April 2025

MARITIME REPORTER AND ENGINEERING NEWS

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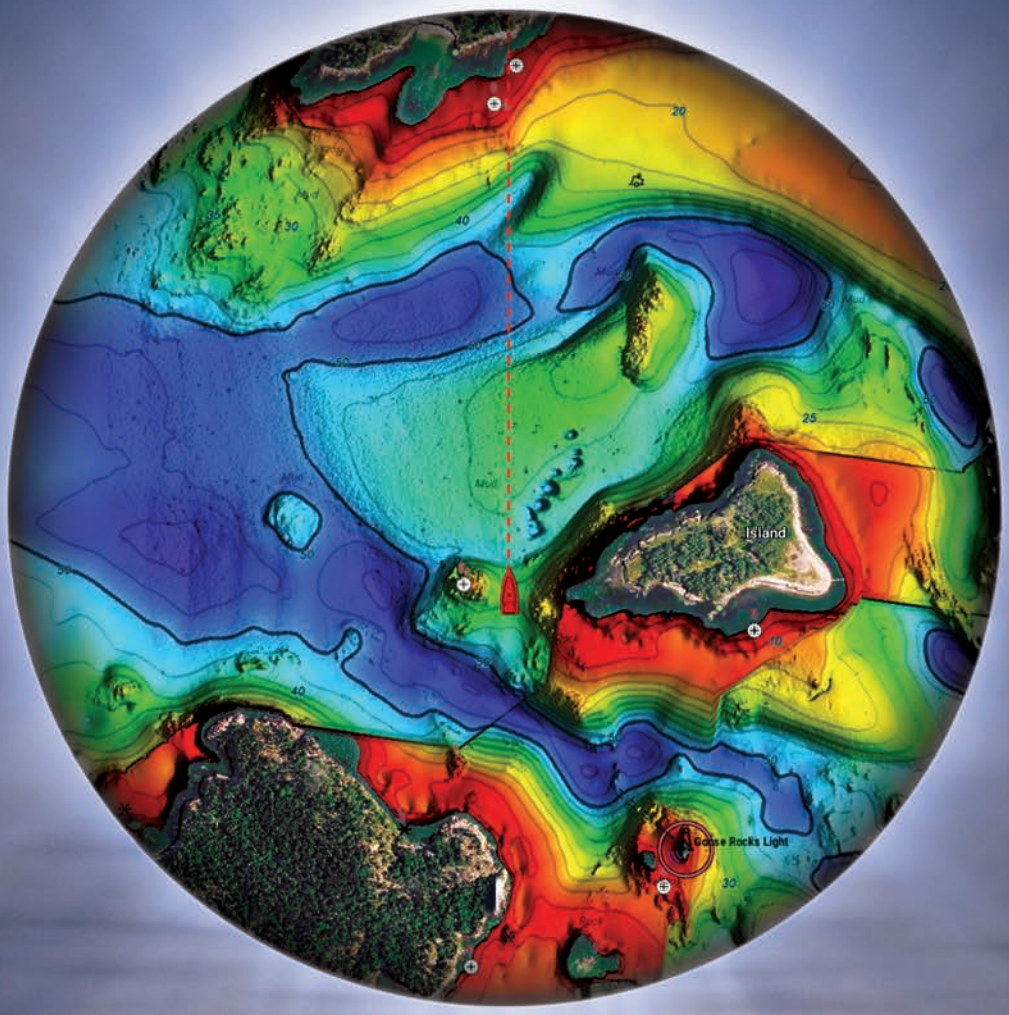

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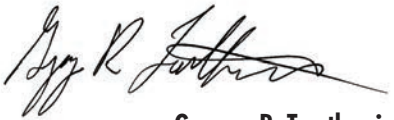
The news cycle on nearly every media – consumer and business, regardless of focus or industry – is dominated by the speed of change being doled out by the Trump administration, changes which promise to have direct, sometimes dramatic material impact on every audience we serve, from maritime to offshore energy to subsea. Regardless on which side of the aisle you sit, the dramatic swings in priorities as U.S. administrations change has become a central focus of board rooms large and small as businesses navigate the myriad changes and assess the potential impact for the coming four years.

Most reading assume, for example, that the offshore wind business in the United States has been left for dead; but has it? **Phil Lewis, Director of Research, Intelatus**, wrote a piece for the March/April edition of sister-publication *Offshore Engineer* that gives an insightful assessment of where we're at, but also where in the U.S. wind market there are still glimmers of opportunity [visit OEDigital.com for the latest edition]. In this edition of Maritime Reporter, **Alisa Reiner** takes an alternate view, examining in depth the Asian market for offshore wind. While most operating in and around the U.S. renewable market are lining up to pay last respects, the world outside of our borders are popping champagne as offshore wind grows at speed in Europe – the world's most mature market – and Asia. You can read Alisa's assessment starting on page 28.

And then there's **Bob Kunkel**.

Anyone who knows Bob Kunkel, a regular contributor to our pages, knows that when you ask him a question, you will receive a direct, no-nonsense answer. Case in point is the recent OpEd he wrote for sister-publication *Marine News'* April 2025 edition, an opinion that also ran directly on MarineLink.com as it was too timely to hold: ***OPINION: Hold the Bricks, Start the Discussion on the Future of Domestic Shipbuilding***. You can visit MarineLink.com and simply search "Bricks" to read it immediately, you can scan the QR code to the left, or you can check out the April edition of *Marine News*. Regardless, Kunkel puts into perspective the most recent moves by the Administration – moves that have, for the first time in my 30+ years in this seat put maritime and shipbuilding directly in the political spotlight and discussion – and how these political initiatives and the Jones Act are on a collision course when it comes to shipbuilding. Give the OpEd a read; just put down the bricks first.

Read Bob Kunkel's OpEd Here
OPINION: Hold the Bricks, Start the Discussion on the Future of Domestic Shipbuilding



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Maritime Propulsion:
THE FUTURE IS NOW

Large Internal Combustion Engines + Digitalization, System Integration, Automation, non-conventional propulsion systems – a changing industry relying on its traditions.

— ***By Rick Boom,*** *Director of Business Development for Woodward and CIMAC President* —

The landscape of large internal combustion engines (ICEs) is undergoing a significant transformation, especially driven by the forces of digitalization and green technology. As we navigate this evolving industry, it is essential to recognize the challenges and opportunities that lie ahead.

The shift towards greener technologies and digital solutions is imperative. This transformation involves integrating digitalization, system integration, and automation with traditional ICE knowledge. Among other factors, societal changes are influencing the workforce, necessitating a reevaluation of the role of humans in the system. This includes handling new fuels, non-conventional and hybrid propulsion systems, and addressing the challenges posed by digitalization.

Combatting emissions, pollution and noise, has been a long-standing concern for our industry. It will remain a crucial challenge in the future, and we will only be able to successfully address it with a variety of combined methods. The industry must align knowledge about conventional combustion engines with advances in digitalization and non-conventional drive systems. A growing challenge is the decreasing number of research and development personnel working on combustion engines in Europe. Here, too, we are called upon to introduce young people to our industry and our or their opportunities.

Despite these challenges, there are numerous opportunities. The applications for ICEs are expanding, particularly in maritime and rail transport. The combination of ICEs with green hydrogen and its derivatives also presents opportunities in stationary energy supply. Highlighting the industry's attractiveness beyond its emissions is crucial. Emphasizing digital, hybrid, and new fuel technologies can draw young talent to the field. The industry is becoming more diverse, both in terms of professions and through image campaigns by associations like VDMA. This diversity is essential for fostering innovation and growth. There is also a cultural shift from a purely technical exchange platform to an NGO with consultative status at the International Maritime Organization (IMO). This change enhances the industry's ability to influence global strategies and decisions.

Since July 2024, our NGO status with the IMO allows us to provide valuable insights and consultations on strategies and decisions affecting the international maritime industry. Reviving working groups like WG10, a forum to intensify the dialogue between engine users and manufacturers and introducing new event formats are crucial. Expanding our membership network to regions like India, Africa, South America, Australia, and the Arabian Peninsula is a priority. This expansion will help us address new topics and challenges. Establishing new working groups, such as those focused on radiated noise, will enable us to tackle emerging issues effectively.

The upcoming CIMAC Congress in Zurich, from May 19-23, 2025, is an event not to be missed. This global event on large engines, power, drives, and propulsion offers a unique opportunity to stay updated on industry developments and to discuss technological challenges and solutions with other specialists and colleagues. The Congress will feature over 200 presentations, discussion panels, poster sessions, social events, and technical tours, attracting experts from around the world. It is an unparalleled platform for networking, knowledge exchange, and exploring the latest innovations in our field.

As an active member of CIMAC for two decades, I have witnessed industry's evolution firsthand. My roles as Chair of various working groups and a member of the Board have prepared me for my current position as President and a member of the Digitalization Strategy Group. Together, we can navigate the challenges and seize the opportunities that lie ahead, ensuring a sustainable and innovative future for the ICE industry.

The Author

Boom

Rick Boom is Director of Business Development for Woodward and CIMAC President. He has been an active CIMAC member for 2 decades.

CIMAC Congress 2025 is scheduled to take play from May 19-23, 2025 in Zurich, Switzerland. For more information on the event, please visit: https://www.cimac.com/events/cimac-congress/index.html

IP CODE COMPLIANCE *More than a Regulatory Formality, it Impacts Commercial Viability*

By Maciej Jozwiak, Technical Manager, GLO Marine

With the International Code of Safety for Ships Carrying Industrial Personnel (IP Code) now in force under SOLAS Chapter XV, offshore vessel owners are facing new compliance challenges. This regulation applies to vessels carrying more than 12 industrial personnel and mandates stricter safety, stability, and fire protection measures.

For vessels already classed under the Special Purpose Ship (SPS) notation, transitioning to compliance is relatively straightforward. However, many offshore support vessels (OSVs), including Platform Supply Vessels (PSVs) and Construction Support Vessels (CSVs), were not initially designed to meet these standards. That is narrowing their operational profile and this step is not following the market trends. There is a huge demand for CSOVs that can be covered by mobilized for purpose PSVs. Such mobilization can be done by temporary installation of for example motion compensated gangways and accommodation units. Non compliant vessels require engineering modifications, safety system upgrades, and operational changes to obtain an Industrial Personnel Safety Certificate (IP Certificate)—a requirement for continued operation in offshore industrial projects.

The IP Code is more than just a regulatory formality; it directly affects a vessel's commercial viability. Without proper compliance, OSVs risk losing contracts and being sidelined from the offshore market. To avoid operational disruptions, vessel owners must act quickly to evaluate compliance gaps and implement necessary modifications.

Photo courtesy GLO Marine

LEARN MORE: Read the full article authored by Maciej Jozwiak, Technical Manager, GLO Marine in Offshore Engineer, scan the QR code:

Louis Dreyfus Armateurs (LDA) Plows Forward on Offshore Fleet Renewal

LDA, a 170-year-old French company, announced a fleet expansion with the order for a series of three next-gen SOVs, a series that will lean on five years of experience operating some of the first Hybrid-Electric SOVs. **Gaël Cailleaux, Renewables General Manager, LDA,** *discusses the investment and lessons learned.*

By Greg Trauthwein

LDA's journey over the past five years has been marked by significant strategic shifts. Moving away from its traditional dry bulk transportation division, the company has refocused on specialized industrial services, including aircraft parts transportation, telecom cable activities and renewable energy support. Today, LDA operates a fleet of more than 100 vessels – 23 under the French flag – and employs 3,000 people. "We've seen tremendous growth across our core businesses," said Cailleaux. "In transportation and logistics, we're set to double our fleet of RoRo vessels. In submarine cable installation and repair, we've added four new vessels since 2019. And in offshore wind, we've secured a major contract with Vattenfall for up to three new SOVs, complementing our existing fleet serving Orsted."

A milestone in LDA's offshore wind ambitions came with its recent announcement of a new series of SOVs designed to support operations in the North Sea. The company selected Salt Ship Design as the naval architect and ZPMC shipyard in China to construct the vessels. "We're not newcomers to this market," Cailleaux said. "Our first SOVs, Wind of Change and Wind of Hope, were launched in 2019 for Ørsted and have proven to be highly successful, leading to contract extensions. This experience allowed us to win a competitive bid with Vattenfall, and we're applying those lessons to refine our next-generation vessels."

