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THE NAVAL ARCHITECT

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# NEW FUELS, NEW RISKS: IS THE MARITIME INDUSTRY READY?

By **Daniel Johnson**

With shipowners and operators facing increased pressure from regulators, investors and other stakeholders to decarbonise their fleets, the pace required for the adoption of alternative marine fuels continues to accelerate. Encouragingly, throughout its history the maritime industry has shown that it is capable of continuously transforming itself to improve efficiency and productivity, irrespective of the challenges along the way. But for the alternative fuels transition to be successful, there are a number of key questions that need to be answered, one of which is: how capable is the industry of managing the associated safety risks?

FACILITATING THE FUEL TRANSITION REQUIRES CAREFUL MANAGEMENT OF ITS RISKS. SOURCE: SHUTTERSTOCK

It's a question that has been the subject of a lot of discussion and debate and was touched on again last month during a Maritime Technologies Forum (MTF) panel event at Singapore Maritime Week (SMW) 2024. MTF, a forum of flag states and classification societies, has been established to provide technical and regulatory expertise for the industry's decarbonisation journey. Its flag state administrations include Japan's Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism, the Norwegian Maritime Authority, the UK Maritime and Coastguard Agency, and the Maritime and Port Authority of Singapore. The classification society members are ABS, DNV, Lloyd's Register and ClassNK.

Warning of a looming safety gap between today's safety risk management approaches and the changing safety risks picture that the fuel transition will shape, the panel event at SMW 2024 presented findings from recently released MTF guidelines that make recommendations for developing and implementing the safety management system (SMS) under IMO's International Safety Management (ISM) Code, addressing specifically potentially more hazardous alternative fuels used on board ships. The new report follows MTF's publication last year of 'Operational Management to Accelerate Maritime Decarbonisation', which identified critical gaps in implementing three current regulatory conventions and codes: the ISM Code; the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW); and the Maritime Labour Convention (MLC).

The new guidelines address potential gaps related to safety management systems development and implementation, including emergency procedures and maintenance measures. Through collaboration with industry stakeholders, MTF members developed recommendations after reviewing the ISM Code's Part A implementation for each section.

Some takeaways from the report are as follows:

- While the experience with alternative fuels will at first be limited, the MTF guidelines outline actions for companies to develop new or strengthen existing SMS for alternative fuels on board their fleet.
- Companies should implement a structured risk management within SMS to proactively identify improvements and learn through non-conformities, accidents and hazardous occurrences related to alternative fuels, or through other companies or pilots.
- The SMS should be versatile to accommodate mixed fuel operations and adapt to be ready for new fuel scenarios as alternative fuels are progressively scaled and become more mainstream throughout the industry.
- Safe operations with alternative fuels will require an assessment of the competency, training, familiarisation and resources relevant to the specific alternative fuels. The human element in the operations associated with the handling, storage and utilisation of alternative fuels is critical, and should be considered to ensure safe operations.

Commenting on the guidelines, Nick Brown, CEO of Lloyd's Register, noted: "The ISM Code provides a top-down approach to safety and is the ideal vehicle through which to drive training and skills for the safe handling of these fuels, not only under routine operations but also during emergencies such as equipment failures, fires, collisions and malicious attacks. Our biggest strength, however, will be learning from each other throughout the energy transition, ensuring we have a solid foundation to promote safety for our people at sea and in port."

What emerged from the MTF panel discussion and is demonstrated in the forum's new report is that the maritime industry is not ready for the safe adoption at scale of alternative fuels yet. However, MTF's recommendations are a significant step in the right direction. Used in addition to other similar existing and upcoming guidelines, they will be an important starting point for maritime industry collaboration to establish the proper safety control and management procedures critical to guiding the industry through the challenges ahead. ■

# NEWS

DECARBONISATION

## EMISSIONS FROM CONTAINER SHIPS INCREASE SUBSTANTIALLY IN LIGHT OF THE RED SEA CONFLICT

Conflict in the Red Sea has brought massive carbon emissions increases in ocean freight container shipping, according to new data.

The Xeneta and Marine Benchmark Carbon Emissions Index (CEI), which measures carbon emissions per ton of cargo transported across the world's top 13 trades, hit 107.4 points in Q1 2024 - the highest it has been since the index began in Q1 2018.

For containers being shipped via sea from the Far East to the Mediterranean, the CEI reveals carbon emissions increased by 63% in Q1 2024 compared to Q4 2023. From the Far East into North Europe, carbon emissions increased by 23%.

This is seen as a direct result of conflict in the Red Sea region, which escalated in December and has seen most ocean freight container services avoid the Suez Canal due to the threat of attack by Houthi militia.

LONGER JOURNEY TIMES AND HIGHER SPEEDS HAVE BROUGHT CONSIDERABLE CARBON EMISSIONS INCREASES. SOURCE: IAN TAYLOR/ UNSPLASH

Emily Stausbøll, market analyst at Xeneta, says: "We are all aware of the human and economic cost of war, but this data demonstrates there is also price to pay for the climate."

Containers being shipped to the Mediterranean from the Far East travelled 9,400NM on average in Q4 before the escalation in the Red Sea. They are now sailing an additional 5,800NM due to diversions around the Cape of Good Hope in Africa, with the inevitable consequence of more fuel being burned.

Stausbøll adds that ships are also being sailed at higher speeds in an attempt to make up time due to the longer distances, which again results in more carbon being burned.

Xeneta data also reveals disruption in the Red Sea has pushed some shippers into using air freight to protect supply chains.

With the largest sea freight carriers still choosing to avoid the Red Sea, cargo from the Far East is now arriving via ocean at ports such as Jebel Ali in the Arabian Gulf before being flown out of Dubai Airport for onward transportation to Europe and North America. As a result, air cargo demand from Dubai Airport to European destinations increased by 190% in March compared to the same month in 2023.

Stausbøll says: "Not only is air freight more expensive than ocean freight it is also far less sustainable, so this shift to hybrid sea-air services via the Middle East will result in increased carbon emissions per ton of cargo transported."

The deterioration of carbon emissions performance comes at a time when the International Maritime Organization (IMO) is working towards net zero in global ocean freight shipping by or around 2050. 2024 has also seen the introduction of EU ETS regulations which require ocean freight service providers to pay a subsidy based on the amount of carbon emitted on sailings to and from European ports.

"The initial IMO targets are based carbon intensity rather than actual emissions so longer sailing distances won't necessarily have a negative impact on these measurements," says Stausbøll. "However, this peculiarity in the way the IMO records carbon performance cannot hide the fact that conflict has the potential to have a detrimental impact on the sustainability of global supply chains."

Stausbøll warns that longer sailing distances will also see an increase in the cost of ocean freight shipping. As well as needing more fuel to sail around Africa, higher $CO_2$ emissions will result in a higher EU ETS bill for ocean freight carriers.

"With geopolitical conflict and major international incidents such as the Covid-19 pandemic becoming a seemingly more regular occurrence in recent years, there is a lot to consider in terms of how ocean freight shipping responds to protect supply chains while also meeting carbon emissions targets," she says.

CRUISE SHIPS

# YSA DESIGN REVEALS CONCEPT FOR SAIL-POWERED CRUISE SHIP

Norwegian company YSA Design has unveiled a concept for a new type of sail-powered catamaran cruise ship.

Codenamed Seabreeze, the design includes a host of features to attract premium-end cruise guests and proposes a 104.5m-long ship with a 4m draught, allowing access to shallow waters. Dual hulls counteract listing under sail to maintain stability and comfort for up to 200 guests on board.

Four 50m high foldable sails are mounted on 6m high bases on deck to capture wind for the main source of propulsion. Engines running on green bio-methanol can sustain hotel operations and – if wind is insufficient – the main propulsion, although the ship will also be enabled with a hybrid drive to incorporate silent running on battery power.

Two 18.2m wide hulls are connected by an inverted U-shaped structure spanning 18.5m, with the cat's two-deck central superstructure incorporating the bridge and some public spaces. Each hull includes four decks plus a 'yacht top', with room for 100 dual occupancy guest cabins and 155 crew.

The hulls also feature retractable aft and central platforms extending down to the water when Seabreeze is at anchor or in dynamic positioning mode. Sea lounges can then open up for sunset dining, as spas, or as beach and watersports clubs.

"Sustainability is critical but cruise shipping also needs to continuously reinvent itself," says Trond Sigurdsen, senior architect and partner at YSA Design. "A sustainable ship which brings environmentally conscious guests closer to the sea and reaches destinations others cannot is a clear opportunity at the premium end of the cruise market."

THE CONCEPT IS INTENDED FOR PREMIUM MARKET CRUISERS. SOURCE: YSA DESIGN

FERRIES

## SECOND DUAL-FUEL FERRY SUCCESSFULLY LAUNCHES ON THE CLYDE


MV *GLEN ROSA* IS LAUNCHED AT FERGUSON MARINE SHIPYARD. SOURCE: KIERAN CHAMBERS

The much-delayed MV *Glen Rosa*, the second of two dual-fuel vessels being built at Ferguson Marine in Port Glasgow, has been successfully launched into the Clyde.

Like her sister ship MV *Glen Sannox*, MV *Glen Rosa* is being built on behalf of Caledonian Maritime Assets Ltd (CMAL) to service the Isle of Arran on the Ardrossan-Brodick route. Both ro-pax vessels have been the subject of an ongoing political scandal known as the "ferry fiasco" owing to increased costs and lengthy delays to their construction.

