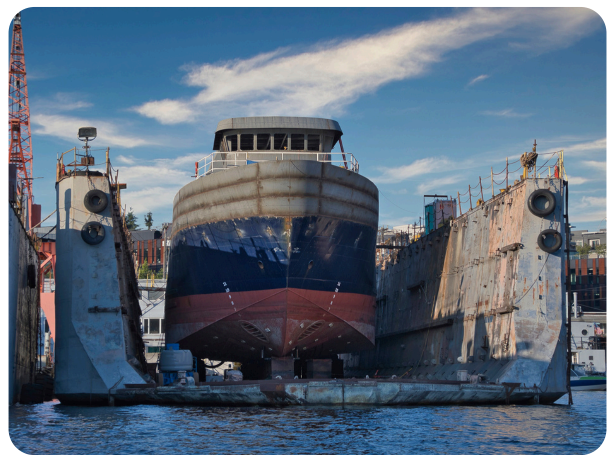
Shipbuilding in Washington and Oregon: Challenges and Opportunities



Pacific Northwest NATIONAL LABORATORY

MARITIME blue

Glosten

ABS

NOISE CONTROL ENGINEERING

December 2025

1 Authors and Acknowledgements

1.1 Authors

David Hume, PNNL
Ryan Calkins, PNNL
Cassidy Fisher, Maritime Blue
Sara Adams, Maritime Blue

1.2 Contributors

We would like to thank the contributions of the following organizations:

- American Bureau of Shipping
- Glosten
- Noise Control Engineering

1.3 Copyrights and Citation

David Hume, Ryan Calkins, Cassidy Fisher, and Sara Adams. Shipbuilding in Washington and Oregon: Challenges and Opportunities. Maritime Blue. 2025. www.maritimeblue.org/wa-or-shipbuilding-report/

Cover photos (top left to right): Dakota Creek Industries, Everett Ship Repair, Vigor Marine Group, Lake Union Dry Dock, All American Marine, Lake Union Dry Dock.

1.4 Acknowledgements

This report was prepared by Pacific Northwest National Laboratory (PNNL) and Washington Maritime Blue (WMB) in collaboration with the American Bureau of Shipping (ABS), Glosten, and Noise Control Engineering, LLC (NCE). The project report compiles findings captured through a workshop that supported a larger META Program research project and direct interviews that aimed to investigate and understand the challenges that U.S. shipyards, specifically Pacific Northwest yards, are encountering in meeting the demand for increased vessel production in an ever-changing fuel, energy, and technology landscape across the maritime sector.

This work would not have been possible without the participation and engagement of the numerous shipyards, design firms, and technology providers, and government agencies that are supporting the U.S. shipbuilding sector.

Table of Contents

2 Executive Summary

Shipyards build and repair the vessels upon which our global economy depends. Building and repairing vessels is growing more complex as vessels evolve and use newer powertrains, energy sources, and hull forms. While shipbuilding is critical to national security and economic interests, the sector has faced major challenges over the last several decades.

The April 9, 2025, Executive Order *Restoring America's Maritime Dominance* asserts that "It is the policy of the United States to revitalize and rebuild domestic maritime industries and workforce to promote national security and economic prosperity." To realize these goals, the current challenges limiting U.S. shipbuilding must be addressed. While some challenges facing shipyards are common across the country, others are intrinsic to the region due to its local fleet composition, supply chain, or labor pool.

An effort was undertaken in 2024 and 2025 by the American Bureau of Shipping (ABS), Glosten, Noise Control Engineering (NCE), and Maritime Blue to identify challenges and opportunities for U.S. shipbuilders implementing emerging technologies. Through interviews and a full-day workshop, fifty-five vessel owners, designers, builders, technology providers, and regulators discussed barriers and solutions to incorporating new technologies. Separately, during the summer of 2025, the Pacific Northwest National Laboratory (PNNL) sought to understand the unique challenges faced by shipyards in Washington and Oregon. PNNL conducted structured interviews with a dozen shipyards and repair facilities in the region.

These efforts were combined into a common report. The challenges gleaned from these outreach efforts across both regional and national shipbuilding have been distilled into five thematic areas: standardization; workforce; advanced manufacturing; finance; and energy.

Recommendations for addressing some of these challenges include: standardizing design, building processes, and charging standards; supporting serial production to establish supply chains and learning curves; collecting best practices in meeting requirements for vessels utilizing emerging technology, including for hybrid and all-electric vessels, and/or quiet vessels; documenting energy needs for vessel construction and repair; reviewing and expanding existing financing and incentive mechanisms for shipbuilders; collaborating on workforce development and training; and supporting advanced manufacturing and automated technology transfer from other sectors.

Thanks to the region's abundance of deepwater ports, co-location of commercial shipyards with major U.S. Naval facilities, and concentration of industry and technology innovation, the Pacific Northwest maritime sector already plays a strategic role in strengthening the United States' domestic shipbuilding and repair capacity. With durable federal and state support, shipyards and repair facilities in the Pacific Northwest are uniquely situated to meet critical military and commercial needs throughout the U.S. and region.

3 Maritime Sector and Shipbuilding Context

The maritime sector encompasses the domestic and international network of ships and ports that makes the global economy possible. It includes a broad group of stakeholders from vessel operators to fuel producers. In 2017, marine vessels and seaports handled 80 percent of all international trade by volume and more than 70 percent by value.[1] As of 2019 the U.S. maritime industry directly employs nearly 650,000 Americans across all 50 states and contributes $154 billion to the nation's economy annually.[2]

Vessels come in numerous designs, shapes, and configurations, but most can fall into one of three categories: ocean going vessels; commercial harbor craft; and recreational boats.[3] There are approximately 180 large ocean-going vessels registered in the U.S., nearly 40,000 commercial harbor craft like ferries, tugs, and fishing vessels, and over 12 million recreational boats.[4]

Designing and building most types of vessels requires substantial capital investment as well as strong technical and management expertise across several skillsets, from welding to computational fluid dynamics. The role of shipyards is to provide these skillsets to deliver ships that meet the functional and regulatory requirements of the customer.

Shipbuilding is a long-cycle business as ships can take several years to design, build, test, and deliver. Moreover, demand for vessels can have significant variability from one year to the next. Therefore, observing trends in shipbuilding often requires looking across multiple years or decades, not quarters, as shown in Figure 1.

---

[1] Hoffmann and Shamika, *Review of Maritime Transport. Edited by Deniz Barki and Lucy Deleze-Black*.

[2] "U.S. Maritime Workforce Grows to 650,000 Americans in Booming Jobs Economy."

[3] Josh Messner et al., An Action Plan for Maritime Energy and Emissions Innovation.

[4] United States Coast Guard, "Merchant Vessels of the United States."

