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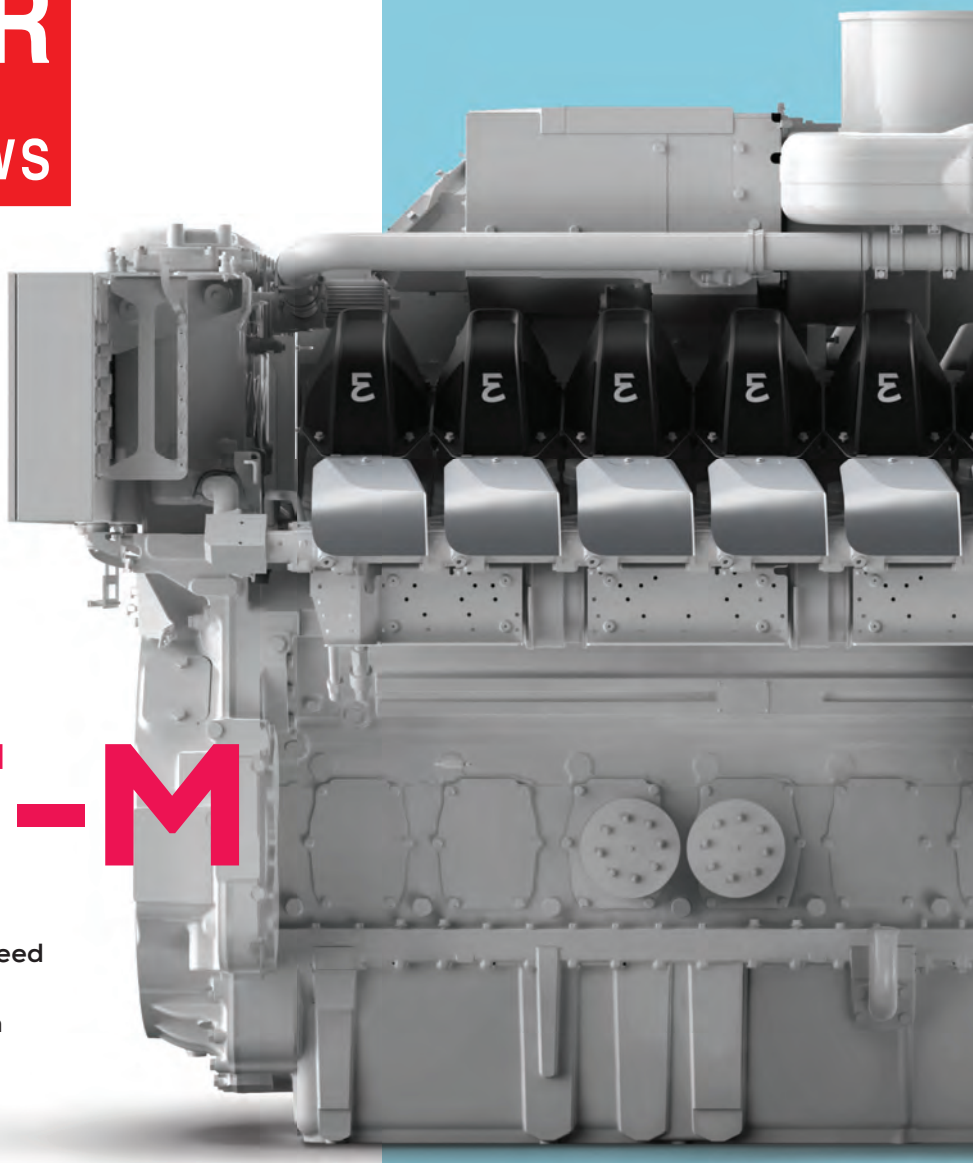

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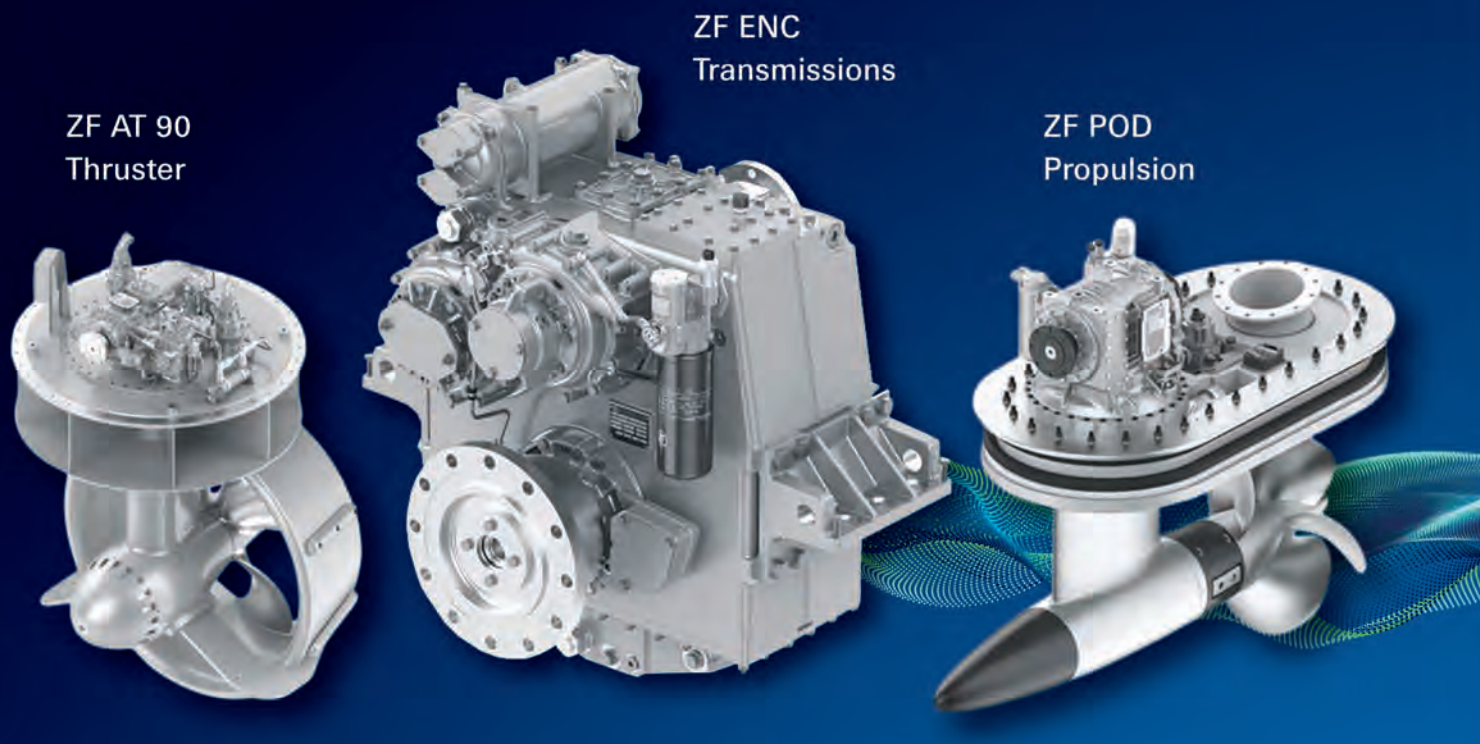

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Editorial

Photo by Justin Zurre

I write this from the home I grew up in, Fairfield, Ohio, a community just north of Cincinnati where my parents have lived in the same home they built in 1960. My mom and dad were born five years before the outbreak of World War II, part of *'The Greatest Generation'* that helped to build the United States into the innovative industrial powerhouse; my father a Tool & Die Maker for General Motors, my mom a fixture in the local school district and community. Growing up, time and again, I saw this pair sacrifice their own personal gain for the good of their immediate and large extended family. Long story short, they are the bedrocks of their family, community and country.

I offer this as I'm just back from Chicago and the **American Great Lakes Port Association's** annual meeting, a fantastic event that represents a centrally vital – though less celebrated – maritime artery that is the backbone of U.S. commerce and national security. At the event I had the chance for an hour+ one-on-one with **Stephen Carmel**, Administrator, United States Maritime Administration.

When Carmel took the job, the universal reaction from those I've known in the business for more than three decades was: "he's the right person at the right time for the job." Carmel is clearly passionate and knowledgeable about the maritime sector and economics, and trust that the job before him and the U.S. industry is neither easy nor quick. There are many facets to our interview that will come out in the coming weeks and months, but three that truly resonated:

- **"We cannot out-China the Chinese":** America must change the game entirely and stop competing on yesterday's playing field. China today has an overwhelming manufacturing advantage; its shipyards dominate global commercial shipbuilding and its industrial ecosystem is unmatched. "The U.S. is awesome at innovating, at technology, at disrupting," Carmel said. "That's what we're great at. We have to make what the Chinese do irrelevant. We have to reset the terms of competition." Rather than trying to become a lower-cost version of Asia, Carmel believes America should compete where it has historically excelled: technology, innovation and systems engineering.
- **Nuclear Changes Everything:** If there is one technology Carmel returns to repeatedly, it is nuclear propulsion, specifically, Small Modular Reactors (SMR's). "This is a transformative," Carmel said. "SMR-powered nuclear technology will transform trade and shipping every bit as much or more than the container did."
- **"Our biggest weakness is our own attitude."** Carmel pulled no punches, saying too many people begin from the assumption that rebuilding American maritime capability simply cannot be done. History says otherwise, as industrialist like Henry Kaiser and William Knudsen [and many others] designed and facilitated an extraordinary industrial mobilization of World War II; industrialists that knew how to solve enormous industrial problems. America, Carmel insists, remains capable of similar achievements … provided it first decides to believe it can.

So as I write from Ohio to help out my own personal touches with the Greatest Generation, I look forward to reporting on the endless facets of rebuilding the U.S. maritime sector by this and the next generation.

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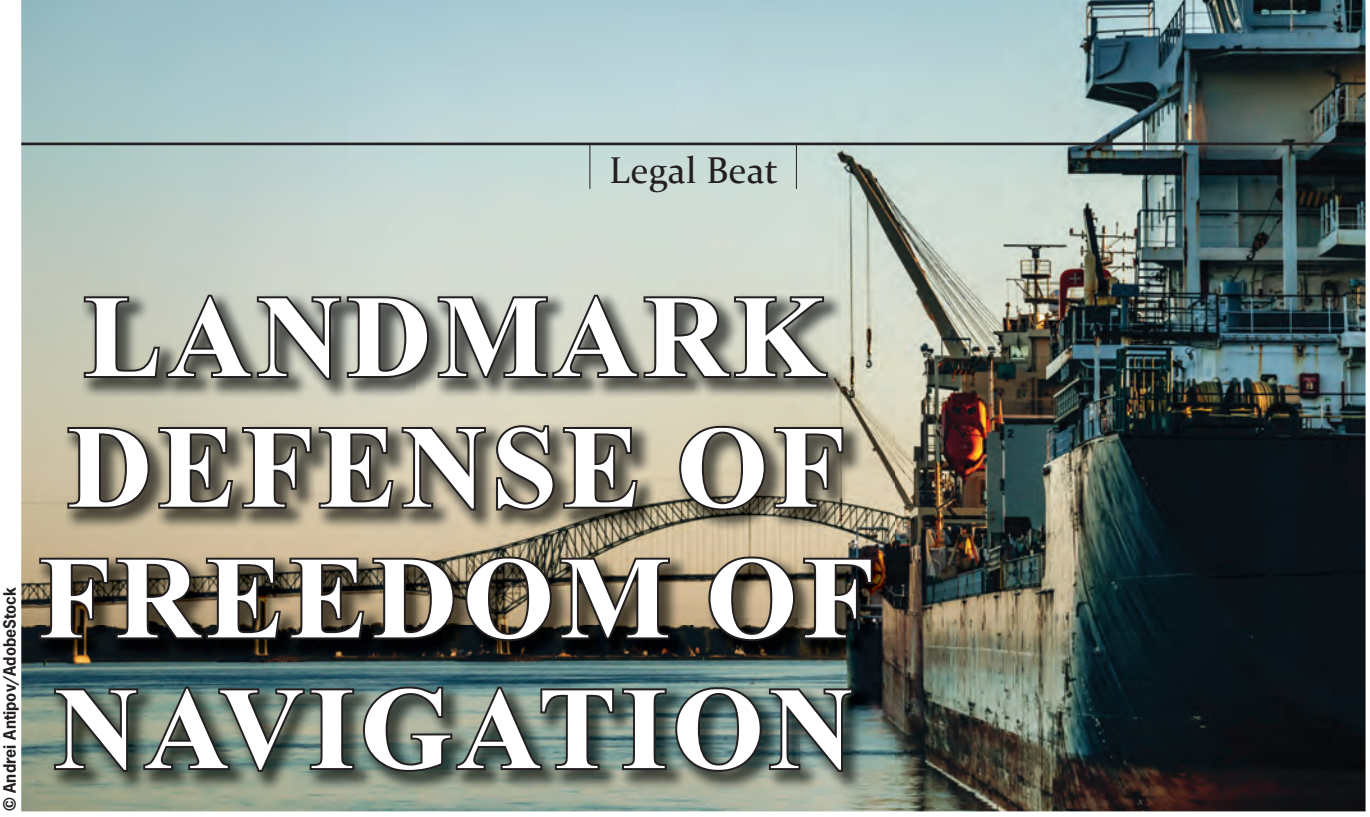

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LANDMARK DEFENSE OF FREEDOM OF NAVIGATION

ITLOS Ruling Exposes Improper Seizure and False Justifications in West African Maritime Incident

By Richard Gunn and Julia Cyrson, Reed Smith LLP

In the largest penalty the International Tribunal for the Law of the Sea (ITLOS) has ever levied, a Special Chamber ruled unanimously against Equatorial Guinea on May 27, 2026, ordering it to pay over €14 million in damages to the Republic of the Marshall Islands for the unlawful seizure of a commercial tanker and detention of its multinational crew. The ruling in the M/T Heroic Idun (No. 2) case represents a watershed moment for international maritime law, delivering a forceful reaffirmation of freedom of navigation.

Large-scale Maritime Seizure

M/T Heroic Idun, a very large crude carrier flying the flag of the Marshall Islands and under charter, arrived near Nigeria's Akpo Offshore Terminal in August 2022 to load crude oil. When the requisite loading authorizations were not yet in place, the master moved to a waiting position while charterers arranged for the paperwork.

On the evening of August 8, 2022, the vessel was approached by a small craft whose automatic identification system (AIS) was switched off – a classic warning sign of pirate activity in the notoriously dangerous Gulf of Guinea. Fearing an attack, the master declined to follow the craft's instructions and moved further offshore. The vessel subsequently drifted into the exclusive economic zone (EEZ) of São Tomé and Príncipe while awaiting clearances.

It later transpired that the unidentified craft was NNS Gongola, a Nigerian navy vessel. On August 10, 2022, Nigerian authorities sent WhatsApp messages and a diplomatic note to Equatorial Guinea asserting a suspicion that the Heroic Idun had attempted to load crude oil without approval and had raised a "false piracy alarm" to evade interception. Nigeria requested that Equatorial Guinea "track and arrest the vessel and hand them (both vessel and crew) over to the Nigerian Government."

Two days later, the Equatoguinean naval vessel Capitán David intercepted the Heroic Idun – not in Equatorial Guinea's own waters, but in the EEZ of São Tomé and Príncipe, a third country. The warship threatened the use of force, including announcing that it had "orders to shoot," and compelled the tanker to divert to Luba Freeport on Bioko Island.

Nine Months of Unlawful Captivity

The vessel and its 26-person crew – comprising mostly Indian and Sri Lankan nationals – were detained in Equatorial Guinea for 92 days. In addition, the master was fined €2,000,132 by the Equatoguinean Ministry of National Defense for alleged violations of domestic merchant marine law, including sailing without authorization in Equatorial Guinea's EEZ.

Even after the shipowners paid the fine in full, which the Mashall Islands claimed had no legitimate basis, the vessel and crew were not released. On November 11, 2022, they were forcibly transferred to Nigeria, where they endured further detention until May 27, 2023, when a plea bargain agreement was finally reached and the crew was released. In total, the innocent seafarers were held captive for approximately nine months.

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The Chamber's Ruling

The Special Chamber, presided over by Judge Albert Hoffmann of South Africa, ruled unanimously against Equatorial Guinea on all counts. The judgment methodically dismantled each of the respondent's defenses.

First, the Chamber held that Equatorial Guinea's interception of the vessel in São Tomé and Príncipe's EEZ – including threatening force and compelling a change of course – constituted a clear breach of freedom of navigation under Articles 87(1), 90, and 92(1) of the United Nations Convention on the Law of the Sea (UNCLOS).

Second, the Chamber rejected Equatorial Guinea's claim that its actions were justified under regional anti-piracy cooperation arrangements. The tribunal clarified that while states have a duty to cooperate in repressing piracy under Article 100 of UNCLOS, this duty "does not provide an autonomous basis for seizure." Any enforcement action must conform strictly to the specific conditions in Articles 101 to 107, read with Article 110. A coastal state cannot rely on a generalized duty of cooperation to board, seize, or divert a foreign vessel without satisfying those requirements.

Third, the Chamber found that Equatorial Guinea's domestic laws provided no valid basis for the fines imposed. International law does not permit a state to fine a foreign vessel simply for transiting its EEZ or for not flying a physical flag – provisions that are flatly inconsistent with UNCLOS.

Record-breaking Damages

The tribunal ordered Equatorial Guinea to pay €2,000,132 (approximately $2.3 million) representing the illegally imposed fine, plus more than $12 million in additional damages. This included $5.9 million for loss of hire during the vessel's detention and just under $4.2 million specifically directed to the 26 crew members for non-material damages arising from their mistreatment. The total award of over €14 million represents the highest damages award in ITLOS history.

We at Reed Smith think the implications of this ruling are especially important today for the maritime industry.

Reaffirmation of Exclusive Flag State Jurisdiction & Freedom of Navigation

This ruling stands as a powerful reaffirmation of two bedrock principles of international maritime law. Under UNCLOS, a vessel flying a nation's flag is under that state's exclusive jurisdiction while on the high seas or in an EEZ. Physical interference with a foreign-flagged vessel – including compelling a change of course under threat of force – violates freedom of navigation unless justified by specific provisions of the Convention or other international treaties. The Chamber's ruling sends a clear message that these principles have real, enforceable teeth in international courts, even when the flag state is a small nation operating an open registry.

Limits on Anti-Piracy Enforcement Powers

The judgment imposes clear limits on states' anti-piracy enforcement powers. Regional cooperation arrangements such as the Yaoundé Code, which seeks to operationalize anti-piracy cooperation in Central and West Africa, cannot confer powers beyond those contained in UNCLOS itself. A state cannot simply invoke "cooperation against piracy" as a blanket justification for seizing foreign vessels without proper grounds. The duty to cooperate does not create autonomous enforcement powers – states must still satisfy the specific conditions set forth in UNCLOS before taking action against suspected pirates.

Crew Protection and State Responsibility

The ruling sets important precedent for crew protection. International tribunals have long established that a ship, its crew, and its owners form an indivisible legal unit under the flag state's protection. The Chamber confirmed that the rights of the flag state under UNCLOS extend beyond the vessel itself and encompass the protection of all those serving on board, regardless of their nationality. Critically, the Chamber held that the exhaustion of local remedies requirement does not apply where individuals are present in a state's territory solely because of that state's unlawful conduct. A state cannot create jurisdiction over foreign nationals through its own illegal actions and then demand they exhaust local remedies before seeking international recourse.

Significance for Future Maritime Disputes

The record-breaking damages award signals that international maritime law has real financial consequences. While incidents of this precise nature may be relatively rare, this case serves as valuable precedent and powerful messaging for the entire industry. The innovative approach taken by the legal team – submitting detailed, evidence-backed damages calculations rather than seeking nominal fines – enabled the tribunal to issue a far more substantial judgment and may serve as a template for future claimants.

The precedent may prove particularly relevant given current tensions in maritime chokepoints. With periodic blockades and vessel seizures around the Strait of Hormuz continuing to make headlines, flag states and shipowners now have a clear roadmap for pursuing substantial claims when their vessels and crews are unlawfully detained. The case demonstrates that when states take action under UNCLOS, the rule of law is upheld – and that the rights of those involved in maritime commerce carry meaningful financial consequences.

For shipowners, charterers, and flag states, the message is clear: pursue claims when vessels and crews are improperly treated. Recovery is possible – and in this case, substantial.

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This is the Last Article on the Jones Act *You Ever Need to Read*

By Rik van Hemmen

I first heard about the Jones Act from my father in 1976. He had just become part of the US maritime community and one day came home and started to tell me about the differences between the US maritime community and the Dutch maritime community. Two things stood out; the heavy US union influence and the Jones Act. My father despised unions, as a lifelong non-unionized shipping company employee (but a very benevolent one, sponsoring employee vacation resorts and excellent employee housing, and later found to have one of the most generous pension plans one can imagine). In later years his stance softened as he gradually realized that unions keep pressure on bad employers, and make it easier for good employers to compete against the bad ones.

The Jones Act was a funnier subject, because he pointed out that the prime reason for the Dutch fighting wars with Great Brittain in the 1600's was Brittain's insistence on cabotage.

To him cabotage was an artificial means of protecting inferior abilities against superior commercial and maritime skills. He may have been right about the British, but not so much about the Americans.

In later years my father became a strong Jones Act supporter. Not because he liked the concept, but rather because it made sense for America and, weirdly, the world at large.

It is bizarre that the Jones Act has been a subject of discussion for over a century. It is a simple concept, but somehow manages to ruffle random feathers particularly of politicians who don't take the time to think through the issue. I even remember John McCain criticizing the Jones Act and dragging out the standard stale arguments that it hindered competition, and raised prices in Hawaii, Alaska and American territories.

He did recognize the national security aspect, but never suggested a better solution.

Let's make things simple. The Jones Act or rather US cabotage can be expanded at will to increase the US flag merchant fleet by, in the extreme case, only allowing US-built, US-flag vessels to carry goods into the United States. It quickly becomes clear this is madness and while there can be less dramatic expansions, the Jones Act is sort of the simplest most barebones version of cabotage.

For every column I write *MREN* makes a small contribution to an organization of my choice. For the foreseeable future I am selecting SL7Expo. An industry wide effort to develop a Smithsonian level exhibit center for commercial maritime. https://sl7expo.org/members/

Let's consider what will happen if the Jones Act is repealed. Almost immediately lower cost foreign shippers will start to move cargo (and passengers) between US ports, and what little ocean going commercial shipbuilding exists in the United States will also disappear.

The impact on the US ocean going skill base will be even more significant. In a matter of years, the US will have no active skilled ocean mariners and shipyard workers and zero young entrants into the industry.

What will be the benefit? Shipping costs to some locations will come down resulting in lower consumer prices in those locations.

How much lower will those prices be? Let's take Hawaii as example, since it is a long ocean route which aggravates the cost difference between US flag and foreign flag vessels. An extreme example suggest that the Jones Act adds $5 per day to each Hawaiian citizen's cost of living, which would be $1,800 per year.

It is almost certainly an overstatement, but if it is true, one cannot escape the fact that this premium for living in Hawaii has existed for over 100 years and, as such, is a free choice from the moment that every living Hawaiian was born. The issue is equally flawed as people buying a house under an airport runway and then arguing that the airport should close because it makes too much noise.

