NOVEMBER 2026

MARITIME REPORTER AND ENGINEERING NEWS

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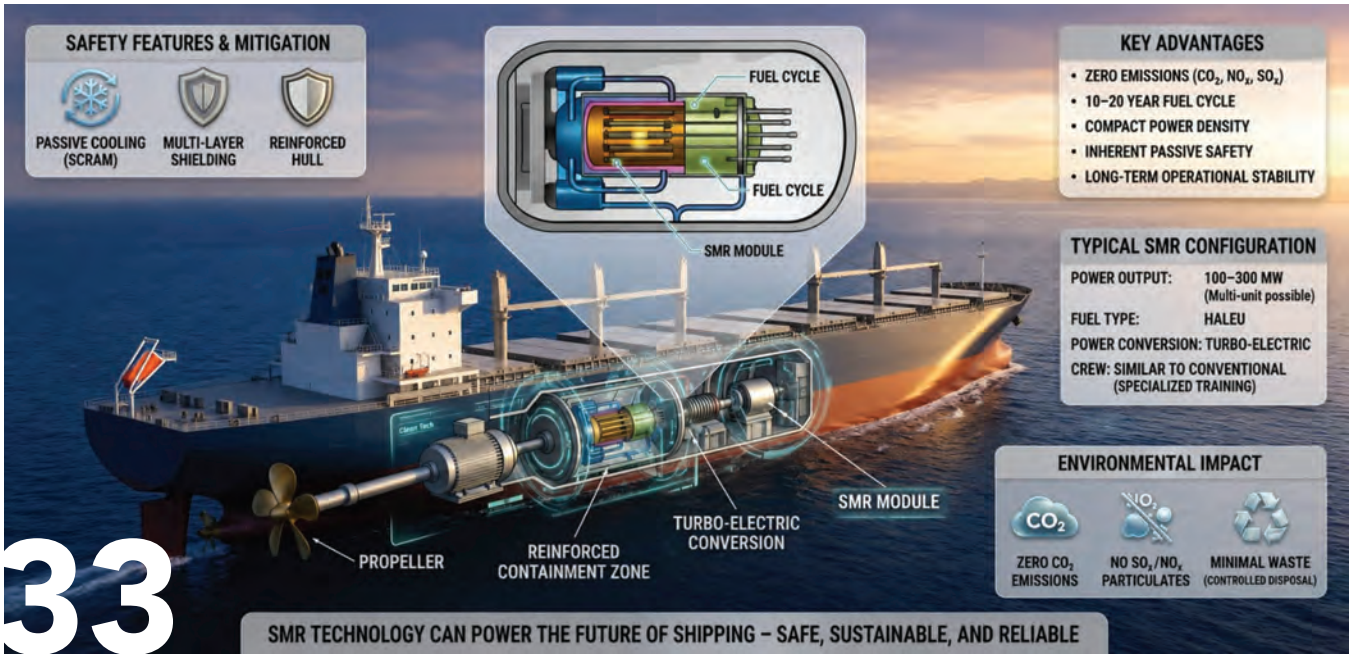
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Credit: Authors (Lakshya, Krish Uniyal, Raj Singh)

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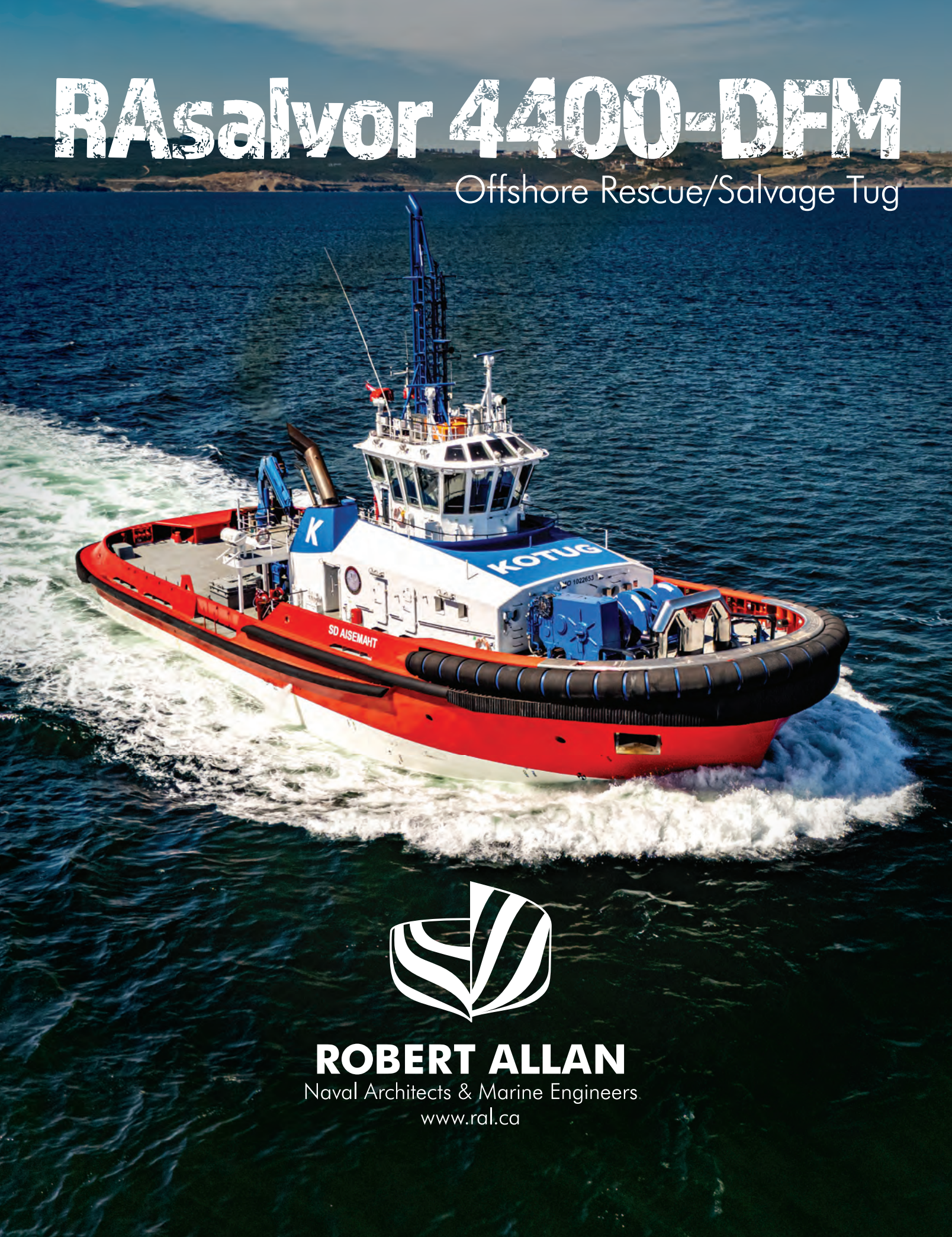
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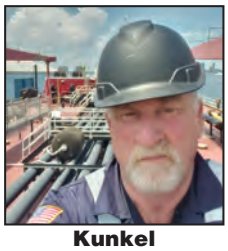
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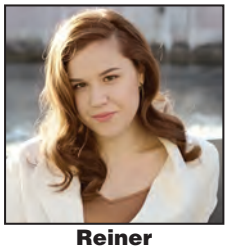

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In 1897,



Photo by Justin Zurre

William McKinley was sworn in as the 25th President of the United States; **Rudolf Diesel** was demonstrating the practical potential of his new engine; **Charles Parsons** was showing the British Navy what steam turbine propulsion could achieve; and **Guglielmo Marconi** was experimenting with wireless communication across open water. The U.S. Navy had yet to commission its first modern submarine, and the Wright brothers' first powered flight was still six years away. That same year, a tugboat was built that would outlast generations of ships, machinery and maritime technology. Nearly 130 years later, while the industry debates alternative fuels, autonomous navigation and the digital transformation of shipping, tugboat ***America*** is still doing what it was built to do: working commercially on the waters of the Great Lakes. This edition features a diverse array of maritime technology, starting with our cover story interview with her captain, **Paul C. LaMarre III**.

While the maritime industry continues to evolve quickly on the technology front, *America* is not only a testament to investment in quality vessel design and construction; her captain is a testament to the human factor and its importance to this industry and its future. Turn to page 24 for Capt. LaMarre's take on what makes *America* special and still working in today's maritime market.

Technology is a pervasive theme in our pages print and electronic, and in this edition find a pair of reports on two technologies – **AI** and **nuclear propulsion** for commercial shipping – that have the potential to radically impact the course of maritime's future for all.

As of 2024, the maritime AI market stood at $4.1B, with a projected five-year CAGR of 23%. Market-size estimates should be treated cautiously, but the direction is clear – AI solutions have advanced from trials into voyage planning, machinery monitoring, bridge decision support, port coordination and digital assurance. AI comes to the fore when talk turns to autonomous ships, but AI is not about de-crewing, rather applying vessel and shore data to make operations safer, more fuel-efficient, and easier to maintain, as **Alisa Reiner** writes starting on page 20.

While nuclear propulsion for commercial maritime applications may seem far-fetched when I interviewed **U.S. Maritime Administrator Stephen Carmel** a few months ago, he said, and I quote:

> *"SMR-powered nuclear technology will transform trade and shipping every bit as much — or more — than the container did."*

We've written quite a bit on the topic here and on MarineLink.com, and this month I'm happy to provide an article from a trio – **Lakshya, Krish Uniyal** and **Raj Singh**, of the International Maritime Institute, India – for insights on Small Modular Reactor (SMR) technology and the possibilities for its use across shipping, starting on page 33.



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LEARNING FROM MARITIME HISTORY:

THE HANSEATIC LEAGUE

By Rik van Hemmen, Martin & Ottaway

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I remember a quick reference to the Hanseatic League in my Dutch history classes, but I did not learn much more about it until I came across another reference in a university class in the United States. Since then, I often think about the Hanseatic League and what it means in today's world.

The early form of the Hanseatic League goes back to the 1100s and consisted of friendly trading relationships between towns and merchant communities around the Baltic and North Sea. They fished for herring along there shores but then it suddenly disappeared in the 1200's and was rediscovered closer to the North Sea.

The movement of herring stocks was long something of a mystery. More recent research suggests that changes in fish populations were influenced by a combination of overfishing and environmental and climatic factors, although the precise causes remain debated. Either way, it was an early lesson in the interaction between natural resources, climate, and human economic activity.

The German and Baltic fisheries were now faced with a problem — and an opportunity. Herring was a desirable commodity because Christians ate fish on Fridays and during other religious fasts. While herring was relatively cheap, it spoiled quickly. Salting was the main method of preservation, and salt came from Lüneburg, some distance inland from Lübeck. Salt could be shipped more easily through Hamburg, which helped establish maritime trade routes connecting salt production, fishing communities, and commercial centers. The Hanseatic trading network eventually connected places such as Lübeck, Hamburg, and Bergen, Norway, where preserved fish and other commodities could be exchanged and shipped onward.

Nothing terribly special there.

Maritime trade routes like this had waxed and waned for millennia around the world. Venice was doing something similar at about the same time in the Mediterranean. But there were subtle differences. While Venice often played for dominance and control of trade, the northern trade developed more as a league approach: the Hanseatic League.

Instead of a monopoly, the Hanseatic League more closely resembled a cartel or, more accurately, a trade alliance.

There are many options in the development of maritime trade. One can simply go with the traditional — and often incorrectly characterized — Viking approach of uncooperative rape and pillage (zero-sum trade), all the way to fully cooperative maritime trade.

From a game-theory point of view, this northern trade had many of the hallmarks of an iterated prisoner's dilemma. Instead of one big haul, the trade depended on long-term reliance and many transactions between partners, with each contributing a piece of the puzzle. That characteristic is extremely powerful and is a core source of cooperation in evolution, nature, social settings, and commerce.

True maritime trade — not rape and pillage — needs credit, currency, contracts, and eventually financial agreements between financiers and the various cities and merchants involved in the trade. Next came insurance, trade agents, and other mechanisms for reducing commercial risk. Since it was a commercial venture, other cities and trading communities wanted in on the game. As long as everybody played by reasonably consistent rules, there was no obvious limit to its growth.

Soon the trade expanded from fish to other products, and by the 1400s the Hanseatic League was a major force in northern European commerce, with trading connections extending from the eastern Baltic to London and along the Rhine to Cologne. Almost all the participants in the League were cities, and if one city stopped participating or violated the interests of the others, the other cities could boycott it or shift their trade, all without a formal central government structure. Meanwhile, very high levels of operational agreement and standardization strongly increased any merchant's holy grail: high predictability and steady profits.

It was far from all sweets and roses. The cities also maintained military capabilities, and ships from different cities could be combined into fleets to fight aggressors and pirates.

While nowhere near as glitzy as the Southern Renaissance, the Northern Renaissance was real and had its own character, although the distinction between a "Northern" and "Southern" Renaissance can be overstated. The differing commercial environments did, however, influence local philosophy and political thought. The North talked in terms of Erasmus—humanism and moral ethics—while the South talked in terms of Machiavelli—power and dominance.

Crazily, Erasmus and Machiavelli were almost exact contemporaries, and the comparison of their philosophies can seem to describe today's political polarizations almost exactly.

A maritime trade network can create great wealth, with inherently high incomes per person. This is difficult to achieve on land, where the transportation of trade goods was incredibly expensive and therefore constrained eco-

nomic growth. However, feudal landed gentry had its own asset: serfs, and the ability to whip them up in envy of nearby Hanseatic towns. While a single sailor can carry many times more cargo than a serf, on land a serf with a gun is no worse than a sailor with a gun.

This instability contributed to the demise of many city-states and the creation and consolidation of nation-states in both the South and North of Europe.

The Hanseatic League eventually disappeared, but so did the great maritime republics of the Southern Renaissance. Venice lasted longer, in part because it took longer for nation-states to organize and challenge its position in the Mediterranean. In effect, neither model proved immune to the rise of the nation-state.

This would indicate that the Northern and Southern Renaissance concepts were both doomed.

But maybe not, and maybe the Northern approach holds more inherent promise.

After a number of centuries of nation-state strife, what we have today is a Europe that, in some important respects, functions more like a Hanseatic League than a Venetian single-entity dominance model.

Just like the Hanseatic League, in the European Union—and NATO—there are misguided efforts at freeloading, overplaying one's hand, and even moves to secede, along with lots of bickering. But as long as they stick together and work together, everybody in the league benefits.

It would appear that the Northern Renaissance concept is the real winner and perhaps can be Ben Franklin paraphrased as:

"It is a league, if you can keep it."

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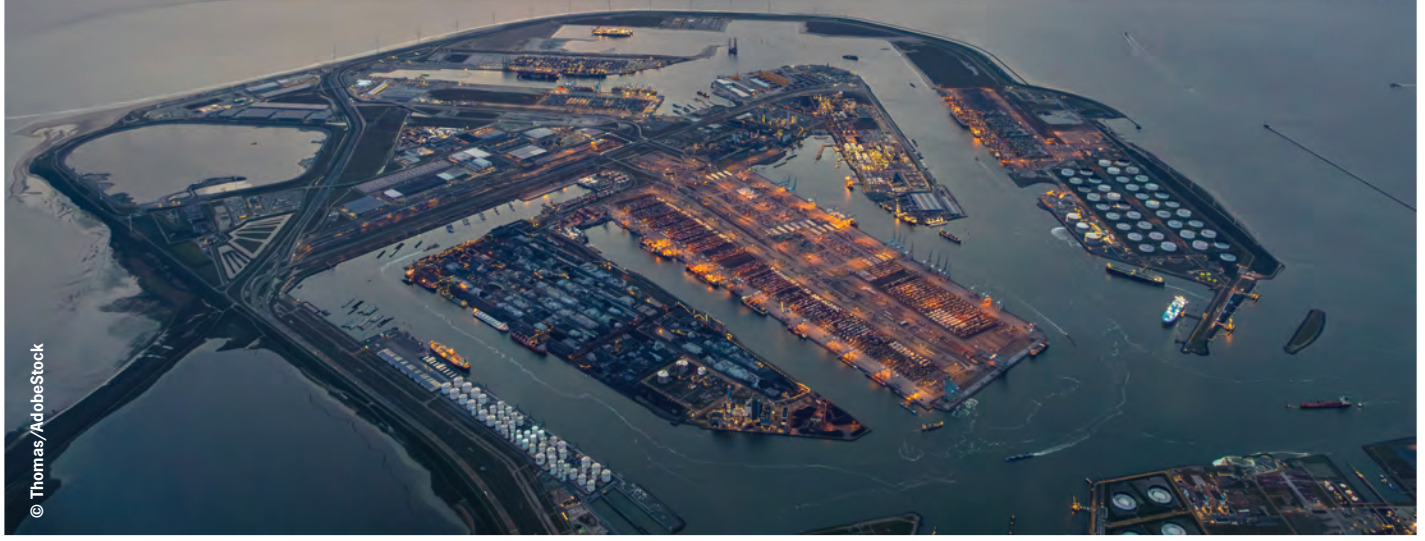


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PORT READINESS: The Resilience Lessons Europe and America Should Share



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By Amine Lehna

The succession of maritime crises since 2020 has exposed weaknesses that ordinary port traffic indicators describe poorly. During the pandemic, staff shortages, misplaced empty containers and constrained inland transport disrupted the movement of cargo even where ships could still call. Russia's invasion of Ukraine in 2022 curtailed access to Black Sea ports and displaced part of the grain trade towards the Danube and overland routes whose capacity could not fully replace established maritime corridors. From late 2023, attacks in the Red Sea and drought restrictions at the Panama Canal altered shipping routes and arrival patterns. The collapse of Baltimore's Francis Scott Key Bridge in March 2024 exposed a different dependency: a single structure could obstruct nautical access to a major port.

The causes of these crises differ. Their common effect is to shift disruption from one part of a transport system to another. This is especially consequential for Europe, whose ports handle about 74% of the European Union's external trade. Globally, seaborne trade volume grew 2.2% in 2024, while ton-miles rose 6% as vessels travelled farther. The latter figure measures transport work, not equivalent growth in cargo volume. It helps explain why rerouting decisions taken far from a gateway can disturb port schedules weeks later.

Port readiness should be defined more precisely than the existence of spare infrastructure. It consists of capabilities that can be verified before a shock: knowledge of critical functions, assigned decision rights, workable alternatives and procedures rehearsed with the operators concerned. Resilience is observed during and after the event, in the continuity of essential services and the time required to restore them. Readiness is a condition for that outcome; it is not evidence that recovery has already been achieved.

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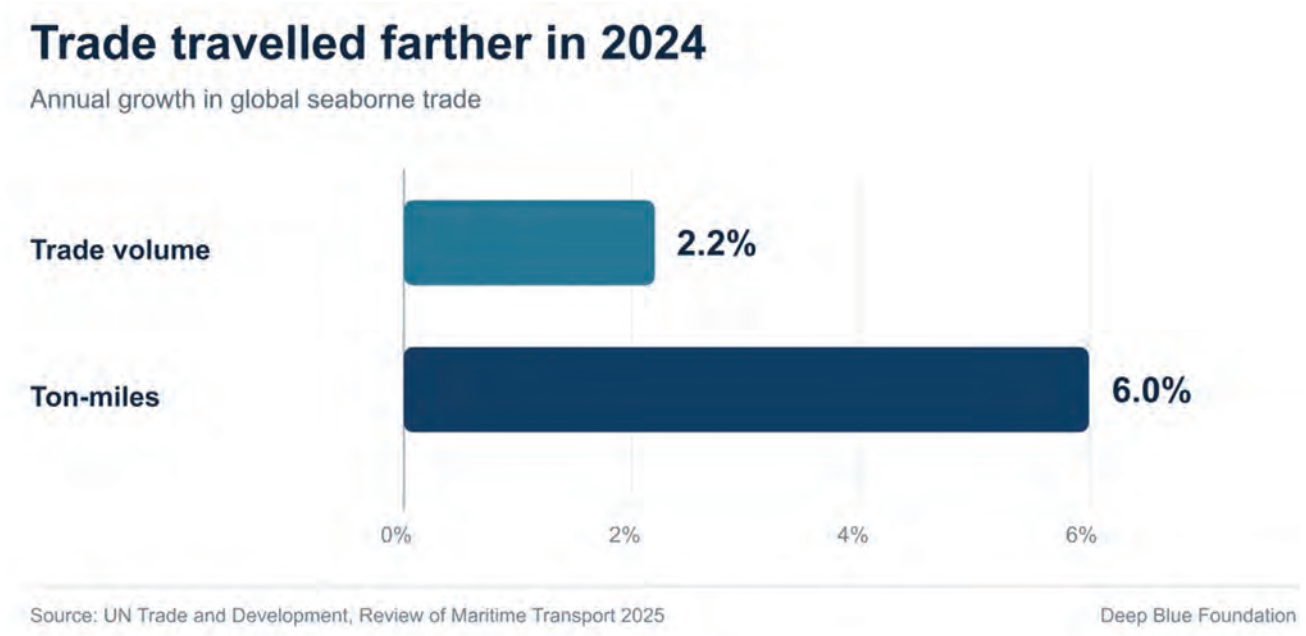


Figure 1. *Growth in global seaborne trade volume and ton-miles, 2024. Source: UNCTAD, Review of Maritime Transport 2025. Original graphic: Deep Blue Foundation.*

Decision-making Across the Port Community

No single organization operates the entire port system. Authorities, terminals, customs services, shipping lines and inland carriers each hold information and assets required to move freight. Martin Christopher and Helen Peck captured the general principle: "even the most carefully controlled processes are still only as good as the links and nodes that support them" (2004, p. 1). At a port, the relevant unit of analysis is therefore the network of decisions connecting these organisations.

Cybersecurity offers a concrete comparison.

In the Netherlands, Ferm Zeehavens brings together five nationally important port complexes to share threat information, examine common vulnerabilities and conduct exercises across the chain. On the U.S. Pacific coast, the Port of Los Angeles established a Cyber Resilience Center in 2022 for participating terminals, shipping lines, road and rail operators. One arrangement spans several ports; the other is organised around a single gateway. Both seek to make warnings usable by the firms whose decisions determine whether cargo can move.

That objective requires explicit operational rules. If a cargo-release system fails, an alert sent only to technical staff will not tell truck dispatchers whether terminal appointments remain valid. The port community must know who confirms the outage, who authorises a temporary manual process and who issues a shared, time-stamped status update. Research by Eline Punt and colleagues on Rotterdam identifies precisely the difficulty of coordinating distributed responsibilities even when cyber risk is recognised.

Public authorities are beginning to address this coordination problem. The European Commission's 2026 Ports Strategy proposes a forum for port and national cybersecurity authorities and an EU-wide assessment of port security risks. In the United States, the Coast Guard is phasing in cybersecurity requirements for covered marine transportation entities. These measures provide a framework. Their operational value at a particular gateway must be tested against decisions taken jointly under time pressure.

Verified Alternatives and Measured Recovery

The second set of dependencies lies beyond the quay. A berth able to receive a vessel does not guarantee a train path, barge slot, truck appointment or inland terminal. César Ducruet and Theo Notteboom's work situates gateways within wider port and hinterland systems. Éric



Figure 2. *Three decisions to test across the cargo journey. Conceptual framework by the author; this graphic does not report measured port performance.*

Foulquier and Antoine Frémont, examining French port governance, describe the widening strategic role of port authorities. Both perspectives direct attention to the corridor through which cargo actually reaches its destination.

HAROPA PORT links Le Havre, Rouen and Paris along the Seine corridor. In 2025 it reported a combined rail-and-river modal share of 20.3% and 145,000 TEU moved by rail to and from Le Havre. On the U.S. East Coast, the Port of New York and New Jersey's ExpressRail system connects its main container terminals to inland rail networks. These connections widen logistical choices. The published figures do not establish how much capacity would remain available during a simultaneous terminal and inland disruption.

A credible contingency route must therefore be specified with the receiving operator. It requires confirmation of admissible cargo, equipment, available slots and transferable customs information. Timothy Pettit, Joseph Fiksel and Keely Croxton describe resilience as "a fit between the vulnerability factors and the capability factors" (2010, p. 7). For ports, the practical implication is to test each alternative against the failure it is meant to cover, rather than to maintain a generic list of possible diversions.