The MV *Glen Rosa* will be capable of operating on liquefied natural gas (LNG) and marine gas oil (MGO) and is designed to carry 127 cars, 16 HGVs – or a combination of both – and up to 852 passengers. The 102m vessel will still need more than a year of fitting out work at the quayside before it is ready for delivery in September 2025.

MV *Glen Rosa* is the 363rd vessel launched on the Clyde under the Ferguson Marine name. At around 3,000tonnes, the ship is considerably heavier than MV *Glen Sannox* was at launch and sets a new record for the yard in terms of weight at launch.

Launched in November 2017, MV *Glen Sannox* sailed under its own power for the first time this February, eight years after construction on the vessel began. The ferry is scheduled for delivery this summer.

Kevin Hobbs, chief executive at CMAL, states: "We know how important these two vessels are for the Arran community, and for both vessels to start serving the island. We will continue to work with Fergusons to get them delivered as soon as possible.

CAD/CAM

## NYK LINE COMPLETES BASIC DESIGN PROCESS USING ONLY 3D DRAWINGS

ClassNK has approved the basic design drawings of a multi-purpose container carrier developed by NYK Line utilising 3D models.

According to the classification society, this marks the first instance of an ocean-going ship completing the basic design process, including class approval, solely through 3D drawings from the conceptual design to the basic structural design, during the initial stages of ship construction.

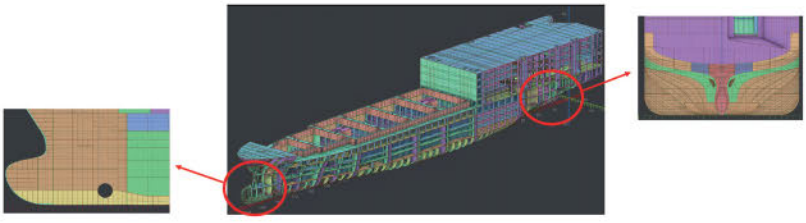
A spokesperson says: "Traditionally, the sharing of design information among shipyards, shipowners, and class societies has relied on 2D drawings, necessitating the conversion of shipyard-created 3D models into 2D drawings for approval processes.

"This practice, along with the input of drawing data into the class society's ship structure design support system and the model modifications by designers, has posed challenges in terms of time and cost for both parties. Additionally, accurately interpreting complex 2D drawings requires extensive experience and expertise, resulting in the precision of information sharing among parties dependent on the individuals involved."

Recognising these challenges, NYK Line and ClassNK have been advancing a project to enhance the utilisation of 3D models in new ship designs.

The 3D model data created by NYK Line on its ship design 3D CAD system was processed with the interface system of ClassNK's PrimeShip-HULL, which ensures the use of consistent design data across different tools, and ClassNK completed all plan approvals at the basic design stage without the need for the conversion to 2D drawings.

EXAMPLE OF 3D DRAWING. SOURCE: NYK LINE



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# NEWS ANALYSIS

## *DALI* DEVELOPMENTS, SHAPOLI AND TRADE GROWTH PREDICTIONS

By **Malcolm Latarche**

Three days after a Houthi missile strike on a Chinese operated tanker caused a fire onboard, events in the Red Sea were knocked of the top of maritime news topics when in the early hours of 26 March the 10,000TEU NeoPanamax *Dali* collided with the Francis Scott Key Bridge in Baltimore, USA.

The collision resulted in the bridge being destroyed and several fatalities as workers and vehicles on the bridge were dumped into the water.

The immediate cause of the catastrophe is reported to be a power outage on the vessel for a very brief period of just a few minutes. That seemingly prevented the vessel from steering away from one of the bridge supports which it struck causing the whole elevated section of the bridge which spanned the width of the port approaches.

Unusually for such an event, the moments before the collision were caught on video and have been seen around the globe. Further images have continued to be released including stills and footage taken by investigating officers from the US National Transportation Safety Board (NTSB). Details taken from the vessel's VDR have also been released which indicate some alarms were sounded immediately prior to the power loss but all sensors ceased providing data after the power outage. Audio recording of the bridge did continue using the VDR's back up power supply.

Speculation as to the course of the power outage has been rife, however as yet there is no official word of what the NTSB investigation suspects but it is anticipated that the preliminary report will be published in early May.

As a consequence of the bridge collapse, the port of Baltimore was effectively closed down for four weeks disrupting trade. By 23 April, three new shallow channels had been opened and one deeper channel for larger was expected to be ready on 25 April. The deeper channel will allow five of the seven vessels held in the port since 26 March to leave the port and a small number of other ships to enter and leave. However, it was planned to use the channel for just a few days after which it would be closed so as to permit the *Dali* to be refloated and steel debris blocking the main channel to be removed.

The owners and managers of the vessel which was on time charter to Maersk have declared General Average and have also filed documents in the US courts seeking to limit their liability under the 1851 Limitation of Liability Act to US$44 million. The port authority is counter suing claiming the ship was unseaworthy and that those responsible for it were aware of an issue and therefore limitation of liability should not be permitted.

THE PORT OF BALTIMORE HAS FACED WEEKS OF DISRUPTION SINCE THE *DALI* BRIDGE COLLISION. SOURCE: X/PORT OF BALTIMORE

Elsewhere, shaft power limitation systems have been making the news. The subject was already a hot topic having been marked down for further investigation by the IMO at MEPC 81 after several reports of incidents involving vessels losing power in restricted navigation settings and industry bodies presenting papers to MEPC about the issue. The problem of power loss was also warned about in a USCG Policy Letter (01-24) issued on 10 April.

It has also been announced that new requirements were being introduced at the ports of Melbourne and Geelong in Australia for vessels equipped with any form of ShaPoLi for EEXI reasons. With effect from 29 April, vessels calling at the ports must either disable the device prior to pilots boarding or must be able to immediately override or disable the device to have access to the vessel's full power capability.

Vessels that are unable or unwilling to comply could be restricted to daylight only passage, subject to restrictions depending on weather conditions or be obliged to have additional tug assistance.

On a very different issue, the World Trade Organization (WTO) has some encouraging news for shipping and has forecasted a 2.6% increase in trade volume for 2024 and 3.3% in 2025. These figures follow a small fall of 1.2% in 2023. But there was a warning as well with the WTO suggesting that the enthusiasm for free trade is showing signs of waning with some countries looking to repatriate production that had moved abroad or to look towards more friendly partners.

The general optimism of the WTO report was followed by reports that the crude tanker and Capesize sectors were both experiencing a small upturn and coal shipments are also showing healthy activity. ■

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# NEWS EQUIPMENT

CARGO EQUIPMENT

## WÄRTSILÄ SELECTED AGAIN TO SUPPLY CARGO HANDLING SYSTEMS FOR NEWBUILD SOLVANG VESSELS

Wärtsilä Gas Solutions, part of technology group Wärtsilä, is to supply the cargo handling systems for an additional two newbuild very large LPG carrier vessels being built by South Korea's HD Hyundai Heavy Industries (HHI) for Norwegian shipowner Solvang.

The order follows a similar one placed in 2023 for five vessels being constructed at the same yard for the same owner.

The VLGCs are of Panamax size and form a "next generation of eco-vessels". The vessels will have a cargo carrying capacity of 88,000m³, and will incorporate environmental technology developed through 12 years of Solvang's ECO LPG Carrier programme.

"Solvang has a fleet of modern and efficient vessels, all built in accordance with the most up-to-date specifications and fitted with the latest technology. These two new additions to the fleet will feature the most efficient solutions currently available, which is why we have again opted for Wärtsilä cargo handling systems," says Tor Øyvind Ask, fleet director, Solvang.

Patrick Ha, sales manager at Wärtsilä Gas Solutions, says: "We continue to enjoy excellent relationships with both Solvang and HHI, as evidenced by this repeat order. The most advanced ship designs demand the most efficient and reliable cargo handling solutions, and that is what we are able to deliver."

The Wärtsilä equipment is scheduled for delivery to the yard commencing in mid-2025, and the first ship is expected to commence operations in mid-2027.


WÄRTSILÄ WILL SUPPLY CARGO HANDLING SYSTEMS FOR AN ADDITIONAL TWO NEW VLGCS. SOURCE: SOLVANG

ENGINES

## WINGD SHORT-STROKE ENGINE DESIGN SET FOR DEBUT

Swiss marine power company WinGD has announced plans for the first installation of its new X-S short-stroke engine design following successful factory acceptance tests with engine builder Dalian Marine Diesel.

The six-cylinder, 62cm-bore 6X62-S2.0 engine will be installed on a pulp carrier being built for a Chinese owner at COSCO Dalian shipyard.

The X-S series succeeds the well-established RT-flex50 and RT-flex58 engines and is available in 52cm and 62cm bore sizes, for the range of fuel options including traditional diesel or dual-fuel LNG, methanol and ammonia operation. The combination of a compact, simple design and best-in-class fuel efficiency – around 10g/kWh lower than equivalent RT-flex engines, a saving of around 4% depending on operating profile – make the new platform ideal for vessels that benefit from short-stroke engines, according to WinGD.


