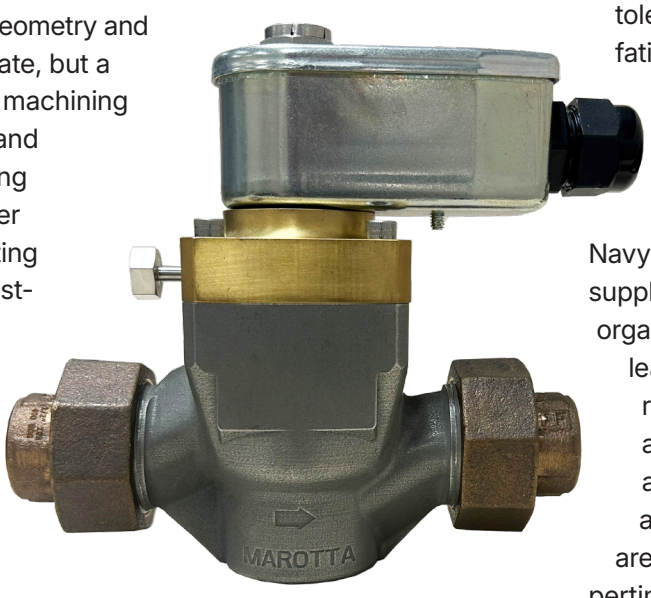
installed its first 3D-printed metal component on an operational asset, the cutter Forward. The project also marked the first metal additive part deemed "critical" by NAVSEA for any military surface ship. The part, a seal housing for the cutter's fin stabilization system, helps keep the vessel watertight 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.



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.

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. ■

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