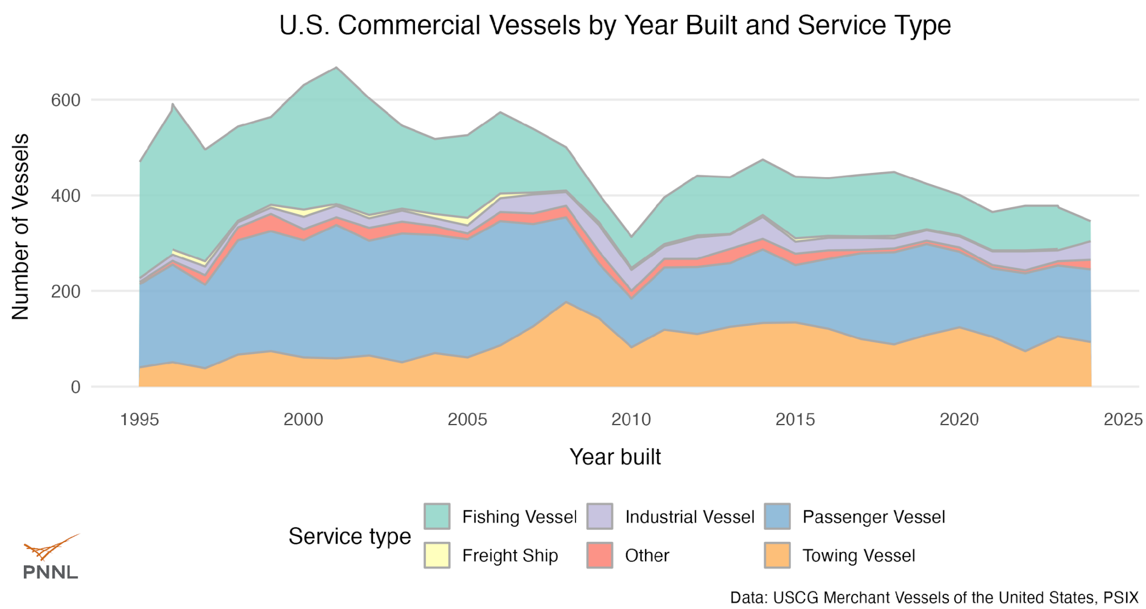


Figure 1: U.S. commercial vessel production from 1995 to 2021. Colors represent different vessel types

Vessels can carry thousands of passengers or hundreds of millions of dollars in cargo, which is just one of the reasons that it is heavily regulated in terms of design standards, safety equipment, and more. In recent years, regulations governing shipping air pollution have also become more common and are likely to become stricter over the coming decades.[5] Given that the operating life of a commercial vessel in the United States is usually 30 years or longer,[6] this raises important considerations for future-proofing designs for both vessel owners and shipyards alike. A growing number of vessel owners/operators are considering the use of alternative fuels and technologies. These include hybrid and all-electric propulsion; alternative fuels like biofuels, methanol, ammonia, or liquefied natural gas; and technologies that reduce noise while improving fuel economy.[7]

[5] Regulation (EU) 2023/1805 of the European Parliament on the Use of Renewable and Low-Carbon Fuels in Maritime Transport, vol. 2023/1805.
[6] United States Coast Guard, "Merchant Vessels of the United States."
[7] DNV, "Alternative Fuels Insight."

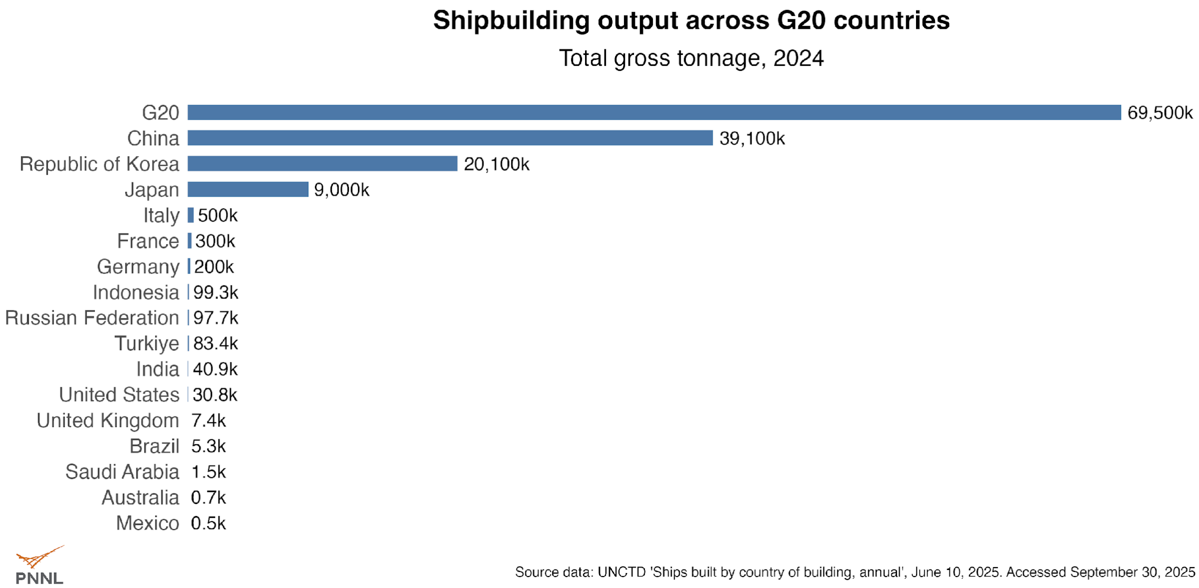


Figure 2: Gross tonnage of vessels built in the G20 economies in 2024[8]

U.S. industrial policy supports shipyards through federal grants managed by the Maritime Administration (MARAD) and protections provided by the Merchant Marine Act[9] (colloquially known as the Jones Act) and the Passenger Vessel Services Act, which prohibit the transport of cargo and passengers between U.S. ports on foreign built, owned, or crewed vessels. Collectively the goal is to ensure a fulsome U.S. commercial fleet. Despite these efforts to protect a vital sector, U.S. shipyard output has been gradually decreasing for several decades, as shown in Figure 1. Shipyards have been sold and consolidated from 30 down to 9 shipyards. Of those 9, only 6 are active and capable of building deep-draft ocean-going vessels of 400 feet or more.[10] The limited capacity to build and repair larger vessels significantly impacts the ability of the U.S. to rebuild and revitalize a robust ocean-going fleet to support defense needs, growing international trade, while keeping up with repair of the existing fleet.

On April 9, 2025, Executive Order (EO) *Restoring America's Maritime Dominance* was signed, directing several federal actions to reinvigorate and grow shipbuilding in the U.S. As shown in Figure 2, U.S. shipbuilding output in 2024 was low relative to other nations; for example, the U.S. had 0.08% the output of China and 32% the output of Russia. This puts the United States at an economic disadvantage and presents a national security risk. Addressing this discrepancy will take years of continued investment, innovation, and collaboration to expand the nation's shipbuilding capacity.

---

[8] UNCTAD, "Ships Built by Country of Building, Annual (Analytical)."
[9] Merchant Marine Act.
[10] Tim Colton, "Shipbuilding History."

3.1 PNW Regional Overview

The Pacific Northwest (herein referring to Washington and Oregon) has a strong maritime heritage with two key centers: the Puget Sound and the Columbia River. Barge traffic on the Columbia, passenger ferries and ship-assist tugs in the Puget Sound, and commercial fisheries in both areas sustain the region's maritime economy. Regional vessel owners support local shipyards, training centers, chandlers (marine supply companies), and the professional services specializing in maritime (lawyers, insurers, accountants, naval architects and marine engineers).

A 2022 analysis showed that the maritime sector in Washington was responsible for 174,300 direct and indirect jobs and $45.9 billion direct and indirect revenue.[11] Equally, if not more important, are the shipyards that build and repair these vessels upon which our global economy functions. Shipbuilding, repair, and maintenance was the second largest contributor to direct employment by the maritime industry in Washington, at 18,500 jobs, just behind maritime logistics and shipping sector employment.[12]

In the Puget Sound, the U.S. Navy's substantial presence—including bases, shipyards, and testing facilities—augments an already robust maritime economy. Oregon and Washington are home to over 100 commercial shipbuilding or repair organizations,[13] 10 are in Seattle.

Generally, commercial vessels with valid operating permits that are registered in Washington and Oregon are older than the national average, as shown in Figure 3. This is particularly evident for towing, passenger, fishing, and industrial vessels, whose median age is nearly the same as the oldest 25% nationwide. Note that age in this context represents the age of the hull, not necessarily the vessel's powertrain or equipment.

