the nacelle improvement complete, and we are seeing very tangible positive gains on that: double-digit increases in mission readiness on those tails, and close to double-digit reduction in maintenance man-hours."

Nacelle modernization provides both near-term readiness gains and long-term sustainment benefits in availability and affordability – an increasingly important consideration as the Navy plans to operate the CMV-22B well into the future.

Delaying investments, like nacelle improvement, has its own inherent costs: lower readiness, increased maintenance, and greater pressure on the aviation workforce. Over time, this can negatively influence the confidence of warfighters who depend on reliable logistics to carry out missions at sea. Taking a proactive approach to modernization shows a stable commitment to readiness, today and in the future.

There is also a broader signal at stake. By supporting CMV-22B modernization through the Nacelle Improvement program can demonstrate that the Navy and the Department of War are committed to learning from experi-



A V-22 Osprey departs from USS Iwo Jima (LHD 7) while conducting an air assault in Icelandic terrain. Photo credit: U.S. Marine Corps | Lance Cpl. Margaret Gale. The appearance of U.S. Department of War (DoW) visual information does not imply or constitute DoW endorsement.

ence across all service branches and sustaining critical platforms for the long term.

The Nacelle Improvement program exemplifies a responsible approach to effective acquisition and sustainment. There is a strong case to be made for close collaboration between manufacturer, customer, and maintainers to create a collective understanding that evolving systems create an avenue for responsible care of our fleet.

Congress, of course, has a role to play as well. Although the recent budget reconciliation package authorized \$160 million to accelerate the V-22 Osprey Nacelle Improvement program, uninterrupted funding from the U.S. Congress can help prevent the stop-start

cycles that lead to delays and inflated costs.

The success of the CMV-22B is often measured by what does not happen: delayed missions, personnel stuck in place, waits

on parts or maintainers, or disrupted fleet operations. The Nacelle Improvement program is an essential part of the effort to ensure this success continues.

The path ahead is clear, and it's one the Air Force has already trailblazed. The Nacelle Improvement program is essential not just to the Osprey's readiness, but indeed to the readiness of the entire fleet. ■

ABOUT THE AUTHOR

Capt. Christopher "Chet" Misner, USN (Ret.) is a former naval rotary-wing aviator. He has commanded a Naval Air Station and an H-60 Squadron. He currently manages naval strategic pursuits at Bell. The views expressed are his own and do not reflect those of the U.S. government.



New MAP Offers Wish List for Achieving White House Maritime Goals

BY MATT REISENER

In April 2025, the White House released its executive order on “Restoring America’s Maritime Dominance,” which called on the federal government to “revitalize and rebuild domestic maritime industries and workforce to promote national security and economic prosperity.”

In an era of increasing political polarization, this executive order nonetheless garnered bipartisan praise in Washington. Policymakers on both sides of the aisle eagerly

awaited the release of the Maritime Action Plan (MAP), a document which the executive order directed the national security adviser to produce by Nov. 5, 2025, to provide a legislative pathway to “to achieve the policy set forth in this order.” When this deadline came and went with no MAP in sight, many experts questioned the White House’s follow-through on this executive order in the wake of former National Security Adviser Mike Waltz’s departure and the Trump administration’s

prioritization of other domestic and foreign policy issues.

Those questions were answered when the White House unveiled the MAP on Feb. 13, 2026. Strictly speaking, this document is not the “action plan” promised by the executive order. While the 34-page document does contain a one-page list of potential legislative proposals to strengthen America’s maritime industrial base, the MAP reads much more like a wish list than an actionable blueprint

for how to achieve these goals. However, the MAP nonetheless provides an ambitious outline of the Trump administration's industrial and economic policy priorities as they relate to shipbuilding and commercial shipping. While not necessarily providing a roadmap to help the administration implement its executive order, the MAP serves as a clarion call for policymakers to address America's declining maritime power.

This call to action could not be more timely. Once a global leader in shipbuilding, America is now responsible for building less than 1% of the world's commercial ships and possesses only seven shipyards capable of producing complex naval vessels, down from 155 at the end of World War II. That America's maritime decline is concurrent with China's ascension in this realm is further cause for concern. China can produce 200 times the tonnage of the United States and is responsible for more than half of the world's commercial shipbuilding. This disparity is not only an economic threat to the United States but a security one as well, as China's capacity to build and repair vessels at scale could give Beijing an advantage over the U.S. in an armed conflict at sea. America must act urgently to reverse its maritime decline, and the MAP serves as an important reminder of the stakes for failing to accomplish this goal.

Four Pillars of Restoration

How does the MAP seek to restore American maritime dominance? The document focuses on four pillars which could collectively bolster America's maritime capabilities: rebuilding U.S. shipbuilding capacity and capabilities; reforming workforce education and training; protecting the maritime industrial base; and preserving national security, economic security and industrial resilience. The MAP outlines several potential steps to accomplish these goals, including increasing the use of artificial intelligence and automation in shipbuilding, revitalizing America's federal and state Merchant Marine Academies, promoting supply chain resilience by decreasing "single-point failures and foreign dependence" on critical shipbuilding components, and creating a "Strategic Commercial Fleet" of U.S.-built and U.S.-flagged trade vessels, the construction and operation of which could be subsidized using federal funds. These recommendations, like many others included in the MAP, have long been advocated for by maritime experts to help reverse America's decline in this domain, making their presence in this report a welcome addition.

A central tenet of the MAP involves incentivizing greater investment into America's shipbuilding and

maritime infrastructure, including by providing a clear and stable demand signal to encourage recapitalization. The MAP calls for the creation of "Maritime Prosperity Zones" which would provide incentives and regulatory relief to those investing in waterfront communities; the establishment of a "Maritime Incentives Coalition" to coordinate the efforts of federal, state and economic development organizations to support maritime infrastructure development; and increased support for public-private partnerships to help attract institutional investors into shipbuilding.

Yet the MAP recognizes the reinvigoration of America's domestic shipbuilding and ship repair industries cannot happen overnight. Accordingly, it hints at a potential "bridge strategy" for shipbuilding with support from America's maritime allies, in which the first vessels in a multi-ship purchase could be built in an ally's shipyard, "while concurrent direct capital investments are made in a U.S. shipyard they have purchased or partnered with to eventually onshore construction." While this strategy could face legal hurdles due to existing laws restricting the domestic use of ships built outside the U.S., it nevertheless represents a creative approach to encouraging multilateral cooperation on shipbuilding while America prepares to once again build ships at scale.

Unsurprisingly, the MAP is closely aligned with the Trump administration's economic worldview. On one hand, the MAP represents a clear call for deregulating shipping

Left: Amphibious assault ship USS America (LHA 6) is raised from the water at General Dynamics National Steel and Shipbuilding Company (NASSCO) shipyard dry dock, Feb. 21, 2026. America entered the dry dock in support of a regularly scheduled maintenance period for modernization and repairs. The United States now has only seven shipyards capable of producing complex naval vessels. Photo credit: U.S. Navy | Mass Communication Specialist 1st Class Jomark A. Almazan.

That America's maritime decline is concurrent with China's ascension in this realm is further cause for concern.

and shipbuilding and advocates for “eliminating outdated, redundant, or unnecessary regulations that impose undue burdens on the maritime industry.” On the other hand, the MAP embraces trade protectionism, particularly in its treatment of non U.S.-flagged merchant vessels. The MAP calls for strengthening the language of the Jones Act (the law requiring all goods shipped between U.S. ports to be carried on vessels built, owned and crewed by Americans) to require a greater percentage of ship materials to be made in the U.S., while also promoting an increase in the percentage of civilian U.S. government cargo that must move on U.S.-flagged ships (this rate is currently set at 50%). The MAP also proposes creating a new “U.S. Maritime Preference Requirement” for countries with considerable exports to the U.S. to transport a higher share of U.S.-bound goods on American-flagged vessels — a measure which could potentially increase demand for U.S.-flagged ships to satisfy this requirement.

Imposing Fees

Arguably the MAP's most controversial recommendation is its call to impose a “universal infrastructure or security fee on all

foreign-built commercial vessels calling at U.S. ports,” which would be assessed based on the weight of the cargo being imported. These fees, which the MAP argues could be accompanied by the imposition of a new tax on overland imports to discourage companies from attempting to circumvent the fees, could be used to fund a “Maritime Security Trust Fund” that could “provide a dedicated, mandatory funding stream to support programs that strengthen the U.S. maritime industry and Merchant Marine.” Since 99% of the global container fleet was built outside the U.S., these fees would functionally serve as a surcharge on all international shipping companies doing business in the U.S.

This proposal may be increasingly attractive to the Trump administration considering the Supreme Court's recent ruling in *Learning Resources Inc. v. Trump*, which limited the president's ability to unilaterally impose tariffs through the International Emergency Economic Powers Act. The MAP doesn't set a rate for this fee but suggests charging anywhere between one cent to 25 cents per kilogram being shipped. While setting fees at ¢25 per kilogram could raise as much as \$1.5 trillion in

revenue over 10 years, it could also depress maritime trade by making it prohibitively expensive or raise the price of consumer goods as shipping companies shift the costs of these fees to American families.

In theory, the universal fees proposed by the MAP could raise the demand for U.S.-built commercial vessels as shipping companies seek to avoid these fees, which could help revitalize America's commercial shipbuilding industry. However, the supply of U.S.-built commercial ships cannot immediately match a spike in demand for such vessels, which are both time and labor-intensive to build and which will require the recapitalization of American shipyards to be produced at scale. Accordingly, universal fees could risk significant short-term price hikes and the disruption of the shipping industry even if they help American shipbuilding in the long run.

Similarly, it is unclear how other countries such as China would respond to the imposition of such fees. In November, the U.S. Trade Representative enacted a one-year suspension of its Section 301 port fees targeting China as part of the Sino-American trade agreement, which was reached after China imposed port fees on U.S.-linked vessels in response to the Trump administration's planned tariffs against Beijing. America's imposition of new port fees could easily result in China following suit, which could potentially damage the market for American exports. How the Trump administration navigates

these complex dynamics could ultimately determine whether the more protectionist elements of the MAP achieve or undermine their intended goal of strengthening America's economy.

Another open question is how the Trump administration will attempt to implement the MAP's proposals. Some elements of the

White House backing the SHIPS for America Act of 2025 (S.1541 and H.R.3151), a bipartisan bill which contains several of the MAP's proposals, including creating a Strategic Commercial Fleet and Maritime Trust Fund. The SHIPS Act is actually mentioned by name in the MAP as an example of "sweeping legislation that seeks to address the vulnerabilities in

administration can secure adequate funding and legislative support for the MAP's ambitious proposals will determine the lasting legacy of this document.

While the MAP doesn't outline a clear, actionable strategy for achieving the executive order's policy goals, the document does, as its name suggests, serve as a map of the White House's priorities for restoring America's maritime dominance. Despite bipartisan interest in addressing America's declining maritime industrial base, it remains to be seen whether the White House will continue to prioritize this issue (which notably went unmentioned in the recent State of the Union address) and whether it can chart a course to achieve congressional authorization and sustainable funding for its policy prescriptions.

The MAP's final sentence proclaims that "the execution of this plan will reestablish America's position as a global maritime power, strengthening U.S. national security and ensuring greater economic prosperity." It's now up to Congress and the White House to live up to that promise. ■

Matt Reisener is the Senior National Security Advisor for the Center for Maritime Strategy. He holds a Master of Arts in International Relations from the University of Chicago's Committee on International Relations, as well as a Bachelor of Arts in Political Science and Rhetoric & Political Communication from William Jewell College.



The Yang Ming cargo ship YM Topmost passes under the Vincent Carter bridge near the Port of Los Angeles. The United States is now responsible for building less than 1% of the world's commercial ships. Photo credit: Port of Los Angeles.

plan, such as its call to enhance America's military presence and domain awareness in the Arctic, can be directly enacted by executive agencies, which are awaiting guidance from the Office of Management and Budget on how to proceed. However, many of the MAP's tenants require congressional action.

One potential legislative avenue to enact the MAP involves the

our domestic maritime industry." However, given the ongoing tension between the Trump administration and SHIPS Act sponsor Sen. Mark Kelly (D-Arizona) over his participation in a video urging American troops to ignore "illegal orders," it is unclear whether the White House is willing to support or back amendments to this bill or prefers to propose competing legislation. Whether the Trump

2,000,000+

**nautical miles sailed
didn't happen overnight.**

Some companies talk about what they might do in the future.
We talk about what we are doing today:

**Delivering the maritime advantage necessary to defend sovereignty,
secure commerce, and deter adversaries on the world's oceans.**

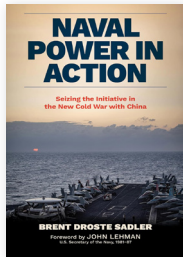


Meet us at:
Sea Air Space Booth #1315



Naval Power vs. China, Cold War Intel, WWII Ace Thach, Vietnam Destroyer, 7th Fleet in Korean War, British Monitors, Officers Guide

BY RICHARD R. BURGESS, SENIOR EDITOR



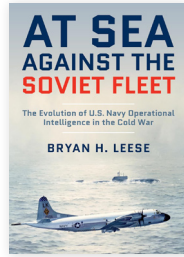
NAVAL POWER IN ACTION: Seizing the Initiative in the New Cold War with China

By Brent Droste Sadler. Annapolis,

Maryland: Naval Institute Press, 2025. 352 pages. \$34.95

ISBN: 978-1-68247-577-5

The author, a retired Navy submarine officer and one of the foremost navalists today, looks at the present global naval and maritime postures of the United States and its primary adversary, China. Calling the present situation a new Cold War, the author describes the challenges the Navy faces as it struggles to meet them. Sadler recommends three major efforts: modernizing institutions to meet the challenges; reducing exposure to economic coercion; and maintaining naval superiority over China. These steps would include increasing the strength of the industrial base, increasing maritime presence and commercial shipping. This book is an urgent call to action for the Navy and the nation to take the steps needed to counter its most serious external threat since the earlier Cold War.

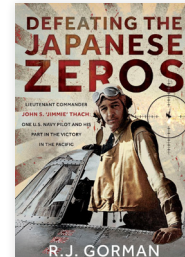


AT SEA AGAINST THE SOVIET FLEET: The Evolution of U.S. Navy Operational Intelligence in the Cold War

By Bryan H. Leese. Annapolis, Maryland: Naval Institute Press, 2025. 472 pages. \$44.95

ISBN: 978-1-68247-202-6

The author, a retired Navy captain and intelligence officer, took on the immense task of describing the evolution of the Navy's operational intelligence collection and analysis during the Cold War, as the Navy moved aggressively to keep pace with the evolving Soviet threat. The book begins with the Vietnam War era, including the air war, coastal interdiction and riverine wars. Shipboard operational intelligence became more developed. Ocean surveillance became increasingly netted. Intelligence analysis became increasingly decentralized. The book also covers in great detail the technology that made intelligence more abundant and useful. Intelligence professionals who served in the Cold War will find this book an exceptionally well-told monument to their accomplishments.



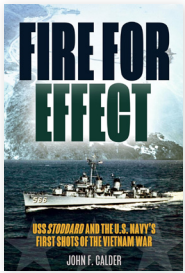
DEFEATING THE JAPANESE ZEROS: Lieutenant Commander John S. 'Jimmie' Thach: One U.S. Navy Pilot and His Part

in the Victory in the Pacific

By R.J. Gorman. Yorkshire and Philadelphia: Air World Books (Pen & Sword Books) 2025. 224 pages. \$34.95

ISBN: 978-1-03613-759-5

This biography of Naval Aviator John S. "Jimmie" Thach concentrates on his service in World War II as a fighter ace who had a consequential impact on the effectiveness of carrier task force operations. The Allies faced a Japanese navy fighter aircraft, the highly maneuverable Mitsubishi A6M Type Zero, which outperformed contemporary U.S. fighters in most respects. Thach devised a tactic called the Thach Weave which enabled pilots flying the F4F Wildcat fighter to out-fight the Zero and proved highly successful. The author covers Thach's combat in the Battle of Midway and as operations officer for a carrier task force. Thach went on to a long and successful post-war career, achieving the rank of admiral.



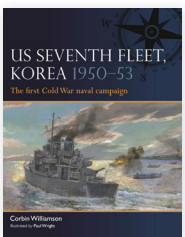
**FIRE FOR EFFECT:
USS Stoddard and
the U.S. Navy's
First Shots of the
Vietnam War**

By John F. Calder.
Havertown,
Pennsylvania and

Yorkshire, U.K.: Casemate Publishers, 2026. 304 pages. \$37.95

ISBN: 978-1-63624-598-0

This is a personal memoir of a Navy radarman who was a crew member on board the destroyer USS Stoddard during the Vietnam War. His ship had the assigned role of providing harbor defense in the area of Da Nang, one of the most important U.S. bases in South Vietnam. The Stoddard provided naval gunfire support for the Marines and Navy underwater demolition teams along the coast, pounding Viet Cong and North Vietnamese troop concentrations and interdicting supply craft, demonstrating the power of naval gunfire. The author gives an up-close and personal account to which destroyer Sailors of the era will relate.



**US SEVENTH
FLEET, KOREA
1950-53: The first
Cold War naval
campaign**

By Corbin Wil-
liamson. Oxford,

United Kingdom: Osprey Publishing Ltd., 2025. 80 pages. \$23.00

ISBN: 978-1-4728-6686-8

Though primarily a land war in a confined area, the Korean War also featured a wide variety of naval



**NEWLY COMMISSIONED NAVAL OFFICER'S GUIDE:
3rd Edition.** By Commander Samantha A. O'Neil.
Annapolis, Maryland: Naval Institute Press, 2025.
202 pages. \$34.97 | ISBN: 978-1-68247-260-6

The author, a naval officer with experience at every level of leadership, updates this edition for officers newly joining the fleet. O'Neill outlines the fundamental expectations for newly commissioned officers reporting to their first assignment. This fully revised edition broadens the reader's knowledge base to include naval etiquette and practical guidance for spouses. In a single, accessible volume, the book provides junior officers with clear direction, accurately describing the Navy's various staff corps. O'Neill clearly explains the chaplain's role and how division officers can leverage onboard resources to support the Sailors entrusted to them. The edition also recommends further reading and encourages continued education through Navy service schools.

Review by: LCDR Edwin Y. Handley, currently serving as the Deputy Chaplain for Marine Corps Base, Camp Pendleton.

and naval air operations, including shore bombardment, amphibious invasion, close air support, air interdiction, mine countermeasures, special operations and logistics. The U.S. Navy's 7th Fleet ran the naval war, with rotating deployments of ships and aircraft in a constant campaign for three years. The fleet's performance demonstrated the relevance of the U.S. Navy in the post-World War II era and the Cold War. The book compactly describes the organization, ships, aircraft, operations and logistics in a highly readable and well-illustrated manner.



**ROYAL NAVY
MONITORS OF
WORLD WAR II:
Britain's
battleship-
calibre gunboats**

By Angus Kon-
stam. Oxford, United Kingdom:
Osprey Publishing Ltd., 2025. 48

pages. \$20.00 | ISBN: 978-1-4728-6813-8

Royal Navy monitors that served in World War II were medium-sized ships that featured a single turret with a battleship's large-caliber guns. They were designed specifically for shore bombardment, with their guns outranging typical shore batteries. They were armed with smaller-caliber guns for self-defense. The four large monitors — Erebus, Terror (lost in action), Roberts, and Abercrombie — served in the Mediterranean Sea for the North Africa campaign and the defense of Malta and Crete, and the Madagascar, Sicily, Italy and Normandy invasions. Five smaller monitors also served. The author, a prolific historian, covers the subject with expertise and a well-illustrated account. ■

Please note: Navy League does not distribute books in Ship's Library. Please contact your local bookstore or go online to purchase. Seapower does not review works of fiction or self-published books.



An oil painting depicts Continental Sailors and Marines landing on New Providence Island, Bahamas, on March 3, 1776, an operation commanded by Commodore Esek Hopkins. Photo credit: Naval History and Heritage Command | V. Zveg.