To that end, the new SOVs will feature enhanced crew comfort, optimized workspaces for technicians, and cutting-edge energy efficiency measures. One of LDA's key innovations in its new SOVs stems from real-world operational data. Hybrid-electric propulsion, first introduced in the Wind of Change, has proven to be a game-changer in reducing fuel consumption and emissions.

"Based on years of operational insights, we've made three major improvements," Cailleaux said. "First, a redesigned layout for technician workflow, reducing unnecessary steps and improving efficiency. Second, optimized electrical systems and energy-efficient equipment to cut consumption. And third, enhanced seakeeping capabilities for better performance in rough waters."

The offshore wind sector is expanding at an unprecedented pace. **Europe's installed capacity is set to quadruple from 40GW today to 140GW by 2030, fueling demand for SOVs and Crew Transfer Vessels (CTVs).** Cailleaux sees this as a major growth driver for LDA's fleet. "As wind farms move further offshore, the industry will rely more on SOVs than CTVs," Cailleaux said. "This aligns well with our expertise. We're also actively involved in installing inter-array cables, which complements our vessel operations."

Beyond fleet expansion, decarbonization is another pressing priority. The maritime industry accounts for [approximately] 3% of global CO2 emissions, and LDA is committed to sustainable solutions, exploring full-electric, e-methanol, and other alternative fuels to meet client demands for greener vessels.

Among LDA's most notable projects is the **Saint Nazaire Offshore Wind Farm**, located 10 nm off the French coast. LDA first secured a contract to install inter-array cables, completing the project in 2020-2021. Building on this, the company later won a contract to operate three CTVs for ongoing maintenance, supporting both General Electric (turbine manufacturer) and EDF (wind farm operator). "It was a complex, multi-phase project that showcased our ability to deliver end-to-end solutions in offshore wind," Cailleaux said. "It also reinforced the strong synergy between our divisions."

Geopolitical events have added uncertainty to global markets, but LDA sees offshore wind as a resilient and growing sector. Through the LDA lens, there are three major markets today: **Europe** – The world's most mature offshore wind market where LDA is "very active"; **North America** – Political decisions have slowed this market, but LDA has no exposure; and **Asia** – An interesting market in its infancy. LDA is engaged and interested to expand here.

"Geopolitical challenges are actually accelerating offshore wind development in Europe, and we're well-positioned to benefit from this growth," Cailleaux said.

LDA's ambitions received a major boost in February 2024, when InfraVia acquired an 80% stake in the company, paving the way for a €1 billion investment over the next several years. This capital infusion will enable LDA to double its fleet, accelerate technological innovation, and further its commitment to energy transition.

GAËL CAILLEAUX, RENEWABLES GENERAL MANAGER, LOUIS DREYFUS ARMATEURS (LDA)

"We're not newcomers to this market. Our first SOVs, Wind of Change and Wind of Hope, were launched in 2019 for Ørsted and have proven to be highly successful, leading to contract extensions. This experience allowed us to win a competitive bid with Vattenfall, and we're applying those lessons to refine our next-generation vessels."

– Gaël Cailleaux, Renewables General Manager, LDA

Images courtesy LDA

Photo courtesy Rik van Hemmen

SALVAGE AWARDS

How to Do the Right Thing and Still Get It Wrong

By Rik van Hemmen

Tony Siciliano provides a bunch of his friends and I with an invaluable service by sending us daily emails with copies of articles that may be interest to us. This includes an occasional maritime court or regulatory decision. I tend to ignore the court decisions, but a decision with this title piqued my interest:

Admiralty Court determines salvage remuneration
***SD Rebel BV & another -v- Elise Tankschiffahrt KG (VB Rebel)* [2025] EWHC 376 (Admty)**

The decision provides an interesting insight into the difficulties and flaws of determining salvage awards.

Contractually the salvage was a bit unusual and part of the decision relied on whether the salvage was a Lloyds Open Form.

It ended up in an English Court and it was ruled that, for all practical purposes, the salvage was conducted under Lloyds Open Form and, as such, a salvage award was to be made.

The salved values were agreed at GBP 1.8 million for the ship and GBP 0.6 million for the cargo for a total salved value of GBP of 2.4 million.

The salvage was quick and easy. It basically consisted of a grounding, with a tug showing up, attaching a line and pulling the ship off at the first tide.

Once the ship was delivered, the ship owner refused to be involved in a salvage award negotiation and settlement, and this is why it became a court case.

However, the cargo owners did not fight the LOF approach and agreed to settle the matter for a total award of GBP 150,000 and therefore paid a salvage award of 0.6/2.4 times GBP 150,000, resulting in a cargo contribution of GBP 37,500. A negotiated salvage award of 6.35% by cargo interest.

Since the Court ruled it was an LOF, it noted that Article 13 of the Salvage Convention 1989 provides the criteria for fixing a salvage award. The Court considered the criteria in the usual manner. It also noted it would be appropriate for it to be guided by appropriate awards issued under LOF Arbitration, but they found no sufficiently comparable award.

Ultimately the Court made an award determination in the amount of GBP 90,000 (3.75%), substantially lower than the amount agreed on by cargo prior to the litigation at GBP 150,000.

The court noted that as part of the cargo settlement, cargo interests had only paid minimally towards costs and would likely have been willing to strike a quick bargain before the Tug owners' legal costs became disproportionate and therefore the court only attributed limited weight to this data point.

To me this was a very strange and illogical comment. The court simply ignored a real commercial settlement. It is like going to court to ask for the price of eggs where the court ignores the real-world price of eggs, and argues that because there is a shortage of eggs they can can come up with their own lower price of eggs.

As a person who does not first rely on legal procedures to solve real commercial life problems, I have found that law and reliance on precedent are no guarantee for an equitable, reasonable or logical outcome.

This becomes even more complicated with salvage awards, because they exist in a strange straddle of commerce and law, and on a quantitative level can be compared to equitable criminal punishment, which operates in a straddle of society and law.

Punishments need to punish the criminal and also need to exist as a deterrent to the rest of society. This quickly becomes complicated and should rely on real data and rarely does. In the United States capital punishment is incredibly uneconomical and has been proven to be a poor deterrent, but persists in a patently false belief that capital punishment is a more effective deterrent than life imprisonment.

Society is fuzzy and there is often a desire to ignore real data. However, commerce is much less fuzzy because it relies on the exchange of money instead of the exchange of emotions.

Therefore, commerce can produce real data, and in this case, commerce supplied real data. The salvor and cargo negotiated an award that in the end can only have been equitable based on the resolution of an issue between knowledgeable parties without interference of the law (but with an understanding of the laws driving commerce).

They arrived at an award that was 6.35% of the salved goods. This was a clear commercial transaction and a true data point. Instead of relying on that data point, the Court decided to rely on archaic legal standards and guidelines without commercial data to determine their own reward and determined that the award should be 3.75% of the salved goods.

Admittedly the commercial award was only one data point, but the legal award had no actual data points at all! From a technical point of view, the court determined salvage award is nothing more than the result of incestuous navel staring. Moreover, the commercial award relied on the exact circumstances of the salvage, while the legal award can do no more than use subjective judgement of award guidelines.

When considered carefully, one can only conclude that the use of the salvage award guidelines does not provide a realistic commercial value.

But it gets worse. Remember, salvage law does not only regulate the equitable reward for salving a specific property at sea, they are also supposed to encourage the entire maritime community to invest in salvage resources. As such, the law should be slightly more generous than a single exchange award and, similar to criminal punishment, it should provide an additional inducement "pour encourager les autres." As such, it should be slightly higher than the commercial data point. Based on this, the award should have been in excess of the commercial data point, at least 7% and maybe more.

In the "encourager les autres" vein, in this particular decision the court could have made the award even higher to simply point out that stiffing a salvor and driving the case into a court is not beneficial to commerce. This would have also been equitable to the cargo interest who came to agreement with the salvor without the cost and burden of the court. In this case, while both cargo and the court agreed it was LOF, by being equitable, cargo ended up paying more than the party that lost in court!

To an engineer this rather minor case indicates that, based on commercial data and commercial efficiency, it is time for the salvage courts to truly think strategically and to update their award standard such that the awards are not lower than a simple in the field LOF award agreement. If we do not provide realistic and properly incentivizing salvage awards, nobody will show up when the trouble starts. This court decision certainly would not encourage a salvor.

For each column I write, ***MREN*** has agreed to make a small donation to an organization of my choice. For this column I choose the National Marine Sanctuary Foundation, ***marinesanctuary.org***, protecting our marine sanctuaries requires robust salvage resources.

Decarbonizing Shipping:
Managed Hull Care Drives Vessel Performance

The shipping industry stands at a pivotal moment. As the International Maritime Organization (IMO) tightens regulations on greenhouse gas (GHG) emissions and customers increasingly demand more sustainable practices, ship owners and fleet managers face mounting pressure to improve fuel efficiency and reduce environmental impact. One of the most overlooked yet impactful ways to achieve these goals lies beneath the waterline: the condition of the ship's hull.

All images courtesy of Greensea IQ

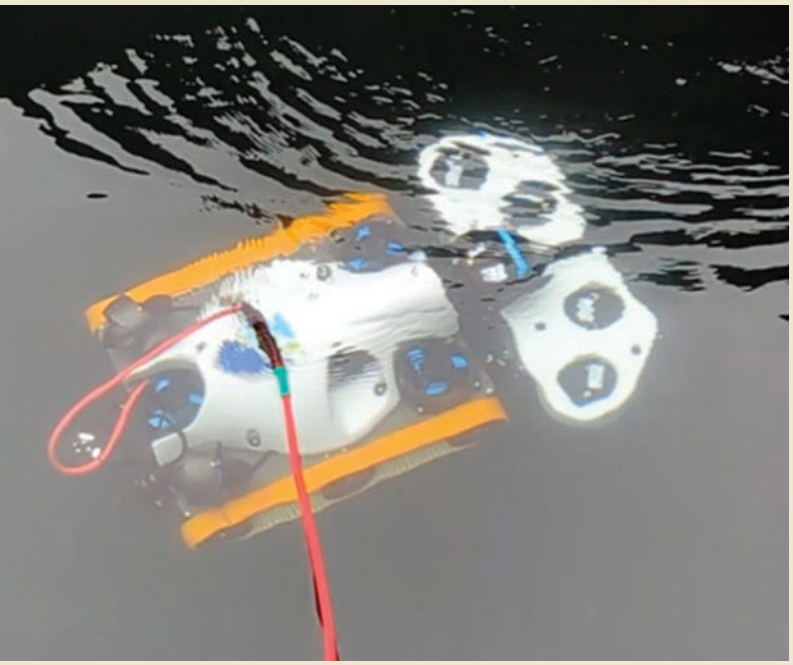
Biofouling—the accumulation of microorganisms, plants, algae, and animals on the hull—can increase drag, decrease fuel efficiency, and raise emissions significantly. Even a thin layer of slime can increase fuel consumption, adding millions of dollars in additional operating costs across a fleet. The solution? Professionally managed hull performance by EverClean.

EverClean is much more than just a cleaning robot—it's a comprehensive hull performance optimization solution. Leveraging advanced robotics and proprietary cleaning technology, EverClean removes biofouling at the microfouling stage, ensuring that ships maintain a pristine hull surface at all times.

Unlike traditional hull cleaning methods, EverClean takes a **holistic** approach to hull management:

- **First Do No Harm** – Adaptable to all coatings EverClean's proprietary nylon brushes have been tested extensively with many major hull coatings demonstrating both compatibility and gaining approvals from leading manufacturers.
- **Adaptive Performance plans** – Professionally managed and ship specific maintenance plans are developed to achieve the optimal performance of the ship going into service.
- **Continuous Maintenance** – EverClean robots safely clean the ship as prescribed by the performance plan regularly, preventing fouling from developing into macrofouling and protecting the coating from heavy fouling the harsh techniques needed to remove it.
- **Complete Hull Management** – insights learned during routine EverClean service continuously inform the performance plan including managing additional services such as propeller polishing and niche area cleaning for vessels in service.
- **Data-Driven Reporting** – EverClean IQ, the service's reporting platform, provides detailed insights into hull condition and performance. Fleet managers can view before-and-after images, track fouling patterns over time, and measure cleaning effectiveness.

The result is a cleaner hull, improved hydrodynamics, and a measurable reduction in fuel consumption and emissions over the term of the service contract.