Exercises and actual emergencies provide different evidence. ENISA's Cyber Europe 2026 simulated a coordinated attack on European maritime and rail infrastructure with more than 5,000 participants. At Baltimore, the U.S. Army Corps of Engineers restored the federal channel to its usual 700-foot width and 50-foot depth on 10 June 2024, following a period of restricted access. The European exercise tested coordination; the American response documented the restoration of nautical access. Neither measure alone establishes when all affected shipments reached their consignees.

Europe and the United States could adopt a common method without imposing identical port models. A paired exercise involving authorities, terminals, carriers and inland operators would use the same disruption scenario and record four intervals: from incident to a reliable shared status report; to restored release and gate functions; to confirmed substitute inland capacity; and to clearance of the cargo backlog. Differences in governance and cargo mix would remain visible. What becomes comparable is the ability to make and execute the decisions on which freight continuity depends.



MARITIME TRAINING:

What Happens Between Seeing a Risk and Speaking Up

By David Christie, FCMI

A vessel is approaching a berth. The bridge team has a passage plan, functioning equipment and experienced officers. Then one officer notices that the vessel is setting closer to the edge of the planned track than expected. The master is engaged with the pilot. The officer has the information, but pauses before speaking.

This is an illustrative situation, not a report of an incident. Its significance lies in a question that applies far beyond one bridge: how quickly does an observation become information that the whole team can use?

We spend considerable time and money teaching people the technical aspects of their roles. We should. But operational excellence also depends on what happens between recognising a change and responding to it together. Knowledge held silently by one person cannot improve a decision made by another.

The Part of Competence that is Easy to Miss

Over the past three years, our organization has supported **Enhanced Bridge Resource Management** with more than 300 deck officers. The work has reinforced something I have believed throughout my career in human factors training: communication, leadership and self-awareness cannot be treated as optional additions to technical competence. They influence whether technical competence is

used when circumstances change.

Bridge resource management already recognizes situational awareness, teamwork and challenge. The difficulty is that agreement with these principles in a training room tells us little about what a person will do under pressure. A junior officer may know that they should challenge a decision yet still worry about interrupting the master. A master may sincerely welcome challenge yet close it down with an impatient first response. A team can follow its procedure and still fail to build a shared picture.

Consider two possible calls from the officer in our opening example. "Something doesn't look right" leaves others to work out what has changed. "Our lateral movement is greater than planned; I recommend we verify our position before continuing" gives the team an observation, its significance and a proposed next step. The master's reply then determines whether that information is examined: "Show me what you're seeing" is a short invitation with an operational purpose.

Where Emotional Intelligence Earns its Place

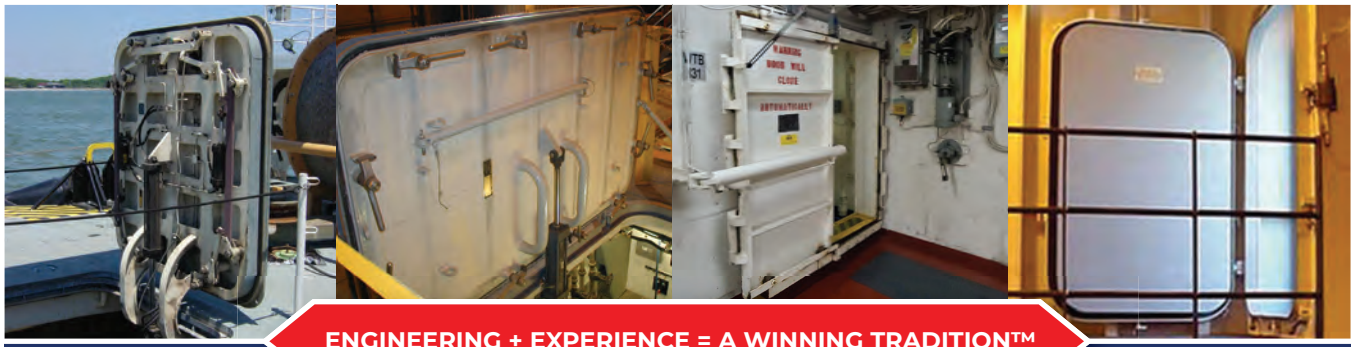
Emotional intelligence can sound remote from navigation until we describe it in behavior. It includes recognizing our own response, regulating it and taking account of how another person may receive what we say. Under pressure, an officer may need to recognize their hesitation without allowing it to delay a clear message. A master may need to notice a defensive impulse and listen to an unwelcome observation before making a decision.

That does not mean replacing command with a discussion group. The master remains accountable. The aim is to give that person the fullest available picture. When an officer speaks clearly and the person in command responds constructively, hierarchy can support a decision rather than obstruct the flow of information.

In our programs, we ask people to examine the moment when an observation either becomes a conversation or stays in someone's head. What was noticed? What was assumed about what others knew? What made it difficult

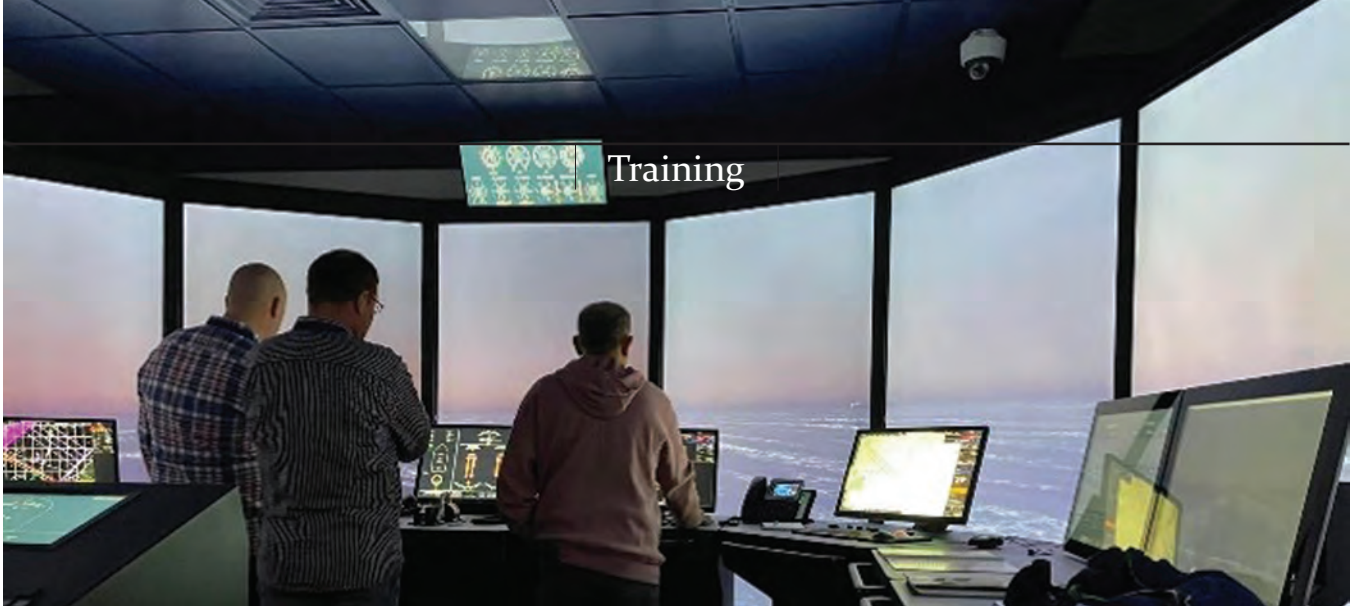
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to speak? How did the response affect what the team did next? These questions make the human factor observable and give people a way to practise it.

The Bridge is Not the Whole System

The same issue arises in the engine room, on deck and between vessel and shore. A handover can omit a constraint because the person giving it thinks the receiving team already knows. A crew member can notice a departure from normal operation yet struggle to raise it across rank or department. Shore management can create schedule pressure without intending to discourage a pause.

This is why I believe leadership matters at every level. The conditions for good decisions are set by many small interactions, not only by the person who gives the final order. Before an operation, a leader can state which changes would cause the team to stop and reassess. During it, they can ask for a second view. Afterwards, they can thank someone for raising a concern even if the original plan proved sound. Those responses tell people whether speaking up is genuinely useful.

The responsibility runs both ways. Team members need to describe a concern promptly and precisely. Leaders need to make it possible for that concern to be heard. Neither behavior is strengthened by a poster declaring that everyone has a voice.

How Would an Operator Know it is Working

A completed course is evidence of attendance, not proof that behavior has changed. We need to look for the actions that the course was intended to develop. In a simulator exercise, for example, an assessor can note when a deviation was detected, when it was voiced, how the message was acknowledged and whether the plan was revised. A structured debrief can then explore both the technical result and the decisions that produced it.

An exercise can end safely even when an important observation was raised too late. That is still valuable evidence. It creates a chance to discuss the hesitation without waiting for a poor outcome. Equally, an early challenge and a well-judged response should be recognised, even if no dramatic maneuver follows. The quality of the team's process matters alongside the result.

Observation needs clear criteria. "They communicated well" is too vague to guide development. Did the person describe the change? Explain its operational implication? Receive an acknowledgement? Confirm the next action? These are behaviors that can be practiced, observed and discussed. Follow-up on board can help establish whether they survive outside the training environment.

This also gives managers better questions to ask after a difficult operation: what information was available, who held it, when did it become shared, and what made the conversation easier or harder? The answers may point to coaching, a handover practice, workload or a shore-side decision. Blaming the last person in the chain rarely gives the organisation the whole picture.

The Next Critical Moment

I am not suggesting that emotional intelligence alone will prevent incidents or guarantee performance. Ships need sound equipment, technical competence, procedures and effective oversight. My point is that these investments depend on people connecting with one another at the right moment. The ability to notice our own response, communicate a concern and hear one from someone else deserves the same practical attention as the other parts of the operation.

The next critical moment may look entirely routine until someone sees a small difference. Will that person speak? Will the rest of the team listen and act? If we train technical skills thoroughly but leave these human capabilities to chance, what information might never reach the people who need it?

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FROM CONNECTING VESSELS TO ACHIEVING MEASURABLE VALUE

When artificial intelligence (AI) and digitalization are discussed in maritime, attention still gravitates toward autonomous ships. Yet the market is not about de-crewing but, rather, applying vessel and shore data to make operations safer, more fuel-efficient, and easier to maintain.

By Alisa Reiner, *Analyst, Intelatus Global Partners, Master of Environmental Management, Yale University*

As of 2024, the maritime AI market stood at $4.13 billion, with a projected five-year CAGR of 23%. Market-size estimates should be treated cautiously, but the direction is hard to miss – AI solutions have advanced from trials into voyage planning, machinery monitoring, bridge decision support, port coordination, and digital assurance. The main questions are where it is producing measurable operational value and where the evidence still lags the marketing.

THE VESSEL HAS TO BE CONNECTED FIRST

AI does not create useful ship data – it consumes it. The connected vessel is thus a prerequisite for the AI-capable vessel. Propulsion load, fuel flow, vibration, temperature, pressure, weather, satellite, radar, and camera data are collected through the Internet of Things (IoT) sensors and existing shipboard systems, aggregated and pre-processed onboard, and transmitted to shore via secure communications links.

Data quality and context set the ceiling on model performance. Sensor drift, missing values, inconsistent naming, and different operating profiles can affect the lab-tested solution reliability. Latency is another factor – any critical computer vision or machinery control cannot rely on continuous cloud connectivity, so the processing must happen on board.

AI and digitalization should not be confused with automation in general. Maritime systems are usually a combination of physics-based models, optimization, rules, and machine learning, not a black-box approach. And sensors, inspection, and edge computing are as important as modeling. Leading companies focus on high-value and repeated use cases, hardware-software-AI integration, and actual customer data.

AI and digital tools also serve buyers differently. Table 1 maps key needs to the technologies most directly associated with them, distinguishing shipbuilders' priorities from those of ship operators.

WHERE THE NUMBERS ARE ALREADY VISIBLE

One of the clearest commercial applications is voyage optimization because fuel consumption provides an immediate KPI. In February 2026, **NAPA Voyage Optimization** trials demonstrated fuel savings of up to 7.1% on both long and shorter voyages. On the separate 34-day Lila Global voyage from Suez to China, **NAPA** reported $40,200 in voyage cost savings, 35 tons of fuel saved, 106.5 tons of CO2 avoided, and almost one day less steaming time com-

Table 1. What shipowners and shipbuilders want from AI, digitalization, and enabling tools

Role	Need / use case	What they want from it	Typical AI, digitalization, and enabling technologies
Ship owner / operator	Operational & energy optimization	Lower fuel use, emissions and voyage cost; improved safety	IoT sensors, edge computing, routing platforms, digital twins, optimization software
	Compliance	Continuous monitoring and reporting; reduced manual compliance burden	IoT sensors, data platforms, emissions systems, regulatory databases, AI-assisted search
	Predictive maintenance	Detect faults earlier; improve availability, and reduce unplanned downtime	Condition sensors, time-series data, predictive models, digital twins, remote diagnostics
	Lifecycle management	Maintain a traceable digital record of vessel/component changes	Digital twins, Product Lifecycle Management (PLM) systems, Enterprise Resource Planning (ERP) systems, asset- and document-management systems
	Cybersecure operations	Protect connected navigation, machinery, and vessel data as automation increases	Security Information and Event Management (SIEM) systems, intrusion-detection systems, anomaly-detection systems, firewalls, network-segmentation tools, identity and access-management systems, encryption
	Progressive autonomy	Support decisions and reduce crew burden through remote/semi-autonomous operations	Multimodal sensors, sensor-fusion systems, computer-vision systems, remote-control systems, autonomous-control systems, human-machine interfaces (HMIs)
Shipbuilder / shipyard	Connected design & engineering	Reduce build cost, rework, energy use, and design risk	Digital twins, Computer-Aided Design (CAD) systems, Computer-Aided Engineering (CAE) systems, Computer-Aided Manufacturing (CAM) systems, Computational Fluid Dynamics (CFD) software, PLM systems; virtual reality (VR), augmented reality (AR), and mixed reality (MR) systems
	Digital capture & lifecycle continuity	Connect design, as-built, commissioning, and handover data	3D scanning, point-cloud-processing software, digital-imaging systems, PLM, ERP
	Production planning & yard logistics	Reduce bottlenecks, delays, material movements, and idle time	Scheduling software, production-management systems, digital twins, ERP, computer-vision systems, tracking systems
	Automated production	Automate hazardous/repetitive fabrication and material handling	Industrial and collaborative robots, robotic welding and painting systems, automated material-handling systems, machine-vision systems, 3D printing
	Inspection, quality & commissioning	Detect defects, verify work, and support commissioning	Machine-vision systems, drones, three-dimensional (3D) scanning, robotic inspection systems, non-destructive testing (NDT) equipment, defect-detection models, augmented reality (AR) and mixed reality (MR) systems

Source: author's analysis

pared to the simulated standard route. These case studies illustrate why voyage optimization is being scaled – even low-single-digit percentages matter at the fleet level.

Computer vision on the bridge is also moving beyond pilots. A 2026 Orca AI study covered 139 vessels and more than 10.8 million nautical miles. High-severity close encounters fell 52% between the early adaptation period and months 10-12. Lloyd's Register separately tested Orca AI on an 828-nautical-mile Mediterranean voyage — across 739 targets, the system achieved 94% precision and 98.6% recall, including small and low-radar-signature craft, with no system downtime. It does not mean that AI should substitute the officer on watch, but machine vision can provide an additional layer of attention when humans, radar, and Automatic Identification System (AIS) face certain limitations.

Maintenance presents another application with a measurable business case. Wärtsilä reports that AI-enabled diagnostics reduced unscheduled maintenance by 25% on average, 90% of issues were resolved remotely, and 80% within 24 hours. The operating model here matters – AI detects weak signals and anomalies while engineers validate the diagnosis and reaction. The product thus is not a single algorithm but a combination of sensors, analytics, and expertise.

Physical AI is also entering inspection and sustainment. Wall-climbing robots of Gecko Robotics are equipped with ultrasonic sensors to inspect the steel structure of vessels and collect data on its thickness and defects related to corrosion and degradation. In a U.S. Navy application, the system collected more than 4.2 million data points versus around 100 using traditional inspection methods, while a ship-rudder inspection fell from 11 days to one. The data feed digital condition models for maintenance planning and drydock decisions. This example shows another domain where physical AI produces value – by combining robotics with AI-driven analysis of data.

BEYOND THE SHIP

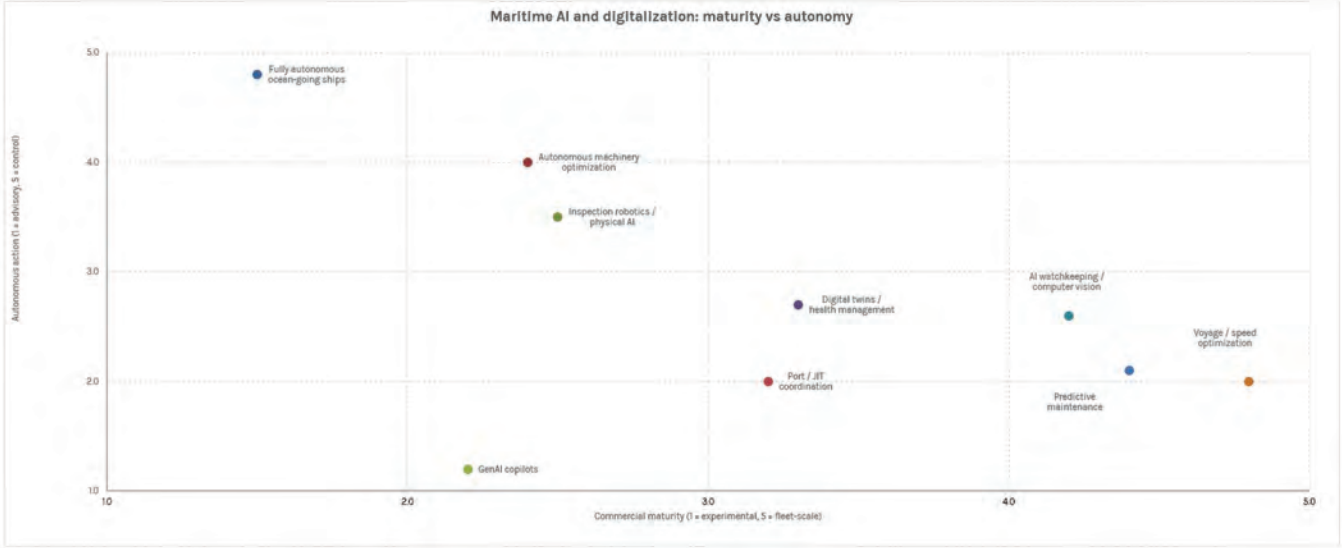
Ports are another natural target due to the abundance of data on arrival times, berth availability, traffic, weather, and terminal capacity. A 2026 peer-reviewed study of an AI-enabled Just-In-Time (JIT) arrival system reported simulated fuel and emissions savings of 6.45%-7.39% where earlier coordination allowed ships to slow down.

Digital twins and data-driven health management are in a similar space – they compare actual behavior of machinery to the expected one to detect deterioration prior to failure. In May 2026, Lloyd's Register granted Approval in Principle to Navantia's AI-based Digital Twin Ready framework. In September 2026, LR also awarded AiP to HD KSOE's VesselWise autonomous auxiliary-machinery optimization function, with onboard validation planned on a 174,000-cbm LNG carrier. AI in maritime is moving from monitoring towards machinery optimization, but the assurance follows closely.

Generative AI is less mature operationally. It can make manuals, maintenance histories, and fleet data more searchable or assist shore teams with anomalies investigation. But for now, hard maritime KPI evidence is still scarce in this field, and errors in safety-critical workflows can be costly.

Taken together, these examples illustrate the variety of maritime AI applications and their different levels of maturity and autonomy.

Figure 1. Maritime AI and digital tools applications: commercial maturity vs degree of autonomous action.



Source: author's analytical assessment based on public deployment. Scores are comparative

THE HYPE GAP IS MOSTLY A SYSTEMS PROBLEM

One of the major obstacles to using AI in maritime is not access to a model but integration. AI works in a closed loop – sensors generate data, the model discovers/predicts something valuable, someone makes the decision or controls systems according to the results, and outcomes become feedback. Any disconnected data or process break this loop.

The importance of cybersecurity grows as the loop closes. The connected maintenance platform is different from a spreadsheet, and AI integrated with navigation or machinery affects physical operations. IMO has repeatedly highlighted cyber risk across shipboard IT and operational technology. Sensor spoofing, corrupted data, compromised communications, and unauthorized access are therefore not separate IT issues – they are operational risks.

Human factors matter too. Too many alerts create alarm fatigue, unexplained recommendations may be ignored, and models can fail in unusual conditions. Crew training, interface design, decision responsibility, and fallback procedures are no less important than model accuracy.

FROM FANCY TOOLS TO OPERATING SYSTEMS

Commercial applications include voyage and speed optimization, computer-vision watchkeeping, condition-based maintenance, and fleet analytics. They solve repetitive, data-rich problems measurable with KPIs on fuel, safety, or downtime.

The second group requires proving at scale – autonomous machinery control, AI-enabled digital twins, robotic inspection, generative copilots and highly autonomous ships. With AI moving closer to physical control, validation, cybersecurity, and class approval become more important.

For shipowners, the relevant question is not "Do we have AI?" but the decision affected, the data backing it, result measurement, and actions in case of error or offline mode. The winning applications would be those that make a few expensive decisions better.

Ultimately, digital tools and AI can help with detection and analysis, but human expertise would still be needed to interpret outputs, take decisions, and apply insights in practice.

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Leading Providers of AI and Digitalization Solutions in Maritime

1. **Orca AI** (navigation & autonomy)
2. **Avikus** (navigation & autonomy)
3. **Kongsberg Maritime** (navigation & autonomy)
4. **ABB Marine & Ports** (navigation & autonomy)
5. **ZeroNorth** (voyage, vessel operations & emissions optimization)
6. **DeepSea Technologies** (voyage, vessel ops & emissions optimization)
7. **StormGeo** (voyage, vessel operations & emissions optimization)
8. **OrbitMI** (voyage, vessel operations & emissions optimization)
9. **NAPA** (ship design, performance, & lifecycle software)
10. **Wärtsilä** (ship design, performance, & lifecycle systems)
11. **Windward** (maritime intelligence & risk)
12. **Bearing AI** (maritime intelligence & vessel performance)
13. **Gecko Robotics** (robotics, inspection & asset integrity)
14. **Ocean Infinity** (robotics, inspection & subsea operations)
15. **Fugro** (robotics, inspection & subsea operations)



TUG AMERICA: 129 YEARS YOUNG AND STILL PRODUCTIVE



Built in 1897, the tug *America* has survived the transition from steam to diesel, generations of Great Lakes shipping and the introduction of modern tugboat technology. Today, under the care of *Capt. Paul C. LaMarre III* and the Great Lakes Towing Company, she continues to earn her keep on the Great Lakes.

By Greg Trauthwein

TUG AMERICA & CAPT PAUL C. LAMARRE III



Pictured: [inset] Tug America under construction @ Union Dry Dock & Tug America today, with its **"America 250"** paint scheme.



"She's what keeps it real for me. I usually start my day or end it having a coffee on the America, smelling diesel, fresh paint, stale coffee, cigarettes ... and it's the magic. It's the spirit of what makes our industry go at the end of the day."

– Capt. Paul C. LaMarre III

Like it or not, the maritime business has evolved from one dominated by tightly held, private, family owned operations to a more corporate approach, as regulatory demand and resultant skyrocketing cost for boats have priced many small- to mid-sized organizations out of the market.

The tugboat America itself, a vessel built 129-years ago and still operating faithfully on the Great Lakes, is owned by Maritime Partners via its acquisition of Great Lakes Towing Company. And while Capt. Paul C. LaMarre III – a third-generation Great Lakes mariner – pointedly assesses the company's new generation of Damen-built units as "those are some bad ass boats!", Capt. LaMarre has an obvious passion for the tug America that is palpable, transcending the latest hulls and tech.

