SPECIAL COMPETITIVE STUDIES PROJECT

Defense Paper Series

Shipbuilding in the United States

Near-term challenges and long-term opportunities

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Executive Summary

The future of U.S. military power in the Indo-Pacific depends on the strength and resilience of the Navy's fleet. With China rapidly expanding the world's largest navy, the next National Defense Strategy (NDS) cannot afford to treat shipbuilding as a routine issue—it must be addressed as a central pillar of U.S. defense planning. But planning and appropriation dollars will not solve this alone. Congressional budget delays and Continuing Resolutions, disincentivizing skilled labor as a career, and offshoring manufacturing and assembly, U.S. shipyard production has contracted to a point of national liability. Coupled with severe shipyard labor deficits, the outlook is grim - at a time when geostrategic headwinds are at their strongest since the close of the Cold War. Transformative advances in advanced and additive manufacturing, automation, software, and AI-driven planning and design capabilities are already here - and can be just the vital lifeline our maritime industry needs to serve our economy and our national security interests.

Background and Context

For years, the Department of Defense and the U.S. Navy have recognized the need for a larger fleet and have pursued efforts to expand it. Force structure reviews going back more than a decade have consistently called for a larger Navy with recommendations for an end strength ranging between 313 to 383 ships. Although the Navy has modestly increased its warship numbers over the past decade, it continues to fall short of meeting overall demand and faces persistent challenges in sustaining the readiness of the fleet it already has.

In recognition of the need for a larger Navy and a greater ability to build and maintain ships, President Trump issued the Executive Order ***"Restoring America's Maritime Dominance"*** on April 9, 2025. The order directs a government-wide effort to counter Chinese dominance in shipbuilding by revitalizing U.S. shipbuilding and strengthening the maritime workforce. The EO assigned the Assistant to the President for National Security Affairs to develop a comprehensive Maritime Action Plan (MAP). It also established an Office of Maritime and Industrial Capacity to coordinate efforts to strengthen the U.S. maritime industrial base. The question is: what can they do now and what might they do to put the U.S. on a better path for the future?

Near-Term Focus

Our inability to increase the number of U.S. Navy combatants is tied to the contraction of shipbuilding capacity, a contraction that occurred years ago when the commercial shipbuilding industry collapsed in this country. There are many reasons behind that collapse; however, as a result, we now have very few shipyards capable of producing ships. The yards which remain are

[1] [https://www.usni.org/magazines/proceedings/2025/february/high-costs-doing-shipbuilding-business]
[2] https://www.usni.org/magazines/proceedings/2025/february/path-navy-force-structure-nation-needs
[3] https://www.jhuapl.edu/news/news-releases/231113-navy-3d-prints-critical-part-with-apl-installed-manufacturing-system

[4] https://3dprint.com/278319/naval-group-uses-waam-to-3d-print-first-propeller-installed-on-french-navy-ship/

tied to a single customer—the U.S. Navy. These yards operate under complex contract regulations and requirements that are very restrictive.[1] Sustaining a significant capacity for the production of ships requires years of effort with stable funding; however, the Navy budget for shipbuilding ebbs and flows. Combined with Congressional budgeting delays and continuing resolutions, the yards have struggled to maintain their capability and capacity in the face of substantial unpredictability from the sole customer they are completely dependent upon. As a result, we have too little capacity in our existing shipyards; the yards we have are in need of repair and modernization; and they are undermanned and face difficulty attracting a capable workforce.

To meet our needs, in the near-term, we must invest in our shipyards and the workforce necessary to run them. We need to find incentives for people to become welders and machinists. We must repair and upgrade the dry-docks. And we must give our shipyards predictable—and increased—funding levels so they can invest in a future where they can be certain they will have the funding levels necessary. We also need to find ways to re-incentivize our commercial shipbuilding industry. By increasing the capacity of our shipyards for commercial ship production, we will simultaneously create capacity and capability to produce and repair our naval combatants.