Bizarrely, the effect of the Jones Act was much higher between 1920 and 1960, because the most significant cost difference between US Flag and low cost foreign flags is the cost of

crews. Since the advent of containerization, the crew cost fraction per ton cargo has declined dramatically and, as such, the cost difference between US and foreign flag vessels has declined. Moreover the overall cost of ocean freight has declined due to the efficiencies of containerization. Those in Hawaii who want to repeal the Jones Act are actually arguing for something that used to be much more burdensome in the past. Moreover, globalization has reduced the Jones act trade fraction to Hawaii, which is now a smaller fraction of all cargo imported into Hawaii than in the past.

The major truth is that the Jones Act is one of the most cost effective methods for ensuring that the US maintains a modicum of ocean going shipping ability, and this is money in the bank with regard to national security. In time of war the Jones Act fleet cannot provide all the sealift needed, but at least there will be a skills and infrastructure starting point to build from.

Let's suppose that there is a national emergency and it is the US against the world. Without a Jones Act do the Hawaiians know who will provide them with the goods to survive on their islands?

What would have happened to Hawaii in World War II without the Jones Act? And what would have happened in the Vietnam War, the Korean War and the various Middle East wars without a Jones Act? Living on an island has its own benefits and burdens. That balance is a complex choice, but it is completely unrealistic to think that repeal of the Jones Act will provide a benefit that will dramatically alter the balance of those complex choices.

The Jones Act has existed for over 100 years and for that period it has provided a modicum of national maritime security for very little cost. Over those 100 years it has not harmed any person in a way that it altered their lives and since it is a competitive commercial proposition, rather than a government program, it is more cost effective than using tax money to create an equivalent level of maritime security.

In over 100 years, nobody has raised any new argument against (and for) the Jones Act and it has worked at no cost to the taxpayer. Unless there is a novel argument against it, or the arguments for it disappear (lasting and stable world peace) discussing the Jones Act any further is a massive waste of time.

Still Below the Waterline:
What Hull Inspection Has to Produce

The Navy is moving to predictive maintenance and seeks proven technology to do so. For most systems aboard a ship, the condition data is well documented. For the hull, it is a different story.

The Plan Asks for Something the Hull Currently Cannot Provide

The Navy's FY27 shipbuilding plan is direct about the future of maintenance. Two specific points within the plan are significant to anyone who works on hulls. The first is a pivot from the single long dry dock period toward a maintenance continuum. This means smaller and more frequent work that keeps ships in service. The second is a move toward predictive maintenance using AI and machine learning to discover problems before they become failures. The plan is clear about the stage of technology it requires. It does not intend to fund prototyping where mature commercial systems already exist. The bottom line is that both these directions require the ability to routinely collect reliable vessel condition records through effective and readily available solutions.

This is not a novel requirement for most systems aboard. Engine performance, auxiliary load, and fuel consumption are all logged continuously, and the data is frequently reviewed. Hull condition, however, does not have a daily assessment. As the hull is the largest and most vulnerable surface on a vessel, this is a critical maintenance lapse. It is not simply a static exterior. The hull drives fuel consumption, affecting coating condition costs to structural integrity. In most cases, it is inspected twice in five years by a dive team, with no reliable data record for maintenance comparison. Data cannot be predicted when it has not been logged.

None of this is unique to the Navy. Commercial fleets feel the same gap, and the yards doing the service inherit the problem as they price docking against a hull sight unseen.

Five Musts of an Inspection

It is not sufficient to question whether hulls should be inspected more often; it is widely acknowledged that they should. The more informed consideration is what an inspection needs to produce before it can support a proactive initiative.

1. **Coverage:** The inspection must cover the majority of the hull, including niche areas like sea chests and thruster tunnels. Detailed coverage requires close contact work.
2. **Position:** Every observation must be tied to a location on the hull, so that same precise location can be evaluated again.
3. **Frequency:** There must be enough controlled inspections to show a direction. A single inspection only illustrates the state of the hull in one day. It cannot show what is changing or the rate of change, which is required to calculate maintenance decisions.
4. **Configuration:** When the inspection demands change, the system must have the ability to adapt. On most vehicles, the sensor and the vehicle are one design decision, so a new inspection requirement means a completely new solution.
5. **Structure:** The data must be presentable. Data and video that require manual aggregation cause friction to a process that must be simplified and streamlined.

Why Most Inspections Meet Only a Few of the Criteria

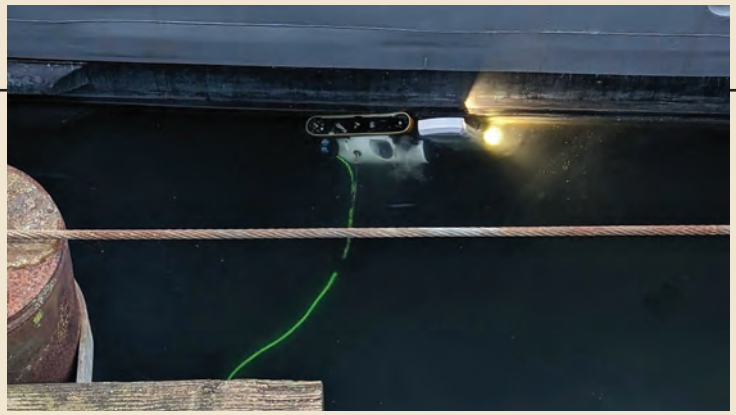
Plenty of hull inspection methods meet one or two of these criteria, but very few meet all five. The reason is not due to effort or quality. A dive team can reach anywhere on the hull, but the output is a description rather than a record. Each dive visit costs enough that owners allocate resources for specific use cases. A magnetically attached crawler with a camera provides close-contact video but is limited when it cannot leave the hull, and a free-flight vehicle covers ground quickly but cannot stay attached to the hull for contact work.

These are all solutions with clear constraints for a comprehensive proactive plan. Achieving all five points at once is not a feature that can be easily added on to upgrade. It requires a holistic approach to robotic system design from the start.

There Is No Substitute for Time in the Water

The marine environment is a punishing place to build anything: everything corrodes. Pressure and current break engineering decisions that should otherwise be successful. Visibility is often close to zero. Simulation is a great training tool, but it does not compare to placing a vehicle in the water and finding out what fails.

EverClean identifies an object on the hull and approaches for detailed inspection.



EverClean crawls the hull, capturing condition data tied to precise locations.

All images courtesy of Greensea IQ

This challenge gives context to twenty years of software development and illustrates how fielded robotic hardware actually matters. Greensea IQ was founded in Vermont in 2006, and its autonomous navigation and control software now runs on thousands of robotic systems across defense, science, and commercial work, from explosive ordnance disposal to seafloor mapping. Two decades represent not just a timeline, but a volume of hypotheses, tests, failures, and lessons carried back into the product.

The robot is the hardware and the software is the intelligence, and that is what dictates whether the five criteria can be met at all. Georeferenced observation is a navigation solution, not a camera capability. Structured data depends on observations being logged as they are captured. A vehicle can only truly be modular and carry different payloads if the software treats the payload as a variable. And the operator can only control the vehicle if the interface gives them a clear picture of what the robot sees.

EverClean is the proof of this configurable software maturity. It is an active grooming vehicle in service today. It holds hulls at their clean baselines while delivering the fuel and emissions results that drove its development from day one.

The capability for inspection was in the architecture from the beginning. Greensea IQ builds inspection into the baseline of every robotic system it develops, so the sensing and the data structure were already there. What changed was the requirement. When operators needed hull inspection as its own answer rather than a byproduct of grooming, the system did not have to be overhauled to provide it.

The vehicle can fly the hull for broad survey, similar to a traditional ROV, but its crawling ability allows it to perform close-contact detail work. It carries flexible payloads rather than being built around one. Greensea IQ has developed custom payload applications for specific measurement requirements, including hull thickness, and is continually developing configurations to solve industry problems as they arise.

Since July 2025, EverClean robots have logged 1,717 hours on customer hulls with each one of these hours fed back into the vehicle and the software.

The Other Side of a Flexible System

Configuration is also usually treated as a hardware question. What other sensor can be attached to the vehicle? There is a second version of this, and it is most significant for a shipyard:

Who is controlling the robot?

EverClean's grooming system was built as a service. Greensea IQ crews show up and operate the robot. For a fleet owner buying hull performance, this model makes sense. The software that allows the vehicle to be agile and carry a different payload is the same software that allows a non-Greensea IQ crewmember to operate it.

This is intentional. An explosive ordnance disposal technician is not a robot engineer, and neither is a survey crew aboard a research vessel. They are trained operators running someone else's machine, often in remote locations. Software written for that user must hold navigation without expert intervention and support an operator at a distance.

Greensea IQ is now developing EverClean as a self-hosted capability. A shipyard receives the robotic system, and Greensea IQ experts train the yard operators and provide engineering support, remotely.

This direction aligns with the path that naval sustainment is taking. The shipbuilding plan is clear about proprietary lock-in on technical data, software, and sustainment information. It commits to making the right to repair and expanding what Sailors can do themselves. Creating the self-hosted operation of a vehicle that can capture a routine dataset provides a solution for these requirements.

The Result

Once the hull produces a consistent condition record, prediction becomes possible. Coating breakdowns become visible while the damaged areas are still minimal. Fouling patterns reveal which parts of the hull need attention. Anomalies that would otherwise wait for the next docking or pose security risks appear sooner in reporting. On an asset that is so valuable operating in such an unforgiving environment, the standard for hull inspections must be higher than an episodic, case-specific assessment.

Proactive assessment is the difference between knowing what a hull looks like and knowing what is really happening. Greensea IQ has been building on this foundation for years.

GreenseaIQ.com/EverClean
+1.802.434.6080 | sales@greenseaIQ.com

Shipbuilding in America @ *The Maritime Industry Museum*

A June 2026 article in the *Maritime Reporter & Engineering News* featured a column from **Rik van Hemmen, CEO, Martin & Ottaway**, reminding readers that New York City was once a hotbed of maritime activity. He called for the industry to reconvene in the city to remind ourselves of the importance of New York maritime history.

The Maritime Industry Museum not only heard the call, but is taking action.

On October 20, 2026, the Maritime Industry Museum at Fort Schuyler will hold its Shipbuilding in America Conference, scheduled to be held in the Maritime Academic Center of SUNY Maritime College. This venue is an ideal spot for executives from industry, academia and government to convene to discuss critical topics affecting the shipbuilding and ship repair sector in and around the United States, with panelists examining shipbuilding and ship repair at the national and regional levels.

Shipbuilding in America Conference 2026

What	U.S. Shipbuilding Conference
Where	The Maritime Industry Museum, 6 Pennyfield Ave., Bronx, NY 10465
When	October 20, 2026
Why	New York City is a traditional maritime powerhouse, with ship and boat owners, ship and boat builders in close proximity, plus the financial, legal and educational support organizations. A keen focus from the U.S. Federal Government to revitalize the entire U.S. maritime market has energized the sector.
Register	**https://maritimeindustrymuseum.betterworld.org/events/shipbuilding-america**

Today, while there is much focus from the Federal Government level on rebuilding the entire U.S. maritime industry, the challenges to rebuild the U.S. shipbuilding sector are steep – led by labor shortages and still-fragile domestic supply chains. But for the first time in more than a generation, there is the political focus paid directly to the industry, with a healthy influx of technology companies bringing new-generation technologies to address the gaps.

These events bring together the shipyards, the suppliers, the labor unions and other key stakeholders to discuss strategies and to coordinate training programs and build a more resilient industrial base. How can we take lessons from the U.S. Navy and transfer them to the commercial sector? We will hear from U.S. shipyards such as **Bayonne Dry Dock** on how it is growing its business while maintaining and growing its workforce. Another panel will examine the SHIPS Act to determine its impact to date.

A discussion on the Shipbuilding and Harbor Infrastructure for Prosperity and Security (SHIPS) for America Act will draw in legal experts to discuss how this critical legislation is impacting the maritime industry. Industry experts will discuss how this act impacts financing ship building, repair, and suppliers. Can we expect growth, and if so, when? How has this legislation impacted the development and upgrades to shipyards? In this setting we will also discuss this history of shipbuilding and ship repair in the New York area. From the Hudson valley region to the New York metropolitan area, New York is a maritime state through and through. How has our past shaped the present and our future?

In a panel led by **Bob Kunkel** we will further explore the industry and what needs to be fixed. According to Kunkel: When two markets blur, their traditional boundaries dissolve, creating overlap where participants, products, or regulations from one market bleed into the other. This "blurring" can be driven by technology, legislation, or evolving customer needs. U.S shipbuilding serves one country as one customer. Far East shipbuilding serves more than twenty. Our shipbuilding capacity does not have to "compete" with China – it is divergence of an incomplete market which has resulted in insufficient allocation of resources. The panel will address the reports of an insufficient trained workforce, the timing of Naval support vessel deliveries opening foreign construction discussions, the development of Vessel construction management (VCM) in both commercial & naval contracts and the effort and technology needed to correct the historic problems before investment occurs in massive capacity growth.

The conference will provide a venue to meet with owners/operators, yards, legal experts, and talent from across the country. This will be an excellent opportunity to meet with cadets and students from SUNY Maritime college to find your next star employee.

LEADING MARINE ENGINEERING & DESIGN. BUILT FOR THE WORLD'S TOUGHEST WATERS.

Seaspan Shipyards is leading the way, across all areas of shipbuilding operations.

Over the past century, Seaspan has grown to become the largest marine engineering and design capability in Canada. From our home on Canada's West Coast, our team works every day to innovate and set the standard for shipbuilding.

Seaspan is proud to support the U.S. Coast Guard's new Arctic Security Cutters. By providing our world-class marine engineering capabilities and state-of-the-art icebreaker designs, Seaspan is strengthening Arctic capacity.

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Innovation

IINO Lines Turns Emerging Technology into Operational Advantage

By Greg Trauthwein

@Sea

Image courtesy IINO Lines

Technology identification, trial and adoption is cornerstone to running an efficient, cost-effective maritime operation. But with the speed of technological change, particularly in regards to Artificial Intelligence (AI), the process is neither straight nor short. We visited recently with **Kenji Togasaki, SVP, Innovation Office, IINO Lines (USA),** who's job it is with his IINO Lines team to scout new technologies and implement them onto the fleet with IINO technical group in Tokyo. Japanese shipowners are renowned globally, world leaders in the design, construction and operation of modern tonnage. Togasaki said that IINO Lines technology adoption is led by decarbonization, autonomy and Digitalization/AI. Particularly, he stressed the importance of autonomous technologies for IINO Lines and the Japanese market as a whole, both of which are facing a future with far fewer mariners.

For most shipowners, innovation is no longer a department — it's a necessity, with the rapid pace of technology evolution on the waterfront that now deliver substantial, quantifiable return on investment. Investing in new commercial ship and boat technology is no longer a side show, it is a business imperative with strategic advantages … if you source, evaluate and deploy the right technologies for your fleet.

INSIDE IINO LINES

For **IINO Lines**, the 127-year-old Japanese shipping company operating approximately 90 vessels across chemical tankers, gas carriers, dry bulk carriers and oil tankers, innovation has become a structured process that touches nearly every aspect of fleet operations. The company's objective is

Kenji Togasaki,
SVP, Innovation Office, IINO Lines (USA)

straightforward: identify technologies early, prove their value through disciplined trials, and scale only those solutions capable of delivering measurable improvements across emissions, efficiency, safety and future workforce challenges.

Togasaki's job is not about inventing new technologies, rather creating a repeatable process for finding the right ones — and separating promising concepts from practical fleet solutions.

"IINO has set three targets in innovation," Togasaki said. "First, decarbonization for net-zero by 2050. Second, autonomous technologies to cope with labor shortage. Third is digitalization using AI."

Those three objectives, he explains, are not independent initiatives. The technologies that attract the most attention are those capable of addressing multiple objectives simultaneously.

BEYOND INDIVIDUAL TECHNOLOGIES

Unlike many corporate innovation programs that chase the latest product demonstration or startup pitch, IINO begins with operational challenges rather than technology itself.

The company asks a simple question: *Does this technology solve more than one problem?*

For example, an AI-powered Carbon Intensity Indicator (CII) simulation platform isn't viewed solely as an emissions tool. It also represents a digital transformation initiative capable of improving voyage planning and operational decision making.

Likewise, autonomous shipping isn't simply about replacing human labor. "It covers all three (IINO Lines) targets," Togasaki said.

Whether the technology involves emissions reduction, operational efficiency or vessel automation, the end goal remains

"IINO has set three targets in innovation. First, decarbonization for net-zero by 2050. Second, autonomous technologies to cope with labor shortage. Third is digitalization using AI."

Watch the full interview with Kenji Togasaki @
MARITIME REPORTER TV

Images on this page courtesy IINO Lines

consistent.

"We believe that technologies will enhance our safety, reliability and efficiency, which are all eventually connected to stakeholders' satisfaction."

That philosophy has become increasingly important as maritime operators confront simultaneous pressure to decarbonize, improve vessel economics and prepare for an aging workforce.

INNOVATION ECOSYSTEM

Despite its long history dating to 1899, IINO does not rely exclusively on internal research.

Instead, Togasaki has built an innovation ecosystem that extends well beyond the company's engineering departments.

His position in New York has allowed him to cultivate relationships with startup companies, venture capital firms and innovation platforms before returning to Tokyo this summer.

"New York has been the best place for me to build relationships with startups, venture capitals and innovation platforms," he said.

But those relationships represent only the beginning of IINO's technology pipeline.

When a potential solution emerges, the company assembles internal stakeholders, including technical and commercial departments, to determine whether the technology aligns with operational needs.

If hardware testing is required, shipyards often become part of the evaluation process.

"Our ecosystem, not only startups and investors but also existing industry community, plays an inevitable role to evaluate new technology," Togasaki said. "So we always collaborate."

It's a process designed to reduce risk while accelerating learning.

SHIPBOARD TRIAL

Innovation inside commercial shipping rarely happens overnight.

For IINO Lines, every technology follows a structured evaluation path before reaching the fleet. The process begins with sourcing opportunities through startup networks, venture capital partners or industry contacts. Next comes an initial screening that evaluates both technical feasibility and commercial fit.

From there, technologies undergo more detailed analysis involving data review, simulations and stakeholder evaluation before moving to pilot deployments aboard selected vessels.

Only after proof-of-concept testing does the company determine whether broader implementation makes business

sense. "The timeline typically ranges from a few months to over a year," Togasaki explained. Not surprisingly, software solutions generally move through the process much faster than hardware installations. Physical equipment often requires extended shipboard testing before investment decisions can be made.

LEARNING BY TRIAL

As anyone in any technology space can attest, not every pilot succeeds, and Togasaki is candid about that reality. "We have done plenty of POCs with startups," he said. "To be honest, not every time is successful, but every time we learn something."

That willingness to experiment — and occasionally fail — has already produced tangible operational gains.

On the digital side, IINO has implemented **AI-based CII optimization tools** along with compliance platforms supporting both the EU Emissions Trading System and FuelEU Maritime regulations. According to Togasaki, these systems have significantly improved emissions management while simultaneously increasing operational efficiency. Hardware initiatives are also beginning to show measurable returns.

The company has installed **Norsepower rotor sails** aboard gas carriers and dry bulk vessels, where performance data continues to be monitored. "We are observing significant effect," he said. While decarbonization initiatives have produced the strongest measurable outcomes so far, IINO is beginning to see broader operational improvements as newer technologies mature. Among those are **hull-cleaning robots** and **AI-enabled camera systems** designed to reduce crew workload while improving onboard safety.

PREPARING FOR A DIFFERENT WORKFORCE

Although emissions dominate many maritime technology discussions, Togasaki believes another challenge will ultimately prove even more significant: Finding enough qualified mariners.

"The real challenge our industry is facing is labor shortage," he said. "The statistics are there."

For that reason, **autonomy has become one of IINO Line's Innovation Office's highest priorities.** While fully autonomous oceangoing ships remain years away, IINO is already investing in technologies that automate individual onboard tasks. Hull-cleaning robots reduce labor-intensive maintenance work. AI-powered cameras provide additional situational awareness. Together, these systems represent building blocks for future autonomous vessel operations.

"Those are very important elements for the future of autonomous shipping," Togasaki said.

But achieving that future will require far more than individual technologies. "We need more collaboration with startups, corporates and regulators."

Regulatory development, in particular, will determine how quickly autonomous technologies transition from demonstrations to commercial deployment.

Oceanus Aurora **with installed rotor sails.**

© Norsepower

AI MOVES BEYOND BUZZWORD

Few topics dominate technology discussions today more than artificial intelligence, and Togasaki sees enormous potential for AI throughout maritime operations. “I’m a big fan of AI,” he said. “I use it every day.”

He believes the maritime industry’s adoption curve will mirror the rapid transformation already occurring in everyday business.

“If you look at how fast things are changing by AI in our daily life, I am pretty sure the same thing will happen in the maritime industry.” One area receiving particular attention is marine engineering. Modern vessels continuously generate enormous volumes of operational information. According to Togasaki, new ships can produce approximately 3,000 engine data points every minute. Collecting information, however, is only the first step. The challenge lies in converting raw numbers into actionable operational intelligence.

“We need to analyze it and turn it into meaningful data like predictive maintenance and fuel efficiency,” he said.

Historically, those decisions depended largely upon experienced marine engineers.

Increasingly, AI may provide another analytical layer capable of identifying patterns invisible through traditional monitoring.

INNOVATION AS A COMPETITIVE DISCIPLINE

For IINO Lines, innovation is not measured by the number of technologies evaluated. It is measured by disciplined decision making. Every startup meeting, pilot installation and proof-of-concept trial ultimately serves the same purpose: determining whether a technology can improve fleet performance in measurable ways.

» **Some projects shorten fuel consumption.**
» **Others prepare crews for a future of increasing automation.**
» **Still others convert growing streams of vessel data into better operational decisions.**

Viewed individually, each project addresses a specific challenge. Viewed collectively, they represent something larger: a systematic approach to ensuring that a traditional shipping company remains competitive in an industry undergoing rapid technological transformation.

For Togasaki, the formula remains remarkably consistent.

- **Find promising technologies early.**
- **Test them rigorously.**
- **Learn from every trial.**
- **Scale only what delivers real operational value.**

CRITICAL MINERALS AT SEA:

BATTERY SUPPLY CHAINS BECOME AN INVESTMENT QUESTION

By Alisa Reiner

Batteries have become a practical part of maritime decarbonization. They are used on ferries, harbor craft, tugs, offshore support vessels, crew transfer vessels, various types of remotely operated vessels, and hybrid ships to reduce fuel burn, provide spinning reserve, support dynamic positioning, enable peak shaving, and allow zero-emission operation in port. As of mid-2026, 156 different maritime battery systems from 118 manufacturing companies are commercially available. Notably, systems are becoming more energy dense, lighter and more compact, supporting wider maritime adoption – for a 288.26 m³ energy storage system (ESS), weight intensity has fallen from around 13 t/MWh for a 2016 NMC system to 9.25 t/MWh for a 2019 LFP system and 5.9 t/MWh for a 2024 NMC system. Today, 1392 battery-powered vessels are in operation, 466 on order (Figure 1).

However, the business case extends beyond vessel design and charging infrastructure to include the security of battery supply chains, which depend on battery chemistry and, ultimately, on critical minerals.

The term is often misunderstood. “Critical minerals” is not a geological category but a strategic definition. A material becomes “critical” when it is important for an economy, technology, or national security, while its supply chain is vulnerable to disruption. Critical minerals should also not be confused with rare earths – these are one specific group of elements, while critical minerals vary by country, technology, and market context.