The U.S. fleet is significantly older than the global fleet, with a 60% longer lifespan, on average, than vessels operated outside of the U.S.[14,15] Retrofitting and incorporating new technologies, particularly in ways that improve energy efficiency and reduce underwater noise, into older vessels is far more difficult than utilizing those technologies in new builds. Without modern systems and technologies, older vessels become resource intensive to maintain, operate, and comply with evolving environmental and safety regulations.

---

[11] McKinley Research Group, *Economic Impacts of Washington's Maritime Industry 2022*.
[12] McKinley Research Group, *Economic Impacts of Washington's Maritime Industry 2022*.
[13] Department of Revenue Washington State, "Statistics & Reports: Gross Business Income."
[14] United Nations, *2024 Review of Maritime Transport: Navigating Maritime Chokepoints*.
[15] United States Coast Guard, "Merchant Vessels of the United States."

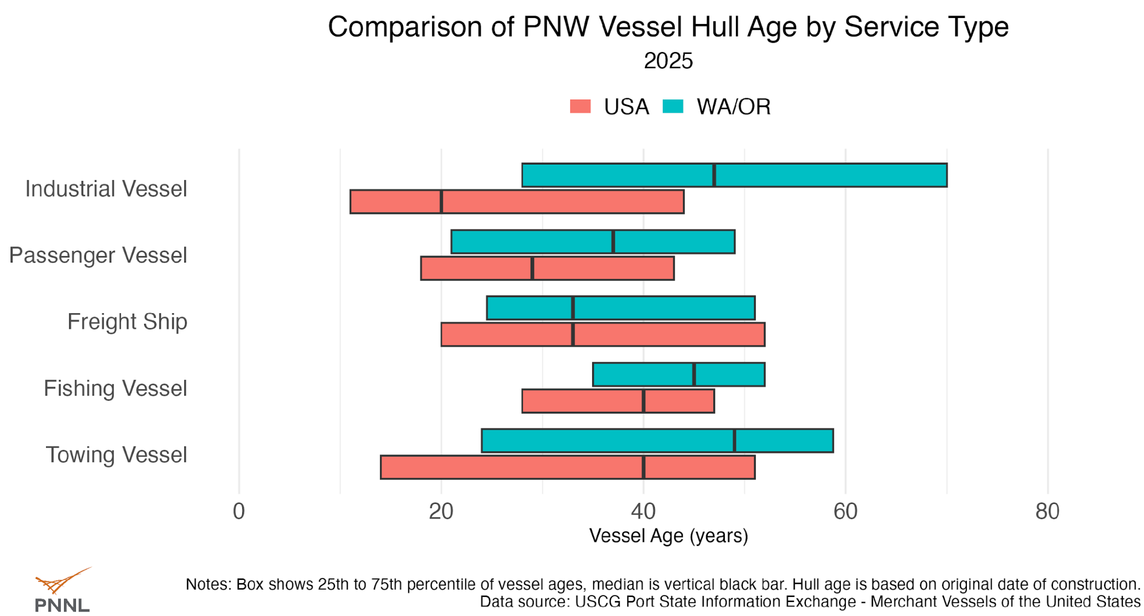


Figure 3: Distribution of ages for commercial vessels registered in Washington and Oregon compared to ages of the broader U.S. commercial fleet

Of the ships operating in the PNW today, Figure 4 shows that nearly two-thirds were built in Washington or Oregon, suggesting that vessels built in the region stay in the region. However, a sizable number of vessels have come from other states like California, Louisiana, and Alabama.

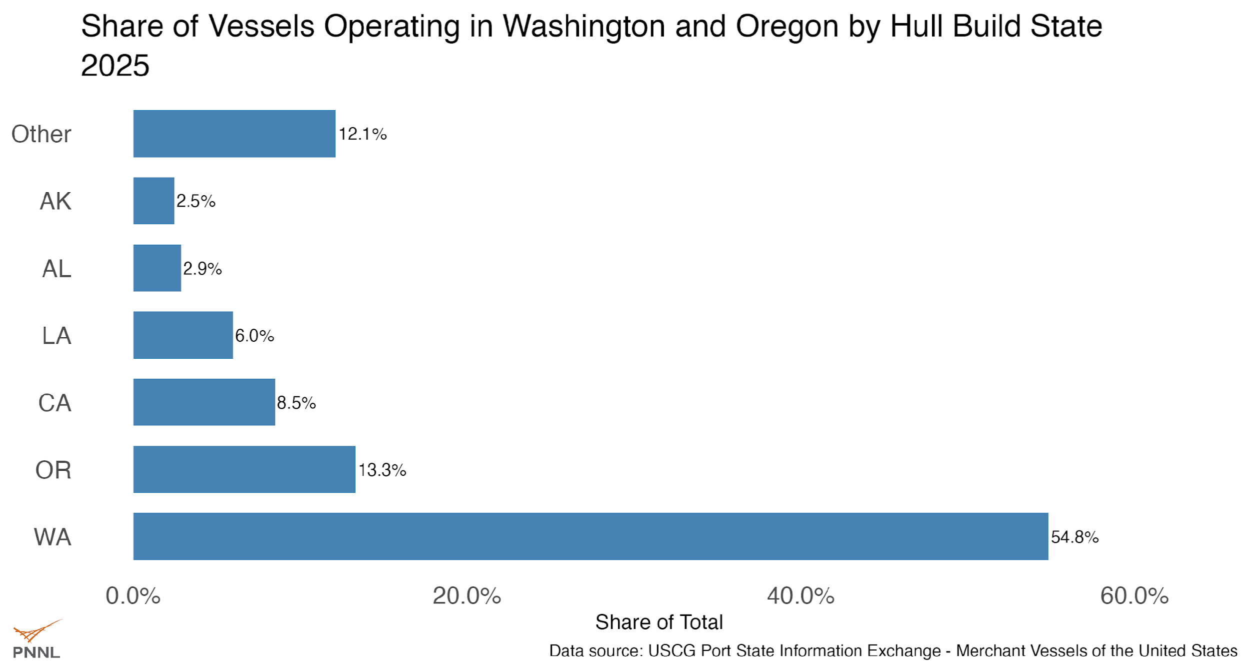


Figure 4: Hull build location for vessels registered in Washington and Oregon

Due to some of the challenges mentioned throughout this report, as well as the prevalence of older ships in the region, shipyards in Oregon and Washington tend to focus on ship repair/maintenance and higher margin newbuilds, such as yachts, passenger vessels, harbor craft, and patrol boats for government (police, fire, fish and wildlife, etc.). Recently, there has been increased interest in the production of passenger vessels, see Figure 5.