Proven Results: Fuel Savings and Performance Gains

EverClean has significantly improved the fuel efficiency of customer vessels, as shown through analysis using the ISO 19030 model. One vessel, which began EverClean service two years after drydock with an 11% loss in efficiency, has nearly returned to its original performance and now operates with just a 3% efficiency loss. This has resulted in monthly savings of about **85 metric tons of fuel** and a reduction of **270 metric tons of CO2 emissions**.

Similar improvements on a 14,000 TEU container ship operating 260 days per year at 80 tons fuel per day would see significant yearly savings

- 1,600 tons fuel per year
- $800,000 per year @ $500/ton
- 5100 tons CO2 per year

In addition to performance gains and cost savings, EverClean's comprehensive planning and holistic approach to hull management supports shipowners and fleet managers in meeting increasingly stringent environmental regulations:

- **IMO CII (Carbon Intensity Indicator)** – The IMO's CII regulations measure and rank vessel efficiency. EverClean's proactive cleaning helps vessels maintain high ratings by reducing fuel consumption and emissions.
- **Biofouling Management Compliance** – Countries like Australia and New Zealand have implemented strict biofouling regulations. EverClean's consistent hull maintenance ensures vessels meet compliance requirements.
- **Reduced Invasive Species Risk** – By preventing macrofouling, EverClean helps mitigate the risk of transporting invasive species between ecosystems.

Clean Hull, Clean Conscience

As the shipping industry navigates the path to decarbonization, proactive hull maintenance represents one of the most straightforward and effective strategies for reducing emissions and improving performance.

EverClean is more than a cleaning service—it's a holistic solution for fuel efficiency, operational reliability, and environmental responsibility. By combining advanced robotics, data-driven insights, and a commitment to performance, EverClean empowers shipowners and fleet managers to take control of their vessels' performance and carbon footprint.

In an industry where every ton of fuel and every percentage point of efficiency matters, EverClean offers vessel owners, operators, and technical managers a clear path to a cleaner, more profitable future.

The Author

Glowacky

Paige Glowacky serves as the Senior Product Manager for EverClean at Greensea IQ. Before her tenure at Greensea IQ and entry into the maritime sector, she held Product Manager positions at various late-stage startups within the technology and financial industries.

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Maritime's Search for the Holy Grail of Alternative Energy

By Robert Kunkel, President, Alternative Marine Technologies

The Maritime industry has worked with a single fuel source for over a century and with the rush to meet emission standards in both domestic and foreign markets, adapting to the current list of alternative fuels is going to present significant problems. Each market has its issues whether bluewater, brownwater, coastal, foreign or domestic.

Chose any of the larger global shipbuilding yards and the basic Bluewater ship design will include a large two stroke combustion engine.

To remove that single propulsion system from current ship construction to meet emission standards would be devasting to shipyard profitability.

First, we need to realize the current emission time frame will not be met and second ship orders will continue to include this type of propulsion well into the near future.

The climate change and ship emission discussion reach as far back as 2012, with an analysis of ammonia as a military fuel. Doctor William Ahlgren defined the transition away from fossil fuels as a "Dual Fuel Strategy". The analysis coupled fossil fuel energy sources with electric power and the research presented three strategies for an alternative energy future:

- a hydrogen economy coupling electric power and hydrogen fuel,
- a complete electric economy, and
- a dual fuel strategy allowing an introduction of liquid renewables.

The "Dual Fuel Strategy" was based upon the ability of liquid ammonia or methanol to be compatible with the current energy infrastructure. Shipbuilding embraced the concept and continued the development of two stroke combustion by first incorporating dual fuel LNG. Where emission discussion and regulatory goals spoke to ZERO, the strategy was a concept of gradual "transition". Zero could not be reached without the "electrical" component and few if any of the global builders were prepared to take on battery and energy storage at the power levels required to remain competitive.

There are literally hundreds of reports of "dual fuel" deliveries to date. However, the "dual" at this point in the transition has been an alternative fuel and fossil fuel mixture and there are reasons why.

The simple "Holy Grail" mantra has been hydrogen. Not so

difficult to understand as all of future energy alternatives have a hydrogen bond. Begin with determining the actual fuel density and available energy in BTU's new alternative fuels produce. Whether the choice is ammonia, methanol, LNG, bio or hydrogen, none meet the density and energy of simple marine diesel oil. In fact, most provide 50% or less. Add that none meet "zero" in their current state and will not until delivered in a proposed "green" form.

The density problem alone creates issues in ship construction. Less energy requires larger fuel tanks and the necessity to carry more fuel. More fuel, less cargo – less cargo, smaller profit. And the problem continues with the placement of the new fuel tanks and how stability, stowage, trim and draft are affected. The issue may be solved with maintaining current levels of fuel inventory and increasing the number of bunkering operations. A problem associated with the alternative fuel selected and whether the ships trading pattern provides the infrastructure to confirm the fuel is available at bunkering ports. You will find the majority of current ports cannot make that claim for methanol, hydrogen, ammonia or LNG. Add the pilot fuel requirement during ignition and the marine diesel oil being the actual "dual" and we need two types of fuel tanks.

With many new construction projects attempting to meet emission regulations, the fact that we continue with a single large two stroke combustion engine, provides the most difficult hurdle. The "dual fuel" description will be an alternative fuel and a fossil fuel through a long transition period. Long enough that the Korean shipyards believe "carbon capture" will be the next step to keep the standard design alive. The transition to LNG in the combustion engines was over two decades and its use continues to grow. Now take into account the first large two stroke Ammonia combustion engine only completed a successful 25% to 100% load operation on a test bed in February of 2025 and the "zero" light at the end of the tunnel gets dimmer. The end of the transition period is a distance away and we will still be bunkering diesel oil in years to come.

Safety hazards also exist and require major revisions to ventilation, personnel protection and training. Ammonia vapor is toxic and its distribution to and from the propulsion source is a major concern. Ammonia has a higher flash point, albeit a narrower explosive range when mixed with air. The atmospheric calculations to circumvent ignitions or explosion are far different than standard marine diesel or black oil.

On the hydrogen side of fuel, the density of compressed hydrogen adds difficulty and expense to the transportation of the gas to the vessel and the storage when bunkered. To liquify Hydrogen and utilize it cryogenically (similar to Ammonia or LNG), adds another significant cost for both liquefaction and regasification. With all of these new decisions we need to support the "Well to Wake" initiative – using energy to create the "new energy" need to be included in the final emissions calculation as does the major cost disruption to ship construction.

The smaller workboat, tug and ferry markets are much farther ahead in the Holy Grail quest to the point that they can almost say "you have chosen wisely". Many of the four stroke engine manufacturers are producing new products ranging from methanol capability to complete fuel agnostic engines.

Cummins has received Approval in Principle for the methanol ready QSK60 IMO II/III engines with power ranges from 2000 – 2700 horsepower. Others projects have taken on producing hydrogen on board and incorporating fuel cell, EV Hybrid and battery to meet emission goals. This coastal workboat and ferry market has moved past dual fuel and into electrical propulsion revisions as predicted in 2012.

Beyond the ship operation and propulsion issues, we need also to look carefully at the actual fuel suppliers and bunkering companies existing tonnage. With the cruise industry embracing Dual fuel LNG we have seen continued orders and supply of LNG bunkering barges and vessels to support the LNG deliveries. What is missing in the US markets is the necessary "bunker barge" tonnage to deliver ammonia, methanol, or bio fuels. The development of this infrastructure goes well beyond shoreside storage capability in the bunker ports. Specific tank coatings applied to the barges are required for certain Bio fuels or methanol along with the chemical base cargoes need to blend the bio components. Ammonia will require similar cryogenic liquefaction as required for LNG. Advanced polymer coatings such as "Marine Line" will be needed for methanol, ethanol or Fatty Acid Methyl Esters. The foreign fleets can deliver these blends and chemicals into the U.S. However, the domestic fleet must now build and respond to the new cargoes in order to meet distribution demand.

The quickest route for an operator to maintain a "Carbon Intensity Indicator" rating on existing vessels will be to move to Bio. That move will again support the dual fuel strategy and allow an owner or operator to claim an emissions reduction. Each small effort helps us reach our climate goals. Beyond the 2012 analysis lies only Nuclear to reach "Zero" and make no mistake, the discussion of how that propulsion change will affect ship construction is already taking place.

ANCHORING TO DIGITAL OPS

Image courtesy Accenture

Three strategies to modernizing maritime ports through digitization.

By Sarah Banks, Prasanna Ellanti & Johnny Anderson, Accenture

Maritime ports—the lifelines of global trade—are facing unprecedented challenges as stakeholders across entire supply chains react to sudden policy changes shaping the global economy. The advent of mega-container ships, evolving customs regulations and the demand for transparent, real-time shipment tracking have already underlined the necessary shift to smarter and more agile infrastructure. Now, the resilience and readiness of the entire port ecosystem is being tested again.

Many ports are still grappling with significant foundational challenges hindering their modernization and preparedness—ranging from high costs and operational disruptions to workforce resistance and cybersecurity concerns. Our new research, based on interviews with global leaders from port authorities, terminal operators, border agencies and shipping lines, revealed several common obstacles to modernization

and three clear strategies which, when implemented effectively, can result in greater resilience, faster turnaround times, reduced bottlenecks and significant cost savings. At the core, they are based on the need for digitization as a foundation for meeting the demands of the future

Facilitate Ecosystem Collaboration

Imagine a port where longshore personnel empowered with data and AI can unload ships with real-time information seamlessly shared between terminal operators, shipping lines, and customs agencies. This future is already taking shape in ports like Rotterdam and Singapore, where smart sensors and AI-enabled logistics are driving more efficient and safer operations. However, high costs and operational disruption, siloed legacy systems and data-sharing concerns are stopping modernization for many organizations.

One of the key strategies to overcome these challenges is to foster collaboration across the maritime ecosystem. Partnerships between terminal operators and shipping lines can optimize vessel scheduling and reduce bottlenecks. Similarly, ports can collaborate with customs authorities and trucking companies to streamline cargo inspections and speed up the flow of goods. Successful partnerships in the port ecosystem depend heavily on seamless data sharing and trusted multi-stakeholder platforms. Given the significant costs associated such modernization, securing early buy-in based on clear objectives and business cases tailored to each party's goals are essential. Port authorities, with their central role in coordinating operations, are uniquely positioned to drive this collaboration. Finally, for optimal interoperability and enhanced collaboration capabilities to succeed, a strong digital core is key. It is the critical technology foundation that enables organizations to realize their modernization ambitions with security by design at every level. Who's leading the way? The Maritime Port Authority (MPA) of Singapore' Just-in Time (JIT) platform allows multiple stakeholders like ship agents, towage service providers and bunker suppliers to exchange and access real-time data on services required when ships arrive—helping coordinate the entire process more efficiently and reduce time spent at anchorages. In another case, the Port of Rotterdam established the PortXchange startup, a platform that allows shipping lines, terminal operators and logistics providers to coordinate port calls more efficiently and reduce emissions.

Engage the Workforce

A critical part to any modernization is to engage the workforce and secure support for ongoing innovation. Ports cannot simply impose new technologies on workforces to modernize operations—they must engage the people who will use these tools every day. By involving the workforce in decision-making and providing them with continuous learning opportunities, leaders can create a sense of ownership that minimizes anxiety of automation understood one-dimensionally as a threat to jobs, and fosters buy-in. Demonstrating how new technologies can reduce risks and enhance the safety of complex machinery handling can build trust with employees and unions. Creating new paths to re-skilling and professional development can further bolster workforce support and smooth the path to implementation.

Singapore offers a prime example of how effective workforce engagement can support transformation. The MPA of Singapore and the Singapore Maritime Foundation convened the Tripartite Advisory Panel (TAP) to assemble industry partners, unions, and academia. These entities work together to attract young talent, upskill and reskill the current workforce and redesign job roles to keep career pathways fresh and exciting.

Build a Long-Term, Scalable Vision

Finally, ports need to build a long-term, scalable vision

based on their digital core framework. The digital core is a technology capability that brings together key components—like cloud, data, AI and security—to drive reinvention and enable companies to adapt swiftly to change. Digitization can lead ports to enhanced operational efficiency, improved sustainability, strengthened security, regulatory compliance, and increased transparency for stakeholders. However, it's crucial for ports to take an outcomes-driven approach, viewing digitization not as the ultimate goal but as an enabler of broader operational objectives. Starting with quick wins—foundational efforts that deliver early benefits—helps pave the way for future innovations while minimizing disruption. Integrating IT into existing capital infrastructure projects is an easy way to deliver high-impact quickly. Using advanced data for truck gates and deliveries, for instance, can set the stage for future technologies like autonomous vehicles or AI-driven maintenance. Innovation hubs can also play a vital role here, by allowing for continuous exploration of new technologies while minimizing risks.

