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MARITIME REPORTER AND ENGINEERING NEWS

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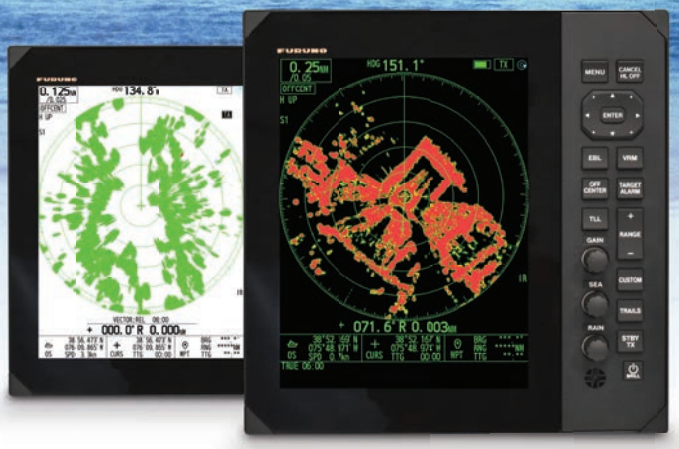

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Photo Justin Zurre

As the world increasingly becomes a geopolitical quagmire, with Russia's war in the Ukraine soon entering year three and disparate groups aiming to disrupt commerce by firing rockets and drones at commercial ships traversing the Red Sea, military spending continues to increase globally, and the importance of maritime transport as both a global commerce enabler and a bedrock of national and economic security again comes to the forefront.

That's why our interview with American Roll-On Roll-Off Carrier (ARC) CEO **Eric Ebeling** was the hands-down choice for our February 2024 cover story, as in ARC you have neatly rolled up a company that embodies so many key tenets to U.S. maritime interest and activities, from its hauling of heavy military and government equipment and supplies (as well as commercial cargo) to the places where it is most needed, to its employment of U.S. citizen merchant mariners that not only crew ARC ships but stand ready in case of national crisis.

As the world has evolved with the use of drones and cyber solutions for both commerce and warfare, it is increasingly apparent once again that meaningful sealift capacity is a matter of national security and economic interest. Our interview with Ebeling starts on page 26.

The ARC interview also delves into the energy transition and some of the unique challenges around greenhouse gas emissions and decarbonization. Ebeling notes that it is central to ARC's long-term strategy, but he – and no small number of vessel owners domestic and abroad – need increased levels of 'clarity and consistency' regarding the rules; how, when and where they are applied, both to ensure individual organizations are ready and able to adapt to changes, and to ensure that there is in fact some semblance of a level playing field as the cost of alternative energies take a bite out of the bottom line.

Energy transition and alternative fuels are everywhere. While traditional diesel is still the overwhelming fuel of choice powering the global fleet of commercial ships and boats, the change is undeniable as several early movers make investments in new technologies.

One such mover is Seaspan Corporation and its program with the Maersk McKinney Moller Center for Zero Carbon Shipping to develop a large 15,000-TEU ammonia-fueled container vessel. I had the opportunity to meet with **Seb Brindley**, Senior Naval Architect, Seaspan Ship Management; and **Jan-Erik Räsänen**, CTO, Foreship, to discuss the ship and the plan late last year on the sidelines of Europort in Rotterdam. While still in its infancy – premised largely on the fact that there still is not an engine commercially available – the effort is but one piece of Seaspan's ongoing effort to future proof its fleet.

Coming back from the future to the here and now, contributing editor **Wendy Laursen** examines the spate of stern tube damage cases that have plagued the industry in recent years. As she writes, it might be easy to blame EALs, but the ongoing causes of stern tube damage are varied, and possibly declining.

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Tip #56

Addressing Cultural and Language Barriers in Maritime Training

By Murray Goldberg, CEO, Marine Learning Systems

In the maritime industry, our inherently diverse workforce is both a great value and a source of challenges. For safe and efficient operations, crew members from various parts of the world must work closely and cooperatively over days, weeks and months, despite differences in language and culture. This diversity, while a source of richness, complicates training, communication, and the implementation of safety procedures. Understanding and addressing these challenges is critical for maintaining safety and operational efficiency. So what, specifically, are the issues and what can we do about them?

The primary issue at hand is the variation in languages and cultural backgrounds among the crew members on board. Misunderstandings arising from language differences can pose significant safety risks, and varied cultural perspectives can impact teamwork, collaboration, communication. All of these are necessary for the execution of both day to day and emergency procedures. Developing training programs that accommodate these differences while ensuring a standardized comprehension of duties and operations is complex and requires a good understanding of the issues. But there is hope.

To tackle these challenges, several strategies can be employed. The most obvious is developing training materials and resources in multiple languages. This can help mitigate language barriers, ensuring all crew members have access to information in their preferred language. However, this effort requires resources to build and maintain the multiple needed versions of your training materials. As difficult as that may seem, new tools such as AI-assisted translation software can help greatly and at minimal cost.

Another opportunity to improve cross-cultural communication and collaboration is to include cultural competence into your training initiatives. Cultural competence is simply an understanding of the cultures of (in our case) those people we work with. This can promote a better understanding of one another and an increased level of respect among crew members with diverse backgrounds. Training for cultural competence includes educating crew on different communication styles, cultural norms and expectations, all of which can enhance collaboration and the effectiveness of safety training. Fortunately, you already have cultural experts in your crew - those members from each of the cultures you wish to train. They can be drawn upon to provide insight into their own cultures, improving their own engagement with the company and their crewmates.

Another solution to cross-cultural training is the use of technologies which are (or mostly are) culturally-agnostic.

Simulation is a great example. This technology offers a great avenue for improvement, providing realistic training scenarios that are relevant regardless of culture. Furthermore, additional simulation scenarios can be built to address inherent cultural norms which can compound safety issues such as a deep respect for authority that can sometimes inhibit effective BRM communication and practices.

Promoting peer-to-peer learning and mentorship within crews is not only another great technique in general, but it is especially useful at bridging cultural gaps. It leverages the diverse experiences and perspectives of mariners to foster a deeper understanding of shared responsibilities. It is also really helpful in creating an environment where feedback is encouraged and used to continuously assess and refine training programs. This helps to ensure your programs effectively address the challenges posed by language and cultural differences.

The maritime industry thrives on its diversity and is unique in that it unites individuals from around the world in a common endeavor. By recognizing and addressing the challenges of cultural and language barriers in training, the industry can not only improve safety and efficiency but also uphold its commitment to being a welcoming and inclusive field. Through collaboration, innovation, and a dedication to continuous improvement, we can ensure a safer and more cohesive working environment for all mariners.

Thank you for reading and until next time, sail safely.

The Author

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Let's Set Some Standards for Micro Cargo

By Rik van Hemmen

As zero carbon cargo efforts are progressing, it is becoming more apparent that the lowest hanging fruit is in the last few miles. This is where a large amount of carbon is expended in delivering small parcels to stores and consumers' doors.

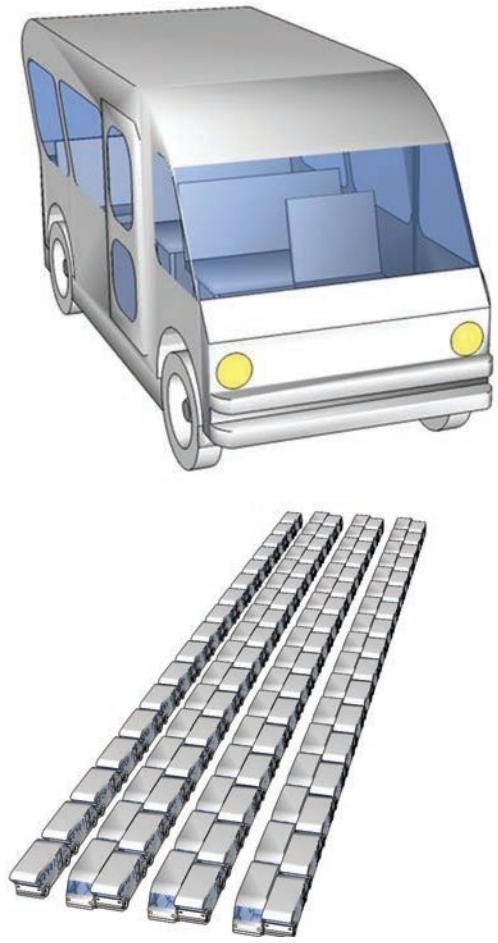
This is particularly apparent in dense pack cities like New York City, where delivery vans clog streets and water crossings. The NYC Economic Development Commission recently issued a Request For Expression of Interest in waterborne micro cargo delivery. The RFEI is asking for equipment manufacturers, cargo shippers, site developers and logistics providers to submit their wares for further evaluation by NYCEDC in an effort to move cargo by water to dedicated shore loading and discharge points along its incredibly long waterfront.

I am intimately familiar with many of the potential players in this field, and there is a lot of interesting stuff out there ranging from cargo bikes, to EV cargo vessels, to specialty cargo providers. I work very closely with Apollonia, a sailing vessel that is delivering a variety of cargo along the Hudson river. Apollonia is doing an amazing job at opening the long-forgotten New York harbor region waterborne trade, but even my friends on Apollonia agree that they are trailblazers and not the final solution for this trade. For this trade to advance to a sustainable and significant portion of last mile cargo delivery, more advanced approaches will need to be developed.

In New York City this will mean a deeply integrated and intermodal approach and intermodality requires standards. Proper standards will result in massive increases in efficiency and therefore massive opportunities to reduce carbon emissions. We know this works because in longer haul cargo delivery we have such a standard, the ISO shipping container. It almost boggles the mind that the success of the ISO container is effectively based on only one standard: 8 feet wide. Today there are other standardization bits and pieces, but they do not affect the efficiency of the entire system. Only by agreeing that all cargo will be packed in 8 feet wide boxes did we achieve the incredible efficiency of intermodal transportation.

Before that, cargo transportation was inefficient mayhem, and if we do not set a standard for micro cargo we will have to live through that level of mayhem with micro cargo or, worse, may never achieve critical mass in these systems and fail to develop micro cargo and continue to struggle with last mile inefficiencies.

So please, let's set a micro cargo standard width. I have been thinking about this subject for more than a decade and just like the reason for 8 foot standard (basically railroad car and truck widths, which are mythically reported to be related to the width of two horse's asses) there is a relatively obvious answer for micro cargo too. That width is roughly two human asses plus the additional width of the packaging.



That adds up to about 5 feet. The actual width is not terribly important, but it needs to be a single fixed width and having spent a fair amount of time on this issue I am pretty certain that 5 feet is the proper width.

We know that 8 feet wide is too wide in micro cargo delivery. The mathematical analysis of the inability of 8 feet wide to function well in micro cargo delivery is complex, but it only takes a little visualization to realize that if I pack an 8 feet wide box with stuff that needs to be delivered door to door in NYC and carry at maximum, parcels the size of a pallet, I spend a lot of time blocking traffic with a mostly empty truck. Stepping

down to a smaller size, and especially a smaller width relieves that issue. One may argue that one human with a bigger truck can deliver more cargo than one human with a smaller truck, but in a city like NYC even that argument holds no water, especially if NYC water can be crossed at higher speeds by avoiding tunnels and bridges and using the water itself.

NYCEDC, and many others, realize that at a gut level, and that is why NYCEDC is looking at waterborne micro cargo delivery. Such a system uses the water itself as a bypass intersection to deliver cargo point to point without delays, and as long as there are lots of waterfront delivery points, the delivery can be done in smaller moving units. Those smaller moving units can move more quickly to their final destination and thereby increase efficiencies and reduce costs even if human drivers are still needed. These 5 feet wide units can slip into spots that 8 wide foot trucks cannot. When double parked, and with minor traffic lane modifications, a 5-foot-wide delivery unit prevents blockages without the need for total street surface increases.

These units fit standard shipping pallets if pallets need to be moved, and also fit most human objects, such as beds, furniture and appliances, since these need to fit through human sized doors. These five feet wide units are loaded on cellularized ships whether as rolling units or standard containers, and can be loaded and unloaded very quickly thereby reducing waterfront infrastructure footprints and costs.

These 5-foot wide units will zip through the city much faster and easier than conventional cars and if they become ubiquitous, New Yorkers will think: "Why don't we fit our asses in those five feet wide rolling cargo units?" Then NYC parking garages realize they can fit 30 percent more cars in their parking facilities, and NYC may say: "Maybe we should reduce congestion pricing by 30 percent on five foot wide passenger cars. And why not provide dedicated five foot wide traffic lanes?"

And yes, Ladies and Gentlemen, we will have entered a beneficial transportation cycle with the ability to achieve massive system wide efficiency increases. But remember: No proper width standard, no efficient waterborne micro cargo transportation system.

Somebody needs to set that standard. It costs nothing. NYCEDC, and the region's tax payers, are you listening? Set that standard before it is too late! It is free and will save you tons of money and carbon emissions!

For each column I write, **MREN** has agreed to make a small donation to an organization of my choice. For this column I nominate the **Waterfront Alliance, *www.waterfrontalliance.org***. This organization has been fighting for waterfront access in all its forms since 2000.

Top Marine Business Risks in 2024

By Rich Soja, *North American Head Marine, Allianz Commercial*

Cyber incidents such as ransomware attacks, data breaches, and IT disruptions are the biggest worry for companies globally in 2024, according to the 13th annual Allianz Risk Barometer, an annual business risk ranking incorporating the views of 3,069 risk management experts in 92 countries and territories including CEOs, risk managers, brokers and insurance experts. The closely interlinked peril of Business Interruption ranks second while Natural Catastrophes rose from sixth to third place this year.

While those risks may be top of mind for the global business community, the Marine and Shipping respondents had other threats keeping them up at night. Here is a look at the top five industry risks for 2024 according to the latest Allianz Risk Barometer. It's important to note that the Risk Barometer survey was conducted in October and November 2023 before tensions in the Red Sea escalated to the extent we are experiencing today:

Fires and Explosions

Retaining the top spot for another year is Fire/Explosion with 34% of industry respondents citing it as the leading 2024 business risk for marine and shipping businesses. Although fire risks are well understood and typically well risk managed, fire remains a significant cause of business interruption and supply chain disruption.