Rest assured there are plenty of historic tugboats around the Great Lakes, around the country and around the world; some beautifully restored; others awaiting the attention, money and expertise needed to bring them back to their former glory; many already serving a second life as razor blades or rebar.

Then, there is *America*.

Built in Buffalo, NY, in 1897, the tug remains an active member of the Great Lakes Towing Company fleet, handling ships, breaking ice and occasionally towing considerably younger tugboats that need a little help themselves.

For Capt. Paul C. LaMarre III, Port Director at the Port of Monroe, President of the American Great Lakes Ports Association and a working tugboat captain for Great Lakes Towing Company, America represents something that cannot be measured in horsepower, bollard pull or annual operating hours.

"What's amazing is that she's still doing that same job today," said LaMarre during a recent **Maritime Matters: The MarineLink Podcast** interview. "This tug in 2026 is doing the exact job that it was built for in 1897."

That is a remarkable distinction in any industry, and operating on the fresh water found in the Great Lakes is no small part of her longevity.

It also makes America an interesting study in what constitutes a successful tugboat design, particularly when her captain regularly operates some of the newest tugs on the Great Lakes.

LaMarre has considerable affection for the old vessel, but he is also a practical mariner. He understands that sentiment cannot substitute for a sound hull, reliable machinery, a competent crew and the ability to perform a commercial job safely and economically.

For now, America continues to meet those requirements.

Built During, *and For,* a Different Era

America was constructed by Union Dry Dock Company in Buffalo for the Erie Tug Line of Erie, Pennsylvania. Her original assignment was harbor towing and ship assistance, with firefighting capability. The Great Lakes shipping industry of 1897 was a very different place: schooner barges and wooden steamships remained common, while steel freighters were still relatively new.

Against that background, America represented modern technology. "When the America was built, she was lauded as this very modern, sophisticated, large steel-hauled machine that was really beyond just about anything the lakes had seen at that point," LaMarre said.

Two years after her construction, the formation of the Great Lakes Towing Company brought many independent towing operations under one organization, and America became part of that fleet. According to LaMarre, she is the only surviving vessel from the towing company's original 1899 fleet.

The tug began life with a coal-fired reciprocating steam engine. In 1950, she was converted to diesel propulsion with an EMD 567C engine, which amazingly remain at the heart of her machinery arrangement today.

"She's a time capsule," LaMarre said. "The tug is nearly entirely original from 1897, except for having been repowered in 1950 with an EMD 567C."

Externally, he notes, the most conspicuous change is her shorter diesel exhaust stack, replacing the tall stovepipe stack of her steam-powered years. But America's history is not exclusively a story of engineering longevity.

LaMarre recalled that six mariners lost their lives aboard the tug in 1941, one of the most tragic episodes in Great Lakes Towing Company's history. For him, operating the vessel carries an obligation to remember those men and the generations who worked aboard before him.

"Each voyage is a fitting tribute to not only the sailors who were lost on here, but each one who made their living keeping her going."

He describes the relationship between a vessel and its crew as the bond between steel and spirit. "A vessel takes on a life of its own because people breathe life into it."

The tug's continued commercial operation was not inevitable. In 1986, America was renamed Wisconsin. She subsequently worked in Milwaukee, where she eventually spent several years largely inactive. Her next chapter began in 2018.

LaMarre, who had longstanding relationships with Great Lakes Towing Company and had previously served on its board of directors, was overseeing the redevelopment of the Port of Monroe. The port needed harbor towing capability. Great Lakes Towing had an available tug.

The decision was made to relocate Wisconsin to Monroe, where she returned to service under her original name, America.

"It really gave the tug a second lease on life," LaMarre said. "She may not still be here today if she hadn't come to Monroe and really served as our staple harbor tug because we had not had one previously."

The arrangement has proved valuable to both the port and the tug's owner. At Monroe, America assists vessels carrying liquid asphalt, steel coils and project cargo. Her workload, like every working tugboat, varies with vessel traffic, and she is particularly busy during the winter, when ice-breaking becomes an important part of harbor operations.

The port recorded its busiest season since 1932 in 2020, according to LaMarre, and America experienced her highest level of activity in decades.

Further growth could follow the development of Michigan's first marine container terminal at Monroe, which is expected to attract additional international vessel calls.

For LaMarre, who arrived at Monroe in 2012 and helped

Tug *America* was repowered with an EMD 567C in 1950, and it's still running strong today.



"When I have the opportunity to tow a brand new tug back to the shipyard for repairs with the tug America, there is never a more rewarding or cool moment in my opinion."



transform a largely dormant facility into an active commercial port, the tug has become inseparable from the port's identity.

She appears on its logo and serves as its unofficial mascot. "She's what keeps it real for me," he said. "I usually start my day or end it having a coffee on the America, smelling diesel, fresh paint, stale coffee, cigarettes, and it's the magic. It's the spirit of what makes our industry go at the end of the day."

That appreciation comes from someone who has spent his life around working vessels.

A third-generation Great Lakes mariner, LaMarre grew up in a family closely connected to tugboat operations. His father spent 51 years with a major Great Lakes Towing Company and was inducted into the Great Lakes Maritime Hall of Fame.

LaMarre III himself graduated from California Maritime Academy and served as a naval aviator before returning to the Great Lakes. He subsequently worked at the Toledo-Lucas County Port Authority, helped establish the National Museum of the Great Lakes and became Port Director at Monroe. Today, he divides his time between port administration, maritime advocacy and the wheelhouses of working tugboats.

He regularly operates vessels in Detroit, Toledo, Saginaw, Sault Ste. Marie and Monroe.

That experience gives him a useful perspective on the differences between America and the modern tugs entering service.

TUGBOAT AMERICA | FACT BOX

Vessel name	America
Year built	1897
Age in 2026	129 years
Builder	Union Dry Dock Company Buffalo, New York
Original owner	Erie Tug Line Erie, Pennsylvania
Original duties	Harbor towing, ship assist, FiFi
Original propulsion	Coal-fired reciprocating steam engine
Diesel conversion	EMD 567C (in 1950)
Engine output	Approximately 1,250 hp
Propulsion	Single screw
Steering	Cable with hydraulic actuator
Hull construction	Riveted steel
Operating base	Port of Monroe, MI
Owner/operator	Great Lakes Towing Co.
Next drydocking	Summer 2027

Old Tugs v. New Tugs: The Difference is in the Handling

LaMarre is among the captains responsible for training and evaluating new tugboat masters within the Great Lakes Towing fleet. His assignments include the company's modern Damen-designed tugs, which have considerably more power and maneuverability than America.

The differences are substantial.

America has a single propeller, cable steering and approximately 1,250 horsepower. The newer tugs have twin screws, fixed nozzles and approximately 2,000 horsepower, with modern MTU or Cummins engines and contemporary control systems.

Their ability to maneuver quickly, change direction and maintain position offers clear advantages during ship assistance.

"The new tugs are highly capable. They are cool. They're unbelievably maneuverable … they are bad ass," LaMarre said.

But he believes the older vessel offers something increasingly rare: the opportunity to practice traditional single-screw ship handling. "Single screw has become an art. It is such a rarity anymore," he said. That said, the basic principles of tug handling have not changed.

"What I try to teach our new younger tug captains is situational awareness is everything. And the biggest thing is knowing your vessel, whatever that is."

America cannot rotate within her own length as readily as a modern twin-screw tug, nor can she reposition as quickly when putting up a line or changing from pushing to pulling.

But her handling characteristics are distinctive.

"She's a single screw tug that backs both directions,

which is a rarity because her rudder is the size of a barn door and she's got a big propeller and 1,250 horsepower."

LaMarre takes particular satisfaction in making the older tug perform maneuvers that younger captains might associate only with modern equipment. "The proudest moments as a tug captain are when I can make the America maneuver like one of the new tugs." He describes taking her out as getting to dance with his lady, and affectionately calls her the 'Sophia Loren of tugboats'.

The comparison may be personal, but the underlying point is technical. Experienced operators can extract considerable performance from a vessel whose characteristics they understand intimately.

Where the Old Hull Still Excels

Although America gives up horsepower and maneuverability to newer tugs, LaMarre believes her hull remains exceptionally well suited to certain towing operations.

"Her hull design is near perfection," he said. Much of the vessel's hull is below the waterline, and her substantial keel allows her to maintain a towing angle and resist lateral movement under load.

"The old hull design when towing, when you are towing off the stern and you need to dig in and hold a particular towing angle, she will dig like nothing else."

That ability is particularly useful when maintaining a pull on a vessel during a maneuver.

LaMarre says America can lean heavily under load while continuing to hold the towline.

Her performance in ice is another advantage.

The tug has a slender hull, pointed bow and considerable weight below the waterline, allowing her to climb onto and break harbor ice effectively.

"For icebreaking, let's say, this tug is phenomenal," he said. "She has the ability to climb and break ice just about better than anything else I've ever run."

The modern tugs are stronger in other respects, and LaMarre makes no attempt to suggest that the older vessel is universally superior. He sees considerable value in using the different designs together.

On some ship assistance jobs, America takes the lead position at the bow while a newer tug works a checking line, applying its greater horsepower and braking capability.

The arrangement allows each vessel to contribute its particular strengths.

He has also used America to reposition other tugs within the fleet, including occasions when newer vessels required towing to a shipyard. "When I have the opportunity to tow a brand new tug back to the shipyard for repairs with the tug America, there is never a more rewarding or cool moment in my opinion."

In one memorable operation, the 1897 tug towed three modern Damen tugs simultaneously. (pictured left). "She's still got it," LaMarre mused.

Yet the important measure remains commercial performance.

"She's never let me down. That's the most important thing because, as you said, it's about the commercial industry, it's about economics, efficiency, safety." As long as America can perform her assigned work safely and reliably, her age alone is not a reason to remove her from service.

Keeping America Working

Arguably, the most difficult part of keeping old tugs working is keeping old tugs working. Those that generally know how to restore an old tugboat know that it's not a good idea to restore an old tugboat, which can quickly consume mass amounts of time and money. Operating a historic tug commercially presents maintenance challenges that cannot be ignored, because when a part breaks and needs replacement, the chances are slim to none that their remains a part fit for refit.

The first is understanding machinery and systems that few contemporary mariners encounter.

LaMarre points to America's electrical panels, including equipment marked Edison Light and Power and an arrangement of old knife switches that he compares to Tesla's workshop.

Modern safety requirements have necessitated modifications, including protective coverings over exposed electrical equipment.

The tug's steering arrangement is another unique feature: Cable steering remains, although it now operates through a hydraulic actuator aft. Earlier arrangements included chains.

Keeping these systems functioning requires personnel familiar with their particular characteristics.

LaMarre credits two Great Lakes Towing engineers, a father and son, whom he calls the "diesel doctors," with maintaining the older machinery. Their experience is essential because America is not a vessel for which replacement components can be ordered from a current manufacturer's catalog.

At the end of the day, like on any vessel, hull preservation is paramount. America's riveted steel construction has benefited from freshwater operation and consistent maintenance, but corrosion protection remains an ongoing responsibility. "Folks think that a paint job is just a paint job. It's called a protective coating for a reason." LaMarre emphasizes proper surface preparation, including needle

gunning, grinding, priming and painting.

"It is a 24/7/365 deterioration cycle," he said. His experience restoring museum vessels, including the 1911 lake freighter Col. James M. Schoonmaker and the 1903 tug Ohio, has taught him valuable lessons in old boat maintenance. He frequently advises organizations considering the acquisition of historic vessels to reconsider unless they have the resources to maintain them. In America's case, commercial operation has helped support her preservation.

"That's actually what really, I believe, has probably kept the America alive, is the fact that she has continued to operate and undergo maintenance, and that she's part of a company that has a shipyard."

Great Lakes Towing's Cleveland shipyard provides an important resource.

During a short drydocking in 2025, crews repaired several leaking rivets. LaMarre said the hull was in surprisingly good condition. A more comprehensive five-year drydocking is planned for summer 2027, and that inspection will be important in determining the tug's continued commercial future.

Restoring the Details

LaMarre's largest personal restoration project aboard America has been her pilothouse. Over the decades, original woodwork had been painted over or concealed behind later materials, including particle board and decorative coverings. "She looked for a while like a '70s Italian restaurant," he recalled. LaMarre stripped the interior to its framing, renewed insulation and restored the woodwork using traditional techniques. The work included building a steam box to bend wooden paneling.

The completed pilothouse incorporates wood decking, period lettering, decorative scrollwork and other details intended to reflect the vessel's original character. One particularly meaningful feature is the eagle mounted on the pilothouse. LaMarre shared a photo showing America under construction in 1897, with a shipyard worker installing the original eagle. He located the only known surviving example of the ornament, borrowed it from its owner and commissioned a casting. A gold-painted aluminum reproduction now occupies the original position.

For the USA's 250th anniversary in 2026, the tug also received commemorative decorative elements. These details do not increase bollard pull or improve fuel efficiency, but LaMarre believes they demonstrate the respect owed to a working vessel with such a long history. They also help distinguish preservation from simply keeping old machinery running.





The Next Five Years

The immediate question facing America is what her 2027 drydocking will reveal. LaMarre is optimistic, but he understands that hull condition and repair economics will determine whether she remains commercially viable.

"That will ultimately be hull condition. It is going to be everything when we get right down to gauging various areas of the hull."

He also recognizes that modern tug designs will eventually dominate the fleet.

"My practical side knows that our Damen tugs and others will inevitably be the entire future at some point."

Nevertheless, he believes America can continue working as long as her condition and performance justify it.

He jokes that the vessel was paid off in 1902, meaning everything earned since then is a bonus.

The economics are not quite that simple, of course. Maintenance, drydocking, crew costs and regulatory compliance remain real expenses. But a vessel that continues generating revenue while meeting operational requirements has a strong argument for remaining in service.

And when her working days finally end, LaMarre intends to ensure that she survives.

He says he has a longstanding handshake agreement with Great Lakes Towing Company to take personal possession of the tug upon its retirement. "She'll never go to razor blades. We will make sure that as long as I'm alive, she'll be taken care of to the best of my ability."

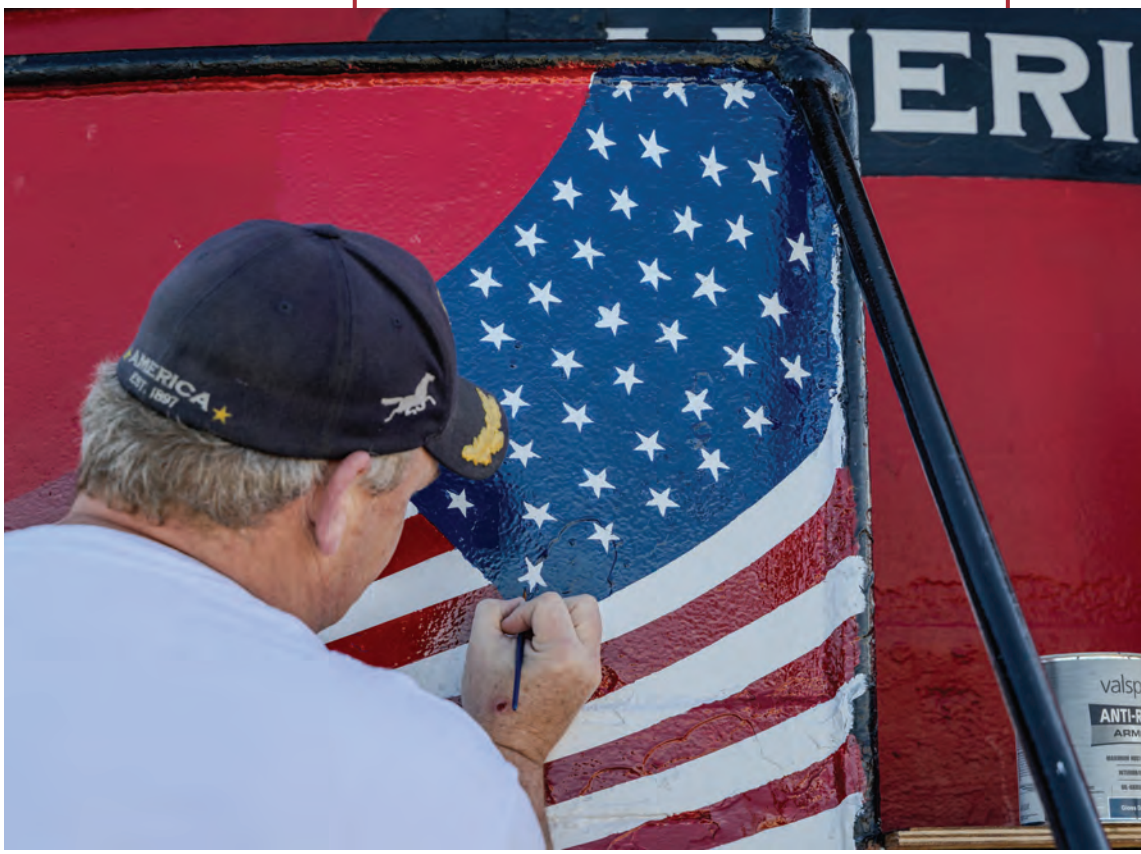
For now, there are ships to assist, ice to break and another Great Lakes winter approaching.

The tug that entered service when William McKinley was president remains a working part of the maritime economy. LaMarre does not take that for granted.

"Every day sailing the America is a new page in the history books," he said. And with every turn of her propeller, another page is written.

From her refurbished wheelhouse (far left), which beforehand looked like a *"70's Italian restaurant,"* to her custom paint job to celebrate America's 250th, keeping tug America ship shape is a labor of love.





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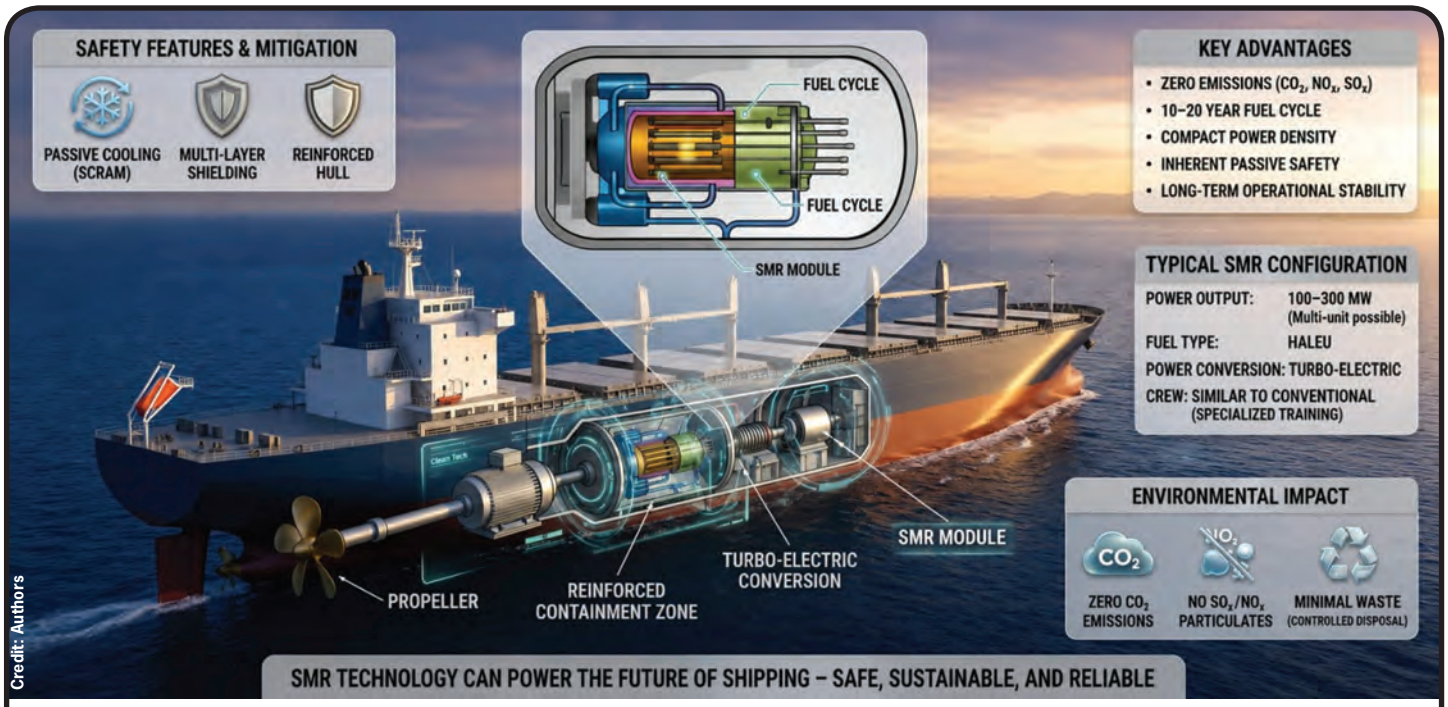
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Credit: Authors

SMALL MODULAR REACTORS FOR MARITIME SHIPPING: A NUCLEAR PROPULSION PATHWAY

Nuclear power has already crossed oceans. The harder question is whether modern small modular reactors can be integrated, licensed and financed for merchant ships, and where they make sense first.

By Lakshya, Krish Uniyal and Raj Singh,
International Maritime Institute, Greater Noida, India

Image above: Conceptual view of an SMR module, turbo-electric conversion and reinforced containment zone installed in a bulk carrier.

In 2023 the International Maritime Organization (IMO) set a goal of net-zero greenhouse gas emissions from international shipping by around 2050. LNG, methanol, ammonia and hydrogen each solve part of the problem and create another. Nuclear propulsion offers a different trade: fuel so energy-dense that a ship can sail for years without bunkering, with no combustion emissions at the point of use.

Nuclear ships are not new. Four civil vessels proved the concept decades ago. What is new is the Small Modular Reactor (SMR), and the fact that classification societies are now approving ship designs built around it. Our study asks whether SMR propulsion is a realistic option for merchant shipping. The short answer: promising for selected high-utilization ships, but not a universal replacement, and the barriers are as much institutional as technical.

MORE THAN A REACTOR

A nuclear ship takes its thrust from heat released by fission. In a pressurized water reactor (PWR), the coolant is held at high pressure so it does not boil while carrying heat from the fuel. But a marine installation is far more than a reactor and a steam generator. As Fig. 1 shows, heat passes through a steam cycle or intermediate heat exchanger to a turbine-generator, then through a high-voltage switchboard to the propulsion motors, with waste heat rejected to the sea.

Electric transmission gives designers freedom, including multiple shafts and flexible power allocation, but it adds conversion equipment and demands redundancy against correlated failures. One point is easy to miss: what matters is net propulsion power, not the reactor's thermal rating. Emergency systems, pumps, ventilation, hotel loads and low-power operation all take their share. Large container ships, tankers and bulkers need tens to hundreds of megawatts, which may mean several modules, and reliability must then be judged for the whole ship rather than reactor by reactor.