The Port Innovation, Engagement and Research (PIER) center at the Port of Halifax is a collaborative hub designed to foster innovation and collaboration across various stakeholders by allowing participants to test innovative ideas in a controlled environment. This enables companies and public sector organizations to explore the potential of new technologies with minimal impact on day-to-day operations.

Why Modernization Matters

Our experience shows organizations that embrace reinvention as a strategy—focusing on a digital core and new ways of working that establish a culture and capability for continuous innovation—can improve outcomes in the face of almost any type of disruption. By embracing the three strategies outlined above, ports can not only retain, but grow their crucial position as anchors of resilient global trade networks. Organizations that seize this moment will not only position themselves as essential hubs in global shipping routes but also contribute to local and national economic growth by driving job creation, boosting trade volumes, and fortifying supply chains. Those who innovate today will thrive and shape the future of the industry, securing economic growth and a pivotal role in the global economy for years to come.

Key Regulatory Change Across Maritime in '25 *[& Beyond]*

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A tidal wave of new regulations is set to hit the global maritime sector this year, representing fresh, highly-complex compliance challenges. From environmental performance to evolving security and safety standards, the shipping industry faces a raft of new rules intended to ensure safe operations and reduce greenhouse gas (GHG) emissions. ***Stamatis Fradelos, Vice President of Regulatory Affairs at ABS****, explains what the flood of new regulations really means, and how operators can navigate through the period of change.*

At a global level, the International Maritime Organization (IMO) has been publishing important new regulations for the past five years, with others under consultation, but many critical updates have only just or are expected to become applicable. They have wide ranging implications that can be broken down into two key areas: first, environmental protection. This relates to international efforts to improve ship design, operational efficiency and reduce the world's reliance on fossil fuels; therefore, lowering the sector's environmental impact.

Second, a focus on maritime safety, specifically related to the use of alternative fuels, as well as the importance of robust cybersecurity protocols.

Cyber Threats

Cyber protection remains of critical importance for the maritime sector. The recent digitalization of ships, combined with growing geopolitical tensions, have created the perfect storm.

There were reports of a spike in incidents in 2024 but the true scale of the impact today is yet to be revealed. Official statistics identified at least 64 cyber incidents targeting maritime organizations in 2023, according to the Netherlands' NHL Stenden University of Applied Sciences. A decade earlier, there were three, and zero in 2003.

According to a 2023 report , on average a cyberattack within the maritime industry costs the target organization approximately USD$550,000 – up from USD$182,000 in 2022. Demands for ransom have increased by more than 350%, with the average ransom payment at USD$3.2m in 2023 – up from USD$3.1m the previous year.

In response to intensifying concerns over safety at sea in a digital world, IMO has published several standards in recent years with the aim of enhancing ship safety standards. These include a focus on improving crew training, implementing new technologies, and ensuring that international regulations keep pace with innovations such as autonomous shipping.

The Path to Zero

In July 2023 the IMO adopted the '2023 Revised IMO Strategy on Reduction of GHG Emissions from Ships', which included targets to tackle harmful emissions. The targets are broken down into four key areas:

1. To lower the carbon intensity of new ships, by strengthening their energy efficiency design requirements.
2. To reduce CO2 emissions per transport work, as an average across international shipping, by at least 40% by 2030, compared to 2008.
3. Uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources to represent at least 5%, striving for 10%, of the energy used by international shipping by 2030.
4. Reduce GHG emissions from international shipping compared to 2008,
    a. By 20%, striving for 30% by 2030
    b. By 70%, striving for 80% by 2040
    c. To net zero by or around 2050.

Environmental Protection

The IMO's Marine Environmental Protection Committee (MEPC) is expected to finalize and approve a series of short to mid-term measures that will underpin these ambitious environmental targets by April 2025, with an anticipated roll-out by 2027. One element will likely focus on the measurement of the ship's GHG intensity on a Well-to-Wake (WtW) basis per energy consumed on board — the GHG Fuel Standard (GFS) - combined with a phased reduction of the GHG Fuel Intensity (GFI) over time. This equation will relate to a possible correction factor for ships serving ports of developing countries. Furthermore, there are plans to attach a price to carbon dioxide (CO2) emissions to incentivize shipowners and operators to reduce emissions by selecting cleaner fuels such as synthetic fuels derived from renewable sources, as well as adopting energy-efficient technologies.

We can also expect an increased governance of the fund under the IMO's remit. This emphasizes the need for transparency, accountability and good governance of revenue management, and a balanced geographical representativeness of its membership.

Key Priorities for the U.S.

1. Cybersecurity: In-line with the international agenda to safeguard shipping and port companies from bad actors online, The Vessel Cyber Risk Management Work Instruction (CVC-WI-027), which was published in October 2020 and revised in October 2023, provides guidance on the United States Coast Guard's (USCG) approach to assessing cyber risk in commercial vessels. It outlines expectations for U.S.-flagged vessels and companies to integrate cyber risk management into their Safety Management Systems (SMS). Furthermore, foreign-flagged vessels calling at U.S. ports must have adequately addressed cyber risk management in their SMS.

Additionally, an executive order signed in February 2024 mandates that cyber threats be addressed through updates to Part 6 of Title 33 of the Code of Federal Regulations (CFR), which includes cybersecurity protocol. The executive order

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defines a "cyber incident" and establishes reporting requirements for them. This reporting requirement also applies to foreign-flagged vessels operating in U.S. waters and ports.

Furthermore, the USCG has taken steps to update its maritime security regulations. This proposed rule would introduce several requirements for owners or operators of U.S.-flagged vessels, facilities and Outer Continental Shelf facilities. It would mandate the implementation of cybersecurity measures aimed at identifying risks, detecting threats and vulnerabilities, protecting critical systems, and facilitating recovery from cyber incidents.

2. Increased environmental protection at sea: October 2024 saw the U.S. Environmental Protection Agency (EPA) publish its final rule under the Vessel Incidental Discharge Act (VIDA). It established federal performance standards for marine pollution control devices applicable to discharges into U.S. waters and the contiguous zone.

The USCG is required to develop corresponding implementation, compliance and enforcement regulations within two years. These regulations may include requirements for the design, construction, testing, approval, installation and use of devices necessary to meet the EPA standards. The EPA's rule took effect on 8 November 2024; however, the federal standards will only become enforceable once the USCG finalizes its regulations. Until then, existing requirements from the 2013 Vessel General Permit (VGP) and the USCG's requirements under section 1101 of the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) will remain in effect.

Two types of standards have been established under VIDA. The general standards are organized into these three categories:

- General operation and maintenance
- Biofouling management
- Oil management

The specific standards address discharges of 20 different pieces of equipment and systems. The new requirements are at least as stringent as those in the VGP. We can expect these to transition into regulation that reflect national technology-based standards of performance, improve clarity, enhance enforceability and implementation, and incorporate new information and technology.

CARB 2020 At-Berth Regulation

Vessels visiting California must now report each visit within 30 days of departure and meet opacity requirements. Emissions controls compliance will also take effect. Two years ago, container and refrigerated cargo vessels, as well as passenger cruise vessels were required to comply with these controls, while roll-on/roll-off vessels and tanker vessels that visit the Ports of Los Angeles or Long Beach are now following the requirements as of January 2025, and finally, all remaining tanker vessels must comply by January 2027.

As well as communicating with the regulated terminal at least seven days prior to arrival, the vessels must comply by reducing emissions while at the terminal. This could mean connecting to shore power, employing a CARB-approved Emission Control Strategy (CAECS) or an approved innovative concept, within two hours of the vessel arriving at the berth continuing on until one hour before the pilot boards the vessel for departure.

Building Awareness to Manage Uncertainty

Uncertainty remains as the IMO, and country-specific regulators, work towards finalizing these safety and environmental policies. Maritime and shipping organizations should take a proactive approach to prepare for compliance by building their awareness of new regulations on the horizon. Awareness will help them to steer a smooth course to compliance in the long-term.

FPSO MARKET 2025

DEMAND STEADY, PRICES SOAR

***Matt Tremblay**, Vice President, Global Offshore at ABS, shares with Maritime Reporter his insights on drivers for the market in 2025 and beyond, from new designs to digitalization's evolving role in maintenance.*

By Greg Trauthwein

FPSOs are the backbone of offshore oil and gas production discovery and recovery, providing a bridge between deepwater reservoirs and global energy markets. Today the oil and gas industry as a whole faces consistent and sometimes rapid shifting landscape in terms of economics, technology and sustainability.

According to Tremblay, the FPSO market in 2025 is expected to remain stable, with 10 to 12 offshore production projects reaching final investment decisions (FIDs)—a continuation of 2024 trends. Brazil remains a focal point, with Petrobras leading significant developments, including the Petrobras 86 project and SEAP 1 and SEAP 2 FPSOs. Shell's Gato do Mato project is also anticipated to move forward early in the year.

"The year is front-loaded with Brazil's activity," says Tremblay. "We expect around four to six FIDs in both the first and second halves of 2025, with the majority leaning toward new construction. However, some conversions will still play a role."

SHIFTING DYNAMICS

Traditionally, FPSO conversions—modifying existing tanker hulls for offshore production—offered a cost-effective and faster alternative to new builds. However, the industry has seen an increasing tilt toward new construction, with 80% of projects in 2024 being newly built.

This trend is fueled by major players such as Exxon and Petrobras, who are commissioning high-capacity FPSOs, exceeding 200,000 barrels per day.

Tremblay notes, "Conversions can't accommodate FPSOs of this scale, as they're larger than even the biggest ultra-large crude carriers (ULCCs). And with limited shipyards capable of building them, costs are naturally higher."

"The cost of FPSOs has soared. The P-78 FPSO was contracted at $2.5 billion, but just a few years later, P-84 and P-85 are each valued at $4.1 billion."

– Matt Tremblay, Vice President, Global Offshore at ABS

SBM Offshore's Fast4Ward program is one example of maximizing efficiency, a program which builds FPSO hulls on spec, essentially helping to shorten delivery timelines, bringing new builds below the traditional 36–40 months to under 30 months.

Even with efficiency fixes, the global supply chain remains a critical concern for FPSO construction. Tremblay emphasizes that while equipment delivery delays have stabilized, prices continue to rise.

"The cost of FPSOs has soared," he said. "The P-78 FPSO was contracted at $2.5 billion, but just a few years later, P-84 and P-85 are each valued at $4.1 billion."

One factor behind this cost escalation is vendor strategy, as they take a more measured approach to growth. Tremblay compares FPSO equipment manufacturers to offshore drillers: "After years of financial losses, they're holding off on expanding capacity and instead capitalizing on high demand."

Another factor in the cost equation is, of course, the shipyard.

With only a handful of shipyards capable of building FPSOs, the market remains constrained and China dominates, with four to five active yards, while South Korea's Hanwha is aggressively competing for market share, leveraging geopolitical concerns, specifically U.S./China relations.

Meanwhile, even the shipyards that dominate the FPSO sector are actively weighing their options, as shipyards must weigh the size and particularly the length of FPSO contracts against more profitable alternatives like gas carriers. "FPSOs take a lot of steel; they're big; they take up a ton of space. I can probably build three, maybe four gas carriers per square meter of dry dock space versus one FPSO; so I'm making more money building gas carriers than I am building FPSOs," observed Tremblay.

FPSO MAINTENANCE & THE DIGITAL SHIFT

While designing and building modern FPSOs present their own challenges, once built and operational a growing challenge for FPSO operators is maintaining these larger, more technically complex vessels. Traditional calendar-based maintenance cycles are giving way to vessel-specific, condition-based maintenance strategies, supported by digital tools and remote inspection technologies.

"Inspecting every tank in a five-year cycle is logistically tough, especially with FPSOs getting bigger," says Tremblay. "We need digital twins—fully integrated, real-time asset models that allow operators, regulators, and class societies to collaborate on maintenance plans."

Remote inspection tools like drones, cameras, and LiDAR are advancing but remain limited by the need for physical cleaning. "You can't detect bottom pitting corrosion if the tank is covered in sludge," Tremblay explains. "That's why the new double-bottom FPSO designs will be a game-changer," as they simplify tank cleaning, reduce manpower and improving inspection efficiency.