These are things we must do in the near term; however, they are not easy and they will be very expensive.[2] Furthermore, time is not on our side and we must make near-term investments if we are to increase our U.S. shipbuilding capacity.

A New Approach

While each of these near-term efforts are essential, the shipbuilding crisis, coupled with the President's Executive Order, creates an opportunity to embrace new technologies to build and repair ships differently. Significant advances have been made in advanced manufacturing technologies. The combination of advanced software, engineering, and the advanced manufacturing industry could enable entirely new approaches to shipbuilding and repair.

For example, in the area of ship repair, the integration of software and 3D printing now allows Navy vessels to produce critical parts on demand, enabling faster repairs and minimizing downtime at sea. On the USS Bataan (LHD 5), the Johns Hopkins University Applied Physics Laboratory assisted NAVSEA in installing a hybrid manufacturing system that combined computer-aided design (CAD) software with 3D printing. Using this system, sailors were able to fabricate a needed repair part that was unavailable in the supply system, restoring the ship's readiness without waiting for shore-based support.[3]

For ship production, there have been breakthroughs in metal printing that have allowed production of parts as large as full-scale ship propellers.[4] Advances in wire arc additive

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manufacturing (WAAM) technology are making production of propellers and other large ship components possible.

Photo Source: Naval Group.

Research is continuing to expand the capabilities of advanced manufacturing techniques. Commercial companies have begun adopting these technologies and bringing them to market. This combination of research, laboratory prototyping and testing, and commercialization provides a significant opportunity to re-design production and repair of ships in the U.S. By adopting these new technologies, the U.S. can build a modern manufacturing ecosystem for shipbuilding and ship repair which prioritizes flexibility, speed, and rapid optimization of production resources for both peacetime and conflict.

JHU/APL has been developing a concept called Maritime Industrial Agility that would pull these technology advances together and push the U.S. shipbuilding capability and capacity forward. The Maritime Industrial Agility concept focuses on developing a federated network of manufacturers, manufacturing institutes, and researchers to rapidly distribute maritime production, produce parts closer to the point of need, and smoothly pivot based on shifting priorities. A distributed network would engage traditional and non-traditional suppliers, and allow expertise and designs to be quickly distributed across the nation. By pairing this network with digitally-driven design, engineering, and validation approaches, the U.S. has the opportunity to significantly reduce production time, increase yield, and reduce cost. It would also require—and attract—a different kind of workforce. This workforce would need software and advanced engineering skills that could be more appealing to the younger workforce.

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Critically, the majority of software, engineering, and industry 3.0/4.0 practices necessary for Maritime Industrial Agility already exist. With a focused initiative, this concept could be deployed rapidly; however, it would require a dedicated effort that embraces these new methods through direct investments and new policies, including new approaches to certification.

Implementation

One approach would be to establish a government-funded federal, state, and private industry Maritime Tech Hub. This Hub would act as a test site and innovation cell that would:

- Implement, test, and maintain a nationwide digital manufacturing environment to support federated manufacturing across a range of US commercial manufacturers, labs, government assets, and expeditionary manufacturing cells.
- Provide access to dedicated experts, mission expertise, and facilities to assist in maturation, rapid transition, and federation, of disruptive technologies and designs.
- Mature advanced manufacturing and repair methods which dramatically improve the capabilities, production/repair times and performance of DoD platforms.
    - Immediately build replacements for hard to source parts
    - Immediately prove out new advanced manufacturing and repair techniques for use in industry and government
    - Design new components and systems with advanced manufacturing techniques
    - Provide a facility to test technologies in-situ without affecting shipyard workflows
- Pioneer new approaches to quality assurance, design, and royalty-based manufacturing which allow the U.S. to rapidly create, integrate, and redesign DoD platforms at software speeds.

This is an approach that would push the U.S. shipbuilding industry in new directions that take advantage of increasingly mature technologies. By focusing not just on solving today's problems with the existing shipyards, but also on new approaches that leverage new technologies, the U.S. has the potential to create a unique national capability and would allow us to re-build our maritime industrial base and lead the global shipbuilding industry.

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