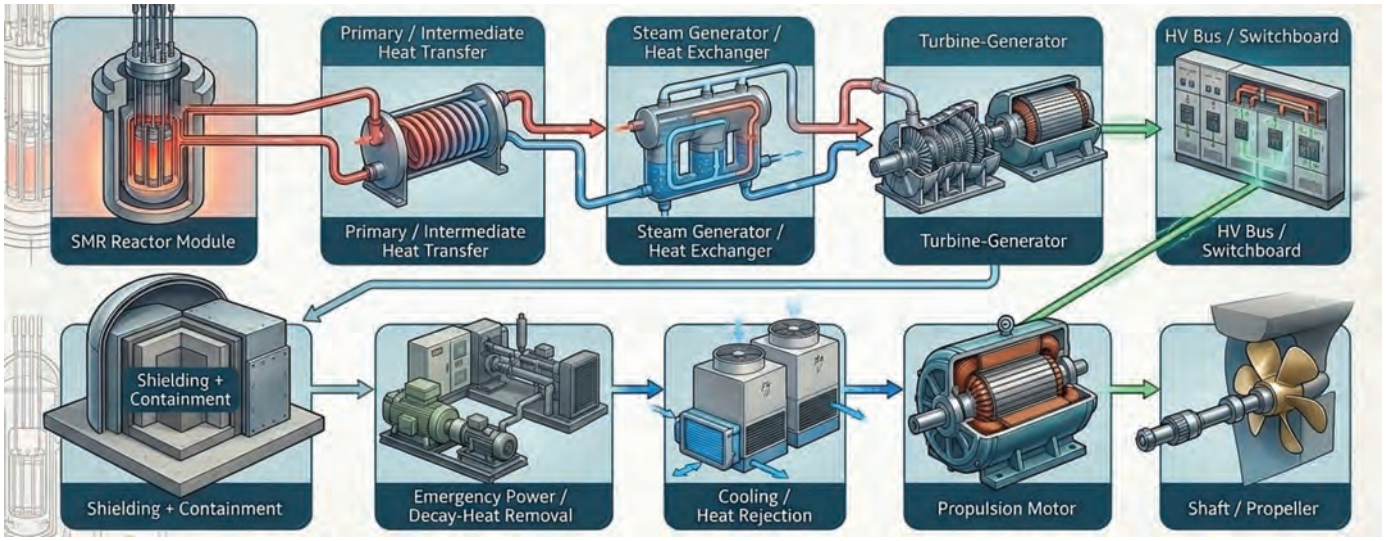
PROOF FROM THE FIRST NUCLEAR MERCHANT SHIPS

Four civil ships supply the real-world evidence. The US-built NS Savannah, with a 74–76 MW thermal PWR and about 16.4 MW at the shaft, logged roughly 450,000 nautical miles on a single refueling. Germany's Otto Hahn, with an integrated 38 MW reactor, covered around 650,000. Japan's Mutsu (36 MW) developed automatic load-following and showed stable response in 1991 sea trials. The Soviet icebreaker Lenin, commissioned in 1959, began with three reactors totalling 270 MW thermal and was later upgraded to about 342 MW.

Together they show that turning nuclear heat into ship propulsion works. They also carry a warning: Savannah's retirement showed that technical success does not guarantee commercial viability.

WHICH REACTOR?

PWRs have the strongest marine record, but a reactor in a protected central hull section competes with cargo space. Advanced concepts promise more. Molten salt re-



Credit: Authors

Figure 1: SMR propulsion chain, from reactor module to propeller, with shielding, emergency decay-heat removal and cooling supporting the plant.

actors (MSRs) run hot at low pressure, though corrosion and chemistry questions remain open. Lead-cooled fast reactors (LFRs) use low-pressure heavy-metal coolant but bring fuel-cycle and safeguards complexity. Heat-pipe microreactors are passive and compact, but their limited output suits smaller vessels and auxiliary roles. High-temperature gas-cooled reactors still need validation at merchant-ship scale. Fig. 2 shows the trade: advanced designs offer long refueling intervals, yet only the PWR is close to commercial maturity.

THE MOTHER-DAUGHTER IDEA

Our central proposal tackles the most awkward problem: every port a nuclear ship visits must accept it. The Nuclear Mother-Daughter Transshipment Network (N-MDTN) sidesteps this. A nuclear-powered mother vessel sails long-haul trunk voyages between a few nuclear-enabled gateway ports, while conventional daughter vessels carry cargo onward to regional ports that never need nuclear acceptance.

The logic mirrors existing mother-daughter distribution systems, but it concentrates reactors, specialized crews, regulatory responsibility and emergency capability in one trunk service. That shrinks the number of ports needing nuclear-specific preparedness and allows nuclear corridors to be introduced in phases.

Strict separation is the design rule. Daughter vessels handle cargo only, with no reactor fuel, coolant, radioactive waste or access to nuclear machinery. Gateway terminals act as controlled zones with segregated cargo operations, mooring safeguards, weather limits and emergency separation procedures. Safety cases must show that no transfer operation or feeder incident can compromise reactor shutdown, decay-heat removal, containment or emergency power. N-MDTN remains a prospective model, and moving energy between vessels would add significant technical requirements.

SAFETY AND SECURITY AT SEA

Ships add hazards that land plants never face: collision, grounding, flooding, fire and blackout. Decay heat continues after shutdown, so the seawater cooling interface must fail safe. The marine-specific danger is common-cause failure, where redundant systems sharing a compartment, cable run or sea intake fail together, so physical and functional separation is essential. Passive cooling helps, but passive features alone do not guarantee accident tolerance.

Security is a separate discipline from safety. It means protecting reactor, material and control systems against theft and sabotage through layered physical protection, controlled access, cybersecurity and coordination with flag, coastal and port authorities. Crews need combined nuclear and maritime competence, built on simulator-based training.

REGULATION IS THE REAL BOTTLENECK

Nuclear ships must satisfy maritime law and nuclear regulation at once. SOLAS Chapter VIII and the IMO's 1981 Code of Safety for Nuclear Merchant Ships remain the operative international benchmark. In June 2025 the IMO's Maritime Safety Committee tasked its Ship Design and Construction sub-committee with revising the Code in a technology-neutral way, drawing on IAEA standards. A work plan was agreed in January 2026, with adoption targeted for 2030 (a date that may change), so the updated framework is not yet mandatory.

Flag states need the capacity to license a nuclear installation, and registration does not guarantee entry to foreign ports. Classification societies must bridge marine and nuclear standards, and liability and insurance need provisions that conventional policies lack. International harmonization is a prerequisite for deployment, not a current condition.

INDUSTRY AND GOVERNMENTS ARE MOVING

Design work is accelerating. In October 2025 DNV granted HD KSOE an Approval in Principle (AiP) for a 15,000 TEU SMR-powered container ship designed for 24 knots. ABS and HD Hyundai agreed in March 2026 to design a 16,000 TEU ship with nuclear-linked electric propulsion. Lloyd's Register granted an AiP on June 2 for a 7,000 CEU car carrier using a molten salt reactor, and ABS followed in July with an AiP for a 15,000 TEU ship with two such reactors. An AiP is a preliminary independent assessment, not a nuclear license, an operating certificate or proof of commercial viability.

Policy is following. In the U.S., the Maritime Administration (MARAD) opened an SMR request for information in May, then signed cooperation agreements with the Port of Long Beach in July and with CORE POWER in August. Days later the International Atomic Energy Agency launched ATLAS, an initiative backed by 26 countries to build licensing and safeguards frameworks for nuclear technology at sea.

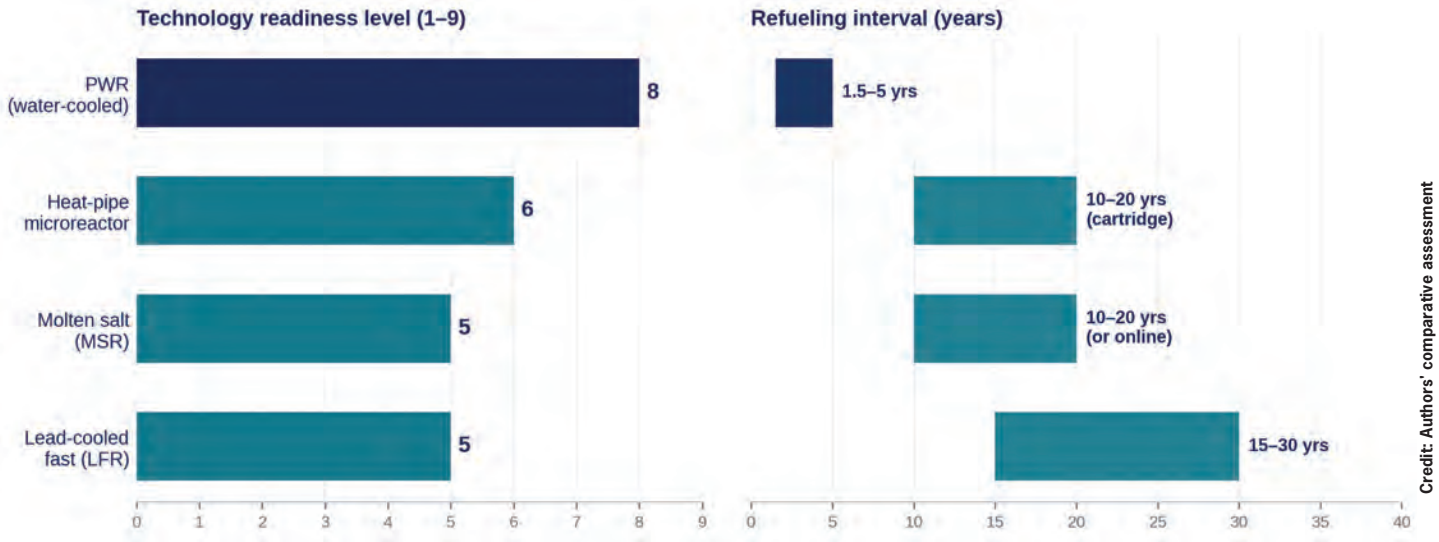


Figure 2: Technology readiness level and refueling interval of candidate marine reactors.

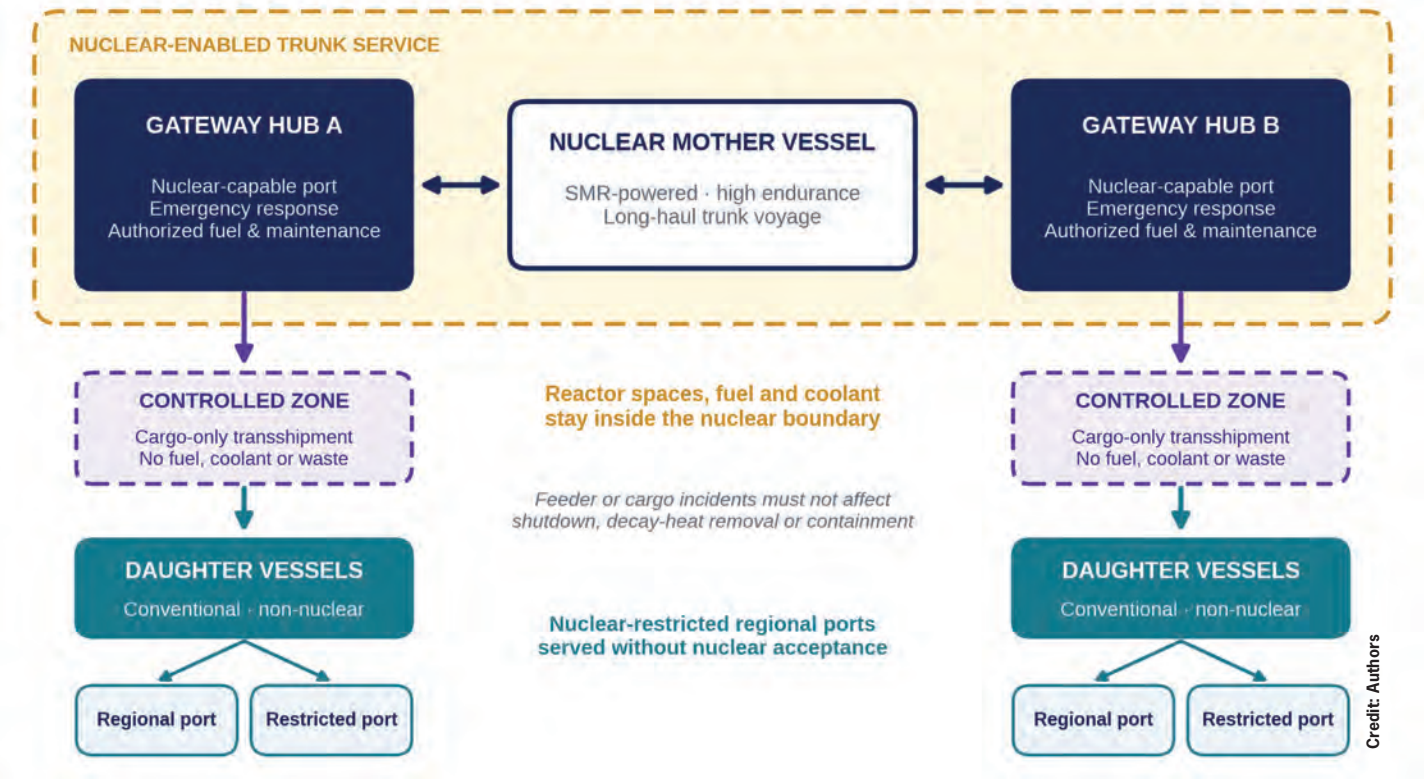


Figure 3: The N-MDTN, the authors' proposed concept: nuclear systems stay on the trunk route while non-nuclear feeders serve restricted regional ports.

ECONOMICS: UTILIZATION DECIDES

High energy density does not make nuclear automatically cheaper. Owners must add the reactor, shielding, ship integration, licensing, training and maintenance. The test is whether extra capital cost is repaid by discounted fuel savings, avoided carbon costs and operating advantages, after nuclear operating expenses and financing risk premiums. The best cases combine long annual operating hours, long service lives, steady propulsion demand and stable routes.

A Reactor-as-a-Service (RaaS) model could ease the burden. A specialist provider would own the reactor and fuel and handle refueling, servicing and spent fuel, while the shipowner keeps the hull and conventional systems, paying a fixed availability fee plus a per-MWh tariff. Nuclear liability, however, is set by statute and cannot be transferred by contract alone. Fuel supply matters too: low-enriched and high-assay low-enriched uranium need dependable, regulated supply chains.

WHERE NUCLEAR FITS FIRST

Large container ships, tankers, ice-class cargo ships and offshore support vessels with continuous power demand show the strongest cases. Low-utilization bulk carriers and small coastal vessels are weaker, and passenger ships raise public-acceptance questions. For India, with its nuclear infrastructure and large shipping sector, the opportunity is strategic, but nuclear-grade manufacturing and quality assurance would take sustained effort.

OUTLOOK

Nuclear propulsion shifts environmental risk rather than removing it: operational emissions largely disappear, but fuel-cycle emissions, radioactive waste and decommissioning remain. SMR propulsion is therefore best treated as a targeted option for future fleets, not an immediate replacement for conventional fuels. The sensible path is phased: demonstration projects, incremental licensing, gradual port acceptance, and reactor qualification that goes beyond land-based testing to cover vibration, shock, collision, grounding, fire and flooding.

Commercialization is a system-of-systems problem. Reactors, ship integration, safety, regulation, ports, people, liability and finance must advance together. If they do, SMRs could power a safe, reliable and economically viable part of the future blue economy.

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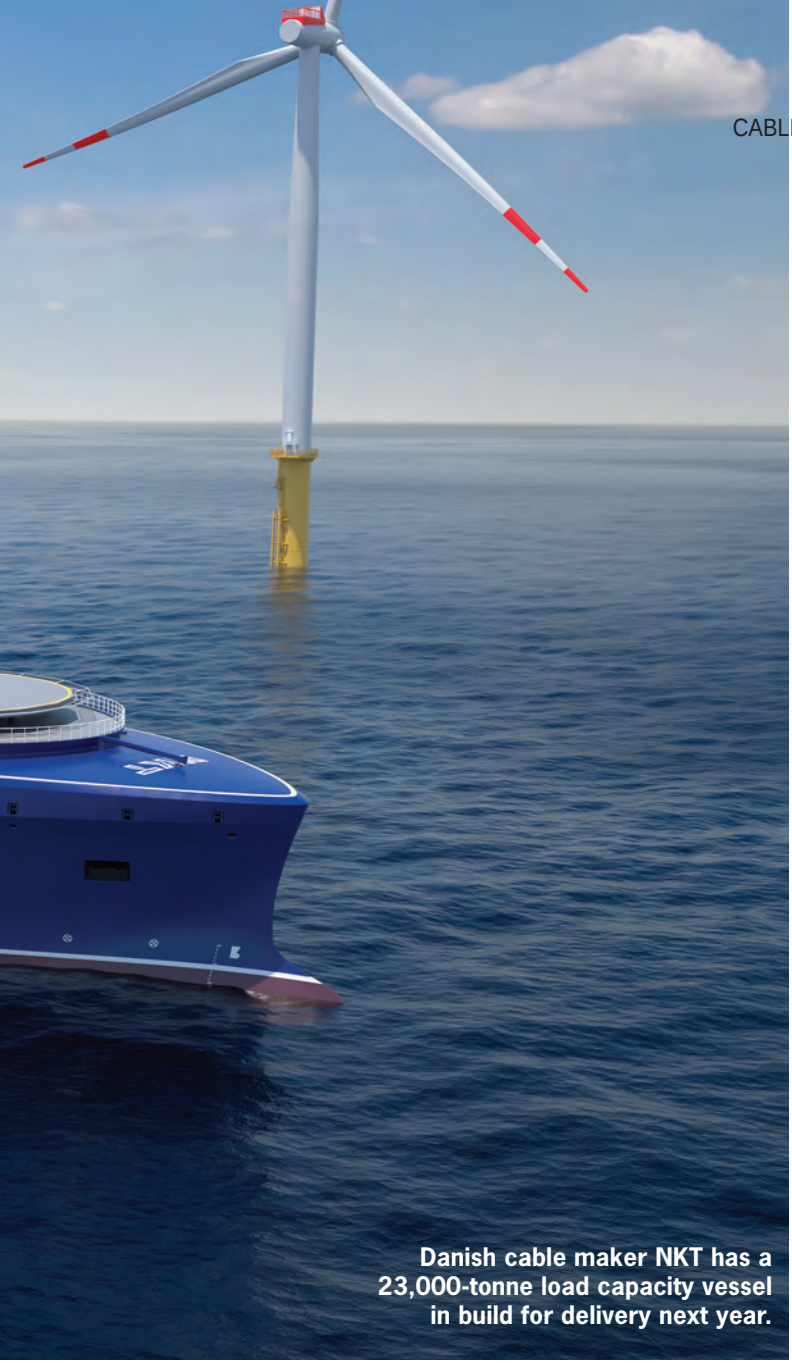


credit: NKT

CABLE LAYER FLEET GAINS SCALE, SCOPE

Accelerating demand for subsea power and telecoms cable network construction is fuelling major expansion of the world fleet of purpose-designed cable laying, maintenance and repair vessels.

By David Tinsley



Danish cable maker NKT has a 23,000-tonne load capacity vessel in build for delivery next year.

Driven by the growth of the offshore renewables sector and its advance into deeper waters, as well as by widening investment in cables connecting electrical grids in different countries, emergent generations of cable ship are distinguished by scale, productivity, and technological intensity.

Ongoing geopolitical tensions are also giving a fillip to the development of subsea cable infrastructure, whereby concerns over energy security are being addressed through offshore wind energy and international interconnector projects, further extending the scope for specialized vessels.

Belgian international construction and dredging group Jan De Nul is set to take cable ship capacity to a new highpoint with its 215-metre, Chinese-built Fleeming Jenkin. Scheduled for imminent introduction, the vessel brings an unrivalled 28,000-tonne cable load intake to the market in a design also distinguished by the capability to operate on methanol fuel.

The first of two sisters booked with China Merchants Heavy Industry (CMHI) Haimen yard, the Fleeming Jenkin gives an added edge to competition for assignments in the electrical interconnector and offshore renewable energy sectors. The design's overall scale facilitates lay jobs in both shallow and ultra-deep waters (down to 4,000 metres) over longer distances with fewer connections and allowing for HVDC cable bundling in a single operation.

The ship's home-grown medium-speed machinery emanates from the Ghent factory of Anglo Belgian Corporation (ABC). The five main gensets, feeding electrical energy to the propulsion units and maneuvering thrusters, are based on prime movers that will enable firing on methanol, biodiesel or hydrotreated vegetable oil (HVO) as well as diesel oil. The plant comprises four 12-cylinder DV36MeOH models plus an eight-cylinder DZDMeOH engine, for a maximum combined output of 30,600kW, with emission abatement achieved using SCR and DPF systems.

Contributing to the efficiency and designated ultra-low emission vessel (ULEv) concept behind the new breed of cable layer is a hybrid power element featuring a 2.5MWh battery installation and related drive arrangement. The ESS is designed to confer peak shaving, load smoothing, spinning reserve, and optimized engine loading.

Second-of-class William Thomson was put into the water in April 2026 and is expected to make her service debut by mid 2027.

Meanwhile, a newbuild with a 23,000-tonne capacity for high-voltage (HV) cable is nearing completion in Norway to the account of Danish cable maker group NKT. Developed by Norwegian consultancy Salt Ship Design and due to enter service in 2027, the 177-metre NKT Eleonora will work in conjunction with the 140-metre NKT Victoria to connect offshore wind farms to the onshore grid, as part of a project led by Dutch-German transmission system operator TenneT.

Shipbuilding contractor VARD assigned hull fabrication to its Tulcea yard in Romania, and the vessel was subsequently towed to VARD Brattvaag's premises in western Norway during July for the final phases of construction and outfitting. The building of the new fleet addition has progressed concurrently with the expansion of HV cable manufacturing facilities at NKT's Swedish plant at Karlskrona.

UK-based Global Marine, a specialist in subsea fiber-



credit: Global Marine

Global Marine's newbuild from Colombo Dockyard will be tailored to fiber optic cable maintenance work.



HIGH PRODUCTIVITY: Nexans Electra has three carousels and the ability to lay four cables simultaneously.



credit: Ulstein

Nexans Electra sailing from Ulsteinvik in western Norway after delivery, May 2026.

optic cable operations, has implemented a fleet development strategy, following-up the mid-2026 purchase of a 128-metre Norwegian cable ship with an order for a 100-metre newbuild. Nominated shipbuilder Colombo Dockyard has a growing reference list in the sector, and the vessel for Global Marine will be a customized version of a proven type from the portfolio of VARD Design.

Conceived primarily to support the British company's long-term telecoms cable maintenance contracts, while affording more capacity to capitalize on growing demand in the subsea cable market, the new ship will incorporate 1,800-tonne of cable storage.

She has been engineered with a strong focus on station-keeping capability, reduced energy consumption and resilience. The newbuild will host a hybrid power generating arrangement, melding the four main genset, diesel-electric system with a bank of batteries. Propulsive effect, maneuvering and position-holding precision will be delivered by way of two Azipod electric main propulsion units aft and two tunnel thrusters forward.

The construction award to Colombo Dockyard is further testament to the Sri Lankan company's prowess in penetrating a high-end segment of the international market. References to date include the 113-metre cable layer KDDI Cable Infinity, delivered to her Japanese owner in 2019, and the 100-metre cable layer and repair vessel Sophie Germain, completed in 2023 for Orange Marine of France. Two further newbuilds for the French concern are in hand at Colombo and scheduled to be handed over in March 2028 and January 2029, respectively. The Global Marine ship is expected to follow during the fourth quarter of 2029.

The UK firm's latest acquisition, the 25 year-old Normand Clipper (now CS Clipper), was formalized in June this year pursuant to the end of charter from Solstad Maritime. Encapsulating the VARD VS4125 design, the 128-metre vessel is arranged with two tanks that can hold 5,000t of cable.

Malaysian subsea digital infrastructure company the OMS Group has four new cable layers under construction on the strength of ramped-up demand from the telecoms industry. Towards the end of December last, just one week after two newbuilds booked from IHC Offshore Energy were laid down at the Dutch group's Vietnamese partner yard Pacific Shipbuilding, OMS sealed contracts with Norwegian designer and builder Ulstein for two further cable ships. The respective pairs, while distinct in design, will collectively constitute the Great-class.

The vessels contracted from the Royal IHC Group are based on its proven Type 22 platform. Each incorporates two cable tanks of an aggregate 6,500-tonne capacity, dual firing lines enabling both lay and maintenance operations, and a plough trenching and cable burial capability to a depth of 3.3 metres. The 128-metre CS Genesis is planned for delivery in 2027, with sistership CS Triumph to follow in 2028.

Each of the 130-metre Ulstein duo have also been specified with a maximum intake of 6,500-tonne of fiber optic cable and will employ the proprietary SX252 design featuring the innovative X-Bow configuration for enhanced seakeeping and motion reduction. Highlights of the system delivery from Ulstein Power & Control will be variable speed generator (VSG) technology and banks of batteries.