According to Allianz Risk Barometer global respondents it is the third top cause of business interruption they fear most after cyber incidents and natural catastrophes. Allianz Commercial analysis of more than 1,000 business interruption insurance claims over the past five years (worth US$1.3bn+) shows fire it is the most frequent driver of these claims and accounts for over a third by value (36%).

Fire has also become an elevated risk with electrification and the growing prevalence of lithium-ion batteries. Inadequate handling and transportation of these batteries has been linked to several large fire incidents at sea in recent years.

Regularly assessing and updating prudent fire mitigation practices, including preventative measures, fire extinguishing methods and contingency planning remain essential for all businesses to lower the risk of loss from an incident.

Natural Catastrophes

For Marine and Shipping risk professionals, Natural Catastrophes, which includes storm, flood, earthquake, wildfire and other extreme weather events, rank as the second most concerning business threat at 30%, up from fourth position in 2023.

Natural catastrophes incidents are already the fifth biggest cause of marine insurance claims, by frequency and severity according to Allianz analysis. Extreme weather was a contributing factor in at least 25% of the 54 total vessel losses reported in 2021, while drought in Europe during 2022 again caused major disruption to shipping on the Rhine. In the US, it dropped inland waterways around the Mississippi River to levels not seen for decades, impacting global transportation of crops such as grain.

Legislation and Regulation

Changes in legislation and regulation took the third spot at 23% falling from second place in 2023. Central to this issue for the shipping industry is decarbonization. Shipping is thought to contribute almost 3% of global greenhouse gas (GHG) emissions annually. If it were a country, the shipping industry would be considered the sixth largest emitter.

In 2018, the International Maritime Organization (IMO) committed to cut annual GHG emissions from international shipping by at least half by 2050, compared with their level in 2008, and work towards phasing out all GHG emissions from shipping as soon as possible in this century. It also set a goal to reduce the carbon intensity of international shipping by at least 40% by 2030, and 70% by 2050.

The IMO's target is ambitious, and the industry will need to accelerate its adoption of energy-efficient technologies and fuels, such as wind propulsion, biofuels, hydrogen, and ammonia to meet its goal.

Political Risks

Political risks and violence, including political instability, war, terrorism, coup d'état, civil com-

Top 5 risks in **Marine and shipping**

Source: Allianz Commercial

Figures represent how often a risk was selected as a percentage of all responses for that industry sector

Respondents: 80

Figures don't add up to 100% as up to three risks could be selected

NEW New entry in the top 5 risks

Rank		Percent	2023 rank	Trend
1	Fire, explosion	34%	*1 (29%)*	→
2	Natural catastrophes *(e.g., storm, flood, earthquake, wildfire, extreme weather events)*	30%	*4 (23%)*	↑
3	Changes in legislation and regulation *(e.g., tariffs, economic sanctions, protectionism, Euro-zone disintegration)*	23%	*2 (25%)*	↓
3	Political risks and violence *(e.g., political instability, war, terrorism, coup d'état, civil commotion, strikes, riots, looting)*	23%	NEW	↑
5	Business interruption *(incl. supply chain disruption)*	21%	*4 (23%)*	↓

Image courtesy Allianz Risk Barometer

motion, strikes, riots, and looting, is a new top five risk for the marine and shipping industry this year at 23%.

Businesses and their supply chains face considerable geo-political risks with war in Ukraine, conflict in the Middle East, and ongoing tensions around the world. Political risk in 2023 was at a five-year high, with some 100 countries considered at high or extreme risk of civil unrest.

Clearly shipping companies are facing something of a perfect storm in 2024 with the Red Sea attacks, potential escalation of tensions between the US and China in the South China Sea (which could impact trade routes further) and even some signs of piracy returning around Somalia.

Business Interruption

Rounding out the top five risks for marine and shipping companies is Business Interruption at 21% falling one spot from the 2023 rankings.

While companies may be confident that the worst of two key disruptors of recent times, the pandemic and the energy crisis, are behind them. Business disruption remains a key concern as firms are challenged to build resilience and diversify supply chains in a rapidly changing world. The shipping industry experienced this in the last months of 2023 when a severe drought restricted transits through the Panama shipping canal causing congestion and delays of up to two weeks.

The recent disruption in the Red Sea – a vital trade route between Europe and Asia – due to Houthi rebel attacks on vessels is the latest risk to hit shipping companies and supply chains. More than 400 container ships were diverted via the Cape of Good Hope around the southern tip of Africa between mid-December 2023 and the beginning of January 2024, as a result of the attacks, prolonging journeys and causing delays to the delivery of products.

The maritime industry is critical to the global economy with shipping transporting between 80% to 90% of world trade. While risks continue to evolve, significant improvements have been achieved. Thirty years ago, the global fleet was losing more than 200 vessels a year. At the end of 2022, fewer than 40 losses were reported. It has now been six years since a triple-digit total loss year. Commercial insurers continue to work closely with their shipping clients to identify and mitigate risks to protect the long-term health and safety of the industry.

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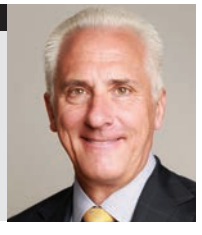


The Four E's of Marine Sustainability: EverClean's Solution to Biofouling

It is a new year, but the age-old problem of biofouling persists. Previous articles in this publication have highlighted the ongoing work in the field of biofouling management, but it is a drum that must be beaten frequently. Biofouling causes excessive fuel consumption and greenhouse gas (GHG) emissions, as well as enables the spread of aquatic nuisance species (ANS). Left unchecked, it can also become a maintenance problem. Simply, biofouling is both an economic (fuel consumption and maintenance costs) problem and an environmental (fossil fuels, GHG emissions, and ANS) problem. New solutions are emerging, but for successful uptake, these solutions must be effective, efficient, and economically viable—not to mention environmentally friendly.

Although finding an environmentally friendly solution seems painfully obvious with regard to solving an environmental problem, it's critical that the solution to the immediate problem does not simply kick the can down the road. Addressing the economic impacts also must not supersede the environmental concerns. As complex as this balancing act may seem, the early returns suggest taking a truly proactive cleaning approach to biofouling management works, such as utilizing Greensea IQ's EverClean product offering. This is achieved through the four E's: effectiveness, efficiency, economic viability, and environmental friendliness.

Greensea IQ van used for remote operations of EverClean robot fleet.

All images courtesy of Greensea IQ

The effectiveness of proactive cleaning can be viewed simply as the removal of fouling from a hull. It's quite obvious that if biofouling isn't removed, the cleaning wasn't terribly effective. But that's only part of the measure. Nearly as critical as removal when assessing frequent cleaning, the cleaning method must not damage the coating in any way or decrease the lifespan of the coating. Greensea IQ has conducted significant research to determine the optimal combination of brush material, speed, and downforce to ensure comprehensively effective cleaning. Panels are coated to manufacturers' specifications and allowed to foul naturally, then cleaned in a controlled environment. Accelerated wear testing is also conducted: the panels are subjected to up to a thousand brush passes, greatly exceeding the cleaning load a ship would ever expect to experience. The coating is then studied to determine if any scratching or other mechanical damage has occurred, and the dry film thickness is calculated and compared against the readings following application. With this information, shipowners can feel confident that employing EverClean for biofouling maintenance will not negatively impact the performance of their hull coating and will keep their hull free of performance-robbing fouling.

The efficiency of proactive cleaning is the measure of how the completion of a cleaning evolution impacts the vessel schedule. Time is money; traditional hull-cleaning methods often take multiple days to complete a cleaning, which may require the ship to be removed from service during that time. Large cleaning systems designed to clean macrofouling can be difficult to mobilize and deploy, adding time and expense to the operation. A large pierside footprint may prevent cleaning concurrently with other necessary in-port operations. EverClean, however, can fit into vessel operational schedules.

Cruise ships can be cleaned during normal passenger transfer port calls. Cleanings and cargo operations can occur simultaneously. How is this possible? The EverClean robots are small and require only a single cargo van on the pier. Multiple robots can be deployed simultaneously. Precision navigation ensures that the robots clean the targeted hull areas in an optimal pattern, typically overlapping passes running along the length of the hull without wasting time by repeatedly covering the same area or missing spots. Accurate navigation and minimal mobilization effort also allow for a full hull cleaning to be broken up into multiple visits over a short period of time. And finally, new advancements in long-range control allow for the EverClean system to be installed as a resident system onboard a ship and to be controlled from Greensea IQ's Massachusetts office. This allows cleanings to occur during idle or loiter times outside of port that would otherwise be lost time for the ship.

The economic viability of hull cleaning differs from most other types of ship maintenance, as there is a direct return on the cost of the cleaning recognized through fuel savings. Biofilms and microfouling increase hull resistance and thus fuel consumption and fuel costs. Hull cleaning costs money. All other things being equal, as long as the fuel savings are greater than the cost of cleaning, there is a positive return on investment. When considering traditional reactive cleaning methods, the limitations on their efficiency and effectiveness do not support the economic viability. Although 12 months of EverClean may cost more than one annual reactive cleaning, the total fuel saved (without damaging the coating or obstructing vessel operations) more than offsets the increased maintenance cost. The efficiencies previously described allow an EverClean evolution to be conducted at a significantly lower cost than a traditional reactive cleaning. Data collected over the past year has shown an average of 6% fuel savings and a 40% return on investment.

Environmental friendliness, or the "eco cost" of a cleaning, must consider all aspects of the cleaning, including the benefits provided and any environmental costs incurred by the process. A transfer from one type of environmental impact to another is not an acceptable solution. A clean hull is better for the environment than a fouled one. Burning less fuel, releasing fewer emissions, and minimizing the transport of ANS are all positive outcomes. Proactively maintaining a clean hull can maximize those benefits, and EverClean can accomplish this while keeping the other side of the balance sheet low. Gentle removal of fouling helps minimize the release of biocides, microplastics, and other contaminants into the water. The EverClean robots use very little power and can be easily powered by hotel power from a ship or the port facility; a small cargo van is far more fuel efficient than tractor trailers and crane trucks.

EverClean robot perfoming cleaning on ship hull in Port Canaveral, Florida.

EverClean robot during cleaning pattern.

When seeking hull-cleaning solutions, shipowners should be asking themselves how their options compare considering all these factors. In-water cleaning solutions that aim to keep hulls always clean are better for the environment, the ships' long-term performance, and the wallet.

The Author

Lander

Karl Lander is the Director, Regulatory Compliance and Outreach for EverClean at Greensea IQ having held the role at Armach Robotics following 4+ years with Greensea Systems, where he was Director, Hull Robotics.

Methanol's Superstorage Solution

Technical inquiries to SRC Group ramped up after it received Approval in Principle (AIP) for a concept which 'reinvented methanol fuel storage' on board ships. Delivering the answers has seen technical talk converting into project discussions

'Green' methanol has the ability to one day run vessels almost emission-free, and commercial shipping increasingly investigates. Derived today principally from natural gas, methanol is nonetheless available, relatively easy to handle and predictable. Lower carbon today, and potentially zero carbon tomorrow, methanol offers an alternative to HFO, and a pathway towards decarbonization targets.

A chief challenge to incorporating methanol as a maritime fuel traditionally has been its space inefficiency, as ton-for-ton, it takes 2.4 times more methanol to generate the equivalent energy as HFO.

Conventionally, tanks storing low flashpoint fuels on board ship feature cofferdams of at least 600mm across to separate internal and external walls. Included as a safety precaution, the gap also restricts capacity.

Imaginative design can help find unused spaces for extra storage on board a newbuild ship, but opportunities are more limited on existing vessels. Where retrofitting a dual fuel engine to run on methanol is feasible, the fuel storage issue may restrict a ship to short voyages or demand more frequent bunkering – both of which impact on ROI.

In October 2023 Lloyd's Register granted Approval in Principle (AiP) for SRC Group's 'Methanol Superstorage,' a retrofitted tank storage solution that increases volume by 85%, according to SRC, but can be installed with only a minimal impact on the general arrangement.

Closing the Gap

Methanol Superstorage solution dispenses with the cofferdam altogether and instead installs tank walls formed by sandwich panel system (SPS) technology, consisting of a continuous polymer core that has been injected between two steel surfaces.

Approved for permanent repairs by all major IACS class societies, SPS technology has been used in maritime and offshore applications for over two decades - including for corrosion repairs in ship structures. Class approvals secured have involved laboratory testing of the polymer core material for chemical resistance - including for methanol. Engineering, Procurement, Construction and Installation (EPCI) service provider SRC has experience of complex refits across over 5,000 projects worldwide, including extensive experience of the patent protected SPS technology process.

For the Methanol Superstorage fuel tank, a 25mm thick steel-polymer-steel barrier provides protection against fire or leakage that is equivalent to a conventional tank, according to SRC. The injected polymer also creates oxygen-free conditions behind the steel plates to prevent corrosion.

The SPS sandwich panel system can be used in lieu of cofferdams on all tank boundaries including those facing to shell plating.

"We always knew how significant Methanol Superstorage would be, because existing ships need to play a full role in energy transition if GHG emission targets are going to be met and storage capacity is a key challenge," said Hannes Lilp, CEO, SRC Group. "We are already in detailed discussions with a well-known ferry operator, while we've been approached by cargo ship operators, offshore support vessel owners, tug companies, shipyards in Europe and Asia, and by the marine engine suppliers. One area that has surprised us has been the high level of interest from the super yacht sector."

Less surprising has been the flow of inquiries from cruise ship owners, many of which have already been studying the feasibility of retrofitting ships for methanol as a marine fuel.

"These are new and confidential discussions, but what I can say is that live projects are under review to accommodate consideration of Methanol Superstorage, while one project that looked dead is being revived," said Lilp. The in-flow of technical questions from all corners of the maritime industry has been "almost overwhelming."

The Path to Classification

Securing AiP provides a technology developer with a statement from Class confirming that there are no major obstacles to future certification or classification. Discussions covering ap-

provals from other classification societies are ongoing, said Lilp, although he acknowledges that journey from AiP to full class approval is substantive. In an area where the regulations underlying fuel storage are evolving, additional scrutiny can be expected.