Falling Short: The U.S. Navy's First Fleet Action

BY DAVID F. WINKLER

April 2026 marks the 250th anniversary of the return of the U.S. Navy's first "fleet" deployment and "fleet" action. As detailed below, the cruise under the command of Esek Hopkins will execute a successful raid but fall short in an at-sea engagement. For Hopkins, controversies that emerged would contribute to Congress's decision to dismiss him as the Navy's commander a year later.

Born in 1718 in the colony of Rhode Island and Providence Plantation, Hopkins went to sea at age 20. He saw success as a merchant skipper with one noted exception when he took charge of a slave ship where over half of his human cargo would die enroute to his destination in the West Indies. Ashore, he supported the political aspirations of his older brother Stephen, who, starting in 1751, would spend much of the next

quarter-century as the colony's chief justice or governor. Stephen would serve as a delegate to the Continental Congress and place his signature on the Declaration of Independence.

With the outbreak of war in Massachusetts in April 1775, the younger Hopkins would be appointed a brigadier general Oct. 4 to oversee the defense of Rhode Island. Meanwhile at the Continental Congress, John Adams, backed by Stephen Hopkins, advocated for a Continental Navy. With the authorization for the acquisition of two vessels approved by the Continental Congress on Oct. 13, 1775, the United States Navy was born. By the end of October, the number of ships approved for acquisition had doubled and Congress created a naval committee to oversee the fitting out of this nascent fleet. The elder Hopkins would serve on that committee and successfully lobby that his younger brother be appointed "Commander-in-Chief of the Fleet of the United Colonies."

With his appointment dated Dec. 22, 1775, "Commo-

dore" Esek Hopkins made his way to Philadelphia where the flotilla of converted merchantmen to warships had grown to eight. Not hesitating to wield this first manifestation of American sea power, on Jan. 5, 1776, Congress, with the urging of delegates from the southern colonies, ordered Hopkins to proceed to the Chesapeake Bay to determine the extent of British naval assets, and, if they were not greatly superior, to attack. If successful in the Chesapeake, Hopkins was to sail on and repeat the process in waters off North and South Carolina. The orders concluded:

... if bad winds, or stormy weather, or any other unforeseen accident or disaster disenable you so to do, you are then to follow such courses as your best Judgment shall suggest to you as most useful to the American cause and to distress the Enemy by all means in your power.

With a flotilla of vessels that were not built to be combatants and crews that he suspected were not ready for combat, Hopkins saw this closing clause as an off-ramp — and he took it. Upon clearing Delaware Bay following his departure on Feb. 17, Hopkins aimed his small fleet on a southerly heading. The raid on Nassau of New Providence Island in the Bahamas was detailed in the "Historical Perspective" section in last September's *Seapower*. By most measurements, the raid could be graded a success. After landing on March 3, the Marines, led by Captain Samuel Nicholas, convinced the defenders of one of the forts to not offer resistance. Exhausted, the Ma-

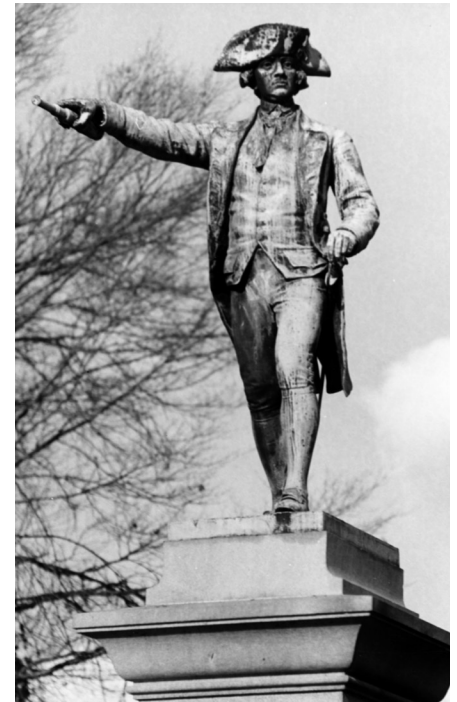


rines slept overnight at the fortification while the British governor was able to load much of the gunpowder stockpile onto a merchantman that cast off in the darkness enroute to St. Augustine. Though most of the gunpowder got away, some 88 cannon, 15 mortars and thousands of rounds of round shot remained for the taking. Fully loaded, Hopkins's flotilla departed on March 18. Preceding the raid, Hopkins captured two Bahamian sloops.

Rather than return to Philadelphia, Hopkins ordered his ships north toward his home colony of Rhode Island — a wise decision given the Royal Navy had set up a trap in Delaware Bay in anticipation of his return. It was a miserable journey as many of the crews suffered sickness and death, and the weather off Cape Hatteras proved challenging. Off Montauk Point on April 4, the flotilla captured the Royal Navy schooner *Hawke* that provided tender services for British warships on station. The next day Hopkins captured a bomb brig. Used for mortar shelling, the prize meant that the American

Left: Commodore Esek Hopkins, initially lauded as a hero but then fired as commander of the United States' new Navy. Photo credit: Naval History and Heritage Command | Orlando S. Lagman.

Below: A statue of Commodore Esek Hopkins stands at Branch Avenue and Charles Street in Providence, Rhode Island. Photo credit: U.S. Navy.



flotilla — with the Bahamian sloops — now had a dozen vessels.

On the dark morning hours of April 6, the flotilla stumbled upon the 20-gun HMS *Glasgow* and her tender heading south to Virginia. Commanded by Tyringham Howe, the British warship was outgunned by the American squadron. However, the challenge proved to be massing those guns against the British captain and his well-trained crew. Fighting one-on-one, the *Cabot* suffered crippling blows and pulled away. Alfred took her turn, with gun batteries commanded by John Paul Jones. The American flagship exchanged broadsides for 30 minutes as Marines on both ships

levied deadly musket fire. Unfortunately, an “un-lucky shot,” as Jones described it, took out Alfred’s ability to steer, and Howe maneuvered Glasgow ahead of Alfred to rake the flagship. Other ships from the American flotilla joined the fight and inflicted such damage that Howe placed his codebooks in a weighted pouch and tossed them overboard.

A change of wind proved fortuitous for Glasgow as Howe turned his ship toward Newport where a British squadron awaited. Hopkins sailed in pursuit with his repaired Andrew Doria, Alfred, and Columbus. As

dawn broke, Hopkins realized he truly was sailing into harm’s way and broke off toward New London under the cover of fog and rain.

Given what was accomplished with the resources at hand, Hopkins was hailed a hero throughout New England. However, his reputation began to falter as details of Glasgow’s escape leaked out. Hopkins directed courts-martial for skippers of some of the ships that failed to engage. One would be exonerated, and another would lose his commission. Unfortunately for Hopkins, he would face challenges getting ships back

out to sea in the coming months as Congress offered letters of marque to privateers who offered crews greater compensation opportunities. With representatives from southern colonies upset that Hopkins had disregarded his orders, the Rhode Islander fell into disfavor. A year after his successful deployment to Bermuda, Congress would suspend Hopkins from command. It would be left to the likes of John Barry and John Paul Jones to carry on the fight to the British at sea. ■

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

Treat Yourself to a New Ride With Our Great Rates¹

You could get on the road with:

- ✓ decisions in seconds, in most cases
- ✓ preapproved loans good for up to 90 days
- ✓ military discounts available²



ARMY
MARINE CORPS
NAVY
AIR FORCE
SPACE FORCE
COAST GUARD
VETERANS

Our Members Are the Mission



Apply Today!
Scan the QR code,
use our mobile app³ or visit
navyfederal.org/auto

Navy Federal is federally insured by NCUA. ¹Credit and collateral subject to approval. ²Direct deposit is required. This military special may expire at any time. Applicants must contact Navy Federal by phone or visit a branch to receive the discount. Active Duty rate discounts (which are also available for retired military members) can be applied, subject to certain restrictions. ³Message and data rates may apply. Visit navyfederal.org for more information. © 2025 Navy Federal NFCU 14497 (7-25)

THE UNCREWED SUBMARINE HUNTER



WHATEVER THE MISSION

MQ-9B DELIVERS

In the air, on the ground, or at sea, forces can count on **MQ-9B SeaGuardian®** and **SkyGuardian®** for extended endurance, powerful effects, and mission success.

A highly interoperable open systems architecture permits rapid adaptability and seamless integration of nearly every global or sovereign technology. MQ-9B is future proof.

From a family of aircraft with more than 9 million flight hours, MQ-9B delivers range, loiter, payload, and proven multi-mission capabilities everywhere — which are unmatched anywhere.



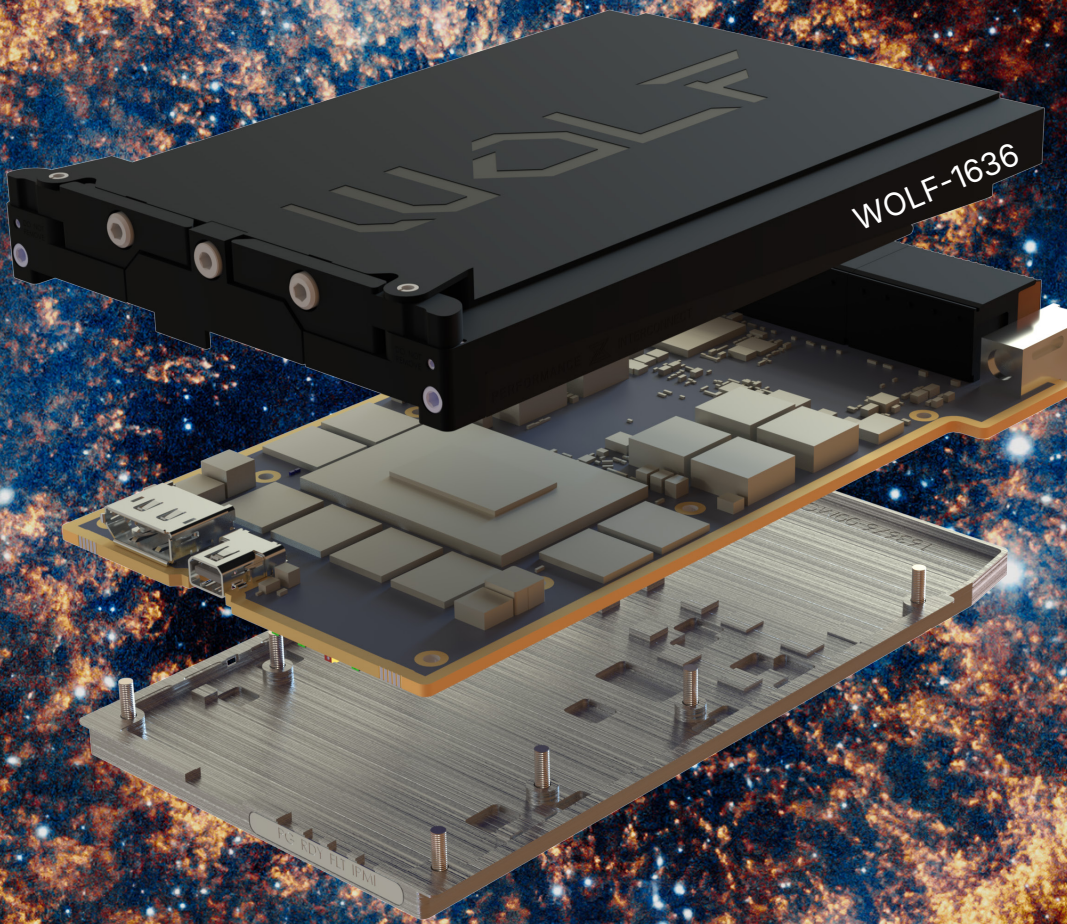
©2026 GENERAL ATOMICS AERONAUTICAL SYSTEMS, INC.

Avenger®, EagleEye®, Gray Eagle®, Lynx®, Predator®, Reaper®, SeaGuardian®, and SkyGuardian® are trademarks of General Atomics Aeronautical Systems, Inc., registered in the United States and/or other countries.




BLACKWELL TESTED • QUALIFIED SHIPPING NOW.

WOLF's Blackwell 3U and 6U VPX family—**1636, 163L, 167S, and 2638**—brings next-generation accelerated compute to rugged, open-architecture systems built for aerospace and defense. Designed for deployment at the edge, they deliver high-density performance with modern memory and high-speed I/O across 3U and 6U VPX form factors. Engineered for harsh environments, they operate from -40°C without sacrificing reliability. When the mission gets colder, WOLF keeps computing.



WOLF[®]
ADVANCED TECHNOLOGY

wolf-at.com
sales@wolf-at.com • 1-800-931-4114



Aurelius Systems fires a laser during an experiment at the Naval Postgraduate School's quarterly Joint Interagency Field Experimentation (JIFX) event at Camp Roberts, Feb. 6, 2025. Photo credit: U.S. Navy | Dan Linehan.

Swarms at Sea

Navy Prepares for Future Where Drone Mass is a Key Enabler, and a Threat

BY DAN TAYLOR

The U.S. Navy's next contest in autonomy is not about one exquisite drone, but about many. Air, surface and undersea unmanned systems are increasingly being discussed as collaborative fleets: distributed sensors, decoys and strike enablers operating as coordinated groups rather than standalone platforms.

That shift creates two races. The first is operational; how quickly can the Navy can turn swarming concepts into usable maritime capability? The second is defensive; how quickly can it build layered counters against adversary swarms designed to saturate traditional defenses?

A Navy official told *Seapower* the service is making "significant investments in unmanned systems and advanced technologies," and described those systems as "force multipliers across a wide array of missions." The official added the Navy is "committed to the continuous evaluation of new technologies and proposals to build, equip and sustain our fleet."

The official pointed to a recent Navy statement on the Naval Postgraduate School's Joint Interagency Field Experimentation (JIFX) program, which offers perhaps the clearest official window into where the ecosystem is moving.

Acceleration Model

At the May 2025 JIFX event at Camp Roberts, California, more than 100 flights were conducted across technologies tied to drones, AI, swarms, countermeasures, sensors, navigation, communications and electronic warfare. The event included 29 unique technologies and 111 drone sorties in over 10 research focus areas, according to the Navy.

That pace matters. Swarm effectiveness depends less on any single airframe and more on how quickly operators can test autonomy behaviors, sensor fusion, communications resilience, and human-machine command arrangements under realistic field conditions.

Experiments are run repeatedly, often in collaboration between companies and military stakeholders, with a "fail-friendly" culture intended to reduce time from concept to usable capability. That approach aligns with how swarm tactics are likely to be fielded: not as static platforms but as software-defined force packages that can be reconfigured by mission.

For example, Firestorm Labs, a participant in JIFX,

focused on expanding the flight envelope and testing the new capabilities of its Tempest drone, which has a wingspan of about seven feet and maximum takeoff weight of 65 pounds. They were able to swap between a pusher prop or a micro turbojet engine during the experiment.

"Tempest has an architecture that also allows it to easily integrate with various payloads," Rosario Aiello, Firestorm's integrations group leader, said in the Navy statement.

Meanwhile, Rhoman Aerospace tested a payload on the Tempest that can run autonomous missions with passive sensors to handle a GPS-denied environment, using artificial intelligence to detect objects.

"Our system has very complicated physics driving it," James Croughan, Rhoman's head of technology, said in the statement. "So, we're also using AI for advanced model tuning and highly complex model corrections. We flew our test platform to collect data that we'll use to tune the system."

The future mix may include small ISR drones, loitering assets to pressure adversary air defenses, decoy platforms and maritime vehicles to maintain sensing in contested littorals. What changes from mission to mission is the blend, sequence and control method.

When it comes to drone swarms, the conversation rarely centers on the platform itself, but rather the software layer that determines whether distributed systems behave like a coherent team or a loose collection of nodes.

You train an AI model to become hyper-intelligent at differentiating a drone from just a random mass in the background environment.

– John Marmaduke, cofounder and CTO, Aurelius

For the Navy, that has implications well beyond experimentation. The service's challenge is to translate a high-velocity test ecosystem into repeatable fleet tactics, training pipelines and command-and-control doctrine that operators trust at sea.

The defensive race may be harder.

Drone swarms stress legacy naval defense models because they attack economics as much as hardware. A ship's layered defenses were built for high-value threats, but large numbers of low-cost autonomous systems can force disproportionate defensive expenditure.

The JIFX event hints at how the Navy and broader defense ecosystem are approaching this problem. One highlighted effort involved live-fire laser weapon system testing against quadcopters, with automation used to scan, detect, identify and engage drone targets. That sequence is the core of counter-swarm warfare.

During the event, Aurelius Systems used a laser weapon system to engage a small group of quadcopters from distances of up to 500 meters using automation to track the drones and determine the aim-point, heavily relying on AI.

"You train an AI model to become hyper-intelligent at differentiating a drone from just a random mass in the background environment," Aurelius cofounder and Chief Technology Officer John Marmaduke said in the statement. "Basically, you feed it a bunch of data on drone profiles, like physical parameters. Dimensions, shapes, what the props and cameras look like. You're making the AI model very good at identifying those key features as well as key features of kinematic movement, which is just the understanding of how an object flies in the sky."

Defending against swarms will require combining hard-kill and soft-kill tools: electronic warfare, cyber effects, spoofing and jamming, directed energy where feasible, and conventional weapons as backstop.

The harder problem is decision speed. Counter-swarm defense depends on machine-assisted triage that can separate threats from decoys, then allocate effects without wasting scarce interceptors.

It's a particular vexing challenge for the Navy. Ships cannot simply relocate defensive infrastructure the way land forces can shift



air-defense batteries. A vessel carries what it carries. In a prolonged exchange, reload realities and power management become tactical constraints.

This is why directed energy keeps surfacing in swarm conversations. If technical and environmental limits can be managed, lasers offer a potential means to preserve missile inventories against low-cost aerial threats. But they are not universal answers; weather and geometry remaining limiting factors.

In practical terms, the Navy’s near-term path appears to be iterative rather than declarative — run frequent field experimentation, integrate industry and operator feedback, test in realistic conditions and mature both mission applications and counters in parallel. That is less dramatic than announcing a single “swarm program of record,” but it may be the more durable strategy. After all, swarms are not a platform, they are a method, and methods evolve through repetition.

What remains unclear publicly is how quickly lessons from experiments will impact the real world. The Navy is not saying much when it comes to timelines.

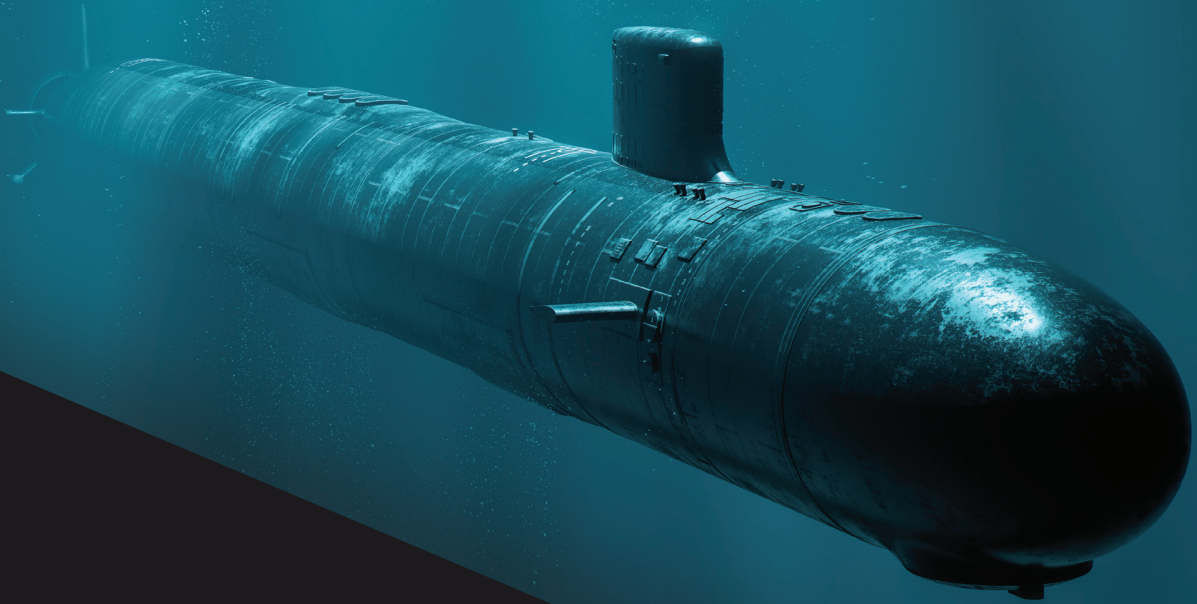
Top left: A Group 1 quadcopter burns after being engaged by Aurelius Systems’ laser weapon system. Bottom left: Side-by-side comparison of quadcopters with and without laser damage. Right: Modular airframe components of Firestorm Labs’ Tempest drone built by its xCell expeditionary additive manufacturing station. Naval Postgraduate School runs the quarterly Joint Interagency Field Experimentation event at Camp Roberts. Photo credit: U.S. Navy | Dan Linehan.