At the same time, FPSO designs are also evolving to align with sustainability goals, with companies like Yinson and Petrobras pioneering technologies such as onboard carbon capture and FPSO electrification.

"Petrobras' new FPSOs will operate like electric cars—using large natural gas turbogenerators to power electric motors instead of diesel engines. This reduces CO2 emissions by approximately 20%," says Tremblay.

GEOPOLITICS & CLIMATE CHANGE
OFFSHORE WIND IN EAST ASIA & PACIFIC

By Alisa Reiner

The East Asia and Pacific (EAP) region is rapidly emerging as a global leader in offshore wind energy, a critical component of the clean energy transition. With its vast coastlines, growing energy demand, and ambitious decarbonization goals, the region is poised to play a pivotal role in shaping the future of renewable energy. However, this growth is unfolding against a backdrop of complex geopolitical tensions, economic challenges, and technological hurdles.

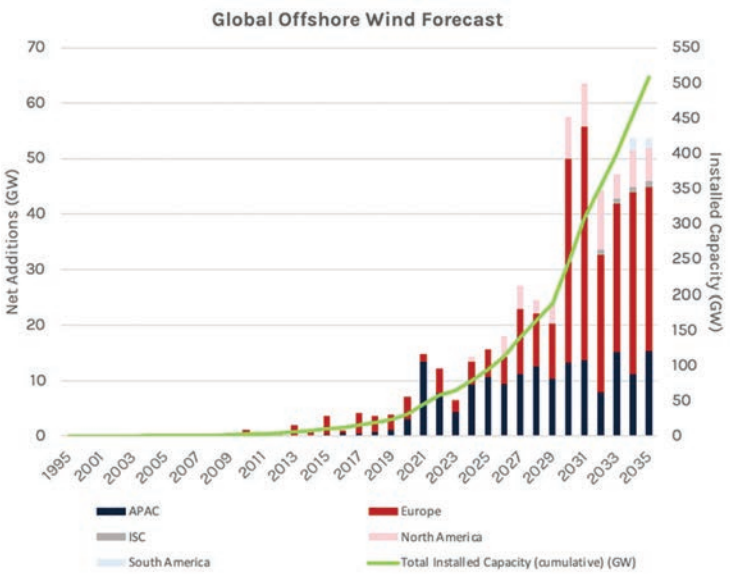
Five key markets, including China, Taiwan, Japan, Vietnam, and the Philippines, demonstrate the opportunities and challenges facing offshore wind development in the EAP region. These nations are not only at the forefront of offshore wind innovation but also at the intersection of competing maritime claims and geopolitical interests.

The Growing Importance of Offshore Wind

Offshore wind energy has become a cornerstone of global efforts to combat climate change and reduce reliance on fossil fuels. Unlike onshore wind farms, offshore installations can harness stronger and more consistent winds, making them ideal for densely populated coastal regions.

Globally, offshore wind capacity stood at about 75 GW in 2023 but is projected to grow exponentially to over 510 GW by 2035 and nearly 1,200 GW by 2050. This rapid expansion is driven by advancements in technology—particularly floating wind turbines that can operate in deeper waters—and increasing commitments from governments to achieve net-zero emissions targets.

The EAP region is at the heart of this transformation. By 2035, its cumulative installed offshore wind capacity is expected to reach approximately 144 GW. China leads the charge with aggressive targets and substantial investments, while Taiwan and Japan are steadily building their capabilities. Emerging markets like Vietnam and the Philippines are also beginning to explore their offshore wind potential.



Source: *interpretation of data from Intelatus Global Partners. Data Collection was capped as of November 1, 2024.*

China: The Global Powerhouse

China dominates the offshore wind landscape in EAP, with an installed capacity of approximately 37 GW as of 2024—more than any other country in the world. The nation's ambitious renewable energy policies aim to expand this capacity to nearly 90 GW by 2030.

China's success is underpinned by its robust and vertically integrated supply chains, low-cost production capabilities, and significant government support. Coastal provinces such as Guangdong, Fujian, Zhejiang, Jiangsu, and Shandong are leading the way in developing offshore wind projects. Additionally, China is investing heavily in "deep-sea" wind farms, which require advanced floating turbine technology.

However, China's dominance also raises concerns about market dependencies and geopolitical risks. The country controls a significant portion of the global supply chain for offshore wind components, including rare earth minerals (REMs) essential for turbine production. This concentration of resources has prompted other nations to diversify their supply chains to reduce reliance on Chinese imports.

Taiwan: Balancing Opportunity and Risk

Taiwan has positioned itself as a key player in the offshore wind sector with an installed capacity of approximately 3 GW as of 2024. The island's government has set ambitious targets to achieve up to 55 GW of offshore wind capacity by 2050 as part of its Net-Zero Roadmap.

Offshore wind is critical for Taiwan's energy security. Currently, 98% of its energy is imported, making the island vulnerable to supply disruptions. Offshore wind offers a pathway to reduce dependence on fossil fuels while supporting Taiwan's energy-intensive semiconductor industry—a global leader in advanced chip production.

Yet Taiwan's geopolitical situation poses significant challenges. Tensions with China create risks for infrastructure projects near contested waters in the Taiwan Strait. International investors have expressed concerns about these risks, leading to higher insurance premiums and potential delays in project timelines. Despite these challenges, Taiwan remains an attractive market due to its favorable incentives and strategic importance in the global renewable energy landscape.

Japan: Floating into the Future

Japan's unique geography—characterized by deep coastal waters—makes it an ideal candidate for floating offshore wind technology. While Japan's current installed capacity is modest at just 0.3 GW, its government aims to achieve up to 45 GW by 2040.

Japan has pioneered floating wind technology with several demonstration projects already operational. These innovations could unlock vast areas for development far from shorelines where traditional bottom-fixed turbines are not feasible. However, high costs and regulatory barriers have slowed progress. Japan also faces grid integration challenges due to its isolated electricity network split between two frequencies (50 Hz in eastern and 60 Hz in western regions).

To overcome these hurdles, Japan is strengthening partnerships with European firms while investing in domestic manufacturing capabilities. With steady annual additions projected through 2035, Japan's offshore wind sector is poised for gradual but significant growth.

Vietnam: Untapped Potential

Vietnam boasts high technical potentials for offshore wind—an estimated 599 GW—yet its installed capacity remains negligible. The government's Power Development Plan VIII targets up to 6 GW by 2030 and over 70 GW by 2050, although only around 3.5 GW of offshore wind capacity is realistic by 2035 given the current project pipeline.

Vietnam's South Central region offers attractive conditions for bottom-fixed turbines due to shallow waters near existing port infrastructure. However, regulatory uncertainties and insufficient grid capacity have hindered progress. International developers have been cautious about entering Vietnam's market due to unclear policies and high investment risks.

Despite these challenges, Vietnam's extensive experience in offshore oil and gas could provide a foundation for developing its offshore wind industry if regulatory support to attract foreign capital is implemented.

Maps courtesy CIA: The World Factbook

The Philippines: A High-Stakes Frontier

The Philippines also has significant potential for floating offshore wind due to its deep waters and fragmented geography comprising over 7,000 islands. The country's technical potential stands at approximately 178 GW.

Offshore wind could address several pressing issues for the Philippines: reducing reliance on imported fossil fuels, alleviating land-use conflicts for energy development, and enhancing energy independence amid volatile global markets.

However, like Vietnam, the Philippines faces significant obstacles including regulatory inefficiencies and limited local supply chain capabilities. Recent government initiatives, such as streamlined permitting processes, offer hope for accelerated development.

The first commercial-scale projects are expected online by 2030 with gradual growth thereafter.

Geopolitical Challenges: Navigating Troubled Waters

Offshore wind development in EAP does not exist in a vacuum—it is deeply intertwined with regional geopolitics:

1. Territorial disputes: Competing claims over maritime territories, such as the Pratas Islands, Paracel Islands, Spratly Islands, and Macclesfield Bank the South China Sea, create risks for infrastructure projects near contested waters.

2. China's strategic dominance: China's assertive actions, including militarization of artificial islands in the East and South China Seas, raise concerns about security vulnerabilities for neighboring countries.

3. Supply chain and investment leverage: Heavy reliance on Chinese components exposes other nations to economic coercion or trade disruptions in case of potential disputes. Further, China's investment in its neighbors' infrastructural development creates asymmetric dependencies. For instance, the State Grid Corporation of China owns a 40% stake in the National Grid Corporation of the Philippines, which could become a threat to the latter's national sovereignty and energy security.

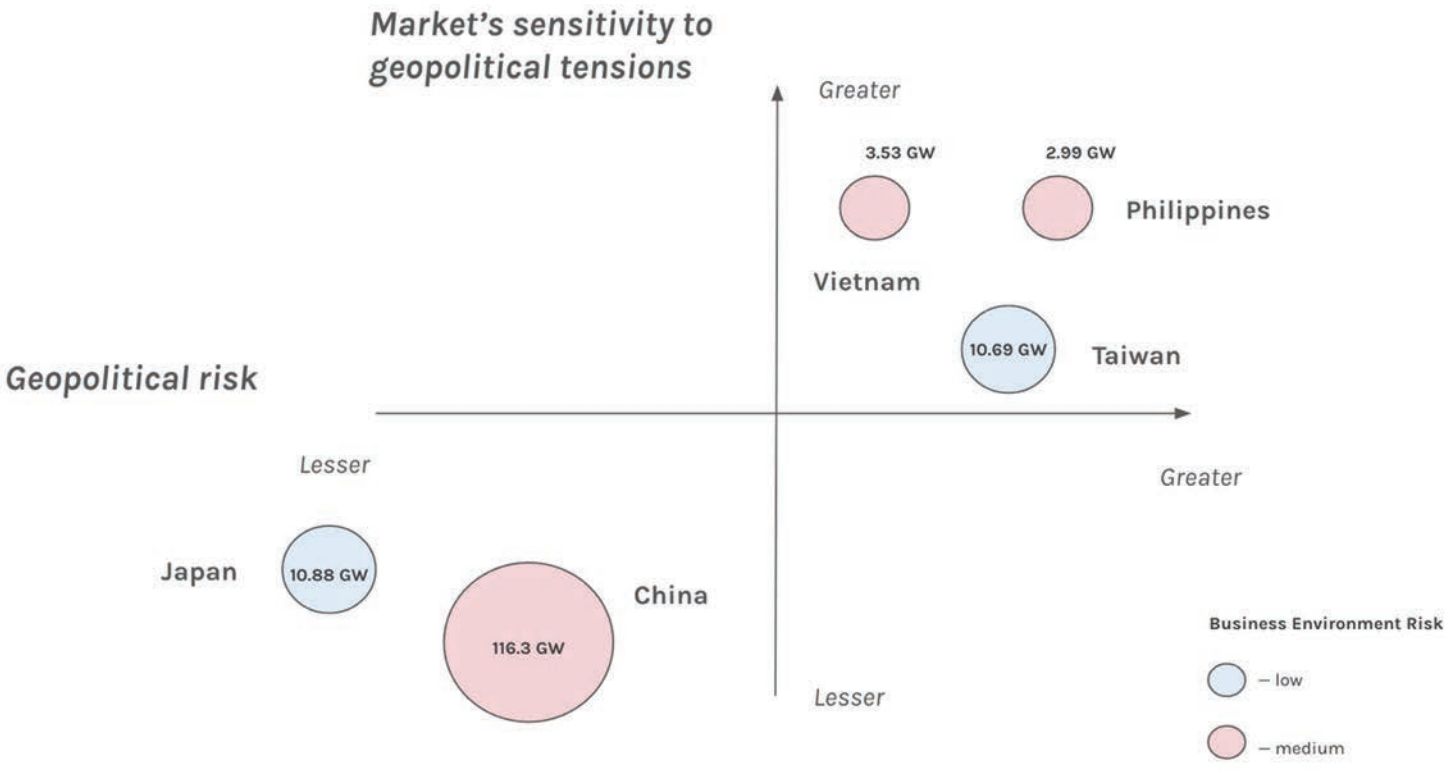


Exhibit 8 Geopolitical risk—market sensitivity—business environment risk matrix. Bubbles and their titles represent the total installed capacity market size (projected for 2035). Source: author's creation. For the "business environment risk" indicator, interpretation of data from Allianz Trade ("Country Risk Ratings & Reports," Allianz Trade, accessed December 4, 2024, https://www.allianz-trade.com/en_US/resources/country-reports.html).