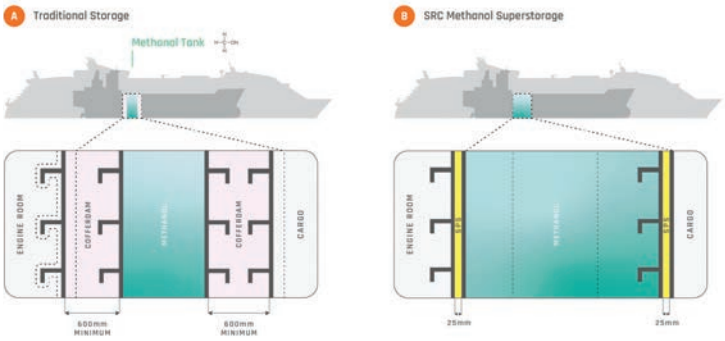
"Due to the regulatory status of low flash point fuels all methanol fuelled ships need to go through a Risk Based Certification process that includes full risk assessment for the whole methanol fuel system from bunkering station to the engines," said Alex Vainokivi, Innovation Manager, SRC Group. "AiP is part of the risk assessment. Any final approval for a methanol fuelled ship comes from the Flag State Administration."

Nevertheless, key SPS technology characteristics are not in dispute. "For example, under fire testing, and when the core thickness for SPS structure is more than 25mm it has satisfied the fire safety objectives and the functional requirements of SOLAS A-60 regulations without the need to install thermal insulation," says Vainokivi.

"We will establish whether inerting and venting are needed on a case-by-case basis – and the same for fire and leakage detection – but the requirements relating to cofferdams can be dispensed with. From that perspective, the solution provides equivalent 'triple barrier protection' to prescriptive requirements for cofferdams adjacent to all space categories – including accommodation."

As of September 2023, methanol had been specified for 216 newbuilds, according to figures from DNV, and Clarksons estimates that 1,200 ships could be powered by methanol by 2030.

Lilp says the most frequently asked question SRC has been fielding concerns whether Methanol Superstorage is as appropriate for newbuildings as it is for retrofits. "The answer is an emphatic yes: fuel storage tanks can be constructed using the SPS sandwich panel system in lieu of cofferdams on both new build and refit projects. We seek to open more direct channels of communication for questions from major shipbuilders and designers worldwide."



Scan the QR Code to Download the Intelatus Floating Production White Paper.

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Floating Production – A growing segment in transition

The specialized deepwater oil & gas and floating offshore wind segments will share many of the same stakeholders and supply chains, competing for increasingly scarce resources.

By Philip Lewis, *Director of Research, Intelatus*

The established floating production segment is forecast to experience continued growth through this decade, driving demand for, among other things, moorings, subsea systems, umbilicals, risers, flowlines and the large anchor handlers and subsea support vessels that will install and maintain the elements.

At the same time, the floating wind segment will move from demonstration and pilot scale projects to pre-commercial and commercial scale arrays and will consume large amounts of mooring components and dynamic electrical cables as well as the large anchor handler and subsea support vessel capacity that will install and maintain the elements.

Much of the new floating wind supply chain will leverage the existing floating oil & gas supply chains. Players experienced in deepwater oil & gas operations, whether developers, EPCI contractors or component and service suppliers, will find a growing opportunity to leverage their skills in the emerging floating wind segment.

These are the findings of a new whitepaper produced by Intelatus Global partners entitled “Floating Production and Floating Wind – increasingly close segments”.

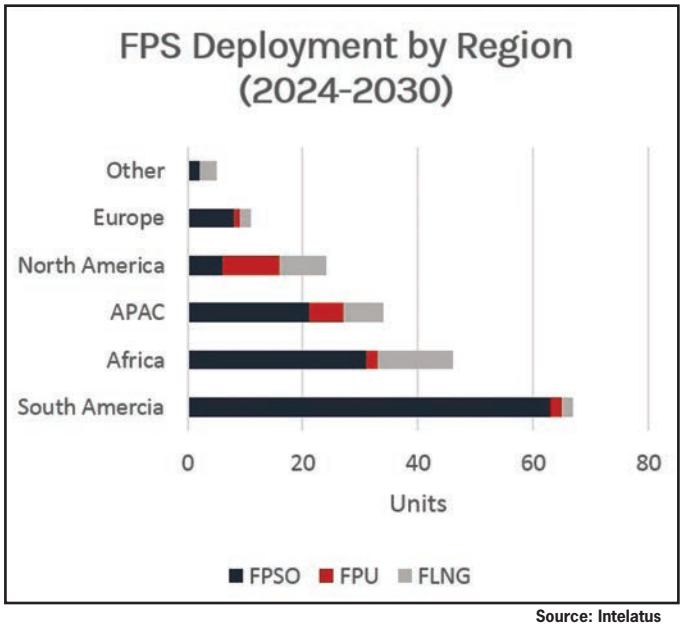
A Growing Floating Production Segment

According to the latest Intelatus deepwater floating production forecast, floating production activity in the oil & gas sector is set to grow at an average 25 floaters per year through 2030, and the foundations are in place for continued activity through the next decade.

There will be over 260 floating production systems installed globally by the end of 2023. Over 185 new floaters will be installed by the end of 2030, of which 70% will be FPSOs, close to 20% FLNGs and floating production units without storage (semi-subs, TLPs and spars) over 10%.

We forecast that more than two thirds of new floating production units installed between 2024 and 2030 will be located in South and Central American countries, of which Brazil and Guyana will account for around 90% of the share of units.

FLOATING PRODUCTION SYSTEM FLEET DEPLOYMENT BY REGION (2024-2030)



Source: Intelatus

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What fuel next?

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FPSO technology dominates the region's FPS demand.

In all, 18 countries in West and East Africa are expected to receive new FPSOs, FLNGs and FPUs between 2024 and 2030. Africa is forecast to be home to the largest number of FLNGs in our forecast, accounting for over 35% of global installations.

The third most active floating production region from 2024-2030 is forecast to be Asia Pacific. Over 60% of the activity in the region is anticipated to come from FPSOs, with FLNGs and FPUs each accounting for around 20% of the units.

Over 80% of the activity forecast for North America will be located in the U.S and Mexican Gulf of Mexico. The region will be home to the largest number of FPUs, accounting for close to half of our global forecast.

A segment in transition

We are noting a transition in the business models of many floating production system owners. Changes include deploying the latest technologies to decarbonize floating production operations and transition floating production activity into a wider floating energy business that leverages the skills and lessons learnt from deepwater oil & gas projects into the emerging floating wind segment, with measures including:

- The use gas and reduction in routine flaring, whether through liquefaction or pipeline export.
- The increased deployment of carbon capture technologies coupled with the reinjection of carbon dioxide into wells (e.g. Petrobras plans to inject CO2 into pre-salt storage).
- The wider scale adoption of combined cycle power generation and topside electrification by several leading FPSO owners. Sources of power investigated by some developers for floating production systems include renewable energy, such as offshore wind.
- Leveraging Industry 4.0 technologies to improve production unit operations and maintenance performance, including IoT connectivity, digital twins and autonomous operations.
- An emerging floating production segment – the production and storage of low and zero emission energy carriers, such as methanol and ammonia. One exciting development leverages Generation IV small modular nuclear reactors to provide the power and heat required to desalinate seawater, power electrolyzers and other production, storage and offloading systems. Concepts are being developed in South Korea and Europe.
- Finally, we are seeing a trend of certain key players in the floating production segment to leverage their expertise for executing challenging and large projects in deep water into the floating wind space, including Petrobras, Shell, TotalEnergies, Equinor, CNOOC, SBM Offshore, MODEC and BW Offshore.

COMPARING DEEP WATER OIL & GAS AND FLOATING WIND MOORING DEMAND DRIVERS

Example Project Comparison	1 GW Floating Wind Farm	Deepwater FPSO
Units	66	1
Mooring line/ unit (m)	1,000	2,500
Line/floater	≥3	16
Mooring lines (m)	198,000	40,000
Anchors	≥198	16

Source: Intelatus interpretation of information from Equinor and Shell

Competing for the Same Supply Chains

The growth in activity in both the floating production and the floating wind segments will drive increased demand for engineering services, shipyard and port capacity, mooring system supply, dynamic subsea cables and specialist installation vessels. We are forecasting some potential supply chain bottlenecks as a result of the increased activity.

To show how floating production and floating wind projects will compete for similar resources, we will use a high-level simple example comparing a "typical" FPSO with a "typical" floating wind project deploying conventional moorings.

If we apply this simple "rule of thumb" approach to our floating production and floating wind mooring pre-lay forecast through 2030, floating wind accounts for around 30% of the total mooring line quantity required and nearly 50% of the anchor volume.

This will be a challenge for the existing higher spec vessel supply side to accommodate, given its current high utilization. The Intelatus Floating Wind Installation Vessel Forecast analyses the commercial and technical potential vessel capacity and capability gaps in detail as well as why the commercial conditions don't yet really exist for sustained new building activity.

Floating wind is a new technology where engineers continue to search for innovative ways to deliver commercial scale projects. However, at least in the short- to mid-term, developers will need to rely on existing technologies and supply chain capabilities to deliver commercial scale wind farms, technologies that have been developed over years in the deepwater floating production segment.

Players experienced in deepwater oil & gas operations, whether developers, EPCI contractors or component and service suppliers, will find a growing opportunity to leverage their skills in the emerging floating wind segment.

However, the stakeholders in both segments should be aware of a forecast shortage and therefore increased competition for supply chain resources.

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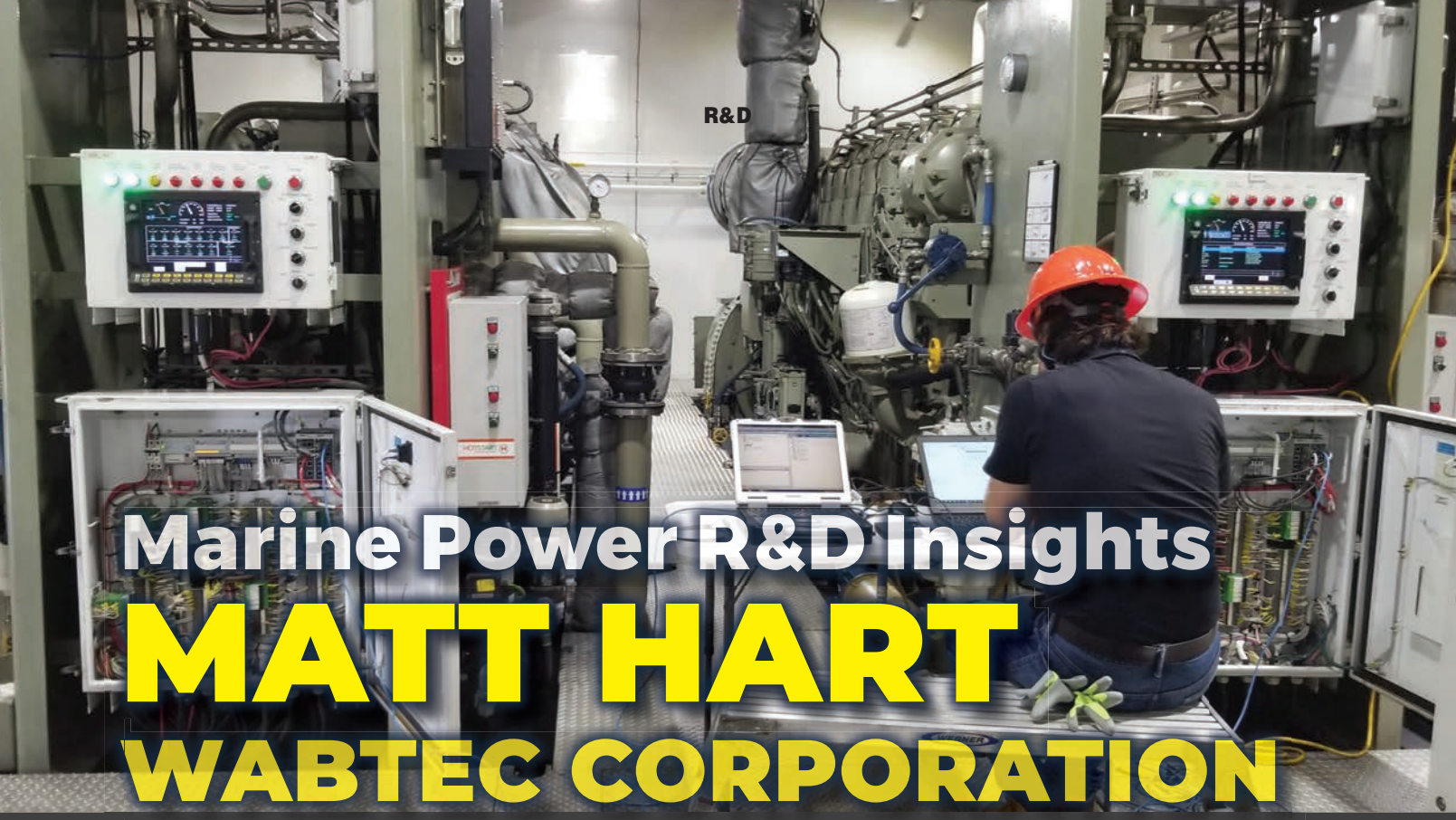


Marine Power R&D Insights

MATT HART

WABTEC CORPORATION

***Matt Hart**, Manager & Platform Leader, Marine & Stationary Power Systems, Wabtec, offers insights on how the megatrends of decarbonization, energy transition and autonomy all inspire and impact the marine power solutions from Wabtec.*

By Greg Trauthwein

Image courtesy Wabtec

Matt, to start us off, can you provide insight on the journey to your present position?

I graduated from the University of Notre Dame with an undergraduate in Mechanical Engineering and started with General Electric in the Edison Engineering Development rotational program at the Erie, PA, site, primarily focused on the development and release of the new Tier 4 locomotive. Following that, I focused my interest into the area of engine performance calibration, emissions and combustion research through a ME master's degree at Georgia Tech and through experience at GE with development programs for our Tier 4 Rail and FDL Locomotive Modernization programs. From there, I decided to go back to school and get my MBA from Gannon University here in Erie. Leveraging that growth opportunity, I moved into Wabtec's Engine Platforms Team, leading key reliability cases and maritime programs; which led me to the current role I have now as the Marine & Stationary Platform Leader, responsible for the product development and install base support across our full Engine Technology organization, as well as leading our Marine & Stationary Systems team.