For batteries, the focus is on generally recognized critical minerals – lithium, nickel, cobalt, manganese, graphite, phosphate, and titanium, depending on chemistry. As battery costs continue to fall, the concentration of production and processing capacity, along with price volatility, remains a key risk for investors and developers.

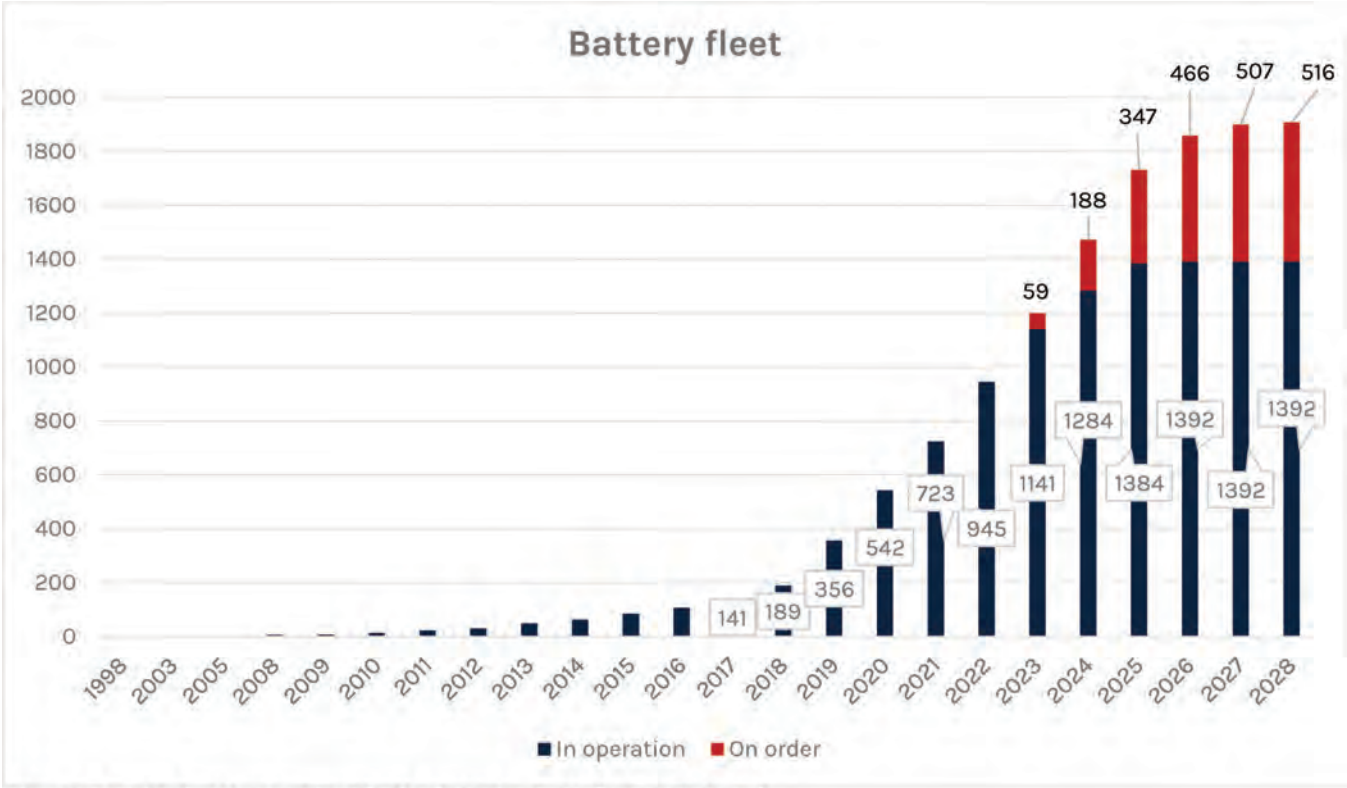

Figure 1. Li-ion battery and critical mineral prices: five-year trend.
Source: Intelatus Global Partners' interpretation of DNV Veracity data.

Table 1. Most common battery chemistries in maritime applications

Battery chemistry	Key materials	Advantages	Disadvantages
LFP	Lithium, iron, phosphate, graphite anode	Lower cost, no cobalt or nickel, strong safety profile, long cycle life	Lower energy density than NMC, exposure to China-centered supply chains of lithium and graphite, exposure to lithium price shocks
NMC	Lithium, nickel, manganese, cobalt, graphite anode	Higher energy density, mature technology, useful where space and weight are constrained	Exposure to China-centered supply chains and commodity price volatility, higher cost, greater thermal-management needs
LTO	Lithium titanate anode, usually paired with lithium-manganese-oxide (LMO) or NMC cathodes	Fast charging, long cycle life (can last for a vessel's entire lifetime, high power; strong safety and low-temperature performance	Lower energy density, higher upfront cost, still depends on cathode materials

Chemistries That Matter at Sea

Mostly commonly used ones – lithium-ion (Li-ion) batteries – are not a single technology. At sea, three types are particularly relevant – lithium iron phosphate (LFP), nickel manganese cobalt oxide (NMC), and lithium titanate oxide (LTO) (Table 1).

LFP cuts nickel and cobalt exposure but still depends on lithium, graphite, cell manufacturing, and Chinese LFP know-how; NMC delivers higher energy density but increases exposure to volatile nickel and cobalt markets; LTO suits high-cycle maritime use because of fast charging and long life, though it is more specialized and costly. Hence, chemistry is a major supply-chain choice

Supply Chain Risk Is Not Only About Material Availability

A key vulnerability in the battery value chain is dependence on a limited number of countries supplying raw and processed critical materials. In cobalt, 74% of global mine production is concentrated in the Democratic Republic of Congo – much of it developed with the help of China's investment over the last 15 years. Any regulatory, (geo)political, logistics, or natural disaster, such as the Ebola epidemic, disruption in the country, can affect physical availability and global prices.

Lithium and nickel (cathode materials, like cobalt) supply chains also remain highly concentrated (Figure 2). While lithium has diversification potential by 2030, copper faces a growing risk of future shortages unless timely investment offsets strong demand growth and declining output from existing mines. By 2030, in a conservative scenario, lithium demand could grow by 122%, cobalt by 42%, and nickel by 30%.

Graphite is also a major bottleneck. It is the basic anode material for most Li-ion batteries, including both LFP and NMC. This means that switching between battery chemistries may reduce cobalt and nickel exposure, but it does not eliminate graphite dependence. Chinese companies account for up to 80% of global natural graphite production. Meanwhile, demand for battery-grade graphite could grow by more than four to six times by 2035.

Another layer of vulnerability is processing and component manufacturing. Even where raw materials are mined elsewhere, much of the value-added processing happens in China. According to different estimates, China represents 60% to 90% of global installed cathode active material manufacturing capacity and more than 90% of anode material production. Even in recycling, China is expected to maintain a dominant position, accounting for over 80% of global pre-treatment and 75% of material recovery capacity by 2030.

The scale of this concentration is also evident in installed manufacturing capacity. Global Li-ion battery cell and ESS nameplate capacity exceeded 4 TWh by the end of 2025, with China accounting for the largest regional share (Figure 3). This dominance is reinforced by China's broader strategy to control critical mineral supply chains through the Belt and Road Initiative (BRI) – up to 2021, Beijing provided nearly $57 billion in aid and subsidized credit for transition-mineral projects across 19 BRI countries. Most of this financing supports assets in which Chinese firms have direct stakes – 83% of official financing for transition-mineral operations in developing countries went to mining sites partly or wholly owned by Chinese companies. Critical minerals also feature prominently in China's recently announced 15th Five-Year Plan, where they are positioned as central to scientific and technological innovation, self-reliance, and industrial leadership.

To note – capacity located in a country is not the same as that controlled by local producers. In China and Korea, most installed capacity belongs to domestic companies. In the European Union and the United States, the share of local produc-

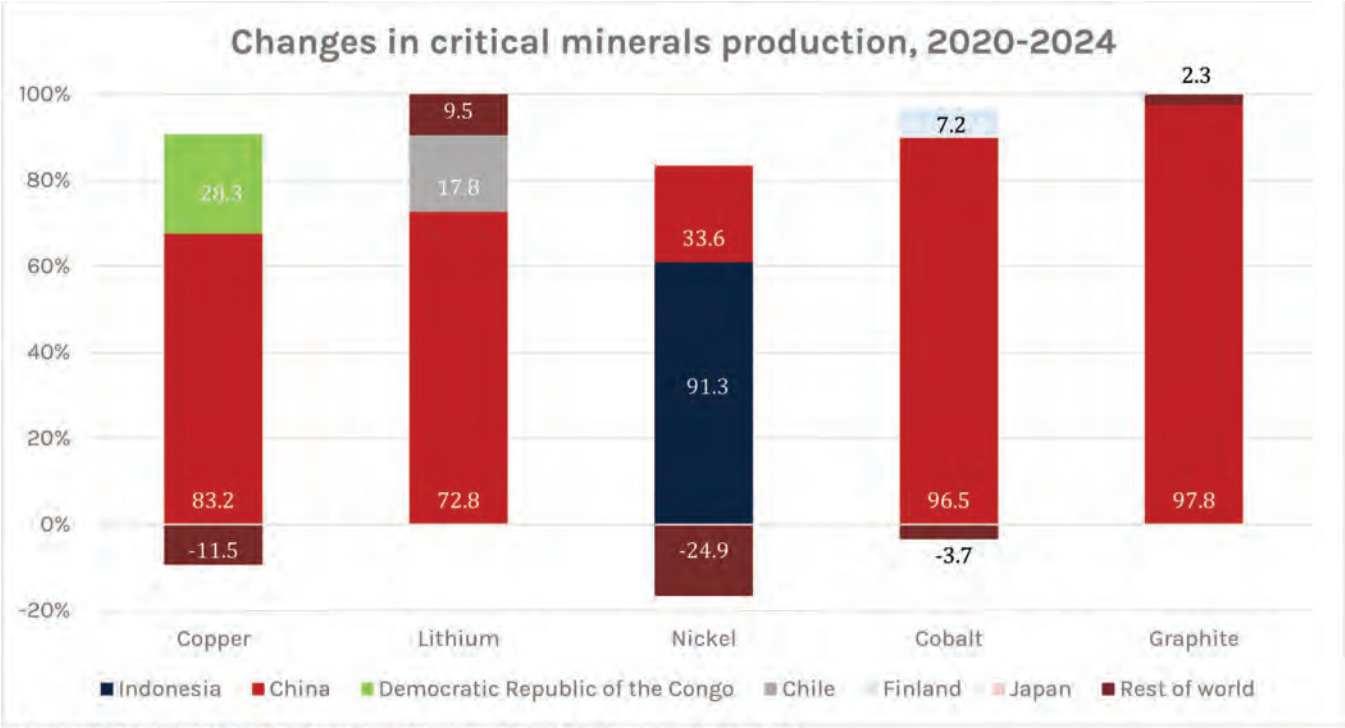

Figure 2. Changes in critical minerals production by region, 2020-2024
Source: Intelatus Global Partners' own calculations, based on interpretation of S&P Global, Bloomberg NEF, and IEA data.

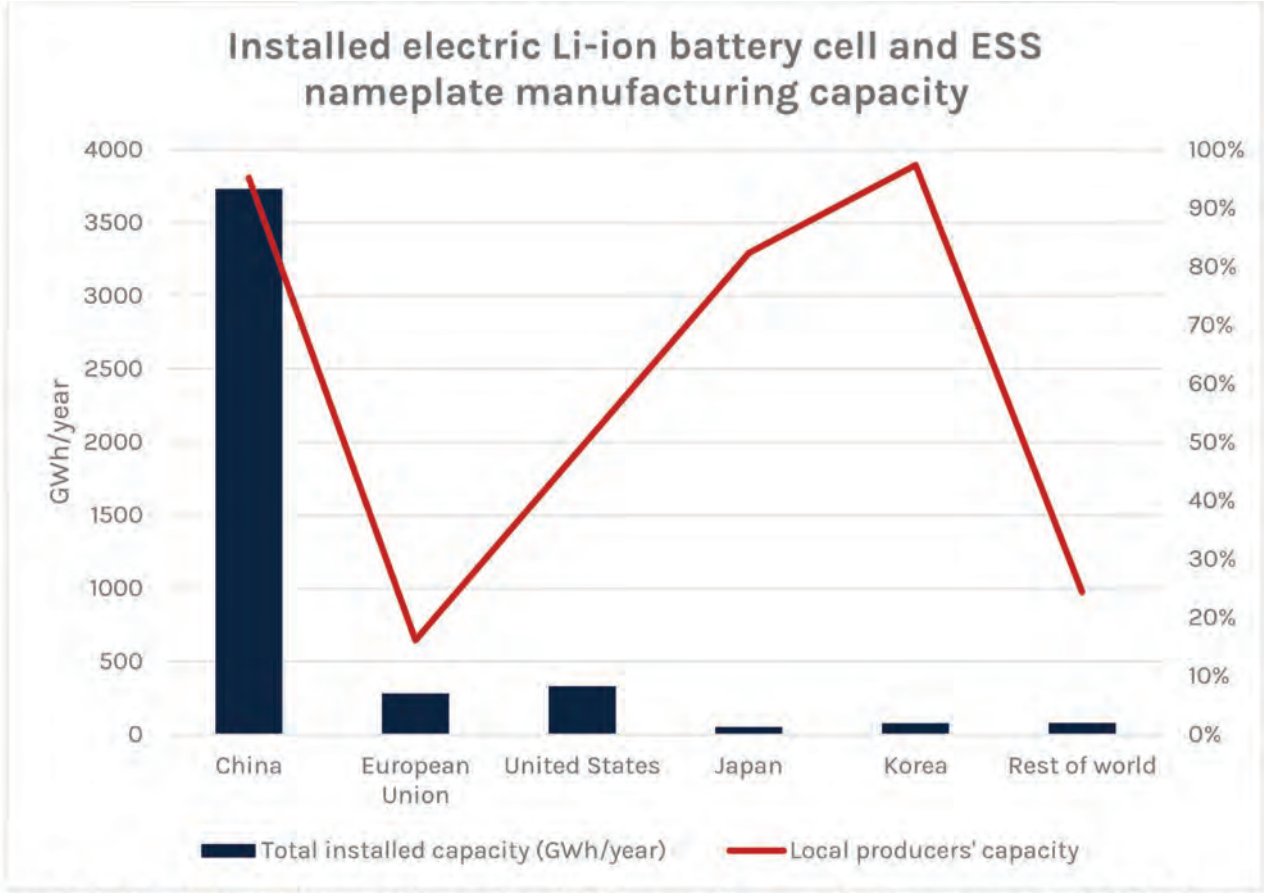

Figure 3. Installed electric Li-ion battery cell and ESS nameplate manufacturing capacity in 2025, by region.
Source: Intelatus Global Partners' interpretation of IEA data

ers is much lower.

Therefore, the relevant question is not only where lithium, cobalt, nickel, or graphite are mined. It is also where they are refined, processed into battery-grade materials, and assembled into cells, as well as which companies and investors ultimately control these stages of the value chain and what the trends are going forward.

Prices Are Falling, But Volatility Has Not Disappeared

Battery prices have continued to decline (Figure 4). Chemistry shifts, process improvements, and intense competition have pushed pack prices downward, especially for LFP systems, which avoid cobalt and nickel and benefit from China's production scale. In 2025, average battery prices fell by around 8%, with the average Li-ion pack price standing at $108/kWh.

However, declining prices do not eliminate primary materials supply-chain risk. Battery prices are exposed to shocks in commodity markets driven by supply shifts, geopolitical tensions, and other "black swans." A sustained supply shock for battery metals could increase global average battery pack prices by as much as 40-50%.

What This Means for Maritime Investors

First, maritime players need to pay closer attention to supply-chain localization and resilience. The objective is not full self-sufficiency, which is unrealistic, but the reduction of critical bottlenecks. This can be achieved through technological diversification, broader supplier networks, and, where possible, long-term supply contracts guarding from mineral price volatility. Another possibility is participation in mining projects in third countries, including through minority equity stakes or strategic offtake agreements.

Second, recycling is becoming an investment theme, though it is not a near-term fix for mineral dependence. In the short term, feedstock remains limited because many batteries have not yet reached the end of life. Yet, over time, recycling can reduce exposure to primary mineral markets and create opportunities in collection, dismantling, and recovery of critical materials. Battery recycling could supply 20-30% of lithium, nickel, and cobalt demand by 2050.

Third, investors should monitor technology diversification. Two trends matter – new battery types with different material profiles, including sodium-ion, lithium-sulfur, and solid-state batteries, and higher energy density in existing chemistries. Sodium-ion could reduce dependence on lithium and nickel in some applications, though it still faces energy-density and scale-up limits. Lithium-sulfur and solid-state systems promise higher energy density – the latter prototypes have already reached energy density around twice today's Li-ion levels and improved safety but remain too early-stage for commercial deployment.

Don't Look at the Lowest Price

Batteries are becoming increasingly attractive for maritime and offshore applications, but the sector should not treat them as plug-and-play commodities. Strategic risk is moving upstream

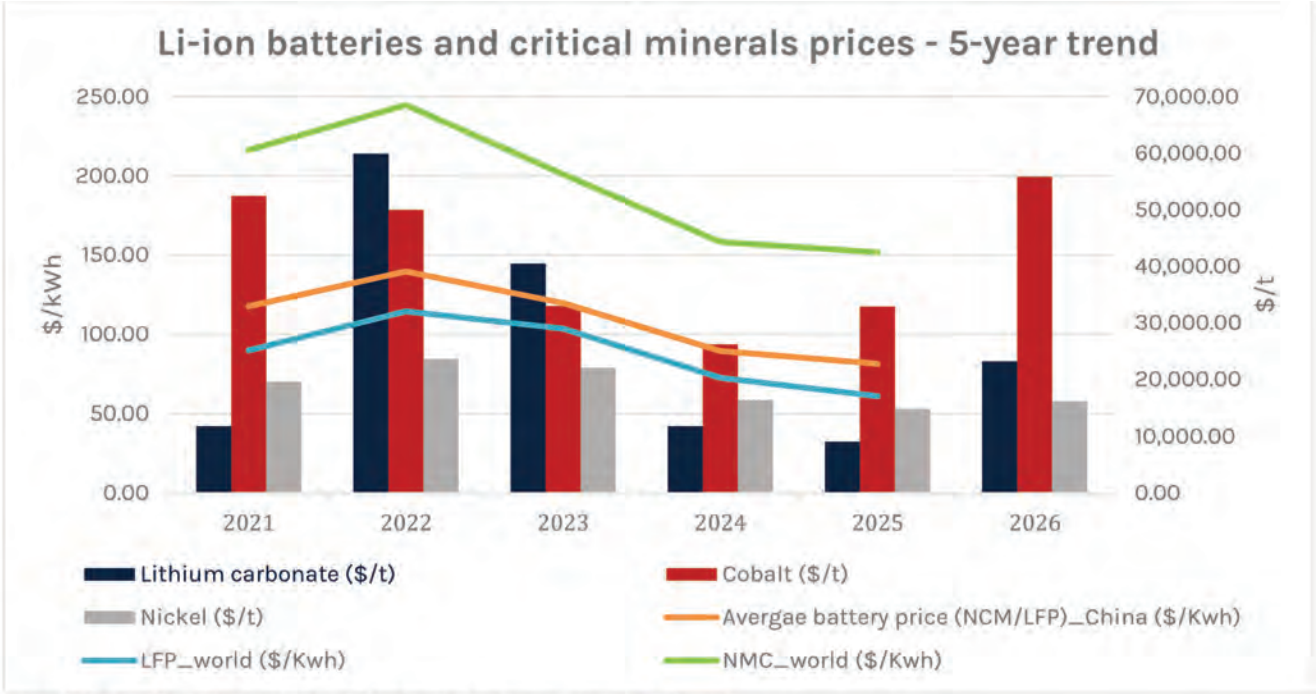

Figure 4. Li-ion battery and critical mineral prices: five-year trend.
Source: Intelatus Global Partners' own calculations, based on interpretation of S&P Global, Bloomberg NEF, and IEA data.

– LFP, NMC, and LTO each offer useful maritime pathways, but each carries different exposure to critical materials production and processing concentration and commodity markets volatility.

For owners, shipyards, and investors, the conclusion is straightforward – don't focus purely on the lowest price per kWh but on supply-chain resilience. Assessing supplier bankability, replacement strategy, and contract structure should underlie project due diligence. The strongest investment cases will combine operational logic, secure procurement, diversified suppliers, and technology flexibility.

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Top 25 Leading Companies in the Battery Metals Market

1. Albemarle Corporation SQM (Sociedad Quimica y Minera de Chile)
2. Livent Corporation (Allkem now part of Arcadium Lithium)
3. Arcadium Lithium Ganfeng Lithium Co., Ltd.
4. Tianqi Lithium Corporation
5. Pilbara Minerals Limited
6. Sigma Lithium Corporation
7. Mineral Resources Limited
8. Lithium Americas Corp.
9. Piedmont Lithium Inc.
10. AMG Advanced Metallurgical Group
11. Glencore plc
12. Vale S.A.
13. BHP Group
14. Rio Tinto Group
15. First Quantum Minerals Ltd.
16. Norilsk Nickel (Nornickel)
17. China Molybdenum Co., Ltd. (CMOC Group)
18. Zijin Mining Group Co., Ltd.
19. Eurasian Resources Group (ERG)
20. Western Areas Ltd. (now part of IGO Ltd.)
21. IGO Limited
22. Talga Group Ltd.
23. Umicore S.A

Source: Spherical Insights

DESIGNING THE FUTURE AMERICAN ICEBREAKING

Inside Seaspan Shipyards' efforts to help accelerate the U.S. Coast Guard's Arctic Security Cutter program.

By Greg Trauthwein

For decades, conversations about rebuilding the United States Coast Guard icebreaker fleet have largely centered on budgets, politics and the strategic necessity of maintaining a credible presence in the Arctic. Less frequently discussed is perhaps the most critical ingredient of all: engineering maturity.

Building a modern heavy icebreaker is among the most technically demanding challenges in commercial or naval shipbuilding. Hull forms must balance open-water efficiency with brutal icebreaking capability. Propulsion systems must survive impacts measured in hundreds of tons. Every mechanical, electrical and structural system must function in some of the harshest operating environments on earth. Success depends not simply on building ships, but on getting the engineering right before the first steel is cut.

That reality explains why one of the most consequential elements of the U.S. Coast Guard's Arctic Security Cutter (ASC) program is occurring largely behind the scenes.

While Rauma Marine Constructions in Finland and Bollinger Shipyards in the United States will also construct the Arctic Security Cutters, much of the engineering foundation comes from Canada's Seaspan Shipyards and its experienced engineering team led by **Senior Vice President of Engineering Jim Carr.** Through a licensing agreement built around Seaspan's Multi-Purpose Icebreaker (MPI) design, the Coast Guard is leveraging years of engineering development instead of beginning with a clean sheet of paper, a decision that could significantly reduce technical risk while accelerating delivery.

For Carr, the project represents the culmination of a career spent designing some of the most complex naval platforms ever built.