Still, the direction is evident. The service is betting that autonomy, AI-enabled coordination, and rapid field testing can generate combat mass without waiting for one-for-one growth in major hulls.

The central question for the U.S. Navy, then, is not whether swarms matter. It is whether the fleet can institutionalize a cycle fast enough to deploy them effectively and defeat them when they are used against U.S. ships. ■

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.

BELOW THE SURFACE ABOVE THE REST



WHEN YOU NEED PERFORMANCE, KEEL DELIVERS.

Our advanced techniques and cutting-edge equipment guarantee that every fabrication, component and assembly is built with precision – ensuring the durability and reliability to face the toughest challenges.

Our next-level capabilities include:

- Fracture-critical steel fabrication
- Welding to NAVSEA specifications
- Deep-water access
- Heavy lift & transport
- Blasting, painting & coating

LEARN MORE



keelusa.com

Submarine Module Fabrication by Keel

Shipbuilding's AI Moment

Navy Makes \$448M Bet Software Can Boost Industrial Capacity

BY DAN TAYLOR

The U.S. Navy has a shipbuilding problem that no strategy document can obscure: Fleet demand is rising faster than yard throughput and schedules are slipping as a result. Now the service is making a bet that data and automation can narrow that gap.

In December, Secretary of the Navy John Phelan announced a \$448 million investment in the Shipbuilding Operating System — “Ship OS” — to scale AI and autonomy tools across the maritime industrial base. The initiative, run through the Maritime Industrial Base program with Naval Sea Systems Command, is intended to unify fragmented production information and turn it into faster decisions on schedules, materials, engineering and risk.

“This investment provides the resources our shipbuilders, shipyards and suppliers need to modernize their operations and succeed in meeting our nation’s defense requirements,” Phelan said in a statement. “By enabling industry to adopt AI and autonomy tools at scale, we’re helping the shipbuilding industry improve schedules, increase capacity and reduce costs. This is about doing business smarter and building the industrial capability our Navy and nation require.”

A Navy official told *Seapower* the selected software platform offers a mature baseline that could produce immediate effects while avoiding the time and cost of building a government-unique system from scratch. The official said the approach leverages billions of dollars in prior private-sector investment and was chosen in part for its ability to integrate quickly with enterprise resource planning systems, legacy databases and operational tools across multiple facilities.

That last point gets to the core of what Ship OS is trying to solve. Shipyards already have data. Suppliers already have data. Program offices already have data. The problem is naval shipbuilding data often lives in separate systems, with different owners, update cadences and quality levels. In practice, that means teams spend significant time reconciling information before they can act on it. Ship OS is intended to reduce that reconciliation burden.

While the Navy certainly has used data to improve its shipbuilding processes in the past, this is a significantly different approach.

“Earlier efforts focused on improving Navy-side oversight,” the Navy official said. “Ship OS

is designed specifically to enable industry. It gives shipbuilders, shipyards and suppliers the tools they need to plan, execute and measure performance more effectively. The system aligns data across the entire enterprise, government, and private sector, creating a shared, transparent view of progress and challenges that support collaborative solutions.”

The Navy says the effort goes beyond prior analytics pushes because it is designed less as a Navy oversight tool and more as an industry execution tool, a shared decision environment where shipbuilders, shipyards, suppliers and government stakeholders are looking at aligned data and measuring progress against the same operational picture. If that works at scale, the implications are significant.

Promising Prognosis

For planning teams, AI-assisted schedule generation could reduce manual sequencing work that currently consumes skilled labor hours. For engineering teams, automated extraction of specifications and requirements could free personnel from document-heavy tasks and shift effort toward integration and problem-solving. For materials teams, near-real-time visibility into supplier constraints could allow earlier interventions before shortages become schedule slips.

The Navy says early pilots already suggest this kind of acceleration is possible. In the initial deployments cited by the service, submarine



**ADVANCED
ACOUSTIC CONCEPTS**
A THALES COMPANY

ADVANCEDACOUSTICCONCEPTS.COM

Counter Mine **Find. Fix. Finish.**

Built in America. Trusted worldwide. Delivered for the Fleet.



Advanced Acoustic Concepts delivers real-time target management solutions that complete the operational kill chain, from detection to engagement. Built on American innovation, our trusted allied technologies provide the U.S. Navy what it needs now: precision, speed, and confidence in mine warfare operations.

schedule planning at General Dynamics Electric Boat reportedly dropped from 160 manual hours to under 10 minutes. At Portsmouth Naval Shipyard, material review timelines reportedly fell from weeks to under an hour. The Navy also cited engineering productivity gains through automated specification extraction, including a reported 67% increase in engineering capacity at Nautilus-PRL.

“These early outcomes show that integrating AI and autonomy directly into shipbuilding operations can dramatically improve efficiency, accuracy, and output,” the Navy official said.

Those are eye-catching numbers, and they help explain why the service is putting substantial funding behind the concept. However, the battle is not won yet; a great pilot result does not automatically translate into enterprise-level transformation. Shipbuilding is not a uniform production line. It is a high-variability environment with shifting design baselines, long-lead components, labor bottlenecks and unpredictable disruptions that can cascade across programs.

In that setting, AI tends to help most where work is repetitive, data-rich and delay-sensitive: schedule conflict detection, material tracking, document parsing, workflow triage and risk flagging. It helps least where data is sparse, context is ambiguous or judgment is deeply experiential — especially in one-off technical decisions, cross-

trade coordination under unusual conditions and unforeseen yard-floor realities.

That means Ship OS is unlikely to eliminate shipbuilding friction entirely, but it could change where friction accumulates and how quickly leaders detect and address it. The strategic question is whether these gains can compound across the broader industrial base.

The Navy says initial investment will prioritize the submarine industrial base — builders, public yards, and critical suppliers — with broader expansion to surface programs informed by implementation lessons. Submarine construction and sustainment are already among the Navy’s most schedule-sensitive priorities and the supply chains involved are both complex and capacity-constrained.

But phased rollout also reflects institutional reality, as digital modernization requires data governance, process redesign and sustained training. A dashboard can be fielded quickly. Behavior change takes longer.

For Ship OS, success will depend on whether the Navy and its industry partners can keep the implementation focused on operational decisions people make every day, not only on executive-level visibility.

What changes could be seen on shop floors and in planning offices if this works as intended?

Planners should spend less time building schedules by hand and more time testing alternatives

before disruptions occur.

Engineering teams should be able to identify document conflicts and spec dependencies earlier in the workflow. Materials managers should have faster insight into supplier readiness and long-lead risk. Program leaders should see bottlenecks in near real time rather than during periodic status drills

In short: less clerical reconciliation, more decision velocity.

In an era of prolonged strategic competition, maritime power depends not only on who designs the best ship, but on who can build, repair, and modernize fleets with greater speed and resilience. If the pace of naval competition is increasingly set by industrial throughput, digital command of production data could become a warfighting variable.

The Navy’s \$448 million move suggests the service believes that to be the case.

Whether Ship OS delivers on its promise will be measured less by pilot anecdotes than by sustained outcomes: fewer schedule slips, faster engineering turnaround, reduced rework, steadier supplier performance and ultimately more deployable ships delivered on time.

If those metrics move materially, this investment will look less like an IT modernization story and more like a foundational shift in how American sea power is produced. ■

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.



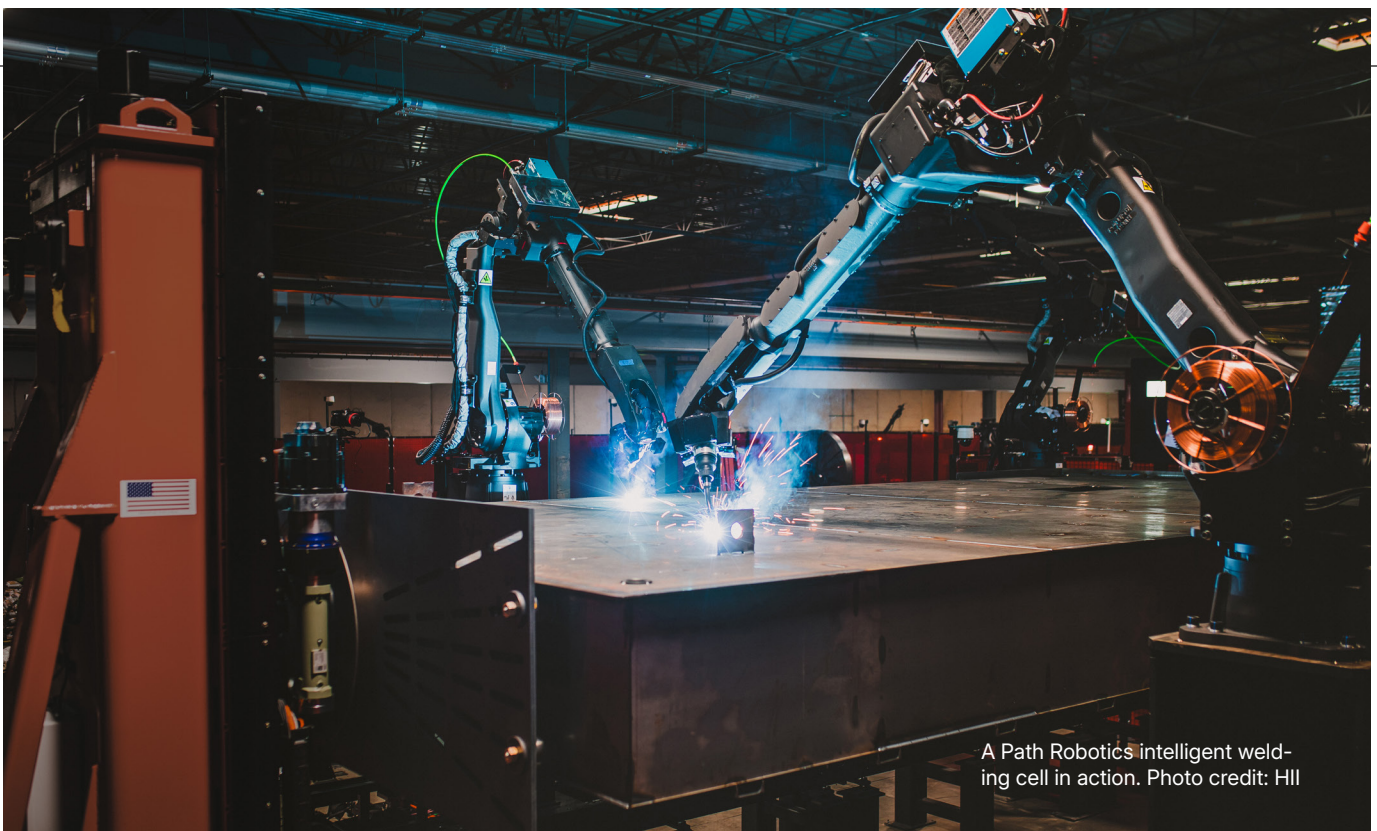
PROVEN ELECTRIC POWER AND PROPULSION FOR WHAT'S NEXT – SO YOU OWN THE EDGE™

Modular, scalable electric power and propulsion Ready Today to support the power requirements of the Future Fleet

Future U.S. Navy platforms will demand substantially more electrical power to operate in contested maritime environments—supporting advanced radars, directed-energy capabilities, and high-performance combat computing at the edge. Meeting this demand will require modular, common designs for electric power and propulsion systems that can rapidly scale across ship sizes.

Leonardo DRS brings proven naval electric power and propulsion experience—and is already delivering these capabilities for the Navy's priority COLUMBIA-class program. With expanded manufacturing and test capacity at our 140,000+ sq. ft. Charleston, SC facility, we deliver at speed and scale using proven, production-ready designs.

Ready today. Scalable for tomorrow – So Our Navy Can Own The Edge.™



A Path Robotics intelligent welding cell in action. Photo credit: HII

HII Explores AI Welding to Add to Shipbuilding Technology Portfolio

BY BRETT DAVIS, EDITOR-IN-CHIEF

Last year, HII announced it had teamed with C3 AI to use artificial intelligence to help streamline its complicated workflows. It also announced it was working with C3 AI, Shield AI and Applied Intuition on its Romulus family of AI-enabled uncrewed surface vessels to provide enhanced autonomy, object classification and lifecycle sustainment.

More recently, HII announced it's also looking to bring AI into its physical work, namely welding.

This latest AI venture finds HII teamed with Ohio-based Path Robotics, a company founded in 2018 to incorporate AI into legacy manufacturing processes. For HII, that means exploring the use of Path Robotics' AI-powered robotic arms for some welding work.

The companies signed a memorandum of understand-

ing for the work in February. Because the systems haven't yet been approved by the U.S. Navy, the work is being done at Path's Columbus headquarters.

"Our shipbuilding throughput was up 14% in 2025 and we are looking for an additional 15% increase in 2026," said Eric Chewning, HII's executive vice president of maritime systems. "By working with new partners like Path Robotics, we can further accelerate shipbuilding production. I look forward to jointly developing an autonomous AI-based welding solution that can help us meet Navy standards and be scaled in our shipyard facilities."

The companies will look for future opportunities for autonomous shipbuilding capability development, workforce training to extend automation and integrating Path Robotics' systems into HII's existing systems for building ships, including its new Romulus line of uncrewed surface vehicles.

"Welding is one of the hardest processes to automate in any industry, and shipbuilding is no exception," said Andy Lonsberry, Path Robotics' CEO and cofounder. "Path's physical AI is purpose-built for that challenge — seeing, understanding and adapting to real-world conditions in real time."

HII's Ingalls Shipbuilding has delivered 40,000 pounds

of steel to Path Robotics along with the design for a welded component from a Navy destroyer, both to train the model and to help put Path Robotics on the path to getting Navy certification for its welds.

Chewning said Path will make the weld, get it certified by the Navy, then work on different weld types.

“As they get certified by the Navy, then we can begin to migrate the technology into the shipyard to augment activities that we’re currently doing,” he said.

What will be considered a success for the effort?

“The end objective is always, what do we need to do to increase shipbuilding throughput?”

Chewning said.

Path Robotics’ welding system is named Obsidian and transforms a traditional industrial robot arm from doing only rigid, repeated work into “a real-time perception and decision-making system that can see, understand and adapt to the variations of a shipbuilding environment,” HII said in a statement.

HII currently uses many welders and welding systems, of course, including automated robot welders that require human collaboration and mechanized welders that follow pre-programmed paths.

Lonsberry described how the Obsidian welding platform is different from those existing coworker robots, or cobots.

Cobots are built to do the one task, maybe 10 million times with perfect tolerance, he said. “Our systems are built to handle extreme variabil-



Eric Chewning, executive vice president of maritime systems and corporate strategy at HII (left), and Andy Lonsberry, CEO and co-founder of Path Robotics, sign a memorandum of understanding at Path Robotics’ headquarters to explore integrating physical AI-powered welding into shipbuilding operations. Photo credit: HII.

ity, very unique parts, every part can be different. Our system looks at every part, it uses its eyes to get 2D images, to get 3D data, it uses its sensor, such as a microphone to take audio data, and it basically uses all that data to be able to understand how to weld,” he said.

In a statement, HII said AI-driven autonomous welding technology “presents a promising potential opportunity to expand distributed shipbuilding capacity and augment HII’s skilled workforce to accelerate delivery and meet the U.S. Navy’s growing demand.”

Five-Part Strategy

The new move with Path Robotics, and the previously announced work with C3AI, is part of a five-part strategy to increasing shipbuilding throughput by 15% in 2026. That includes expanding capacity through investments, growing the

supply chain, boosting and improving the workforce and investing in new technologies such as AI, Chewning said.

“In the past, automation focused on applications where one task would be done numerous times,” Chewning said in opening remarks at the time of the MOU signing. “Think one robot doing the same task 10,000 times. But in shipbuilding, you need 10,000 tasks done once. This is why physical AI is a game changer. We finally have systems able to do a variety of tasks.

“By working with partners like Path Robotics, we feel we can further accelerate shipbuilding production, for manned and unmanned systems. We look forward to jointly developing an autonomous AI-based welding solution that can help us meet Navy standards and compound capacity across the maritime industrial base,” he said. ■



Autonomous Ships Prepare to Hit the Water for Navy, Marine Corps

BY BRETT DAVIS, EDITOR-IN-CHIEF

The U.S. Navy and Marine Corps are pushing for the development of systems to expand the footprint of the fleet with autonomous, uncrewed craft for carrying (or firing) weapons and for logistics resupply, expected to be a critical component of any future conflict with China in the vast realm of the Indo-Pacific region.

The expected surge in shipbuilding for a variety of relatively inexpensive, autonomous craft is likely to rival the World War II-era push for Liberty Ships, simple,

cheap cargo ships built at an unprecedented rate.

"The analogies we draw from World War II are things like the Sherman Tank, the Liberty ships," said Charles Fralick, chief technology officer for Leidos' Defense Maritime business, which is competing for some of the pending work.

"The difference this time is ... take the Liberty ship. They were extremely simple vessels to build. It's not the same with the current crop of warships and

U.S. Marines operate an Autonomous Low-Profile Vessel at Naha Military Port, Okinawa, Japan, Jan. 17, 2025. Marines with 12th Littoral Logistics Battalion executed the first ALPV rehearsals in Okinawa, increasing 12th LLB's operational readiness and amphibious capabilities. Photo credit: U.S. Marine Corps | Lance Cpl. Rodney Frye).

unmanned systems. They are complicated devices," Fralick said. "So, we've had to learn to employ more innovative approaches to manufacturing than we did even, say, in World War II. And that includes things like additive manufacturing, that's heavy use of AI-enabled design tools."

ALPV

One of the autonomous ships expected to hit the water relatively soon in larger numbers is the Autonomous Low Profile Vehicle,

**CURTISS -
WRIGHT**



Operating From Seabed to Space Isn't a Mantra, It's a Mandate.

You need reliability. You need dependability. You need 120 years of expertise.

We are a global, integrated provider of highly engineered, technologically advanced products and services able to meet the demands of the complex battlespace. Your mission is too critical for anything less.

or ALPV, a ship intended to carry a variety of cargo without being spotted. Leidos' version is built by Leidos subsidiary Gibbs & Cox.

While the concept has lowly beginnings — it's loosely based on narco-sub cartels have used to smuggle drugs — the U.S. Marine Corps has taken a shine to it and has been testing three Leidos prototypes for the past couple of years, with a program of record expected to follow in 2027. The Marines have tested the vehicles in a variety of locations and scenarios, including in Okinawa as part of exercise Resolute Dragon 2025.

Reflecting the increased interest in the capability, in early March the Defense Innovation Unit issued a new solicitation for an ALPV for the Department of Defense and U.S. Marine Corps to help them "resupply units spread over wide distances in contested littoral environments." The system needs to be operate autonomously in congested waterways and ports, be capable of manual operation via remote control and be capable of one human to multiple ships control.

While the ALPV is more sophisticated than narco-sub, "it's not a complex vehicle to operate," said Jeff Holmes, chief engineering officer for Leidos Gibbs & Cox. "It's a mission system that's ready to go do its thing."

The company is continuing to refine and update its ALPV design on one of the prototype boats, dubbed Sea Specter, to make it ready for the expected request for high-volume production.