4. Cybersecurity risks: Increased offshore wind farms' technological sophistication and reliance on digital control systems makes them vulnerable to cyberattacks that could disrupt operations or compromise national grid stability.

Looking Ahead: Offshore Wind Development Opportunities

Despite geopolitical complexities and technical hurdles, the outlook for offshore wind in EAP remains promising:

- **Technological advancements:** Innovations in floating turbines and energy storage solutions will unlock new opportunities across deep-water regions, most notably Japan and the Philippines.

- **Policy support:** EAP governments are increasingly prioritizing renewable energy through strategic plans, favorable policies, and incentives aimed at attracting foreign developers and investors.

- **Diversification:** Partnerships with European original equipment manufacturers (OEMs), developers, and suppliers could enhance supply chain resilience and decrease reliance on Chinese imports.

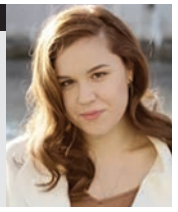
Going forward, China, despite rising geopolitical tensions with regional neighbors and the United States along with domestic economic challenges, will continue leading the charge due to its scale and cost advantages. Japan and Taiwan's markets are projected to grow steadily with increased technological expertise, especially for offshore technologies, and diversification of supply chains and capital sources to include European partnerships. Emerging markets like Vietnam and the Philippines must overcome regulatory bottlenecks to attract investment while balancing geopolitical risks and dependencies on Chinese investments.

In EAP, offshore wind holds immense promise as both an engine of economic growth and a pillar of sustainable development—provided nations can navigate turbulent waters ahead.

The Author

Reiner

Alisa, a second-year Master of Environmental Management student at Yale, specializes in energy geopolitics, markets, and security, with experience in energy research and consulting.



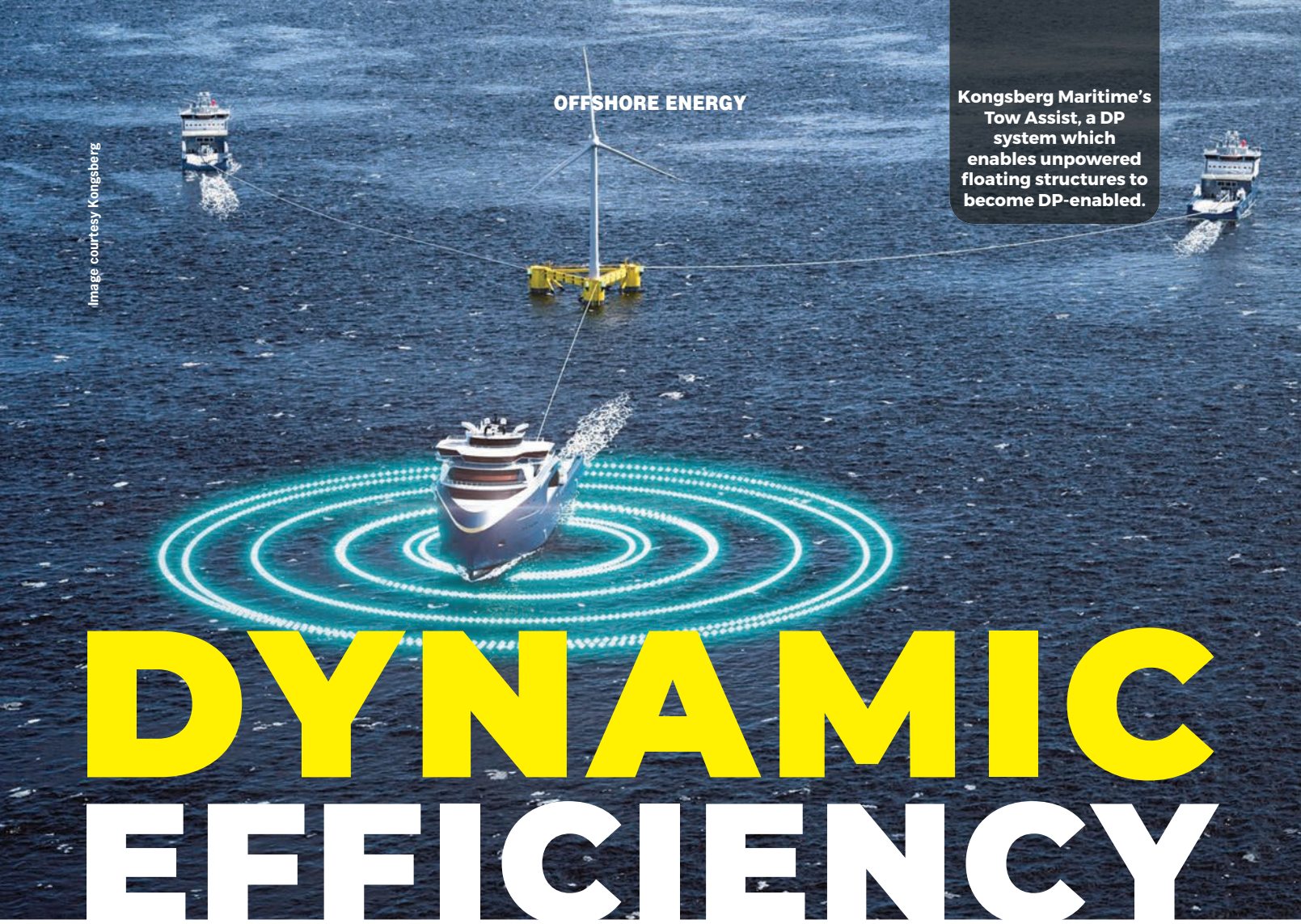


Image courtesy Kongsberg

Kongsberg Maritime's Tow Assist, a DP system which enables unpowered floating structures to become DP-enabled.

DYNAMIC EFFICIENCY

There's no one-size-fits-all in dynamic positioning systems, but each is crafted with efficiency in mind.

By Wendy Laursen

If the dynamic positioning (DP) system went down on an offshore supply vessel, it could result in a collision. On a dive support vessel, it could result in injury or death for a diver. On a drilling rig, it could result in a blowout with loss of life, pollution and fire.

Built-in redundancy is key to avoiding failures, and this in turn determines the thruster, electrical and engine configurations that are designed to enable DP systems.

"There is no single, universal solution," says Lauri Tiainen, Director Thrusters and Propulsion Control Systems, **Wärtsilä** Marine. "Each vessel has unique operational requirements and design considerations. Vessels working in shallow waters, especially those supporting walk-to-work operations, require different system solutions compared to traditional oil and gas vessels operating in deeper waters."

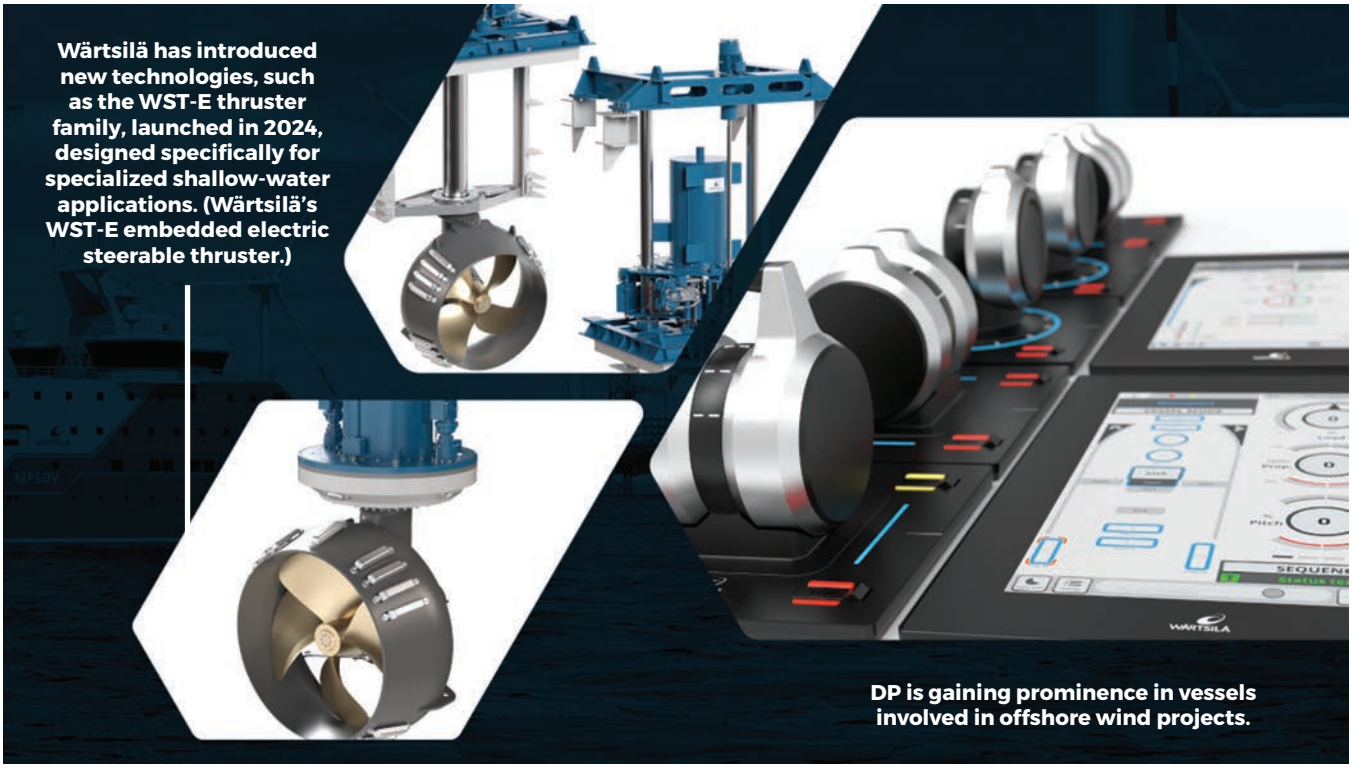
The company's design philosophy begins by examining the hydrodynamic and aerodynamic forces acting on a vessel and determining how best to counteract these forces with thrusters. This includes assessing the placement and integration of steerable and tunnel thrusters within the hull to optimize propulsion efficiency. Electrical systems, gensets and DP control systems are then chosen to support the required redundancy and performance needs.

DP is gaining prominence in vessels involved in offshore wind projects, and Wärtsilä has introduced new technologies, such as the WST-E thruster family, launched in 2024, designed specifically for specialized shallow-water applications. Wärtsilä has been a long-standing advocate for 8°-tilted thruster designs, which reduce thruster-hull interactions, lower energy consumption and improve positional accuracy.

"Vessels working in shallow waters, especially those supporting walk-to-work operations, require different system solutions compared to traditional oil and gas vessels operating in deeper waters."

– Lauri Tiainen,
Director Thrusters and Propulsion Control Systems, Wartsila Marine

Image courtesy Wärtsilä



Wärtsilä has introduced new technologies, such as the WST-E thruster family, launched in 2024, designed specifically for specialized shallow-water applications. (Wärtsilä's WST-E embedded electric steerable thruster.)

DP is gaining prominence in vessels involved in offshore wind projects.

Image courtesy Wärtsilä

Wärtsilä has also developed its patent-pending OPTI-DP simulation tool and thruster allocation logic that provides detailed insights into thruster-to-thruster and thruster-to-hull interactions. Conventional methods for assessing accurate DP capability calculations have become increasingly challenging as offshore operations move further from shore and as the vessels serving them become larger and more complex. OPTI-DP allows the simulation of environmental operating conditions, with independent wind, wave and current directions, if desired, plus the ability to simulate multiple failures.

As well as enabling safe and smooth operation, **ABB** Ability Marine Pilot Control uses speed-dependent hydrodynamic models of the ship and its thrusters to increase the energy efficiency of DP operations. Kalevi Tervo, Corporate Executive Engineer and Global Program Manager, ABB Marine & Ports, explains these models encode the behavior of the ship and the thrusters into a format which the control system can use to proactively "understand, plan and decide" the most efficient control strategies, instead of only acting in a reactive way based on conventional feedback control.

This is especially beneficial in dynamic situations when the setpoint or weather changes or when there is a need for more complex dynamic maneuvers such as dynamic track control or simultaneous turning and moving. However, it is also still beneficial for energy-efficient control in steady situations due to being able to use the most efficient thruster angles, instead of using inefficient angles for prolonged periods (e.g. for several hours). Ship and actuator dynamics are nonlinear, says Tervo, and linear model-free approaches struggle to control these kinds of systems efficiently.