SUCCESSFUL TESTING OF WINGD X-S SHORT-STROKE ENGINE AT DALIAN MARINE DIESEL. SOURCE: WINGD

Director of sales Volkmar Galke says: "The factory test for our first X-S engine confirms that this new generation of short-stroke engines delivers outstanding value for ship operators, providing significant operating cost advantages while enabling high efficiency in compact ship designs. We anticipate strong uptake as the global fleet of merchant vessels using short-stroke engines is renewed and prepares for future regulation demands."

The X-S combination of shorter stroke length and higher engine speeds allows smaller propellers to generate similar power to long-stroke engines of similar cylinder bore. The compact design is well-suited to vessels that operate in shallow waters or need lower main deck or engine room height.

COMMUNICATIONS

## WARSASH UNVEILS INMARSAT BRIDGE SIMULATOR

THE INMARSAT GMDSS SIMULATOR IS HANDED OVER TO WARSASH MARITIME SCHOOL. SOURCE: INMARSAT

Warsash Maritime School (WMS), part of Solent University, Southampton, has become the only provider in the UK to have a dedicated Global Maritime Distress and Safety System (GMDSS) bridge simulator thanks to satellite communications company Inmarsat.

Inmarsat's donation will enable both students and professional seafarers to benefit from access to a real-world view of how to effectively put safety at sea into practice.

The new facility will be housed in the School's Maritime Simulation Centre, the largest in the UK, where seafarers, ship's officers, pilots, superintendents and students from around the world undergo scenario training in a safe environment.

Kunal Anand, director of Warsash Maritime School, says: "As an industry standard GMDSS bridge, Inmarsat's incredibly generous donation is a welcome addition to our Maritime Simulation Centre. Giving students teaching experience that brings them as close to the real world as possible is our top priority, and with thanks to Inmarsat, our offer continues to grow.

"We will use this bridge as part of our GMDSS course, which will allow students to gain first-hand knowledge of how to interact with GMDSS equipment in the context of a ship's bridge and grow their confidence in effective distress and radio communications at sea. Inmarsat's donation will hugely benefit our learning community, and we are grateful to them for underpinning our future-ready ethos."

PROPULSION

## STEERPROP PROPULSION CHOSEN FOR CANADIAN COAST GUARD MPVS

Finnish propulsion systems specialist Steerprop has been chosen to provide a comprehensive Polar Class 4 (PC 4) propulsion package for the Canadian Coast Guard's multi-purpose vessels (MPVs) renewal programme.

The contract entails the supply of propulsion packages for the initial six MPVs, integral to Canada's National Shipbuilding Strategy (NSS). The new MPV design, which has a length over all of 100m, beam of 20.3m and design draught of 6.2m, is replacing up to three classes of older ships with one platform.

When built, the MPVs will be tasked with multiple missions including icebreaking in moderate ice conditions and assisting in search and rescue, environmental response, emergency towing, and maintaining aids to navigation. Seaspan Shipyards has been contracted for the construction of the vessels.

Steerprop's package comprises two tunnel thrusters for auxiliary propulsion and two contra-rotating propulsors (CRP) for main propulsion. According to the firm, the solution ensures exceptional operational reliability, manoeuvrability and efficiency, essential for the diverse missions undertaken by the Canadian Coast Guard in the Eastern and Western Seaboards and the western and lower Arctic.

THE MPV PROJECT WILL RESULT IN HIGHLY VERSATILE ICEBREAKING SHIPS DESIGNED WITH MULTI-MISSION CAPABILITIES. SOURCE: SEASPAN

Juho Rekola, director of sales and project management at Steerprop, says: "The CRP units not only serve propulsion needs but also facilitate efficient ice management, crucial for maintaining safe navigation channels and responding to emergencies in icy conditions. With a design that optimises efficiency even at lower power levels, Steerprop's solution minimises energy consumption while maximising operational versatility and reliability."

# OPINION

# THE BALTIMORE BRIDGE 'BLACK SWAN EVENT' AND ITS EFFECT ON THE INSURANCE MARKETS

By **John Butler** CEng FIMarEST, Global Maritime

In the early morning of 26 March the container ship *Dali* struck the Francis Scott Key Bridge in Baltimore forcing its dramatic collapse which was captured and circulated on television and social media across the world. This is a textbook example of a Black Swan Event, an unexpected incident that has disproportionately created a social and economic impact on a local area. This incident also shines a light on the offshore industry, maritime insurance, and the importance of Marine Warranty Surveyors.

The collapse of the Francis Scott Key Bridge in Maryland has not only had significant implications for the local community but has also raised important concerns for maritime shipping operations. As a major artery for maritime traffic, the collapse of the bridge has disrupted supply chains, impacted shipping schedules, and raised concerns about insurance coverage for the companies involved both in maritime shipping and infrastructure.

The collapse of the bridge also draws questions about liability. In the case of a bridge collapse, determining liability will be a complex process involving multiple parties. Unpicking how and where the liability lies will be assessed and reviewed through the investigation process.

Nevertheless, this incident raises some immediate questions, for example:

- What preventative measures were put in place to mitigate potential incidents?
- Has modernisation of the global shipping fleet increased risk of damage to critical infrastructure such as bridges?
- Is there an increased role for marine warranty to support risk mitigation for insurers?

This incident also highlights the necessity of hull and machinery insurance for maritime vessels. Such insurance provides coverage for physical damage to a vessel and its equipment, including damage resulting from collisions, grounding, and other accidents. With a bridge collapse potentially posing a hazard to vessels navigating the waterway, insurers will need to assess the risks to insured vessels and determine the coverage available under their policies.

Vessel owners may need to take additional precautions when ensuring the safety of their ships and crew.

Another area of concern is the risk to vessels and their insurers when operating in waters where there is poor design of infrastructure. It could be argued that had the Francis Scott Key Bridge had adequate fendering, the third-party liability claim would be far less.

The main protection in the case of the Francis Scott Key Bridge are structures known as 'dolphins', these circular concrete structures are located near the bridge's main supports. Any vessels that drift off course are expected to collide with these structures and avoid impact of the bridge. The design of these dolphins has not significantly changed since the 1970s when the bridge was first built.

Over the same period the size and frequency of vessels visiting Baltimore has significantly increased. This naturally elicits questions concerning the suitability of aged infrastructure, such as the Francis Scott Key Bridge, and how these structures are designed to mitigate vessel impacts. What effect could this have on other bridges and how should the risk of older infrastructure be addressed?

All of this leads to protection and indemnity. Following a major incident protection and indemnity insurance, also known as P&I insurance provides protection for shipping operations. This is a form of mutual maritime insurance provided by a P&I club which covers for a wide range of liabilities, including third-party bodily injury, property damage, pollution, and wreck removal.

THE CARGO SHIP *DALI* SITS IN THE WATER AFTER RUNNING INTO AND COLLAPSING THE FRANCIS SCOTT KEY BRIDGE ON 26 MARCH. SOURCE: US COASTGUARD/PETTY OFFICER 1ST CLASS BRANDON GILES

JOHN BUTLER

In the event of a maritime incident resulting from a bridge collapse, P&I clubs may need to respond to claims from injured parties, property owners, or environmental regulators. Insurers will need to work closely with their policyholders to manage these liabilities and ensure appropriate coverage is in place. So, with all these liabilities and insured risks, how do underwriters protect themselves, considering they may never see the ships they underwrite?

This is where the "Marine Warranty Surveyor" (MWS) is responsible.

## What is a Marine Warranty Surveyor?

Insurance underwriters require an MWS as a part of the insurance policy. The insured party engages a competent organisation to review and approve planned operations on behalf of the insurer. The MWS is ultimately a risk mitigation. This is performed through review of design calculations, and procedures to perform specific tasks. This verifies all work is performed to the accepted standards and that it presents no undue risk, other than that normally expected to the insurance underwriter.

Depending on the purpose there are different types of marine warranty policies, these include Marine Machinery, Project Cargo, General Cargo, or Construction All Risk (CAR). Surveyors are not always required; however, this does not mean that they are not always needed.

Independent third parties such as MWS can play a greater role by reviewing maintenance records on behalf of P&I clubs. Thereby safeguarding other interested stakeholders that are generally not covered by class societies. This would create an additional layer of protection to ensure that adequate reviews are undertaken for the management and transportation of cargo.

In general terms for Marine policies, i.e. hull and machinery, there is not a requirement to have an MWS present. Cargo policies which include large assets such as drydocks, and MODUs will have some allowance for MWS. CAR polices usually have the largest engagement with Marine Warranty Surveyors where the potential cost of equipment or project delays is substantial.

So, considering the collapse of the Francis Scott Key Bridge, it is clear now is the time to review our engagement with Marine Warranty Surveyors and ensure that we are adequately de-risking the impacts on vessels, infrastructure, and the local economy. By increasing engagement between vessel owners, operators, and insurance underwriters there is the potential to both save costs and increase safety performance.

These events have a broader implication for the maritime shipping industry. Supply chain disruptions, increased transportation costs, and delays in cargo delivery could impact the bottom line for shipping companies and their insurers. Insurers and policyholders will need to work together to navigate these challenges and ensure that appropriate coverage is in place to mitigate the financial risks. As an industry we also must be cognizant of the rapidly changing shipping sector in comparison to aged infrastructure. Port studies need to recognise that there is an increasing risk to their infrastructure and adequate mitigations need to be put in place to protect their systems.