Wabtec is huge, pervasive in power across industries, but not broadly known globally in the maritime sector. Please give a 'By the Numbers' look at the company today.

Wabtec is a Fortune 500 company based in Pittsburgh, PA with about a $8-9B revenue. We are based in more than 50 countries, with more than 27,000 employees, and we have more than 50 years of engine manufacturing experience, with more than 30,000 engines produced across all applications. The maritime business is a group within our Freight Equipment business, with more than 1,000 engines in service or commissioning, primarily powering customers in the work boat sectors, including dredging, river tugs, harbor tugs, ATBs, ferries, and medium-size cruise ships.

Can you give us a bit more on the background of the engine line-up?

Wabtec's first marine engine product was introduced back in the late 1960's for Lower Lakes Towing and was primarily the rail V228 engine, or FDL as it is known in the rail industry. Fast forward to the 1990s and 2000s, Wabtec was now offering a

"Wabtec achieved Tier 4 NOx and PM without the use of aftertreatment, *which sets our product apart from the competition in unlocking logistical flexibility and life-cycle cost savings for the owner."*

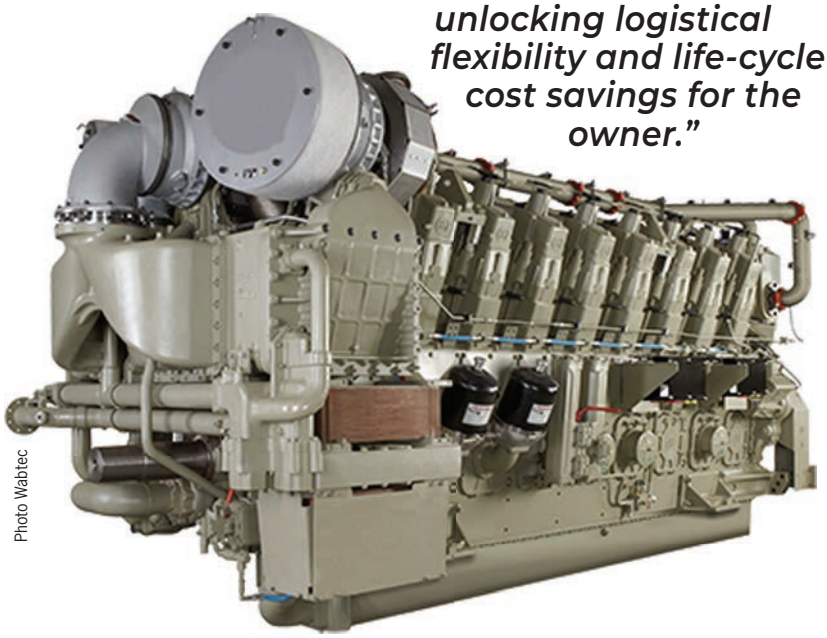


Photo Wabtec

Matthew Hart, Manager & Platform Leader, Marine & Stationary Power Systems, Wabtec

Photo Carly Masiroff

marinized version of the V228 product from 8 to 16 cylinders. That engine is called the V228 for the bore size in millimeters.

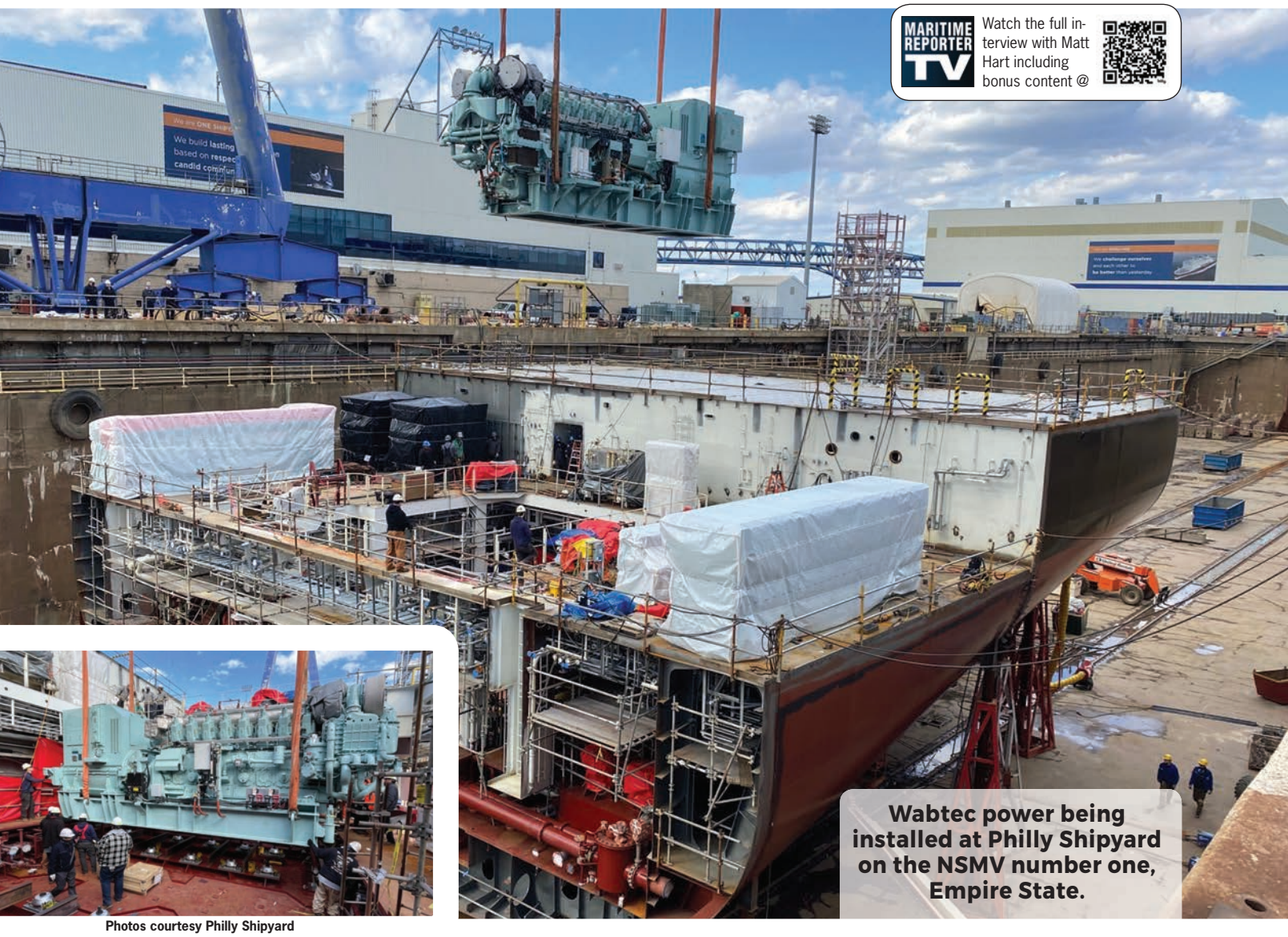
With the advent of emissions regulations for EPA and IMO, Wabtec developed a marinized version of its Evolution-series Engine, known as the 250MDA & MDB products. When EPA Tier 4 and IMO Tier III were introduced in 2015/2016, Wabtec again offered a marinized version of its Tier 4 solution. Wabtec achieved Tier 4 NOx and PM without the use of aftertreatment, which sets our product apart from the competition in unlocking logistical flexibility and life-cycle cost savings for the owner.

How does the experience from working in multiple sectors lend to the marine engine line-up?

First and foremost is the design robustness. When we talk about the rail application, one of the things that come to mind is tunnel performance, extreme environment performance, as well as long maintenance cycles. Serving our customers through improved lifecycle cost, trade-offs, it also allows us to do concurrent design and reliability demonstrations. We're able to learn across both applications to make them better where one application might be more extreme from another, so we can take the most robust design proven in all applications and apply it in the best manner possible. The biggest piece for Tier 4, when we were developing that in the rail industry, was a heavy push away from the use of urea because of the logistics and the infrastructure that would be needed. That really helped prop up the unique marine solution.

Can you discuss Wabtec R&D efforts designed to cut emissions?

Wabtec is committed to offering alternative fuel solutions across it's inline and V-configured 250mm bore diameter engine families. The L/V250 engine family has more than a decade of dual fuel operation with diesel fuel and LNG. Bio-



Wabtec power being installed at Philly Shipyard on the NSMV number one, Empire State.

Photos courtesy Philly Shipyard

fuel blends up to 100% are in operation today, running on both biodiesel and renewable diesel blends. Wabtec also is investing in low carbon fuel technologies through its' alternative fuels programs that includes the use of hydrogen, methanol, and ammonia fuel. The L/V250 engines are designed with the features, like 250bar firing pressure capability, that allow for minimally invasive engine adaptations (top deck and fuel system) of the engine when transitioning to low carbon fuels if and when our customers operations support the introduction of such fuels. One example of this is the single cylinder and combustion modeling research and development we are conducting with Oak Ridge National Lab and Argonne National Lab.

With alternative fuels come a new set of technical considerations. When you look at the adoption of alternative fuels, where do you see the need to explore potential points of weakness?

One of the big components is going to be the cylinder head based on the requirements of a customer for multi fuel use. The substitution ratios they require is going to determine what kind of fuel injection system is used – port, low or medium pressure fuel injection, high pressure direct injection – that's going to dramatically change the fuel injection technology, and the cylinder head design could include multiple injectors.

Another big one is, depending on the injection technology and like we talk about hydrogen with high pressure, is driving towards a cryo fuel pump, which is something that does not exist in service. It is being invented by a number of companies, so that's another key area that we're investigating.

Is Wabtec preparing its engines for the advent of the autonomous engine room?

Absolutely. It is something that we're taking to heart readily, designing for long maintenance intervals to make sure that our engines don't have to be touched from a maintenance perspective to allow longer unmanned operation. In 2022 we released a new technology to our engine, an automated blow-down strategy to allow an unmanned engine room.

What's the biggest challenge in your job?

The ever-changing regulatory landscape on fuels and making sure that we are ready when the "green-fuel" supply chain catches up to the desire to transition.

ARC KEEPING THE CARGO ROLLING

With a fleet of nine U.S.-flag RoRo ships, American Roll-On Roll-Off Carrier Group (ARC), is the U.S.' premier commercial RoRo carrier of U.S. government and military cargo. As the world becomes an increasingly contentious place, ***Eric P. Ebeling, President & CEO, ARC****, discusses the vast capabilities of the ARC fleet and logistics network, as well as the challenges and opportunities ahead for U.S.-flag ships in the international trade.*

By Greg Trauthwein

'By the numbers' is a simplistic means to gauge the size and shape of any shipping company, and ARC, with its nine U.S.-flag RoRo ships in the fleet, its 64 shoreside employees and 350 American merchant mariners, ranks at the top as the largest U.S.-flag RoRo operator. But the numbers only tell part of the story and ARC is not only a shipowner. ARC is a multi-modal logistics services company built to serve primarily the needs of the U.S. government transporting heavy lifts of government machinery globally, predominantly into Northern Europe as of the last few years.

Headquartered in Ponte Vedra Beach, FL, ARC ships sail primarily out of three U.S. base ports (Baltimore, Brunswick and Galveston), today sailing primarily into three key Northern European ports (Antwerp, Southampton and Bremerhaven). ARC has operated in the transatlantic trade for more than 35 years. Sitting at the helm is Eric P. Ebeling, long-term with the company and President & CEO since 2015.

"We've fully recapitalized our fleet since 2016; that's eight ships we've brought into the U.S.-flag fleet and the Maritime Security Program (MSP) and Voluntary Intermodal Sealift Agreement (VISA) since 2016," said Ebeling. "A lot of work goes into finding the right ships with the right capabilities. It's exciting and you have to make a business case to make those kinds of investments too, because you're talking about 30-year assets that cost hundreds of millions of dollars."

ARC is focused on acquiring and operating the most militarily useful and commercially viable ships for its military, and commercial customers, too. Via its participation in the U.S. government MSP and VISA programs, ARC guarantees capacity to the U.S. government, and in the most recent year around 55% of ARC's revenue was from ocean cargo carried for the U.S. government, said **Christian Heibel, SVP Commercial, ARC**. "The underlying bedrock maritime program for the international U.S. flag fleet is the Maritime Security Program; it's important that that program stays strong and stable," he said.

The latest vessel to enter the fleet is the M/V ARC Honor, a 230-m long RoRo with with a 6.5-m high stern opening and a stern ramp rated for cargo weighing up to 320 MT, the company's fourth U.S.-flag LCTC (large car truck carrier) vessel.

According to Heibel, the characteristics that make the ARC fleet stand out are the door and deck heights and the strengthened ramps and decks to accommodate volumes of heavy military kit.

"We need a high main deck to accommodate certain aviation assets and projects" said Heibel. "For example, every aviation brigade has the Chinooks, and if you can't carry the Chinooks, you can't carry the brigade. It also helps us to carry certain project government and commercial cargoes for the 'high and heavy' market, which includes mining, agricultural and construction equipment."

While each ship in the ARC fleet has its own capabilities, Heibel was

"MSP really only works when it's hand in glove with the cargo preference laws. Those are the laws that generate the cargo that moves on US flag vessels. **Really, it's cargo – those preference cargoes – that's the key incentive for US flag operators in international trade.** Nobody's going to operate a US flag ship just for the MSP stipend. It's a cargo driven industry, and those cargoes help to offset the foreign flag cost differential."

Eric P. Ebeling, President & CEO, ARC

Image courtesy ARC

particularly bullish on the ship Endurance, which he calls "extraordinary." Endurance is a ro-ro built originally for the mining industry in 1996 and boasts 262,000 sq. ft. of military capacity and nearly 500,000 sq. ft. of commercial capacity. "Although the oldest ship in MSP, Endurance is still the most militarily useful vessel in the U.S.-flag fleet."