FOUR DECADES OF DESIGNING COMPLEX WARSHIPS

Carr's résumé reads like a history of modern naval shipbuilding. Beginning his career at Bath Iron Works, he worked on the Arleigh Burke destroyer program, managed the Flight IIA upgrades, helped lead engineering on the LPD-17 amphibious transport dock, served as technical director on the Littoral Com-

*My mentor, **Fred Harris**, had a mantra:*

"You finish the design, you finish the plan, then you build."

All projects live and die by the types and amount of changes along the way.

Jim Carr, SVP, Seaspan Shipyards ►

bat Ship program, and later relocated to Australia to help establish the engineering organization supporting the Hobart-class Air Warfare Destroyer program.

Today, at Seaspan Shipyards in Vancouver, Carr has overseen an equally dramatic transformation.

"When I arrived, engineering consisted of roughly 20 people," Carr said. "Today we have approximately 300 engineers. We've become what I believe is the largest marine engineering organization in Canada."

That growth mirrors Canada's National Shipbuilding Strategy (NSS), which has evolved Seaspan from a regional commercial shipbuilder into one of North America's premier designers and builders of complex government vessels.

The company's engineering backlog now stretches well into the next decade, encompassing Offshore Fisheries Science Vessels, Offshore Oceanographic Science Vessels, Joint Support Ships, Canada's future Polar Icebreaker, and ultimately as many as 16 Multi-Purpose Icebreakers under the Canadian Coast Guard program.

It was this engineering maturity — not simply an existing hull design — that attracted the attention of the U.S. Coast Guard.

MORE THAN AN "OFF-THE-SHELF" DESIGN

The phrase "off-the-shelf" often oversimplifies complex naval acquisition programs.

In reality, the Coast Guard is receiving far more than drawings.

By the time Seaspan licensed its MPI design to support the Arctic Security Cutter program, Carr explained the engineering package had already progressed well beyond conceptual design.

The design had completed class approval. Major equipment selections had been finalized. Technical procurement specifications covering roughly 100 major equipment packages had been completed. Material definitions were established, and the three-dimensional production model had already advanced to what Carr describes as "production-ready."

In practical terms, the engineering package represented nearly 47,000 individual technical information files transferred to the two ASC builders.

"It gave them a tremendous head start," Carr said.

Rather than recreating years of engineering work, Bollinger and Rauma Marine Constructions can focus their efforts on adapting the production information to their own shipyard processes.

That distinction is important. Every shipyard builds differently. Production drawings, sequencing and fabrication methods are highly specific to each facility, but starting from a mature design significantly reduces engineering uncertainty.

ENGINEERING BEGINS LONG BEFORE CUTTING STEEL

One of the recurring themes throughout Carr's career is that successful shipbuilding begins long before construction starts. His philosophy echoes lessons learned from legendary Bath Iron Works executive Fred Harris. ***"Finish the design. Finish the plan. Then build."***

Carr believes that disciplined engineering remains the single greatest predictor of shipbuilding success. For the Arctic Security Cutter program, that means resisting the temptation to continually refine or expand requirements once construction begins.

Every experienced shipbuilder knows what happens when programs become consumed by change orders: Schedules slip; Costs escalate; Learning curves reset.

Carr believes the Coast Guard has largely avoided that trap.

Rather than pursuing extensive redesigns, the service has deliberately limited changes to those that can be incorporated without disrupting production, while reserving more substantial capability upgrades for post-delivery modernization efforts.

That discipline may ultimately prove as valuable as any engineering innovation.

DIGITAL SHIPBUILDING COMES OF AGE

The engineering tools supporting Seaspan's current programs differ dramatically from those Carr used earlier in his career. The company's philosophy can be summarized in three words:

"Digits to steel."

Every vessel is fully modeled in three dimensions before production begins.

The engineering model is directly integrated into the Product Lifecycle Management (PLM) system, creating a complete digital thread from design through manufacturing. Bills of material, planning information, work packages and installation sequencing remain digitally connected throughout construction.

Supervisors carry tablets directly onto the shop floor, allowing them to interrogate the model, review work orders, verify dimensions and immediately resolve engineering questions without relying solely on traditional drawings.

Dimensional control employs laser surveying and total station technology to ensure individual blocks fit precisely during assembly.

Carr offered a recent example involving equipment supplied by Babcock for Canada's Joint Support Ship program. Rather than simply accepting manufacturing deviations, the engineering team verified the installation using digital survey data before proceeding.

That same attention to detail becomes exponentially more important on icebreakers, where massive hull structures, heavy scantlings and tightly integrated propulsion systems leave little room for accumulated error.

LEARNING FROM FINLAND

Another strength of the Seaspan approach lies in recognizing where additional expertise already exists.

Rather than attempting to develop every aspect of icebreaker engineering independently, Seaspan partnered early with Finnish specialists.

Railo Technology (Railotech) [formerly known as Aker Arctic] is a Finnish organization that brought decades of experience optimizing icebreaking hull forms.

Engineering partner Elomatic contributed detailed design knowledge while simultaneously serving as a training ground for Canadian engineers.

Seaspan embedded engineers within Finnish design teams, allowing them to absorb practical experience before returning to Vancouver.

Today, those engineers form the core of Seaspan's internal icebreaker expertise while Finnish personnel continue supporting construction activities in Canada.

That technology transfer may prove one of the program's most enduring benefits.

BUILDING COMMONALITY INTO THE FLEET

Carr also emphasized the importance of one particular engineering objective: standardization.

While engines and mission-specific systems naturally differ between Canada's Polar Icebreaker and Multi-Purpose Icebreaker designs, Seaspan deliberately sought commonality wherever

"We call it 'digits to steel.' We are fully 3D modeled... It's a fully integrated connectivity that allows manufacturing to interrogate the model and execute as quickly as possible."

practical. Approximately 40 percent of major engineered equipment packages are standardized between programs. Among commercial components—valves, fittings, flanges, fasteners and similar hardware—the commonality approaches 90 percent.

Icebreakers routinely remain in service for four or five decades, and standardized components simplify logistics, reduce spare parts inventories, streamline maintenance training and lower lifecycle costs throughout the fleet.

Carr believes similar commonality between Canadian and American fleets could eventually create operational advantages for both nations as Arctic cooperation continues to expand.

AN EXPANDING GLOBAL ICEBREAKER MARKET

Philip Lewis, Director of Research at Intelatus, views the Arctic Security Cutter program within a much larger global context. According to Intelatus' recent global icebreaker market assessment, approximately 70 to 80 polar and sub-Arctic icebreakers are currently planned, under construction or moving toward procurement worldwide.

The primary drivers are clear:

- **Aging North American, Baltic and Russian fleets requiring replacement.**
- **Expanding Arctic commercial shipping.**
- **Increased geopolitical competition.**
- **Growing demand for scientific research.**
- **Natural resource development.**
- **Rising national security concerns.**

Russia continues expanding both conventional and nuclear-powered icebreaker fleets. Canada's National Shipbuilding Strategy remains one of the world's largest government icebreaker construction efforts. Finland and Sweden are modernizing aging Baltic fleets.

Meanwhile, interest continues growing across Asia as China, Japan and South Korea position themselves for increased Arctic operations.

For suppliers specializing in propulsion, steel, machinery, electronics and cold-weather technologies, the market extends well beyond North America.

ENGINEERING AS STRATEGIC CAPABILITY

Ultimately, the Arctic Security Cutter program illustrates something larger than a single shipbuilding contract. Modern naval construction increasingly depends upon engineering capability as much as industrial capacity.

The transfer of nearly complete digital ship designs, validated procurement specifications, mature production models and decades of accumulated engineering knowledge represents an entirely different approach than beginning each program from scratch.

For the United States, that strategy may compress schedules while reducing technical risk.

For Seaspan, it validates years of investment in engineering capability under Canada's National Shipbuilding Strategy.

And for Jim Carr, it reinforces a lesson learned across more than four decades designing warships on three continents: Technology matters; Digital tools matter; and Supply chains matter.

But disciplined engineering—and resisting unnecessary change—remain the foundations of successful shipbuilding.

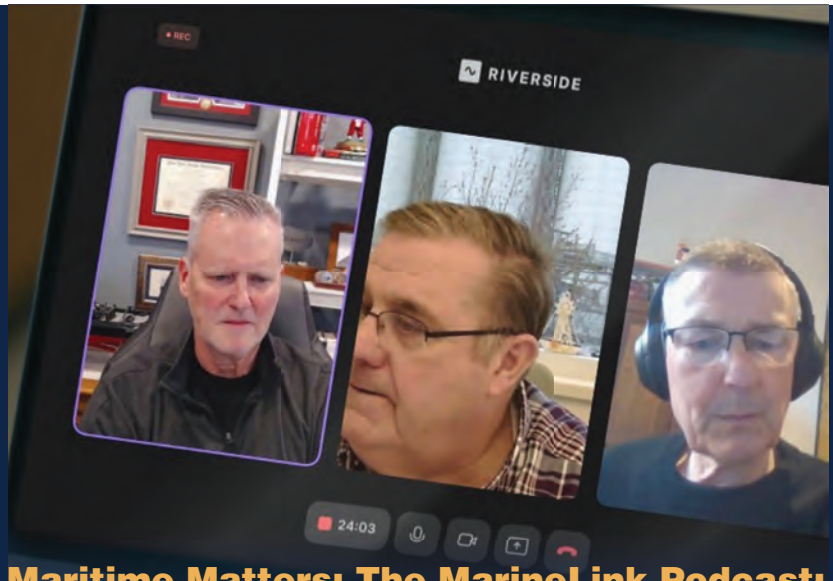
As America works to rebuild its Arctic presence, one of its greatest competitive advantages may already exist, not in steel, but in the engineering expertise quietly flowing from Vancouver to Finland and ultimately into U.S. shipyards.

If that expertise helps deliver capable Arctic Security Cutters faster and with fewer surprises, the international partnership behind the program could become a model for future complex naval construction programs well beyond the ice.

"There are probably 70 to 80 polar-class and sub-Arctic icebreakers either under construction, committed or planned worldwide. These are billion-dollar assets that feed an entire supply chain."

► Philip Lewis,
Director of Research, Intelatus

MARITIME MATTERS:
The MarineLink Podcast



Watch the full interview on Maritime Matters: The MarineLink Podcast: The quest to rebuild the U.S. icebreaker fleet is an international affair, and part of the project centers on Jim Carr, SVP Engineering, Seaspan Shipyards, and his team that is serving as a design and expertise hinge for construction of the USCG Arctic Security Cutter (ASC) program to be built at Rauma Marine Constructions and Bollinger Shipyards. Carr has had a long and distinguished career across major U.S. Navy shipbuilding programs, and he shares with Maritime Matters insights on the promise and challenges; while Philip Lewis, Director of Research, Intelatus, provide depth and breadth to global icebreaker design, supply chain logistics and construction.

Bubble Robotics has received pre-seed funding for the development of its fleet of intelligent robotic systems capable of operating continuously at sea for months.

MISSION AND AUTO

-READY

ONOMOUS

Greater vehicle sophistication is pushing surveys and offshore energy inspections further towards autonomy.

By Wendy Laursen

This HUGIN AUV can operate at depths of up to 6,000 meters, collecting high-resolution data.

Source: Jørgen Ramse Vadla

XOCEAN acts as a global ocean data delivery partner, providing full scope geophysical, geotechnical and environmental data.

Source: Midgard Infra

When the Norwegian Offshore Directorate set its new HUGIN autonomous underwater vehicle (AUV) to work in June, there was a moment's reflection on the fact that deep sea areas have actually been mapped since the 1800s. In the early days, simple weights were used to measure water depth and give the first indications of subsea structures and seabed morphology. There have been substantial technological developments since then.

Philip Lewis, Director of Research at Intelatus, has been analyzing the latest AUV and unmanned surface vessel (USV) developments in the offshore energy sector, including the increase in data-as-a-service deals for specific projects rather than long-term robotics ownership. For example, XOCEAN acts as a global ocean data delivery partner, providing full scope geophysical, geotechnical and environmental data to support offshore development and operations.

Simplicity is also making way for more complex, project-focused solutions. "In commercial applications, if you're deploying a small system, it may only be able to do one function, let's say bathymetric survey. You may need two or three passes to complete the survey, along with other vehicles to get the complete picture. Now, some of the bigger, more capable USVs that are available can deploy an ROV as well, so they can do the bathymetric hydrographic survey as well as the geophysical survey. You can do more with one vehicle, and you can use it to extend the range of manned vessels while reducing costs and emissions."

He cites Fugro's Blue Essence USVs which have been used alongside traditional crewed vessels. They can act as a "force multiplier" offshore or handle survey tasks in shallower water close to shore.

Another example of the growing sophistication in autonomous systems that Lewis describes is OceanAlpha's new 24-meter-class V180 USV–ROV system which is designed to support deep and offshore subsea operations. It integrates a DP2-enabled offshore USV with a work-class ROV for subsea inspection, maintenance, and repair missions. The USV features a dual-moonpool configuration and an open deck layout suitable for flexible deployment of a wide range of mission modules.

The system supports subsea operations at depths of up to 3,000 meters and offers an endurance of up to 30 days, while allowing rapid transition between deep-sea engineering, subsea surveying, and oceanographic research missions. Additionally, operators can control both the USV and the deployed ROV from an onshore control center.

Saipem is hitting the 3,000-meter mark with its most advanced AUV, Flatfish, which has now undergone functional acceptance tests with Petrobras. FlatFish has been developed as part of Saipem's underwater robotics program aimed at industrializing a family of underwater robots capable of performing complex, autonomous inspection tasks.

Throughout the tests campaign, Flatfish executed multiple fully autonomous inspection missions including structure and pipeline inspections, cathodic protection measurements and wall-thickness assessments. Following the positive tests outcome, Petrobras has been able to grant approval to proceed with the final phase of the project which aims at the full implementation of FlatFish in the ultra-deep waters of Brazil.

Navigation ability is critical to these advances, and Sweden's Njord Survey has chosen Sonardyne navigation technology

OceanAlpha's new 24-meter-class V180 USV–ROV system integrates a DP2-enabled offshore USV with a work-class ROV.

for its ecoSUB Robotics AUVs. Using Sonardyne's smallest navigator, SPRINT-Nav U, on ecoSUB's low-logistics AUVs, Njord Survey is expecting that deployment at scale will enable parallel operations, reducing vessel dependency, logistics, cost and time. Combining detection and verification and allowing re-tasking, with the same easily transportable platforms, also means surveys can be delivered faster and more flexibly, without compromising data quality.

Iain Vincent, Director & General Manager, at ecoSUB Robotics, says, "With SPRINT-Nav U providing reliable, survey-grade navigation into our one-person-portable AUVs, we've been able to move from standard, off-the-shelf designs to a more engineered, project-focused approach. This means creating vehicles that can carry high-quality payloads, operate independently and adapt to evolving customer needs. Together with Njord survey, we're transforming small AUVs into scalable, primary survey platforms."

Eni and Fincantieri subsidiary IDS – Ingegneria dei Sistemi have partnered on the commercialization of Clean Sea, Eni's proprietary underwater robotic system designed to monitor marine ecosystems and subsea infrastructure. The agreement initially focuses on inspection work for subsea carbon capture and storage projects. Clean Sea is based on hybrid ROV/AUV system that can be used in remote-controlled form, from a support vessel or in fully autonomous mode.

The system incorporates interchangeable modular payloads which combine instruments and sensors tailored to specific monitoring and inspection tasks—including water sampling, detailed visual analysis and 3D acoustic reconstructions. The technology will be integrated with various autonomous plat-

Source: Sonardyne

Sweden's Njord Survey has chosen Sonardyne navigation technology for its ecoSUB Robotics AUVs.

Saipem's AUV, Flatfish, has now undergone functional acceptance tests with Petrobras.

Source: Saipem

Clean Sea is Eni's proprietary underwater robotic system designed to monitor marine ecosystems and subsea infrastructure.

Exail Technologies' DriX O 16 USV has an operational endurance of up to 30 days and a range of approximately 3,500 nautical miles.

Source: Exail

forms developed by Fincantieri to broaden its scope into other applications and to allow for scale-up of production volumes.

Endurance is a critical consideration for subsea cable installation, and Exail Technologies announced an order in April for its transoceanic DriX O 16 USV from OMS Group, an international civil player in digital infrastructure and subsea cables. The order follows an initial acquisition made in 2025, and it will be deployed for survey missions related to subsea cable installation, including bathymetric surveys, route verification and the monitoring of telecommunications infrastructure. It has an operational endurance of up to 30 days and a range of approximately 3,500 nautical miles. The DriX O 16 can be supervised remotely from an operations center in Singapore.

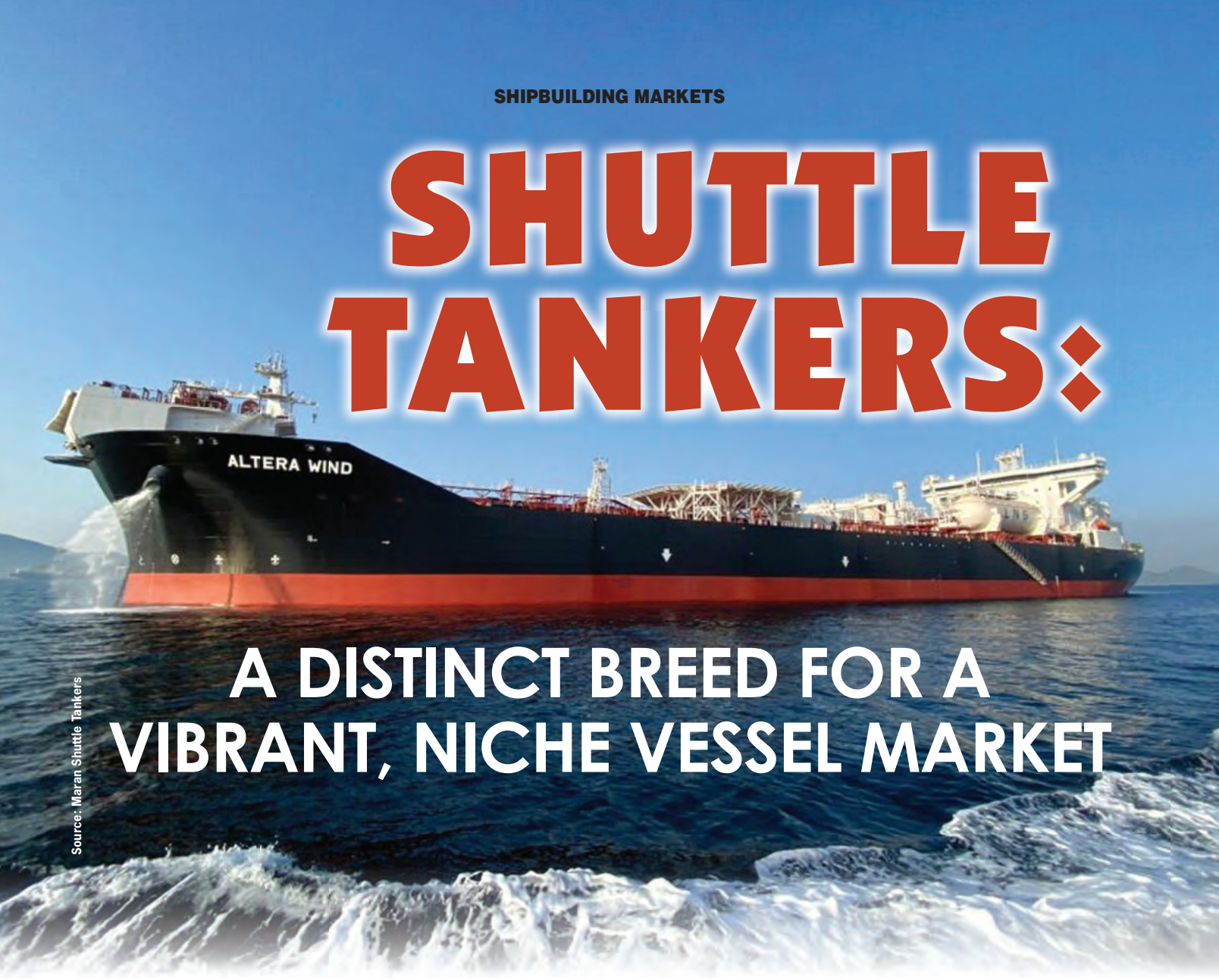
The robotic options continue to grow. Bubble Robotics has received pre-seed funding for the development of its fleet of intelligent robotic systems capable of operating continuously at sea for months, without the need for human intervention. Today, says CEO Jean Crosetti, offshore operations rely on vessels, crews and heavy equipment costing up to $100k per day. Yet, the industry faces a structural workforce shortage, with 600,000 additional professionals needed by 2030 in the energy sector alone.

Bubble's thesis is simple: offshore operations should not require humans at sea. Instead of episodic, vessel-based missions, Bubble deploys resident autonomous systems that stay at sea for 24/7/365, continuously inspecting, monitoring and collecting data.

"Today, 80 to 90% of offshore inspection costs come from vessels and crews," said Crosetti. "By removing that dependency, we unlock a step change in cost, safety and operational frequency. What used to be episodic becomes continuous."

Advances in robotics, edge AI, and satellite connectivity have reached an inflection point, he says. For the first time, it is possible to deploy persistent, autonomous systems at sea that can perceive, decide and act with minimal human oversight.

SHUTTLE TANKERS:



Source: Maran Shuttle Tankers

A DISTINCT BREED FOR A VIBRANT, NICHE VESSEL MARKET

A wave of new investment in dedicated shuttle tankers has been spurred by the age profile of the existing fleet coupled with surging developments in the Brazilian offshore market.

By David Tinsley

Image above: The 105,000dwt ***Altera Wind*** (now the Maran Wind), one of the former Altera shuttle tanker fleet taken over by the Angelicoussis conglomerate.

Constituting a specialized asset class, dynamic positioning (DP) shuttle tankers are a flexible and cost effective way of lifting and transporting oil from offshore fields, where subsea pipelines are not a practical or economically viable option.

Production platforms or floating units are increasingly located in deepwater areas prone to challenging weather and hydrological conditions, and where high extraction rates generate demand for consistent, dependable service in transporting crude oil and condensate to refineries and terminals ashore.

Tailored to a niche segment of the offshore oil delivery chain, shuttle tankers command a substantial premium in capital cost, reflecting a technical specification aimed at ensuring the highest standards in operational and environmental performance, redundancy and maintenance regime. Moreover, exacting parameters regarding maneuvering and position keeping when loading (over the bow) in open waters, be it in high sea states and raging winds, place a particular imperative on crew competence alongside equipment and system grade.

The requirement for replacement of older tonnage and for a new generation of vessels meeting charterer's ever-stricter environmental criteria, together with Brazil's aggressive expansion of deepwater oil production capacity, are stimulating a wave of investment in dedicated tonnage. The current tranche of high valued added contracts is yielding fresh business for South Korean yards well experienced in the sector, but increasingly also for China's ascendant builders.

Energy corporations are the primary long-term charterers of shuttle tankers, in a regulatory sphere more akin to the offshore oil and gas industry than shipping. Environmental rating is accordingly critical and colors engineering design for the incoming new generation.

As vessels are subject to very high and constantly fluctuating electrical loads when handling cargo and keeping station offshore, thus spending extended periods in DP mode, energy efficiency is equally a major factor influencing technical concept and specification.

Market leader Knutsen NYK Offshore Tankers (KNOT) is in the midst of a vigorous investment program, and has augmented its order tally this year at COSCO Heavy Industry (Zhoushan). The 2026-2028 period is scheduled to see a total of nine newbuild entrants to the fleet, underpinned in each case by long-term charter assignments, primarily involving Brazilian clients.