Paris-based Nexans Group strengthened its subsea installation capability this year through the May commissioning of the Norwegian-built cable layer Nexans Electra. Constructed by Ulstein Verft to a Skipsteknisk design, the 150-metre Nexans Electra is a derivative of the technologically acclaimed Nexans Aurora, completed by the same shipbuilder in 2021.





Setting a new benchmark in load intake and power setup: Fleeming Jenkin, seen here on trials.

credit: Jan De Nul



Subsea telecoms infrastructure builder OMS Group has two cable layers booked with Ulstein in Norway.

credit: Ulstein

The DP3 newbuild, vested with a total cable capacity of 13,500-tonnes on three turntables, furthers the Aurora concept, having the wherewithal to lay up to four cables simultaneously, conducive to large-scale, time-critical schemes. Assigned to Nexans Marine Operations of Oslo, Nexans Electra fulfils new environmental goals through a hybrid power system and five Bergen B33:45L6A-driven main gensets able to run on bio diesel blends. The integrated ABB power and propulsion setup in closed-ring configuration affords high fault tolerance and optimized engine use in DP mode.

Italy-headquartered Prysmian Group took delivery in July 2026 of a unique power cable burial tool produced in the UK and destined for utilization on the company's latest deep-sea cable installation vessels Prysmian Monna Lisa and Prysmian Alessandro Volta.

The heavy-duty plough is the first of two contracted from subsea engineering firm SMD in north-east England and provides the wherewithal for electric cable burial at a maximum five metres beneath mean seabed level.

A Turkish yard is the cradle for a South Korean cable layer project, overseen by a Norwegian management company with recourse to a Norwegian design house. First steel was cut in June 2026 at Tersan Shipyard's Yalova premises on LS Marine Solution's 148-metre newbuild, scheduled for completion during the first half of 2028.

Developed by Salt Ship Design, the vessel will provide a capability spanning high-voltage AC, high-voltage DC, and fiber optic cable. Having been responsible for the critical drawing approval stage, OSM Thome is now handling on-site construction supervision.

The Korean ship forms part of a supply chain strategy implemented by parent organization LS Cable & Systems, which includes expansion of LS Greenlink, the US submarine cable manufacturing subsidiary on the Chesapeake Bay waterfront in Virginia.

Persisting geopolitical instability along with energy transition goals look set to continue to expand the market for building and maintaining subsea infrastructure.



EASTERN SHIP



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A'S MARITIME REVIVAL

With three shipbuilding facilities, 1,300 employees and a diversified orderbook extending into the next decade, ***Eastern Shipbuilding Group (ESG)*** *is well positioned to benefit from renewed investment in America's maritime industrial base.* ***CEO Joey D'Isernia*** *discusses the company's growth, its commercial and government contracts, and why workforce development and fundamental changes in shipbuilding practices are essential to a sustainable industry revival.*

By Greg Trauthwein

American shipbuilding has received more attention from Washington in the past two years than it has in the past few decades combined. The Trump administration has made rebuilding the nation's maritime industrial base a political imperative, driven by national security concerns, China's dominance of global shipbuilding and the need to expand and modernize the U.S. fleet: navy, government ships and commercial.

For shipbuilders, the renewed attention is welcome, but turning that political narrative into shipbuilding contracts, infrastructure improvements and a larger skilled workforce will take considerably longer.

But Joey D'Isernia, CEO of Eastern Shipbuilding Group (ESG), sees substantial opportunity in the renewed emphasis on maritime manufacturing. As the company celebrates its 50th anniversary, he remains focused on the practical considerations of operating a shipyard: selecting the right projects, investing in people and equipment, managing production and delivering vessels.

"There's a lot of really positive things that are out there," D'Isernia said of the federal initiatives. But much of the proposed legislation and announced funding is still moving through the system. "It's not going to have an overnight effect."

Eastern, founded in 1976 and now led by the second generation of the D'Isernia family, operates three facilities across two counties in Northwest Florida. The privately held company employs approximately 1,300 people and serves commercial and government customers.

D'Isernia describes Eastern as one of a relatively small number of remaining mid-tier American shipbuilders, with the engineering capability and physical infrastructure to handle a broad range of sophisticated vessel construction projects.

Fifty Years of Investment

Eastern's facilities include its Allanton shipyard, encompassing approximately 300 acres, of which 160 are developed; the 50-acre Nelson Street facility; and its Port St. Joe yard. Each serves a distinct role in the company's operations, and each offers opportunities for future expansion.

Over the years, Eastern has invested in larger launch ways and basins, additional crane capacity, fabrication facilities and other infrastructure improvements that have increased the size and complexity of vessels it can construct.

As a privately held business, D'Isernia said Eastern has considerable flexibility to reinvest earnings in facilities, equipment and employees without the pressures that can accompany public ownership.

Today, however, the investment priorities are changing.

Rather than concentrating primarily on building larger vessels or increasing physical capacity, Eastern is emphasizing productivity improvements that allow its existing workforce to accomplish more. This includes additional covered fabrication space, process improvements and practical applications of automation.

"We're heavily investing in covered fabrication area in levels of automation that are realistic for the U.S. shipbuilding industry," D'Isernia said. He cautions that technologies developed for large Asian shipyards do not necessarily translate directly to American commercial and government shipbuilding, where vessel designs, production volumes and customer requirements are substantially different.

Eastern's approach is to invest in technologies that can improve efficiency without introducing unnecessary risk or creating new production problems.



"When that came out, we just looked at it and said, we're the shipyard to build it."

– Joey D'Isernia, CEO, Eastern Shipbuilding Group, on the contract to build a trip of hybrid electric ferries for **Washington State Ferries (WSF).**

A Diversified Orderbook

Eastern's current construction program reflects the company's broad capabilities across commercial and government markets. At Allanton, Eastern is building four 84-foot harbor tugs for Saltchuk. The first two are approaching delivery, with the remaining vessels expected to follow within months. The yard is also building a 6,500-cubic-yard hopper dredge for the U.S. Army Corps of Engineers, with launch anticipated in spring 2027 and delivery targeted toward the end of that year.

Following it through production is a 10,000-cubic-yard hopper dredge for The Dutra Group, representing a substantial investment in fleet renewal for the West Coast dredging contractor. Both dredges involve collaboration with Dutch dredging specialist Royal IHC.

At Port St. Joe, Eastern is completing two 360-foot multipurpose subsea construction vessels for Hornbeck Offshore Services. Originally started at another shipyard, the projects were interrupted when that builder failed, leaving the vessels in litigation for approximately a decade.

Taking over the projects required Eastern to assess partially completed construction, identify deficiencies, replace unusable materials and develop a path to completion.

Eastern has developed experience in recovering troubled shipbuilding projects, a capability that D'Isernia believes distinguishes the company. The mix of tugs, dredges, offshore vessels, ferries and naval construction also reflects a deliberate strategy of diversification. "There's no ideal mix," D'Isernia said of balancing commercial and government work. "We want to take on the right risks. We want to match our expertise and our core competencies to the right projects."

That approach provides flexibility as market conditions and federal procurement priorities change.

A Big Win: Washington State Ferries

One of Eastern's most important recent contracts is its selection to build three hybrid electric ferries for Washington State Ferries (WSF).

The approximately 400-foot vessels represent a major addition to Eastern's commercial orderbook and build on its experience constructing large passenger ferries, including the three Staten Island ferries delivered previously.

The initial Washington contract was valued at approximately $714 million for two vessels. Eastern subsequently received the option award for a third ferry, extending the program's importance to the yard.

For D'Isernia, the opportunity was significant because Washington had historically restricted ferry construction to shipyards within the state. Legislative changes opened the competition to other American builders. "When that thing came out, we just looked at it and said, we're the shipyard to build it," he said. The ferries feature hybrid electric propulsion and are designed to complete their operating missions entirely on battery power.

D'Isernia believes the project is particularly well-suited to Eastern's engineering capabilities. The company currently employs approximately 70 to 80 engineers, and electrical engineering is among its strongest disciplines.

"Our electrical design team is top-notch, and this particular vessel with the hybrid electric design was just a great opportunity for us to showcase those capabilities," he said.

D'Isernia also credited Washington State Ferries for investing heavily in design development before construction, particularly through its work with ABB.

That preparation allowed Eastern to focus on optimizing equipment arrangements, accessibility, maintainability and production efficiency rather than resolving fundamental engineering questions after steel cutting.

The state exercised its option for the third ferry as construction began on the first vessel, a decision D'Isernia views as validation of the yard's performance during design development.

The program extends Eastern's Allanton workload through 2032 and could lead to additional opportunities as Washington continues replacing aging vessels.

"We want to build more," D'Isernia said. "They need more. They need a steady pipeline of recapitalization, and we want to be their shipyard of choice to build out that fleet."

Building for the Navy

Eastern is also participating in naval construction through its partnership with HII's Ingalls Shipbuilding division – an example of distributed shipbuilding where naval shipbuilders use qualified partner yards to manufacture substantial vessel sections.

At Nelson Street, the company is producing fully outfitted structural units for the U.S. Navy's Arleigh Burke class guided missile destroyers.

Eastern has delivered a major block for DDG 135, is completing another for DDG 137 and has received an additional award for a subsequent destroyer. The yard is also producing outfitted units for HII's San Antonio class amphibious transport docks (LPD).

D'Isernia estimates that distributed construction currently accounts for approximately 10% or less of Eastern's orderbook, although the company has capacity and interest in expanding that business.

He emphasizes that successful distributed shipbuilding requires considerably more than fabrication capability. Large outfitted units involve thousands of components, extensive scheduling, supplier coordination, documentation and quality assurance.

"We're really a force multiplier," D'Isernia said, explaining that Eastern helps HII manage material flow, identify problems and maintain production schedules. "It's one thing for somebody to send you stuff and send you drawings and you just put it in. It's another to schedule it, track it, do all the QA call-outs properly."

Eastern sees additional potential in this model, provided it can balance subcontracted naval construction with its broader commercial and government workload.

Rebuilding the Workforce Remains Job 1

Despite the attention given to robotics and advanced manufacturing, D'Isernia identifies skilled labor as the industry's most significant obstacle. "The number one constraint in U.S. shipbuilding today is a skilled workforce."

He attributes the shortage to decades of declining participation in shipbuilding trades, a problem that cannot be resolved through short term recruitment campaigns alone.

Eastern is addressing the challenge through competitive compensation, employee retention, educational partnerships, apprenticeship programs and on the job training. Its initiatives include a Maritime Training Academy in Gulf County and partnerships with high schools, vocational institutions and colleges.

One particularly successful initiative involves high school welding students designing and fabricating artificial reefs that are subsequently deployed offshore. The program combines technical education with interests relevant to the surrounding coastal communities.

Eastern also recruits inexperienced workers into general labor positions, allowing them to become familiar with shipyard operations before progressing into skilled trades.

D'Isernia believes these programs are effective, but insufficient to address the national workforce shortage. He advocates substantially stronger federal incentives to attract workers into shipbuilding, potentially drawing on approaches used for military recruitment.

Automation can reduce certain labor requirements, but he cautions against treating it as a comprehensive solution. "You can spool pipe and you can bend it on benders and you can have automated welding and all these things, but somebody has to install it in the ship."

Lessons Learned

D'Isernia sees opportunities for American shipyards to adopt production practices from South Korea, Japan and other leading shipbuilding nations, but believes an important structural difference must first be addressed.

In major Asian commercial shipyards, builders generally exercise substantial control over vessel design, equipment selection and procurement. This enables standardized production, repeatable engineering and greater control over suppliers.

In the United States, vessel owners and independent designers frequently determine equipment selections and design details, resulting in extensive customization.

Even relatively minor equipment substitutions can affect machinery arrangements, electrical systems, cable routing and installation requirements.

D'Isernia believes this limits the efficiencies available through automation and repetitive construction.

"You can't just take the model of South Korea and dump it over here and expect it to work," he said.

Greater shipbuilder control over design and supply chains, he believes, would improve productivity while creating more opportunities to apply advanced manufacturing technology.

Turning Policy Into Orders

Looking ahead, D'Isernia believes the renewed federal commitment to shipbuilding must translate into economic incentives that encourage commercial operators to replace aging vessels and expand their fleets.

Government shipbuilding can grow through increased appropriations and procurement. Commercial construction depends on vessel owners having sufficient financial justification to invest.

He believes meaningful subsidies, tax incentives and depreciation benefits could help make fleet recapitalization economically viable, particularly for Jones Act operators. "Washington is going to have to take a bigger risk on shipbuilding," he said.

Eastern sees potential across several commercial vessel sectors, although offshore oil and gas remains relatively quiet. D'Isernia noted that many offshore vessel operators continue to exercise financial discipline following the industry's downturn beginning in 2014, despite the advancing age of their fleets.

Ultimately, he believes rebuilding American shipbuilding will require sustained investment, workforce development and procurement reform across multiple administrations. "Strengthening the shipbuilding industrial base is a national security and economic security priority," he said. "It's not a partisan thing."

For Eastern, the immediate priorities remain executing its existing orderbook, improving productivity and maintaining the flexibility to respond as markets develop.

The company's facilities may change considerably over the next five years, depending on demand and the types of vessels customers require. Its underlying business philosophy, D'Isernia maintains, will remain consistent.

"We've been around for 50 years and we want to be here for at least 50 more years."

As Eastern enters its second half century, the opportunity is substantial. Whether the broader American shipbuilding revival succeeds will depend less on the volume of political announcements than on sustained investment, a stronger workforce and the ability of shipyards to deliver vessels efficiently and consistently.





Image courtesy Bayonne Dry Dock

BAYONNE DRY DOCK: BUILDING CAPACITY TO KEEP SHIPS WORKING

With a 1,092-ft. graving dock, a 1,280-metric-ton mobile boat hauler and nearly 300 people, Bayonne Dry Dock has steadily expanded its role in maintaining government and commercial vessels. By Greg Trauthwein

For all the attention focused on rebuilding American shipbuilding capacity, there is another part of the maritime industrial base that deserves equal consideration: the ship repair yards. At Bayonne Dry Dock & Repair Corp. (BDD), located at the former Military Ocean Terminal in Bayonne, New Jersey, that responsibility translates into a steady stream of Military Sealift Command (MSC) and Maritime Administration (MARAD) vessels, Coast Guard cutters, Army Corps of Engineers equipment, harbor tugs and commercial workboats.

The company's business has expanded considerably in recent years, particularly following its investment in a massive mobile boat hoist that opened an entirely new segment of the repair market.

Today, BDD puts nearly 300 people to work daily, with approximately 75% of its business coming from government customers and 25% from commercial operators.

"We do government work through both operating work platforms," said Ryan Patrick Woerner, Executive Vice President and General Counsel, referring to the company's graving dock and mobile boat hauler operations.

The graving dock typically handles three to five major regulatory overhauls annually, primarily for MSC and MARAD. The mobile boat hauler, meanwhile, has become a considerably higher volume operation.

"Last year we did over 60," said Bob Magas, Vice President, Commercial Operations. "So in the five years we're running, we've averaged over 50 a year."

That represents more than 50 vessel haul outs annually, ranging from inspections and routine maintenance to comprehensive repairs.

The distinction is important. While the graving dock accommodates large government vessels requiring extended maintenance periods, the mobile boat hauler allows BDD to process numerous smaller vessels simultaneously. For a shipyard operating in one of the nation's busiest ports, flexibility has become a competitive advantage.

A $25m Investment That Changed the Business

One of BDD's most consequential investments was the installation of its 1,280-metric-ton Cimolai mobile boat hauler, which entered service in July 2021. The company invested approximately $25 million of its own money in the project, including the lifting equipment and substantial infrastructure improvements necessary to support its weight. The hauler accommodates vessels with beams up to 50 feet, while the associated laydown area can hold as many as eight vessels simultaneously.

Five years later, the business case is evident.

The hauler serves commercial operators including McAllister, Moran, Reinauer, Kirby and Vane Brothers, alongside government customers such as the Coast Guard and Army Corps of Engineers.

Its reach extends well beyond New York Harbor.

"Since the inception of the boat hauler, we've done, I

think it's been five FRCs (Fast Response Cutters) with the Coast Guard," said Magas. For Magas, the Coast Guard work demonstrates how the yard has established itself in a market that did not previously exist at Bayonne.

"We've earned that opportunity, proven ourselves," he said. The mobile hauler also provides a practical benefit to regional vessel operators. Instead of traveling considerable distances for scheduled maintenance or emergency repairs, tugs, barges and other workboats can be serviced within the Port of New York and New Jersey. That reduces transit time and allows operators to return vessels to revenue service sooner.

While the mobile hauler has increased BDD's throughput, management believes another asset deserves greater recognition: its available waterfront. The shipyard has approximately 1,600 feet of wet berthing capacity, including a continuous 1,200-ft. section capable of accommodating vessels drawing up to 32 feet. Woerner said this allows BDD to perform substantial portions of a vessel's overhaul before it enters the graving dock. The process is particularly valuable when multiple MSC or MARAD vessels are scheduled consecutively.

While one vessel occupies the dock, another can be berthed alongside, where regulatory inspections, familiarization and topside maintenance begin.

When the first vessel departs for sea trials, the second can move into the dock after the blocking arrangement is prepared. The incoming vessel therefore arrives with considerable work already completed. "Regulatory has already been on board. Our people have already gotten familiar with the orientation of the vessel and they've begun all of the topside work. So you're not starting from zero."

The arrangement cannot eliminate work requiring dry dock access, but it can reduce the time a vessel occupies that increasingly scarce infrastructure.

"It's a running start," Magas summarized. President Kevin Sullivan emphasized that early inspections also help identify work requirements before docking. For government customers managing aging vessels and limited maintenance availability, those efficiencies have implications beyond the shipyard's bottom line.

"We're in a moment now where efficiency is critical and having these vessels being active and in their ready reserve status is critical," Sullivan said. "We want to minimize the amount of time they're at our facility, especially when we have project overlap." In practical terms, BDD is using its waterfront to increase the productive capacity of its existing graving dock without building another one.

Federal Investment Meets Shipyard Reality

BDD recently received a $673,123 grant through MARAD's Small Shipyard Grant Program to modernize its surface preparation equipment and expand workforce training. Combined with the company's own investment, the funding will support an integrated robotic ultra-high-pressure hydroblasting system, an additional surface preparation unit and associated equipment. The objective is to improve coating removal and surface preparation productivity while reducing downtime and vessel turnaround periods. "This vital federal investment allows us to modernize our surface-preparation infrastructure with state-of-the-art robotic technology," Woerner said when the award was announced.

The grant follows earlier MARAD support, including $1.08 million awarded in 2018 for graving dock and welding equipment improvements and $730,477 in 2023 for hydroblasting equipment and telehandlers. Still, Woerner offered a measured assessment of the broader effort to revitalize American shipbuilding and repair.

Asked whether the national maritime revitalization agenda has translated into substantial new investment for BDD, he identified the Small Shipyard Grant Program as the yard's principal federal funding source. "At the federal level at this time, the only funding signal for our shipyard has been the MARAD small shipyard grant."

At the state level, BDD has established a workforce development partnership supported by New Jersey funding and is working with Hudson County Community College.

The company has used that initiative to acquire equipment and support employee training.

For medium-sized shipyards, the experience illustrates the distance between national industrial policy ambitions and the resources reaching individual repair facilities.

The Workforce Starts on the Waterfront

Workforce shortages remain a persistent concern throughout American shipbuilding and repair, but BDD's executives describe employee retention as one of their strengths. Woerner said the company has developed employees who began in entry-level positions and advanced into supervisory and project management roles.

"Many of our employees initially began their journey here in entry level roles, both on the trade side and the administrative side, and have kind of grown with the company." Sullivan is a particularly direct example. "I started at the company 30 years ago at the entry level," said Sullivan. "I attribute much of my success to my mentor, former BDD president Mike Cranston." That progression reflects a management philosophy that em-

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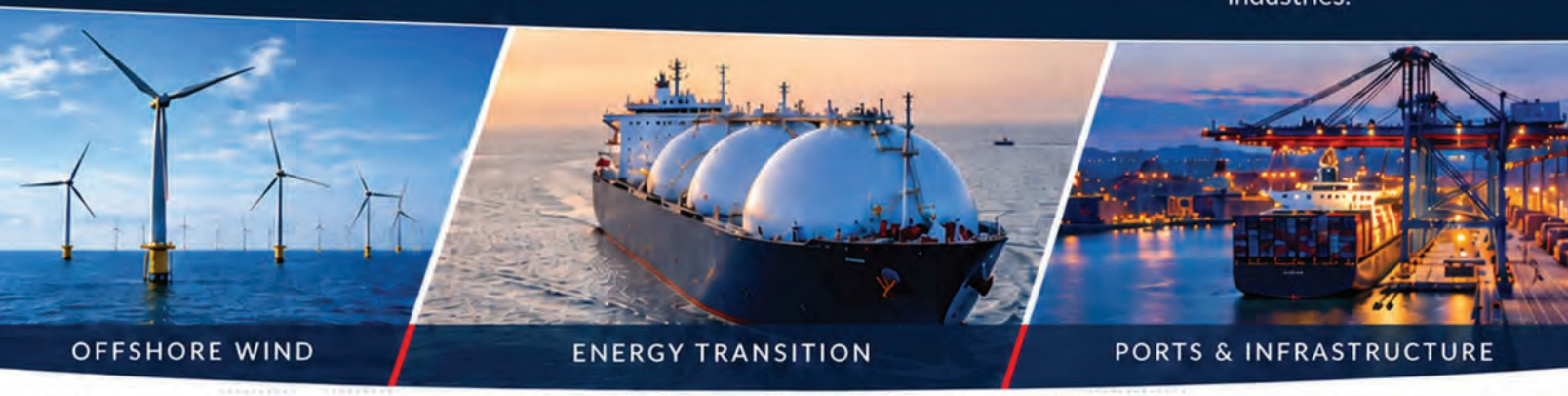
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phasizes developing employees internally as the business expands.

The approach is particularly important for a yard handling a varied workload. Repair projects demand experienced personnel who can adapt to different vessel classes, regulatory requirements and unexpected technical problems.

Magas, whose background includes work with K-Sea and Kirby, was brought into BDD ahead of the mobile boat hauler operation to help establish the management expertise required for the new business.

Woerner said that kind of preparation is essential as a shipyard grows.

Expansion creates additional exposure in manpower, regulatory compliance, quality assurance and project execution.

"All of those elements need to scale up with your revenue growth," he said. The challenge is not simply attracting more contracts. It is ensuring that the organization can execute them profitably and safely.

For BDD, that has meant expanding capabilities while developing the personnel and management systems needed to support them.

The national discussion about rebuilding U.S. maritime capability often concentrates on new ship construction, additional shipyard capacity and the enormous investment required to expand the fleet. Bayonne Dry Dock's experience offers another perspective.

Existing repair infrastructure can contribute more to fleet readiness when supported by targeted equipment investments, skilled personnel and operating practices that reduce maintenance delays.

BDD's 1,092-foot graving dock provides capacity for major government vessel overhauls. Its mobile boat hauler handles a growing volume of smaller military, government and commercial vessels. Its deepwater berths allow work to begin before a ship enters dry dock.

Together, those assets give the company several ways to serve a fleet facing increasing maintenance demands.

But the economics remain challenging, particularly in the New York metropolitan region.

Woerner believes sustainable growth requires management to recognize and address those exposures before they become problems. "What it really comes down to is having a management strategy that addresses each of your exposures and what's required to successfully mitigate them."





SCHOTTEL technology is found on a broad array of ships and boats globally. Recently it was selected to provide the propulsion package for the new Mersey Ferries passenger ferry Royal Daffodil, officially launched in September 2026.

Image courtesy Schottel

SCHOTTEL

GEARED UP TO MEET MARITIME'S PROPULSION NEEDS

Schottel builds on 75 years of azimuth propulsion with a sharper focus on electrification, digitalization and lifetime support.

By Greg Trauthwein

For Schottel, change in the maritime industry is coming from several directions at once. Vessel electrification and decarbonization are reshaping propulsion requirements. Control systems are becoming more integrated. Artificial intelligence and condition monitoring are changing how equipment is maintained. At the same time, shipowners still demand what they always have: propulsion systems that work, vessels that remain available and service that arrives when and where it is needed.