"Ship and actuator dynamics are nonlinear and linear model-free approaches struggle to control these kinds of systems efficiently."

– Kalevi Tervo,
Corporate Executive Engineer and Global Program Manager, ABB Marine & Ports

Image courtesy ABB

ABB has developed thruster models that consider the state of motion of the vessel. This is valuable when, for example, a vessel is in position but performs a heading-change maneuver. When the vessel rate of turn picks up, the thruster is travelling along an arc where the experienced speed of the flow at the thruster depends on the rate of turn and the distance of the thruster from the center of the vessel. If the DP system only considered zero speed, the control angles for the thrusters would lead to a situation where the rudder effect of the thruster is fighting against the thrust it produces, resulting in excessive energy consumption.

Thrusters cannot change their angle or rpm infinitely fast, says Tervo.

There are also forbidden / undesired angles which typically mean angles where one thruster is flushing the other thruster or the hull, reducing the effective thrust and increasing power need as well as wear-and-tear. The ability to anticipate the future force required to accomplish a task enables the control system to prepare thruster angle and RPM for future needs using the most efficient angles while continuously taking into account the limitations of the thrusters.

Miros has launched a new wave and vessel motion prediction technology PredictifAI that anticipates the future to improve the energy efficiency of DP operations. It provides accurate and real-time wave, wind and current predictions up to a couple of minutes in advance. These are deterministic predic-

Miros has launched a new wave and vessel motion prediction technology PredictifAI™

Image courtesy Miros

tions of ocean waves and vessel motion, and by leveraging machine learning and advanced data analytics, the technology continuously improves its forecasting accuracy. The system pairs artificial intelligence with X-band radar and local high-accuracy wave height measurements to deliver a monitoring solution that automatically adapts to varying sea and weather conditions.

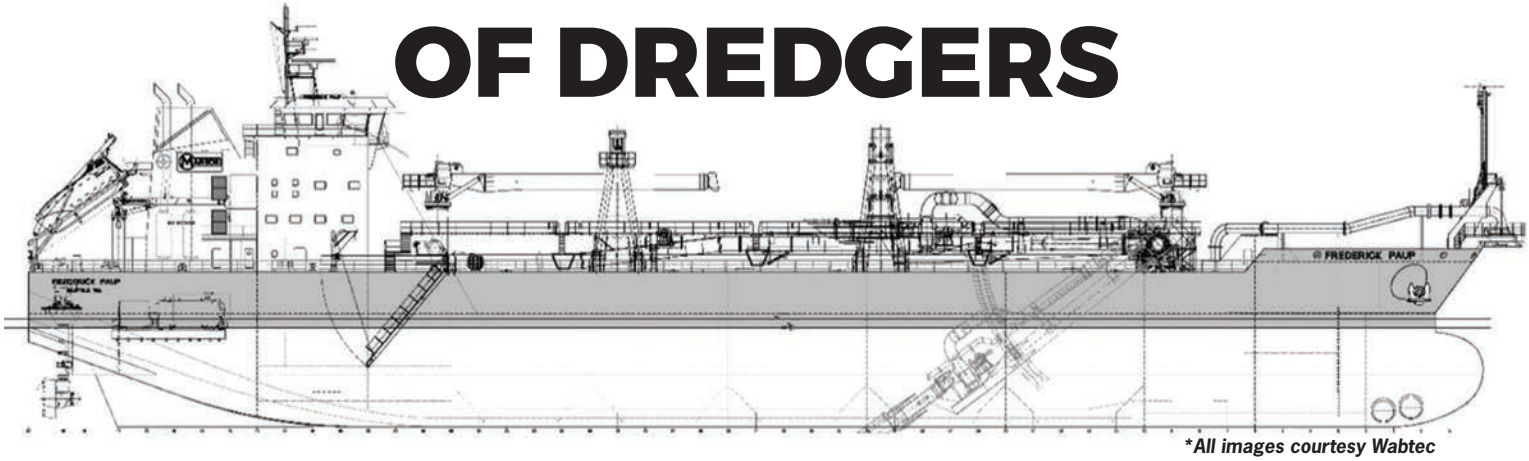
Kongsberg Maritime has focused its recent DP optimization on offshore wind operations, looking beyond individual vessel dynamics to enable them to maneuver within a wind farm more efficiently, saving fuel and time and increasing safety. Birger Teien Evensen, Sales Director – Offshore at Kongsberg Maritime, says the functionality enables vessels to move in to a safety zone and reach an optimal position for gangway operations automatically. It can also do this for floating wind farms. "Floating turbines move quite fast within their anchor pattern, and it is difficult for a vessel to follow whilst keeping the gangway in position," says Evensen.

In another big-picture development Kongsberg Maritime has addressed the challenges of transporting and installing giant floating wind turbines with Tow Assist, a DP system which enables unpowered floating structures to become DP-enabled. Positioning equipment is temporarily installed onboard that links wirelessly to the DP-enabled towing vessels. Real-time data on position and heading, along with thruster and winch status, is transferred wirelessly to the Tow Assist master computer located on the lead towing vessel. The other two towing vessels then act as thrusters for the floating structure. The idea is to ensure optimal performance of all the vessels involved while reducing the risk of manual communication and coordination between the towing vessels.

The new Tow Assist System was successfully trialed in the North Sea in summer 2024 and is set to be commercially available in 2025 – ready to reduce operational risks for the rapidly maturing floating wind industry.

MEGA MACHINES:

MANSON TO ADD *"THE BIONIC MAN"* OF DREDGERS



**All images courtesy Wabtec*

Manson Construction is a U.S. Jones Act dredging and marine construction firm, founded in 1905 and family owned until converting to an employee-owned company in 2012. ***Fred Paup, Chairman of the Board, EVP,*** *discussed the drivers for this multi-billion dollar company, from finding and retaining the best crews, to the construction of the $200 million+ 15,000 cu. yd. hopper dredge in Brownsville, Texas – the Frederick Paup – a dredge that Paup says will be "the Cookie Monster" of beach replenishment.*

Manson Construction has long been a pillar of the U.S. maritime industry, rooted in a tradition of U.S.-built, U.S.-owned, and U.S.-operated vessels. The company was founded in 1905 by Peter Manson, when he dug up a jar of gold coins [because he didn't trust the banks] and purchased a winch, a winch that was then put on a barge and that became Manson's first pile driver. With barge-mounted pile driver, Manson Construction embarked on its journey into marine construction and eventually dredging, a journey which continues today as it has become a dominant player today in the U.S. maritime market, playing a crucial role in building and maintaining the nation's maritime infrastructure.

A HALF-BILLION DOLLAR COMPANY

While Manson Construction started as a small pile-driving operation, it has evolved and grown into a $500 million enterprise in 2025, with a pivotal moment coming in 2012 when it flipped to a 100% employee-owned company.

Fred Paup, today serves as EVP and Chairman of the Board of the company his great-grandfather founded, joining the company in 1992 and playing a key role in its growth, helping to expand operations while maintaining the company's core values.

Operating primarily in the U.S., Manson specializes in heavy civil marine construction and dredging, with a fleet equipped for various dredging techniques, including cutter suction, clamshell, and hopper dredging. With headquarters in Seattle and regional offices across the country, the company remains strategically positioned to serve key U.S. waterways.

FREDERICK PAUP: "THE BIONIC MAN" OF DREDGES

The *Frederick Paup* is a massive new hopper dredge that Paup believes will redefine efficiency and capability in the dredging industry. Currently being finished at Seatrium AmFELS in Texas, this 15,000-cubic-yard hopper dredge is the largest ever constructed by Manson and marks a significant leap forward in dredging performance.

Key Features of the Frederick Paup include:

- **Increased Capacity:** At 420 feet long and 81 feet wide, it surpasses the Glenn Edwards, Manson's previous largest hopper dredge.
- **Advanced Power System: Featuring** Tier 4 Wabtec diesel-electric engines, the dredge is more fuel-efficient and environmentally friendly, eliminating the need for urea treatment to hit emission targets.
- **Enhanced Safety and Crew Comfort:** The design includes improved below-deck passageways, reducing exposure to harsh weather conditions.
- **Superior Pumping Capabilities:** Equipped with in-hull pumps for more efficient beach nourishment and land reclamation projects.

Expected to enter service in 2025, the Frederick Paup will begin operations in Mobile Harbor and the Mississippi River, reinforcing Manson's strong presence in the dredging sector.

"The Frederick Paup is years of experience and knowledge that Manson has built up with our hopper dredge Glenn Edwards," said Paup, referencing the 2006-built and delivered Glenn Edwards a 13,000-cubic-yard dredge.

"The Frederick Paup is like the bionic man of dredges: she's bigger [15,000 yards versus 13,000 cubic yards]; she's faster, her hull form has been modified [so she measures] 420 feet long by 81 feet wide," said Paup.

A key lesson learned came in the aftermath of Superstorm Sandy, when Manson was working offshore New Jersey in February, putting two million cubic yards of sand back on the beach. Keeping workers out of the such conditioned as much as possible was a priority with the new Frederick Paup, and with the new ships "we made it to where our crew can go bow to stern and still be below deck.

The new Wabtec powerplants were also an upgrade, as Paup explains "one of the benefits of engines being more modern, they will be more fuel efficient, and their footprint isn't quite as big."

But the benefits don't stop there, as Paup explained. "We could have gotten engines where you use urea to get to Tier 4 emission levels, but we didn't want to do that. We've done that before on one of our cutter section dredges … before we repowered it for the third time to meet air quality requirements and we knew that we didn't want that again. The complexity and the cost for doing diesel-electric versus straight diesel is a lot of money but," but that is made up over time in fuel, environmental benefits, and efficiency.

"So, we will be the Cookie Monster of dredges, eating up the work like crazy … we'll be coming to a harbor near you soon," said Paup

THE JONES ACT & A LEVEL PLAYING FIELD

The Jones Act has been, and will continue to be a hotly debated requirement for operating in U.S. waters, and Manson Construction's adherence to the Jones Act is not just a legal obligation—it is a fundamental commitment to national security, economic stability, and the preservation of American maritime jobs according to Paup, as the law ensures that domestic maritime commerce remains in American hands, protecting the nation's supply chains and bolstering its shipbuilding industry.

For Paup and Manson Construction, the Jones Act guarantees a level playing field and supports a robust, skilled maritime workforce.

"For us, it's about an even playing field. If it's going to cost me X dollars per day for a US shipyard, then I want my competitor to have that same thing," said Paup. "I like to say 'you can demand that I have a goat on the deck of a dredge as a requirement, so long as my competitor has to have a goat on the deck of their dredge, I'm okay with it; that's fine. Just be consistent."

"The Jones Act ensures that we maintain a strong domestic maritime industry," says Fred Paup. "Without it, we would see an influx of foreign-flagged vessels undercutting U.S. operators, leading to job losses and a decline in shipbuilding capacity. We take pride in constructing and crewing our vessels in the U.S., and we stand against any efforts to undermine these protections."

Image courtesy Manson Construction

*"**You can demand that I have a goat on the deck of a dredge** as a requirement, so long as my competitor has to have a goat on the deck of their dredge, I'm okay with it; that's fine. Just be consistent."*

– Fred Paup, Chairman of the Board, EVP, Manson Construction, on **the importance of the Jones Act** and a level playing field.

Despite occasional challenges from foreign interests seeking exemptions, bipartisan congressional support has preserved the Jones Act's role in protecting U.S. maritime operations. The law plays a critical role in national defense, ensuring that the country maintains a fleet of vessels and trained mariners ready to support military logistics in times of crisis. In an era of global uncertainty, maintaining a domestic maritime industry is more crucial than ever.

INVESTING IN THE FUTURE: VESSELS AND WORKFORCE

Beyond the Frederick Paup, Manson is planning additional investments, including a new 30-inch ABS offshore cutter suction dredge for Gulf operations. These expansions align with the company's long-term strategy of strengthening U.S. dredging capabilities.

A key component of this strategy is workforce development. Manson has proactively trained additional crew members across its fleet to ensure a seamless transition when the Frederick Paup begins operations. With industry wages rising—50% of Manson employees now earn over $100,000 annually—the company remains a competitive employer in the maritime sector.