In its business report for the opening quarter of 2026, KNOT stated that Petrobras had continued to set production records with an emphasis on fields that depend upon regular shuttle tanker service. The Brazilian major has continued to both bring new FPSOs on-line ahead of schedule, and to commit to additional FPSO contracts with deliveries now extending over several years.

Illustrative of the considerable expansion in Brazilian offshore development, an entire newbuild series of DP2 Suezmax shuttle tankers ordered on the Korean peninsula by the Tsakos Group has been committed to Transpetro, the logistics arm of Petrobras. Nine 155,000dwt vessels entrusted by Tsakos Energy Navigation (TEN) to Samsung Heavy Industries have each been fixed for 10 years plus an optional five years.

The first two vessels are scheduled to be completed during the second half of 2027, with the subsequent seven due over the course of 2028, and will virtually double Transpetro's platform offloading capacity. The design incorporates preparation for alternative fuels such as methanol and ethanol, plus shore electrical power connections. Each tanker has been specified with five manoeuvring thrusters, producing a combined 14,000kW hull rotation power, sourced from the Norwegian maker Brunvoll.

Two 154,350dwt shuttle tankers of similar design were brought into service by the Greek company from Samsung during 2025, and commissioning of a

Source: DSIC Dalian Shipbuilding Industry Co

Digital rendering of a 154,000dwt shuttle tanker ordered by AET of Singapore and specified with ethanol-ready main propulsion plus a battery bank for peak shaving.

Source: KNOT

Knutsen NYK Offshore Tankers (KNOT) has multiple Suezmax-size shuttle tankers on order in China. The 152,700 dwt ***Tuva Knutsen*** is a Chinese-built unit of the fleet dating from 2021.

third-of-class was expected in the 2026 third quarter.

Reflecting the particular operational, technological and regulatory edicts that impose a high threshold for market entry, the number of players engaged in the offshore loader business is few. Against this backcloth, the Angelicoussis Group has recently emerged as a major force. Having shown its intent by awarding a three-ship shuttle tanker order to Daehan Shipbuilding of South Korea in early 2024, the Greek organization acquired Altera Shuttle Tankers and its 18-strong fleet in January 2025, rebranding the entity as Maran Shuttle Tankers.

The design legacy embodied in the former Altera vessels reflects predecessor Teekay Offshore, which had been a leading light in shuttle tanker development. The trio of 154,000dwt DP2 Korean newbuilds is due to be completed between November 2026 and May 2027, for assignment on long-term charter to Petrobras.

Singapore-domiciled AET, part of Malaysian group MISC Berhad, deploys some 17 DP shuttle tankers in Brazilian and Norwegian offshore waters, and has this year ordered a 154,000dwt DP2-class newbuild from Dalian Shipbuilding Industry Co (DSIC). Due for delivery in 2028, and fixed on long-term charter, the vessel is distinguished by the nomination of ethanol-ready, dual-fuel propulsion and an energy storage system.

While AET already offers a dual-fuel capability across-the-board, the addition of hybrid propulsion further broadens lower-emissions optionality for customers. The rationale for including ethanol within the prospective fuel range of the newbuild is that this offers a relatively high energy density as a renewable fuel while significantly reducing CO2 and SOx emissions.

The hybrid electric propulsion element conferred by incorporating batteries will allow for peak shaving of sudden electric load fluctuations during dynamic positioning, enabling the main engines to be run at a constant, optimum speed.

The assignment of the latest phase of fleet development to a Chinese yard follows the company's award of two LNG dual-fuel Suezmax shuttle tankers to Samsung Heavy Industries in late 2025.

DSIC first demonstrated Chinese shipbuilding's capability to make the transition from large crude oil carriers to the highly specialized shuttle tanker domain by delivering the 155,000dwt DP-equipped NS Pioneer to China National Offshore Oil Corporation (CNOOC) in 2023. The self-reliance expressed in the home-grown design and construction project is claimed to extend to certain Chinese intellectual property rights. NS Pioneer was followed out of Dalian a year later by sistership NS Explorer. Both vessels were assigned from the outset to liftings from Brazilian deepwater offshore fields.

Prominent deep-sea crude carrier operator China Merchants Energy Shipping (CMES) is also adding another string to its bow by entering the shuttle tanker segment, and has selected DSIC to realize its opening gambit. The deal struck in the closing stages of 2025 calls for construction of a DP2-class Suezmax shuttle tanker, to be delivered by the end of September 2028 to CMES subsidiary Associated Maritime Company (Hong Kong).

An option on a second ship is appended to the contract. Industry sources suggest that the vessels will be tied to offshore operations in South America under long-term charter.

Source: TEN

Two 154,350dwt DP2 shuttle tankers were completed in 2025 by Samsung Heavy Industries for Tsakos Energy Navigation (TEN).

BALLAST WATER TECH:

ERMA FIRST's Portfolio for Shipping's Next Chapter

As the ballast water treatment market matures, ERMA FIRST is betting that the future belongs not to a single technology, but to engineering flexibility, lifecycle support and operational excellence.

By Greg Trauthwein

There was a time, not all that long ago, when the ballast water treatment (BWT) business was a technology race. Manufacturers competed to earn IMO and U.S. Coast Guard approvals, shipowners raced to meet retrofit deadlines, and success was measured by installations. Today, that market looks very different. The retrofit boom has largely passed, regulations have become normalized, and owners have years of operating experience behind them. The industry's questions have changed.

And according to **Eleni Polychronopolou, President of ERMA FIRST**, that's exactly where opportunity begins.

"I actually think one of the biggest changes in our industry is that shipowners are asking much better questions than they were 10 years ago," says Polychronopolou. "During the early years of ballast water management, the discussion often centered on which technology was 'best.' Today, owners recognize that the better question is, '***Which technology is best for my vessel?'***"

That distinction has become the foundation of ERMA FIRST's strategy.

Building, Acquiring Multiple Technologies

ERMA FIRST entered the ballast water market with electrochlorination technology. Today, however, the company stands apart for offering one of the industry's broadest treatment portfolios through both internal development and strategic acquisitions, including Ecochlor, RWO and oneTANK. Polychronopolou says that transformation wasn't accidental.

"It was both," she says when asked whether diversification was driven by strategy or market demand. "From the beginning, our strategy was to provide shipowners with the best ballast water management solution for every vessel, not to promote a single technology."

Experience quickly demonstrated that every ship presents a different engineering challenge: available electrical power; ballast capacity; crew experience; retrofit constraints trading routes; water quality … the list goes on, and on, and each variable changes the equation. The result is a portfolio designed around applications rather than products.

Electrochlorination remains the backbone of the business through ERMA FIRST FIT and ERMA FIRST FLOW, particularly for medium and large commercial vessels. Ecochlor's chlorine dioxide technology fills an entirely different niche where electrical power is limited or operational flexibility is paramount. oneTANK addresses compact installations on workboats, offshore vessels, tugs and yachts where conventional ballast water systems simply cannot fit. Meanwhile, **RWO** strengthened both engineering capability and the company's electrochlorination offering. Rather than asking owners to adapt to one technology, ERMA FIRST is adapting technology to the vessel.

Engineering Before Equipment

The “Engineering Before Equipment” philosophy extends to every project. Polychronopolou describes a process that begins not with equipment selection but with understanding the vessel itself. "Our objective is to help shipowners identify the solution that delivers the best combination of operational performance, installation practicality, efficiency, and long-term value for their specific vessel," she explains.

It is a subtle but important shift.

Instead of leading with a preferred treatment technology, engineers first examine ballast capacity, available power, trading pattern, water conditions, retrofit limitations, maintenance philosophy and long-term fleet strategy.

Only then does the technology conversation begin.

That approach reflects the reality that ballast water treatment has become an engineering discipline as much as an equipment business.

A Mature Market

Perhaps nowhere is the market's evolution more evident than in how purchasing decisions are made.

During the retrofit years, owners had one overriding objective: install a compliant system before regulatory deadlines.

Today, compliance is simply expected.

"The market has definitely evolved," says Polychronopolou. "Today's purchasing decisions are less about meeting a regulation and more about reducing operational risk. Owners want confidence that they're investing in technology—and in a company—that will continue to support their fleets for many years to come."

That means conversations increasingly revolve around issues rarely discussed a decade ago:

- **Lifecycle operating cost**
- **Reliability**
- **Ease of operation**
- **Energy consumption**
- **Crew simplicity**
- **Maintenance requirements**
- **Global service support**

The market itself remains surprisingly healthy despite the end of the retrofit wave.

Newbuilding activity continues. Fleet expansion continues. First-generation systems are reaching replacement age. Fleet acquisitions often leave owners operating multiple ballast water platforms, creating demand for standardization across spare parts, maintenance and crew training.

The ballast water market, in other words, has transitioned from installation growth to fleet optimization.

Service Is the Differentiator

Another consequence of market maturity is consolidation.

Several ballast water suppliers have exited the business altogether. Others have reduced investment in product development or global support.

That has fundamentally changed how owners evaluate suppliers.

"Ten years ago, most discussions focused on technology," Polychronopolou says. "Today, they're equally focused on the company standing behind that technology."

Increasingly, shipowners want reassurance that their supplier will still be investing in software, engineering, spare parts and service ten years from now.

Digital capabilities have become an important part of that equation.

Remote diagnostics, predictive maintenance, software updates and continuous system monitoring allow many issues to be identified before they interrupt operations. Combined with global service hubs and experienced field engineers, these capabilities have become competitive differentiators rather than optional features.

In today's market, a ballast water system is no longer simply equipment—it is a long-term service relationship.

Thousands of Ships, Thousands of Lessons

Polychronopolou repeatedly returns to one advantage she believes cannot be duplicated: operational experience.

Nothing, she argues, teaches engineers more than equipment operating aboard thousands of vessels under real-world conditions.

"Nothing has influenced our products more than real operating experience," she says. "Laboratory testing and Type Approval establish performance requirements, but thousands of installations operating around the world teach you how equipment performs under real operating conditions."

Those lessons have reinforced surprisingly simple design principles.

- Systems should be intuitive.
- Diagnostics should be meaningful.
- Maintenance should be straightforward.
- Automation should simplify operation rather than complicate it.

Perhaps most importantly, every installation becomes feedback for the next generation of products, with commissioning teams, service engineers and vessel operators continually informing software updates and future designs.

Beyond Ballast Water

While ballast water remains ERMA FIRST's foundation, the company's ambitions extend well beyond a single equipment category.

As part of ERMA TECH GROUP, the portfolio now encompasses tank management, wastewater treatment, emis-

sions reduction, energy efficiency and vessel performance optimization.

Polychronopolou sees a broader trend emerging across the maritime equipment sector.

Shipowners increasingly prefer fewer suppliers capable of delivering integrated environmental solutions supported by common digital platforms and lifecycle services.

Rather than managing multiple vendors for separate environmental systems, operators are looking for long-term technology partners.

It mirrors a broader evolution occurring across shipping as digitalization connects previously independent onboard systems into unified operational platforms.

The Third Chapter

Polychronopolou describes ballast water management as entering its third chapter.

The first was innovation. The second was execution. Today's chapter, she says, is operational excellence.

"Shipowners already know what the technologies are capable of," she says. "What they're evaluating now is the company behind the technology.

Can they support a global fleet? Can they respond quickly when assistance is needed? Will they continue investing in product development, software, digital capabilities, and worldwide service? Those questions increasingly determine purchasing decisions."

That observation may ultimately define where the ballast water market goes next.

Type approvals have become table stakes.

Technology has largely matured.

The winners will increasingly be determined not by who invented a treatment method, but by who can support a fleet over decades of operation.

For ERMA FIRST, that means offering multiple technologies rather than championing one, applying engineering before equipment selection, and viewing every installation as the beginning of a long-term relationship rather than the end of a sale.

It's a philosophy that reflects the maturity of the ballast water market itself — and perhaps offers a glimpse of how other environmental technology sectors in shipping will evolve in the years ahead.

FLOATING NUCLEAR: A NEW OFFSHORE ENERGY FRONTIER

For decades, floating nuclear power occupied a niche position in the energy debate – technically feasible, strategically intriguing, but commercially marginal. Today, however, combined pressures of decarbonization, energy security, land constraints, rising electricity demand and water scarcity are making floating nuclear power a more serious proposition for policymakers, utilities, and infrastructure.

By Alisa Reiner

Floating Nuclear offers a potential source of reliable, low-carbon electricity and heat (and, where possible, desalinated water) for locations where conventional energy systems are expensive, carbon-intensive, or physically impossible to build.

The strongest case emerges in remote coastal regions and small island developing states (SIDS). In these contexts, the challenge is not only decarbonization – it is the high cost of imported fuel, the vulnerability of supply chains, and the difficulty of scaling grid infrastructure.

A floating nuclear power plant (FNPP) can be manufactured in a shipyard, towed to site, moored near shore, connected to the local grid, and later serviced, replaced, or decommissioned with less land disruption than a large onshore plant.

This is particularly relevant for SIDS. Many islands remain dependent on imported diesel or fuel oil, face volatile electricity prices and have limited space for large-scale generation assets. At the same time, these countries are on the front line

of climate change and often face freshwater scarcity. Floating nuclear could provide firm, clean power without consuming scarce land, while also supporting water resilience by powering desalination processes with excess heat. For SIDS, where energy security and water security are often closely linked, this dual-use capability significantly improves the economic case for floating nuclear.

Floating Nuclear Power '101'

FNPPs are nuclear generation units mounted on barges or platforms and deployed near coastal demand centers. They provide reliable baseload electricity with minimal operational carbon emissions. Unlike solar and wind, they are not intermittent, which is critical in smaller or weaker grids where balancing variable renewables can be more difficult. Typically, they can be fabricated in part or in whole in controlled shipyard environments, potentially reducing construction risk and making replication easier. Notably, they do not require large greenfield land sites. Finally, they can make use of waste heat for industrial processes or desalination.

The floating nuclear landscape today includes both deployed technology and emerging concepts. The only operational FNPP is Russia's Akademik Lomonosov, a FNPP deployed in Pevek in the Russian Arctic. The plant uses reactor technology derived from Russia's long experience with nuclear icebreakers and marine propulsion systems. Another ready-to-go is Russia's Baim FNPP to be commissioned in the Baimskaya ore zone in 2028.

Other players, including the United States, Denmark, South Korea, and China, are exploring floating reactor solutions. Some rely on compact pressurized water reactors, drawing on naval reactor experience and established nuclear technology. Others are based on advanced concepts such as molten salt reactors, high-temperature gas-cooled reactors, fast-spectrum reactors and micro modular reactors.

According to the author's analysis, there are currently 118 FNPP reactor designs and/or prototypes globally (Figure 1). The market is developing along several parallel pathways – relatively familiar water-cooled systems for near-term deployment; marine-based reactors drawing on propulsion and icebreaker experience; high-temperature and molten salt systems targeting industrial heat and cogeneration; fast-spectrum designs with longer-term fuel-cycle potential; and microreactors aimed at smaller, remote, or mission-critical loads. This matters commercially because different reactor types imply different safety cases, fuel cycles, operating temperatures, end-use markets and licensing pathways.

The commercial value of these designs also depends on what energy products they can supply (Figure 2). Floating nuclear is often discussed as a power-generation technology, but several concepts are designed for broader multi-utility use, including heat and desalinated water. This is particularly important for islands, ports, remote coastal regions, and industrial clusters where electricity demand is only one part of the infrastructure challenge.

This output breakdown demonstrates that floating nuclear should not be assessed only on a dollar-per-megawatt basis. In some markets, the bankability of a project may depend on stacking several revenue streams – electricity sales, heat supply, desalinated water, industrial energy services, grid resilience payments, or long-term capacity contracts.

The Wider SMR Market

Most current FNPP concepts are based on small modular reactor (SMR) designs. These are smaller than conventional gigawatt-scale nuclear plants and offer several advantages. There are 83 SMR designs at various stages of development or deployment worldwide (Figure 3). These included water-cooled reactors , high-temperature gas-cooled reactors , liquid metal-cooled fast neutron spectrum reactors , molten salt reac-

Figure 1

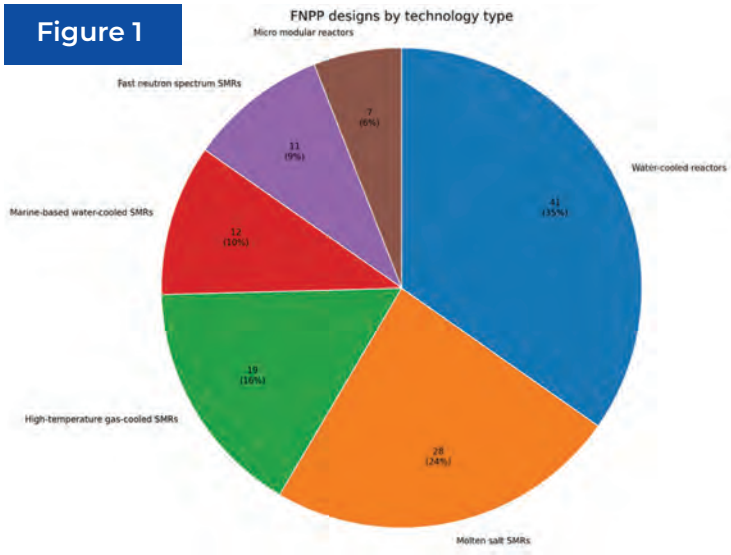
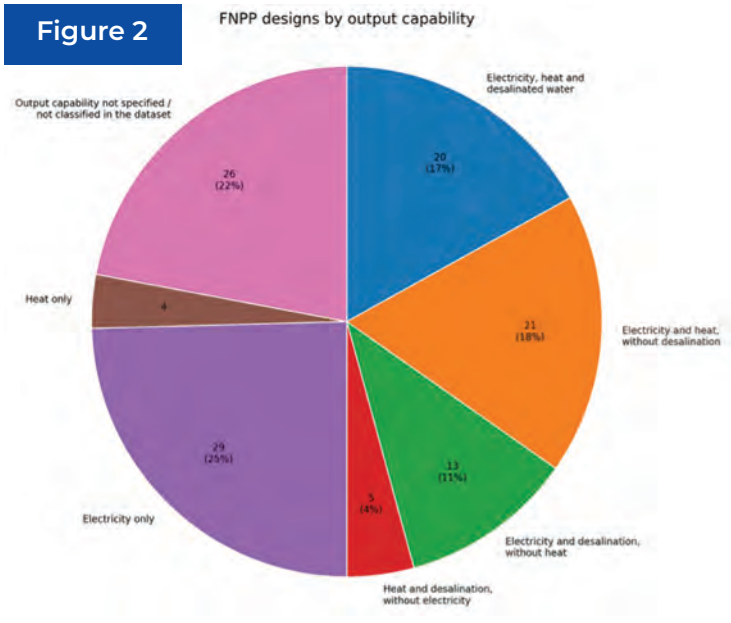


Figure 2



tors , and microreactors .

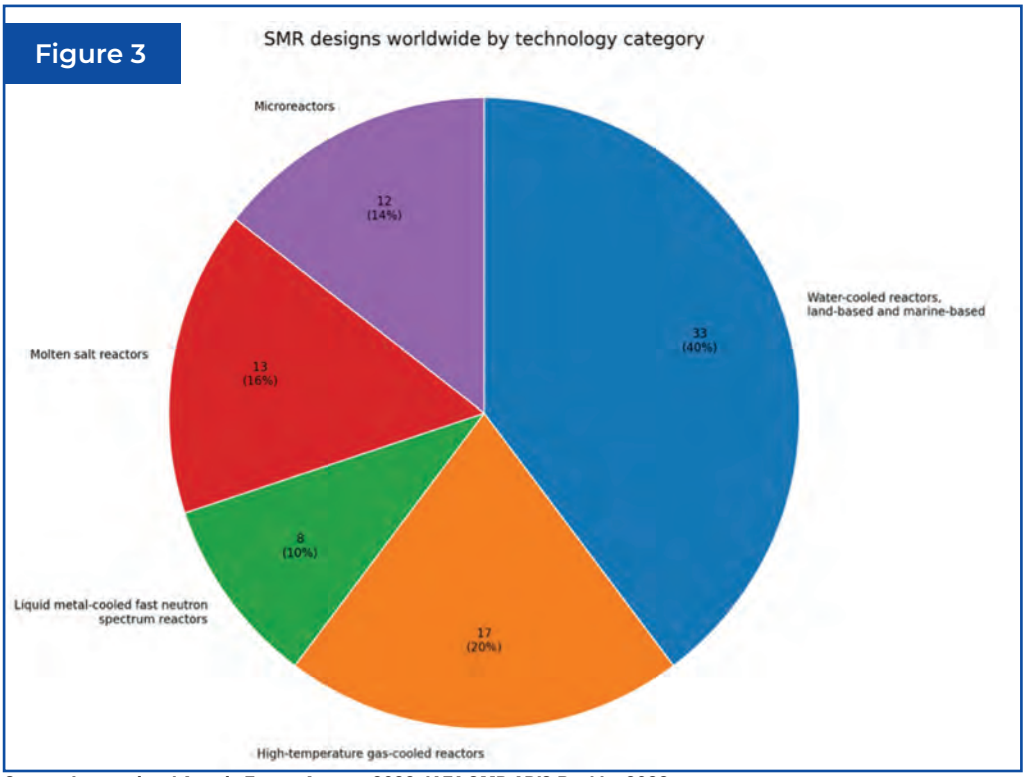
SMRs offer several advantages over traditional large-scale nuclear power plants. Standardized designs facilitate cost reductions through replication and accumulated operational experience, extending benefits beyond reactor design to include associated delivery processes. Modular construction methods enable the pre-fabrication of reactor components off-site in factories with higher productivity levels and improved quality control compared to traditional on-site construction methods.

Modularity also allows for incremental power additions based on demand. For offshore power markets, this flexibility is commercially relevant – customers may not need a single large baseload plant, but rather a scalable, modular source of firm low-carbon power that can be matched to the needs of an island grid, industrial cluster, remote mine, port, desalination facility, or offshore energy hub.

Refueling cycles are also an important part of the value proposition. Depending on the design, floating SMRs may require refueling only every three to seven years, with some advanced concepts being developed with fuel cycles extending up to 30 years. For countries that currently rely on regular fossil fuel imports, this offers a pathway toward greater energy independence and lower exposure to fuel price volatility.