## Understanding risks

Overall, the collapse of the Francis Scott Key Bridge has significant insurance implications for maritime shipping operations. Insurers will need to carefully assess the risks and coverage available under various policies, while shipping companies will need to take steps to protect their vessels, cargo, and personnel in the wake of this tragic event.

More focus needs to be placed on mitigation of risk and how the industry can leverage the knowledge of the MWS community to drive safety and reduce exposure. By working together, insurers and policyholders can address the challenges posed by the bridge collapse and help the maritime shipping industry recover from this disruption. Infrastructure exposure is another key risk that has been highlighted through the impact of maritime shipping. This is something that needs to be addressed and accounted in marine operations.

As the investigations into the cause of the collapse continues, insurance adjusters will play a key role in helping to navigate the complex insurance landscape in the aftermath of this tragedy. By understanding and mitigating risks associated with complex marine operations it will be possible to learn the lessons from this tragedy and ensure that these are brought forward for future operations.

If you want to find out more about the role of Insurance Underwriters, Loss Adjustors and Marine Warranty Surveying please do not hesitate to get in contact. ■

*John Butler is a marine engineer with over 25 years' experience in maritime, oil and gas and now energy transition industries. A Chartered Mechanical Engineer and a Fellow of the IMarEST, he holds the role of global lead – Energy Transformation at Global Maritime where he is responsible for the strategy and development of new and existing business streams within the marine sector.*

# SALVAGE

## SALVORS AVERT SUBSTANTIAL MARINE POLLUTION

ISU's latest Pollution Prevention Survey shows environmental benefit of salvage industry

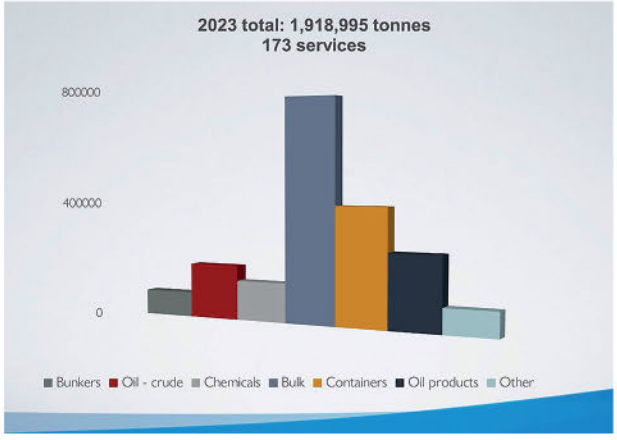
Members of the International Salvage Union (ISU) provided 173 services to vessels carrying 1.9 million tonnes of potentially polluting cargo and fuel during operations in 2023, demonstrating the key role of professional salvors in protecting the marine environment. The data come from the recently published ISU Annual Pollution Prevention Survey for operations in 2023.

According to ISU president John Witte: "More than ever, ESG requirements are at the top of the agenda for all industries and of course for shipping. The focus on emissions and climate change must be maintained but we must not lose sight of the importance of simply protecting the environment. It affects those providing services to shipping as much as the owners: the insurers and financiers as we see with the adoption of the Poseidon Principles.

"Sustaining a viable professional salvage industry ready to respond to all kinds of incidents around the world is vital and that is recognised by insurers and owners but it needs to be properly funded."

There were fewer services in 2023 compared with the previous year and that is in line with the downward trend of the ISU general industry statistics. But each year there can be significant variations of the quantities of pollutants in each category. That may be due to vessel size increasing so that, for example, one major container ship case might significantly affect that category.

And the number of containers is lower than last year but, after bulk cargo, still represents the most significant category with ISU members providing services to vessels carrying 30,000TEU amounting to some 400,000tonnes of cargo. It compares with 187,000tonnes of crude oil. Containers carrying a great variety of harmful and dangerous goods including plastic pellets (nurdles) represent one of the biggest threats to the marine environment.




ISU MEMBERS PROVIDED 173 SERVICES TO VESSELS CARRYING 1.9 MILLION TONNES OF POTENTIALLY POLLUTING CARGO AND FUEL DURING OPERATIONS IN 2023. SOURCE: ISU

### EVs an increasing concern

Witte adds: "Containers continue to be difficult to deal with – offloading, storing and perhaps backloading. But the traditional threat from oils remains and there were also several cases of car carriers and ro-ro fires and the carriage of electric vehicles (EVs) is an increasing concern. Salvors often do not know if there are EVs or batteries on board or the quantity."

Cargoes of refined oil products increased significantly in the 2023 numbers as did chemicals. Dirty and hazardous bulk cargoes in 2023 were 770,000tonnes – down from 1,236,000 the previous year. An increased number of the services in the survey did not record the quantity of bunkers or the cargo type meaning the reported numbers likely represent a more modest total than the reality.

The 173 services in 2023 included 43 wreck removal/ marine services contracts; 19 Lloyd's Open Forms; 24 towage contracts; 10 Japanese Forms; five Lump Sum, six Day Rate contracts; 37 other contracts – including commercial terms and common law salvage and OPA 90 (Oil Pollution Act of 1990) responses – and 29 Turkish Forms.

ISU is transparent about the fact that not all these potential pollutants were at immediate risk of going into the sea. Some cases will have had limited danger, but others will have carried a real risk of causing substantial environmental damage. In an era of "zero tolerance" of any pollution, even the smaller cases represent a significant concern.

The survey was first conducted by ISU in 1994 and the methodology was updated in 2014 to include a wider range of potential pollutants including containers and hazardous and dirty bulk cargoes. In the period 1994 to end-2023, ISU members have provided services to casualty vessels carrying 43,397,100tonnes of potential pollutants, an average of 1.5 million tonnes per year. ■

# DENMARK

## DENMARK PUTS DECARBONISATION AT THE FOREFRONT OF ITS SHIPPING AGENDA FOR 2024

By **Tom Barlow Brown**

DENMARK'S COMMITMENT TO EMBRACING SUSTAINABLE PRACTICES HAS PLACED THE COUNTRY AT THE VANGUARD OF SHIPPING'S GREEN TRANSITION JOURNEY. SOURCE: MARK KONIG/UNSPLASH

"The green transition is at the forefront of our minds in this industry, and it underscores everything that we do, because it's the right thing to do." That was the message from Anne Steffensen, CEO of Danish Shipping, when she spoke to a room of assorted reporters in Copenhagen in April.

Steffensen, who was appointed as chairperson of the organisation in 2022, was launching a series of presentations from companies focused on Denmark's aims to put decarbonisation at the forefront of its agenda for its shipping industry. The Danish maritime industry's trajectory toward decarbonisation emerged as a central theme at the event and Steffensen's discourse highlighted the urgent imperative to mitigate greenhouse gas (GHG) emissions, emphasising that an impressive 80% of tonnage in the Danish shipping sector is on the brink of transitioning to green fuels. This notable commitment extends beyond industry giant Maersk, with numerous Danish shipping entities, such as bulk carrier TORM, actively investing in alternative fuels, indicative of a collective determination to steer through the green transition.

The shipping industry stands as Denmark's largest export industry, surpassing all records in 2023 with exports exceeding DKK500 billion. In 2022, Danish shipping accounted for a staggering 27% of Denmark's total exports, underscoring its significant contribution to the nation's economy. Despite a slight dip in the number of Danish-flagged ships over that year, primarily due to divestment by shipping companies, the fleet remains considerably larger than a decade ago. Anticipated developments such as the introduction of Danish-flagged ships powered by e-methanol signify ongoing advancements within the industry.

At the core of the Danish maritime industry's attempts lies an imperative to sustain competitiveness in an ever-evolving global landscape while still showing it can put necessary safeguards in place to stay in the lead of tackling climate change. Steffensen articulated the industry's solid commitment to embracing sustainable practices and attempts to position Denmark as a country innovating in maritime environmental stewardship. This is highlighted by a goal set by the country to achieve carbon neutrality by 2050.

### Robust regulations and global collaboration

Central to this transition is the pivotal role of robust regulations and global collaboration. Steffensen underscored the indispensable need for regulatory frameworks that not only incentivise sustainable practices but also foster innovation. "We are working very hard to provide the leadership in our community and this association, together with our members, to make sure that we get the right regulation in place for this transition and this revolution to happen in the right way," she noted.

Danish Shipping also actively engages with regulatory bodies, notably the European Union, advocating for policies that strike a delicate balance between environmental imperatives and industry viability.

However, amidst the industry's ambitious green goals, concerns loom regarding competition for new fuels from other sectors. Access to sustainable energy sources emerges as a critical determinant of the shipping industry's decarbonisation strategy and Steffensen stressed the imperative of ensuring equitable access to green fuels, warning against disparities that could undermine the industry's sustainability objectives.

Addressing queries about competition for new fuels, Steffensen acknowledged the multifaceted challenges confronting the industry. "The big problem in what we are doing there is of course that we don't have enough fuels. And I think that's no big secret," she said.

The imperative to secure access to sustainable energy sources amid growing demand underscores the industry's urgency to collaborate with governments and fuel producers. Steffensen emphasised the industry's readiness to embrace renewable energy sources, provided they are readily available and economically viable.