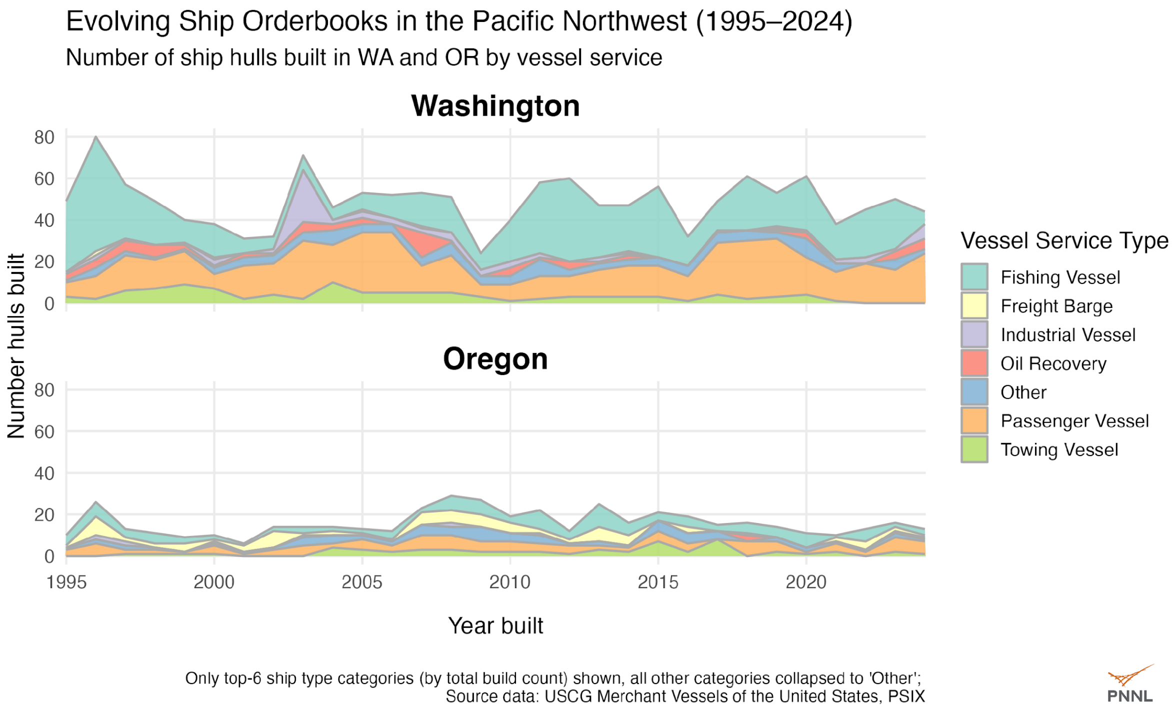


Figure 5: Number of vessels built by service type in Washington and Oregon

4 Scope and Methods

This report is built around extensive engagement with regional and national maritime stakeholders from two distinct, but related efforts.

PNNL conducted structured interviews with eleven privately owned and operated shipyards and repair facilities in the Pacific Northwest, primarily in Washington, in the summer of 2025. Interviews focused broadly on challenges faced by shipyards in the Pacific Northwest (PNW). The findings contained herein are limited to privately operated shipyards that focus on small- and mid-sized commercial vessels (tugs, ferries, fishing, etc.) and some repair of government vessels.

In late 2024 and early 2025, the American Bureau of Shipping (ABS), Glosten, Noise Control Engineering, and Maritime Blue conducted interviews and a full-day workshop with fifty-five vessel owners, designers, builders, technology providers, and regulators to understand barriers and opportunities in the uptake of emerging technologies in U.S. shipbuilding. Across both bodies of work, findings are intentionally left anonymous to protect against divulging sensitive business information and instead are aggregated by stakeholder groups.

This report highlights challenges and opportunities seen at the regional and national level, while diving deeper into opportunities for action in Washington and Oregon shipbuilding.

5 Challenges in Building Ships in Washington and Oregon

Vessel construction is a complex process involving numerous skilled trades, waterfront real estate needs, and a small set of customers with specialized requirements. As vessels evolve to incorporate new power trains, energy sources, and hull forms, it adds additional complexity to both the construction process and supply chain management. While many challenges facing shipyards are region agnostic, there are some that are unique to certain regions. In the PNW, high costs of living, more stringent environmental standards, lack of adequate waterfront real estate, and a tight labor market create an even more challenging business environment for shipyards.

Through conversations with vessel owner/operators, naval architects, and original equipment manufacturers across the U.S., and shipyard and repair facilities in the PNW, we surfaced a number of challenges centered around five thematic areas:

- Standardization
- Workforce
- Advanced and automated manufacturing
- Finance
- Electricity

Each is discussed in detail in the sections that follow.

5.1 Lack of standardization prevents process optimization

Building vessels is more akin to construction than it is to manufacturing. Most vessel orders are custom, and each order is typically for single units. For comparison, in the U.S. annual Class 8 truck orders vary between 10,000 and 50,000.[16] Conversely, production of tugboats in the U.S. varies between 60 to 120 units per year.[17] This equates to a single shipyard possibly producing one to six vessels a year, compared to a truck manufacturer building thousands of units per year.

Low-volume, custom orders inhibit the development of standard workflows and optimized processes. Standard process is a prerequisite for the types of automated manufacturing and assembly seen in sectors like automotive, an aspiration for many shipyards. This is especially

[16] *Trucking Dive*, "Class 8 Truck, Trailer Orders by Month."
[17] United States Coast Guard, "Merchant Vessels of the United States."

true for vessel repairs or retrofits. All else being equal, shipyards prefer multi-vessel projects as they provide more opportunities for cost efficiency, learning, and training opportunities, and incentivize retention with consistent work for employees.

The prevalence of custom builds and one-off processes affects numerous aspects of shipbuilding. Even seemingly small issues, like converting units can add unnecessary time and cost and introduce inefficiencies during the manufacturing process. The lack of standardization becomes most apparent in two distinct, but related issues: emerging technologies, and obtaining regulatory approval.

5.1.1 Uncertainty with integrating emerging technologies

The maritime landscape will continue to evolve over the next several decades due to emerging technologies and regulations that govern their design and implementation. Given that U.S. commercial ships often operate for 30 or more years,[18] shipyards and repair facilities must future-proof vessels for new, possibly unknown, fuels or technologies with uncertain approval processes and timelines. Indeed, owners/operators are pushing the envelope beyond what is required now to avoid the increased cost of retrofitting to meet needs down the road.

Shipyards are often hesitant to take on one-off innovative projects given the financial and human resources required to hire and train staff, ensure facilities and drydocks can build the ship, acquire designs from the engineer, and put in place quality assurance processes. Without prior experience, shipyards may unintentionally provide a lower estimate for the work than is required to meet the vessel specifications while still being competitive with their bid. Further complicating matters is that tradespeople often do not receive the design criteria outlined in the vessel specifications until shipyards have been awarded the contract, which inhibits efficient production.

The technologies available to meet energy efficiency and noise requirements outlined in the vessel specification sometimes require trade-offs in space or cost. While extensive work has been done to collate available technologies,[19] shipbuilders need support in understanding which technologies are ready for implementation, their associated trade-offs, and where to procure them. Some of these technologies are not produced in the U.S., posing a challenge in meeting U.S. materials and equipment preference programs, such as Build America Buy America requirements.

5.1.2 Navigating a complex approval process for novel powertrains

Marine vessels are gradually shifting towards fuel and propulsion systems that differ from what has been conventionally used. Regulations lag behind technological advancements, which

[18] United States Coast Guard, "Merchant Vessels of the United States."
[19] American Bureau of Shipping, *Energy Efficiency and Underwater Radiated Noise Technologies*.

inherently creates uncertainty in regulatory approval requirements and timelines for novel technologies.

The U.S. Coast Guard (USCG), or a ship classification society acting as a Recognized Organization, approves commercial vessel designs and standards and certifies vessels for commercial operation. However, the USCG does not yet have regulations in place governing the safety standards for newer systems like hydrogen fuel cell, all-electric, or ammonia-fueled vessels. In these instances, the USCG requires applicants to submit equivalency proposals proving their systems meet the same level of safety specified by existing standards.[20]

The USCG employs a methodical regulatory process for novel technologies, which evolves from project-specific equivalencies to broader published policy, and ultimately to formal regulations. This deliberate progression is essential for proving a new technology's practical safety and appropriate regulatory approach, which in turn provides the maritime sector with the long-term regulatory stability required for confident, widespread adoption. As an example, although the USCG issued a 2019 policy letter referencing an American Society for Testing and Materials (ASTM) standard for lithium-ion battery power systems,[21] designers are exploring other standards, and associated risks are still under evaluation.