The Importance of MSP

CEO Ebeling is naturally concerned first and foremost with ARC and all that goes into running a safe, efficient, and profitable fleet and company, primarily eying the dual challenges of fleet decarbonization while simultaneously working to ensure that ARC has the people it wants and needs to conduct business. But as the country's largest RoRo carrier transporting equipment that is central to U.S. presence and influence globally, he also embraces a higher calling to a bigger purpose; namely "the development and implementation of a national maritime strategy that is focused on the importance of a U.S.-flag commercial fleet in international trade."

"We're talking about the fleet and the assets here, but as we are the country's biggest RoRo carrier, we are also keenly aware of the importance of the U.S. Merchant Marine as well, the guys that are actually operating on the ships," said Ebeling. "Another part that's an important component that sometimes gets lost: we talk a lot about national defense, national security, and those are obviously important aspects, but we also support the country's economic security, and that's increasingly (and equally) important."

The Maritime Security Program (MSP) was established by President Clinton in 1996 as part of the Maritime Security Act of 1996, and MSP maintains a fleet of 60 commercially viable, militarily useful merchant ships active in international trade.

The MSP fleet is available to support U.S. Department of Defense (DoD) sustainment sealift requirements during

times of conflict or in other national emergencies, and the program also provides DoD access to MSP participants' global intermodal transportation network of terminals, facilities, logistic management services, and U.S. citizen merchant mariners.

Ebeling is understandably supportive of the Maritime Security Program (MSP), a program that pays a 'readiness retainer' of $5.3m per year per U.S. flag ship in the program, primarily positioned as payment to offset the higher costs of operating U.S.-flag ships and employing U.S. citizen crews as compared to mariners from developing countries which crew the majority of the international commercial fleet.

"I think it's important and relevant to focus on the commitment and the performance of the U.S. flag fleet and international trade over the decades," said Ebeling. "If you look at Iraq and Afghanistan, 98% of those cargoes were transported to the region, either on U.S.-flag commercial ships or US. government owned and or controlled ships. Those are all crewed by U.S. citizen merchant mariners; that's important. Taking a more recent look, something like 90% of the sustainment cargo that supported military options in those countries moved on the U.S.-flag commercial fleet as well. And then of course, more recently, that trend has continued today in Europe with those operations relating to Ukraine."

Ebeling's point is highlighting the cumulative true value of MSP and the operations it supports.

"It's much more than just the floating asset, it's also the global intermodal networks, it's the mariners, it's the systems that the carriers and operators bring to the table, all provided by the MSP fleet, and it would cost the government tens of billions of dollars to try to replicate that … if they could replicate that. And these US flag commercial ships can also operate in places that a gray hull might not be able."

He cites the Navy League's most recent maritime policy document for 2023/24, which estimated it would cost $13 billion in taxpayer funds just to do the vessel capacity alone without MSP, not to mention the billions it would add to emulate the logistics network.

"MSP really only works when it's hand in glove with the cargo preference laws," said Ebeling. "Those are the laws that generate the cargo that moves on US flag vessels. Really, it's cargo – those preference cargoes – that's the key incentive for US flag operators in international trade. Nobody's going to

Left: Christian Heibel, SVP Commercial, ARC
Below: M/V Patriot loads a V22 in Jacksonville, FL.
Below Right: M/V Freedom loads an Amtrak railcar for export in Zeebrugge.

Images courtesy ARC

operate a US flag ship just for the MSP stipend. It's a cargo driven industry, and those cargoes help to offset the foreign flag cost differential."

The $5.3m stipend per ship was the amount decided when MSP was last reauthorized in 2019, and at the time Ebeling said the amount was sufficient for its purpose. But with the Covid pandemic and the myriad of changing cost dynamics, from raging inflation to supply chain snarls, he said it's worth revisiting if that payment is sufficient in 2024.

ARC & the Wallenius Wilhelmsen ASA Group

As a part of the Wallenius Wilhelmsen Group ASA, ARC is able to tap a shipping, port and logistics value chain globally that measures its experience in centuries, not decades. With experience

"We're one of four different business units in the group, and there are a lot of synergies," said Ebeling. "But we have an independent board of US directors at ARC. Our chairman is General John Handy, a former commander of U.S. Transportation Command. We have a strong U.S. citizen leadership team also, and that's really to make sure that we maintain U.S. control of the company and our ships, which are carrying those government cargoes. So that's relevant."

In total Wallenius Wilhelmsen Group ASA [according to its 2022 Annual Report] encompasses 125 vessels transporting 3.65 million units; eight terminals handling more than 3.1 million units; and 66 services and processing centers, processing more than 5.1 million vehicles. In 2022 it had 8,875 employees in 29 countries.

"We have a lot of synergies within the Wallenius Wilhelmsen group of companies," said Ebeling. "We can tap into port services, logistics services, other capabilities. So it is a bit of a force multiplier for us, and it does help us in turn, provide better service to our customer through that global network. We are certainly a unique business unit within the Wallenius Wilhelmsen group given our mission and our customer set. But there's a lot of benefits to being a part of that global company as well."

This synergy extends too when facing one of the most pervasive challenges facing any shipowner today: embracing and enacting energy transition to hit decarbonization targets.

"There are some really unique challenges around greenhouse gas emissions and decarbonization," said Ebeling. "That's an important part of our long-term strategy, but by the same token, industry is not going to do that alone. We need clear policy guidance to guide our strategic decisions, whether that's from the U.S. government or the IMO."

As an example of "clarity and consistency," Ebeling points first to "the simple stuff" … or what reasonably should be considered simple, and that's scoring a ship's emission signature. "Are we scoring it on well to wake or are we scoring it on tank to wake? You can get different answers, and that's just one potential talking point. Also, there are around 16 different fuel options for ships today. But are those fuels available in industrial quantities? Are they available globally? You can't easily, or cost-effectively change fuel in an existing ship."

"So really it's about getting to some uniform, consistent regulation so that we can make the smart capital investments and decisions to continue to grow our US flag merchant fleet."

Photo courtesy Marine and Industrial Transmissions

STERN TUBE DAMAGE DECLINING?

It might be easy to blame EALs, but the ongoing causes of stern tube damage are varied, and possibly declining.

By Wendy Laursen

Photo courtesy Marine and Industrial Transmissions

Environmentally Acceptable lubricants (EALs) gained market traction with the introduction of US VGP regulations in 2013. Since then, DNV has observed two major trends. The first, starting in 2013 was early life damage, either during sea trials or within the first five years of operation, where aft stern tube bearings typically failed under extreme load conditions. Then from around 2018, vessels of about 10 years of age and above started experiencing bearing damage, with many of them having lubricant contamination problems. The affected vessels were often delivered with mineral oil then converted to EALs and subsequently suffered sealing problems.

DNV rules support the use of mineral lubricants, EALs and water lubrication and are complemented by relevant technical publications with recommendations to overcome known issues. In its November 2023 guidance, DNV recommended in-

Photo Courtesy DNV

"Our recommendations are simple. Please have good control over your oil quality in the primary barrier, the aft sealing system,"

– Arun Sethumadhavan
Senior Principal Engineer, DNV

Photo Courtesy DNV

"A good bearing design is important."

– Øystein Åsheim Alnes
Head of section for Propulsion and Steering, DNV

stalling a proactive warning system that alerts the crew to any concerning rate-of-rise in bearing temperature or if the draft of the vessel could leave the propeller partially immersed. In addition, on older vessels DNV recommends that EAL viscosity should be increased one grade up from the design specifications of the installation.

"Our recommendations are simple. Please have good control over your oil quality in the primary barrier, the aft sealing system," says DNV Senior Principal Engineer Arun Sethumadhavan. "The solutions are not intrusive."

Current sentiment seems to bear that out. Manufacturer Panolin noted strong support for EALs at a 2023 trade show. "As the shipping industry looks toward the future, sustainability is becoming a priority. In fact, it was the overriding theme at Sea Asia."

However, insurer Gard remains concerned about EAL failure, and company analysts voiced them in October 2023 when they released an analysis of the last 10 years of claims. One of the things they noted was the IACS suggested limit of 1% water being allowable: "The speed of hydrolysis depends on various factors, for example, chemistry of the oil, temperature and additives. The most important factor, however, is the quantity of sea water present in the lubricant. The 1% limit is quite 'relaxed' for EALs."

Still, the Gard data shows claims in excess of $5,000 increasing in number up to 2020 and then declining: from 134 in 2020, to 118 in 2021 and 87 in 2022 – a noteworthy decline.

Ship repairs are the day-to-day concern of UK-based Marine and Industrial Transmissions, and the company's engineers don't see any current trends in the causes of stern tube damage. A recent case study demonstrates what can go wrong though: upon interviewing the Chief Engineer of a vessel they were recently called out to, it was discovered that the stern bearings had overheated due to loss of lubricating fluid. This caused the bearing faces to become seized to the shaft momentarily, leading to accelerated bearing wear, with the bearing material migrating through the lubrication system. Rudder, propeller and shaft needed to be removed in dry dock before the required repairs could be completed.

"Design fault" was a common category assigned to Gard claims, which could indicate shipyard errors unrelated to lubricant choice.

DNV Head of section for Propulsion and Steering in Oslo, Øystein Åsheim Alnes explains one of the key challenges. Different operating conditions mean different loading conditions on different parts of the aft stern tube bearing. "The weight

Photo Courtesy Marine and Industrial Transmissions

Removing the stern tube bearings.

of the propeller in combination with hydrodynamic propeller loads in certain operating conditions can lead to aft end edge loading. The most critical parameter for ensuring that doesn't happen is to slope the bearings to better match the slope of the shaft. A good bearing design is important." DNV's November 2023 guidance suggested the use of double-sloped aft bearings to optimize load distribution.

A large number of the incidents analyzed by Gard were attributed to ghost fishing gear that enter the stern tube seal area causing seawater to contaminate the lubrication oil. A 2022 study by CSIRO scientists estimated that the amount of longline fishing gear littering the ocean each year can circle the Earth more than 18 times. Additionally, 14 billion longline hooks litter the sea each year, but this too could be a declining problem. Huge as they are, the researchers found lower levels of fishing gear losses in this study than in a previous study published in 2019 – potentially the result of better weather forecasts and improved marking and tracking of fishing gear.

President Bob Shortridge says Lignum Vitae's water-lubricated stern tube bearings stand out for its longevity and shock resistance. The company places a strong emphasis on addressing the issue of high bearing wear, particularly in slow sailing vessels. In pursuit of optimal performance, Lignum Vitae is engaged in engineering tests in collaboration with Hydro Tech in Canada. These tests are focused on modeling bearing performance under different loads and speeds, enabling customization of clearance and pitch angles. This approach deviates from the one-size-fits-all method commonly observed with other bearings and has led to dramatically reduced bearing replacement time in drydock.

Unsurprisingly, seawater-lubricated bearings pioneer Thordon Bearings welcomed the publication of Gard's data. "Let's

A Thordon Bearings stern tube-less ship concept.

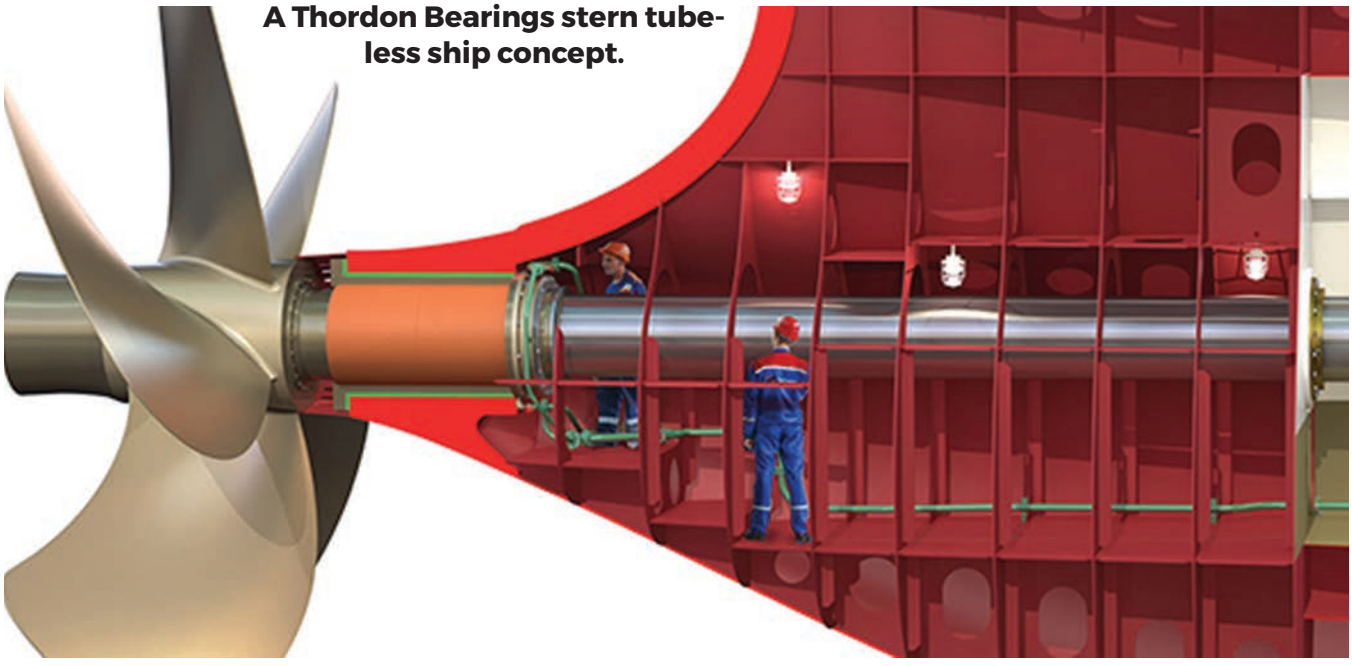


Photo Courtesy Thordon Bearings

not forget any oil leak, big or small, can be catastrophic to the marine environment and marine life, with some EALs found to be only slightly less damaging than the phased-out traditional oils," said VP of Business Development, Craig Carter.

Water lubrication has faced its own challenges over the past decade. Individual class societies have gradually updated their rules to reflect the modernization of seawater lubricated bearing materials and systems. Previously, seawater-based systems had to comply with costly five-yearly shaft withdrawal requirements. They are now subject to the same extended 15 to 18-year shaft withdrawal inspection periods as those using oil lubrication, subject to monitoring criteria.