Navigating geopolitical complexities, Demark remains vigilant in safeguarding vital maritime routes crucial to global trade. Steffensen highlighted collaborative efforts with international stakeholders, including the British government, to address security concerns in regions such as the volatile Red Sea. Disruptions in maritime routes not only jeopardise supply chains but also pose risks to the safety of seafarers and vessels and the country's proactive engagement underscores its commitment to fostering stability in crucial maritime corridors. Moreover, concerns regarding piracy attacks in regions like the Indian Ocean underscore the complex operational landscape within which the shipping industry operates.

## Setting new benchmarks

Denmark's focus on environmental protection extends beyond mere compliance with environmental regulations; it aspires to set new benchmarks for sustainability within the global maritime sector.

The country has recognised the ban on the discharge of scrubber water in Danish waters. The ban, which was reached following a broad political consensus, prohibits ships sailing through Danish waters from discharging wash water from smoke-cleaning systems. The ban is notable as scrubbers have become widespread following stricter sulfur regulations in 2015, and especially after global sulfur regulations took effect in 2020.

"I am pleased that the politicians have chosen to listen to our request to introduce a sensible phase-in period, so that the shipping companies that have invested a lot of money in complying with the rules and reducing their sulfur emissions with a scrubber have time to adapt to a new reality," stated Nina Porst, director of Climate, Environment and Safety at Danish Shipping.

The sector's commitment to green shipping and energy is evident in ambitious reduction targets set in the final GHG strategy of 2023, aiming to align with the Paris Agreement. Additionally, efforts to increase Danish shipowners' contributions to global offshore wind capacity and carbon capture projects reflect a commitment to environmental sustainability.

Maintaining and developing a robust supply chain of competencies remains a priority, with initiatives aimed at providing at least 400 internships at sea annually to cater to the growing Danish fleet and offshore sector. Moreover, Danish Shipping remains dedicated to addressing members' day-to-day challenges and monitoring and improving Danish conditions to support the continued growth of the merchant fleet and shipping industry.

## Significant challenges ahead

Steffensen's presentation in April underscores Danish Shipping notable attempts to place itself at the forefront of a transformative journey towards sustainability. However, while its initiatives are commendable, there are challenges and limitations ahead. Despite its efforts, achieving complete decarbonisation poses significant technical and economic challenges that may require further innovation and investment. A current lack of available fuels and ships able to run on alternatives could prove a sticking point.

However, Danish Shipping's proactive approach and commitment to collaboration offer valuable lessons for the broader maritime community. By addressing these challenges head-on and fostering dialogue and cooperation, Danish Shipping sets a positive example for the industry stakeholders moving forward. ■


ANNE STEFFENSEN, DANISH SHIPPING CEO.
SOURCE: DANISH SHIPPING

# HUMAN FACTORS

## SMOOTH SEAS AHEAD: ENHANCING MARITIME OPERATIONS THROUGH HUMAN FACTORS

By **Hans Huisman**, team leader, Human Factors, Maritime Research Institute Netherlands (MARIN)


TWO MARIN EMPLOYEES ON BOARD A VESSEL OBSERVING THE OPERATION AS PART OF THE HUMAN-CENTRED DESIGN APPROACH

The human element in the maritime industry gets more and more attention. Why is this happening, and is it relevant to have the human element addressed more in the maritime industry?

It is often quoted that more than 80% of shipping accidents are caused by human error. It is difficult to prove where this 80% figure originates, but the fact is that human error is indeed in many cases the cause of an accident happening with technically sound vessels. This is most likely a key driver for setting the human element in the spotlight because accidents are expensive in terms of economic damage, injuries, lost lives and environmental harm. So, no surprise that the suspected cause, the human element, is very relevant and therefore gets increasing attention in the growing maritime industry.

This article illustrates that the Human Factors discipline is broad and provides various methods to enhance safety and efficiency of maritime operations during the operational phase but even more importantly during the design and developments phase of these maritime operations. In other words, this article depicts that the human in the operation is not just the mariner on the bridge – many more human actors are involved and play an important role in what sometimes can result in a sequence of events leading up to the so-called 'human error' on the bridge.

### Human factors in the various parts of the industry

To get a better understanding of why a technically sound vessel with a well-trained and experienced crew gets into trouble it is worthwhile to zoom in where human factors in the maritime world play a role. Most attention is focused on the frontline operator, the one who pushed the button the moment before it all went wrong. Seems logical, but is it sensible? Only partly. The frontline operator, the mariner, finds him- or herself in a situation which has built up over time. Time can be the order of minutes, hours but also many years. A mariner does not do their job in splendid isolation – he/she is part of a complex ecosystem with many actors, all having their own drives and agendas.

Zooming in on the vessel itself, a mariner is part of the crew on board. Zooming out a bit, the mariner contributes to the operation of a shipping company which in turn is contracted by other parties to, for example, transport goods from A to B or perform a job

at sea. Zooming out further, the mariner is tasked to operate a vessel which has been designed by engineers for a certain type of operation, meeting requirements defined in the vessel design phase by other engineers. The mariner is given a set of tools on board, designed and developed by supplier companies of maritime components – for example, the bridge instruments. Of course, this is all carried out in line with current regulations and class rules for each component of the vessel the mariner is responsible for.

### Human-centred operations design

Performing the various tasks on the bridge is supported by a number of systems, some being more user friendly than others. Having equipment on the bridge that provides optimal support to the (navigational) tasks generally leads to safer and more efficient operation. This is no surprise of course. In terms of human factors, a human-centred design (HCD) approach guarantees the design of the bridge layout and the development of equipment which supports the crew best and reduces the risk of human error in system usage most. A well-designed user interface is based on good design decision rather than a coincidence in hoping the system will meet the requirements of the crew. In brief, an HCD approach involves experienced operators in the design process.

In an iterative way, with a starting point of a good understanding of the daily operational life, prototypes are being developed. First as low-cost desktop equipment that is easy to modify, and in a number of steps growing towards fully capable systems being evaluated in a whole task environment. This can be a bridge simulator or on board a vessel. It requires involvement of scarce resources, the experienced mariner, and this is a difficult economic and scheduling hurdle. But in terms of business risk, modifying an end product after it has been put into service brings a lot more costs than the limited time spent on an HCD approach.

Human-centred design does not only apply to the design of technical systems but can also be applied to procedures and job definitions. Ill-defined procedures and ill-defined team roles are a precursor to human error somewhere down the road. Explicit design of procedures and team roles is feasible both for teams cooperating as part of one single organisation, and across organisations. In both cases, well-defined roles and ways of working are valuable and result in a safer and more efficient operation. The effort to streamline business processes across organisation boundaries is more complex but worthwhile to pursue. In a technical environment, as the maritime industry is, it is sometimes overlooked that both the organisation and working methods can be designed in a structured way rather than growing organically over time.

## 'Human in the loop' simulator evaluations

Due to rapid advances in technology, simulations are increasingly used as a good instrument not only to train people but even more so to develop, evaluate and validate new technologies and processes before operational deployment. Setting up a valid simulator evaluation requires a high-fidelity simulation environment in which the crew is truly submerged in a copy of the real world and is challenged to do their daily jobs as seriously as the real world would require. Just as important as this highly realistic simulated shipping operation is creating a scenario which is partly implemented in the simulator, such as vessel behaviour (wind and weather for example), as well as clear instructions for the tasks at hand, operational procedures and events scripted to occur during the simulation, which add to the realism of the situation created for the crew.

A third topic to cover in a simulator evaluation is the recording of pivotal data in order to draw conclusions about the performance of the new technology and the crew. Since the evaluation is often used as part of a development process of new solutions, the data recording serves as an objective basis for decision making business processes for further investments. One of the sources of data which can be recorded is the human operator themself. For instance, eye scanning behaviour, facial expression, pupil diameter, heart rate (variability) and skin conduction give an insight into the effort spent by the operator while performing a task. It is this insight into the balance between spent effort and resulting performance which is relevant when evaluating future concepts and deciding whether the operator is optimally supported, or if modifications should be made in order to improve support for the operator.

## Safety

This article started by saying that human error is in many cases the cause of incidents and accidents and subsequently the human factors contribution to safer and more efficient operations has been illustrated. Still, incidents and accidents will occur, no matter how good the design of the vessel, the equipment, the procedures, the organisation, and the competence level of the crew. Also, in accident prevention and responding to accidents human factors has its role. On the prevention side, a safety assessment is a well-known method to estimate the probability of occurrence of certain hazards and to estimate the consequences of hazards. As part of such probability and consequence estimations the role of the human operator should be an integral part. Which human errors can occur and what is their likelihood? In addition, if a hazard occurs, which actions can be taken by the operator to limit the consequences or which actions may even increase the severity of the consequences? These questions are addressed in a safety assessment and form the basis for implementing mitigating measures to reduce the risks.

Another safety related human factors area is reporting and learning from incidents and mistakes. An incident or accident caused by human error is an expensive lesson to learn from for the future, making sure the same mistake will not happen again. A prerequisite for people to report their role in incidents and be open in explaining what happened in an incident and accident is that people are allowed to be open and give a full explanation of what happened. If they are not directly being prosecuted and being accused of bad behaviour but listened to with the intention to learn from them, they will dare to share. In the maritime domain, such a no-blame culture hardly exists, and the maritime industry deprives itself of the possibility of learning from expensive lessons, as accidents are.