While equivalency provisions allow for alternative designs and some degree of flexibility, demonstrating compliance can be complex, costly, and uncertain in both process and time required. But for good reason; a recent USCG safety alert[22] highlights the fire risk from lithium-ion battery systems and the need to protect our mariners, ships, and marine transportation system. While balancing innovation and safety is vital for advancing the maritime industry to remain competitive, shipyards often find themselves navigating this challenging middle ground.

For vessels utilizing innovative technologies that do not align with existing equivalency provisions, a USCG Design-Basis Agreement (DBA) is often pursued. These one-off approvals are provided on a case-by-case basis and the results are not publicly available to the next designer or vessel that may utilize the same technology. This adds significant time, cost, and risk to innovative technology integration and makes it challenging to reasonably estimate the cost or timeline for vessels built under a DBA structure.

5.2 Training, developing, and retaining the workforce

U.S. shipyards employ approximately 145,000 workers,[23] including welders, machinists, fitters, electricians, marine systems techs, and other skilled tradespeople and professionals. In

[20] Daniel Cost, CAPT USCG, "Personal Communications," September 22, 2025.
[21] Robert Compher, CAPT, "Design Guidance for Lithium-Ion Battery Installations Onboard Commercial Vessels."
[22] *Marine Safety Alert: Lithium-Ion (Li-Ion) Battery System Installations*.
[23] U.S. Bureau of Labor Statistics, "National Industry-Specific Occupational Employment and Wage Estimates."

Washington state alone, shipyards employ 18,500 workers.[24] Recruiting, training, and retaining that workforce was one of the most frequently cited challenges across all shipyards interviewed. Nearly every shipyard expressed that the inability to find and retain sufficient workers has constrained their ability to grow, and in some cases to even maintain current production capacity. Workforce challenges were attributed to dealing with fluctuating demand for vessels; navigating training and the workforce development pipeline; and addressing the high cost of living through offering competitive wages.

5.2.1 Employers and workers alike navigate training and retention challenges

The small- and medium-sized shipyards that were interviewed shared challenges on recruiting and training new workers. From the perspective of the job seeker, the process for attaining the necessary credentials and certifications required for shipyard work can be difficult to navigate, expensive, and time-consuming. This results in worker reluctance to undergo training without a guaranteed job at the end.

To secure the specialized workforce needed for shipbuilding (see Table 1), shipyards seek out early-career employees across a dispersed workforce pipeline. New hires may come from high schools, vocational technical schools, union apprenticeship programs, military service, or four-year colleges, depending on the position. Unfortunately, many of the organizations that train apprentices suffer from inconsistent or dwindling funding sources. Shipyards have a difficult time hiring project managers with specific shipbuilding expertise and instead hire from outside industries. This results in increased time needed for onboarding and gaining experience to support accurate bidding estimates. This extended training period then also impacts the human resource line item of the bid.

[24] McKinley Research Group, *Economic Impacts of Washington's Maritime Industry 2022*.

Table 1: List of unions with workers in ship manufacturing

Shipyard Craft Unions in the PNW	
Ship Fitters/Welders	Pipefitters
Sheetmetal Workers	Machinists
Laborers	Riggers
Painters	Shipwrights
Marine Electricians	

While pre-employment training is required for most shipyard workers to attain necessary skills and credentials, additional education occurs on the job through the transfer of knowledge and skills from experienced workers. A 2022 study conducted by Washington State Ferries identified a “silver tsunami” in their workforce as the percentage of employees at or approaching retirement threatened ferry service and repair.[25] Shipyard managers expressed concern that the aging of the current workforce could limit that critical knowledge transfer.

In some trades, workers move among other sectors and industries, such as welders who work in maritime, commercial building construction, and oil and gas. One executive of a shipyard located near two refineries shared that many of his workers move to oil and gas employers once they have reached a certain level of skilled credentials, as oil and gas jobs pay welders upwards of 20% more than shipyards. This worker retention challenge is exacerbated when expertise gained by skilled workers on innovative builds is not retained from project-to-project.

5.2.2 Competitive wages are required to offset high living costs

Many PNW shipyards are located around Seattle. Shipyards operating within areas with high costs of living like Seattle must pay competitive wages to attract workers. The PNW, particularly

[25] Seattle Jobs Initiative, *Washington State Ferries Workforce Planning Report*.

within the Seattle and Portland metropolitan areas, have some of the highest prevailing wages in the country. One Seattle-based shipyard shared that none of their skilled tradespeople live in the city, instead opting for more affordable housing in the suburbs and exurbs with the tradeoff of a longer commute. Wages naturally differ across regions. Using Gulfport, Mississippi as an example for the broader Gulf region, Figure 6shows that the competitive wage for a welder in Seattle is approximately 20% higher than in the Gulf, and 37% above the national average.[26,27]

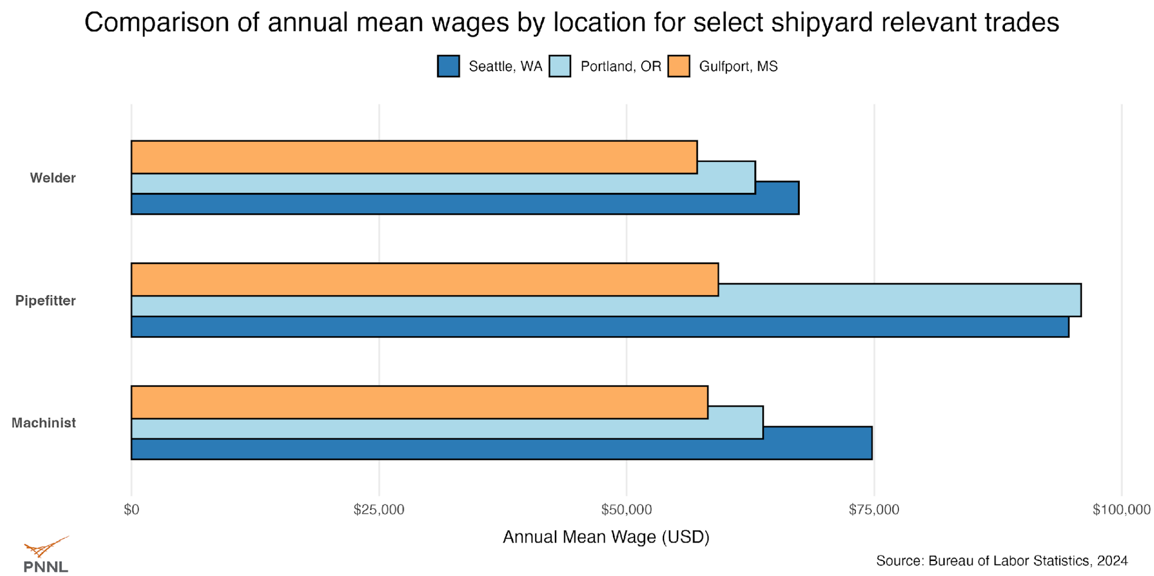


Figure 6: Comparison of mean annual wages in Seattle, Portland, and Gulfport for select trades that perform work in shipyards. Wages are not specific to shipyards but rather to the trade.

5.2.3 Volatile demand makes for inconsistent work

Tradespeople often work in economic sectors with boom-and-bust cycles like construction, oil and gas, manufacturing, and shipbuilding. Good years in one sector will attract workers seeking better wages or steadier work, effectively stealing workers from other sectors. Shipbuilding can be volatile due to external market forces resulting in hiring and layoff cycles, or complicated by project-based hiring for specific hull builds. For instance, as shown in Figure 1, some years displayed 100% year-over-year changes in the number of hulls built.