LOOKING AHEAD

As the Frederick Paup nears deployment, Manson Construction continues to cement its position as a leader in the U.S. dredging industry. With a steadfast commitment to the Jones Act, strategic investments in advanced technology, and a dedicated workforce, the company is poised to drive the future of American maritime infrastructure. Whether through expanding dredging capabilities or fostering new talent, Manson remains committed to maintaining and improving the nation's waterways for years to come.

In the Shipyard

From Design to Delivery

TSH Dredge Adele

ESG

Eastern Shipbuilding Group, Inc (ESG) announced The Dutra Group has issued a Notice to Proceed for the new-build construction of a 10,464 cubic yard Trailing Suction Hopper Dredge, the Adele, to be built at ESG's Allanton and Port St. Joe facilities. Delivery is scheduled for late 2028. Adele will join The Dutra Group's 9,870 cubic yard Trailing Suction Hopper Dredge Stuyvesant. The new vessel's name honors Bill Dutra's mother, Adele Coelho. She was born on December 4, 1924 in Honolulu, Hawaii. Raised on the island of Molokai, she subsequently worked as a receptionist to the US Army Corp of Engineers at Pearl Harbor where she met Bill's father Edward, who was then a captain in the U.S. civilian dredging fleet under the Jones Act.

Adele is based on Royal IHC's Beagle design. The IHC Beagle Mk2 is a twin screw trailing suction hopper dredge with a maximum hopper capacity of 10,464 cu. yd. The hopper has a V-shaped cross section and is provided with a single row of bottom doors, which is ideal for quick offloading of dredged material. The design also incorporates a bow connection for high efficiency material pump off to service the shoreline and wetland material placement market. The hull shape is optimized with a bulbous bow to reduce drag and improve fuel efficiency.

WTIV Wind Pace

Cadeler

Cadeler took delivery of its latest jack-up wind turbine installation vessel, Wind Pace. Built at COSCO Shipping Heavy Industry (COSCO) shipyard in Qidong, China, it will be deployed in the U.S. under a contract from Q2 2025 to Q1 2026, supporting a project at an offshore wind farm in the region, Cadeler's second project in U.S. waters. The P-class vessels are capable of transporting and installing up to seven complete 15 MW turbine sets per load or five 20+ MW turbines.

USS Jeremiah Denton (DDG 129)

HII

HII's Ingalls Shipbuilding division has launched the future USS Jeremiah Denton (DDG 129), the third Flight III Arleigh Burke-class destroyer to be built at the shipyard. DDG 129 is named for former U.S. Sen. Jeremiah Denton Jr., a Vietnam War veteran who was awarded the Navy Cross for his heroism as a prisoner of war. Following his Navy career, he was elected to the U.S. Senate representing his home state of Alabama in 1980.

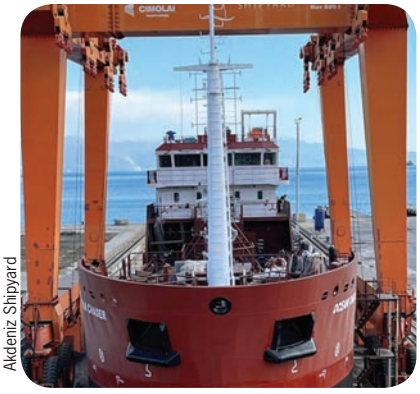
Cable Recovery Vessel Maasvliet

Holland Shipyards Group

Holland Shipyards Group delivered Maasvliet, a cable recovery vessel, to Hartel Shipping & Chartering, part of Hudig & Veder Group. Maasvliet measures 90.6 x 13.2 metersand is designed to support offshore cable recovery operations efficiently. The vessel will be on long-term charter to Subsea Environmental Services and deployed for vital cable projects over the coming years. The ship sports a diesel-electric drivetrain, allowing for running on sustainable fuels now and later on in the future. Two 374 bkW electro motors propel the new build and have a total installed power of 749 kW.

In the Shipyard

From Design to Delivery



Akdeniz Shipyard

1200 CBM Tanker Launched

Akdeniz Shipyard launched a 1200 cbm capacity tanker for delivery to an American client. The tanker, which will operate in the Bahamas, stands out with its shallow draft feature. Measuring 61 x 10.95 meters and a 2.90-meter draft, the vessel is designed to offer excellent maneuverability even in narrow waters.

Shipbuilding RFP Issued Hydrogen-Hybrid RV

Glosten

UC San Diego's Scripps Institution of Oceanography issued a request for proposals (RFP) to select a shipyard for the final design and construction of its new 163-ft. Coastal Class Research Vessel (CCRV). The vessel will feature a dual-powered hydrogen fuel cell and diesel-electric propulsion system, capable of conducting 75% of its missions using only liquid hydrogen. When running on hydrogen, CCRV will produce zero emissions and operate with minimal noise, ensuring contamination-free sampling and enhanced performance of its underwater acoustic sensors. Shipyards interested in submitting proposals can contact Lynda Ta at L2ta@ucsd.edu or Gary Oshima at gmoshima@ucsd.edu. Proposals will be accepted through May 9, 2025, with a final selection expected by June 20, 2025.

BlueKick: Electric Pusher

Western Baltic Engineering

Western Baltic Engineering (WBE) and Belgium's Batia Mosa Shipyard launched WBE's design electric pusher vessel series, BlueKick, a series of pushers to ensure zero-emission ops in while offering enhanced power and range capabilities. The BlueKick series includes a battery pack with up to 16.4 MW of power, 12.2 kg of hydrogen, 7.83 tons of methanol, and 4.23 tons of ammonia. The vessels feature drafts ranging from 1.2 to 1.5 meters, an upstream speed of 10 km/h, and the ability to propel barges weighing up to 2,000 tons.

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Tech Files

Latest Products & Technologies

Aircraft Carrier Gets 3D-Printed Valve Manifold

HII's Newport News Shipbuilding installed the first valve manifold assembly created by additive manufacturing technology on a new construction aircraft carrier. NNS continues to integrate additive manufacturing, also known as 3D printing, into the shipbuilding process. The use of certified 3D-printed parts has the potential to accelerate construction and delivery of vessels to the U.S. Navy by cutting lead times and improving manufacturing quality for critical components. The valve manifold assembly, a specialized assembly that allows distribution of a single source of fluid to multiple points on the ship, is installed in a pump room on Gerald R. Ford-class aircraft carrier Enterprise (CVN 80). The assembly, is approximately 5 feet long and 1,000 pounds.

New Fuel Injector Test Unit for 4-Stroke Engines

Chris-Marine launched its latest innovation, the VPU 1600, a fuel injector test unit for 4-stroke engines, manufactured at its facility in Denmark. The test unit is designed to efficiently assess the leakage, opening pressure, and spray pattern of fuel injectors, ensuring optimal engine performance. VPU 1600 is designed to deliver a reliable, intuitive solution for verifying injector performance, and its advanced testing capabilities makes it the ideal choice for engine makes, like MaK, Caterpillar, Deutz, Wärtsilä and MAN gensets.

Nexus Energy Zero Emissions PowerPack

Nexus Energy supplied its PowerPack to a pilot project taking place in the seaport of Dordrecht, a project where Van Oord, in cooperation with ZEDHub, Smart Delta Drechtsteden, the Municipality of Dordrecht and Port of Rotterdam, assessed the potential of a fully electric dredging operation. During the test, Paans Van Oord demonstrated the operation of its fully electric crane vessel, Christiaan P, which had its engines replaced with electric motors and crane replaced with an electric model. For the pilot project, the vessel was outfitted with mobile battery systems of 870kWh.

AIP for Liquefied Hydrogen Tank Tech

DNV awarded an AiP to HD Korea Shipbuilding & Offshore Engineering (HD KSOE) for its vacuum-insulated large-scale liquefied hydrogen tank. A challenges in developing large scale LH2 storage is achieving and maintaining vacuum insulation in large tanks. HD KSOE have addressed this by creating a new method that significantly reduces the time needed to create a vacuum, an essential part of making larger tanks viable.

AIP for Ammonia-Fueled Ammonia Bunkering Vessel

An Approval-in-Principle (AiP) certificate for an ammonia-fueled ammonia bunkering vessel designed through the collaboration of Nippon Yusen Kabushiki Kaisha (NYK) and its partners. Seatrium, through its wholly-owned subsidiary, LMG Marine, provided engineering for the vessel's design, which will now be submitted to the Maritime and Port Authority of Singapore (MPA) for evaluation.

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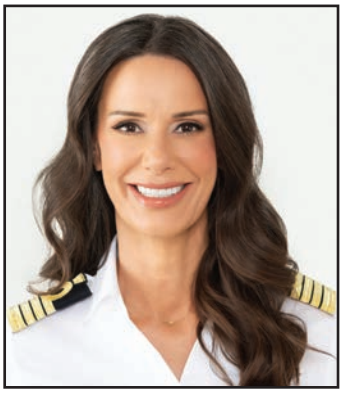

McCue

Sadler Nominated to MarAd's Top Spot

Brent Sadler of Virginia, was nominated to be Administrator of the Maritime Administration. Sadler is a Senior Research Fellow, Naval Warfare and Advanced Technology, Allison Center for National Security. Sadler joined Heritage Foundation after a 26-year Navy career.

Lindholm CEO @ Meyer Turku Oy

Casimir Lindholm has been appointed CEO of Meyer Turku Oy and will start his duties in the beginning of May 2025. Lindholm is currently President and CEO of Cargotec Oyj.

ClassNK Appoints New CEO

Current SVP Hayato Suga has been appointed as President & CEO as well as Representative Director of ClassNK and current Corporate Officer Fumihiko Higashi has been appointed as Executive Vice President. Former President & CEO Hiroaki Sakashita has been appointed as Chairman of the Board of Directors.

McCue Takes the Helm

Four Seasons Yachts appointed Kate McCue as the inaugural Captain of Four Seasons l, the first ultra-luxury yacht in the highly anticipated fleet. A graduate of the California Maritime Academy, Captain McCue made history in 2015 as the first American female captain of a mega-ton cruise ship.

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INTERCOM SYSTEMS

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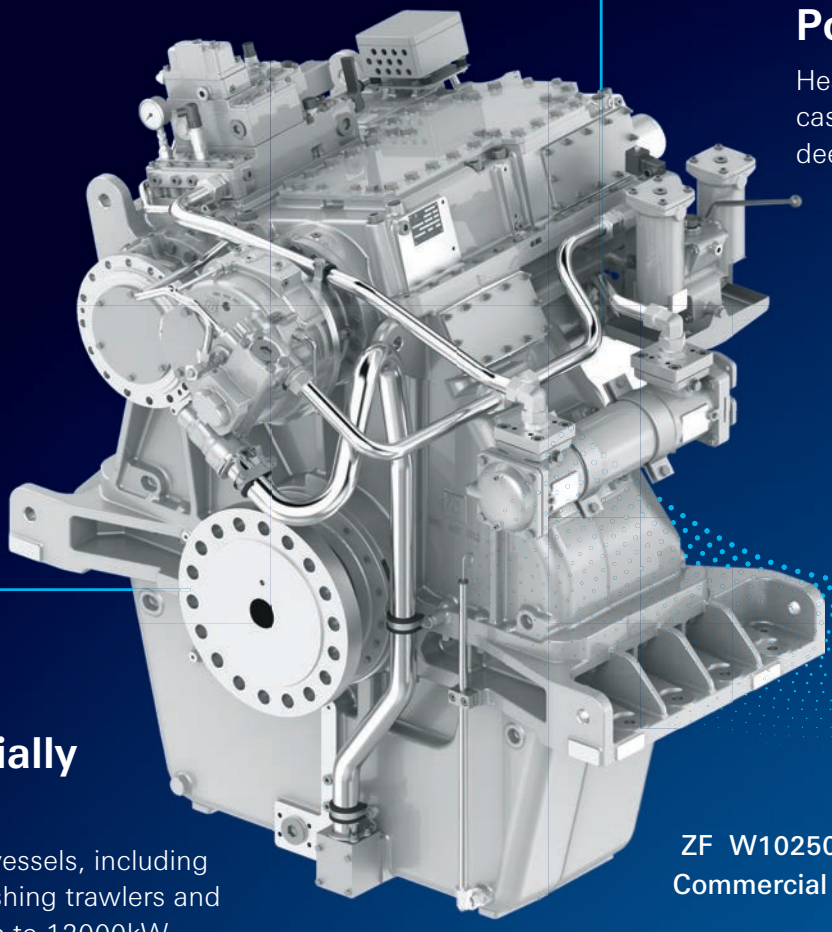

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