For **Roland Schwandt,** who took the CEO position at Schottel at the beginning of 2026 after serving as deputy CEO since 2024, navigating those changes comes with the benefit of perspective. Schwandt joined Schottel in 2000, when the company employed roughly 300 people and operated only a handful of its own international subsidiaries. Today Schottel Maritime Group employs more than 1,200 people, operates 16 international subsidiaries and has six repair facilities, with about one quarter of its workforce dedicated to service.

Schwandt has watched that transformation from inside the company.

"What has remained the same is Schottel's pioneering spirit, engineering excellence and close relationship with its customers," Schwandt said. "We are still family owned, that thinks long term and takes responsibility for its products throughout the entire life cycle."

What has changed is scale.

"When I joined Schottel in 2000, we have been roughly 300 employees and only two or three of our own subsidiaries," he said. "Today, we are 1,200 people and operating through 16 international subsidiaries providing OEM service around the globe."

In Schwandt's view, Schottel has evolved from a German engineering company into a global maritime technology and service organization without abandoning the engineering culture that built the business.

From the Rudder Propeller Forward

Schottel's foundation remains propulsion. The company traces its roots back 105 years to founder Josef Becker's machine shop. It subsequently evolved into a shipyard, and in 1950 Becker invented the Schottel RudderPropeller, the steerable propulsion unit more broadly known today as an azimuth thruster or Z-drive.

That invention helped define Schottel, but Schwandt sees another lesson in the company's early history. A propulsion technology that was different from conventional systems required technical consultation and support. As the rudder propeller gained customers outside Germany, Schottel followed them. In 1958, it established its first foreign subsidiary in the Netherlands.

The same concept remains central to the company's strategy today.

Schottel propulsion systems now operate across tugs, ferries, offshore vessels, naval and government ships, merchant vessels and special-purpose craft. Rather than identifying one vessel sector as its core market, **Vice President of Sales Viktor Brickmann** defines the company's prime targets of opportunity by application.

"The sweet spot itself is where the maneuverability and reliability and efficiency are mission critical and come together and where the operator values the strong support over the full life cycle," said Brickmann.

Tugs are perhaps the clearest example. They operate in confined waters, require high thrust and precise control, and generate revenue only when they are available. A propulsion failure becomes immediately visible operationally and commercially.

But Brickmann sees similar requirements spreading across ferries, offshore vessels, naval and government applications.

"The common question is not simply what is the lowest initial price?" he said. "It is rather what gives me a safe, efficient, and dependable operation for many years."

Efficiency First

Decarbonization is influencing virtually every new marine technology discussion, but Schottel's role is somewhat different from that of an engine manufacturer. A thruster does not determine whether the energy entering the propulsion train originated with diesel, batteries or another source.





"What has remained the same (since he joined the company in 2000) is* Schottel's pioneering spirit, engineering excellence and close relationship with its customers. *We are still family owned, that thinks long term and takes responsibility for its products throughout the entire life cycle."

– Roland Schwandt,
CEO, Schottel

For Schottel, the starting point is efficiency.

"Decarbonization itself is not a single product," Brickmann said. "For us, it's a direction which is influencing how we design, how we build and how we support the propulsion system."

The objective is simple: use less energy to accomplish the same work. That means matching a hydrodynamically optimized propulsion system to the vessel and its operating profile while supporting electric and hybrid architectures where appropriate.

"Each and every single percentage point of efficiency makes important impact because over the years it can reduce the fuel consumption, emissions, operating costs," Brickmann said.

That lifecycle view matters when propulsion equipment may remain aboard a vessel for decades. The objective, Brickmann said, is to offer solutions that are "both technically sound and commercially realistic."

That thinking is shaping R&D, too.

Customers increasingly expect propulsion, electrical power, automation and digital services to function as an integrated system. At the same time, crews need increasingly sophisticated technology to remain straightforward to operate and maintain.

"It's no longer enough to improve the components as one single part isolated for itself," Brickmann said. "We have to look at the entire vessel actually, including the operating profile and the full life cycle."

That is pushing Schottel toward modular products, standardized interfaces, greater cybersecurity, improved control systems and designs that can be serviced and upgraded over a vessel's operating life.

PropControl 4 Debuts

Earlier this year at SMM 2026 in Hamburg, the most visible manifestation of that development strategy was PropControl 4, Schottel's new modular propulsion control system.

Brickmann describes it in straightforward terms as the connection between the mariner on the bridge and the propulsion equipment below deck.

The difference lies in the architecture and interface. New bridge components are intended to make increasingly complex propulsion arrangements easier to operate, with improved ergonomics and haptic feedback available to assist crews during demanding maneuvers.

Importantly, Schottel brought vessel operators into the development process.

"We asked a lot of customers who really operate such systems in the fields and we implemented all the feedbacks into our new design," Brickmann said.

PropControl 4 is also intended to be more than the controls and displays visible on the bridge. The modular architecture allows it to be adapted to different vessels and propulsion configurations, while monitoring and connectivity functions are designed to improve transparency and facilitate service. Redundancy is incorporated to help maintain control in the event of a problem.

"The main message of our PropControl 4 is actually a simple operation for the crew, strong foundation for reliable service, and a platform that can evolve over the entire vessel's life cycle," Brickmann said.

Service as a Technology Business

With approximately one quarter of Schottel's workforce involved in service, aftersales support is a substantial piece of the business rather than an adjunct to equipment sales.

The company operates six repair facilities globally: two in Latin America, one in North America, two in Europe and one in Asia. Recent investments include new subsidiaries, including one in India; new repair facilities in Brazil and Colombia; expansion of the Wismar service center on the Baltic Sea; and logistics improvements at the Dörth headquarters.

Vice President of After Sales Service Stefan Buch said the underlying goal is vessel availability.

Schottel has invested in digital services, condition monitoring and remote support, with future development focused on predictive maintenance and standardized global processes. "The target is simple and pragmatic," Buch said. "Higher vessel availability, less downtime for our customers combined with the best practice and the utilization of appropriate technology."

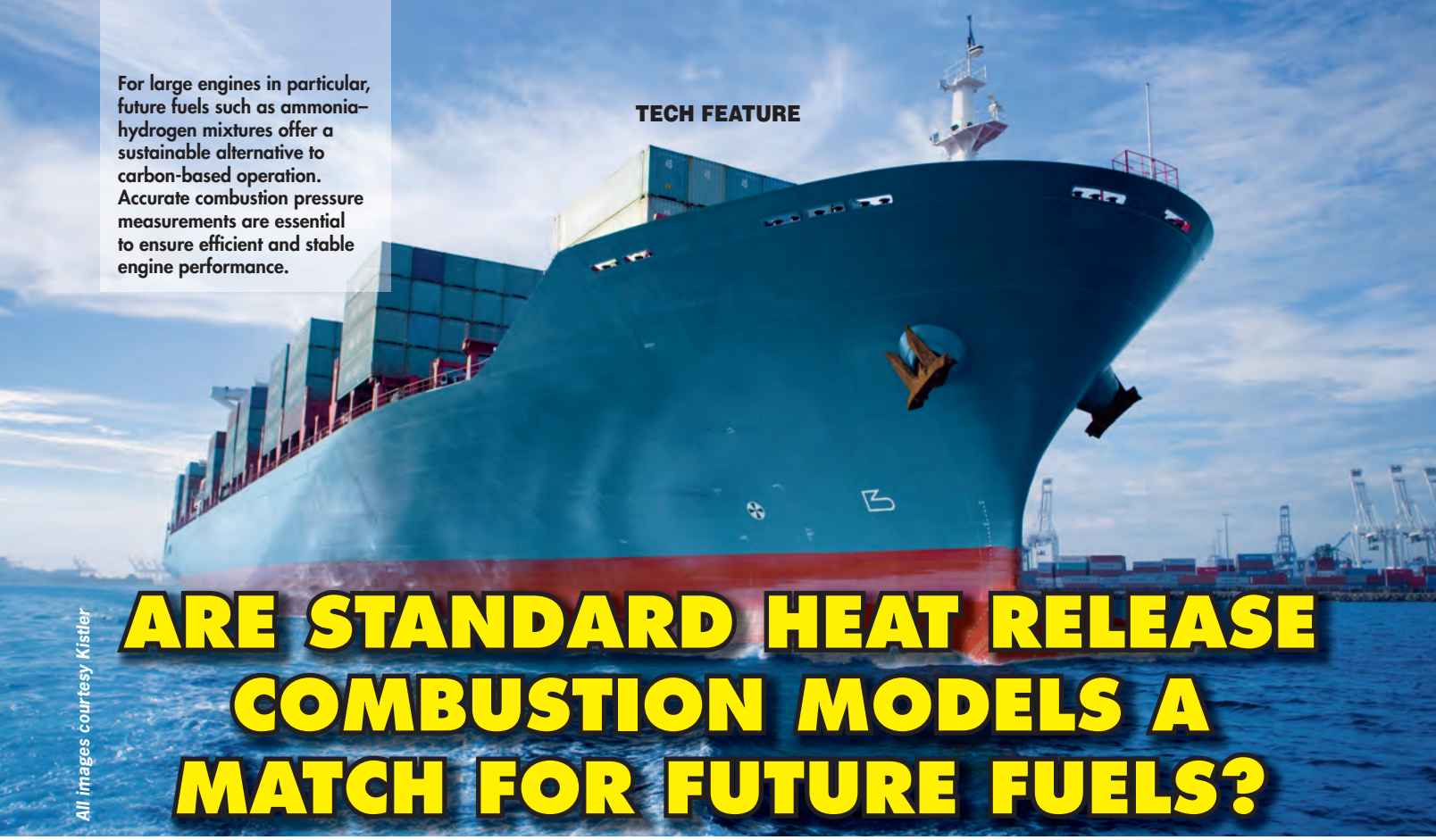
The changing maritime workforce adds urgency. Experienced technical personnel are becoming more difficult to find, increasing the value of remote support and digital diagnostics. At the same time, operators want predictable maintenance costs and rapid support regardless of where a vessel is operating.

Schottel's answer combines local technicians with expertise elsewhere in the organization.

"A customer can receive onsite support in a port while at the same time having access to specialists and engineering resources from anywhere in the world," Buch said. "A combination of people, digital tools, and global collaboration enables us to provide support whenever and wherever is needed."

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For large engines in particular, future fuels such as ammonia–hydrogen mixtures offer a sustainable alternative to carbon-based operation. Accurate combustion pressure measurements are essential to ensure efficient and stable engine performance.

All images courtesy Kistler

ARE STANDARD HEAT RELEASE COMBUSTION MODELS A MATCH FOR FUTURE FUELS?

KISTLER REVEALS WHY CONVENTIONAL IN-CYLINDER PRESSURE CALCULATION MODELS MAY NOT HOLD UP WHEN ANALYZING ZERO-CARBON FUELED ENGINES

Optimizing engines to efficiently burn zero-carbon fuels is a key task in the current shift towards a more sustainable future. A fundamental measurement requirement, in the development of combustion systems engines, has long been the detailed analysis of combustion pressure data. However, for many, the basis for interpreting the test data still relies on calculation models for carbon-based fuel combustion. Given the chance to conduct their own extensive study at the University of Nottingham, pressure measurement experts from Kistler took a closer look at how these models hold up with these low or zero-carbon fuels. After tests with various ammonia-hydrogen mixtures, the experts were surprised by how significantly even small changes in fuel-mix affected the derived results. The good news is that these findings might now help engineers optimize their combustion systems more efficiently.

Combustion pressure measurement gives engineers a clear image of what happens inside the engine during operation. To get relevant data, a small piezoelectric sensor is mounted directly in the cylinder head. As air and fuel are compressed and ignited, the rapidly increasing in-cylinder pressure is captured with high fidelity creating a detailed pressure curve for each combustion cycle. Based on this data, engineers know how fast the fuel burns, when exactly peak pressure is reached, how efficiently the energy is released, and whether the combustion is stable. These insights are crucial for optimizing any combustion engine. They help with finding optimized combustion phasing to avoid knock or mechanical overload, improving fuel efficiency and reducing emissions.

In other words, measuring and analyzing combustion pressure is an indispensable tool for building better and more eco-friendly engines. Yet, researchers and engineers still rely heavily on simplified first-law heat release models, which typically assume fixed polytropic indices. Polytropic indices are thermodynamic parameters which lie at the core of the analysis. They describe how pressure and volume change during gas compression or expansion in the cylinder, providing insights into how much energy is retained or lost during the process.

Questioning the Calculation Model

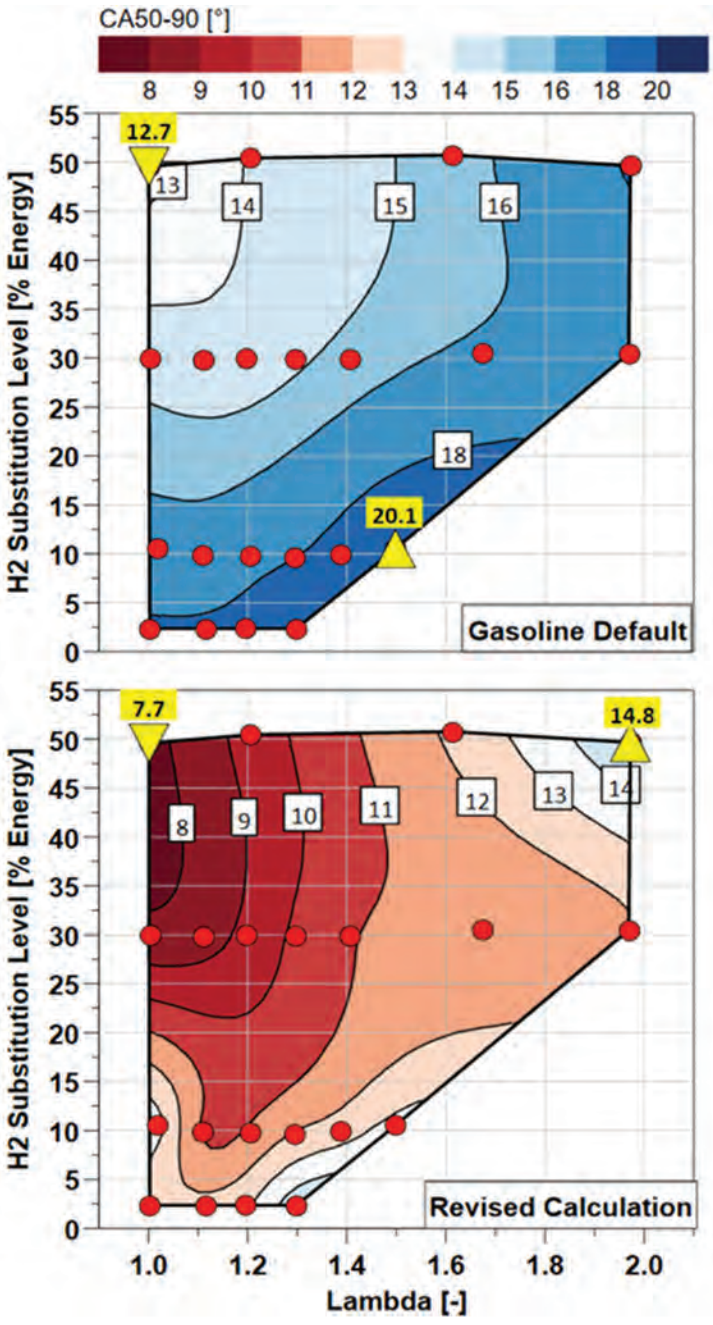
The polytropic index commonly used in combustion analysis has been well established and proven in many years of research on engines burning hydrocarbon fuels. Other types of fuels, however, differ significantly in thermodynamic properties, flame speed, ignition characteristics, and specific heat ratio. The team at Kistler, a manufacturer of piezoelectric pressure sensors, wanted to explore the sensitivity of this aspect, with respect to zero-carbon fuels – and how much this might influence the results in engine development work. "We wondered whether parameters proven in the research of carbon fuels would hold up when applied to zero carbon fuel combustion. So, we decided to look into it," explains **Dr. David Rogers, Head of ICE Systems at Kistler**, who led the study.

In collaboration with the **Powertrain Research Center, at the University of Nottingham,** the team decided to make the most of the opportunity to work with the sophisticated test equipment and research engine that the facility has. The mixture of ammonia (NH_3) and hydrogen is increasingly considered a carbon-free fuel alternative with a high potential for heavy-duty combustion engines as used in marine propulsion applications. Ammonia and hydrogen have combustion characteristics that differ significantly from conventional carbon fuels: while ammonia has a lower burning velocity than gasoline, hydrogen has a higher one and their specific heat ratios are different as well. The Kistler team wanted to explore: are gasoline-based assumptions still valid for ammonia-hydrogen blends? Or might they introduce systematic errors in burn-rate analysis, combustion phasing prediction, and ignition delay estimation? "Ammonia and hydrogen are tricky to store. Also, you need an engine that is able to burn it. Thanks to the university, we had access to both," reveals Rogers. "We really did not know what to expect and would have been happy if nothing had shown up in our findings. But that was not the case."

The Test Approach

The laboratory at the university was equipped with a modern single-cylinder spark-ignition research engine with variable valve timing, direct fuel injection, and a dedicated port fuel injection for ammonia and





Comparison of the late-stage combustion duration for the gasoline default setting (upper) and revised indices (lower).

hydrogen. The high-speed in-cylinder pressure data was recorded using a Kistler piezoelectric transducer (Type 6045B), which was flush-mounted in the cylinder head. The connected KiBox2 combustion analysis system from Kistler prepared the data for interpretation. The tests covered both pure ammonia combustion and various ammonia-hydrogen blends (up to 60% hydrogen share).

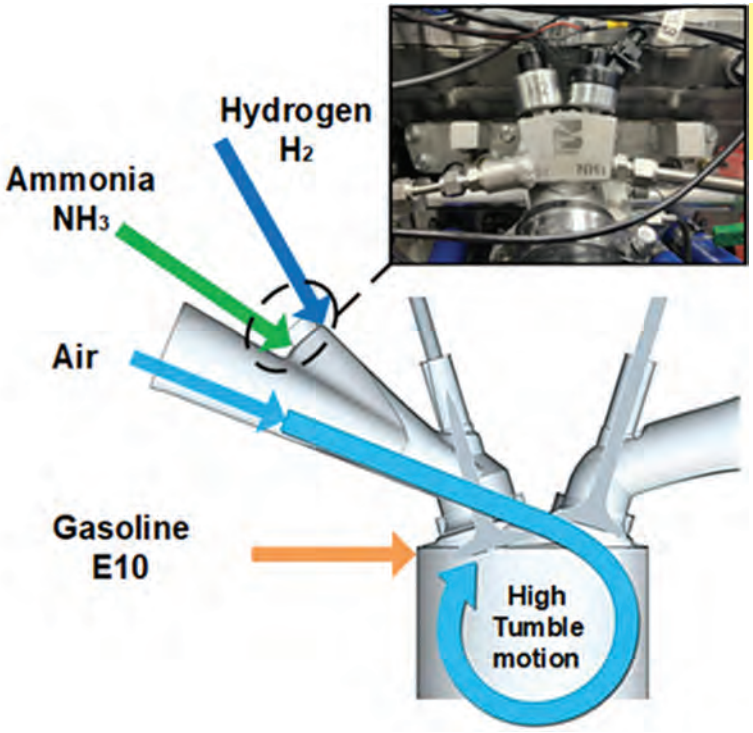
The measured in-cylinder pressure was used as the main input, converting the pressure curve into a energy release curve, showing how quickly and at what crank angle the fuel's energy is released during combustion. The research team compared the standard polytropic index based on gasoline combustion with a more detailed method: based on the measured pressure data and the specific fuel blend, the polytropic index was calculated individually for each operating point and each cycle. This allowed the Kistler team to quantify the potential error that is introduced when standard gasoline models are applied to ammonia-hydrogen combustion. Conversely, they were able to quantify the increase in accuracy achieved through fuel-specific, cycle-resolved calculations.

The Results: Facing the Potential for Errors

Rogers and his team were stunned by the results: "We found the sheer magnitude of the potential errors surprising. For some of the operational points the errors were so significant that they rendered the test results borderline unusable." Under pure ammonia operation, the polytropic index deviated in compression by about four percent from the gasoline default value. The experts found out that the discrepancies primarily affected the late combustion phase, while the early burn phase was less sensitive. Also, combustion accelerated and modeling discrepancies decreased as the hydrogen share increased. "Our findings show that conventional gasoline-based heat release analysis is not universally transferable to zero-carbon fuels," summarizes Rogers. "For accurate prediction of burn duration and combustion phasing, fuel-specific or cycle-resolved polytropic indices are required."

Creating More Sustainable Engines

In day-to-day engine research and development, engineers are under a lot of pressure to quickly improve engines. Here, discrepancies in the test results require repeated measurements, making the whole process less efficient. With more accurate calculation models and, consequently, a more accurate analysis, engineering decisions



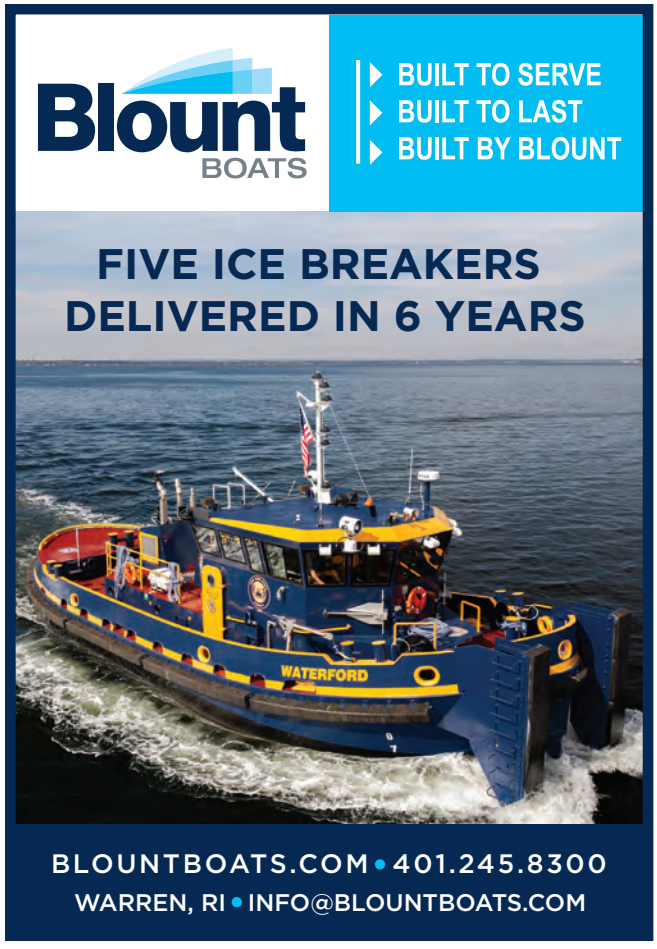
Dr. Rogers and his team used a modern single-cylinder spark-ignition engine with variable valve timing, direct fuel injection, and a dedicated port fuel injection for ammonia and hydrogen to conduct their research.