The Human Factors discipline has many aspects, and this article just scratches the surface and intends by no means to be complete. Striving to address the human factors at play in the maritime industry in a more structured and coherent manner will pay off without a doubt. Applying human-centred design, conducting 'human in the loop' (simulator) evaluations before operational implementation and last, but not least, learning from incidents and accidents is not rocket science and concerns existing methods already in use in various industries and ready to be used (more) in the maritime industry. Doing so will contribute significantly to many areas in the maritime industry to increase safety, efficiency, and keep it an attractive business to work in. ■

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# SET COURSE FOR METSTRADE 2024

WHERE THE GLOBAL LEISURE MARINE INDUSTRY COMES TOGETHER

# PARAMETRIC ROLL AS A CONTRIBUTOR TO CONTAINER LOSS AT SEA: A SIMULATOR STUDY

By **Heike Diepeveen**, Maritime Research Institute Netherlands (MARIN)

Over the past decade the size of deep-sea container ships has increased dramatically, with the largest vessel having a capacity of 24,346TEU. Although economically beneficial, there is a growing public and political concern about the environmental risks associated with container shipping. According to the World Shipping Council's 2023 report on container loss at sea, an average of 1,566 containers were lost annually between 2008 and 2022.

This is a multifaceted problem caused by factors across the entire container shipping supply chain. Container loss is often the result of a snowball effect starting from mistakes in the stowage, leading up to wrong calculations in the loading computer, which in turn affect the decision making of the ship's crew. To get a better understanding of the container loss problem and tackle the factors influencing it from multiple viewpoints, the TopTier joint industry project (JIP) was set up by MARIN. This article focuses on one of the upcoming studies within the project delving into parametric rolling as a contributor of container loss.

## Recognising preconditions

In simplified terms, parametric rolling is a phenomenon that can occur when the wave encounter period is approximately half of the ship's natural period, in head seas, following seas or quartering seas, leading to severe rolling within a short time period. When the preconditions are met, parametric rolling may build up any time and roll angles can increase rapidly to extreme angles, with only a couple of oscillations between mild and extreme angles. What makes parametric rolling complex is that it is rather difficult to predict if and when it will occur, while it is highly important to take preventative actions. Acting upon it while angles are already being exceeded would not allow for sufficient time to make course and speed changes. Therefore, it is important for a container ship crew to be aware of parametric rolling preconditions, have the appropriate tools and knowledge to recognise it, and have an understanding on how to take preventative actions.

In the first phase of the TopTier project a questionnaire was administered to over 1,500 seafarers, which gave insight into their overall experience with different factors within the container shipping supply chain, both during stowage as well as during sailing. One of the findings was that the seafarers had little experience with parametric rolling, limited knowledge on what it entails and limited knowledge on what to do when it occurs. A review of incidents performed within the programme found that parametric rolling

A SHIP'S VULNERABILITY TO PARAMETRIC ROLLING CAN BE A CONTRIBUTOR TO CONTAINER LOSSES AT SEA. SOURCE: RINSON CHORY/UNSPLASH

## HUMAN FACTORS 2024

The Human Factors 2024 conference, taking place from 8-9 October 2024 in Wageningen, the Netherlands, will provide an opportunity for human factors experts, naval architects, bridge officers and others to come together and discuss recent developments in the Human Factors discipline.

The conference will focus on lessons learned from interventions and applied research that were successful or, even more interestingly, featured unexpected or bad results – for example, the implementation of new automation on board that worked out differently or behavioural interventions that had unexpected effects. Human Factors 2024 is all about applied research that provides learned lessons for future Human Factors research, specifically for the maritime domain.

As part of the conference, the delegates will have a unique opportunity to visit MARIN's new Seven Oceans Simulator Centre, where the attendees will have a chance to:

- Tour the brand new Seven Oceans Simulator Centre.
- Attend a workshop on how to design a bridge layout for special purpose vessels with physical mock-ups.
- Attend a workshop measuring human performance covering eye-tracking, emotion recognition, heart rate variability and galvanic skin response.

Further details on the Human Factors 2024 conference, a preliminary programme and a registration form can be found on the RINA website at: https://rina.org.uk/events/events-programme/human-factors-2024.

WAGENINGEN. SOURCE: CREATIVE COMMONS

was a likely cause of major container loss incidents. Therefore, this questionnaire finding was marked as a high priority problem to tackle. Furthermore, it was found that information about lashing and loading conditions and the roll natural period was not always accurate, affecting the ability of the crew to make appropriate informed decisions. This factor is also of importance when it comes to recognising and preventing parametric rolling, since predictions rely on the accuracy of this information.

### Studying the operator behaviour

Based on the project findings, the decision was made to further explore parametric rolling from an operator perspective. The best way to truly understand how seafarers experience and act upon parametric rolling preconditions is by observing and questioning them when the situation arises. However, parametric rolling is a relatively rare phenomenon, making it unfeasible to plan observations in a real-life environment. For this reason, a user study will be performed on MARIN's new large motion simulator (LMS). The six degrees of freedom motion platform, alongside the immersive projectors and control panels, allow us to mimic parametric rolling preconditions, making it a suitable environment for studying the operator behaviour.

The operator group will consist of bridge crews from different shipping companies, with different experience levels, to have a representative population sample. The study takes place in June this year and aims to bring more awareness to the complexity of recognising parametric rolling as well as gaining insight into the information and system requirements that should be put into place to improve the awareness and decision-making process of the crew. Three main questions will be studied:

1. Does the bridge crew recognise parametric rolling preconditions?
   - What actions does the bridge crew take to prevent parametric rolling?
   - Will the bridge crew be able to prevent parametric rolling at the time they observe the preconditions?
2. Would the actions taken have been effective in preventing parametric rolling under the given conditions?
3. Does adding information prior to and during sailing affect the situational awareness and decision making of the crew in recognising and preventing parametric rolling?

This autumn, the results of the study will be presented at the Royal Institution of Naval Architects and MARIN organised Human Factors 2024 Conference, which will be held on 8-9 October 2024 in Wageningen, the Netherlands. ■


SOURCE: CARONTE & TOURIST

# RO-ROS & FERRIES

## A NEXT GENERATION OF COMPACT DOMESTIC FERRY

The vast Mediterranean Basin is dotted with hundreds of small islands that rely on lifeline ferry services. Quite often, these routes are served by obsolete small- to medium-size ro-pax ferries as operators have failed to invest in a much-needed tonnage rejuvenation boasting alternative fuels. One of the few exceptions is Italy's Caronte & Tourist that recently introduced the hybrid LNG-powered *Nerea*

By **Philippe Holthof**, Correspondent

Norwegian fjord ferry operators pioneered LNG as an alternative fuel with Fjord1's *Glutra* being the world's first LNG-powered ferry when introduced in 2000. Twenty-four years on and the Norwegians have turned their back on LNG as operating zero-emission ferries has become a prerequisite to obtain a route concession from the public transportation authorities. However, Norway is the exception rather than the rule with many of the ferry services warranting full-electric operation on account of the relatively short distances covered. In addition, Norway is also a heavy producer of renewable energy thanks to hydropower. The situation is totally different in most other parts of Europe and especially in Italy and Greece it is a far cry from Norway's as the former countries even struggle to develop an LNG bunkering infrastructure and supply network, not to mention authorities' red tape.

In late 2018, Caronte & Tourist introduced the Mediterranean's first LNG-powered ferry, the Messina Strait double-ender *Elio*. Despite Caronte & Tourist's relentless efforts to use LNG as an alternative fuel, continuing bureaucracy has hindered them to do so. But this didn't discourage the Sicilian ferry operator to specify a more expensive dual-fuel (LNG) setup when ordering *Nerea* at Sefine Shipyard in February 2021.

Turkish shipyards have carved a niche in the small- to medium-size ro-pax segment. Besides *Nerea*, Sefine Shipyard also built *Elio* and its soon-to-be-delivered near sister ship *Pietro Mondello*. This clearly illustrates that the Yalova-based shipyard has gained a reputation as a reliable and prolific ferry builder whose customer portfolio also includes Norled, Bastø Fosen, Boreal, Fjord1, and Estonia's TS Laevad.