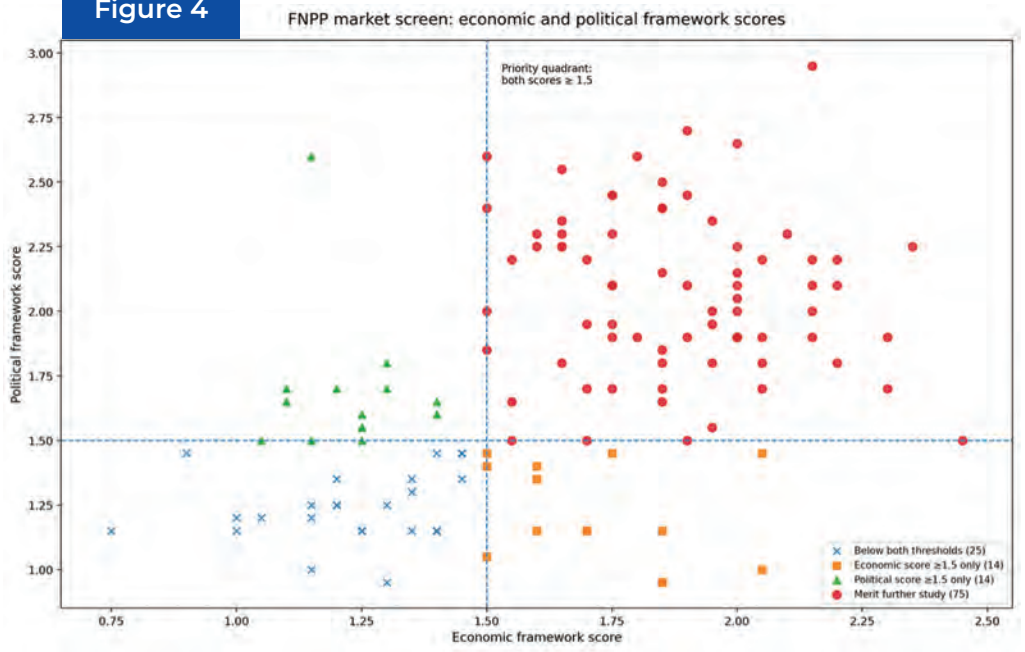
Importantly, smaller core inventories reduce radiation exposure risks both on-site for workers and off-site by limiting potential accident consequences and emergency planning zone requirements.

Figure 3



Source: International Atomic Energy Agency. 2022. IAEA SMR ARIS Booklet 2022

Figure 4



Source: author's analysis. Countries and territories in the upper-right quadrant achieved scores of at least 1.5 in both dimensions and therefore merit further study.

Identifying Priority Markets f

The analysis began with a dataset covering 252 countries and territories and then focused on 128 markets identified through preliminary screening as having potential for floating nuclear deployment. Based on aggregate political and economic framework scores, 75 countries and territories merit further study (Figure 4).

This result represents a balanced investability screen rather than a simple technical-opportunity map. Several markets may show strong demand for floating power but fall be-

low the threshold on either political or economic conditions. Conversely, the countries that pass the screen combine sufficient economic capacity with a political framework that could support further project development.

Within the broader group of 75 countries and territories that merit further study, 14 markets form a higher-priority subset, with both economic and political framework scores at or above 2.0. These countries combine comparatively stronger economic capacity with more favorable political and regulatory conditions, making them relevant for deeper feasibility assessment, investor engagement, and project readiness screening. The result is therefore not a final investment shortlist but a commercially meaningful funnel including the following countries:

- Algeria
- Egypt
- France
- Ghana
- India
- Indonesia
- Mexico
- Oman
- Saudi Arabia
- South Africa
- South Korea
- Sweden
- United Kingdom
- Vietnam

Commercial Challenges and Investment Questions

The case for floating nuclear may be strong, but the barriers remain substantial. These include nuclear licensing, maritime regulation, physical security, emergency response planning, spent fuel management, insurance, liability regimes, public acceptance, grid integration and financing capacity. For international deployment, an additional challenge arises – the plant may be built in one country, operated by an entity from another, and deployed in a third. That raises complex political, legal, and regulatory questions.

From an investor perspective, the key issue is whether floating nuclear can become a repeatable infrastructure product rather than a bespoke megaproject. If shipyard-based fabrication, standardization, and modular deployment reduce construction risk, floating nuclear could become more attractive than conventional nuclear in certain markets. That remains to be demonstrated at commercial scale.

For offshore companies, however, the delivery model is familiar. Floating assets, modular construction, tow-out, offshore installation, and long-term operations are all part of the sector's core capabilities. The main question is not whether the offshore industry can build and deploy such platforms. It is whether the regulatory, political, and financial ecosystem will mature quickly enough to support bankable projects.

Overall, floating nuclear is worth attention. It may not become a mass-market solution overnight – however, as the search intensifies for firm, clean, and flexible energy infrastructure, floating nuclear has the potential to become one of the most strategically important new segments in offshore power.

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4. Lovering, J.R., A. Yip, and T. Nordhaus. 2016. "Historical Construction Costs of Global Nuclear Power Reactors." *Energy Policy* 91: 371–382
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All images courtesy ESAB

20 COMMON AUTOMATION PITFALLS IN SHIPBUILDING

By Dan Colvin, *ESAB Vice President, North America Robotics & Digital Solutions and* ***Gino Martinelli,*** *ESAB and GES Consultant with 35 years in submersible and surface shipbuilding experience*

America, not just shipbuilding, needs automation. To meet the U.S. Navy's goal[1], we need to build 85 manned ships and 134 unmanned surface/subsurface vessels to achieve a fleet strength of 515 vessels. Overall, the U.S. only builds about 0.1% of global shipbuilding[2], a decline from about 5% in the 1970s. If we are to learn from history — much less current events — America needs to recognize that we face an existential threat[3] that requires a strong shipbuilding strategy. Given the chronic shortage of welders (80,000 jobs to be filled annually[4]) and 439,000 open manufacturing jobs[5] in February 2026, reinvigorating our defense industrial base requires using digital manufacturing technologies as a workforce multiplier. However, what we don't need to do is to throw a robot at everything — and that's the first among common pitfalls in automating shipbuilding applications.

[1]Source: U.S. Naval Institute
[2]Source: Center for Strategic & International Studies
[3]Source: U.S. Naval Institute
[4]Source: Weldingworkforcedata.com
[5]Source: BLS

PITFALL 1: Starting with the Solution

Before automating, start by identifying the bottlenecks and problems that hinder workflow, cause rework or consume excess human or financial capital. Establish baseline metrics for your current welding and cutting processes, as well as associated activities. Once you establish what you could improve, then start looking at associated automation technologies.

PITFALL 2: Judging Productivity by Welding Speed

Welding speed is just one metric. Also consider joint preparation, filler metal and consumables use and post-weld cleaning like spatter removal. Advanced robotic GMAW processes can travel faster, but they also offer greater process stability for more repeatability and little-to-no post-weld clean-up. There are also processed that concentrate the arc to reduce bevel angles from 60 to 40 degrees and can complete welds from a single side, even on ¾-inch plate. Benefits include fewer passes, reduced weld time, lower consumable use and lower overall cost per joint.

To stay on the leading edge, consider working with non-biased third-parties to assess new GMAW and other joining processes. Large defense contractors routinely work with organizations such as the Edison Welding Institute.

PITFALL 3: Limited Definition

Expand the definition of automation beyond physical movement to automating data and process management. Look for solutions and software applications at every step of the workflow. Digitize document and record management (PQRs, WPSs, WPQs) and QA/QC tasks. Software can save time, lower costs, reduce the chance of human data-entry error, provide faster progress updates, and enable analytic insights. Attend AWS conferences and walk the aisles at FABTECH to look for new ideas, because you don't know what you don't know.

PITFALL 4: Automating the Wrong Thing

With complex weldments, humans often remain the most efficient option because their decision-making skills and flexibility accommodate variability. Trying to automate a process that's not repeatable just automates chaos and produces bad parts faster. Do not start an automation journey with the hardest part. Start with the easiest part, the most repeatable parts and the 80%; build on success, free talent for where it can add value and then chase the next bottleneck.

PITFALL 5: Ignoring Material Preparation

Poor and inconsistent fit-up causes automation failures. These problems often manifest themselves as bottlenecks at fit-up and fixturing stations and increased repair and rework. The key to successfully implementing a cobot or robot often becomes investing in a high-precision automated cutting system. The payoff that comes from multi-high automating comes not primarily because it cuts faster (although it can), but because it improves consistency, fit-up, inspection and repair outcomes.

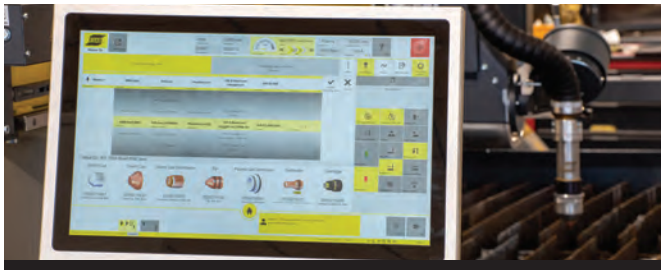
PITFALL 6: Not Using Nesting Software or Lot-Based Nesting

CAD/CAM programming and nesting software optimizes plasma, oxy-fuel, laser and waterjet cutting processes. Step up to the manufacturer's advanced software to:

- Nesting to optimize cycle time, consumables life, plate usage and remnant management.
- Implement Lot-Based Nesting. Cut what is needed in the next 3-6 weeks. Too many people use the largest size plates and fill them up, focusing only on cutting parts.
- A few structures require 52-ft. plates (outer shelves of a ship or sub, decks, wall); 80% of the rest of the parts will fit on 4x4, 4x8 or 8x10 ft. plate. Cut what you need on smaller plates. Using Lot-Based Nesting will eliminate remnant management.
- Simplifying programming by integrating beveling data and geometric compensations necessary to cut V, X, Y, and K bevels, eliminating the need for trial-and-error programming.

PITFALL 2: Don't judge productivity purely by travel speed. Also consider processes stability, repeatability, lower post-weld clean-up, ability to reduce bevel angle and the ability to retrofit existing robots with advanced processes.

PITFALL 4: Start an automation journey with simple parts. Rather than the whole assembly, this manufactured started automating the welding of lifting pads, a simple yet critical component, using a cobot.



PITFALL 6: Whether nesting or cutting parts, CAD-CAM software combined with a plasma bevel head brings a multitude of benefit, including better plate utilization and faster and more accurate cutting of square cut faces, circles and bevels.

• Look for software that reduces bevel angles, lets you balance speed vs bevel minimization and improves hole cylindricity.

PITFALL 7: Not Looking at the Whole System

Some yards blame poor cutting table utilization rate (e.g., about 30%) on the table manufacturer. The reality is that they could achieve 65-70% if they focused on the entire process, including material handling, nesting to avoid tilt-ups that cause crashes, marking, clean-up, changing consumables, preventive maintenance schedules and operator training for all of it.

PITFALL 8: Weak Plate Traceability

Use durable barcode and marking options, including laser marking, if other options fade or don't enable precision. Given the hours forklift drivers spend hunting for plates in laydown yards, much less limited (or no) ability to track remnants, automating identification and traceability can produce big gains in plate management alone.

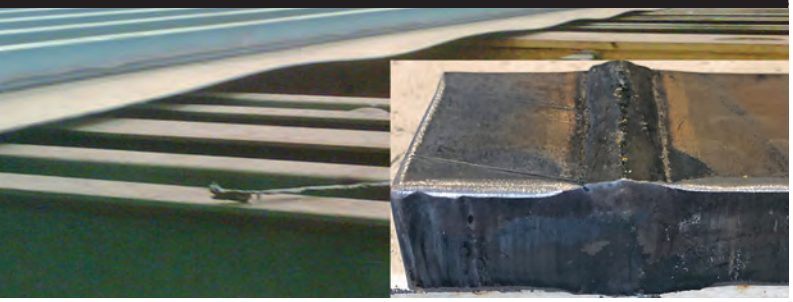
PITFALL 9: Relying on Traditional Solutions

For both seam tracking and weld inspection, advanced solutions exist as a result of advances in 3D scanning, laser, IR (thermal profile), and camera technology combined with the computational power of advanced microprocessors and AI-driven analytics. Robot-friendly solutions are an order of magnitude faster, many times more accurate and connect to QC programs. Shipyard CWIs should consider inspection tools that use vision systems to confirm joint preparation and validate weld dimensions. There are hand-held devices that work faster than traditional gages and digitize data (including an image) for importing into records. And rather than manually assembling records, consider software that automates QC document management and enables traceability. Software tools exist that can identify the details of every weld seam in minutes.

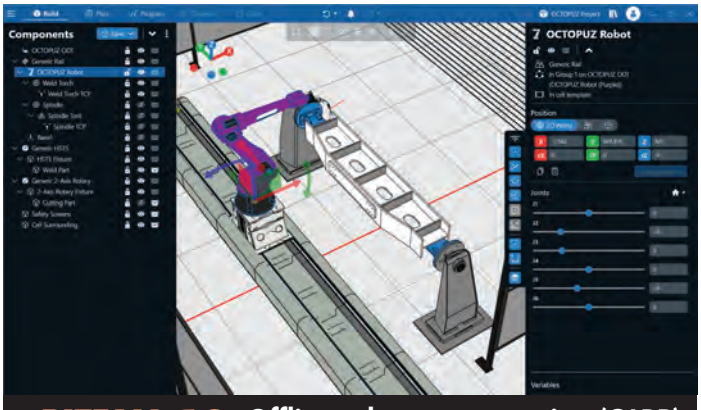
PITFALL 10: Accepting Distortion

For welding the main deck and wall side plates, which ranged from 3/8- to 1-in.-thick, one Gulf coast shipyard faced productivity issues with its old SAW technology. The plate would warp as soon as the hold-down bed magnets were released due to high heat input. So that the deck plate wouldn't look like a potato chip when presented to the stiffener welding station, the shipyard placed multiple 10-ton concrete weights on the plate immediate-

PITFALL 10: Many yards accept warping when then don't have to. New SAW process reduce heat input to mitigate warping while also increasing deposition rate and weld quality.

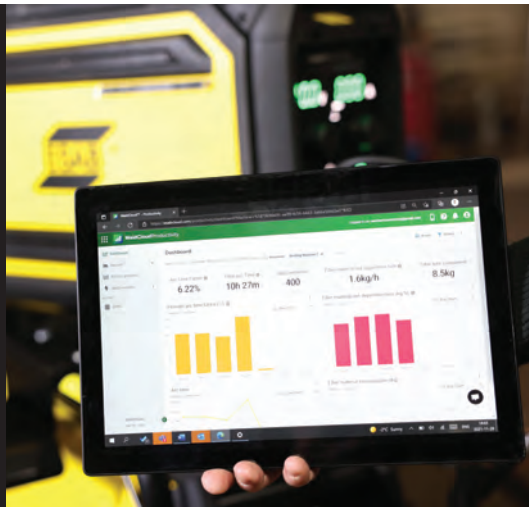


PITFALL 11: RFID technology links operators and machines to weld seams for improve traceability, plus it can ensure only qualified operators weld on a joint.



PITFALL 12: Offline robot programming (OLRP) functions in a virtual, offline environment to maximize robotic uptime.

PITFALL 16: Don't collect data because you can. Rather, focus on metrics that lead to actionable intelligence.



ly after releasing it from the magnetic bed.

Other issues included rework to repair weld defects and the need to manually weld the last several inches of the plate because excess heat input could cause weld cracking. By shifting to a newer multiwire technology that features a DC leading arc, AC trailing arc and an electrically cold electrode in the center, the shipyard can now weld a 40-ft. seam without distortion, perfect reinforcement on the top side and an excellent back side bead profile. Actual results for welding a 3/8-in. plate a V-bevel configuration: welding speed of 55.1 in./min, heat input of 51.6 kJ/in. and a deposition rate of 52.7 lb/h.

PITFALL 11:
Unwillingness to Change

The hardest thing to change is human nature because changing what currently works introduces the possibility of failure. It may take a crisis to induce change. On one component valued at more than $750,000 dollars, a company discovered that an unqualified operator worked on the project. Because it could not link the operator to specific work, it had to scrap the component. The company has subsequently implemented software that tracks variables associated with each weld seam, including the operator, machine and consumables. An adjacent solution includes machines that require RFID card access so that operators can only use processes for which they're qualified.

PITFALL 12:
Programming at the Robot

Programming at the robot guarantees a lower arc factor. Offline robot programming (OLRP) functions in a virtual, offline environment on a computer. It eliminates the need for robots to be taken out of production, greatly improving productivity and the bottom line

PITFALL 13:
Thinking Humans Need to Plan Weld Seams

Adaptive planning or "deep learning" welding systems for SAW combine hardware (laser and optical vision systems), software and PLCs to automatically read the bevel, plan bead placement and automatically compensate for irregularities. They can weld U or V grooves on plate up to 6 in. During weld execution, feedback sensors adjust weld metal deposition rate, travel speed and bead placement (while staying within the WPS) so that the complete weld will not need any patching. After completing the cap, the system can even automatically read and document the bead height and toe angle for documentation purposes.

PITFALL 14: Fearing AI

Some in the industry still fear automation will take their jobs. The reality is that automation changes the nature of work and opens new opportunities, and industry should treat AI the same. The shipyards that win more contracts and operate more profitably will be the ones that make best use of AI and automation. AI agents (or "agentic AI" solutions) act autonomously on behalf of a human user and can interact with other software and AI solution.

There are already "AI agents" that layer on top existing CAD/CAM, ERP, PLM and QC systems for manufacturing, such as for automating process planning, estimating, inventory management and customer service (the dreaded chatbot).

Expect to see AI-driven solutions that further enhance vision systems, enable autonomous decision-making to drive robot adaptability and flexibility, plans weld sequences to manage distortion on complex weldments, and monitor machine data and QC analytics to optimize performance. As with any other technology, the best sources of advice will come from people who know the industry and their customer's operation.

PITFALL 16: Drowning in Data

Don't confuse data collection with actionable intelligence. Avoid systems that merely fill spreadsheets; rather, focus on systems that interpret what the data means, such as pattern recognition, operational guidance and alerts when a process goes/trends out of specification. Examples include:

- QC software that sends an alert about undersized welds. The solution may to be work with the operator to improve gun mechanics and travel speed.
- Identify top-performing areas to replicate success elsewhere.
- Uncover hidden bottlenecks (waiting for cranes to move parts, consumables and tools are common culprits of slow cycle time).
- Weld sequence software can recognize when an operator did not weld the correct seam; if a 10-ft. seam took 10 seconds to weld, something is wrong.

PITFALL 17: Relying on Clipboards

Unless you have stock in an orthopedic company, data management by walking around a shipyard makes no sense when digital solutions exist. Manually checking parameters on hundreds (more probably of thousands) of welding systems consumes thousands of hours and opens the door to data entry errors. There is no real way to catch out-of-spec situations in real-time, and any analytics that occur come long after the weld metal gets deposited.

As an example, consider hardware/software solutions that monitor shielding gas flow. Everyone knows that even though a FCAW WPS may call for 35 CFH, operators tend to set gas flow on the high side. An extra 5 CFH on hundreds of welding stations adds up to hundreds of thousands of dollars a year (and possibly millions if it causes weld defects associated with excess flow). The ability of digital systems to identify when gas flow goes outside of the WPS delivers immediate benefits. Detecting leaks (gas flowing when or where it shouldn't) has significant safety implications, plus it could prevent unplanned work stoppages if a cylinder or bulk tank leaked and ran empty.

PITFALL 18: Not Automating for Safety

Hazards in shipyards include injuries to hands (crushes, cuts), skin (burns), eyes (arc flash, spatter, grinding sparks), strain/repetitive stress, fumes, combustible gases, and trips/falls. Automating any process that reduces these injuries improves workplace wellness. For example, automated data col-

PITFALL 17: Manually collecting data, such as gas flow rates or welding parameters, wastes valuable time. Connected hardware and software systems free valuable time, eliminate manual data entry errors, can identify trends quickly and prevent wasting shielding gas.

lection will eliminate tens (or maybe hundreds) of thousands of miles walked …which adds up to fewer chances of tripping.

Using automation also differentiates an operation and may attract employees — which job would appeal most to a younger person: "skills require learning to operate automated cutting equipment" or "able to perform grinding?"

PITFALL 19: Choosing the Wrong Automation Solution

One size does not fit all. Match the application, the shipyard environment and the workforce to the appropriate automation solution. Consider:

- For stitch or intermittent welding, consider mechanized or rail-mounted tractors instead of FCAW
- For pipe, consider orbital GTAW (smaller diameter) or mechanized tractors for larger pipe
- Move from FCAW to SAW tractors, or move from tractors to rail- or gantry-mounted SAW systems
- Instead of GMAW or SAW, consider laser-hybrid welding for thicker sections.
- Use cobots for high-mix and low- to medium-volume parts (and note "medium-volume" may be defined as 10,000 parts or more annually)

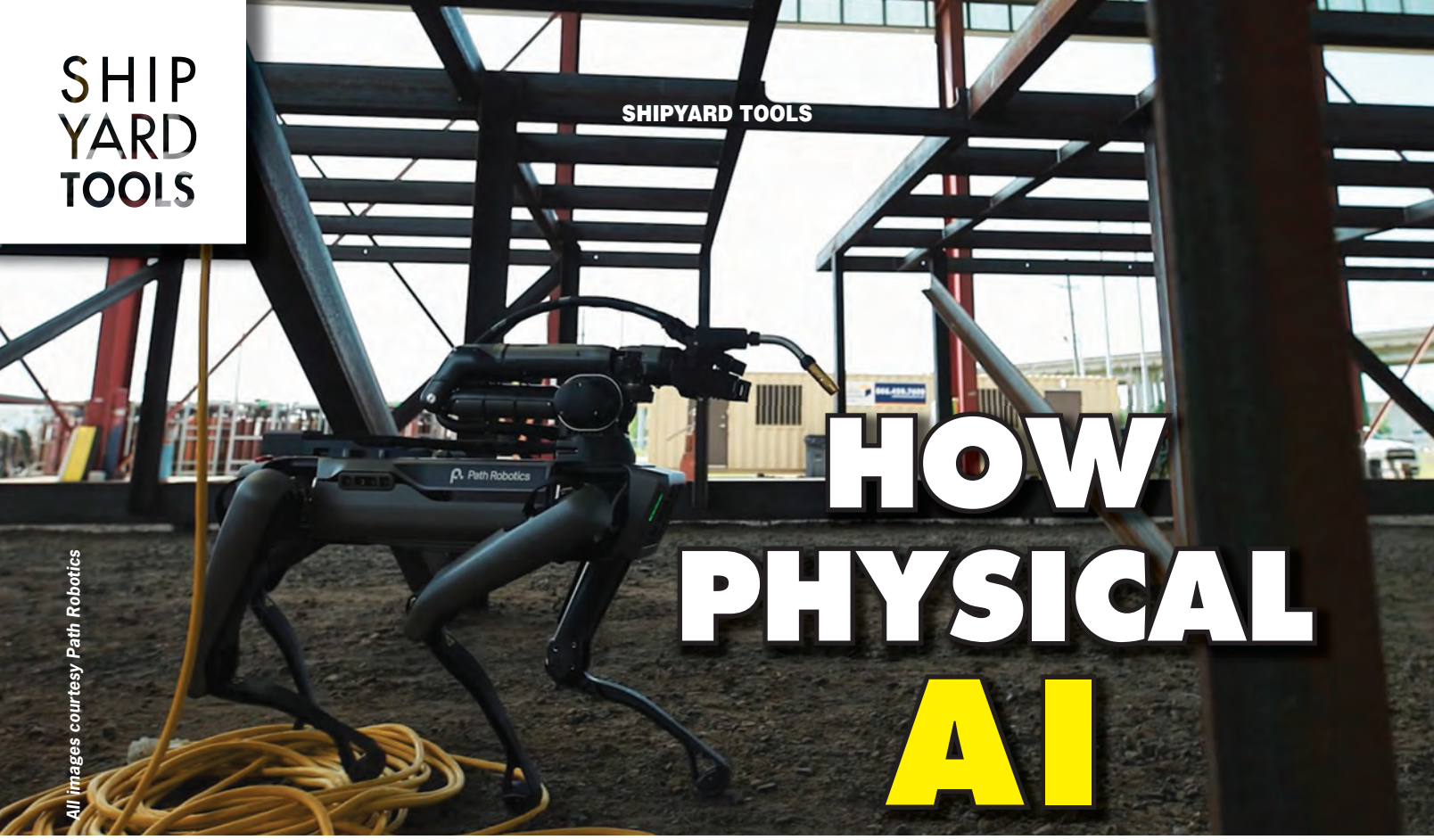
PITFALL 20: Focusing on Money, Not People

Chasing government money to implement the shiniest new technology often results in tech that sits unused because it wasn't part of an automation plan or the plan was cooked up by some VPs with a limited understanding of operations. A successful plan will solicit and obtain buy-in from the people on the deck plates, the maintenance teams and operation-level workers who will use the tech.