[26] Indeed, "Welder Salary in Seattle, WA."
[27] U.S. Bureau of Labor Statistics, "Occupational Employment and Wage Statistics Query System."

5.3 Shipyards struggle to adopt advanced manufacturing and automation technologies

Nearly all shipyards and repair facilities interviewed expressed interest in using advanced manufacturing techniques and equipment, particularly automated machinery. These organizations rely predominantly on manual processes to construct and repair ships, due largely to the non-standardized nature of the work. The reasons for adopting these new technologies tend to relate to building "better, faster, or cheaper."

Many of the organizations believe that they could use automated manufacturing to reduce labor needs or operate more shifts to increase their production capacity. But this presents its own challenges around workforce, sourcing, and financing.

Automated manufacturing often generates rightful concerns from the workforce relating to job displacement or retraining burdens. Worker displacement is a risk, but it is also an opportunity to move people away from work that is dull, dirty, or dangerous,[28] such as doing long seam welds, onto more engaging endeavors that require human ingenuity. Newer machines often require different skillsets from those traditionally associated with vessel construction, computer software skills for example, for automated equipment. Shipyards must be cognizant that they can retrain their existing workforce to use any new equipment and that the learning curve is reasonable for the investment.

When asked about where organizations source new manufacturing technologies from, few respondents had clear sourcing channels other than word of mouth. Of the few that did actively seek new technologies, they relied on trade shows and conferences such as Workboat International or Metstrade. Only one organization noted that they were actively looking at manufacturing equipment used in other sectors and cited the FABTECH conference as a source. All organizations interviewed did note that in whatever technology they do consider, they want it to be proven and ready-to-go, highlighting risk aversion in sourcing. For example, an interviewee suggested that they would only consider technology that was at least 10 years old. Only one interviewee expressed a different opinion with interest in trialing earlier-stage technologies.

None of the organizations interviewed were familiar with advanced manufacturing technology research sponsored by the U.S. Department of Energy at National Laboratories or elsewhere. National Laboratories have researched a variety of advanced manufacturing processes such as friction stir welding, cold spray, and additive manufacturing for applications in manufacturing vehicles, wind turbines, batteries, or solar panels for example. It is likely that much of this

[28] Association for Advancing Automation, "How Robots Are Taking on the Dirty, Dangerous, and Dull Jobs."

Department of Energy-sponsored research has applicability within the shipbuilding supply chain. However, shipyards have had little exposure to the research to say for certain.

PNW shipyards have strong interest to use advanced manufacturing or automation technologies, but financing this equipment is often an issue.

5.4 Modernization efforts stalled by financing gaps

U.S. shipbuilding has steadily lost market share to foreign shipyards and now accounts for less than 0.05% of global capacity (as shown in Figure 2) in 2024.[29] The attrition can be attributed both to the relatively high costs of manufacturing in the U.S. as well as the significantly higher level of government support directed towards shipbuilding in countries like China, South Korea, and Japan which account for 98% of global shipbuilding capacity by tonnage in 2024.[30] As it currently stands, U.S. shipyards face major financing hurdles when acquiring new equipment or infrastructure necessary to expand capacity and capabilities, as identified in Executive Order *Restoring America's Maritime Dominance* to reinvigorate U.S. shipbuilding.

For smaller, non-governmental shipyards like those in Washington and Oregon, one of the major sources of external funding is the MARAD Small Shipyard Program. In 2024, this MARAD program distributed $8.75 million in grants to small shipyards,[31] with grants capped at 75% of the estimated cost for projects "to make capital improvements and for maritime training programs to encourage technical skills and operational productivity relating to shipbuilding, ship repair, and associated industries." The total amount of funds available for shipyards from the Small Shipyard Program is dwarfed by the investment needed to bring total shipyard capacity up to the level required to meet industry and national security needs. In one example, an interviewee cited that a new dry dock they need for capacity increase might cost $15-30M, more than doubling the entire program allocations of the Small Shipyard Program for a single year.

Some government grants include Build America Buy America (BABA) requirements, which can increase the cost and lead-time for equipment purchases. For instance, under BABA, federal grants could fund half the purchase price of new equipment for shipyards, but BABA compliance often doubles the cost of equipment relative to imported options according to multiple interviewees. One contributor noted that even with tariffs, imported equipment and raw materials are often more cost-effective than buying U.S.-made options. Some shipbuilders shared that the time and effort required to apply for federal grants, which were not guaranteed, such as Title 11, makes applying for them not worth it.

[29] UNCTAD, "Ships Built by Country of Building, Annual (Analytical)."
[30] UNCTAD, "Ships Built by Country of Building, Annual (Analytical)."
[31] US Maritime Administration, "2024 Small Shipyard Grant Awardees."

Without multi-vessel contracts or clear market drivers, shipyards struggle to raise the capital required to expand, modernize, or automate their facilities. Since most contracts are one-off builds, shipyards must price the capitalization into the bid for a single vessel. This, in turn, increases costs and limits the pace of fleet renewal. Building ships that utilize novel technologies is more capital-intensive and often requires grant funding. Oftentimes, the total project cost is not known at the design stage, but rather after installation, troubleshooting, familiarization and rework. To accurately estimate costs during bidding, shipyards are often forced to bring on naval architects into their bid process to see the full design of the vessel. Further, whether they take on this additional cost during the bidding phase, the contracts are written such that the shipyard is responsible for performance risks that they might not have control over.

In the last year, there have been instances of foreign direct investment in shipbuilding capacity in the United States. In Philadelphia, the South Korean shipbuilder Hanwha acquired Philly Shipyard and announced a $5 billion investment in infrastructure.[32] Davie Defense, a Canadian firm, announced a $1 billion investment in shipbuilding in Galveston, Texas.[33]

One key financial obstacle to expanding shipbuilding capabilities is the cost of physical space, since shipyards require waterfront locations that are appropriately zoned and permitted, with suitable attributes such as deep water and protection from inclement conditions. Real estate that meets these criteria is not cheap, especially in densely populated areas like the greater Seattle area. Permitting is also a significant challenge due to long timelines and the associated high costs and risks. In addition, some otherwise suitable locations require significant brownfield remediation before they would be considered suitable for shipyard operations. Though several shipyards expressed interest in expanding their orderbooks, lack of space and workers are significantly limiting factors.

Shipyards are also challenged by contracts that require the yards to carry the majority of financial risk. This particularly becomes a challenge when building vessels with more innovative technologies and when projects are publicly funded or cost constrained such that change orders are not feasible.

5.5 Electricity limitations constrain expansion

Energy for operating equipment such as welding machines, cranes, dry dock pumps, etc. is an operating cost for shipyards and suppliers, which is passed on to the customer. The energy associated with ship construction is a poorly researched area; as one researcher states “there are no holistic and interdisciplinary academic studies and discussion on the shipbuilding energy

---

[32] Hanwha, “Hanwha Announces $5 Billion Philly Shipyard Investment as Part of South Korea’s Commitment to US Shipbuilding Growth.”

[33] Davie, “Davie Advances American Shipbuilding Expansion with Planned Acquisition of Gulf Copper’s Texas Shipyards.”

sector."[34] This data gap was confirmed during interviews as none of the interviewees could confirm the electrical energy used in ship construction or repair. Some believe they could derive these values through their electrical utility billing.

The average cost of electricity for commercial users in Washington and Oregon was $0.11 per kilowatt-hour in June 2025, below the national average of $0.14[35], and on par with many of the Gulf Coast states often associated with shipbuilding. None of the interviewees noted the costs of electricity as a challenge. But several mentioned issues with electricity access or capacity constraints. These include getting (or increasing) power to remote facilities on the waterfront or dry docks. Getting easements or permitting for these upgrades are long and tedious, complicated by an "ever-evolving playbook" of what's required by utilities, according to one respondent.