### Purpose built for the Isole Minori

As *Nerea* has been specifically built for Sicily's so-called Isole Minori or minor islands, it doesn't have to comply with SOLAS. Regardless, Safe Return to Port (SRtP) rules don't apply either as the vessel has a length below 120m with not more than two main vertical zones. Even so, *Nerea* is almost fully SOLAS compliant, being built in accordance with EU Class A navigation

rules which are equivalent to short international voyages. So, flexibility is key as Caronte & Tourist, linking Sicilian mainland ports with the minor island chains under the Siremar brand, was poised to have a one-size-fits-all design that could operate on both long-distance and shorter distance routes. During this past winter, *Nerea* connected Trapani on Sicily's west coast with Pantelleria, a 93NM distance. The vessel typically performs a return crossing per day with crossing times varying between six and seven and a half hours. This distance is comparable with e.g. Portsmouth-Le Havre, and like the latter route, the one to Pantelleria is equally exposed as it doesn't follow the coastline. Covering this long-distance Pantelleria route as an EU Class A ship, the total number of passengers is limited to 400. The maximum number of passengers doubles to 800 when operating as an EU Class B navigation vessel which limits domestic voyages to within 20NM off the coast. This is when *Nerea* is homeported in Milazzo, serving the Aeolian Islands off the northeast coast. Even so, the vessel's EU Class A notation allows it to continue all the way to Naples.

| TECHNICAL PARTICULARS *NEREA* | |
|---|---|
| Length oa | 109.95m |
| Length bp | 101.68m |
| Breadth, moulded | 19.50m |
| Depth to main deck | 7.50m |
| Draught, design | 4.80m |
| Draught, scantling | 4.80m |
| Gross tonnage | 8,225 |
| Net tonnage | 2,470 |
| Deadweight | 1,400t |
| Lane-metres/cars | 419m/114 |
| Passengers | 800 (EU Class B)/400 (EU Class A) |
| Passenger cabins/ berths | 20/76 |
| Main engines | 2 x Wärtsilä 6L34DF + 2 x Wärtsilä 8L20DF |
| Output | 2 x 2,890kW at 750rpm + 2 x 1,230kW at 750rpm |
| Propulsion power | 2 x 2,500kW |
| Service speed | 16.5knots (80% MCR) |
| LSAs | 2 x 150-person Palfinger lifeboats + 2 x VIKING MES |
| Class | RINa |
| Class notation | Ro-Ro Passenger Ship, Unrestricted Navigation, +AUT-UMS, Gas Fuelled, DYNAPOS-SAM, IWS, Green Passport Plus, Battery Powered Ship |
| Flag | Italy |

## Italian naval architects

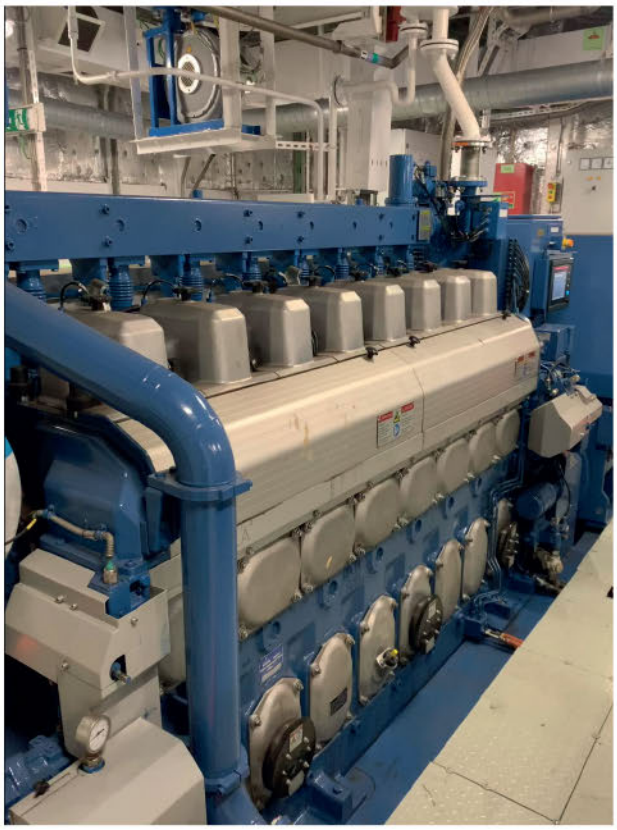
While *Elio* and its near sister ship *Pietro Mondello* were a product of Norway's LMG Marin, renowned for its double-ender platforms, *Nerea* was designed from scratch by NAOS Ship and Boat Design, the naval architects behind the successful, if rather utilitarian Cantiere Navale Visentini ro-pax and ro-ro series. The Trieste-headquartered naval architecture consultancy has also been responsible for innovative ro-ro prototypes built in Germany, Finland and China with Stena RoRo's NewMax class being the latest example.

As befits a NAOS Ship and Boat Design hull form, fuel efficiency is at the heart of the design on the back of in-house CFD simulation and tank testing. *Nerea* also comes with NAOS Ship and Boat Design's proprietary FlexBow with small bulb.

## Excellent manoeuvrability

By virtue of the lifeline element and as per government requirements, reliability is paramount. However, with fairly exposed island ports and tug assistance almost non-existent, *Nerea* relies on its own power. To optimise manoeuvrability, Caronte & Tourist opted for two azimuth thrusters with an output of 2,500kW each, supplemented by 1,600kW of combined bow thrust power. Owing to this, *Nerea* obtained RINa's DYNAPOS dynamic positioning class notation. The rudder propellers and the twin bow thrusters are from Schottel with the 360° rotating EcoPeller propulsors being of the SRE 610 type. For redundancy's sake,

LNG TANK ROOM. SOURCE: NAOS SHIP AND BOAT DESIGN



ENGINE ROOM. SOURCE: NAOS SHIP AND BOAT DESIGN

Caronte & Tourist ordered a spare azimuth thruster which it keeps on permanent on standby. Thanks to its compact size, the propulsion motor or even the entire pod can easily be replaced through hatches on the main vehicle deck, Deck 3. This is further evidence of the company's commitment to ensure territorial continuity at all times.

## Hybrid LNG powered

*Nerea*'s diesel/gas-electric hybrid propulsion system boasts two Wärtsilä 6L34DF gensets in the forward machinery room and two smaller Wärtsilä 8L20DF gensets in the aft one. This arrangement gives the necessary energy flexibility with the larger dual-fuel gensets each having a 2,890kW output at 750rpm while the smaller versions each have a 1,230kW output.

While the service speed at 80% MCR is 16.5knots, 18knots was the contractual speed at 100% MCR. During sea trials, *Nerea* reached a maximum speed of 20.3knots with the excess power primarily meant for manoeuvring purposes and to cope with the prevailing bad weather circumstances.

Located between the aft machinery room and the thruster propulsion room is the midships engine control room, on the starboard side of which is the 1.0MWh battery room (ESS). The Corvus Energy batteries are charged during sailing, warranting about four hours of zero emissions and noise when alongside. When operating to the minor islands of Sicily, *Nerea* remains in port all night when the hotel load is drastically reduced, allowing for a longer battery autonomy. A total of 250m$^2$ of Solbian solar panels that cover a 180-seat semi-open aft deck on Deck 7 produce up to 50kW of power, being connected to the main switchboard with the energy either directly used or used to charge the batteries.

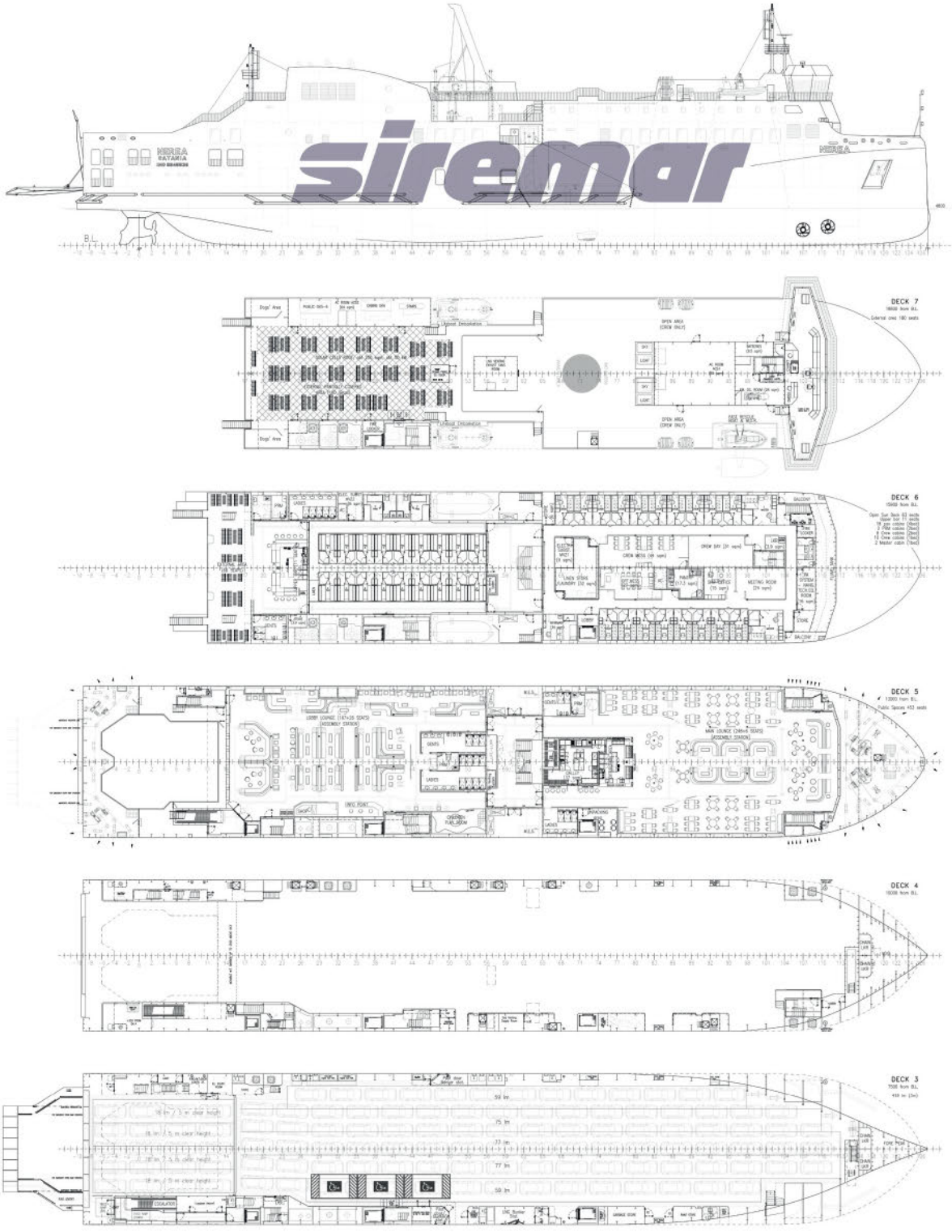
With its zero emissions in port strategy, using battery power, Caronte & Tourist follows in the footsteps of compatriot Grimaldi Group that first adopted this principle on the Cruise class ro-pax ferries *Cruise Roma* and *Cruise Barcelona* when lengthened in 2019. The rationale behind charging batteries as sea is that onshore power supply (OPS) infrastructure, something critical in the electrification of the world's ferry fleets, is lacking in most of the Mediterranean ports as shoreside electricity demand is prioritised, especially in summer when AC units are working overtime. Interferry, the shipping association representing the ferry industry worldwide, recently urged governments and electricity utilities to aggressively invest in the development of OPS capacity to facilitate the ferry sector's transition to net zero.