ALPV is "a low-observable platform," Holmes said. "The idea is that it's hard to detect, but even at that, it's a slow-moving target, and you have to realize there's going to be some losses. So, that means two things. One is the Marines have to have a lot of them. And then of course, the following from that is they have to be affordable to buy in quantity."

Just like the narco subs, there's a good chance they won't all get through. "You've heard the old saying, two is one and one is none. You have to send three or four platforms in hopes that one or two get through. And when you do that, it means you need a large bench. You need a deep roster of platforms that you can send," Holmes said.

Indeed, the DIU solicitation says the vessels will need to be low profile to avoid detection and must have the ability to be scuttled remotely.

Leidos' three prototypes were built quickly using traditional wooden construction methods, enabling the company to deliver the first prototype to the Marine Corps within nine months. Sea Specter "has many of the same attributes but different construction materials and a different build strategy," he said.

Eventually, the military may require five to 10 boats a month, up to 500 a year, "and these are 65-foot boats, they're no small asset." The company or companies that end up contributing ALPVs will need to innovate to be able to match that demand, using aluminum or fiberglass construction, maybe additive

manufacturing, and building the vehicles with robots, he said.

"We don't know exactly where that's going to end up, but we are driving forward to find the right solution," Holmes said.

Seahawk and Sea Hunter

The company's medium USVs are also marking a milestone, as a Navy official announced in January the Leidos-built Seahawk and Sea Hunter USVs are no longer considered experimental and will be deployed, the Seahawk with a carrier strike group this year, according to Defense News.

"We have integrated and tested multiple payloads for the Navy on Sea Hunter and Seahawk," Leidos' Fralick said. Seahawk "will be carrying payloads. Those I cannot comment on, confirm or deny."

Fralick said AI and autonomy are frequently grouped, and AI has been used to enhance operations such as path planning for uncrewed vehicles, but "the real application of AI so far is in the sensor realm, particularly things like optical perception and with optical perception, you're using EO/IR [electro-optical/infrared] cameras to see things out at distance," he said.

These advances, and others, are enabling Seahawk and Sea Hunter to take their places in the fleet, and the insertion of Seahawk into a carrier strike group represents "the first ever combined fleet operation of an ocean-going autonomous platform with crewed warships," he said. ■

SAIC[®]



TRUSTED AUTONOMY AT SCALE

saic.com/undersea-dominance



The Liberty USV, Blue Water Autonomy's entry to the Navy's Modular Attack Surface Craft effort. Photo credit: Blue Water Autonomy.

Behind the MASC

Navy Push for USVs Drives New Partnerships, Technology

BY BRETT DAVIS, EDITOR-IN-CHIEF

As many Navy officials and military analysts have noted, the U.S. Navy is going to require more ships to meet ongoing and increasing demands, especially for countering a surging Chinese fleet.

One way to bolster the U.S. fleet is by building more autonomous, uncrewed ships surface ships, or USVs, which the Navy is seeking under its relatively new MASC program, for Modular Attack Surface Craft, a merging of previous efforts to create medium and large USVs.

A dozen or more companies, a mix of seasoned players and newer entrants, are seeking to step into that breach to provide USVs for the Navy, bringing with them new design philosophies to meet Navy needs and new partnerships for

building a lot of ships, fast. That is intentional, as the Navy has made it clear it's not looking for novelty in designs.

"Utilizing existing commercial designs and production capabilities will enable the Navy to rapidly deploy a formidable and cost-effective USV force," the Navy said in its initial MASC solicitation, issued in the summer of 2025.

That has led to several commercial tie-ups between defense and tech companies and shipbuilders. Among those competing are California-based Anduril, which has teamed with HD Hyundai Heavy Industries to develop a family of modular USVs, including a variant for the MASC program.

While the first USV prototype is being fabricated in Korea, Anduril said "future vessels, including the MASC variant, will be completely built in the United States" at a revamped shipyard in Seattle.

Baltimore-based BlackSea Technologies has announced a 66-foot uncrewed aluminum catamaran with 67,200 pounds of payload capacity, and which shares major system components with its fielded Global Autonomous Reconnaissance Craft, or GARC, which the company says means it could build and deliver a fully integrated MASC prototype within six months, meeting the Navy's goal of rapid development.

Big, High-Tech Ships

In February, Boston-based Sea Machines Robotics announced its Steamracer class of USV developed with several partners, including St. Johns Ship Building for its construction and SNC for its Maritime Advanced Secure Transmission system.

One newer company that has tossed a large hat in the ring is another Boston-based company, Blue Water Autonomy, which in February announced details of its design, the Liberty class of USVs.

Liberty would be a 190-foot steel ship with a range of more than 10,000 nautical miles and a payload capacity of more than 150 metric tons. As per Navy demands, Blue Water Autonomy has teamed with Damen Shipyards Group and the Liberty design is based on Damen's Stan Patrol 6009.

Its shipbuilder is Louisiana-based Conrad Shipyard, which has five shipyards and 1,100 workers and builds ferries, tugs and barges, among others, and which refitted NASA's Pegasus barge used to transport the core stage of the new Space Launch System rocket.

A variety of companies are vying for the MASC work, but Blue Water Autonomy was founded in 2024 specifically to build large USVs.

"We're the first one to focus really entirely on ship-sized USVs," Austin Gray, the chief strategy officer and cofounder of Blue Water Autonomy, told *Seapower*. "We have competitors, but we're the only guys who only do that. We're not a shipbuilder who's now doing unmanned, and we're not a small USV company who's now doing a bigger USV."

Gray, a former Navy intelligence officer, founded the company with CEO Ryan Hamilton, a former Navy engineering and surface warfare of-

The Navy has been really clear it needs and wants unmanned systems to complement the crewed fleet.

— Austin Gray, chief strategy officer, Blue Water Autonomy

ficer, and Chief Technology Officer Scott Miller, who has built deep-sea remotely operated vehicles and helped launch iRobot's iconic Roomba robotic vacuum cleaner.

Given the tech background of the founders, the company is seeking to upend some military practices, building the big ships in commercial yards and incorporating advanced shipbuilding methods.

"We're trying to tell the story that you can launch a ship product like a tech product, like a Tesla or an iPhone, and celebrate that," Gray said. "That symbolizes the new business model that ... lets us go fast and offer great technology and product velocity to the warfighter."

Ultimately, should the Navy be willing, and with additional investment, Conrad could build 20 of the Liberty ships a year, Gray said.

"The Navy has been really clear it needs and wants unmanned systems to complement the crewed fleet," Gray said. The Navy expects to have 11 medium USVs and 500 small ones by the end of 2027. "For smalls, they already have almost that many. The focus is going to be on the ship-sized vessels, because they definitely don't have 11 medium USVs right now."

Changing Methods

The name Liberty is based on the Liberty Ships of World War II, which were produced rapidly and at scale to meet urgent national needs. The new Liberty has been developed entirely with private capital, a typical situation in commercial markets but "unprecedented" for a full-sized Navy ship, the company said.

A January 2026 Congressional Research Service update for Congress noted the Navy is taking a different approach with MASC, not describing how the ships should look, but outlining performance goals and letting industry produce innovative approaches on their own dime. The competition will be fierce and a way ahead on the program is expected soon.

Gray said MASC and his company's offering point the way to increasing shipbuilding in the United States, which has been an issue in recent years.

"You don't really need some crazy process change, or massive influx of workers or new shipyard to build a bunch of ships in the United States. You just need demand signal, and clear planning," he said. ■

Additive Manufacturing and the Future of Sea Power

Standardization is on Deck, Driving Qualification, Certification Processes

BY ANTHONY BASENESE AND ROSS BROW

Maritime dominance is built as much in shipyards and supply chains as it is at sea, a reality that creates persistent readiness challenges for the U.S. Navy. Sea services face an ambitious cadence of new submarine construction, while shipyard overload and reduced maintenance capacity constrain the ability to sustain an aging fleet. These efforts are compounded by long-lead, hard-to-source components, delaying repairs and modernization.

Additive manufacturing, or AM, is proving viable in addressing these challenges, evolving beyond its early experimental capabilities to become a practical enabler of fleet readiness. The technology is supporting faster repairs, more resilient supply chains and more capable shipboard systems.

Where does AM deliver strategic value, and how can it be applied responsibly in mission-critical naval environments? AM's direct operational relevance can be illustrated with a slate of real-world projects, adding the context necessary to build trust in the technology.

An early scenario addressed a submarine's need for high-performance flow control, which pushed the limits of traditional manufacturing processes. Marotta Controls developed an AM metal submarine component that met all performance requirements and could not be manufactured using traditional processes, demonstrating the potential for AM to augment the way submarines are designed and constructed.

The resulting value proposition presented by this flow control component set in motion the development of the first metal AM part with a NAVSEA-approved

qualification plan for any submarine application. During its multi-year qualification process, the team, which also included NAVSEA and the prime contractor for submarines, co-wrote the qualification standard. This, in turn, led to the initial development of NAVSEA Technical Publication S9074-A2-GIB-010/AM-PBF, the technical requirements for metal powder bed fusion additive manufacturing. Deployment continues today, with small quantities of these flow elements installed and many more in production.

A more recent project built on this progress with a redesigned and requalified cast valve body for AM production. The new AM version delivered improved part quality, simplified the supply chain, and achieved a 70% reduction in lead time. Guided by NAVSEA and funded by the Maritime Sustainment Technology and Innovation Consortium, the redesign addressed the difficulty in sourcing cast parts due to supplier decline and increasingly long lead times. Once fully qualified, including high-impact shock and shipboard vibration testing, the valve was approved for shipboard use on U.S. Navy destroyers.

These projects, featuring low-risk components, are paving the way for AM-based acoustic and structural advantages in all maritime applications. For instance, a multi-year research program with America Makes revealed using lattice structures improved mechanical and acoustic performance. The critical submarine valve body had a 33% reduction in part mass while still meeting performance requirements.

AM at the Point of Need

AM aligns closely with the Navy's distributed sustainment strategy to push repair, manufacturing and support capabilities closer to (and occasionally onboard) its fleets. A major milestone was reached in November 2025 when a deployed submarine tender produced a fully metallic submarine component with a shipboard AM system. It was delivered and installed as a perfect fit on a fast-attack submarine within days rather than months.

In particular, a reliable metal AM supply line creates accessibility, ensuring the availability of small-quantity spare parts necessary to maintain the warfighter's essential equipment. Early last year, the U.S. Coast Guard

installed its first 3D-printed metal component on an operational asset, the cutter *Forward*. The project also marked the first metal additive part deemed “critical” by NAVSEA for any military surface ship. The part, a seal housing for the cutter’s fin stabilization system, helps keep the vessel watertight below the waterline and is routinely replaced due to corrosion.

The component has simple geometry and wasn’t an obvious AM candidate, but a deeper dive revealed its long machining times, high material removal and supply chain delays. By shifting to manufacturing through laser powder bed fusion, the resulting part required only minimal post-print machining, reducing time and materials. Most importantly, the supply chain for machined seal housings is completely redefined; they can be manufactured by the Navy Center of Excellence or a qualified AM vendor, an essential transformation as many original suppliers of this part no longer exist or have exited the ecosystem.

Standards are Turning Point

These success stories demonstrate AM’s technical viability, but its long-term impact hinges on standardization. The Navy has begun releasing a roster of military standards to streamline and scale the qualification and certification process. This critical shift carries weight across defense sectors, each defined by unique priorities but sharing an interest in parts that are reliable, high-performance and certifiable.

Standardized material specs, such as process controls, feedstock powder or mechanical properties, let manufacturers produce parts that meet baseline performance requirements across agencies. At

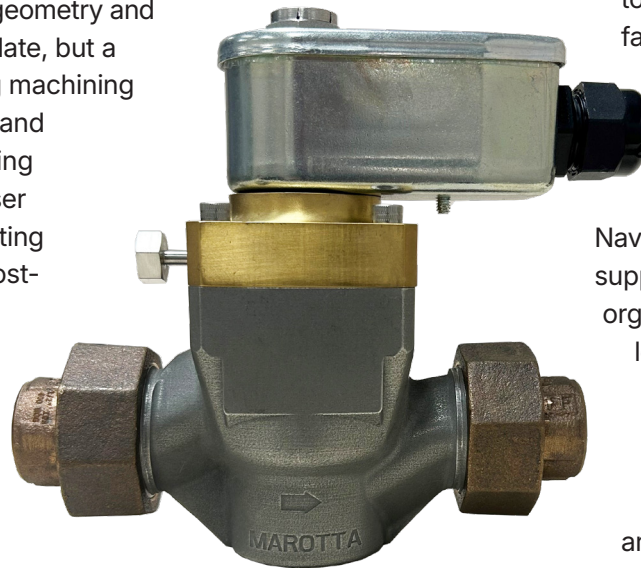
the same time, AM component suppliers can be responsive and nimble without the burden of a costly, “one-off” qualification protocol. It is feasible that the same titanium alloy used in either a satellite bracket or a submarine valve could be qualified under the same spec and produced by the same subcontractor, assuming mutually acceptable tolerances like material strength, fatigue life and corrosion resistance.

AM’s progress has benefited from collaboration among Navy stakeholders, shipbuilders, suppliers and research organizations. Pooling lessons learned and aligning practical requirements has steadily advanced qualification efforts and processes. Shared data and joint problem-solving are proving to be especially pertinent for developing inspection

methods, material specifications and acceptance criteria for new manufacturing approaches.

By focusing on components that historically suffer from long lead times, limited supplier bases or declining availability, the Navy and its industry partners have demonstrated AM can help meet readiness challenges. Emerging standards allow advanced AM materials to be treated more like traditional certified materials purchased, inspected and approved within a familiar acquisition framework.

It takes a small army (or Navy) to collaborate and move forward in a way that builds trust in technology. With a maturing ecosystem and group commitment, AM will reach its full potential, influencing shipbuilding throughput, distributed sustainment and the Navy’s ability to keep combatant ships mission-ready across the globe. ■



Applying additive manufacturing techniques, Marotta produced a direct replacement of a chilled water valve with delta qualification. Lead time was reduced by 70%, and performance was improved. Photo credit: Marotta Controls.

Anthony Basenese is the Engineering Manager in the Naval Systems Business Unit at Marotta Controls for additive manufacturing initiatives. Ross Brown is a senior engineer specializing in additive manufacturing at Marotta Controls.



Marines maneuver toward an objective during a live-fire training event at Pohakuloa Training Area, Hawaii, Feb. 3, 2026. The training was designed to refine weapon system and tactical proficiency, strengthening overall combat readiness. Photo credit: Marine Corps Sgt. Iyer Ramakrishna.





Train the Way You Fight. ZERO COMPROMISE.

Freedom Trainer™ for UJTS is the only solution engineered for authentic FCLP to touchdown, forging the instinctive skills and muscle memory vital for carrier operations. With a 16,000-hour airframe, industry leading lifecycle cost and open systems architecture, Freedom empowers the Navy to train, adapt and excel—today and for the future.

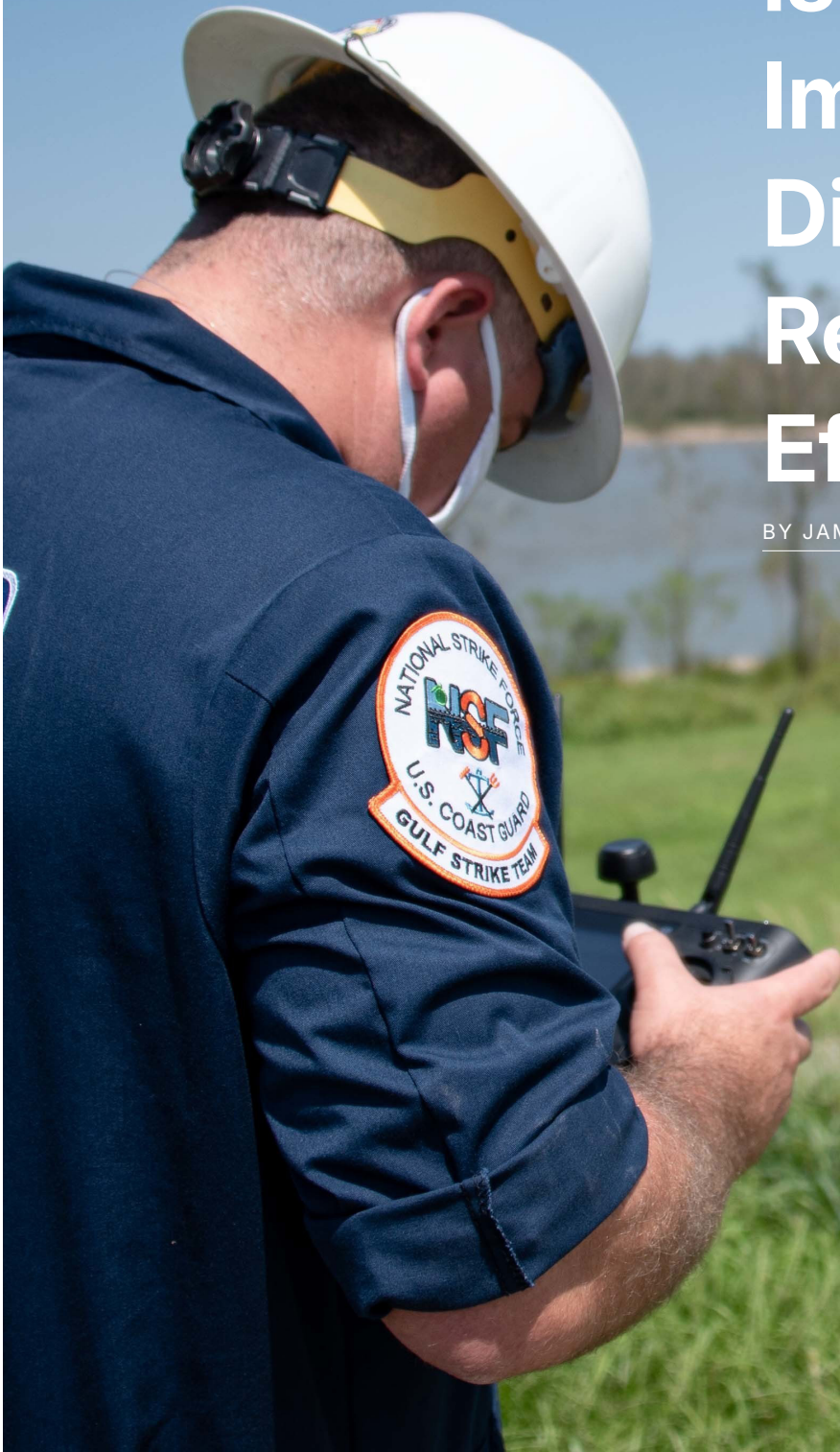
Sea-Air-Space Booth #1101



SNC[®]
sncorp.com

How AI is Helping Improve Disaster Response Efforts

BY JAMIE L. PFEIFFER



Even minor maritime disruptions can cripple supply chains, affecting the global exchange of food, fuel and essential goods. The devastating effects of a maritime disaster can cause damage thousands of miles away. As a result, improving the speed, efficiency and effectiveness of disaster response efforts has become a critical part of the international economy as well as a humanitarian objective.

Autonomous surface and underwater vehicles are increasingly important to disaster relief efforts. Integrated artificial intelligence can help supercharge these robotic tools, enhancing our ability to prepare for, respond to and recover from natural disasters.

Accurate prediction is the first line of defense for many maritime disasters. Traditional storm forecasting relies on satellite imagery, atmospheric models and buoy data. Autonomous ocean gliders and surface drones improve data collection, capturing increasingly detailed and accurate information before a storm. Unlike crewed vessels, autonomous platforms can operate in extreme conditions and linger in areas too dangerous for manned ships or aircraft.

Machine learning algorithms can analyze vast amounts of data in real time, enabling more accurate intensity predictions and improving storm surge modeling. They can integrate decades of storm data, ocean temperature readings and atmospheric pressure measurements to identify patterns better than conventional statistical models. More accurate, faster predictions allow leaders to make more effective evacuation decisions and better allocate onshore resources before a storm hits the shore.