In some cases, amperage constraints are imposed on commercial customers by the service entrance equipment set by the local utility. Since this equipment is sized to a certain electrical load, adding more high energy consumption equipment to a shipyard, like welding machines, would increase the load and possibly require the installation of new electrical equipment to accommodate increases. For example, one respondent noted that their current amperage is capped at 600 amps (A) and they are working with their utility to increase that to 3200A.

As new hybrid and all-electric vessels become more prevalent for yards and repair facilities, a unique energy challenge is emerging for shipyards. Waterside electrical charging infrastructure for vessels is non-standardized and limited, presenting a logistical challenge for yards and repair facilities to conduct sea trials of hybrid and all-electric vessels. Groups like the Charging Interface Initiative (CharIN) are working internationally to align charging standards, including a megawatt charging system for vessels, but there are very few pilot projects using this standard as of this writing. As noted by one respondent, the infrastructure available today in the Puget Sound area for vessel charging is insufficient to fast charge a vessel in a reasonable time for their sea-trials.

6 Recommendations for Addressing Shipbuilding Challenges

The following list of opportunities are suggested actions to support a national research agenda around U.S. shipbuilding in response to the challenges facing shipyards and repair facilities, not just in Washington and Oregon, but nationwide. These reflect recommendations heard directly from shipyards, vessel owners and operators, technology developers, as well as the authors of this report. These recommendations outline opportunities to reevaluate and improve business

[34] Seyedvahid Vakili et al., "The Road to Zero Emission Shipbuilding Industry: A Systematic and Transdisciplinary Approach to Modern Multi-Energy Shipyards."
[35] Energy Information Agency, "Average Price of Electricity to Ultimate Customers by End-Use Sector."

models and standard practices that have become limiting factors to the sector's ability to flourish.

6.1 Standardization

- Develop standardized vessel sections or modules that are designed for manufacturing and pre-vetted and approved by classification societies or other design-approving bodies. This would allow builders to manufacture sections through repeatable processes and optimized over time, leveraging economies of scale and driving down costs. This would also facilitate serial production of vessels, not just their parts, and allow shipbuilders, owners, and designers alike to incorporate lessons learned, and therefore reduce expenditure, in subsequent builds. Collaboration between shipbuilders, owners, designers, and other key stakeholders would be critical to implementing this type of standardization. Preliminary steps could also include incentivization of serial production of standard vessel classes, as was done in the mid-twentieth century.

- Develop case studies by documenting the challenges and solutions for the uptake of a single technology all the way through the design-build process with participation from all parties (OEMs, shipbuilders, designers, operators) to ensure reasonability and applicability. These case studies can be used to develop a reference guide or roadmap for incorporating new technologies into vessel builds that includes realistic cost and timeline projections for emerging technologies. This work could leverage and build on the Technology Matrix for Addressing Underwater Radiated Noise (URN) and Energy Efficiency[36] that was recently published. The matrix articulates the readiness level, considerations, costs, and benefits of various technologies to reduce URN and improve energy efficiency which can facilitate prioritization, selection and installation by shipbuilders.

- Support naval architects, shipyards, classification societies, and the USCG in documenting best practices and processes for ensuring vessels using alternative fuels or power trains are safe and operate as intended. This includes developing incentives or other mechanisms that facilitate the sharing and transferability of risk-based assessments and DBAs to streamline future builds, as appropriate. Publish common best practices in drafting requirements documents for new builds and retrofits that utilize new technologies (such as hybrid, all-electric, or quiet vessel construction) from past DBAs without compromising proprietary details. Given the infrequency of orders and rate of change of technology, this would support owners/operators in designing vessel specs and limit time-consuming and expensive change orders from shipbuilders. Moreover, such information can help the USCG move from issuing project-specific DBAs to publishing effective policy.

---

[36] American Bureau of Shipping, *Energy Efficiency and Underwater Radiated Noise Technologies*.

- Accelerate the pace of development for nationwide charging standards for vessel fast-charging. CharIN is working towards this effort with their Megawatt Charging Standard marine task force. Standardizing charging and safety systems would allow common build practices and designs, further reducing system costs, particularly in the PNW where there is increasing interest in hybrid and all-electric passenger vessels.

6.2 Energy and Electricity

- Conduct in-situ energy measurements during the build or repair process to document energy needs across yards and vessel types to assist with modeling future energy needs nationally. This would support the identification of electrical constraints to facilitate faster upgrading of electrical infrastructure. This data collection will inherently facilitate a review of processes and uncover opportunities for energy efficiency improvements and cost reductions. Most importantly, it will help dismiss or highlight potential energy bottlenecks in ship construction and repair.

- Support flexible energy solutions like mobile or floating assets in lieu of traditional permanent shoreside infrastructure; in some instances, these can be faster to permit and build. For example, floating battery banks could be trickle charged and then in turn, moved to a convenient location for fast-charging hybrid and electric vessels undergoing sea trials.

6.3 Finance

- Explore contractual alternatives that allow shipyards and ship owners to share financial risk associated with building innovative vessels, particularly in the case of publicly funded cost-constrained vessel builds. Utilize Time & Materials (T&M) contracts for portions of the projects for which a yard may be less experienced in, rather than demanding fixed prices, to de-risk innovative bids. This would minimize financial loss by the shipyard should they underprice the effort needed to install new technologies.

- Perform comprehensive review of existing public shipyard and shipbuilding financing and technology assistance mechanisms including programs like MARAD's Small Shipyard grant, the U.S. Center for Maritime Innovation to identify key expansions or improvements necessary to address shipyard funding gaps.

- Use federal and state funds to drive down the cost of capitalizations (e.g., matching funds for new drydocks, robotic welders, and land purchases) and reward the uptake of innovative technologies that improve operational performance. This will require expansion of existing grant programs to cover the larger equipment purchases and infrastructure upgrades, enabling the government to fill a critical gap. The government could also de-risk investments through loan guarantees, expanded infrastructure grants, vessel commitments, and blended capital involving related stakeholder liability.

- Support networks and organizations that bring together ship designers, builders, and owners to understand and document trade-offs and efficiencies learned when selecting and implementing these technologies.

6.4 Workforce

- Mobilize funding to support shipyards to maintain comprehensive worker training programs for the trades, as might be possible for large firms or in industries with significantly larger workforces organized across sectors.[37]

- Conduct an analysis of sectors in which many small- and medium-sized enterprises collectively contribute to workforce development to provide a model for PNW shipyards to utilize in working with existing labor and training partners to collectivize training programs. Support partnerships between shipyards and trades unions such as pre-apprenticeship programs modeled on similar successful programs for construction, aviation, and healthcare, as examples.

6.5 Advanced Manufacturing

- Facilitate opportunities for shipyards to learn about advanced and/or automated manufacturing technologies. This might include attending trade shows and events held by other sectors that have embraced these technologies, such as automotive, or financing or otherwise enabling shipyards to participate in international learning delegations to global shipbuilding hubs. Support shipyard engagement with National Laboratories to learn about DOE-funded advanced manufacturing technologies that may have applicability to shipyards.

7 Conclusion

To bolster domestic shipbuilding capacity, both the Trump Administration and Congress have signaled major new investments in American shipbuilding through executive orders and the One Big Beautiful Bill Act (enacted) and the Ships for America Act (proposed at the time of this publication). Funds could be used to drive down the cost of capitalizations (e.g. matching funds for new drydocks, robotic welders, and land purchases), workforce training, and scientific research into design, supply chain, and manufacturing efficiencies, as examples. The federal

[37] Boeing and the International Aerospace Machinists union is an example of a large employer and union partnership with the capacity to provide workers with little or no experience on the job training.

government, in partnership with state governments, could also de-risk investments through loan guarantees, expanded infrastructure grants, and vessel commitments.