Thordon announced in December 2023 that it is forming the Blue Ocean Alliance with Wärtsilä to promote a stern tube-less ship concept. The design replaces a vessel's stern tube with an irregular shaped chamber that allows a shorter, water-lubricated propeller shaft to be inspected and maintained while the vessel is afloat.

Wärtsilä has also introduced EvoTube, a simplified system with fewer components than a conventional stern tube system, which is suitable for both oil and water lubrication systems. The inboard seal is mounted directly on the aft bearing housing, and the forward bearing is replaced with a standalone bearing inside the engine room. Its design optimizes space utilization and eases maintenance tasks.

So, the coming decade promises to be interesting and hopefully less concerning than the last for the Gard analysts.

Lignum Vitae is engaged in engineering tests in collaboration with Hydro Tech in Canada.

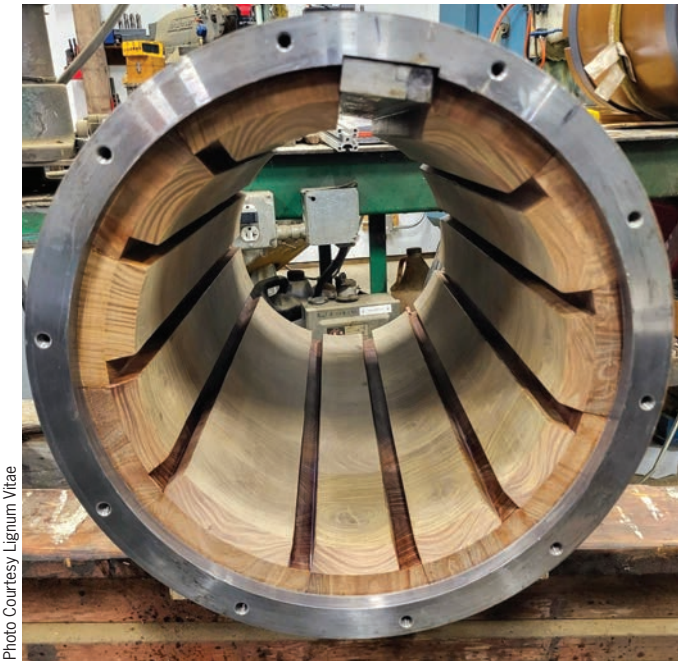
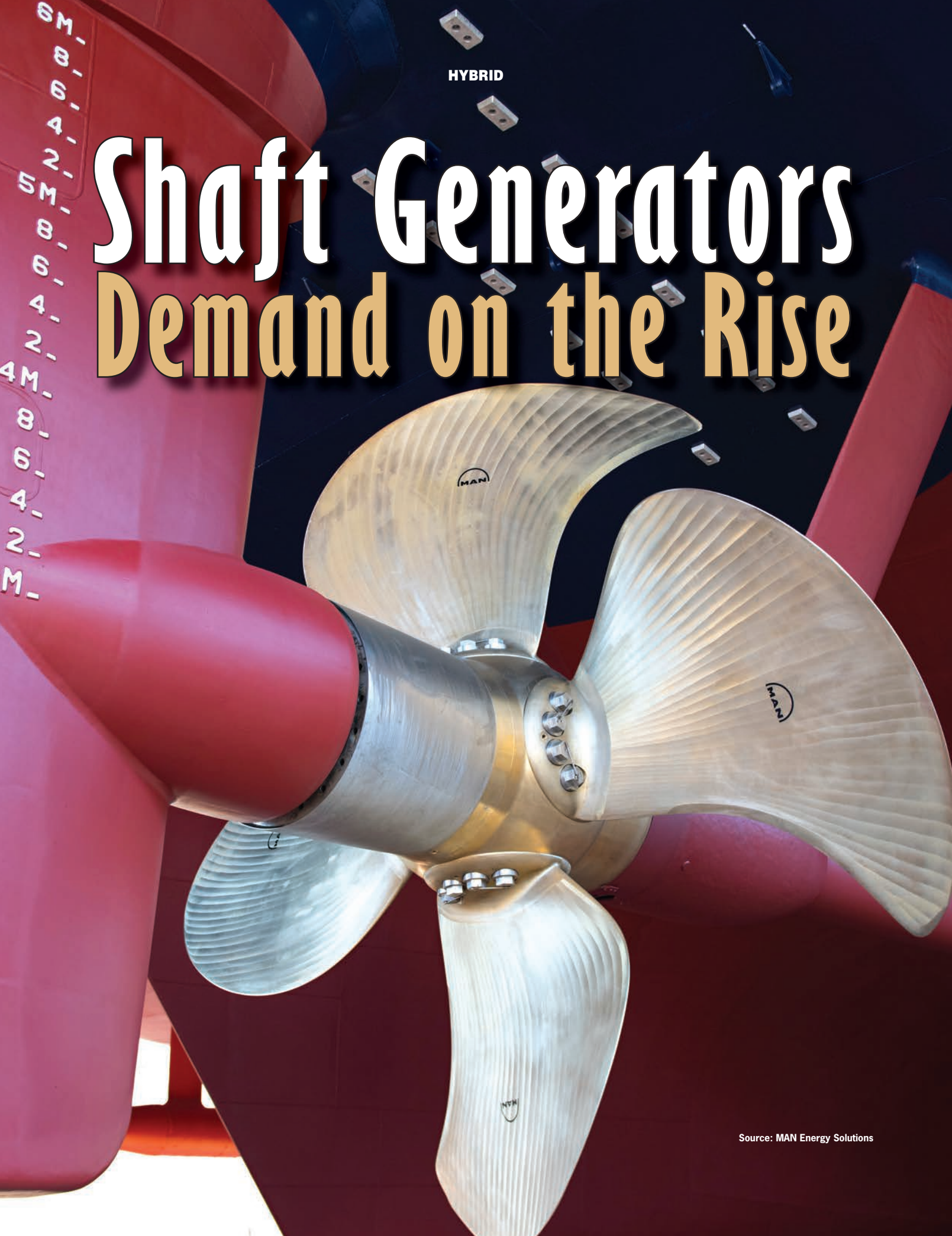


Photo Courtesy Lignum Vitae

Shaft Generators Demand on the Rise



Source: MAN Energy Solutions

30 years ago shaft generators with PTI capability kept container ships sailing at top speed. That purpose gone, PTI/PTO is making a new comeback in more cargo shipping segments, this time for reducing emissions.

By Wendy Laursen

Retrofitting a shaft generator is not an insignificant undertaking. Around 50 tons of equipment needs to be installed into the engineroom through a hole in the hull. A new section of shaft is usually required.

That a few shipowners are undertaking such projects - Klaveness Combination Carriers on the Ballard, along with air lubrication, and Berge Bulk on the Berge Olympus, along with wind-assist – is testament to technology developments and the times.

A power take off (PTO) shaft generator can reduce genset operation time and therefore reduce fuel consumption by making better use of a ship's less expensive main engine power. Adding power take in (PTI) functionality means the system can also act as a motor to provide the power boost needed to keep schedules in heavy seas or to navigate ice-infested waters without the need for overloading or oversizing the main engine. This power comes from gensets or batteries. With the addition of a clutch, PTI also enables a ship to run on full electric mode during port maneuvering and can provide safe return to port power in an emergency (power take home (PTH) mode).

Shaft generators are beneficial to EEDI/EEXI/CII calculations and can reduce fuel consumption by up to 20% thanks to the efficiency of modern permanent magnet technology that lowers their energy consumption and to the variable speed drives that enable them to provide constant power over a wider engine speed range.

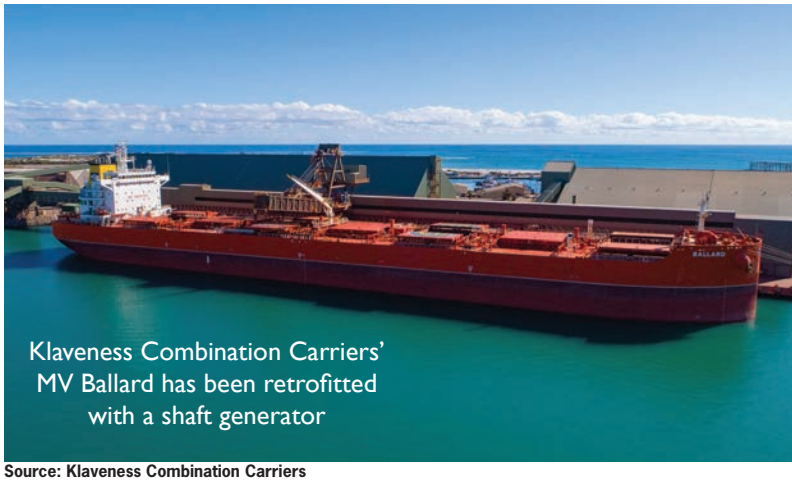
This added potential is mostly evidenced in the newbuild market where equipment suppliers are reporting increased interest from the cargo ship market. The specific fuel savings achieved will vary depending on whether the ship has a 2-stroke main engine or a 4-stroke-based electric power system, and whether it has controllable or fixed pitch propellers. The propulsion configuration is important, because specification of shaft generators involves careful optimization of engine and propeller. Propeller efficiency and cavitation are considered along with the efficiency of the engine over a range of power outputs.

"We do a lot of optimization," explains Jens Ring Nielsen, Senior Technology Engineer at MAN Energy Solutions. "If you ask an engine designer about the most efficient way of operating, they'll point to one path on the engine map. If you ask the propeller OEM, they'll say another. The truth is somewhere in between."

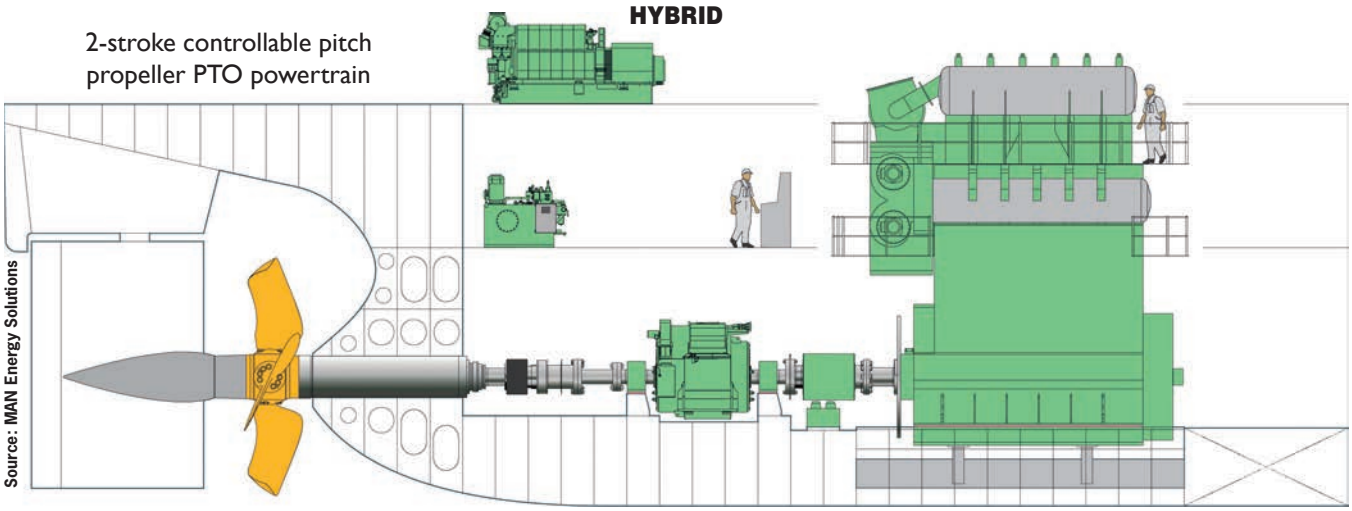
Specific considerations, such as whether to have a clutch between the shaft generator and the main engine or whether to have a primary or secondary shaft installation, depend on

Berge Olypus has been retrofitted with a shaft generator

Source: Berg Bulk


Klaveness Combination Carriers' MV Ballard has been retrofitted with a shaft generator

Source: Klaveness Combination Carriers



Source: MAN Energy Solutions

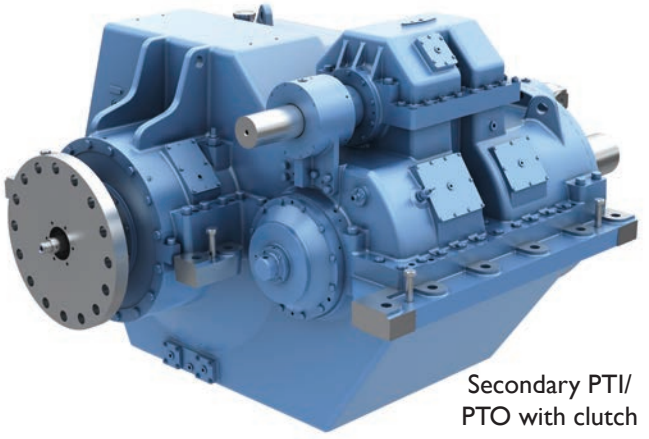
how the system is intended to operate, says Oskar Levander, VP Strategy & Business Development, Kongsberg Maritime. For example, a primary shaft-driven PTO rotates whenever the engine is running; a secondary one whenever the propeller is rotating. "A secondary PTO/PTI is used if you want to run the propeller with only the electric motor (PTI) without using the diesel engine. If you only intend to use a PTO and want to use it in port without the propeller, then you select a primary PTO."

The Switch's shaft generators start from <1MW and range up to 12MW+, although the biggest existing projects are around 5MW for large container ships. In a typical LNG carrier or other bulk carriers, permanent magnet technology improves efficiency by 2-4% compared to the synchronous machines that were commonly used in the past, says Dr Jussi Puranen, Head of Product Line, Electric Machines, at Yaskawa Environmental Energy / The Switch. This adds up to several million dollars in fuel savings over the lifetime of the vessel.

The Switch has more than 100 shaft generators in operation and well over 100 in its production pipeline. Most commonly to date, orders have been for 174,000cbm LNG carriers. These vessels typically have two propulsion lines, with about 2MW PTO power from each. Now, 15-20,000 TEU container ships are adding to the company's order book. These typically have one propulsion line with the shaft generator providing about 5MW of electric power.

