Additive Manufacturing and the Future of Sea Power

Standardization is on Deck, Driving Qualification, Certification Processes

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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