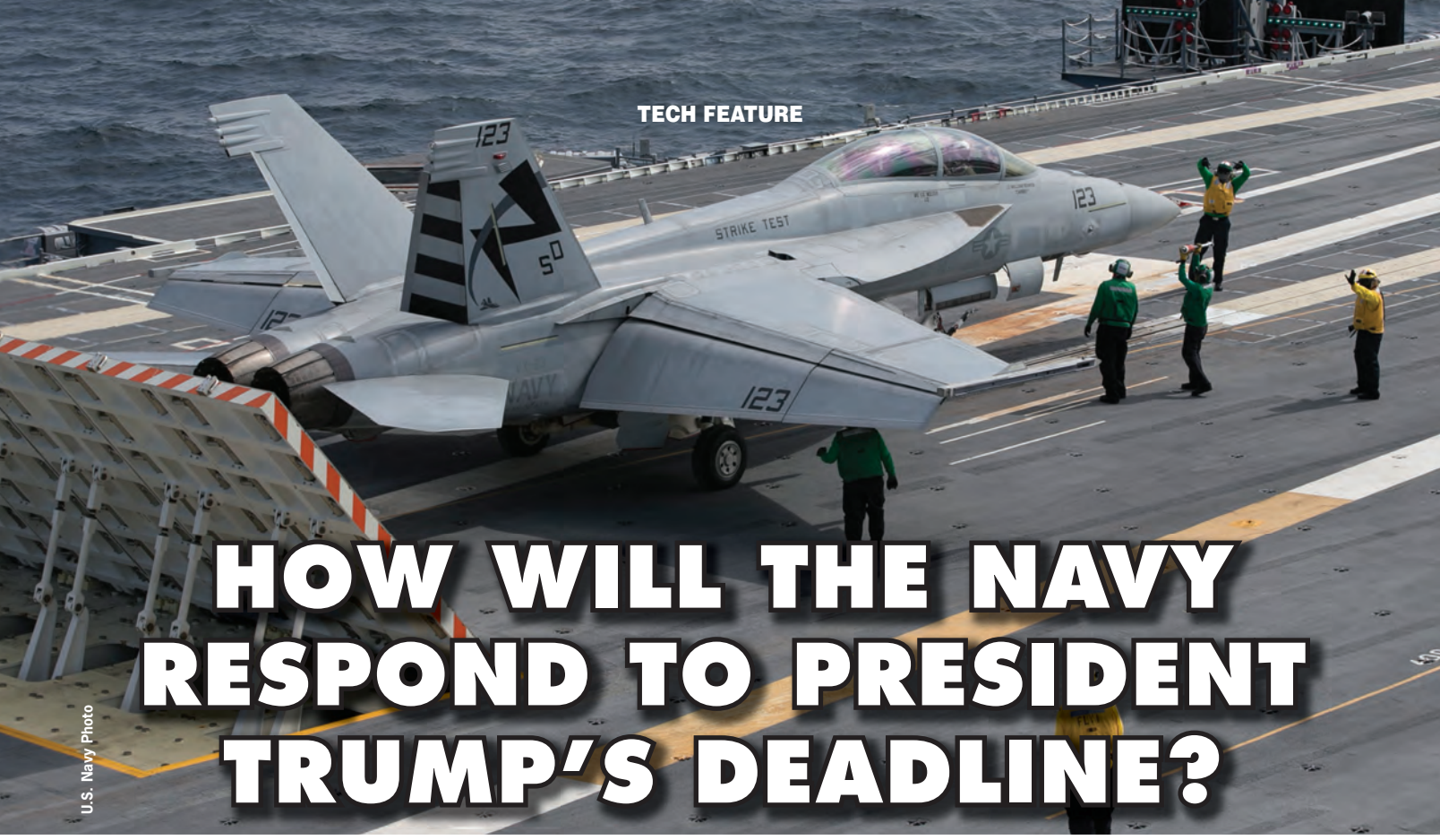


The KiBox2 analysis system from Kistler enables the implementation of cycle-resolved polytropic indices. This makes it easy to implement the findings of the study in combustion pressure analyses of engines running on zero-carbon fuels.

can be made earlier in the development cycle. "These combustion metrics are commonly used by our customers in their research and development, so of course we are interested in supporting them as best as we can. Experimental work like this helps us a lot in doing so. We want the users of our technology to be confident about the quality of their analysis," Rogers explains the motivation for their study. "The ultimate goal is to make the calculation models better and easier to use through our products. Ideally, the data is so precise and the analysis so conclusive that engineers will be able to make informed engine design decisions already during the measurement phase. This way, we can speed up development time significantly and help engineers create better and more efficient engines."

In the next step, Kistler intends to embed these findings into its measurement technology to ensure seamless user access. The KiBox2 analysis system enables straightforward implementation of cycle-resolved polytropic indices. Also, the team wants to do more experimental work – with different engine types and zero-carbon fuel mixtures. "This is just a small part of a bigger picture. The goal of our work is also to clear the path for more cooperations with partners from the industry and universities to continue our research," concludes Rogers.





U.S. Navy Photo

HOW WILL THE NAVY RESPOND TO PRESIDENT TRUMP'S DEADLINE?

REPLACING THE CATAPULT SYSTEMS ON FORD-CLASS CARRIERS WITHOUT BREAKING THE BANK

By Drew Robb

The catapult systems on Ford-class aircraft carriers known as electromagnetic aircraft launch systems (EMALS) have been plagued with problems. President Trump has decided that enough is enough, issuing an Executive Order in August of 2026. It gave the Navy two months to come up with a plan to replace EMALS with steam-based systems in the next Ford-class vessel, the CVN-81, currently under construction.

Easier said than done. Ford-class carriers are electric. Their reactors do not create service steam for major ship systems. It is generally believed that retrofitting the vessel to provide sufficient steam to operate catapults would entail a major and expensive change to the nuclear reactor's steam generation system, deck alterations, and a whole new steam distribution system. The price tag to revert to steam could end up higher than fixing the beleaguered EMALS system.

"Unproven EMALS technology was implemented with a concurrent engineering/build strategy that hasn't worked out," said steam engineer Matt Janssen, President of Vapor Motive Company of Sandpoint, Idaho.

His proposal is to rip out EMALS and install a modern steam system beneath each of the four catapults. This avoids the need to change any nuclear energy infrastructure, while keeping costs low and resolving the reliability and affordability issues surrounding EMALS.

EMALS Frailties

The Ford-class carrier program has gained a reputation for lengthy delays and cost overruns. The original version, and the only one fully commissioned to date, is the CVN-78 USS Gerald R Ford. It was launched several years late with massive cost overruns. It gained unwanted attention in 2026 for being out of service in the Mediterranean. Fire damage, inoperable toilets, and other issues led to it limping home. It is estimated that it will be sidelined for maintenance for more than two years. As part of it, the EMALS catapult system is scheduled to receive a $25 million soft-

"The Ford carrier architecture doesn't support steam so we make it onsite using the electricity that is available. This limits the modifications necessary to the Ford-class carriers avoiding excess cost and construction delays to CVN-81 and enables competitive sourcing of parts."

– Matt Janssen, President, Vapor Motive Company



ware upgrade and other repairs.

EMALS is one of many ship systems that were shifted from steam-driven to electric-driven when the Navy transitioned from the older Nimitz-class carriers to the Ford-class. Many processes and loads such as desalination, space heating, domestic water heating, cooking, and laundry are now served by electrically-driven equipment. Some of this appears to be working well, but other systems have been seriously problematic.

The ship's vacuum collection, holding, and transfer (VCHT) system, for example, is reported to suffer frequent clogs or lose vacuum. Maintenance challenges also affected some of the vessel's next-generation systems, including the Advanced Arresting Gear system to catch fighter jets during landing, as well as weapons elevators and EMALS.

How EMALS Works

EMALS accelerates aircraft using a linear induction motor embedded into the flight deck. The power to operate it is drawn from the carrier's power plant and stored in energy storage units (consisting of a motor and a flywheel). During a launch, an enormous electrical charge is discharged through solid-state pulse thyristor converters and a row of energized electromagnetic coils beneath a 300-foot track that the jet follows during takeoff. A shuttle is attached to the nose gear of the jet to propel it along the runway at speeds of up to 180 knots (200 mph).

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A Carrier Air Wing 8 F/A-18F Super Hornet, attached to Strike Fighter Squadron 213, launches from the flight deck of the world's largest aircraft carrier, USS Gerald R. Ford (CVN 78), July 14, 2025.

U.S. Navy photo by Mass Communication Specialist 2nd Class Maxwell Orlosky

EMALS was supposed to save money, reduce the manpower needed for the catapults, and simplify maintenance. These benefits have yet to materialize. Probably the biggest bone of contention is unreliability. EMALS has been failing on average every 400 launches, a tenth of its contracted specification. That could spell disaster in a combat arena. If one catapult fails, it can't be repaired if other jets are being launched. The designers opted for three Energy Storage Groups supplying the catapults rather than having four independent launch systems. This is one of several expensive mistakes that now haunt the program. Around a billion has been spent on EMALS development to date. Another half billion contract is in play to install EMALS in Ford-class carrier CVN-80 USS Enterprise, which is under construction.

An assessment of EMALS by the Director, Operational Test and Evaluation (DOT&E) is damning: "Poor or unknown reliability of the newly designed catapults, arresting gear, weapons elevators, and radar, which are all critical for flight operations, could affect CVN-78's ability to generate sorties, make the ship more vulnerable to attack, or create limitations during routine operations."

Running out of Steam

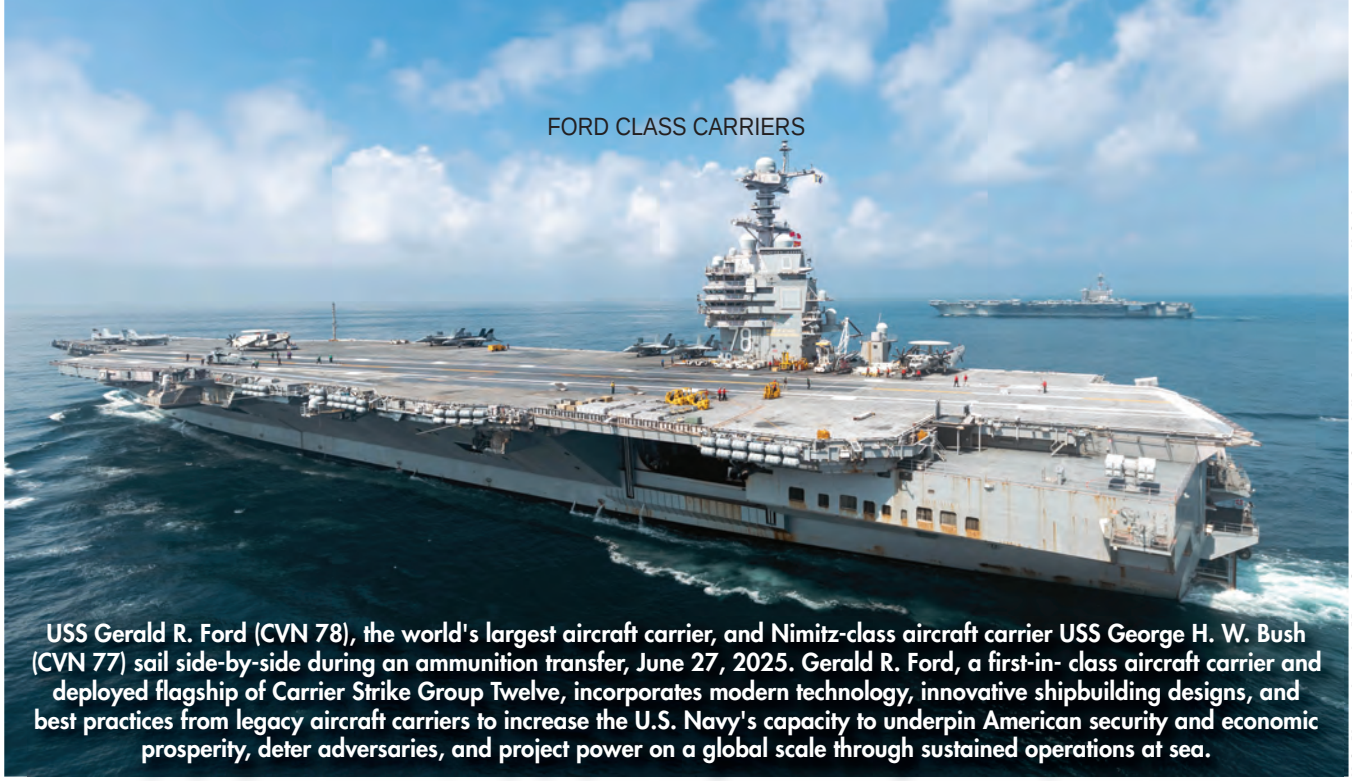
Steam powered systems largely disappeared from Navy procurement when the last Nimitz-class carrier was launched in 2006. Each catapult system is comprised of a steam engine and a wet steam accumulator mounted below deck. Two pistons in cylinders simultaneously propel a shuttle along the deck, similar to how EMALS works. Each launch requires about 1000 lbs of steam that is stored in a wet steam accumulator with the steam obtained from pipes fed from nuclear-fueled steam boilers.

Janssen has worked on boilers and steam engines for 25 years. He is well versed in the wet steam accumulators that are used for energy storage in steam catapults. Instead of making iterative changes to the original carrier design and redesigning the nuclear energy system to incorporate more steam, he advocates installation of a local steam boiler and accumulator in each of the four catapult areas. It gets its power from the existing high-voltage, 13.8-kilovolt zonal power grid electrical energy distribution system of the Ford Carrier. There is more than enough electrical capacity to accommodate these systems. Additionally, removal of EMALS hardware leaves plenty of space to fit a big enough boiler and accumulator.

"The Ford carrier architecture doesn't support steam so we make it onsite using the electricity that is available," said Janssen. "This limits the modifications necessary to the Ford-class carriers avoiding excess cost and construction delays to CVN-81 and enables competitive sourcing of parts."

His analysis of the 20th century steam technology employed on Nimitz-class vessels is that it was probably developed by gun specialists rather them steam experts. The materials used and the supporting lubrication are ripe for efficiency upgrades.

Steam technology advances since the days of the Nimitz-class carrier can be incorporated to reduce water consumption, reuse condensate, and control the power and velocity of a steam catapult launch or "shot." According to Janssen, the latter can accommodate a wider range of aircraft weights and throwing speeds to meet the expected future types of aircraft to be utilized by the U.S. Navy



USS Gerald R. Ford (CVN 78), the world's largest aircraft carrier, and Nimitz-class aircraft carrier USS George H. W. Bush (CVN 77) sail side-by-side during an ammunition transfer, June 27, 2025. Gerald R. Ford, a first-in- class aircraft carrier and deployed flagship of Carrier Strike Group Twelve, incorporates modern technology, innovative shipbuilding designs, and best practices from legacy aircraft carriers to increase the U.S. Navy's capacity to underpin American security and economic prosperity, deter adversaries, and project power on a global scale through sustained operations at sea.

U.S. Navy photo by Mass Communication Specialist 2nd Class Maxwell Orlosky

that require catapult launches.

The supply chain that existed to provide steam components and systems for the defense industry has largely evaporated over the past two decades. But there remains a thriving steam ecosystem outside of that perimeter for steam turbines, boilers, refineries and district heating. Those vendors have the manufacturing capacity to deliver what the Navy needs.

"Matt's retrofit design for steam catapults on Ford-class carriers looks feasible and the overall concept is sound," said Linn Moedinger, a retired steam engineer with 50 years of experience. "As the design leans on currently available components used in other common steam systems, this greatly mitigates possible supply chain challenges."

Conclusion

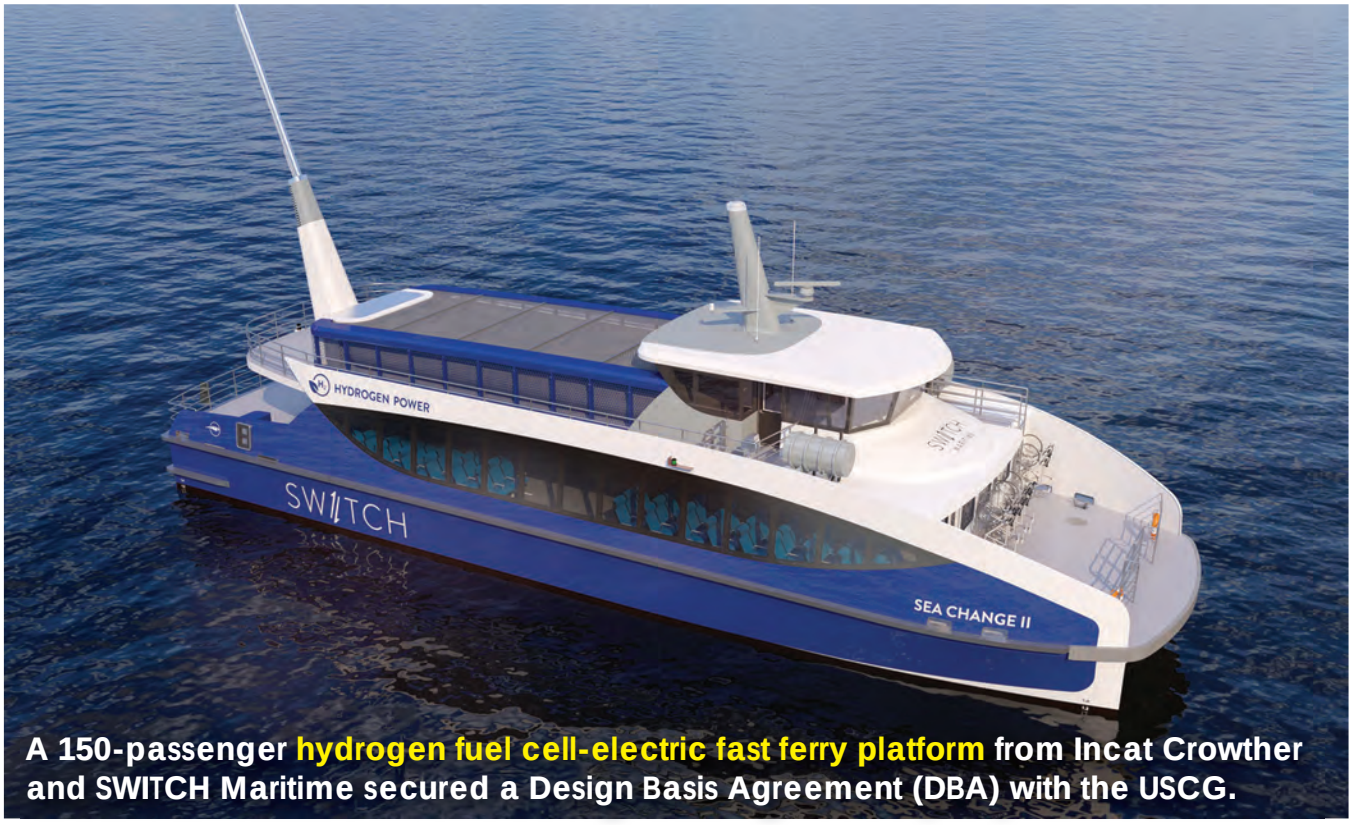
The defense industry is reluctant to do an about face, dump EMALS, and revert to steam. But an order is an order. And faced with cost overruns and a program plagued with delays and setbacks, perhaps a comprise should be reached – retrofit a simplified steam catapult into remaining Ford-class carriers while continuing EMALS research, development, and field testing – but outside of the new carrier arena.

"The carrier program has been beset by severe and persistent diseconomy and reliability issues that have jeopardized the Navy's ability to defend freedom, preserve economic prosperity, and keep the seas open and free," said Janssen. "Reverting to steam catapults is technically and economically feasible."



In the Shipyard

From Design to Delivery



A 150-passenger hydrogen fuel cell-electric fast ferry platform from Incat Crowther and SWITCH Maritime secured a Design Basis Agreement (DBA) with the USCG.

Image courtesy Incat Crowther

From hydrogen-powered ferries and ammonia-fueled bulk carriers to polar icebreakers, LNG carriers and floating data centers, the latest generation of ships and ship designs reflects an industry investing in new technologies while maintaining a sharp focus on operational efficiency. The diversity of the global shipbuilding industry is evident in the projects moving through design, construction and delivery. While conventional diesel propulsion remains central to the world's commercial fleet, shipowners and shipbuilders are increasingly incorporating battery-electric systems, hydrogen fuel cells, ammonia, methanol-ready arrangements and LNG dual-fuel propulsion into new vessel designs.

Featured this month are 12 projects that illustrate the breadth of recent activity: some on the drawing board, others starting construction, and several have already entered commercial service.

One of the more interesting developments in the U.S. passenger vessel market comes from **Switch Maritime** and **Incat Crowther**, whose **SWITCH-150 hydrogen fuel cell-electric ferry design** has secured a Design Basis Agreement (DBA) with the U.S. Coast Guard.

The 92-ft. ferry is designed to carry 150 passengers at a cruising speed of 25 knots, using an integrated hydrogen fuel cell-electric propulsion system. With 720 kg of compressed hydrogen storage, the vessel is intended to complete a full day of high-frequency commuter operations with-out requiring intermediate charging.

The operating philosophy is significant. Rather than adapting a ferry schedule around battery charging, Switch is developing a hydrogen-powered vessel capable of maintaining service speeds and refueling patterns comparable to conventional diesel ferries. Mobile hydrogen refueling equipment would also eliminate the requirement for extensive shoreside charging infrastructure and associated electrical grid upgrades.

The design builds on the companies' experience with **Sea Change**, the first hydrogen fuel cell-electric ferry to enter passenger service in the U.S., which began operating in July 2024. Regulatory development has been an important part of the project. Existing U.S. Coast Guard passenger vessel regulations do not specifically address hydrogen fuel cell propulsion and onboard hydrogen storage. So Switch and Incat Crowther worked with the U.S. Coast Guard to establish an alternative design framework demonstrating equivalent levels of safety and risk mitigation.

The first SWITCH-150 is intended for New York City, operating from the Brooklyn Navy Yard. Its passenger arrangement includes seating for 150, luggage storage, a kiosk and three bathrooms, including an accessible facility.

The project has received $2 million in support from the New York State Energy Research and Development Authority.

At the opposite end of the commercial vessel spectrum, **CMB.TECH's Mineral Europa** has entered service as the world's first **ammonia-powered dry bulk carrier**.

The 210,000-dwt Newcastlemax, built by **CSSC Qingdao Beihai Shipbuilding**, is equipped with a WinGD dual-fuel ammonia engine and a Sun Rui ammonia fuel supply system. The propulsion arrangement allows operation on ammonia or conventional marine fuel, providing flexibility as ammonia bunkering infrastructure develops.

Anglo-Eastern played an important role in bringing the vessel from concept to operation. Its technical services division began evaluating alternative fuels with CMB.TECH in 2018, initially examining hydrogen before shifting toward ammonia.

By 2020, Anglo-Eastern Technical Services was developing the vessel's safety philosophy, fuel arrangements and preliminary engineering. The design subsequently received Approvals in Principle from Lloyd's Register and ABS in 2021. Integrating ammonia into a commercial bulk carrier presents engineering challenges beyond the installation of a different engine. Ammonia's toxicity requires carefully engineered storage, containment, ventilation, leak detection and emergency shutdown arrangements. The challenge was incorporating these systems without compromising the vessel's cargo-carrying capability.

Anglo-Eastern also developed operating, bunkering, maintenance and emergency procedures, supported by crew training using a three-dimensional digital twin, fuel supply simulator and emergency scenarios.

The vessel's entry into service represents the culmination of an eight-year development effort and provides an early commercial reference for ammonia propulsion in large oceangoing ships.

Another alternative fuel development comes from **Fratelli Cosulich Marine Energy**, which took delivery of **Carlotta Cosulich**, the third of four methanol-ready IMO II bunker tank-ers in its fleet expansion program. Built by **Taizhou Maple Leaf Shipyard** in China, the 8,585-dwt tanker follows sister vessels **Anna Cosulich** and **Lucia Cosulich**. The design reflects the changing requirements of the marine bunkering business, where operators must accommodate conventional fuels while preparing for increasing demand for alternatives.

Carlotta Cosulich incorporates MarineLINE cargo tank coatings, single point mooring capability and a 5-ton crane. These features provide flexibility in cargo handling

Mineral Europa



Image courtesy Anglo-Eastern

Felicitas

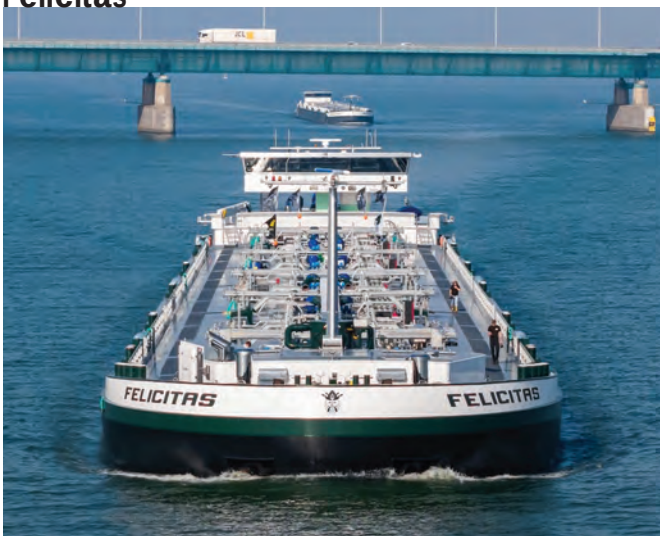


Image courtesy AMS Barging

CMA CGM Electra



Image courtesy CMA CGM

In the Shipyard

From Design to Delivery

Energy North



Image courtesy Nakilat

Disney Believe



Image courtesy Meyer Werft

and bunkering operations, allowing the vessel to serve different customers and operating environments.