Payback time for ABB's PTI/PTO system is five years at current fuel prices (far less for new fuels). Michael D. Christensen, VP Global Sales, Dry Cargo Vessels at ABB, is seeing greater take up on bulker newbuilds, but not yet across all vessel sizes. "CII is a complex equation, and while the addition of PTI/PTO can bring a commercial advantage, it's too soon for this impact to flow through to smaller bulkers. These vessels continue to come standard from shipyards, so while everyone wants sustainability, there are still other commercial considerations for shipowners."

PTO can sometimes reduce CAPEX elsewhere in the propulsion train. "There's the option to use a fixed pitch bow thruster which is significantly cheaper than a controllable pitch



Source: Kongsberg Maritime

Secondary PTI/
PTO with clutch

one once you have a variable speed shaft generator specified," says Christensen. An active front end converter with a DC Link means you can add the control of the thruster, he says.

Additionally, shipowners can move further towards the IMO's 2050. They can test out energy storage and fuel cell equipment, he says, and see what benefits they provide in practice compared to a diesel genset.

Shipowner Aasen Shipping provides a demonstration of how to turn the 20% savings from a shaft generator into 50% as part of a hybrid propulsion system. By combining a Wärtsilä 26 main engine with batteries, PTI/PTO and an intelligent energy management system, along with electrically powered machinery and an optimized hull and cargo design, the company's two newbuild self-discharging bulk carriers were projected to cut fuel consumption by 50% compared to standard self-discharging vessels of a similar size. In December 2023, after two years of operation, the company demonstrated its satisfaction with the vessels by choosing a similar system for three new ones.

While the PTI was only part of a larger solution package, Torsten Büssow, Director for Ship Electrification at Wärtsilä, notes its importance: "Generally, with the increasing complexity of propulsion trains, the share of PTI in shaft generator applications has been growing from roughly below 10% to 25%, so it is definitely growing in demand."

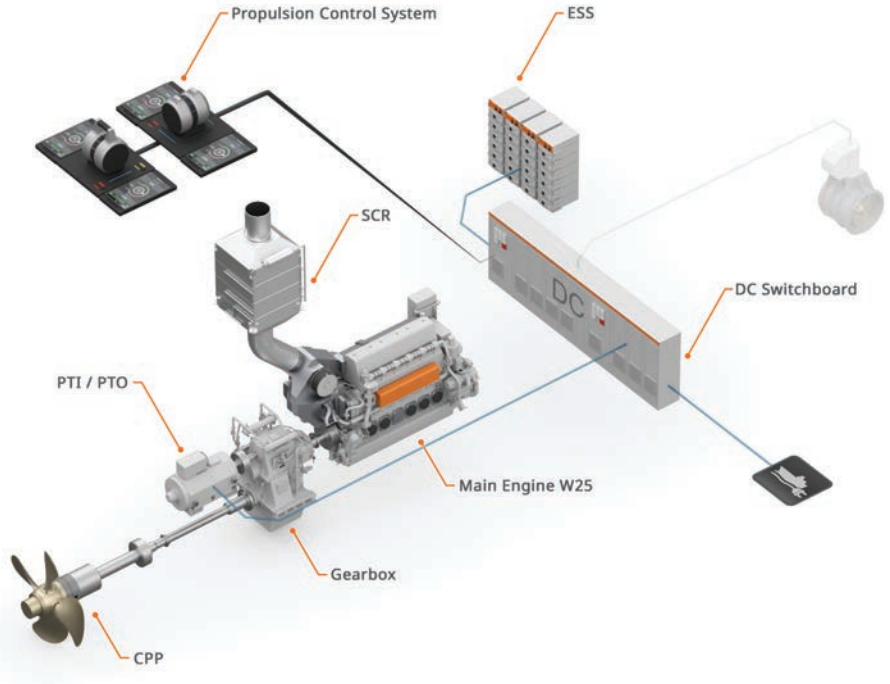
Source: The Switch

"In a typical LNG carrier, permanent magnet technology improves efficiency by 2-4% compared to synchronous machines."

– Dr. Jussi Puranen, Head of Product Line, Electric Machines, at Yaskawa Environmental Energy / The Switch

The Switch's shaft generators start from <1MW and range up to 12MW+.

Source: Aasen Shipping



Source: Wärtsilä

Ammonia and the 15,0

Image Seaspan Corporation/Foreship

A project initiated by Seaspan Corporation and the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping (MMMCZCS) has set out to develop a design for a large 15,000-TEU ammonia-fueled container vessel.

By Greg Trauthwein

Working with ship designer Foreship and the American Bureau of Shipping (ABS), Seaspan Corporation continues work to develop a concept design for a 15,000-TEU container ship, a design which received an Approval in Principle (AiP) from ABS last summer.

It is universally agreed that there are no 'silver bullet solutions' when talk turns to decarbonizing the maritime sector and ammonia certainly has its drawbacks, led by the caustic nature of the fuel itself as well as the fact that the engine fueled by ammonia is still under development. That said, there are compelling arguments to be made for ammonia, and some see ammonia as a leading alternative fuel as the mid-2030s, based on:

- **Low Emissions:** Ammonia combustion produces nitrogen and water as its primary byproducts, which means lower emissions of greenhouse gases and particulate matter.
- **Renewable Production Potential:** "Green" Ammonia can be produced using renewable energy sources, such as wind or solar power, through electrolysis.
- **Energy Density:** Ammonia has a high energy density, which means it can store a significant amount of energy per unit of volume.
- **Established Infrastructure:** Ammonia has an established infrastructure for production, storage, and transportation.
- **Global Availability:** Ammonia is globally produced in large quantities for various industrial purposes, and it is widely traded, making it a practical option for shipping.

While Seaspan Corporation is a driver in the development of the 15,000 TEU ammonia fueled containership, the company is fuel agnostic, exploring many options, and is in fact in the midst of receiving a new series of 25 LNG dual-fueled containerships, as Seb Brindley, Senior Naval Architect, Seaspan Ship Management, explains. "We need to be ready for the future and have the capability to handle whatever fuel our clients require. The clear advantage for ammonia is that there's no carbon involved in its molecule, it's just nitrogen and hydrogen. So it is a scalable alternative fuel that doesn't have a carbon factor. Of course, when burning, we need to worry about laughing gas [Nitrogen oxide (NOx) emissions], which does have a greenhouse effect," an impact that should be addressed either through engine design or after treatment.

While ammonia itself is without carbon, there is the need for a pilot fuel to start the combustion process. "The engine manufacturers are looking at a pilot fuel to help kickstart the ignition in the engine, and the pilot fuel, depending upon where it comes from, may have a carbon factor associated with it," said Brindley.

According to Jan-Erik Räsänen, CTO, Foreship, the prospect of generating ammonia using renewable energy sources makes the prospect of ammonia in maritime even more attractive. "If you do E-ammonia, going through the hydrogen, you don't have

00 TEU Containership

the problematic area of adding carbon like you have with other alternative fuels. When you start to add components into that, carbon is one of the most difficult ones to add to a molecule or to a fuel. So ammonia has a clear advantages from that perspective. It has even better potential than green methanol or e-methanol, because e-methanol, you need to add the carbon content and that is the biggest challenge. So definitely I think the scalability for E or green ammonia is better than methanol."

"Safety has been at the center of the design, and it will continue to be so when we are looking at training and safety systems. That's why we pulled in ABS right at the beginning, to make sure all aspects are covered."

Seb Brindley, Senior Naval Architect, Seaspan Ship Management

Image Seaspan Corporation

Challenges with Ammonia

While ammonia holds promise, it too is not without a long list of challenges, led by safety of the substance itself: ammonia is toxic and poses safety risks to humans. "The way you look at the safety aspects of the whole system [the whole ship] is completely different [as compared to traditional diesel fuel]," said Räsänen. "You need to be careful on the bunkering location, the size of the bunkering, how you pull your pipes between compartments and the larger tank volumes. It's about segregation because of the toxicity."

Safety concerns extend to the bunkering operations. While ammonia is produced in mass globally, the infrastructure needed to fuel ships at scale would have to be built out, with likely local concerns particularly with ports in close proximity to dense populations.

"From a containership perspective, we also need to consider the fact that container ports are close to cities, and [all of the people that will be] working on board the vessel. We need to make sure that everybody's safe," said Brindley. "Safety has been at the center of the design, and it will continue to be so when we are looking at training and safety systems. That's why we pulled in ABS right at the beginning, to make sure all aspects are covered."

Safety and reliability sit at the heart of ammonia's future potential for widespread use in maritime, and in particular the regulatory frameworks and international standards for the use of ammonia as a maritime fuel need to be developed and implemented.

Last, but certainly not least, are the technical challenges, the development, testing and installation of the main mover – the marine engine – that is designed and built to run on ammonia reliably. Development by the dominant two-stroke engine companies – MAN ES and WinGD – are already well underway, with major progress expected in 2024.

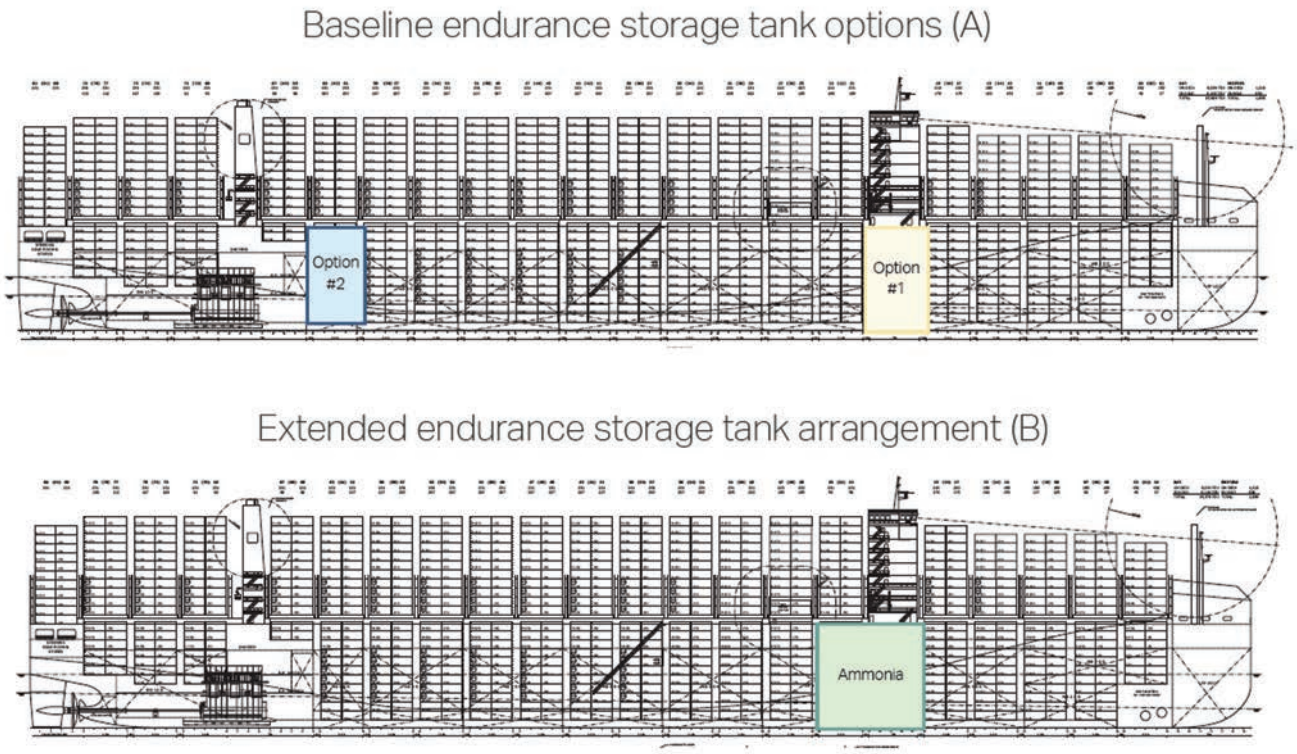
In July 2023, MAN Energy Solutions announced the successful first running of a test engine [MAN B&W two-stroke 4T50ME-X type] on ammonia at its Research Center Copenhagen (RCC).

While the accomplishment is real, challenges remain, as summarized last year by Brian Østergaard Sørensen, Vice President and Head of Research & Development, Two-Stroke at MAN Energy Solutions. "This is groundbreaking for both our company and the maritime industry as a whole. That said, we know we still have a lot of hard work ahead and, over the following months, will execute a testing program that will study aspects such as heat-release, ignition, safety, pilot-oil energy fraction, NOx and N2O emissions."

"You need to be careful on the bunkering location, the size of the bunkering, how you pull your pipes between compartments and the larger tank volumes. It's about segregation because of the toxicity."

Jan-Erik Räsänen, CTO, Foreship

Image Foreship



Images Seaspan Corporation/Foreship

With plans to have a full-scale test engine running on ammonia in early 2024, the company said it expects to hold its delivery timeline for the first ammonia engine, with subsequent operation onboard a commercial vessel from around 2026.

The Ammonia-Fueled Containership Design

The challenge to supplant diesel as the prime fuel for shipping was never expected to be fast, easy or cheap. When focusing on ammonia specifically, it – like many other alternative fuels – suffer from a lack of power density, meaning fuel tanks must be larger, eating into a ship's revenue generating space.

"In terms of weight, you need about 2.2 times more ammonia than HFO," said Brindley. "That's just the weight. When you consider energy density, you need about three times the quantity of ammonia for an equivalent energy of HFO. So the tanks are much bigger."

Foreship's Räsänen, concurs, but adds "more specifically with ammonia, I would say it's the safety and the safety barriers, remembering that ammonia is toxic. Safety and safe design are key."

From the Foreship perspective, the eye on safety when considering ammonia stretches to the shipyard building the ship, right down to the local surveyors that will interact with the ship daily.

Ultimately, like any other business, cost is a top-agenda driver. Regardless of type, fuel prices will fluctuate by supply and demand as well as geopolitical factors. But for Brindley, he finds it difficult to pinpoint just how much more expensive an ammonia fueled ship will be premised on one factor.