Improving Flood Prediction Models

According to some estimates, early warning systems could

reduce flood deaths by up to 43%. Because more than one-fifth of the world's population is vulnerable to flood risks, improving flood prediction models is an urgent priority.

While pure AI modeling systems have so far come up short, combining AI flood predictive systems with traditional modeling systems shows promise. Hydrologists at the University of Michigan recently developed an AI-enhanced system called Errorcastnet (ECN) to analyze existing flood models, identifying and "learning" from past prediction errors. This tool can be adapted to work with existing process-based flood model systems, such as the U.S. National Oceanic and Atmospheric Administration's National Water Model (NWM) and the Global Flood Awareness System (GloFAS) from the European Center for Medium-Range Weather Forecasts. When researchers combined ECN with the NWM, flood prediction accuracy increased significantly.

This hybrid approach could be a game changer for flood-prone regions all over the world, providing detailed flood forecasts up to several days in advance and giving communities vital time to prepare.

Most developed countries now rely on massive computer systems using Numerical Weather Prediction, or NWP, to forecast the weather. Integrating current weather data from satellites and sensors with years of past data and models, supercomputers use complex mathematical equations to predict future conditions. Unfortunately, these systems are still fairly inaccurate. Further, many parts of the world lack the resources to develop such computer-dependent weather forecasting systems.

Responding to Disaster

Researchers at Cambridge University have developed an AI-based forecasting model they claim can outperform NWP systems for a fraction of the cost. Aardvark Weather is an end-to-end model that uses an AI "neural network" to directly translate raw data into forecasts, without complex data assimilation or physics simulations. It could provide accurate local and global estimates to anyone with a laptop, bringing reliable disaster-warning predictions to nearly every global community.

Petty Officer 2nd Class Dylan Zechman operates a small uncrewed aircraft over the Mississippi River in St. James, Louisiana, Sep. 9, 2021, as the Coast Guard Gulf Strike team responded to natural disasters to assist in recovery and assessment. Photo credit: U.S. Coast Guard | Petty Officer 3rd Class Vincent Moreno.



SwissDrones recently announced its uncrewed aircraft will aid Japan's Sanwa Gikou in aerial surveillance, search and rescue operations and natural disaster support. Photo credit: SwissDrones.

Autonomous systems are often the first responders after a maritime disaster. Autonomous surface vehicles and aerial vehicles equipped with radar, lidar and optical sensors can be deployed to patrol areas where debris, damaged infrastructure and unpredictable currents pose hazards to humans and manned vehicles.

Lidar, or light detection and ranging, is an active remote-sensing method that uses laser pulses to create high-resolution, three-dimensional models of surfaces and objects. It works by measuring the time-of-flight of light pulses. Millions of return points are compiled into a 3D "point cloud," which can be used to generate digital elevation models. Feeding this data into an AI-enhanced analysis system enables real-time mapping of disaster zones and the identification of physical, structural, chemical and other types of hazards on land and underwater.

In the immediate aftermath of hurricanes, ports are often closed until navigation channels can be surveyed for hazards. Traditionally, this required hydrographic survey ships and dive teams, which could take days or weeks. Now, fleets of uncrewed underwater vessels can rapidly map underwater debris fields, sunken containers and shifting sandbars using multibeam sonar and AI-driven image analysis.

Machine learning dramatically accelerates the processing of sifting through the massive datasets

gathered by air, land and sea drones. Instead of human analysts manually reviewing every anomaly, AI systems flag likely hazards for rapid verification. This shortens the time needed to reopen ports, restore supply chains and ensure rapid assistance to impacted communities.

In some recent disaster responses, autonomous survey systems have reduced port assessment timelines by more than half, enabling faster humanitarian aid delivery and the resumption of commercial activity.

SAR Work

Search-and-rescue missions are among the most dangerous and time-sensitive maritime disaster response operations. High winds, heavy seas and limited visibility can challenge even the most experienced crews.

While SAR operations have used autonomous aerial drones for years, marine-based AI-integrated autonomous systems are better than ever. The latest innovations help reduce search times, improve decision-making and keep responders safer.

Uncrewed surface vessels equipped with thermal cameras and AI-based object recognition are better than ever at patrolling affected areas for survivors. AI models help them distinguish between floating debris and human bodies. In low-light conditions or heavy rain, AI-enhanced image processing can improve detection accuracy. Some systems can automatically deploy flotation devices when they detect a person in distress, then relay their precise GPS coordinates to human rescue teams.

Underwater autonomous vehicles are especially useful in situations involving submerged vehicles or collapsed infrastructure. AI-assisted sonar analysis can help locate wreckage faster than traditional methods, helping to narrow search zones and focusing diver efforts in areas where they will be most effective.

One promising development in maritime disaster re-

sponse is the use of swarming autonomous systems. Swarm technology uses distributed fleets of smaller, autonomous vehicles that collaborate in real time. Each unit collects localized data and shares it across a network. AI algorithms combine data from each unit into one comprehensive, operational picture.

After a flood, disaster response teams may use a swarm of small surface drones to map water depth and flow rates across an entire harbor or water system. After an oil spill, responders may use a swarm to test water, air, and soil, tracking the spread of contaminants and helping focus their containment efforts.

In addition to allowing teams to map larger areas with greater detail, swarm-based systems offer redundancy: If one unit fails, others continue the mission. This resilience is particularly valuable in unstable post-disaster environments.

Maritime search and rescue operations are highly unpredictable. Militaristic, rigid organizational structures and hierarchical human-centered communication frameworks can be the weakest link. Commanders must process vast amounts of information, make critical decisions and respond to environmental threats quickly and correctly.

Integrated AI could be a way to strengthen this vulnerability. It can already be used to enhance decision-making and optimize resources. As its capabilities improve, it may far exceed any human's capacity to integrate all available data and make better, more informed decisions than a person ever could.

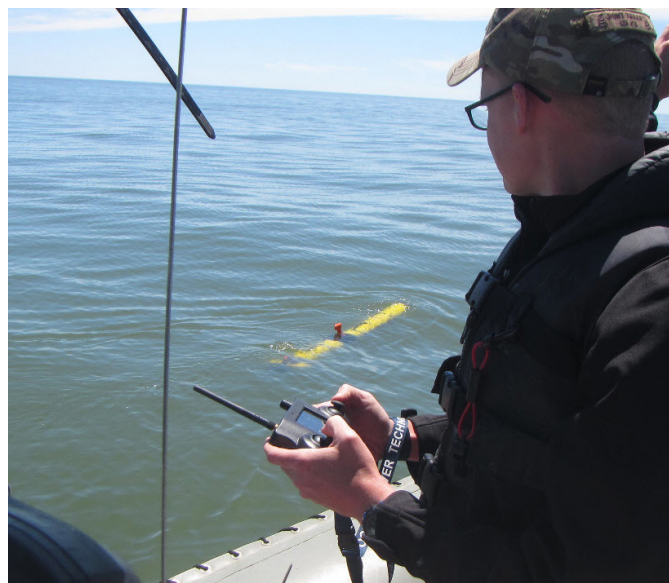
Right now, however, the most effective AI-based models still emphasize human-machine collaboration. AI may recommend courses of action, such as prioritizing certain search areas or identifying likely navigation hazards, but human commanders must make the critical decisions and strategic choices.

Protecting Critical Undersea Infrastructure

In addition to the human costs, disasters like earthquakes, tsunamis and industrial accidents threaten undersea cables, pipelines and energy infrastructure. The security of these resources is critical to trade, international relations and national defense.

Autonomous underwater vehicles equipped with AI-

based anomaly detection are invaluable for inspecting subsea assets quickly after a disaster. Machine learning models can compare new sonar scans against baseline data to identify structural changes or damage. Conducting this type of rapid assessment can reduce downtime and mitigate the impact a disaster has on global communications, energy supplies and maritime traffic.



Fleet Survey Team Survey Technician AG2 Jesse Osborne operates an Iver3 unmanned system via radio frequency remote during compass calibration mission in the Gulf of Mexico in preparation for bathymetric data collection in support of Naval Oceanography Unmanned Systems Operational Demonstration Humanitarian Assistance/Disaster Relief support scenario. Photo credit: Naval Meteorology and Oceanography Command | Kaley Turfitt.

Navies are increasingly interested in this capability, both for disaster response and safeguarding undersea infrastructure against sabotage and natural degradation. As the technology develops, AUVs on routine patrol may be able to use their "judgment" to perform necessary repairs before anyone even notices an issue.

The effects of maritime disasters linger long after headlines fade. Oil spills, chemical runoff and sediment displacement can devastate marine ecosystems. AI-enabled autonomous systems provide sustained monitoring as the initial disaster response efforts transition to recovery phases.

Autonomous gliders can patrol affected regions for months, measuring water quality parameters and

pollutant concentrations. Machine learning algorithms can detect deviations from desired environmental baselines and identify any emerging concerns.

AI and autonomous systems can also improve the effectiveness of disaster recovery strategies by reducing costs and eliminating the need for responders to maintain a significant long-term physical presence.

Challenges and Constraints

Autonomous systems and AI can offer significant benefits for disaster response teams, but they have their weaknesses and shortfalls:

Data connectivity. Severe weather can degrade the communication between autonomous vehicles, hindering their ability to transmit data.

Mission Ready Innovations

Brutus UAS
Rugged Dominance

Arowana UUV
Modular, Reusable

NSI
THE SOLUTIONS COMPANY

Contact:
Binnie VanDeVoort
Chief Growth Officer
240.937.1642
bvandevoort@n-s-i.us

Built for Extremes – Engineered to Perform

Vulnerability. Like any connected system, autonomous platforms are vulnerable to cyber threats and infiltration. Ensuring the integrity and confidentiality of our data must be a top priority.

Regulation. Maritime law and international regulations are years behind technological advances, and change happens very slowly. There are no comprehensive international agreements regarding the deployment, management or use of autonomous vehicles.

Further, incorporating these new technologies into current military operations will require significant additional testing and training.

Enabling the Mission

AI-enabled disaster response systems help advance the core missions of the U.S. naval services, enabling forces to safeguard maritime commerce, protect lives and ensure stability in the wake of disasters.

Soon, autonomous marine platforms may connect with space-based sensors, terrestrial emergency systems and predictive climate models. Advanced AI may be widely used to anticipate and respond to disasters, recommending infrastructure upgrades or optimized evacuation routes before storms even form. Advances to autonomous systems may enable them to make more sophisticated decisions independently when communications are disrupted (or as a matter of course).

Currently, AI expands the reach and effectiveness of maritime disaster response efforts. By venturing where people cannot, processing data at superhuman speeds and operating tirelessly in dangerous conditions, autonomous systems help humans overcome our limitations. But someday, completely autonomous marine disaster response may become as routine as satellite weather forecasting is today. ■

Jamie L. Pfeiffer practiced in Illinois, Oregon and Washington states before retiring from active law practice. She is currently based in Chicago.

THE PLATFORM MATTERS™

We position governments and militaries in 40+ countries
for success with reliable, customized platforms.

Build on half a century of proven special missions expertise.



Aircraft concept rendering for illustrative purposes only



Request your private
consultation


Gulfstream™

Autonomous Weapons in Maritime Theater

Securing the Next Level of Naval Superiority

BY NOLAN BOWLUS



Naval warfare is changing rapidly and autonomous weapons are becoming a vital tool in the maritime theater, as threats such as drone boats rewrite the rules of engagement.

Drone boats have already proven to be a disruptive technology in the Black Sea and Ukraine and are growing in importance in the Indo-Pacific, with the Philippines adopting a “porcupine defense” strategy that explicitly involves autonomous systems.

In turn, autonomy is becoming an ever-more important capability to defend against the threat of uncrewed surface vehicles, underwater vehicles and aerial vehicles. In April 2024, the U.S. Navy reported spending more than \$1 billion shooting down missiles and UAVs in the Red Sea alone. Autonomous defense systems offer a way to cut down this expense.

A 2020 U.S. Navy strategic guidance report, “A Design for Maintaining Maritime Superiority,” concluded, “Our competitive advantage has shrunk and in some areas, is gone altogether. We do not have the margins we once enjoyed.” Among the measures suggested in the report were increased use of autonomous systems. Five years on from that moment, navies around the world are now investigating the feasibility of both USVs and UUVs due to their capabilities and relatively low cost.

This shift is also driven by the reality that traditional naval acquisition cycles cannot keep pace with the speed of technology. U.S. Navy leaders are increasingly looking to USVs to scale capability faster and more affordably than building additional destroyers, cruisers or aircraft carriers, with senior officials hoping for as much as half of the surface fleet to be uncrewed by 2045.

In a recent study, “Technological Transformation and Future Perspectives in Autonomous Maritime Systems,” published in the *Journal of Naval*

Shane Connor, an unmanned systems vessel operator, launches a Lightfish USV during a maritime domain awareness demonstration with the Spanish Navy onboard Naval Station Rota Jan. 26, 2026. Photo credit: U.S. Navy | Mass Communication Specialist 2nd Class Deven Fernandez.

Architecture and Marine technology, the researchers drew parallels between the impact of autonomy and robotics on maritime warfare to the impact of the industrial revolution, with the development of gunpowder-based weaponry, long-range ocean-going ships and armored warships reshaping naval warfare and global power in the 19th and early 20th centuries.

As we leave the first quarter of the 21st century, it’s becoming clear that robotics, autonomy and artificial intelligence will reshape not just the rules of naval engagement but potentially the balance of power.

“Militarily powerful states are increasingly relying on the capabilities provided by unmanned systems while reducing the number and costs of manned systems,” the researchers wrote.

Autonomous weaponry is also uniquely suited to naval settings. In naval warfare, many of the concerns over autonomy on land do not apply. A study published in *International Law Studies*, “Artificial Intelligence and Autonomous Systems in Warfighting at Sea,” concluded, “Ground warfare is often cluttered and fought at close range, whereas naval warfare is often more distributed and fought at distance.”

Emerging threats such as drone boats mean autonomous solutions are growing in importance. Navies are acknowledging a core strategy will be to meet autonomy with autonomy, using AI-enabled defensive systems.

AI-driven defensive systems can track, classify and intercept threats such as drone boats at speeds no human operator could match. Going forward, autonomous systems will be indispensable in everything from surveillance to reducing risk for human-crewed vessels.

The Role of Autonomy

Autonomy has many responsibilities to play in the naval theater, with USVs especially helping to extend the reach of fleets without exposing crews to unnecessary risk. Senior Navy leaders increasingly view uncrewed and “tailored” forces as a way to augment carrier strike groups, allowing navies to deploy smaller, mission-specific systems for tasks such as intelligence, surveillance and reconnaissance; maritime domain

awareness; choke point defense; and protection of sea lines of communication. These are the kinds of missions that simply do not require the presence of a full carrier strike group.

Overall, autonomy is a force multiplier which reduces risk to crews and cuts reaction time. Navies that fail to accelerate the integration of autonomous weapons will be at a disadvantage facing adversaries which exploit cheap, expendable and increasingly capable unmanned systems. But what about the assets in the fleets of navies today and how they can face up to the likes of USVs in the here and now?

Modular autonomy is the most critical approach in enhancing legacy systems to address today's challenges. By adopting modular, open-systems autonomy, navies instantly benefit from interoperability, upgradability and cost-efficiency through relying on

standardized, modular components. This modular approach aligns directly with the Navy's emerging "hedge" strategy, enabling tailored unmanned forces to be fielded and upgraded far faster than traditional shipbuilding programs. This means fielding cutting-edge capabilities faster as well as modernizing systems already in place, which are fundamental to maintaining maritime superiority.

Securing the next level of maritime superiority will require a continued acceleration of autonomy into naval platforms. By doing so, fleets can achieve the speed, responsiveness and resilience required to maintain superiority in the face of global threats evolving at a speed never seen before. ■

Nolan Bowlus is vice president of business development at Aim-Lock, which provides research, development and manufacturing of target detection, classification and identification systems.

WE UNDERSTAND YOUR NEEDS. WE'RE EQUIPPED TO MEET THEM. PUT US TO THE TEST.

Visit us at
SAS Show
Booth #1350



Put Us to the Test.™
RETLIF TESTING LABORATORIES
45+ YEARS OF TESTING EXCELLENCE



VISIT US

When your systems are Retlif-tested, they're tested by the best environmental and EMC engineering teams in the business.

Retlif.com • (631) 737-1500
New York • New Hampshire • Pennsylvania

45+ Years of Experience | 100% American Owned & Operated | Support NAVSEA & NAVAIR Programs
Full Range of Engineering and Testing Services | 3 Secure Facilities | Full EMC and Environmental Capabilities to National and International Standards | EMC and ESS Testing Fully Accredited to ISO-STD-17025

WISMANN

PROPERTY CONSULT A/S

The US Navy League in Copenhagen, Denmark



Former cadet Lars Wismann, could be your guide: e-mail: lw@wismann-as.dk
Sponsor through Wismann Property Consult A/S, www.wismann-as.dk

Special guided tours for Navy League members!

If in Copenhagen send us an e-mail!

**NATO alliance member since 1949, Denmark a strong allied
nation, gatekeeper to the Baltic Sea!**

F352 PEDER SKRAM, commissioned in 1966, as the first CODOG
combined, diesel or gas turbine propelled frigate in the world.

Visit the small diesel electric submarine **S323 SÆLEN**
participated in the operation Iraqi Freedom in 2003.
Climb **NYHOLMS** mast crane commissioned in 1749.

Museet Skibene på Holmen

Elefanten 2, 1439 København K

Denmark Phone: +45 32 57 13 16, Email: info@skibenepaaholmen.dk



An Oshen C-Star performs its final tests near shore before being deployed. Photo credit: Oshen.

Sails Away

NOAA Trials British Mini-Robots for Tracking Hurricanes

BY JIM MCCLURE

The fury and deafening sound of a hurricane can be overwhelming to travelers and researchers alike. The National Oceanographic and Atmospheric Administration, perhaps the least known of the sea services, fights a battle as real as any the uniformed services have faced across the oceans and seas — a battle to save lives in the face of the devastating power nature can pose to people and property.

NOAA, part of the Department of Commerce, does have one familiar component, the National Hurricane Weather Center. For decades the NOAA prediction

center based in Miami, Florida, has informed U.S. citizens and neighboring island nations about conditions that can lead to deadly hurricane systems.

Level Perspective

While weather satellites have been tracking storms since the 1960s, the detection and prediction of hurricanes has reached an important new standard on the sea itself, well below the altitudes of satellites and even NOAA's hurricane-hunting aircraft.

What started with a broad array of uncrewed surface vessels has become a growing fleet of mini sailing robots that don't just penetrate the eyes of powerful storms but float through them, generating nonstop data for up to 100 days, powered by wind, solar and electric sources.

NOAA, in conjunction with the University of Southern Mississippi, a university well known for its meteorological prowess and talented television forecasters, has begun testing a highly advanced mini successor

to the larger Saildrone USVs it has used thus far.

(NOAA's collaboration with Saildrone continues: The company announced in February it and partner Woolpert will acquire and process bathymetric survey data for NOAA's Ocean Exploration and Office of Coast Survey near the Mariana Islands. The effort will use a 20-meter Saildrone Surveyor USV to help close data gaps in the U.S. exclusive economic zone.)

C-Stars, (pronounced Sea Stars) are the four-foot-tall inventions of a British recreational sailor and aeronautical engineer, robust devices that can sail right through hurricanes and keep gathering and transmitting data. They can provide life-saving data now and important beneficial information for the future in learning how to better deal with the most terrifying storms of the sea and shore. They have remained operational even in 25-foot waves in the punishing North Sea.

Anahita Laverack is the president and cofounder of London-based Oshen, who came up with the idea of an advanced autonomous system in 2020 while she was afloat, attempting to outrun a poorly forecast storm for three straight days.

"The data from these C-stars could help improve forecasts and if you can predict the track and severity of the hurricane, you can reduce economic damage and potentially save lives, so it's a really big deal for us," she said.

NOAA's lead on the C-Stars project is Dr. Gregory Folz, an oceanographer with NOAA's Atlantic Oceanographic and Meteorological Laboratory in Miami.