The future of shipbuilding will not be defined by whether automation, software and AI are adopted, but by how intelligently they will be applied. The shipyards that succeed will be those that combine practical experience with emerging technology, avoid common pitfalls and take a measured, strategic approach to change. In doing so, they will play a critical role in strengthening the broader industrial base needed to meet future demands.

PITFALL 19: Robots aren't the answer to every welding automation problem. For long and not-so-long seams, welding tractors may accomplish the goal, plus they deploy quickly.

PITFALL 20: The automation system you choose matters, but your success depends on the people who will run and maintain it. Engage them early in the decision-making process.



All images courtesy Path Robotics

HOW PHYSICAL AI WILL REBUILD AMERICA'S MARITIME INDUSTRIAL BASE

By Andy Lonsberry, CEO and co-founder, Path Robotics

The first thing that stands out when you walk through a modern shipyard isn't the technology – it's the sheer scale of the work and the size of the parts going into these massive ships the size of city blocks. I recently visited a Korean shipyard watching teams of workers join two 50-foot-tall, 100,000-pound hull sections into place. This particular shipyard does this every day, building up to 40 ships a year.

Seeing that kind of scale firsthand puts into perspective just how much coordination, labor, and industrial capacity it takes to keep a yard operating at full speed. Huge steel structures stretch across the yard while teams of people tackle hundreds of tasks simultaneously. Every weld represents years of experience, and every section under construction is part of a much larger effort to keep production moving. What also becomes clear is that there is no shortage of work.

Across the maritime industry, demand is accelerating. Naval modernization, commercial vessel construction, autonomous maritime systems and critical infrastructure projects are all expanding at the same time. Policymakers increasingly recognize shipbuilding as both an economic priority and a national security imperative.

The urgency is hard to ignore. The U.S. has gone from building 5% of the world's ocean-going commercial ships in the 1970s to building about 0.2% today, according to McKinsey. Beijing now operates the world's largest navy, fielding more than 370 warships compared with roughly 296 in the U.S. fleet, according to CSIS.

America already knows how to design world-class ships. The pressing challenge is increasing the industrial capacity to build them faster and at a scale we've never seen before.

Capacity Has Become the Limiting Factor

Order books continue to grow across both naval and commercial programs, hitting 191 million tons in Q1 2026, according to the Baltic and International Maritime Council. But U.S. production capacity has become the industry's greatest constraint.

The U.S. Navy expansion to a larger Golden Fleet is expected to require roughly 250,000 new workers across the maritime industrial base over the next decade. At the same time,

the American Welding Society projects demand for more than 320,000 new welding professionals by 2030.

Shipbuilders are also competing for talent with defense manufacturers, energy infrastructure projects, data center construction, mining equipment manufacturers and heavy industry. Every one of those sectors depends on the same skilled trades.

Experienced welders continue to retire faster than new workers enter the profession, tightening an already strained labor market.

The industry's challenges are becoming increasingly visible. Programs like the Navy's Constellation-class frigate have experienced significant schedule delays and cost growth despite substantial investment, underscoring just how difficult it has become to translate demand into production.

Growing the workforce remains essential, yet even the most successful recruiting and training efforts will take years to meaningfully increase output. Adding workers alone won't close that gap fast enough; the industry needs to rethink how the work itself gets done. That makes improving productivity just as important as adding people.

Why Shipbuilding Is Difficult to Automate

Shipbuilding has never resembled a traditional assembly line. Steel shifts during fabrication. Heat from welding changes geometry. Components rarely arrive perfectly aligned. Conditions on the shop floor evolve throughout production. Experienced welders make countless small adjustments based on what they see in front of them. You have one shot to get it right and risk thousands in material costs and rework if you don't

Traditional industrial robots were never designed for this kind of work. They perform exceptionally well when every part is identical and every movement can be programmed in advance – producing one part exactly the same 10,000 times. When variation enters the equation, their effectiveness drops quickly.

The next generation of automation has to do much more than repeat programmed motions. It needs to perceive changing conditions, understand what is happening, and adjust while work is underway rather than simply repeating a fixed motion. Those capabilities have been missing for years.

Physical AI Expands What Can Be Automated

Physical AI changes that. Traditional automation follows pre-programmed instructions. Physical AI continuously observes its surroundings, interprets what's actually in front of it and decides in real time what it needs to do to achieve the desired outcome.

The key difference is the model behind it. Machine learning is only as good as the data it's trained on, and physical AI is built on a massive multimodal dataset of real-world welding data that teaches the system what good welding looks like across countless scenarios. That trained model becomes the foundation for decision-making, allowing the robot to reason

through variation rather than simply execute a fixed program. Combined with computer vision, planning and motion control, it can identify weld joints, compensate for variation, adapt to heat distortion and modify weld paths as production evolves.

For shipbuilding, that adaptability changes the equation. Tasks that were previously considered too variable for automation become practical. More weld hours become addressable. More production can move forward without waiting for scarce skilled labor.

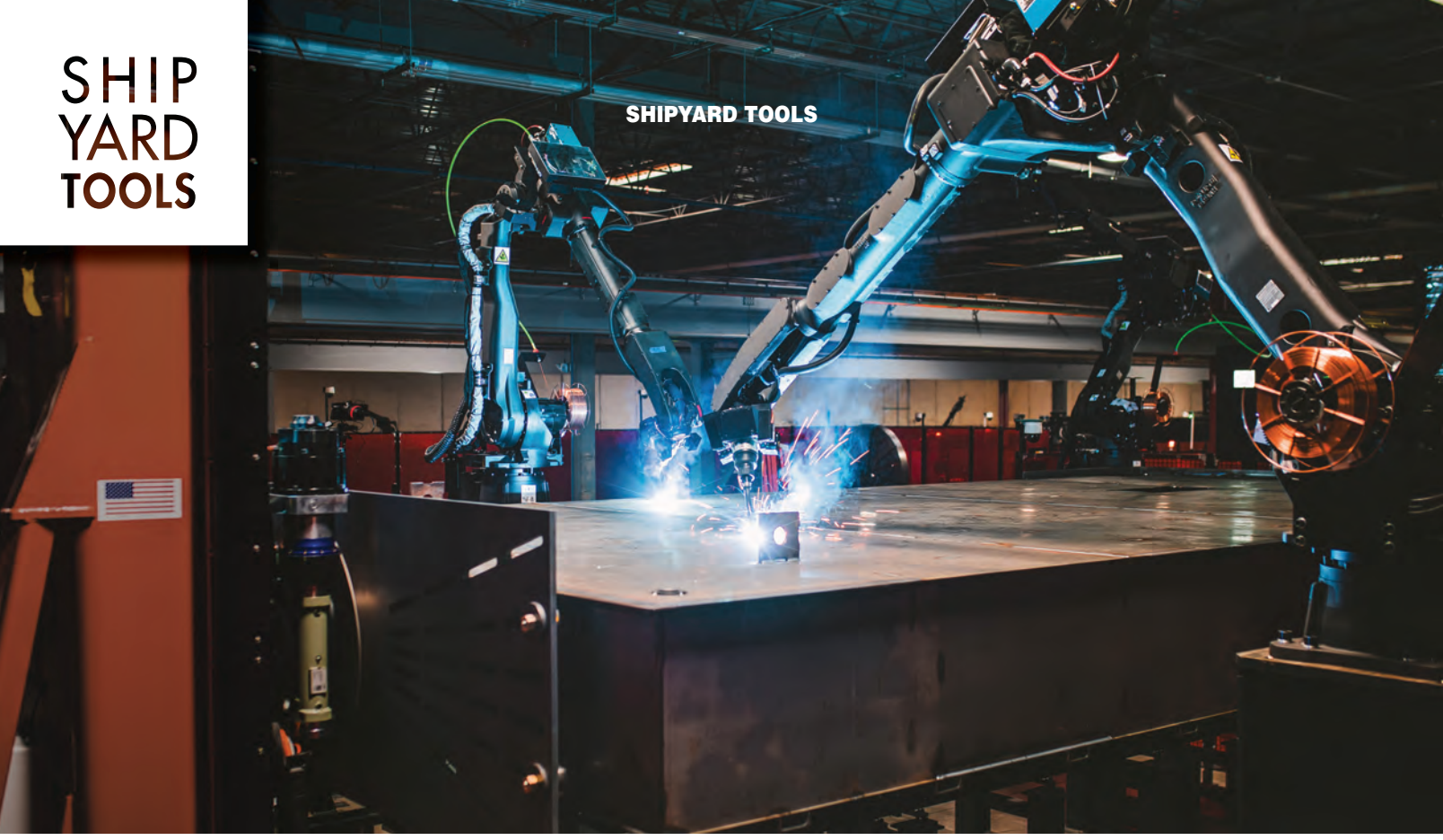
These capabilities are also becoming increasingly mobile. Intelligent systems are no longer confined to fixed robotic cells. They can move throughout shipyards, fabrication facilities and other dynamic work environments, bringing advanced manufacturing closer to where the work is actually happening.

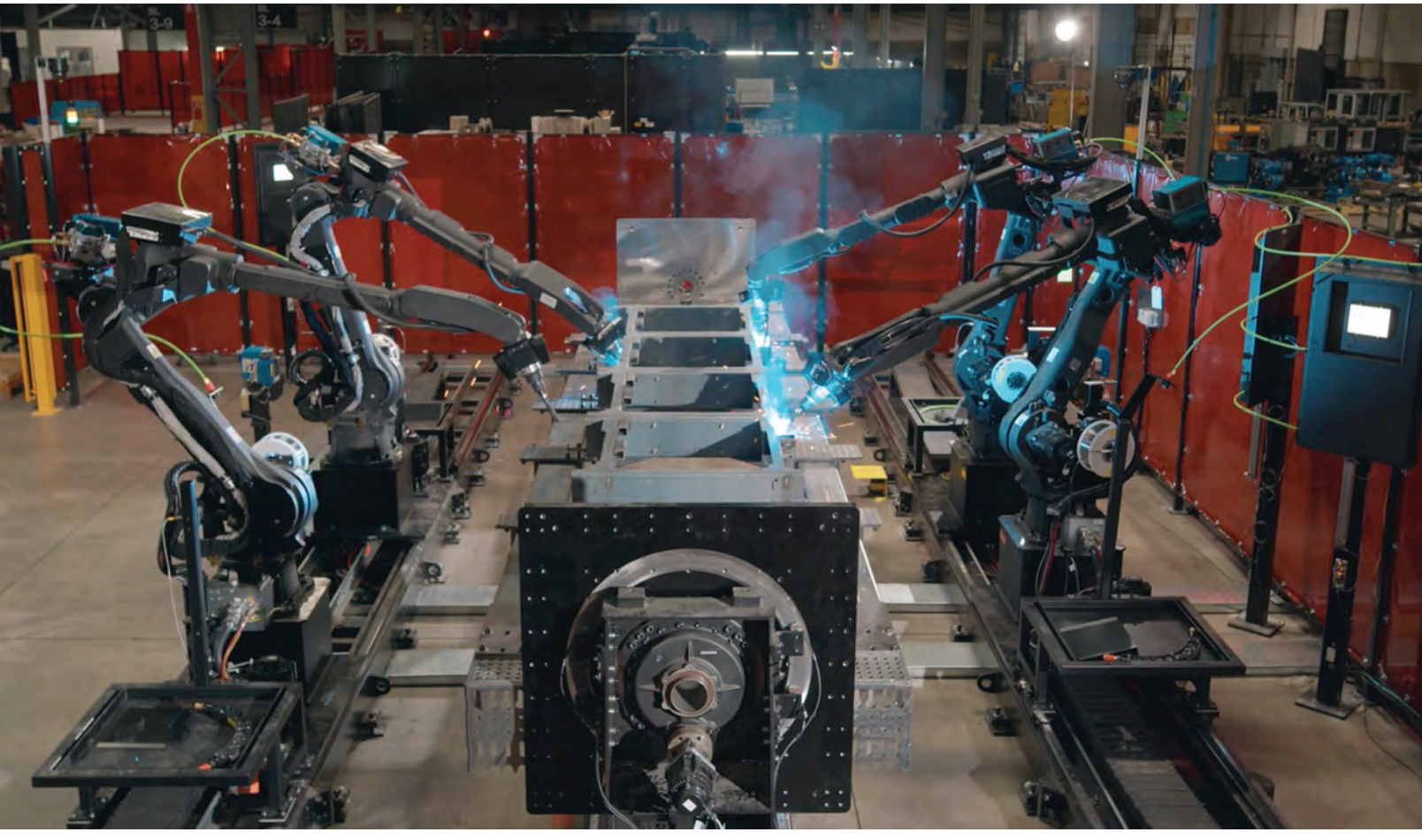
Expanding Capacity Alongside Skilled Labor

This shift is already gaining momentum across the maritime industry. Recent collaborations between shipbuilders and AI technology developers, including Huntington Ingalls Industries' High-Yield Production Robotics (HYPR) initiative, reflect a growing recognition that meeting future production goals will require new manufacturing approaches alongside continued investment in people.

Physical AI extends what experienced welders can accomplish by taking on increased welding operations while keeping human expertise at the center of production. Skilled tradespeople remain responsible for the most complex fabrication, quality oversight and judgment-intensive work, while AI-powered systems increase the amount of productive work the

SHIP YARD TOOLS





entire team can complete.

Every additional welder matters. But the broader objective is increasing completed vessels, and that requires expanding productive capacity alongside the workforce. The significance extends well beyond any individual technology deployment. Increasing welding throughput, shortening production schedules, enabling more distributed manufacturing and strengthening resilience across the defense industrial base all contribute to expanding national shipbuilding capacity.

Building the U.S Maritime Industrial Base America Needs

America's maritime future depends on sustained investment in people, facilities and manufacturing technologies that allow all of the above to work more effectively together.

Workforce development will always remain foundational, and no technology replaces the craftsmanship and experience that skilled shipbuilders bring to every vessel. But expanding the workforce alone will not close today's production gap quickly enough.

Physical AI represents one of the most promising tools for increasing industrial capacity. The shipyards making those investments today are positioning themselves to deliver more vessels, strengthen the defense industrial base and improve America's long-term maritime competitiveness. As demand continues to accelerate, the ability to consistently turn designs into completed ships will become one of the industry's defining competitive advantages.

All images courtesy Weiler Abrasives

BEYOND THE WHEEL:

HOW ABRASIVES CAN IMPROVE SHIPYARD PRODUCTIVITY

*"**We win when we're on the floor**" is the mantra of global abrasive manufacturer Weiler Abrasives, a company with a ubiquitous presence in shipyards, amongst many other industrial operations. Its products are designed to not only hold up and perform in demanding industrial environments, but to also help make the process of shaping and finishing metals more efficient and effective. **John Hines, District Manager, Weiler Abrasives,** discussed with **Maritime Reporter TV** the ways in which Weiler Abrasives can help – whether it's a commercial shipyard or a naval shipbuilder with strict mil spec standards – to help make cutting, grinding and shaping more efficient with insights on how the product's cost impacts a shipyard's bottom line.*

By Greg Trauthwein

Walk through any commercial shipyard or naval construction facility and you'll find cutting-edge technology everywhere, from robotic welding systems and automated cutting tables to digital production planning software. Yet one of the most heavily used tools on the production floor remains one of the least glamorous: the abrasive wheel.

Every weld begins with surface preparation and ends with cleanup. Steel must be cut, edges beveled, welds ground smooth and surfaces prepared for painting or further fabrication. While abrasives represent a relatively small consumable expense, John Hines, District Manager for Weiler Abrasives, argues that focusing solely on purchase price misses the much larger opportunity to improve productivity.

"The hidden cost isn't the abrasive," Hines explains. "It's the labor attached to that abrasive."

That philosophy has become increasingly relevant as shipyards face growing orderbooks while continuing to battle skilled labor shortages. Whether building commercial vessels or meeting demanding U.S. Navy production schedules, yards are under pressure to produce more with fewer experienced workers while maintaining strict quality standards. According to Hines, customers consistently cite four priorities: improving productivity, reducing rework, overcoming labor shortages and maintaining the highest levels of safety. For naval builders, the challenge is even greater, as military specifications demand consistent performance in critical applications such as weld preparation and back-gouging, where mistakes can lead to costly inspection failures and rework.

Rather than approaching customers with a catalog of products, Weiler begins by studying how a yard actually operates. "We win when we're on the floor," Hines says, describing a philosophy centered on understanding operators, production flow and fabrication challenges before recommending a solution.

That process is formalized through **Weiler's Consumable Productivity Program (WCP)**, which evaluates how abrasives are currently being used, establishes performance baselines and identifies opportunities to reduce production costs. The goal isn't simply to recommend a different grinding wheel; it's to quantify the relationship between consumable performance and labor costs. By observing operators, measuring cycle times and analyzing abrasive consumption, Weiler can demonstrate where faster cutting, longer wheel life or fewer product changes translate into measurable savings on the shop floor.

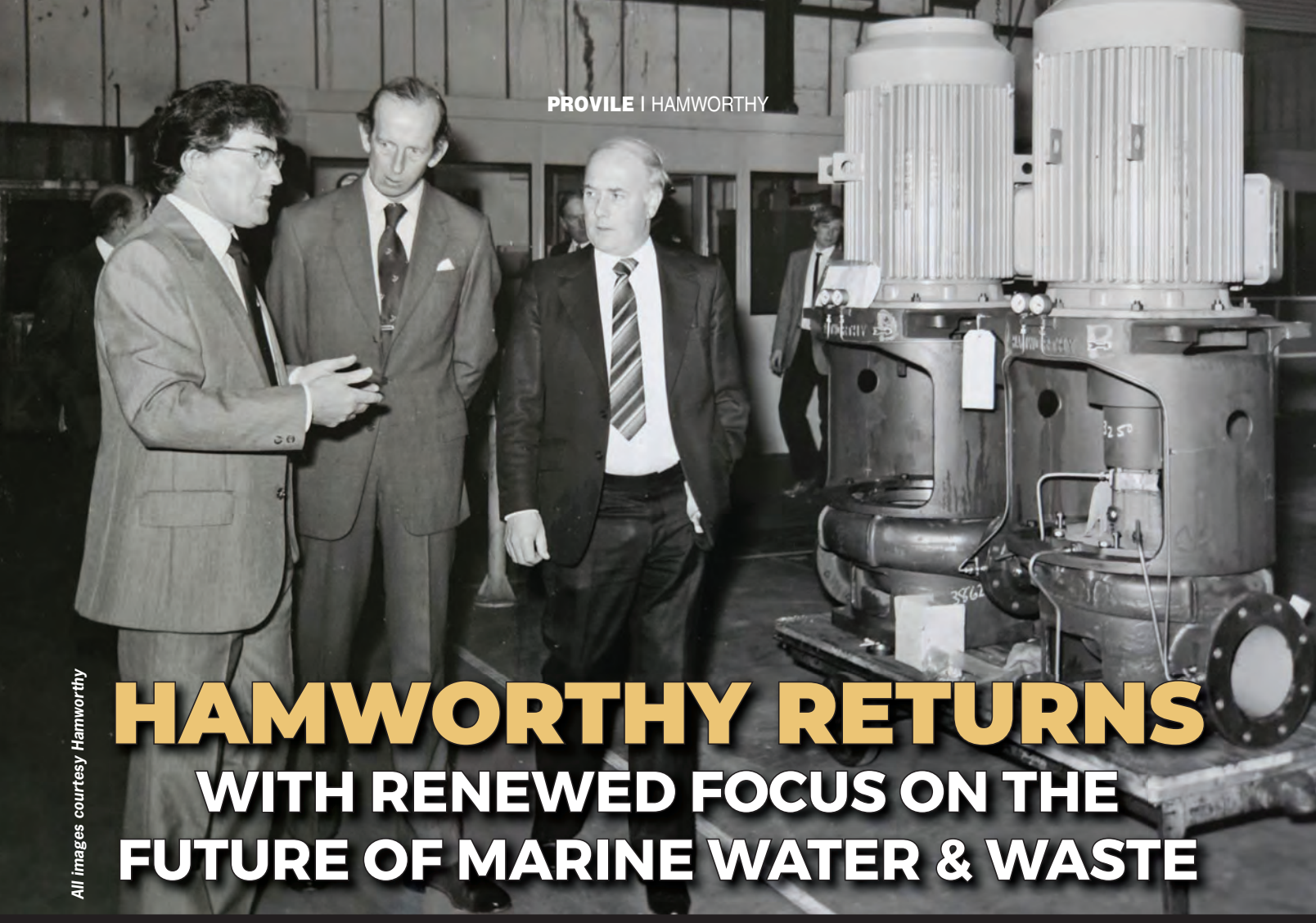
The company's emphasis on consistency begins in its own manufacturing operations. Weiler operates more than 800,000 square feet of manufacturing capacity across facilities in Pennsylvania, Mexico and Slovenia, supported by approximately 20,000 square feet of research and testing laboratories. More than 50 chemists, scientists and technicians work on product development, while automated manufacturing systems help ensure consistent quality from one abrasive to the next.

"The hidden cost isn't the abrasives, it's the labor attached to the abrasives"

– JOHN HINES,
DISTRICT MANAGER, WEILER ABRASIVES

That consistency carries through to new product development. Among Weiler's latest introductions is its **3D Max ceramic grain abrasive system**, designed for aggressive material removal on stainless steel, carbon steel and other demanding materials. The ceramic grain continually exposes fresh cutting edges, allowing operators to maintain higher removal rates over the life of the disc. The company is also expanding its bonded abrasive offerings, including products optimized for aluminum fabrication as the material becomes more common in commercial and naval shipbuilding. Another practical innovation is Weiler's "Optimum Use Line," a wear indicator that helps operators maximize wheel life without sacrificing productivity or safety by replacing abrasives too early — or too late.

For an industry increasingly focused on automation and digitalization, it's easy to overlook the impact of everyday consumables. But every ship still depends on thousands of manual fabrication operations, and the efficiency of those operations often comes down to the tool in an operator's hand. In today's shipyards, the true value of an abrasive isn't measured by what it costs to buy, it's measured by the labor hours it saves and the productivity it helps unlock.



All images courtesy Hamworthy

HAMWORTHY RETURNS WITH RENEWED FOCUS ON THE FUTURE OF MARINE WATER & WASTE

Marking a new chapter for British marine water and waste specialist Hamworthy, CEO Fraser Scott reflects on how environmental systems have evolved from check-box auxiliary equipment into essential infrastructure at the heart of modern shipping.