"We don't have an engine yet, so there are things that are going to have to be put in place before we can start putting a firm dollar sign on the cost. But in terms of the CapEx, I envisage it'll be similar to LNG." Looking at the engine makers and their progress, Brindley is diplomatic in saying that there is no clear front-runner for the ammonia engine, but admitted "we are working closely with all major engine designers."

The Future is Now

While many eyes are on the future, shipping companies today must balance planning for an uncertain fuel future with the reality of maximizing efficiencies on the current fleet. "We have two main divisions; one is maritime technology, which is looking at future technology," said Brindley. "We need to make sure we're ready for the future, but we also have our fleet engineering team, which looks at the here and now, making sure the vessels are as efficient as possible. We need to catch that low-hanging fruit right now and make sure the vessels are operating as efficiently as possible, so we can keep getting good CII ratings into the future. And then we can switch over to alternative fuels. Once we do switch over onto alternative fuels, we're still going to be really focused on the energy efficiency of the design, because it's a much more expensive fuel."

For Brindley and the entire team working on the 15,000 TEU ammonia fueled containership project, there is not a firm timeline to reasonably expect this design to be completed and/or hit the water.

"We want to make sure that we develop a design that's going to work and that's going to be safe," said Brindley. "The main reason we did this design is to show that it is possible to have an ammonia fuel containership design, and potentially to build it. We're still not quite there for the engine. We still need shore infrastructure, we still need ammonia availability, but we want to, as a ship owner, to say to the world that we are ready, and we're moving in this direction."

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GAO: USCG Should Address Workforce Recruitment and Retention Challenges

By Heather MacLeod, Director, GAO's Homeland Security and Justice team

The Coast Guard has struggled for years to recruit and retain a sufficient workforce. The U.S. Government Accountability Office (GAO), the non-partisan, fact-based arm of the Congress, has published multiple reports related to the Coast Guard's workforce including recruitment and retention challenges. Three of these reports published in 2022 and 2023 have resulted in 17 GAO recommendations to address these issues, but as of today, 16 remain open and need to be addressed. Implementing these recommendations is key to the Coast Guard's ability to recruit and retain the personnel necessary to conduct its diverse array of mission requirements.

The Coast Guard—a multi-mission military service employing more than 55,000 personnel—has reported that it is about 3,500 enlisted members short and has missed its recruiting targets for the past five fiscal years. Some of the Coast Guard's recruitment and retention issues fall within critical areas of expertise such as its cyberspace and marine inspections workforces. Competition with higher paying jobs in the private sector, limited opportunities for promotion, and long work hours have made it challenging for the Coast Guard to recruit and retain these personnel.

Cyberspace Workforce. In 2015 the Coast Guard established cyberspace as an operational domain to help protect the marine transportation system from threats that could be delivered through the internet, telecommunications networks, and computer systems. GAO's September 2022 review found that the Coast Guard had determined that nine percent, or 412 of its 4,507 funded cyberspace workforce positions, were vacant.

GAO's review also found that the service had not followed its own guidance that calls for it to assess and determine necessary staffing levels and skills to meet mission needs. For example, as of February 2022, the Coast Guard had not used its workforce determination process to assess 55 percent of its cyberspace workforce positions. Until such analysis is completed, the Coast Guard will not fully understand the resources it requires, including those to protect its information systems and data from threats.

GAO made six recommendations aimed at improving the Coast Guard's workforce planning process for cybersecurity personnel, including assessing it needs, collecting data, and developing a strategy and metrics that could better inform its efforts to recruit these personnel.

Marine Inspectors. The Coast Guard has faced long-standing challenges maintaining an adequate staff of experienced marine inspectors who board vessels to determine whether they meet safety, security, and environmental requirements. A January 2022 GAO report found that the Coast Guard's marine inspection program has had similar recruitment and retention challenges over the past decade—showing a shortage of more than a thousand marine inspectors.

GAO also determined that the Coast Guard had collected and analyzed limited data to forecast future workforce and industry trends that could affect the supply and demand for marine inspectors. For example, the Coast Guard collected industry data to forecast workforce needs for certain vessel types (cruise ships) but not others (freight vessels). The Coast Guard also did not regularly collect and analyze other data, such as future potential retirements of Coast Guard personnel that could affect its supply of marine inspectors.

GAO concluded that collecting additional data to forecast future trends in the maritime industry and its marine inspection workforce would enhance the Coast Guard's ability to identify its potential future workforce needs. GAO made five recommendations to strengthen the Coast Guard's workforce planning efforts, including that the service collect additional data to forecast future industry and workforce trends.

Quality of Life challenges. Chal-

lenges related to quality of life factors also affects the Coast Guard's ability to retain personnel. For example, in April 2023 GAO found that Coast Guard personnel stationed in remote areas may experience challenges accessing medical care. Specifically, 17 of 43 Coast Guard clinics were located in medically underserved areas, which indicate a shortage of primary care services. An additional 11 of 43 were located in areas with a shortage of at least one type of health provider—including primary care, mental health, or dental.

Coast Guard health officials and officials from selected clinics also reported facing persistent staffing challenges, including recruiting and retaining public health service providers who typically serve as the medical and dental providers in Coast Guard clinics. GAO found that the Coast Guard had taken steps to mitigate this challenge, such as initiating its own Health Service Officer Program, but it had not examined reasons for public health service recruitment and retention challenges.

GAO made six recommendations that the Coast Guard, among other things, obtain, share, and monitor several types of data including information on heath care access and the reasons for medical provider recruitment and retention challenges. Doing so would help the Coast Guard determine what, if any, actions it can take to address these challenges and help better ensure its clinics have sufficient staff to meet its medical mission. Challenges related to housing, child care, and education also affects the Coast Guard's ability to retain personnel. GAO has reported on issues with the appropriateness of the housing allowance for military personnel and has also found that the rising cost of child care nationwide was among the most formidable challenges Coast Guard families face. Additionally, military families frequently cited education issues for their children as a drawback to military service.

GAO has additional ongoing studies reviewing Coast Guard recruitment and retention efforts and other factors that may affect this. Currently, reports on these types of issues are expected to be released in 2024 and 2025.

The Author

MacLeod

Heather MacLeod is a Director in GAO's Homeland Security and Justice team. She oversees Coast Guard and maritime security issues, including Coast Guard workforce and strategic planning efforts, and maritime port and supply chain/cargo security.

Tech Files

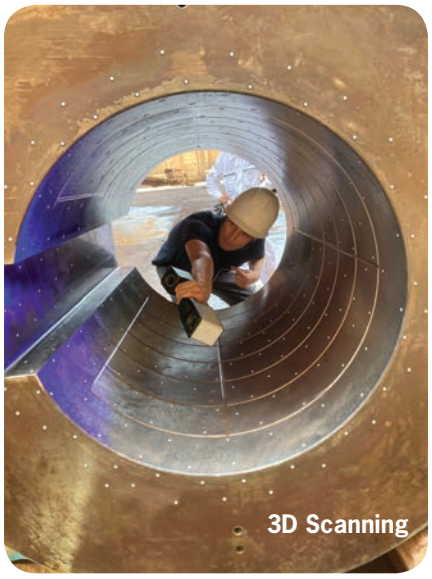
Latest Products & Technologies

MarineShaft

MarineShaft specializes in urgent repair/replacement of damaged rudder and propeller equipment along with many on-site repair services. MarineShaft has a unique repair technique for putting bent shafts and rudder stocks straight with full-class approval. Its repair history includes putting a propeller shaft straight that was 1-meter out-of-center line with full class approval. Heavy equipment with a tiny straightening tolerance of max 0.05 mm.

Cold straightening is carried out using the company's purpose-built hydraulic presses that can straighten shafts up to 1,500 mm in diameter. The shaft will not suffer stress afterward and can be reinstalled and continue its journey for years. When repair is not an option MarineShaft stock raw materials for almost any emergency, whether a replacement for tail shaft, intermediate shaft, rudder stock, or a new hydraulic coupling is needed. MarineShaft offers a wide range of on-site repairs services. Recently a team carried out a job taking place in Canada for a cargo ship. The task was on-site laser measurement of the rudder line and on-site machining of the rudder horn casting. MarineShaft delivered a new propeller shaft, rudder stock, and rudder pintle.

marineshaft.com



3D Scanning

Yanmar Hydrogen Fuel Cell AIP

Yanmar Power Technology Co., Ltd. (Yanmar PT), a subsidiary of Yanmar Holdings, has achieved a milestone as the first company in Japan to receive the Approval in Principle (AiP) for its ***"Maritime Hydrogen Fuel Cell System"*** from ClassNK. The primary objective of this system is to advance the use of zero-emission ships in the maritime sector, effectively eliminating emissions such as CO2, NOX, SOX, PM, and others. The design emphasizes ease of installation, with a configuration that seamlessly integrates key auxiliary components like gas valve units into the system housing. Additionally, the system's capability for parallel connection of multiple units and flexibility in adjusting the number of installed modules in its housing allow it to cater to diverse ship output requirements.

Both the system and its installed modules have successfully met the prescribed requirements for fuel cell power systems based on ClassNK's "Guidelines for Fuel Cell Ships (2nd Edition)." This confirmation follows test results conducted in accordance with relevant standards. Yanmar PT proposed this innovative system to a range of vessels, including passenger ships, workboats, and cargo ships, that operate in coastal areas with access to hydrogen infrastructure. This development marks a significant step towards sustainable and environmentally friendly maritime solutions.

yanmar.com

Emission Monitors

Green Instruments A/S and Danish Technological Institute have developed a real-time flue gas sensor technology – The Extinction-Minus-Scattering (EMS) measurement method – to accurately measure black carbon emissions from ships, a tech which could be instrumental in meeting increasing regulatory demands of the shipping industry for black carbon emission standards. The EMS method enables real-time in-situ measurement capabilities, traceability, and lowered ownership costs, tackling significant hurdles of existing emission monitoring techniques.

greeninstruments.com

GE Vernova

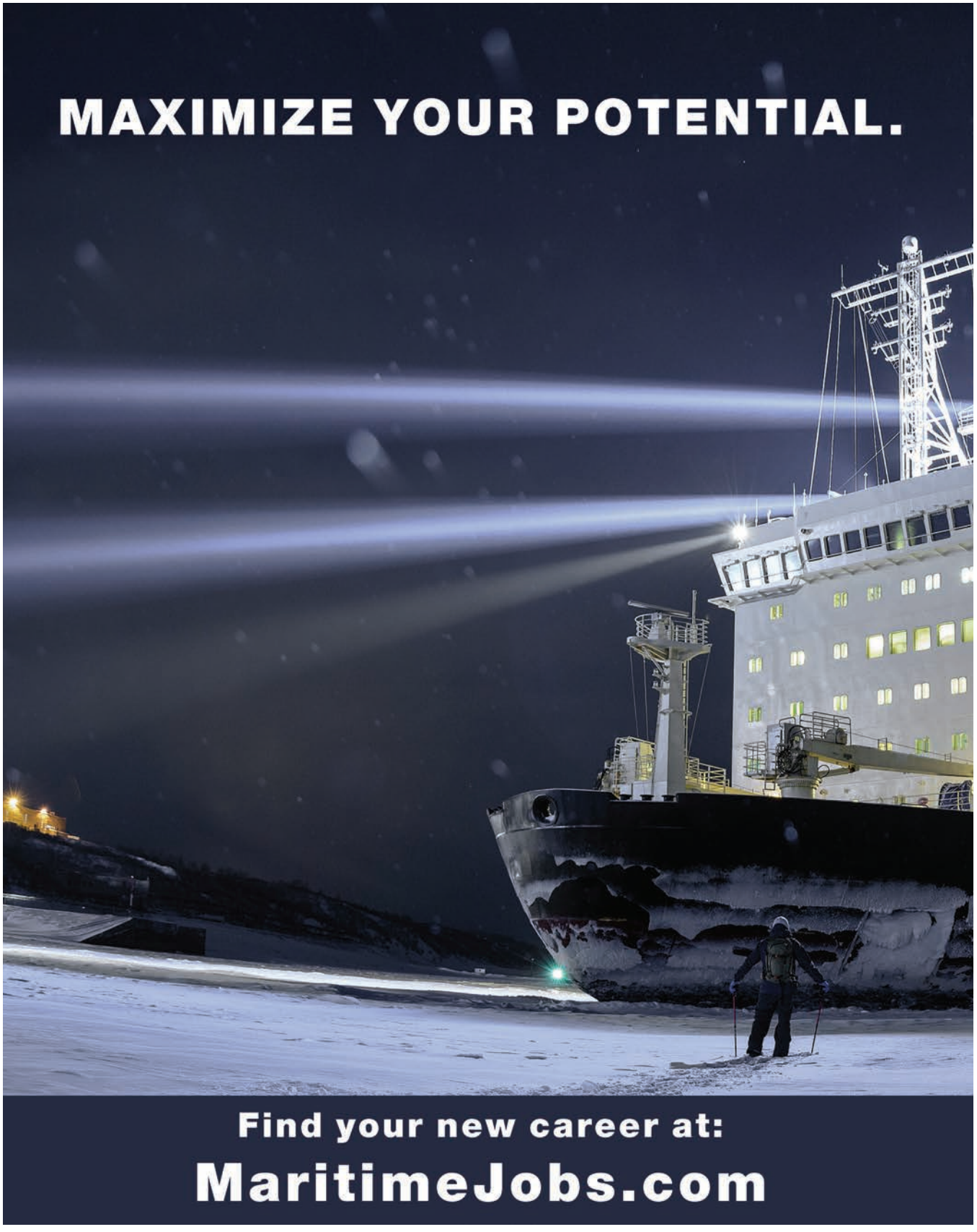
GE Vernova will equip the new UK Fleet Solid Support (FSS) ships with hybrid-electric propulsion technology

Under the contract, GE Vernova will design and manufacture SeaPulse Active Front-End (AFE) power converters and Power Take-Off/Power Take-In (PTI/PTO) hybrid electric induction motor-generators with resilient shock mounts and flexible coupling and hosing. Delivery of GE Vernova's electric propulsion equipment for the first FSS ship is scheduled for 2025, with the second and third vessels planned for 2026 and 2027.

GE Vernova

Employment

www.MaritimeJobs.com



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