His work has contributed to improved understanding of the impact of ocean temperature and salinity stratification on tropical cyclone intensification. He also works closely with NOAA's operational centers to transition research (such as collecting data with uncrewed systems) to operations to improve weather and climate forecasts and assessments.

Tiny and Talented

The C-Stars are the latest marvels of miniaturization that have come in the wake of NOAA's commitment to uncrewed surface vessels. USVs roam the ocean's surface like boats, collecting oceanographic and atmospheric data, but without a human aboard. Operators

Understanding weather conditions where the ocean surface meets the lower atmosphere is key to predicting hurricane intensity.

*— Gregory Folz, oceanographer,
NOAA's Atlantic Oceanographic
and Meteorological Laboratory*

at sea or on shore can remotely control the USVs or program them to conduct preplanned missions and make decisions with minimal real-time human input.

There is no single design for a USV. A USV may be purchased commercially "off the shelf" or custom built. It may resemble a motorboat, sailboat, spaceship, surfboard or even a large bathtub toy. Ultimately, its form and other characteristics will depend on its function. What does it need to do? Where does it need to go? How long will it take to get the job done? Answers to these questions and more will help determine its sensor payload and power, size and type of propulsion. Today, many USVs and the systems they carry are powered by wind, the sun, the waves, or other forms of renewable energy.

USVs are typically deployed from a ship or a pier, and some have their own deployment systems. They may operate with a ship, on their own or with other USVs. They may work in conjunction with autonomous underwater vehicles and remotely automated vehicles, collecting related data and providing their subsea counterparts with navigational support, instructions and the communications link that enables real-time communications, monitoring and data sharing. Some even serve as a mobile docking, data transfer, and recharge station for other uncrewed systems.

The C-Stars successfully gathered and transmitted live data from last year's major hurricane Gabrielle as it headed toward Europe.

"Understanding weather conditions where the

ocean surface meets the lower atmosphere is key to predicting hurricane intensity," Folz said in a NOAA statement. "If C-Stars prove reliable, they could become a critical piece of the observing system for hurricanes in the future."

In a world first late last year, an Oshen C-Star became the first USV to collect data in a Category 5 hurricane with wind gusts of more than 150 miles per hour. Folz said, "this opens up the possibility of more routine use of C-Stars for hurricane data collection in the future in support of hurricane research and forecasting."

Defense Attention

The worldwide defense community has already taken note of C-Stars in general and Laverack's Oshen enterprise in particular. Janes' Defence analysts in the United Kingdom have noted, "in its defense work

the C-Stars use passive acoustic sensors for anti-submarine warfare and electro-optic/infrared sensors for visual surveillance above the waterline."

Laverack told Jane's that threats to Euro-Atlantic maritime areas from actors including Russia have increased since 2023, and Oshen's production rates could come in useful.

"It takes a lot of time to build ships, even medium-sized ships. It takes around five years, even if you try really hard to build these ships, whereas this stuff [C-Stars], it's more like a DJI drone," Laverack said. "Think of it as like, we want to 'McDonald'size' the process. A 19-year-old can walk in and within 30 minutes they're making the subsystems and bashing them out." ■

Jim McClure is a Life Member of the Navy League of the United States and a frequent contributor to Seapower.

JOIN US AS WE UNVEIL

VERTREP INNOVATION

MISSION EXECUTION ACCELERATION

ENHANCED OPERATIONAL SAFETY MEASURES

IMPROVEMENTS IN RESOURCES AND EFFICIENCY

SeaAirSpace
2026

COME VISIT US
APRIL 19-22, 2026
BOOTH #P01

amai
AEROSPACE MACHINING & ASSEMBLY, INC.
AMAI SOLUTIONS.COM

Ready today. Prepared for tomorrow.

Leveraging global collaboration to deliver cutting-edge training solutions.



Learn more about our innovative training
at Navy League Sea Air Space 2026
CAE booth **#249**

CAE

The Little Missile That Can



...And Then Some

Mission Sets, Capabilities for APKWS II Expanding

BY RICHARD R. BURGESS, SENIOR EDITOR



An artist's rendering of an AGR-20 Advanced Precision Kill Weapon System II being fired from a U.S. Air Force F-15E Strike Eagle. The F-15E is shown armed with six seven-shot launchers. Photo credit: BAE Systems.

Production of a small, laser-guided, smart rocket guidance kit recently topped 100,000 units, while the U.S. military orders more of them and expands the mission sets the system can be used for. The Advanced Precision Kill Weapon System II (APKWS II), a guidance kit designed and built by BAE Systems, is fitted to a Hydra 70 2.75-inch-diameter rocket to convert a dumb rocket often fired in multi-shot volleys into a low-cost precision missile weapon system that can home on a target by a laser designation.

On Feb. 24, 2026, BAE Systems announced in a release its delivery of the 100,000th production APKWS II laser-guidance kit. In the previous December, the U.S. Navy — the government's program manager for the system — awarded to BAE Systems a five-year, indefinite delivery, indefinite quantity contract for the APKWS, with an initial order of \$322 million for thousands of kits, with options for a maximum value of \$1.7 billion.

The AGR-20 APKWS II, known inside BAE as the APK, transformed the unguided Hydra 70 with a simple modification into a part of the precision revolution.

During the late 1940s, a small rocket — the four-foot-long, 2.75-inch-diameter Mark 4 Mighty Mouse folding-fin aerial rocket (FFAR) with an explosive warhead — was developed and introduced as an aerial intercept rocket, designed to be fired from an interceptor at formations of bombers. The folding fins that flipped forward on launch enabled the rocket to be fired from a tube launcher. However, accuracy of the Mighty Mouse was low, hence a recommended tactic was to fire multiple rockets in volleys at a target.

The Mark 4 was eventually abandoned as an air-to-air weapon but proved useful as an air-ground weapon beginning in the Korean War. An improved FFAR, the Mark 40, was introduced, with several options for special purpose warheads. The Mark 40 is most famously associated with the UH-1 and AH-1 helicopter gunships during the Vietnam War, which fired the rockets singly or in multi-shot volleys



A U.S. Army Soldier assigned to the 12th Combat Aviation Brigade loads an Advanced Precision Kill Weapon System training round for a live-fire exercise, Sept. 23, 2021. The reloadable pod can house 19 rockets. Photo credit: U.S. Army | Pfc. Jesus Menchaca.

from reloadable pods mounted on the helicopters, each typically housing seven or 19 rockets.

The Mark 40 was further developed into the Hydra 70, which entered service in the 1970s and featured the more powerful Mark 66 motor. It is equipped with curved fins that fold along the tube of the rocket. (The Hydra 70 rocket program is managed by the U.S. Army.)

While the Hydra 70 was a low-cost weapon, the need arose for precision guidance, both to increase the accuracy of a single rocket and to reduce the collateral damage in combat. The size of the Hydra 70 posed a challenge of fitting a laser sensor on the rocket, on which the warhead was nose mounted. BAE's solution was the DASALs (Distributed Aperture Semi-Active Laser Seeker.) A new section for the Hydra 70 was designed to feature four folding fins on the guidance section, each with a tiny laser sensor at the edge of the fin. Each sensor, as it received the light from a laser designator illuminating a target, would send data to the guidance section, which would calculate the different angles and move the fins to guide the rocket into the target. The guidance section is installed behind the 10-pound warhead and ahead of the rocket motor. It is shipped to the customer as a kit and is easily installed by the customer in the field with minimum training.

The Marine Corps was an early customer for the APK, with the missile achieving initial operational capability in 2012 on the service's UH-1Y and AH-

1W helicopters. Today the APK is a standard weapon on the modern UH-1Y and AH-1Z helicopters. The rocket also now is in use with the Army on its AH-64 Apache and AH-6 helicopters and since 2014 on the Navy's MH-60R/S helicopters.

Versatile Weapon

If the APK were limited to just the above-named helicopter types, it would be considered a highly successful weapon. But the missile has been proven more versatile than originally conceived and is being adapted to new uses to meet evolving threats. While helicopters are the main users of the APK, the missile has been arming fixed-wing aircraft, uncrewed aerial vehicles, ground launchers and maritime launchers as well.

"APKWS is qualified on over 25 platforms and can easily be integrated onto new ground and air platforms, including uncrewed air and surface vehicles," BAE Systems Spokesman Eric Peterson told *Seapower*.

"We're always looking how to improve it," said Matt Chrobak, BAE System's technical director for Precision Strike Guidance and Sensing Solutions, told *Seapower*, noting the addition of a proximity fuze and development of a new rocket motor though working with industry partners.

Chrobak said adapting the APK to fixed-wing aircraft was an effort initiated in 2014 or 2015 to improve close air support weaponry, hence the choice to integrate the missile on the A-10, F-16 and AV-8B. U.S. fixed-wing platforms currently certified to fire the APK include the A-10, AV-8B, F/A-18C/D, F-16C and F-15E.

"The APK is modular by design, so if you want to put a different warhead on it or a different motor, it's our job at BAE to make sure that the guidance is still compatible with it, and we take a lot of pride in that you can mix and match however you want," Chrobak said.

The most expansive mission of the APK has been its adaption to an air-to-air role, pioneered by the Air Force and made more urgent by the need for a low-cost, counter-UAS and counter-cruise missile weapon that could be carried in large numbers. Such a weapon would reduce the need to use expensive AIM-9 or AIM-120 air-to-air missiles, reserving these for high-value aerial targets and relieving the strain on missile

stocks. The idea of using APKs in an air-to-air role on the Air Force's F-16C fighter was germinating as early as 2019, according to The War Zone online news site, which also reported in 2024 the APK was used against Houthi rebel-launched drones in the Red Sea region.

An expansion of APK on a fixed-wing aircraft was the Air Force's August 2025 announcement of its "sprint-like effort to integrate and demonstrate APKWS laser-guided rockets on an F-15E Strike Eagle," Peterson said. "The integrated developmental and operational flight testing, including live fire at targets over land and water, was an expedited fielding push to get the capability to the warfighter immediately. The goal of adding this capability to the Strike Eagle's arsenal was to bring it into the counter-unmanned aerial system fight in a cost-effective way alongside the F-16."

To urgently field a low-cost weapon against swarms of UAS, the Air Force is investing \$145 million in developing a major upgrade to the APK, the AGR-20F variant: a dual-mode aerial seeker with long-wave infrared and laser sensors and a proximity fuze. The seeker will be designed to shift from laser designation to infrared tracking in flight, reducing the launch platform's crew workload and enabling more rapid engagement of multiple targets. The upgrade would put the infrared seeker at the tip of the missile's nose immediately ahead of the warhead.

The 2026 Marine Corps Aviation Plan said the air-to-air capability for the APK would be added to the Corps' F/A-18C/D Hornet fleet to enable the aircraft to counter UAS and some cruise missiles.

The APK has also been demonstrated with a UAS acting as a launch platform.

"In July 2025, BAE Systems announced it launched a precision munition from a multi-rotor uncrewed air system and successfully destroyed both air and ground targets during trials in the U.S.," Peterson said. "The launch of munitions upgraded with BAE Systems' APKWS laser-guidance kit from a TRV-150 [a modified version of the BAE Systems' Malloy T-150] marks a major step forward in the development of a low-cost strike and counter UAS option for frontline troops. The successful trials demonstrate the multi-role capability of the platform, showcasing the effectiveness of

APKWS is qualified on over 25 platforms and can easily be integrated onto new ground and air platforms, including uncrewed air and surface vehicles.

— Eric Peterson, spokesman, BAE Systems


advancements in drone technologies, including the first air-to-air engagement of APKWS from a UAS."

The APK has been adapted to ground platforms in the surface-to-air and surface-to-surface roles and has seen combat in these roles as well. In 2021 the missile was successfully demonstrated against a Class 2 UAS. In additional testing in November 2022, the APK was fired from a containerized launcher against a Class 2 UAS travelling at more than 100 miles per hour.

"The key to APKWS rockets' counter-UAS capability is the innovative proximity fuze jointly developed by L3Harris Technologies and Technology Service Corporation," BAE Systems said in a 2021 release. "The fuze combines target proximity detection and point detonation capabilities and is a drop-in replacement for existing M423 fuzes — allowing APKWS rockets to destroy UASs without the need for a direct hit."

In 2024, the Marine Corps began integrating the APK on its JLTV-mounted MADIS (Marine Air Defense Integrated System). Anduril was awarded a contract to integrate counter-UAS capabilities with Invariant to provide a launcher to accommodate the APKWS II.

"With over a decade of proven performance, reliability, and accuracy, APKWS guidance kits have supported precision-strike missions worldwide," Neeta Jayaraman, director of Precision Guidance and Sensing Solutions at BAE Systems, said in a release. "This milestone demonstrates our ability to deliver innovative technology rapidly and at scale. With our new production contract, we're poised to support evolving mission needs for years to come." ■



Seahawk, a Medium Unmanned Surface Vessel prototype, departs Naval Base Point Loma, California, Aug. 6, 2025. Photo Credit: U.S. Navy | Mass Communication Specialist 1st Class Robert Zahn.

Navy Plans Drive USV Development, Even as Questions Linger

BY ERIKA FITZPATRICK

The U.S. Navy sees uncrewed surface vessels, or USVs, as a critical component of its future force.

The Navy's 2025 shipbuilding plan calls for spending \$40 billion per year to create a 381-ship battle force by 2054, about 85 more ships than it has now, and about 130 uncrewed surface and undersea vessels. This combined fleet would result in a "more lethal and distributed naval force," the Navy has said.

To better understand the Navy's plans, it's important to distinguish between types of USVs, said Aaron Marchant, an active-duty submarine officer in the U.S. Navy who is executive fellow at the Center for Strategic and Budgetary Assessments, a Washington, D.C.-based think tank.

In a Jan. 21 article for "War on the Rocks," and in a subsequent interview with *Seapower*, Marchant said USVs fall into two main categories:

Ship-like unmanned surface platforms equipped with weapons or sensors that serve with crewed vessels as low-end fleet combatants.

Munitions-like surface platforms similar to Ukraine's Magura series attack drones that launch from forward-operating bases or manned ships.

The first type of USV is a larger, more expensive vessel maintained as part of the fleet. The latter is a smaller, less expensive vessel meant to blow up.

The Navy has for years favored expanding the first type — especially medium USVs (MUSVs), according to a Jan. 16, 2026, Congressional Research Service (CRS) report.

But recent developments have blurred the Navy's USV acquisition plans.

In a July 2025 request for industry input on the Modular Attack Surface Craft (MASC) program, the Navy sought information on USV design and production capabilities. The Navy emphasized innovation and speed without specifying requirements.

It's a bit of a muddle, at least to the research arm of Congress.

"Certain elements of the MASC program, including the

total number of MASCs that the Navy might want to procure, annual procurement quantities, and the number of firms to be involved in building MASCs, have not yet been announced," according to the CRS report.

By the numbers

The DARPA No Manning Required Ship [NOMARS] USX-1 *Defiant* is an unmanned surface vessel designed to operate for up to one year at sea without human intervention.

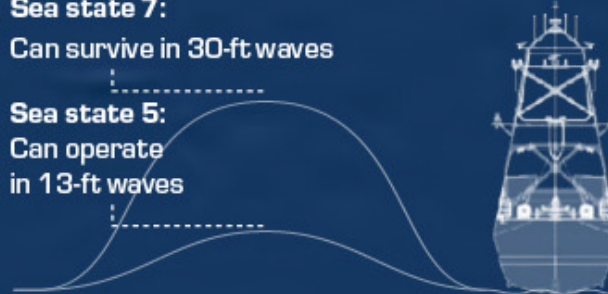
Length: 55 m (180 ft)
Height: 12.8 m (42 ft)
Top speed: 20 knots (23 mph)



Payload: 60 metric tons (132,000 lbs)
Displacement: 240 metric tons (529,000 lbs)

Sea state 7:
 Can survive in 30-ft waves

Sea state 5:
 Can operate in 13-ft waves



Marchant agreed the Navy must fill in more of the blanks.

This is important not only for how USVs are built but how they're used across the DOTMLPF, Marchant said, referring to doctrine, organization, training, material, leadership and education, personnel and facilities.

Navy officers in particular need guidance on using systems in compliance with Department of Defense

Directive 3000.09 on “Autonomy in Weapon Systems,” which aims to prevent mistakes that could lead to or worsen conflicts.

Whether for ship-like USVs or munitions-like USVs, “we don’t have those details figured out quite yet,” Marchant said. “I think we need both, but making that distinction could help us all understand better what the strategy’s going to be.” (Marchant’s opinions do not reflect the views or policies of the U.S. government, Pentagon or Navy.)

Ships and Speedboats

As Navy plans evolve in and out of public view, government and industry are testing both types of USVs.

In the “ship-like” category is the USX-1 Defiant, a medium USV designed by the Defense Advanced Research Projects Agency (DARPA). The vessel is being tested in partnership with the Navy under the No Manning Required Ship (NOMARS) demonstration program.

Defiant is built to operate for long periods of time without human intervention. The 180-foot-long, 240-metric-ton ship is about the size of a yacht operated by a 15-person crew. It can persist in rough seas — waves as high as 13 feet.

In the smaller USV category is Saronic Technologies’ Corsair, a 24-foot autonomous surface vessel that can carry a 1,000 payload over 1,000 nautical miles at speeds of 35 knots.

This is akin to the less complex, more expendable type of vessel Marchant described as functioning more like a munition.

The Navy is investing in these USVs too. Late last year, Austin-based Saronic received a \$392 million Navy contract for Corsair production.

“The Navy isn’t admiring problems from the sidelines, we’re moving at war-footing speed,” Secretary of the Navy John Phelan said on social media in announcing the deal. “With Saronic, we went from prototype to



Autonomous USV company Saronic demonstrated its Corsair vehicle in National Harbor in 2025 during Sea-Air-Space. Photo credit: Brett Davis.

production in under a year. That’s rapid innovation, real competition, and combat power in Sailors’ and Marines’ hands, not on PowerPoints.”

According to Mark Rice, program manager with DARPA’s Tactical Technology Office, naval autonomy has matured, although a range of challenges persist, especially for medium USVs like the Defiant.

In addressing these obstacles on that prototype, DARPA drew on its pioneering work in the field of naval autonomy, including on its Sea Hunter USV prototype, which it christened and transferred to the Office of Naval Research in 2018.

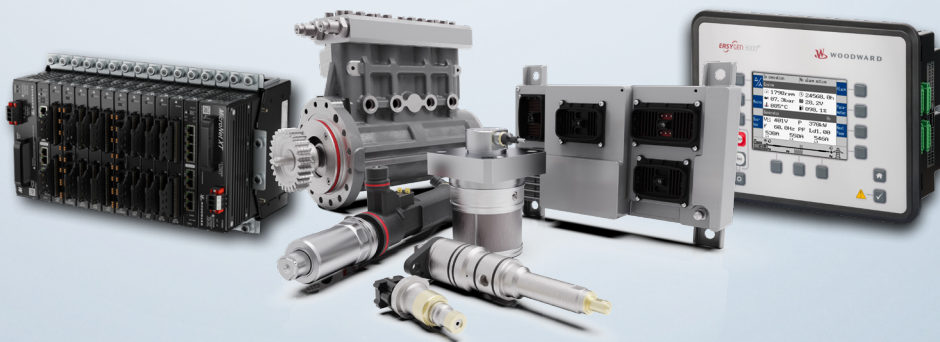
Developers of these types of autonomous vessels, Rice said, have to consider the three main roles in operating a traditional battleship:

The ship captain, who controls navigation, the chief engineer, who sustains ship operations over long periods at sea, and the surface warfare officer in the combat information center, responsible for ship weapons.

In navigation, this includes how to fuse sensors that feed data into the navigation systems that help the USV maneuver at sea; for instance, around a barge tow line or in heavy fog.

“All these complications creep into the navigation

Turbine, Power Management & Engine Control Solutions for Military Marine Applications



With Saronic, we went from prototype to production in under a year. That's rapid innovation, real competition, and combat power in Sailors' and Marines' hands, not on PowerPoints.

- John Phelan, Secretary of the Navy

autonomy but they're reasonably well addressed in the current software that's out there," Rice said.

Another challenge is how to maintain the USV's complex engineering systems — cooling, hydraulics, propulsion, steering, and the like — and conduct intricate processes, such as refueling.