The methanol-ready designation is particularly relevant as shipowners increasingly consider methanol-fueled newbuilds. For bunker suppliers, the ability to respond to changing fuel demand is becoming an important consideration in fleet investment.

With the third vessel delivered, Fratelli Cosulich is approaching completion of its four-tanker construction program. Carlotta Cosulich is undergoing final preparations before entering service.

In the offshore support sector, **BOURBON** is renewing part of its crewboat fleet with two new 112-ft. vessels built by **Grandweld Shipyards** in Dubai. The first vessel was delivered on November 3, 2026, following successful sea trials. Designed for transporting personnel to offshore installations, the new crewboats accommodate 60 passengers in business-class-style seating and offer cruising speeds of up to 38 knots.

Compared with BOURBON's previous generation of 105-ft. crewboats, the new design provides increased passenger capacity, improved operational redundancy and greater attention to fuel efficiency.

An electronic fuel monitoring system, integrated during construction, supports the monitoring and management of fuel consumption. The vessels also incorporate satellite communications systems connecting onboard equipment with BOURBON's shoreside teams. The bridge has been redesigned to improve visibility and ergonomics, while approximately 194 sq. ft. of deck space includes dedicated luggage compartments.

These changes address the practical requirements of offshore crew transport, where vessel availability, transit time, passenger comfort and fuel consumption directly influence operating costs. The delivery continues BOURBON's investment in its offshore personnel transportation busi-ness, a segment where operators are seeking greater efficiency from increasingly specialized vessels.

In Canada, **Seaspan Shipyards** reached a major construction milestone with the October 14, 2026, keel

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In the Shipyard

From Design to Delivery

ARC Freedom



Image courtesy ARC

Floating Data Center Concept



Image courtesy NYK

laying of **CCGS Imnaryuaq**, the future flagship polar icebreaker for the Canadian Coast Guard. The 518-ft. vessel, under construction at Vancouver Shipyards in North Vancouver, will be the largest and most powerful icebreaker built in Canada. Measuring 518 x 92 ft. with a design displacement of 26,036 metric tons, Imnaryuaq will have 47 MW of installed power. Its diesel-electric propulsion system will drive ice-classed azimuthing propulsion units, providing the thrust and maneuverability required for operation in severe Arctic ice.

Designed to IACS Polar Class 2 standards, the vessel is intended to extend the Coast Guard's operating reach into the High Arctic and support sustained year-round operations. The icebreaker is also being developed as a multipurpose platform. It will accommodate up to 100 personnel and include scientific laboratories, a moon pool for deploying research equipment, and a helicopter flight deck and hangar. Additional facilities include a vehicle garage and provisions for future remotely piloted aircraft systems.

These capabilities will support scientific research, search and rescue, maritime emergency response and logistics operations serving Canada's northern communities. Construction began with first steel cutting in April 2025, with delivery anticipated in the early 2030s.

Imnaryuaq is the seventh vessel being designed and built by Seaspan under Canada's National Shipbuilding Strategy. The shipyard has invested more than $200 million in facility modernization and production infrastructure to support increasingly complex construction programs.

The project also illustrates the industrial scope of Canada's fleet renewal effort, with Seaspan's National Shipbuilding Strategy supply chain encompassing more than 800 Canadian companies and over $3 billion in awarded contracts.

In Vietnam, **CMA CGM, Nike and Gemadept** introduced a fully electric inland container barge service connecting Ho Chi Minh City with the Gemalink deep-sea terminal at Cai Mep. The vessel will transport Nike cargo over a 112-mile round trip, providing an alternative to road transportation for container movements between inland logistics facilities and the international terminal.

Developed by CMA CGM's New Build and R&D teams, the barge incorporates CATL battery technology and can be recharged in approximately four hours. Charging infrastructure at Gemalink is supported by a dedicated solar farm, integrating renewable electricity generation with inland waterway transportation.

The service is designed to handle more than 50,000 TEU annually, with the project partners estimating that it will avoid approximately 778 metric tons of carbon dioxide emissions each year.

The commercial significance lies in the operating environment. Inland



In the Shipyard

From Design to Delivery

CCGS Imnaryuaq

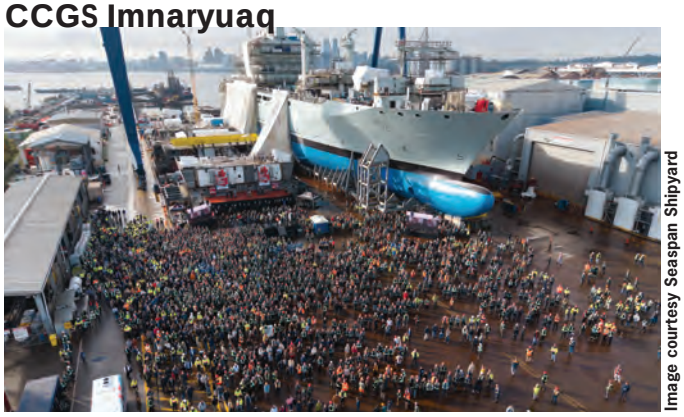


Image courtesy Seaspan Shipyard

Carlotta Cosulich



Image courtesy Fratelli Cosulich Marine Energy

container barges traveling predictable routes can be well suited to battery propulsion, particularly when charging facilities are available at established terminals.

For CMA CGM, the project extends its intermodal logistics activities in Vietnam and offers a potential model for similar operations in other markets.

In the Netherlands, **AMS Barging** christened **Felicitas**, a 443-ft. diesel-electric inland tanker designed by **RensenDriessen Shipbuilding** and outfitted by **Den Breejen Shipyard**. The vessel has a cargo capacity of approximately 9,000 cu. m. distributed across 12 tanks, with dual cargo piping, two mass flow meters, a nitrogen generator and pumping capacity of 1,800 cu. m. per hour.

It also incorporates a bunker boom and has been designed to accommodate future modifications for methanol bunkering. Propulsion is provided by a diesel-electric system with Z-drives, giving the vessel improved maneuverability during inland navigation and terminal operations. Its engines meet European Stage V emissions requirements.

AMS Barging has previously reported fuel savings of approximately 25% from similar diesel-electric arrangements compared with conventionally powered vessels.

The tanker follows sister vessel **Fortuna**, which was christened earlier in 2026, and brings the company's fleet to 17 vessels.

Felicitas completed its maiden commercial voyage and is operating in the spot market. Its cargo capacity allows larger parcels to be transported in a single movement, potentially reduc-ing the number of voyages and terminal calls required.

The methanol-ready cargo arrangement also reflects the uncertainty surrounding future marine fuel demand. Rather than committing exclusively to one fuel market, AMS Barging is investing in vessels capable of serving current customers while retaining options for future cargoes.

A Japanese consortium led by **NYK Line** is developing a **port-based floating data center concept** that could create a new application for floating marine infrastructure.

The consortium includes **NYK, NTT FACILITIES, Eurus Energy Holdings** and **MUFG Bank.**

The concept envisions data centers installed on floating platforms moored alongside existing port quays, where they could use established electrical, telecommunications and other shore-side infrastructure.

This approach differs from more ambitious offshore data center concepts that would rely heavily on independent power supplies and offshore renewable energy generation.

Locating facilities within ports could simplify access for maintenance, improve telecommunica-tions connectivity and reduce some of the infrastructure challenges associated with offshore installations.

NYK will oversee project development and business strategy, while NTT FACILITIES will evaluate data center design, construction and operational requirements. Eurus Energy will examine renewable power integration, particularly offshore wind, and MUFG Bank will assess financing and commercial opportunities.

The partners view port-based installations as a possible intermediate step toward offshore data centers.

To date, no location, construction schedule, investment value or computing capacity has been announced.

In Germany, **MEYER WERFT** marked another milestone in its long relationship with **Disney Cruise Line** with the keel laying of **Disney Believe** at its Papenburg shipyard.

The LNG-powered cruise ship will be the fourth vessel in Disney's Wish class, following **Disney Wish, Disney Treasure** and **Disney Destiny**.

With a gross tonnage of approximately 144,000 GT and more than 1,256 cabins, the vessel is scheduled for delivery in 2027.

The keel-laying ceremony marked the beginning of as-

In the Shipyard

From Design to Delivery

Bourbon Surfer 341



Image courtesy Bourbon

Diamond Gas Nexus



Image courtesy NYK Line

sembly of the ship's second gigablock. The first gigablock had already left the yard's covered building dock in September and was positioned at the outfitting quay.

Nakilat celebrated the naming of **Energy North**, the first vessel completed under its six-ship construction program at **HD Hyundai Samho**.

The 88,000-cu.-m. LPG/ammonia carrier is designed to transport either cargo, providing flexibility as international energy and chemical markets evolve. The vessel incorporates dual-fuel propulsion technology and emissions-reduction systems, with an ammonia-ready design intended to support future developments in marine energy transportation.

Energy North is the first of four LPG/ammonia carriers in the program, which also includes two LNG carriers. The investment expands Nakilat's gas transportation capabilities while providing exposure to the developing ammonia market, where demand could increase as ammonia gains attention as both an energy carrier and potential marine fuel.

For the U.S.-flag fleet, **American Roll-On/Roll-Off Carrier Group** has added **ARC Freedom**, a Large Car and Truck Carrier designed to transport automobiles, commercial vehicles, heavy equipment and project cargo.

The vessel has capacity for nearly 8,000 car-equivalent units across 13 vehicle decks, including five hoistable decks that allow the cargo arrangement to be adjusted for different vehicle sizes and configurations. A 21.3-ft.-high main deck and door, together with a stern ramp capable of handling rolling loads of up to 320 metric tons, provide the capacity to accommodate heavy industrial and military equipment.

ARC Freedom will participate in the Maritime Security Program, operating commercially under the U.S. flag while remaining available to support government sealift requirements.

Its adjustable deck configuration and heavy cargo handling capability provide flexibility for civilian cargo movements while supporting military transportation requirements when needed.

Finally, **NYK Line named Diamond Gas Nexus, a new LNG carrier built at HD Hyundai Samho in South Korea.** The vessel is chartered to Diamond Global Energy, a Singapore-based subsidiary of Mitsubishi Corporation, under a long-term time charter agreement. Operating within the NYK Group's ship management framework, Diamond Gas Nexus is expected to primarily transport LNG associated with the Cameron LNG project in the United States, in which Mitsubishi Corporation and NYK both participate. The carrier is equipped with a WinGD dual-fuel slow-speed diesel engine capable of using con-ventional fuel oil or cargo boil-off gas. It also incorporates a cargo subcooling system designed to suppress excess boil-off gas generation, improving cargo management and transportation efficiency.



THE US MARITIME SHOW

COMING TO A THEATER NEAR YOU – WATCH THE TRAILER

By Bob Kunkel

With only a few weeks remaining in the calendar countdown, the largest collection of U.S. Maritime owners. operators, seafarers, shipyards and supply chain manufacturers will assemble again in New Orleans, La., during the first week of December. Much like a Hollywood production, the week can be a prequel, sequel, saga or franchise blockbuster. Standing with the US Maritime industry we should hope for a long running franchise.

The attendees visiting the city this year will be faced with more than several important dates and activities forcing decisions prior to their arrival. Decisions determining their anticipation or anxiety when answers are received. Those dates and decisions are also occurring after releasing this editorial opinion. For us to predict how these decisions will fall is likely compared to a Tarot Card reading or a visit to a Voodoo priestess. After all this is New Orleans.

With "filming & production" underway and anticipating the movie release, let's provide this opinion as a "trailer".

The Department of Homeland Security issued a "Jones Act" waiver on March 17, 2026. The longest and broadest waiver of the Act since the end of World War II. We believe this to be a lead topic of discussion at the maritime show in Louisiana, considering the current extension is listed to expire on November 15, 2026, at 11:59 p.m. The "end" provided that energy products included in the waiver are loaded prior to the expiration date and time. Foreign flag voyages & cargo moved during the waiver is reaching over 400 voyages and millions of barrels of petroleum distributed. A strong indication the market is important to the US Flag and commerce. Future inventories and movements will be affected despite a new extension announced or not as we enter into the winter season. A rush to load cargo prior to midnight of the end date will occur. Cargo will be delivered by foreign flag after November 15th.

Consider this discussion as the opening scene of the "trailer" on December 1. Question if the show opens with a group photo of roughly four thousand cheering the Department of Homeland Security announcement that the waiver has ended and no further extensions will be issued by the Administration. Or will the announcement extend the waiver into another period?

A follow-on extension will result in a call for a moment of silence in New Orleans signaling the possible loss of 90,000 American seafaring jobs, and adding thousands of lost employment opportunities in shipbuilding and port operations. All occurring during the year of "Maritime Dominance". With that thought let's remember trailers never give up the movie ending.

We intend to arrive as "extras" with balloons and the hope to celebrate the end of the extensions, followed by support of the Flag and coastal registry in the Ships for



MarineLink.com photos augmented with ChatGPT

America Act. Give us a chance to be included in the photo opportunity. That said we will also look for a speaking part in the production with the simple message that the "Jones Act" debate needs to be fixed by addressing the cost to build and the future ability to renew our coastal fleets. **Subsidize our commercial shipyards if the intent is to support US commercial shipbuilding.**

If the US shipyard elects to build for defense, let them enjoy the government support that market has been provided for decades. Defense aside, the selected commercial shipyards should enjoy their own support and join the Far East and European yards we are so anxious to compete with. They are heavily subsidized and their reported cost of delivery into the market does not reflect their government support.

China does not build at the price advertised.

The solution in the coastal market should not be the orchestrated elimination of selected commodity sectors within the registry while separate political decisions favor others trading outside of "energy" and protected in the same legislation. The problem is cost to build not the market.

US commercial shipbuilding has been the discussion of the 2026 year. Back of the envelope calculations show over one trillion dollars of new projects in defense spending providing surface & subsurface tonnage, autonomous warfare and drones. Warfare and defense shipbuilding has changed. Requirements to address more than several warfronts have identified the need to protect both our national security and global trade with new technology. Let our Navy and Military industrial base take precedence and build to meet those requirements.

US commercial shipbuilding will need take a back seat to that effort

for now based upon shipyard "capacity" issues alone. And "capacity" is not only the number of qualified shipyards or graving docks. It addresses our supply chain and labor issues also. That said, defense taking the lead and the 2027 Defense Act funding will raise discussions of how that funding is distributed. The first opening projects have been issued to a single shipyard, with new ownership prior to the award, and determined by a single VCM government contract source. Historically, protests and GAO audits have been the largest issue of military industrial base delays.

There is no intention for us to pack our bags with candles and stand in silence listening to a rumored end of the Jones Act, the failure of coastal registered vessels flying the flag or the delay in commercial shipyard support. In fact, with several other crucial "energy" decisions affecting the industry, **it is our opinion, the Administration would benefit announcing NO FURTHER WAIVERS OR EXTENSIONS will be issued** prior to the opening day in New Orleans while they contend with another crucial date of November 3rd.

An announcement offered in the trailer by the lead actor or director in the production? Maybe so. However, movie trailers rarely announce a huge turn of events prior to release of the movie.

What is equally important to the development of energy in the coastal trades is another decision allowing sanctioned Russian diesel oil delivered into the US market. National news has reported three vessels departing Russian refinery terminals and one of the three arriving November 7 in New York and New Jersey. A second tanker reported arriving in Houston and a third arriving, with the most disturbing of news, into Norfolk. Our largest U.S. Navy homeport and shipbuilding center on the East Coast.

The foreign owner of the third vessel quickly reporting the vessel, port and cargo carried was misinformation as the ship was carrying fertilizer not diesel oil. A smart move considering merchant vessels maintaining their regulatory requirements and 1900 sanctioned vessels ignoring them have been attacked, damaged and with those damages considered a constructive total loss. Misinformation aside, the U.S. Treasury Department has issued a temporary general license bypassing aspects of the 2022 Ending Importation of Russian Oil Act and our opinion ignoring National Security.

Can the trailer lead us to the true story?

The answer is being discussed in New Orleans as Maritime domain awareness. AIS disruption and the concern of 1900 sanctioned "ghost" vessels entering new levels of cyber & National security concerns. The latest technology presented by Quartermaster AI with live demonstrations introducing its SmartMast technology and collection of data mapping the world's oceans at Workboat during the show.

The global security problem has also gathered a new audience as dockworkers around the world called a strike effort on Friday October 30, 2026. An action reported at 113 ports & terminals in 22 countries. Our US west coast ports with the ILWU included. The strike and walkout being advertised as an effort against the militarization of ports and shipments of war-related cargo and tagged as "Dockworkers do not work for war". Rising living costs, and wages were also presented during the "strike" as a result of geopolitical issues worldwide.

Has the trailer identified the good guys and the bad guys the final production will produce? It certainly has the ability to go beyond a drama and into an action film. Let's hope the film does not become the "Good, the Bad and the Ugly". Unfortunately, this is no joking matter as all of the issues waiting for positive decisions are raising costs and disrupting US and global trade. More importantly, seafarers are losing their lives and little commercial industry effort is developing to provide protection of vessel and crew.

See you in New Orleans. Bring balloons.

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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MARITIME REPORTER AND ENGINEERING NEWS

January
Ad close: January 8, 2027

MARITIME PROPULSION

e-Magazine Edition

- Diesel Tech
- Battery | Electric
- Alternative fuels

Tech In Focus:
Fuels & Lubes

Conference & Exhibition Partners
- **Surface Navy National Symposium 2027,** January 12-14, Crystal City, VA
- **PVA Annual Convention at MariTrends 2027,** January 21-24, Tampa, Fla.
- **Breakbulk Middle East 2027,** Feb. 2-3, Dubai, UAE

February
Ad close: January 21, 2027

U.S. NAVY FLEET DEVELOPMENT

- Autonomous Vessels: USVs & UUVs
- Cruise Shipping | Passenger Ferries
- Offshore Renewable Energy

Tech In Focus:
Coatings & Corrosion Control

Bonus Distribution
- **Sea-Air-Space,** April 4-7, National Harbor, MD
- **CMA Shipping 2027,** March 16-18, Houston
- **Seatrade Cruise Global,** April 5-8, Miami Beach, FL
- **IPF 2027,** Tech at Sea, April 11-14, Newport, RI

March
Ad close: March 5, 2027

DATA & DIGITALIZATION

e-Magazine Edition

- Maintenance: Calendar-based vs. Condition-based
- Weather Routing & Voyage Tracking
- Icebreaker Design, Construction & Equipment

Tech In Focus:
Robotic Hull Grooming Solutions

April
Ad close: March 22, 2027

PORTS & LOGISTICS

- Offshore Energy
- Floating Power Production
- Towboats, Tugboats, Barges
- **Special Edition: *PORT OF THE FUTURE* Magazine Supplement**

Bonus Distribution
- **Port of the Future '27,** April 12-14, League City, TX
- **Nor-Shipping 2027,** June 8-11, Oslo, Norway
- **IMX 2027,** May 11-13, Nashville, TN
- **WindEurope 2027,** April 20-22, Copenhagen, Denmark
- **OTC 2027,** May 3-5, Houston, Texas
- **Mari-Tech 2027,** May 4-7, Ottawa, Canada
- **SeaWork 2027,** June 15-17, Southampton, UK
- **Breakbulk Europe 2027,** May 11-13, Rotterdam, The Netherlands
- **XPONENTIAL 2027,** May 17-20, Miami Beach, Florida
- **GreenTech Amsterdam 2027,** June 15-17, Amsterdam, The Netherlands
- **Advanced Maritime Technology Expo 2027,** June 16-17, Barcelona, Spain

May
Ad close: May 7, 2027

GREEN MARINE

e-Magazine Edition

- Hull Design
- Machinery Optimization
- Alternative Fuels
- **Supplement: Norwegian Maritime Cluster**

Conference & Exhibition Partners
- **Nor-Shipping 2027,** June 8-11, Oslo, Norway

June
Ad close: May 21, 2027

DREDGING

- Marine Salvage
- Ship Repair & Conversion
- Maritime Safety Equipment

Tech In Focus:
Waterjets, Thrusters & Propellers

Bonus Distribution
- **Cruise Ship Interiors Design Expo Americas 2027,** June 23-24, Miami Beach, FL
- **Marine Money Week 2027,** New York, NY
- **WEDA 2027**
- **AGLPA 2027 Annual Conference**

July
Ad close: July 9, 2027

GOVERNMENT SHIPS

e-Magazine Edition

- U.S. Navy
- U.S. Coast Guard
- Military Sealift Command

Tech In Focus:
Autonomous Vessels

August
Ad close: July 21, 2027

SHIPBUILDING

- The Modern Marine Bridge
- Ballast Water Management Systems
- Cruise Port & Terminal Innovation

Tech In Focus:
Shipyard Tools - Cutting & Welding

Bonus Distribution
- **Breakbulk Americas 2027,** Houston, TX
- **DSEI UK 2027,** September 7-10, London, England
- **KORMARINE 2027,** October 19-22, Busan, South Korea

September
Ad close: September 10, 2027

MARINE DESIGN ANNUAL

e-Magazine Edition

- Ship & Boat Design
- Alternative Fuels
- Autonomy/Automation

Tech In Focus:
Artificial Intelligence & Maritime

October
Ad close: September 21, 2027

MARITIME TRAINING & EDUCATION

- Thought Leadership: U.S. Maritime Academy Leadership
- Cyber Security
- Ferry Boat Review

Tech In Focus:
Distance Learning Systems

Bonus Distribution
- **Europort 2027,** November 2-5, Rotterdam, The Netherlands
- **SNAME 2027**
- **Interferry 2027**

November
Ad close: October 21, 2027

WORKBOAT EDITION

- Marine Engines
- Emission Reduction Technology
- Deck Equipment, Winches, Cranes

Tech In Focus:
Marine Gears & Transmissions

BONUS DISTRIBUTION
- **Intl. Workboat Show 2027,** New Orleans, LA
- **Underwater Intervention 2027,** New Orleans, LA

December
Ad close: December 10, 2027

GREAT SHIPS of 2027

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In Focus:
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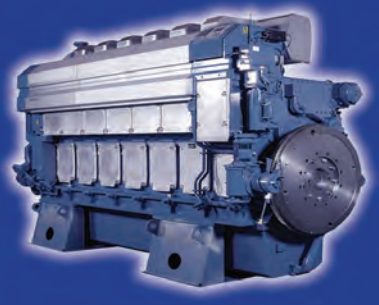
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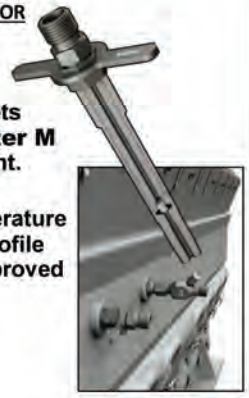


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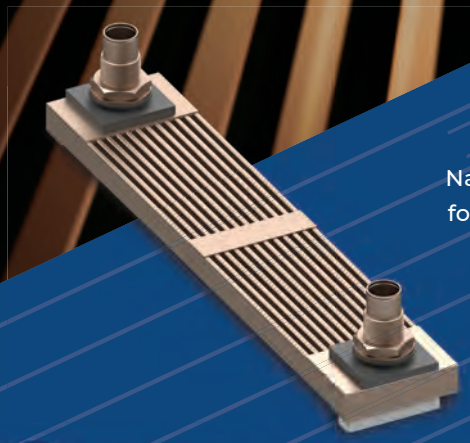
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