The maritime sector is not only critical to the U.S. economy, but also its national security. Building ships is low-volume, complex, capital-intensive, and labor-intensive. Shipyards across the country are facing numerous challenges in increasing capacity, and these challenges are particularly acute in Washington and Oregon. But, with improvements and investment in shipyards and repair facilities, the maritime sector can support a strong workforce and deliver mission-capable vessels.

The U.S. was once a ship-producing powerhouse.[38] The more than 100 shipyards and repair facilities in the Pacific Northwest region, together with their broader supply chain, contribute more than 18,500 jobs to Washington alone.[39] Anchored by an abundance of deepwater ports, co-location of commercial shipyards with major U.S. Naval facilities, and concentration of industry and technology innovation,[40] the Pacific Northwest is uniquely positioned to advance a new age of U.S. maritime excellence. This will require renewed state and federal commitments to collaboration and durable support to bolster U.S. and regional competitiveness.

[38] Arthur Herman, *Freedom's Forge*.
[39] McKinley Research Group, *Economic Impacts of Washington's Maritime Industry 2022*.
[40] Washington State Department of Transportation, "Freight."

8 Works Cited

American Bureau of Shipping. *Energy Efficiency and Underwater Radiated Noise Technologies*. 2025. https://ww2.eagle.org/content/dam/eagle/publications/Energy%20Efficiency%20and%20Underwater%20Noise%20Technologies.pdf.

Arthur Herman. *Freedom's Forge*. Random House Trade Paperbacks, 2013.

Association for Advancing Automation. "How Robots Are Taking on the Dirty, Dangerous, and Dull Jobs." Trade Association. October 15, 2019. https://www.automate.org/robotics/blogs/how-robots-are-taking-on-the-dirty-dangerous-and-dull-jobs.

Davie. "Davie Advances American Shipbuilding Expansion with Planned Acquisition of Gulf Copper's Texas Shipyards." Press Releases. PR Newswire, June 11, 2025. https://www.prnewswire.com/news-releases/davie-advances-american-shipbuilding-expansion-with-planned-acquisition-of-gulf-coppers-texas-shipyards-302479306.html.

Department of Revenue Washington State. "Statistics & Reports: Gross Business Income." n.d. https://apps.dor.wa.gov/ResearchStats/Content/GrossBusinessIncome/Report.aspx.

DNV. "Alternative Fuels Insight." 2025. https://afi.dnv.com/statistics/2ae7811e-af73-4b93-bc9a-19c440816b2a/Fuel_Prices-Basic.

Energy Information Agency. "Average Price of Electricity to Ultimate Customers by End-Use Sector." Electric Power Monthly, June 2025. Tabular. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

Hanwha. "Hanwha Announces $5 Billion Philly Shipyard Investment as Part of South Korea's Commitment to US Shipbuilding Growth." Company. Hanwha, August 27, 2025. https://www.hanwha.com/newsroom/news/press-releases/hanwha-announces-5-billion-philly-shipyard-investment-as-part-of-south-koreas-commitment-to-us-shipbuilding-growth.do.

Jan Hoffman, and Sirimanne Shamika. *Review of Maritime Transport. Edited by Deniz Barki and Lucy Deleze-Black*. United Nations, 2017. https://unctad.org/system/files/official-document/rmt2017_en.pdf.

Indeed. "Welder Salary in Seattle, WA." Job Posting. September 20, 2025. https://www.indeed.com/career/welder/salaries/Seattle--WA?from=top_sb.

Josh Messner, Farhad Masum, Chris Kolodziej, and David Hume. *An Action Plan for Maritime Energy and Emissions Innovation*. U.S. Department of Energy, 2024. https://www.transportation.gov/sites/dot.gov/files/2024-12/Maritime%20Plan.pdf.

Marine Safety Alert: Lithium-Ion (Li-Ion) Battery System Installations. Safety Alert 14-25. United States Coast Guard Inspections and Compliance Directorate, 2025. https://www.dco.uscg.mil/Portals/9/DCO%20Documents/5p/CG-5PC/INV/Alerts/USCGSA_1425.pdf.

McKinley Research Group. *Economic Impacts of Washington's Maritime Industry 2022*. 2023. https://www.washingtonmaritimecareers.org/s/wa_maritime_impacts_2022_-_report.pdf.

Regulation (EU) 2023/1805 of the European Parliament on the Use of Renewable and Low-Carbon Fuels in Maritime Transport, 2023/1805 (2023). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1805.

Robert Compher, CAPT. "Design Guidance for Lithium-Ion Battery Installations Onboard Commercial Vessels." USCG Policy Letter. October 2, 2019. https://www.dco.uscg.mil/Portals/9/DCO%20Documents/5p/5ps/Design%20and%20Engineering%20Standards/Systems%20Engineering%20Division/ENG%20Policy%20Ltr_02-19%20Li-Ion%20Battery%20Policy_Signed.pdf?ver=2019-10-10-073508-267.

Seattle Jobs Initiative. *Washington State Ferries Workforce Planning Report*. 2022.

Seyedvahid Vakili, Alessandro Schönborn, and Aykut I. Ölçer. "The Road to Zero Emission Shipbuilding Industry: A Systematic and Transdisciplinary Approach to Modern Multi-Energy Shipyards." *Energy Conversion and Management: X* 18 (April 2023). https://doi.org/10.1016/j.ecmx.2023.100365.

Tim Colton. “Shipbuilding History.” February 2021. http://shipbuildinghistory.com/.

Trucking Dive. “Class 8 Truck, Trailer Orders by Month.” October 22, 2024. https://www.truckingdive.com/news/data-tracker-class-8-truck-trailer-orders/720224/.

UNCTAD. “Ships Built by Country of Building, Annual (Analytical).” June 10, 2025. https://unctadstat.unctad.org/datacentre/dataviewer/US.ShipBuilding.

United States Coast Guard. “Merchant Vessels of the United States.” September 2025. https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Office-of-Investigations-Casualty-Analysis/Merchant-Vessels-of-the-United-States/.

U.S. Bureau of Labor Statistics. “National Industry-Specific Occupational Employment and Wage Estimates.” Occupational Employment and Wage Statistics, May 2023. https://www.bls.gov/oes/2023/may/naics4_336600.htm.

U.S. Bureau of Labor Statistics. “Occupational Employment and Wage Statistics Query System.” Gulfport-Biloxi, MS. May 2024. Occupational Employment and Wage Statistics, October 15, 2025. https://data.bls.gov/oes/#/area/0025060.

US Maritime Administration. “2024 Small Shipyard Grant Awardees.” Government. 2024 Small Shipyard Grant Awardees, July 22, 2024. https://www.maritime.dot.gov/grants-finances/federal-grant-assistance/2024-small-shipyard-grant-awardees.

“U.S. Maritime Workforce Grows to 650,000 Americans in Booming Jobs Economy.” *Transportation Institute*, March 4, 2019. https://transportationinstitute.org/u-s-maritime-workforce-grows-to-650000/.

Washington State Department of Transportation. “Freight.” Gray Notebook Highlights, 2023. https://wsdot.wa.gov/about/data/gray-notebook/gnbhome/economicvitality/freight/default.htm.

David Hume, Ryan Calkins, Cassidy Fisher, and Sara Adams. Shipbuilding in Washington and Oregon: Challenges and Opportunities. Maritime Blue. 2025. www.maritimeblue.org/wa-or-shipbuilding-report/