"When you remove all the people from a ship, [it's difficult] to keep everything running," Rice said. "Although we can do it for periods of days and weeks, what we really desire to do is [operate USVs] for periods of months or up to a year."

DARPA demonstrated the Defiant could overcome several engineering challenges. These include undergoing five oil changes without human intervention, refueling at sea from an oiler, and repairing components like engines and valves using modular and redundant parts.

"And then when we get to port, we can take a very small crane and lift [a malfunctioning] module out of the ship and replace it" in hours versus weeks, he said.

Lengthening a medium USV's time at sea is still the biggest hurdle. Although Defiant has completed 2,300 nautical miles of unmanned operations, that's just eight or 10 days at sea. This falls short of the goal of 720 hours — 30 days — of continuous USV operations, which was set by Congress in the fiscal 2026 National Defense Authorization Act.

"We can do better," Rice conceded. To that end, engineers relaunched the Defiant in February for further testing along the West Coast. Rice said the aim is to get closer to achieving a "really hard" objective: many months or even a year of continuous operations at sea without human intervention. "That's unfinished business."

Industry Ramps Up

On the industry side, Saronic is among many players — with Blue Water Autonomy, HII, L3Harris, Swiftships, and others — ramping up for expanded USV production, driven by military and commercial imperatives.

Founded in 2022, Saronic is a dual-use commercial and defense company focused on autonomous surface vehicles, with operations in Austin, Louisiana, San Diego, the United Kingdom, and Australia.

Anticipating growth in U.S. shipbuilding, the firm has expanded its Austin footprint to 520,000 square feet, enabling production of over 2,000 Corsairs a year, the firm told *Seapower* in a statement.

And Saronic's late 2024 acquisition of a Franklin, Louisiana, shipyard positions the company for mass production of its prototype medium USV, the 150-foot-to-180-foot Marauder, which will undergo waterborne testing this spring. The firm is investing \$300 million to modernize the Louisiana shipyard, expand the hub's production space to 300,000 square feet and create 1,500 skilled jobs.

Doug Lambert, chief operating officer overseeing research and development, said investments like these can revive U.S. shipbuilding and attract and retain talent in the process.

"If you make shipyards and the maritime industry appealing," he said, "you'll have incredibly talented, skilled people flocking to those environments." ■

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.

BLUE RAVEN SOLUTIONS



TECH-ENABLED, SCALABLE SUPPLY CHAIN SOLUTIONS

Blue Raven Solutions provides tech-enabled, scaleable supply chain solutions throughout Sea, Air and Space platform lifecycles.



WE ARE YOUR FORCE MULTIPLIER

We dedicate the resources necessary to thoroughly understand your program at a level that allows us to become your force multiplier.



CERTIFIED & TRUSTED SUPPLIER

Our extensive Quality Assurance, Counterfeit Prevention, and Cybersecurity Initiatives meet stringent military and aerospace requirements.



FLEXIBLE CONTRACTING OPTIONS

Move your program forward quickly by leveraging our rapid acquisition contracting options tailored to your specific requirement.

OUR TRUSTED SUPPLY CHAIN SOLUTIONS

- Defense and Commercial Parts Supply
- Program Office Support
- Quality & Counterfeit Inspection Lab
- Market Intelligence & Data Analytics
- OEM Partnerships
- Kitting & Logistics



WE SUPPORT MULTI-DOMAIN OPERATIONS

📍 1500 Mt. Kemble Ave., Morristown, NJ 07960

📞 914-779-3500

✉️ info@blueravencorp.com

Building the Navy After Next

Which Fleet Is Best?

BY GEORGE GALDORISI

A small unmanned undersea vehicle assigned to Undersea Unmanned Vehicle Group One, Detachment Little Creek, approaches the Los Angeles-class fast-attack submarine USS Hampton in 2024. The mission combined manned and unmanned teams, integrating autonomous capabilities towards the future hybrid fleet. Photo credit: Commander, Submarine Force Atlantic.



The U.S. Navy is at an inflection point. Two curves are moving in the wrong direction: the U.S. Navy's growing worldwide commitments and the number of commissioned Navy ships (280 compared to China's 400). This has caused national and naval leaders to put forth various options for the Navy-After-Next.

To be clear, the U.S. Navy is more than ships. It is people, ships, submarines, aircraft, command and control architectures, satellites, naval bases and other assets. That said, the "unit of measure" for most navies is the number of ships it fields. Recently, many navies, especially the U.S. Navy, have revealed plans to build and deploy uncrewed surface vessels to put more hulls in the water.

For the United States the primary reason the U.S. Navy is leaning into using uncrewed surface vessels to work alongside its crewed ships is simply that ships are expensive to build and operate. The cost of Ford-class aircraft carrier is \$13 billion and an Arleigh Burke destroyer is \$2.2 billion. The new Columbia-class ballistic missile submarine approaches \$10 billion. However, those procurement costs only represent the tip of the iceberg. Populating those vessels with Sailors is also increasingly expensive, given that 70% of the total operating cost of a ship over its lifespan is providing a crew year-over-year.

Another way of looking at the importance of complementing the U.S. Navy's crewed ships with uncrewed surface vessels is the stark budget realities of the Navy attempting to achieve its desired shipbuilding plans, even in the out years. As the most recent

Congressional Budget Office shipbuilding report notes, “The Navy’s 2025 plan would cost 46 percent more annually in real terms than the average amount appropriated over the past five years. CBO estimates that total shipbuilding costs would average \$40 billion (in 2024 dollars) over the next 30 years, which is about 17 percent more than the Navy estimates.”

To revitalize the U.S. shipbuilding industry and concurrently reduce the cost of U.S. Navy ships, the United States has initiated recent laws, proposed legislation, regulations, and executive actions aimed at shaping and strengthening U.S. shipbuilding, both



Jeremy Salmon, Alexis Colon and Adam Smith, all from Naval Surface Warfare Center Carderock Division’s Additive and Subtractive Shop, stand with two of the Golden Fleet ship models they created at the Surface Navy Association National Symposium, Jan. 13, 2026. CREDIT: U.S. Navy | Capt. Christopher Matassa.

for defense procurement and commercial maritime/ industrial base revitalization. These include appointing a “shipbuilding czar” to lead the White House Office of Shipbuilding within the National Security Council, the bipartisan Congressional SHIPS for America Act, the Executive Order “Restoring America’s Maritime Dominance,” trade and regulatory actions, as well as other initiatives.

Industry would be well served to watch these developments carefully as companies work to review and balance their manufacturing capabilities, and ideally, be prepared to build a mix of crewed ships and uncrewed surface vessels needed by the U.S. Navy.

Fleet Options

As national and naval leaders examine options for the composition of the Navy-After-Next, there are four primary options for fleet structure that have gained purchase within the Navy:

The U.S. Navy’s current shipbuilding plan as reported by the Congressional Research Service. This includes 381 crewed ships and a substantial number of uncrewed surface vessels. CRS tracks the U.S. Navy’s evolving force structure with plans that aim for fleet growth to over 300 ships by 2032 and 381 by 2042. Key issues for Congress involve funding the plan, balancing new construction versus retirements and integrating large unmanned systems.

The second option that has gained traction is called the “hybrid fleet.” This concept was unveiled by then-Chief of Naval Operations Admiral Michael Gilday and endorsed by his successors. This envisions a Navy of 350 crewed ships and 150 uncrewed surface vessels. The idea of a hybrid fleet evolved due the U.S. Navy’s ongoing challenge of building enough crewed ships to adequately meet the Navy’s global commitments. Earlier this year, at the Armed Forces Communications and Electronics Association/U.S. Naval Institute “West” symposium, CNO Admiral Daryl Caudle noted USVs could be used to “up-gun” (provide more offensive firepower) to carrier strike groups.

The third option is called the “hedge fleet.” This envisions a forward-deployed force of crewed ships and robotic autonomous systems to be employed quickly in any crisis. “We need ‘tailored forces’ and a Navy that has other battle formations beyond carrier strike groups. Tailored offsets include capabilities such as attritable and easily replenishable unmanned surface vessels, unmanned undersea systems, mine warfare and cost-effective counter drone defense. The hedge fleet avoids a brittle single-purpose force that is either overbuilt for high-end fights and then underused day to day, or optimized for low-end crises and then gets overmatched when it counts,” Caudle said.

The final option is the U.S. Navy’s “Golden Fleet,” an initiative announced by President Trump in late 2025 to rapidly expand and modernize the fleet. The rationale for this plan is the stark reality that America’s

Navy is too small and its armory too thin for a modern Pacific war that seems inevitable with China — a danger explicitly stated in the recent National Security Strategy. Most observers have suggested small- and medium-sized USVs armed with long-range strike and missile defense systems will be the most strategically impactful assets of the Golden Fleet in the near term.

What ties these four options for the Navy-After-Next is the presence of a substantial number of uncrewed surface vessels working synergistically alongside crewed ships in multiple missions and battle formations. While none of the four options have been fully definitized, more details have begun to emerge through official U.S. Navy documents, presentations at military-industry symposia and online media.

Navy leadership is keen to develop and field capable uncrewed surface vessels. This is an achievable goal. Advances in technology that make USVs a reality and not just an aspiration means USVs will result in more hulls in the water in the near future.

At the AFCEA/USNI West symposium, Caudle signaled his expectation USVs will populate the fleet soon. He spoke about establishing a robotic autonomous systems commander to accelerate integrating uncrewed vessels into the rest of the fleet, noting, “This RAS commander, if you will, knows how to command and control these packages of unmanned capabilities to achieve the mission outcomes that the strike group commander may want.”

While it is expensive, and even risky, to tool up to produce new maritime vessels, it is impossible to miss the Navy’s commitment to field substantial numbers of large- and medium-sized uncrewed surface vessels.

An important consideration for industry is that over the past decade-plus the Navy and Marine Corps have conducted a substantial number of exercises, experiments, and demonstrations where industry has brought capable uncrewed surface vessel prototypes and put them in the hands of Sailors and Marines.

During the West symposium, the CNO noted how Navy and Marine Corps exercises, experiments and demonstrations such as the those conducted by 5th Fleet/CTF-59, 4th Fleet and a series of uncrewed surface vessel-focused events with NATO allies have



John C. Phelan, secretary of the Navy, left, speaks with Rear Adm. Christopher Alexander, special assistant to commander, Naval Surface Force, U.S. Pacific Fleet, center, about unmanned surface vessel capabilities during a tour, Feb. 12. Photo credit: U.S. Navy | Mass Communication Specialist 2nd Class Joshua Martinez.

accelerated the development of this craft. As just one of many examples of this testing that has gone on for years, MARTAC, a U.S. uncrewed surface vessel builder, has been invited to bring its Mantas T12 and Devil Ray T24 and T38 USVs to a wide range of Navy and Marine Corps at-sea events.

These events have included the Integrated Battle Problem series of exercises, the Integrated Maritime Exercise series held under the auspices of U.S. Naval Forces Central Command/Commander Task Force 59 in the Arabian Gulf, NATO exercises BALTOPS, REPMUS, and the follow-on Dynamic Messenger, Australian Defence Force Exercise Autonomous Warrior, and many others too numerous to list here.

As the maritime industry moves forward to produce capable uncrewed surface vessels to meet the Navy’s current and anticipated needs, companies would be well-served to participate in as many exercises, experiments, and demonstrations as possible. This will enable them to “wring out” their USVs to gain fleet feedback to produce uncrewed surface vessels that will meet the Navy’s needs and support the Navy’s worldwide missions and commitments. ■

Retired Navy Captain George Galdorisi is a career naval aviator and national security professional. He is the Emeritus Director of Strategic Assessments and Technical Futures at the Naval Information Warfare Center Pacific.



Cadet Roles in Unit Operations: Building Future Leaders One Cadet at a Time

BY CADET CHIEF WYATT WALTER AND PETTY OFFICERS SAAKSHI KUMAR, GRAHAM PHILLIPS, EMILY RICE AND SOPHIA SALAZAR

Short- and long-range planning may sound like skills primarily reserved for military personnel, but within the U.S. Naval Sea Cadet Corps these concepts structure the training of every cadet on their leadership journey.

The Sea Cadet training pipeline is intentionally designed to develop the critical thinking and planning skills today's maritime forces need, making sure that cadets not only gain technical skills but also understand the "why" of each evolution.

Understanding the "why" helps them solve problems and handle situations not fully covered by policy, using it as guidance while considering human factors.

Whether planning a military drill, seamanship training or logistics, every task prepares cadets for their professional journey. Sea Cadets in unit leadership positions lead their units' monthly drills. Much of what cadets do on a weekly basis centers on planning, discipline, and readiness. Cadets in

The Sea Cadet training pipeline is designed to develop critical thinking and planning skills. Photo credit: U.S. Naval Sea Cadet Corps.

leadership roles are the foundation of each unit, enforcing standards, leading junior cadets and modeling Sea Cadets' procedures and core values of honor, respect, commitment and service.

Cadets rising through Sea Cadet ranks fill billets ranging from squad leader and master-at-arms to leading petty officer and division chief. These leadership roles teach responsibility and accountability, which are not just buzzwords — they are habits that support the program's mission to develop leaders of character.

By arriving in proper uniform and

prepared on time, cadets practice the same standards expected in the fleet. When they set goals, write plans, and anticipate challenges during drill weekends, they begin to understand the long-term thinking required in real-world operational and professional environments, and they learn to safeguard the Sea Cadet legacy by thinking beyond their time in the program.



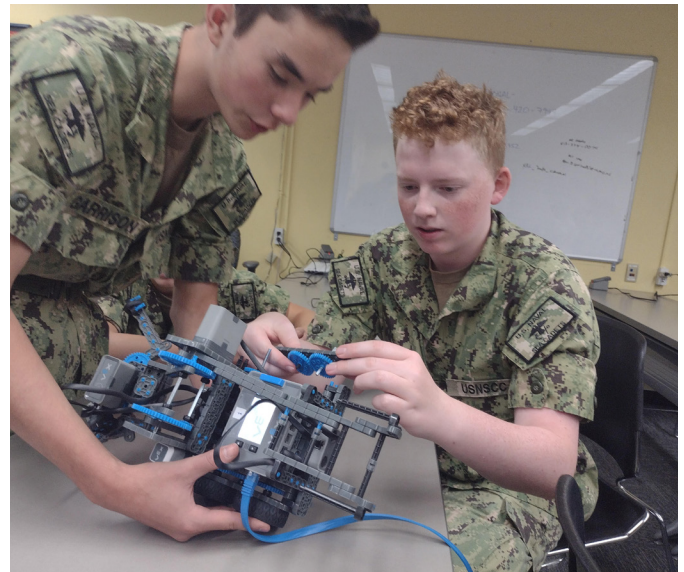
The mindsets cadets develop during the Sea Cadet experience prepare them for future success. Photo credit: U.S. Naval Sea Cadet Corps.

Cadet Chief Wyatt T Walter from Oak Harbor, Washington, said a key part of his role as a cadet chief is training his relief, just like service members do in the military.

“There are positions that keep the unit running, and that’s why it is important to train your replacement to do these jobs,” Walter said. “I’ve mentored five junior cadets and now they are all great leaders in their units.”

Smooth unit operations depend on communication, trust and each cadet fulfilling their role. Units often face unexpected shifts, weather changes, equipment malfunctions or last-minute schedule adjustments. These challenges strengthen cadets and teach them valuable lessons about the adaptability and resilience needed to succeed in the mission.

Cadet Chief Nora Farkas was put to the test when her unit’s outdoor drill location was double-booked and she had to find a substitute location on short notice. By meeting with her junior cadet staff and consulting with



Cadets learn to put fellow cadets first as they develop their leadership skills. Photo credit: U.S. Naval Sea Cadet Corps

adult leadership, they settled on moving the drill to an indoor location.

“We used the indoor location to our advantage and reworked the plan of the day to complete activities that could not have been done effectively at our outdoor location,” Farkas said.

As cadets develop their leadership skills, they quickly learn the importance of putting their fellow cadets first. Cadet Petty Officer Saakshi Kumar from Fulshear, Texas, sees her role as ensuring her cadets are “safe, prepared, and confident through every drill and every challenge.”

“Leadership is not about command, it’s about care,” Kumar said.

The Sea Cadet experience is more than a youth program, it’s a foundation for future service and leadership. Whether cadets pursue careers in the U.S. Navy, Coast Guard, maritime industries or private sector leadership roles, the mindsets they develop by planning ahead, supporting the team and understanding the mission prepares them for future success.

Decisions and actions taken by cadets may seem small to those with decades of leadership experience, but for those ages 10 to 17, they become the building blocks for tomorrow’s leaders. ■

Lieutenant Colonel Charles Springer

Civil Air Patrol/U.S. Air Force Auxiliary, Commander, U.S. Navy, Ret.



My journey into the naval service, and eventually serving the flying public and today's youth, began not so much with my swearing in as a Midshipman Fourth Class at the Norwich University Naval ROTC Unit, but in a movie theater as a pre-teenager.

With all the news of the

USS Nimitz (CVN 68) returning from its final deployment in December, I recalled being back in a Linden, New Jersey, movie theater in 1980 seeing the twin tails of a VF-84 Jolly Roger jump off the deck and onto the screen at the start of "The Final Countdown." What an unforgettable sight for a 10-year-old!

With a script partly science fiction and all Navy, the time-traveling Nimitz would later attempt to change history with the top gunning F-14 A Tomcats and CVW-9 air wing flying right into the face of destiny on Dec. 6, 1941, the day before the Day of Infamy.

In a way, that Christmastime movie debut gift has brought me full circle in 45 years to another airborne defender of the homeland that leapt into action that week in 1941, the Civil Air Patrol. CAP was founded on Dec. 1, 1941, with America short on planes and pilots qualified for military service.

As a naval aviator who retired at commander in 2015 and still flying as a commercial airline pilot, I continue to serve the country, my state and community in the Civil Air Patrol.

Civil Air Patrol is the longtime auxiliary of the U.S. Air Force and as such is a valued member of its Total Force structure. In its auxiliary role, CAP operates a fleet of 560 single-engine aircraft and 1,550 small unmanned aircraft systems. It performs about 90% of continental U.S. inland search and rescue missions as

tasked by the Air Force Rescue Coordination Center and is credited by the AFRCC with saving an average of 82 lives annually. CAP's 66,000 members also perform homeland security, disaster relief and drug interdiction missions at the request of federal, state and local agencies.

As Illinois Wing Director of Operations I oversee a statewide network of pilots, planes and squadrons that fly search and rescue missions, perform humanitarian assistance and train up a new generation of military and general aviation pilots. Every CAP cadet at or under the age of 19 can partake in "O" flights, orientation flights that put them in the cockpit and up the skies.

My path as a naval aviator first took me to the P-3C Orion anti-submarine community, and also its electronic warfare counterpart, the EP-3 Aries, that gained its own place in history as the first crisis of 2001 for the new George W. Bush Administration on April 1. No April Fool's Day joke when the Navy aviator and his crew made a miraculous landing on Hainan Island after a mid-air collision with an over aggressive Chinese interceptor that struck the signals intelligence aircraft. That left the crew detained until April 11 in the international incident.

Perhaps my own brush with history in a Navy where timings weren't always aligned with your career goals was being a shooter on the USS John F. Kennedy (CV 67) on a Med deployment in 1997 prior to Operation Desert Fox. I not only loved the job but the 10-year-old inside the heart of Lt. Charles "Weasel" Springer got to play RIO in a backseat Tomcat cat shot and trap.

After retiring from the Navy I became a commercial airline pilot, flying for a number of firms including the former Continental Airlines at a particularly turbulent time. Through thick and thin my military experience has served me well in giving me the patience to realize that timing can't always work to your advantage, but patience and persistence will.

Today my civilian career path in aviation has me on track and on time, flying state-of-the-art Boeing 737 models



The Future of All-Domain Operations

Blue Ops, the maritime division of Red Cat, delivers advanced unmanned surface vessels (USVs) manufactured in the United States to support flexible maritime operations with scalable, mission-adaptable platforms. Designed for high-speed, low-profile performance, Blue Ops USVs accommodate a wide range of payloads including sensors, communications systems, ISR capabilities, UAV integration, and electronic warfare technologies. Built on an open MOSA architecture with proprietary semi-autonomous command and control, these platforms enable interoperability and rapid technology integration to meet evolving operational requirements.