By Fraser Scott, CEO, Hamworthy

When we reintroduced the Hamworthy name to the maritime industry in June, I found myself reflecting on everything that has changed during our 14 years as the water and waste systems division of the Wärtsilä Group. Hamworthy and Serck Como have been part of the marine environmental systems industry for decades, supporting thousands of vessels across every major shipping sector. Throughout that time, one thing has remained remarkably consistent. Water and waste systems have rarely attracted attention unless something has gone wrong.

Conversations about ship technology and equipment naturally gravitate towards propulsion, navigation, cargo handling and, more recently, digitalisation. Shipboard environmental systems rarely receive the same level of attention, yet we would argue that dependable water & waste systems are just as fundamental to operations. Freshwater must be produced or treated, sewage and grey water collected and processed, bilge water treated before discharge, and sludge and solid waste managed in accordance with international and local regulations.

These systems are fundamental to the operation of every modern vessel, sitting at the intersection of environmental responsibility, operational resilience and commercial performance. And increasingly, regulatory compliance must now be demonstrated every day a ship is in service, which is a significant shift from the install, certify and forget approach that parts of the industry have shown towards the sector in the past.

EVOLVING REGULATIONS

Environmental regulation has become progressively more demanding. MARPOL Annex IV and Annex V continue to provide the global framework for sewage and garbage management, while regional requirements, including the Baltic Sea Special Area, have introduced more stringent discharge standards for passenger ships. Alongside this, more frequent effluent sampling, environmental inspections and growing public scrutiny have increased expectations for the consistent performance of onboard treatment systems throughout a vessel's operational life.

At the same time, ships have become more complex, crews have become leaner, and there is less tolerance for equipment that requires continual intervention simply to maintain stable operation. Environmental systems have therefore become operational infrastructure rather than equipment specified simply to satisfy a newbuild requirement.

Designing equipment capable of meeting a specification is only the beginning. Long-term performance depends on how well systems cope with variations in influent quality, fluctuating operating conditions and the practical realities of life at sea. Biological treatment processes, in particular, require stability. Maintaining that stability over many years of operation demands careful engineering, intelligent process control and an understanding that no two vessels operate in exactly the same way.

Waste is generated around the clock

and every vessel must either reduce it, process it, store it or discharge it where regulations permit. Storage capacity is limited, often measured in hours or days rather than weeks. Once storage is full, or onboard treatment is interrupted, compliance quickly becomes an operational issue. Managing these continuous waste streams reliably is therefore fundamental to keeping vessels trading.

Crew capability remains equally important. Engineers today oversee an increasingly diverse range of sophisticated systems throughout the vessel, often with fewer people than previous generations. That places greater emphasis on environmental systems that are increasingly self-sufficient and self-regulating, requiring little more than routine inspection and maintenance while continuing to deliver stable biological treatment.

LIFECYCLE PERFORMANCE

For many years, development across our sector was driven primarily by changing discharge standards. Today, the conversation is broader. Shipowners are looking for integrated systems that reduce operational complexity, improve long-term performance and ease the burden on shipboard crews. Reliability, consistency and lifecycle performance have become just as important as achieving treatment standards.

Many companies are also choosing to exceed minimum regulatory requirements, particularly when operating in environmentally sensitive waters or carrying passengers. Protecting the environments in which they trade has become an important part of responsible operation, placing even greater emphasis on dependable environmental systems.

Meeting these evolving requirements is where the marine water and waste sector has the greatest opportunity to make a difference. As an independent business, we focus entirely on this discipline, which allows us to respond more quickly to changing technical and environmental requirements while accelerating investment in research and development. It also allows us to build on the engineering heritage of both Hamworthy and Serck Como, applying decades of practical experience to the next generation of marine environmental systems.

OPPORTUNITIES AHEAD

Dry waste management is one of the most active areas of development as we begin this new chapter. Conventional shipboard incineration has served the industry well for many years, but there is growing interest in technologies that can further improve environmental performance. While no single alternative has yet emerged for marine applications, significant progress continues to be made in waste segregation, sludge management, recycling and system integration. Together, these developments are helping improve system performance while reducing demands on shipboard crews.

Alongside technological progress, I believe the industry would benefit from clearer guidance and more consistent best practice around shipboard waste system design and operation. As new technologies emerge and environmental expectations continue to evolve, greater structure from governing bodies would help shipbuilders, shipowners and equipment manufacturers design systems that continue performing reliably throughout a vessel's operational life.

Hamworthy's return has prompted me to reflect on how far this industry has come. The expectations placed on environmental systems are higher than ever before, and rightly so. The ships we support today face very different challenges from those of a generation ago, but one principle has remained unchanged. Reliable engineering, backed by specialist knowledge and long-term commitment, remains the foundation of effective marine environmental systems.

If there is one lesson I have learned over many years in this industry, it is that the best environmental systems are still the ones nobody notices. They quietly produce clean water, process waste, protect the marine environment and allow ships to continue doing what they were built to do. That has always been the objective and as Hamworthy, we are once again able to dedicate ourselves entirely to that purpose.

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In the Shipyard

From Design to Delivery

USGS

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ASENAV to Build Oceanographic RV for UC San Diego

Chile's ASENAV has secured a landmark contract to build its first oceanographic research vessel for export to the United States, signing an agreement to construct a 38-meter hybrid-electric research vessel for the University of California San Diego's Scripps Institution of Oceanography.

Designed by Seattle-based naval architecture firm Glosten, the vessel will join the U.S. Academic Research Fleet as a Coastal Class Research Vessel, replacing the aging Robert Gordon Sproul, which has supported coastal research missions for nearly 40 years. Construction is expected to take 24 months, with delivery scheduled for July 2028.

Operating from its homeport in San Diego, the new vessel is expected to spend more than 200 days at sea annually, supporting up to 55 research missions each year along the U.S. West Coast. The ship will accommodate up to 20 crew members and scientists on expeditions lasting as long as 11 days, while also carrying as many as 40 students during day-long educational cruises.

The 38-meter monohull will feature hybrid battery-electric propulsion, twin azimuthing L-Drive stern thrusters, a bow thruster and dynamic positioning capability, enabling precise station keeping for scientific operations. The vessel is designed to support a broad range of oceanographic disciplines, including biology, chemistry, geology, geophysics and physical oceanography.

Its scientific outfit will include multibeam and sub-bottom mapping sonars, Acoustic Doppler Current Profilers, fisheries acoustics, USBL navigation for autonomous underwater vehicles (AUVs), and heavy-duty handling systems capable of deploying scientific equipment and remotely operated vehicles (ROVs) to depths of 4,000 meters.

Particular emphasis has been placed on acoustic performance. Glosten's subsidiary, Noise Control Engineering, will lead airborne and underwater noise analysis to ensure the vessel meets stringent underwater radiated noise requirements that minimize interference with scientific measurements and marine life.

The vessel will be built to American Bureau of Shipping (ABS) class.

Saronic's Mirage Hits the Water

Saronic launched Mirage, a 52-ft. dual-use Autonomous Surface Vessel (ASV) that joins the 24-ft. Corsair and 180-ft. Marauder as the third flagship platform in Saronic's growing fleet, and is the latest milestone in a production model delivering autonomous vessels at speed and scale. Mirage went from initial design to launch in under a year, and now begins on-water trials at the company's privately funded test facility in Galveston, Texas, with the next hull already on the production line at the company's Austin headquarters.

Mirage has a top speed of 35+ knots, a range exceeding 2,500 nautical miles, and a payload capacity of 3,500 pounds, Mirage more than doubles the range and payload capacity of Saronic's 24-ft. Corsair. Operating fully autonomously or under remote human supervision through Saronic's Echelon command-and-control platform, Mirage supports maritime domain awareness, maritime security, and aerial and surface detection missions.

Mirage is designed and manufactured at Saronic's Austin, Texas headquarters, where the company develops its hardware and software as a single integrated system under one roof. The Austin facility has the capacity to produce hundreds of Mirage vessels per year alongside the capacity to produce thousands of Corsair vessels. Work on the next Mirage hull is already underway.

In the Shipyard

From Design to Delivery

Incat Crowther

Hanwha Philly Shipyard

HD Hyundai Samho

First LNG Carrier-to-FSU Conversion Order for Gabon FLNG Project

As demand grows for floating LNG infrastructure, Danish marine equipment supplier Svanehoj has secured its first contract to supply cargo monitoring systems for an LNG carrier-to-floating storage unit (FSU) conversion, marking a strategic expansion into the rapidly emerging vessel conversion market.

The company has been selected by Drydocks World Dubai to provide four Liquefied Temperature Density (LTD) gauging systems for the conversion of the LNG carrier LNG Bayelsa into the floating storage unit Cap Lopez. The project is being carried out for Dixstone Lower Gulf FZCO as part of a broader floating LNG (FLNG) development aimed at expanding offshore gas infrastructure in Gabon.

The conversion reflects a growing trend across the LNG sector, where operators are repurposing existing LNG carriers into floating storage and regasification units (FSRUs), floating storage units (FSUs) and other offshore energy assets as a faster and more cost-effective alternative to newbuilds.

The Cap Lopez conversion involves extensive modifications, including structural steel work, piping, new process modules, tank coating and life-extension work under Lloyd's Register classification. Svanehoj's scope includes replacing the vessel's existing float-type level gauges with four LTD gauging systems capable of continuously measuring LNG density and gas composition within the cargo tanks.

The real-time data generated by the system will feed into rollover prediction software designed to detect LNG stratification and identify potential rollover events before they occur. Such monitoring is increasingly important for offshore storage applications, where LNG may remain in tanks for extended periods and maintaining cargo stability is critical to both operational reliability and safety.

The Cap Lopez FSU will serve as offshore storage infrastructure supporting Gabon's expanding gas export capability. According to the project partners, the broader FLNG development is expected to reduce routine gas flaring while increasing the country's natural gas production by approximately 105 million standard cubic feet per day.

Completion of the conversion is currently targeted for the third quarter of 2027, underscoring the growing role vessel conversions are expected to play as the offshore LNG sector seeks to maximize existing assets while meeting rising global demand for flexible gas infrastructure.

Hy-line Cruise's CAT Ferry Construction Commences

Construction on a new 48m catamaran passenger ferry designed by Incat Crowther for Hy-Line Cruises is now underway at Midship Marine in Louisiana. The vessel, when completed, will operate on Hy-Line Cruise's critical tourism and commercial routes connecting Hyannis, Mass., with the islands of Martha's Vineyard and Nantucket.

Capable of transporting up to 493 passengers across three passenger decks, the vessel is capable of reaching speeds in excess of 30 knots and has been designed specifically for the unique local conditions experienced off the coast of Cape Cod.

The vessel is powered by four Cummins QSK60-M Tier 4 engines driving four Hamilton HTX65 waterjets. Composite shafting supplied by Driveline Service of Portland is incorporated into the drivetrain, reducing weight and maintenance requirements. The aluminum hull and superstructure construction supports the vessel's performance targets, ensuring efficient and safe operations and features active ride control technology supplied by Naiad.

NSMV Lone Star State Christened at Hanwha Philly

The fourth of five National Security Multi-Mission Vessels (NSMVs), Lone Star State, was christened July 17 at Hanwha Philly Shipyard, moving the U.S. Maritime Administration

In the Shipyard

From Design to Delivery

Northern Lights JV

NYK

(MARAD) one step closer to completing its next-generation fleet of purpose-built training ships for the nation's state maritime academies. Built by Hanwha Philly Shipyard under the Vessel Construction Manager (VCM) model managed by TOTE Services, Lone Star State is scheduled for delivery to Texas A&M Maritime Academy this fall. The vessel will serve as the academy's primary training ship while also providing surge capacity for federal humanitarian assistance and disaster relief missions.

At 159.85 meters in length, Lone Star State is among the largest and most technologically advanced training vessels ever built for a U.S. maritime academy. The ship features two full-mission bridges and two fully operational engine rooms, allowing cadets to train simultaneously in realistic bridge and engineering environments. Accommodations for up to 760 people support large-scale training evolutions as well as emergency response missions.

Designed to cruise at 18 knots with a deadweight of 8,487 metric tons, the vessel represents the latest step in MARAD's effort to replace aging training ships while strengthening the pipeline of licensed U.S. merchant mariners. The program has also supported continued investment at Hanwha Philly Shipyard, including plans for a second drydock to expand both commercial and government shipbuilding capacity.

Maersk Takes Delivery of First Ammonia Carrier

HD Hyundai Samho has delivered its first-ever very large ammonia carrier (VLAC), the 93,000-cubic-meter Jane Maersk, to Danish shipping company Maersk.

The vessel is the first of five ordered in November 2023 and is capable of transporting both liquefied ammonia and LPG. To safely handle ammonia's highly corrosive and toxic properties, it is equipped with advanced systems, including a specialized 'High Level Alarm' to minimize misloading risks.

The company has secured nine VLACs this year alone, bringing its total VLAC order backlog to 22 vessels worth $2.55 billion.

Northern Lights CCS Fleet Set for Next Stage with Latest LCO2 Carrier Arrival

Northern Lights joint venture has taken delivery of its fourth dedicated liquefied CO2 (LCO2) carrier, completing the vessel fleet required for the first phase of its carbon capture and storage (CCS) transport and storage operations.

The Northern Purpose has arrived in Norway following delivery from Dalian Shipbuilding Offshore Company (DSOC), joining sister vessels Northern Pioneer, Northern Pathfinder and Northern Phoenix to provide CO2 transport capacity for customers across Europe.

Northern Lights said the vessel fleet forms the core of its transport solution, enabling liquefied CO2 captured at industrial sites across Europe to be shipped to its onshore receiving terminal in western Norway before being transported by pipeline for permanent storage in a reservoir 2,600 meters beneath the seabed.

Northern Lights joint venture, owned by Equinor, TotalEnergies and Shell, currently operates the world's largest dedicated fleet for commercial CO2 transport and plans to expand capacity under Phase 2, including the introduction of larger CO2 carriers from 2028.The companies began injecting liquefied CO2 for permanent storage in August 2025 as part of Norway's Longship full-scale CCS project.

CNOOC's LNG Vessel Greenergy River

Huajing LNG Transport Ltd. (HLT), a joint venture company in which NYK participates, held a naming ceremony for a new liquefied natural gas (LNG) carrier for the CNOOC Group, a Chinese state-owned energy company. The ship was named Greenergy River at a ceremony at Hudong-Zhonghua Shipbuilding (Group) Co., Ltd. in China, where the vessel is being built.

HLT is a joint venture company comprising NYK; CNOOC Gas and Power Singapore Trading & Marketing Pte. Ltd. (CNOOC SG), a subsidiary of the CNOOC Group; CETS Investment Management (HK) Co., Ltd. (CETS); and CMES LNG Project 4 Company Limited, a subsidiary of China Merchants Energy Shipping Co., Ltd. (CMES), a major Chinese shipping company.

It is the first of a series of six LNG carriers that HLT will deploy for CNOOC SG under this project. It is also the first China-built LNG carrier involving NYK to be deployed under a long-term charter contract with a Chinese customer. From August, the ship is scheduled to transport LNG procured by the CNOOC Group from suppliers worldwide primarily to China. The vessel will be managed by OPearl LNG Ship Management Company Limited, a ship-management company established jointly by NYK, CMES, and CETS.

The 299 x 464m, 174,000 cu. m. ship is equipped with a highly fuel-efficient, state-of-the-art dual-fuel engine (X-DF 2.1 iCER) that uses fuel oil and boil-off gas (LNG vaporized in cargo tanks during navigation) as fuel.

KUSPC:

COMMERCIAL SHIPBUILDING'S NEW PARTNERSHIP *OR AN OUTLET TO SUPPORT DEFENSE ACQUISITIONS?*

By Robert Kunkel

Image courtesy Amtech

On July 23rd, 2026 Amtech, courtesy an invitation from the U.S. Department of Commerce, attended the Grand Opening of the Korea-U.S. Shipbuilding Partnership Center (KUSPC) in Washington DC, a Secretary level event with invitations provided to recognized leaders in the U.S. commercial and naval shipbuilding industry. Amtech has been working with Commerce from the initial release of the first Executive Order issued to recover and develop U.S. maritime dominance. And with that, we will take this opportunity to thank our contacts at Commerce in Washington and Seoul for that support.

On arrival to the morning event, the intent was clear. Red "MASGA" hats with U.S. and South Korean flags side by side announcing "Make American Shipbuilding Great Again" were at every seat position. A sweep of the room indicated the majority of the attendees were South Korean. A subliminal thought for us as the attendee numbers and the U.S. minority defined the comparable size of U.S. commercial shipbuilding versus South Korean capability. Amtech supports an office in Ulsan, South Korea and has members involved in South Korean Shipbuilding since 1982. With that experience it should be clear we are commercial ship construction managers and operators. Our "MASGA" effort involving Hyundai and the South Korean yards has been proposed in many of our recent projects from commercial AIP submarines, Console tankers, Hospital ships and support vessels. Our efforts have not been combatant ships or Navy Registered vessels.

The KUSPC VIP attendees were announced on their arrival and our apologies as the list here is not complete. Maritime Administrator Steve Carmel, Senators Kelly and Young representing the Ships for America Act, and the honorable Huang Cao Acting Secretary of the Navy provided MarAd, legislative and Naval interest throughout the event. Speakers included South Korean/U.S. Ambassadors Michelle Steel, Kyung-Wha Kang. Jung Kwan Kim Minister of Trade and Tae Kon Kim Director General of DAPA (South Korea Defense Acquisition Program Administration) along with Senator Todd Young and Marad's Chief of Staff Anthony Fisher.

Commerce Secretary Howard Lutnick addressed the event on his arrival. His takeaway statement confirming the administration will determine the success of the program by delivered projects rather than rhetoric and media announcements. "We are going to judge the KUSPC by the capital it deploys, the facilities developed, the workers you train, the supply chains you establish, and ultimately the simple number of how many domestically produced ships we build together."

A simple statement confirming KUSPC was not looking to talk the talk, rather walk the walk with commitment and results supporting U.S. manufacturing, the supply chain and U.S shipbuilding.

With that commitment let's look at the "numbers" provided during the event and illustrated by several projection screens and speakers defining the program. KUSPC serves as the premier platform facilitating $150 billion in Foreign Direct Investment (FDI) into the U.S. Maritime Industry. The core mission of that funding is to rebuild and modernize U.S. shipbuilding capabilities through strategic alliances. The program also announced an $80 million-dollar, five-year effort covering areas of new smart ship technologies with AI-assisted design, robotic welding, module-block transportation, and autonomous navigation. Further $5 billion dollar packages were announced for Hanwha to expand their Philly yard and Hyundai to expand their U.S. efforts. $13.5 million was set aside to open and fund the KUSPC Washington offices.

Fifteen MOU's were executed and announced during the event. The top four describing a program with Samsung & Saronic collaboration addressing naval autonomous vessel operation, HD Korea Shipbuilding & Offshore Engineering next generation marine partnerships, Hanwha Ocean announcing a professional services contract with Leidos Gibbs & Cox to jointly design a fast sealift vessel. A dual-use ship to carry commercial cargo during peacetime and move military equipment in a defense theater. A historical return to the time of the MarAd Sealand SL7 fast sealift ships and LMSR program (now in Ready Reserve Force layup) pre- and post-Iraqi wars. The final of the four top MOUs addressing an agreement with HD Hyundai Samho to provide port cranes for Washington United Terminals on the U.S. West Coast. In no uncertain terms, the number of "announcements" favored Hanwha, naval oriented vessels and infrastructure with a continued reference to their purchase of the Philadelphia Shipyard. The remaining 11 MOUs described working platforms with several U.S. shipyard companies, defense technology groups, universities and research organizations covering shipyard modernization, supply chain issues, workforce development and joint technology programs. The top four major announcements may have been the ticker-tape parade, however, the smaller follow-on MOUs addressed important detailed issues towards rebuilding competitive U.S. shipyards. Miller Electric Manufacturing, a well-known source of welding expertise to those of us that live and work in the U.S yards, introduced a MASGA cooperation project with new welding inspection technology. Delaware County Community College was recognized as building shipyard labor training cooperation with Hanwha

Philly. A Department of Labor program Amtech has been involved with at Massachusetts Maritime Academy.

A week or so prior to the KUSPC event, Hanwha Philly announced the award of a $2 billion contract to build two new missile-tracking vessels for U.S. Missile Defense. That award statement is correct with "B" as in Billion. The vessels are replacing the Pacific Tracker and Pacific Collector owned by the US Government and operated by Tote Services. The award indicates another construction movement towards Naval and Military applicable vessels without historical competitive bid.

The interest in this specific U.S. government market is widely reported in the South Korea press and media.

Our interest is how it affects both U.S. and Foreign commercial shipbuilding capacity, price and available delivery dates. An affect that can influence the ability to "flag in" cost affective new foreign tonnage for proposed Marad and Cargo Preference programs and more importantly vessels qualified for U.S. coastwise registry to rebuild an aging "Jones Act" fleet. A market upside down as it responds to the current waiver and over 180 foreign vessel voyages trading along the U.S. coasts.

In 2025, the Korean press announced HD Hyundai plans to merge HD Hyundai Mipo (HMD) with their Naval "Special Purpose" Planning office and production. HD Hyundai Heavy Industries looked to expand its naval defense business overseas with warship orders by combining HD Hyundai warship construction technology with Hyundai Mipo's production infrastructure.

HMD has been long considered the lead designer and builder of Medium Range tankers. A tanker design tagged in many industry reports as needed to support a U.S. Indo-Pacific defense theater with up to 100 vessels. The HD Hyundai production shift earmarked slots for only Naval based contracts and as a result more than several commercial operators, with prior commercial construction history delivering MR tonnage at HMD, set their next projects in China.

Hanwha Ocean and HD Hyundai Heavy Industries failed to win Canada's submarine program order in 2026. The program was a joint cooperation between the two companies and the loss severely affected their future defense revenue projections. The third large South Korean shipbuilder, Samsung Heavy Industries, does not build warships. Its MASGA MOU with Saronic is an indication that may change. As a result of the Canadian Submarine contract loss, Hanwha Ocean and HD Hyundai are targeting warship programs established throughout the world to develop naval defense exports. The most recent orders expected in Southeast Asia and South America. Through the Korea-U.S. MASGA shipbuilding partnership project, they are also preparing a long-term goal of building U.S. warships. Amtech has presented commercial projects to develop tonnage that attracts private investment and supports defense requirements without the delivered tonnage being U.S. Naval registration. To meet expedited delivery requirements a small portion of those projects may be required in foreign yards prior to "reflag". This is the "bridge" issue now being debated.

The U.S. Shipbuilding industry and vessel operators need to understand that these programs are defense programs not commercial shipbuilding and operation. U.S. shipyards need a separate program to address the cost of construction to allow private investment.

A commercial industry is a business sector focused on trade, manufacturing, or providing services with the primary goal of making a profit. To attract private investment that business sector or project must develop a business model that not only provides an acceptable Capital Cost to build the infrastructure or assets, but also an efficient Operating Expense and profit to maintain and operate the asset through its life. The KUSPC program can assist the U.S. Shipyards in meeting those immediate goals for the projects under MOU. It needs to take into account "life" after the Federal Direct Investment and the commercial markets beyond defense that support commercial seafarers and private operators whether under coastal registry, cargo preference, Marad programs or the attempt to reach Global competition levels of operation.

Billion-dollar vessel construction will not meet that commercial goal.

The Author

Kunkel

Robert Kunkel, president of Alternative Marine Technologies and First Harvest Navigation, served as the Federal Chairman of the Short Sea Shipping Cooperative Program under the DOT's MARAD from 2003 until 2008.

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