LEARN MORE :

BLUEOPS.COM



MADE IN THE USA

as a flight officer for American Airlines. My favorite route to date has been the Chicago-to-Bogota run to South America and back.

Five years ago, while logging the miles between continents, it turned out that my next career would come sitting in the chair of an air crew lounge in Denver. A previous occupant had left a copy of Volunteer magazine, the slick, high-end publication that CAP shares with all its adult and teen cadet members.

When I looked, I was hooked. An apt description for someone who had tailhooked and saw Navy values of honor, courage and

commitment also alive and well with a passion for serving others in Civil Air Patrol; which also bears the official title of United State Air Force Auxiliary.

CAP's stated core values are integrity, volunteer services, excellence and respect. We teach that in every squadron and activity in all 50 states, Guam and Puerto Rico.

Our three-part mission is "saving lives, serving communities and shaping futures." It's that last component that is most important to me. We do indeed save lives. We've been in the lifesaving business since the early days of

the Battle for the Atlantic chasing submarines, since mapping rescue routes in the wreckage of the World Trade Center, serving as the Air Force's primary domestic search and rescue resource.

And certainly aerospace advocacy and education is a large component of our mission.

But it's that shaping of futures that is vitally important no matter what organization you're in — Sea Cadets, Young Marines, Civil Air Patrol, scouting — it's your obligation to pass on what you've learned and prepare the next generation to lead. ■



future driven.
fleet proven.

Electro-optic-mechanical cable for demanding marine environments

 **South Bay Cable**
the uncommon connection

a proud U.S. manufacturer
since 1957

HIGH-STRENGTH TOW • ROV TETHERS • UMBILICALS • CUSTOM INTERCONNECT





STABILIZE THE MISSION SECURE THE OUTCOME

Your mission doesn't stop for rough seas, and neither should your team.

Seakeeper, a computer-controlled gyroscope, eliminates up to 95% of boat roll at rest and underway, ensuring a safe and steady platform for crew during critical operations such as surveillance, weapons deployment, or sensor stabilization. Seakeeper Ride, the only Vessel Attitude Control System, replaces traditional trim tabs and provides complete underway stabilization to eliminate pitch, roll, and yaw, providing comfort, control, and confidence to increase mission success, operational efficiency, and crew safety. When the stakes are high and the ocean unpredictable, rely on Seakeeper.

SEAKEEPER
RIDE

SEAKEEPER

seakeeper.com

NAVY LEAGUE OF THE UNITED STATES

FOUNDED 1902
2300 WILSON BLVD., SUITE 200
ARLINGTON, VA 22201-5424

NATIONAL PRESIDENT
Larry Salter

NATIONAL SENIOR VICE PRESIDENT
John Richardson

NATIONAL CORPORATE SECRETARY
Ward Cook

NATIONAL TREASURER
Mark McDonald

NATIONAL JUDGE ADVOCATE
Mark Harden

PAST NATIONAL PRESIDENT
Christopher Townsend

NATIONAL VICE PRESIDENTS
Douglas Fulton
Sara Fuentes
Eva Garcia
Mark Haller
Sinclair Harris
Mark Honecker
Heath Jones
Daniel McCort
Mitch Waldman

REGION PRESIDENT CHAIR
Charles McCleskey

SEAPOW (ISSN-0199-1337)

is published 10 times a year, with combined issues of February/March and July/August, by the Navy League of the United States, 2300 Wilson Blvd., Suite 200, Arlington, VA 22201-5424. Subscription rates \$58.00 per year; schools and libraries; single copy \$5.00; single copy Almanac issue \$22.50. Foreign rates \$145.00 air mail; single copy \$10.00 (includes air mail postage); single copy Almanac issue \$45.00. Annual \$55.00 individual membership in the Navy League includes one year's subscription to SEAPOW. Periodicals Postage Paid at Arlington, Virginia, and at additional mailing offices.

POSTMASTER:

Send address changes to:
Membership Department
2300 Wilson Blvd., Suite 200,
Arlington, VA 22201-5424.
SEAPOW (ISSN-0199-1337)

The Navy League of the United States is an independent, nonprofit, civilian educational organization. Statements contained herein have no official sanction or approval by the U.S. government. Classified by Library of Congress call number VA-49-N28. Copyright © 2026 Navy League of the United States. Reprinted by permission.

Matter printed herein does not necessarily represent the opinion of the publisher. Magazine assumes no responsibility for unsolicited material. SEAPOW invites letters to the editor, but cannot guarantee reply to same. Editors reserve the right to edit letters for style, accuracy and brevity. Letters must be signed to be considered for publication, but the writer's name may be withheld upon request.

STATEMENT OF POLICY

■ 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!

MEMBERSHIP REPORT

2026 February/March Top Recruiters

MEMBER	COUNCIL	MEMBER COUNT
Jane Ferreira	Honolulu	22

2026 February/March Top Recruiting Councils

COUNCIL	MEMBER COUNT
Honolulu	25
National Capital	20
Northern Virginia	16
Palm Springs	15
San Diego	12
Hampton Roads	12

VISIT OUR ADVERTISERS' WEBSITES

AMAI SOLUTIONS 54
amaisolutions.com

BELL 4
bellflight.com

BLUE RAVEN SOLUTIONS 65
blueravencorp.com

CAE USA..... 55
cae.com

CURTISS-WRIGHT 31
curtisswright.com

GENERAL ATOMICS 17
ga-asi.com

GENERAL DYNAMICS
ELECTRIC BOATINSIDE BACK COVER
gdeb.com

GULFSTREAM AEROSPACE 47
gulfstream.com

KEEL USA 23
keelusa.com

KRAKEN ROBOTICS 79
krakenrobotics.com

LEONARDO DRS 27
leonardodrs.com

MARINE HISTORICAL SOCIETY 51
wisemann-as.dk

NAVAL SYSTEMS INC. 46
n-s-i.us

NAVY FEDERAL CREDIT UNION 16
navyfederal.org

POLE STAR SPACE
APPLICATIONS USA..... INSIDE FRONT COVER
polestardefense.com

RED CAT HOLDINGS 73
blueops.com

RETLIF..... 50
retlif.com

SAIC 33
saic.com/undersea-dominance

SAILDRONE 10
saildrone.com

SEAKEEPER 75
seakeeper.com

SIERRA NEVADA COPORATION 40
sncorp.com

SOUTH AUSTRALIA / DEFENCE 77
defencesa.com

SOUTH BAY WIRE AND CABLE 74
southbaycable.com

TELEDYNE MARINE.....BACK COVER
teledynemarine.com

THALES DEFENSE 25
advancedacousticconcepts.com

WOLF ADVANCED TECHNOLOGY 18
wolf-at.com

WOODWARD 63
woodward.com



© BAE Systems

SOUTH AUSTRALIA THE DEFENCE STATE

South Australia is shaping its future through strategic collaboration, investment and innovation – anchored by its pivotal role in the AUKUS partnership as the home of the SSN-AUKUS submarine build.

South Australia boasts Australia's most skilled defence workforce, state-of-the-art infrastructure, and a collaborative industry and research ecosystem that consistently delivers world-class, sovereign capabilities.

With proven expertise across maritime, advanced systems, aerospace, land, research and development and space, South Australia is at the forefront of global defence innovation.

Defence SA, the state's lead Government agency for defence, drives growth and opportunity in major projects locally and internationally, reinforcing South Australia's reputation as a trusted and capable defence industry partner.

When it comes to defence, think South Australia – The Defence State.



Government of
South Australia

DEFENCE SA

VISIT [DEFENCESA.COM](https://www.defencesa.com)



CORPORATE MEMBERS

THE NAVY LEAGUE OF THE UNITED STATES THANKS ITS
CORPORATE MEMBERS FOR THEIR GENEROUS SUPPORT.

CORPORATE GOLD MEMBERS

AAR
Accenture Federal Services
Airbus U.S. Space & Defense
American Maritime Partnership
Applied Research Associates
BAE Systems
Blue Raven Solutions
Boeing
CACI
CAES
Collins Aerospace
Curtiss-Wright
Elbit Systems Of America
EY
Fluor
Frequentis
GE Aerospace
Gecko Robotics
General Atomics
General Dynamics
Govini
Hanwha
Hill
Honeywell
IAI North America
ITI Engineering
Keel Usa
L3Harris
Leidos
Leonardo DRS
Lockheed Martin
Marway Power Solutions
Michell Bearings
Navy Mutual
Northrop Grumman
QinetiQ
RTX
Saab
Shield AI

CORPORATE MEMBERS

AEVEX
American Rheinmetall Defense
American Roll-on Roll-off Carrier
Anduril
ARKA
Astrion
Austal USA
Bardex
Beehive Industries
Bell
Birdon
Blue Forge Alliance

Blue Water Autonomy
BlueHalo
Booz Allen Hamilton
Carahsoft
CAT Defense
Cincinnati Financial Corporation
Click Bond
The Cohen Group
Columbia Southern University
Consortium Management Group
Crowley
Cummins
Cypress International
Divergent Technologies
Dell
Deloitte Federal
EIZO Rugged Solutions
Epirus
Exail
Fairbanks Morse Defense
Fincantieri Marine Group
General Atomics
Aeronautical Systems
Glenair
Goodwin Steel Castings
Grainger
HamiltonJet Americas
Hutchinson Aerospace & Industry
IHG
IXI Technology
Jonathan Engineered Solutions
KATO Engineering
Kearney & Company
Kongsberg Defence and Aerospace
Kontron
KPMG
Kratos
ManTech International
Marvin Test Solutions
Massa Products Corporation
Mass Virtual
Matson Navigation
MBDA Missile Systems
Mercury Computer Systems
Microsoft
Nammo Defense Systems
NASCAR
Naval Surface Technology & Innovation Consortium
Navy Federal Credit Union
Nominal
Ocean Aero

Oceaneering Advanced Technologies
Orbit International Corporation
Orion Talent
Orr Partners
Panasonic Connect North America
Patriot3 Inc.
Precinmac
Rafael
RENK America Marine & Industry (formerly Cincinnati Gearing)
Rochester Cable
Rolls-Royce North America
Rolls Royce Solutions America
SAIC
Saildrone
Saronic
Schneider Electric
ScioTeq
Seacorp
Serrato Corp. dba Workforce Training Academy USA
Sierra Nevada Corporation
ST Engineering
SynQor
Systems Planning and Analysis
Textron Systems
Thales Defense and Security
Thinklogical
Toray Group
Transportation Institute
Trenton Systems
Trident Maritime Systems
Tristar
TTM Technologies
Tyonek
Ultra Maritime
United Titanium
USAA
V2X
Veterans United Home Loans
Vigor Marine Group
VTG Defense
Wärtsilä
Western Governors University
Woodward
Wolf Advanced Technology

BUSINESS ASSOCIATE MEMBERS

ADS
AeroVironment
AIS

Allegheny Technologies
ANSYS
Atlas North America
Axient
Bechtel Plant Machinery
BGI
CAE
Capella Space
Case Equity Partners
CMA CGM
Crystal Group
Daisy Data Displays
Dante Valve
Davie
Eagle Picher
Emcore
EWA
Fairlead Integrated Power and Controls
Field Aerospace
FLIR Systems
Granite State Manufacturing
GSE Dynamics
Harwin
Hensoldt North America
IMP Aerospace & Defense
IntelliSense Systems
Intercon
Interstate Connecting Components
MacArtney Underwater Technology
Marine Engineers' Beneficial Association
Marotta Controls
Meggitt Defense Systems
Metron
Moog
MSI-Defence Systems US
NAIAD Maritime Group
National Armaments Consortium
Navaya Maritime
NIC
Optics 1
Orbis
Parker Aerospace
Parry Labs
Pearlson Shiplift Corp.
Precise Systems
Q.E.D. Systems
Quest Software
RBC Logistics
RENK
Retlif Testing Laboratories
Riverside Research
RIX Industries
Sauer Compressors USA

Sensaras
Siemens Government Technologies
Sightline Media Group
Source Code
South Bay Wire and Cable Co. LLC
Stabbert Maritime
Staubli
Supreme Integrated Technology
Teledyne Brown Engineering
Trideum Corporation
True Blue Power
Zodiac of North America

SMALL BUSINESS MEMBERS

Advanced Technology Group
AJ's Power Source
Albers Aerospace
American Additive Manufacturing
Arete
ASV Global
ATSI
Bailey Specialty Cranes and Aerials
Bramer Group
Business Lens
Carley Corporation
Clark Testing
Consilium Marine
CP Technologies
Creative Solutions dba AMAI Solutions
Darley
David Clark Co.
Decision Lens
Diversified Technologies
Dry Tech
Elinor Coatings
Falkn Solutions
Forcys
General Digital
GET Engineering
Ghostworks Marine
Gradient Marine
GTC General Tool
Hatteland Display
Hepburn and Sons LLC
Incredible Supply
In-Depth Engineering Corporation
Kemlon Products & Development Group
Lexair
MacTaggart Scott USA
Marine Electric Systems
MARTEC Service USA
Metal Shark Boats
Milcots
NAG Marine
Naval Systems
Ocean Power Technologies
ORCA Technologies

Panacea Behavioral Health and Wellness
Phoenix International
Quantum Stabilizers
Qintel
RCT Systems
RGB Spectrum
Rugged Portable Computers
Schaefer Electronics
SeaTrac Systems
Seatronx LLC
Sedna Digital Solutions
Shock Tech
Skyways
Socitec US
Spear AI
STIDD
SubSeaSail
SynMax
Systecon North America
Terradepth
ThayerMahan
Thrustmaster of Texas
Titanium Fabrication
Tocar Blue
Transhield
Tri-Tec Manufacturing
Type 3 Solutions
Vestdavit
X-Bow Systems

NONPROFIT AND GOVERNMENT AGENCY MEMBERS

Applied Research Laboratory, Pennsylvania State University
ATI
British Naval Staff
CNA Corporation
Defence SA
Embassy of Canada
Embassy of the Kingdom of the Netherlands
Embassy of Japan
KDIA
National Defense Industrial Association
Nimitz Foundation
Noblis
Norwegian American Defense Industry Council
SBG Systems
Software Engineering Institute, Carnegie Mellon University
South University
SRC
Team Defence Australia
TECRO-Defense Mission
University of Virginia, Darden School Foundation
Virginia Economic Development Partnership

CENTER FOR MARITIME STRATEGY SPONSORS

RMS



KRAKEN
ROBOTICS

KATFISH



**Actively
Stabilized
Towed SAS
System for USVs**



[KRAKENROBOTICS.COM](https://krakenrobotics.com)

Kraken's KATFISH towed synthetic aperture sonar system is designed for mine countermeasure operations and critical undersea infrastructure inspections. The integrated lightweight payload delivery system is designed for 11 m+ USV platforms. Our 2 cm x 2 cm resolution enables rapid classification of subsea contacts, providing actionable intelligence in real-time.

**Visit Us at
Sea Air
Space
Booth
#T100**

COMING UP IN SEAPOW



MAY 2026

PERSONNEL, TRAINING AND READINESS

A new Navy initiative is targeting barracks and housing improvements.

The Navy is focusing on giving Sailors access to quality housing while ashore, as part of its Total Sailor – Fit to Fight program.

Guam is slated to gain new infrastructure improvements reflecting its importance in the Indo-Pacific theater.

A look at the U.S. Marine Corps' Aviation Plan.

The RIMPAC exercise returns for 2026 at a time when tensions with China continue to grow.

In 2025, the Navy had its biggest recruiting effort in years. Can it last?

Portable virtual reality headsets and gaming computers are helping the Navy keep up with training for its submarine force.

**Book early for prime
advertising space.**

Tim Waddill

Partnership Director

Association Revenue Partners

Toll-free: 855-790-0001 x 1017

Direct: 214-396-6780

twaddill@associationrevenuepartners.com

WHO READS SEAPOW?

Our 40,000+ readers include the most important decision-makers in the Navy, Marine Corps, Coast Guard, Maritime Administration, Pentagon, Congress, the executive branch and related industries.

Put your ads in front of the people with power — through SEAPOW!

SEAPOWMAGAZINE.ORG

Online advertising opportunities available.

Book by: March 16, 2026

Artwork due: March 23, 2026

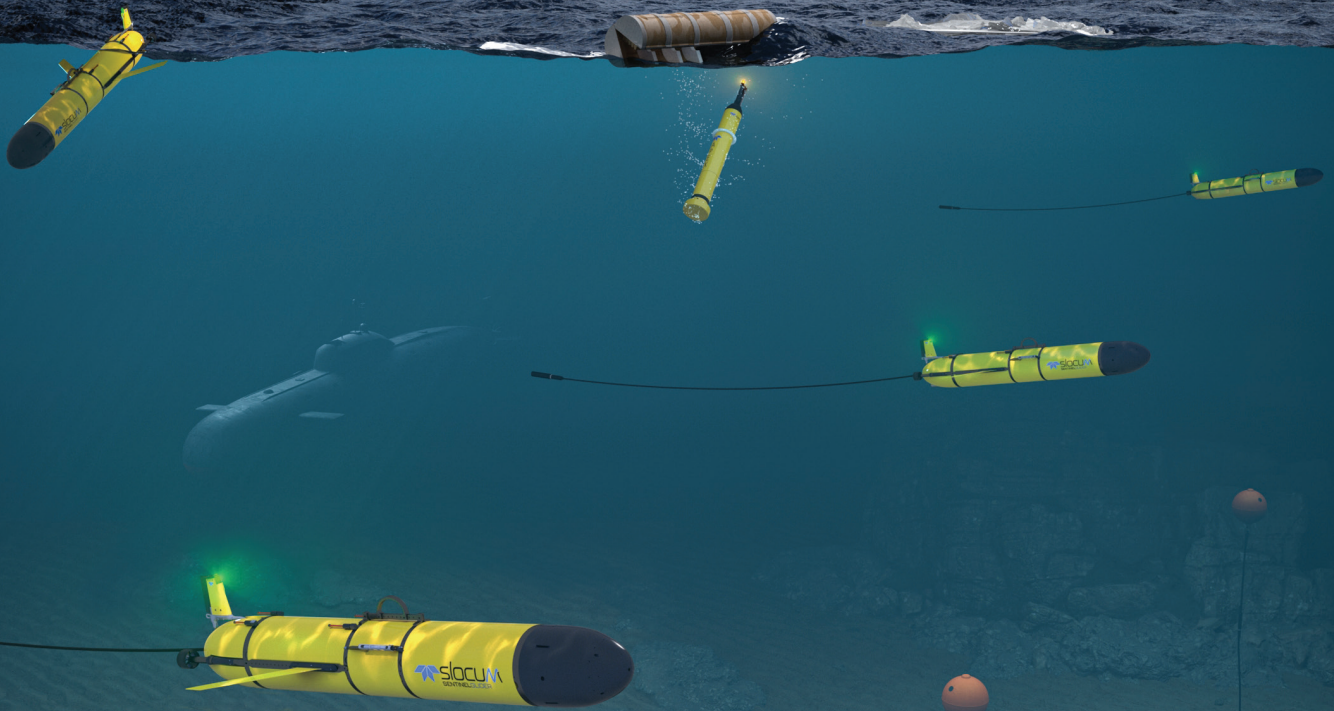
FEAR THE GHOST

IOWA (SSN 797) COMING SOON

GENERAL DYNAMICS
Electric Boat
www.gdeb.com

Free limited edition of this poster.
Email grose1@gdeb.com

Proven Performance with the US Navy and AUKUS



With 1,300 Slocum gliders delivered — including nearly 600 to the U.S. Navy — 12,000+ APEX profiling floats, and 18 naval users of Gavia UUVs across all AUKUS partners, Teledyne Marine delivers proven undersea unmanned systems, sensing, and autonomy that give the war fighter unmatched capability.



Scan QR Code
to Learn more.

 **TELEDYNE**
Marine
teledynemarine.com