*Nerea*'s 150m$^3$ centreline Wärtsilä LNGPac storage tank is located below the main deck, towards the forepeak. Although Caronte & Tourist is pushing hard to bunker LNG instead of MDO, LNG supply for the maritime sector has become problematic in Sicily. However, there was light at the end of the tunnel when a first successful truck-to-ship bunkering operation of LNG was completed in the port of Trapani in mid-April. As Caronte & Tourist will soon introduce a third dual-fuel ferry, the ferry operator has high hopes that LNG supply will improve.

As weather conditions are often challenging, *Nerea* has uniquely been equipped with a pair of non-retractable fin stabilisers and a Hoppe-designed flume tank positioned forward on Deck 6, just below the fully enclosed wheelhouse. SKF's compact non-retractable Type F fin stabilisers are equipped with an anti-vortex tip, being fitted in a position that they don't protrude beyond the ship's maximum beam or bottom.

BUNKER STATION. SOURCE: NAOS SHIP AND BOAT DESIGN

GENERAL ARRANGEMENT OF *NEREA*. SOURCE: CARONTE & TOURIST

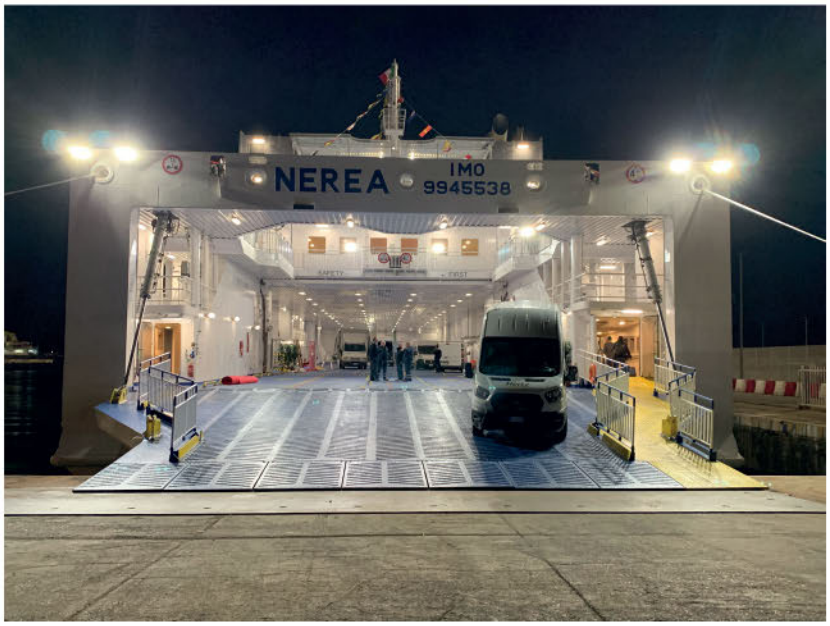



CARGO HOLD. SOURCE: NAOS SHIP AND BOAT DESIGN

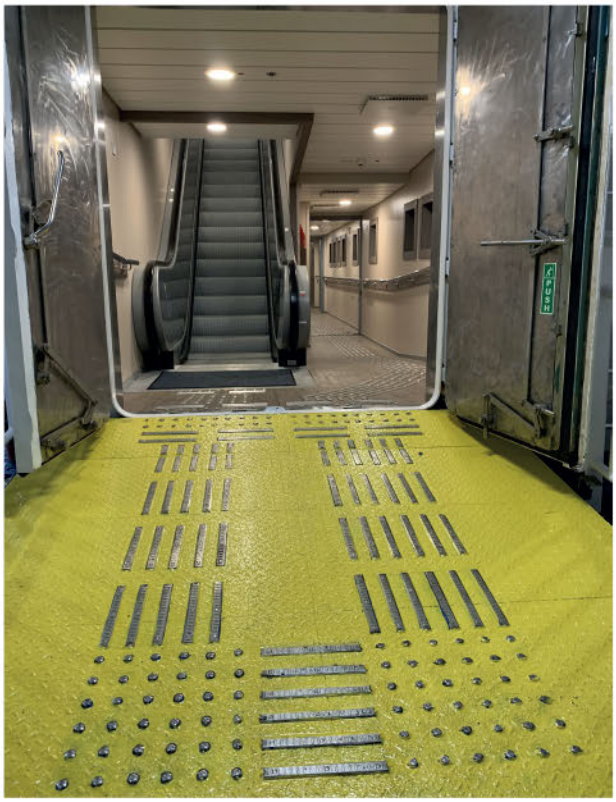
## Single vehicle deck

Port infrastructure quite often leaves a lot to be desired in Mediterranean small island ports. In many ports, it's often nothing more but a concrete quayside or pier finger on which the ferry's stern ramp lands. So, in typically Mediterranean fashion, *Nerea* is a stern-only loader with a single hydraulic ramp designed by NAOS Ship and Boat Design and made in Turkey by Denizsan. The 11m-long ramp, including 1.4m-long flaps, is 16m wide but narrows to 11m at the shore end. Besides vehicles, also foot passengers board *Nerea* via the stern ramp, yet another peculiarity of Mediterranean ferry operations. The ramp has a dedicated foot passenger walkway that leads to the starboard casing with a single Thyssenkrupp escalator connecting Deck 3 directly with Deck 5. The starboard casing houses the uptakes of the four gensets as well as the LNG bunker station, storerooms, luggage locker, three staircases and three Thyssenkrupp elevators, two of which are for passenger use. One barrier-free elevator is located adjacent to three car parking bays for people with reduced mobility. As the starboard casing holds all engine uptakes, the ship's funnel is located on the starboard side. The mirror view portside dummy funnel is used for AC purposes. There is no portside casing, save for a short one at the stern.

Located between both casings is a semi-open and partially covered four-lane vehicle deck with a 4.85m clear height. This is the ship's weather deck for vehicles transporting certain categories of IMDG goods that shall be stowed 'on deck'. This 72lane-metre semi-open aft part is separated from the five-freight lane enclosed deck by a 2.5m-high hoistable barrier. The enclosed vehicle deck has a clear height of 4.85m and has no hoistable car decks installed. The trailer lanes have a width of 3.0m with a total freight




CARGO RAMP. SOURCE: NAOS SHIP AND BOAT DESIGN



PEDESTRIAN EMBARKATION. SOURCE: NAOS SHIP AND BOAT DESIGN

lane-metre capacity of 347m. The total car capacity is 114 cars, parked in six lanes.

## Passenger facilities

Passenger facilities are concentrated on Deck 5 with a total seating capacity of 453, spread over the forward main lounge and aft lobby lounge, both of which have sanitary facilities. The main lounge, which boasts a small centreline self-serve counter offering light snacks and meals prepared in a 37m$^2$ connecting galley, has a mix of chairs and sofas arranged around tables. Thanks to large picture windows wrapped around the whole of Deck 5, there is an abundance of natural daylight in both the forward and aft lounge. The lounges have tip-up seats for people with reduced mobility but there are also dedicated bays for wheelchairs. The starboard escalator starts and ends in the aft lobby lounge with small walk-in shop, information desk and children's playroom located on the starboard side. The main staircase, connecting Deck 5 with Deck 6, separates the forward from the aft lounge. Outboard of it are VIKING MESs connected to six inflatable liferafts. Two fully enclosed 150-person Palfinger lifeboats and a single fast rescue boat that doubles as an MOB complete *Nerea*'s LSAs.

When operating as an EU Class A ferry, the crew typically lives on board with 12 single-bed and eight twin-bed outside cabins located on Deck 6, just abaft the wheelhouse. In the same section, yet inboard, are the skylight-covered crew's mess with pantry, day room, ship's office, meeting room, and laundry with linen store.

Aft of the main staircase is a block of 18 four-berth standard inside cabins, accessed from a centreline corridor. Outboard of the cabins, on both the starboard and portside, are corridors connecting the main staircase with a well-protected semi outer bar that gives access to a small, 66-seat outside deck. Along the portside corridor are two two-person outside cabins for passengers with reduced mobility, bringing the total number of cabins and berths to 20 and 76, respectively. More semi-outdoor seating capacity is available on Deck 7, underneath the solar panels and abaft the gas vent mast.

## What's next?

Caronte & Tourist recently made a strategic move into the second-hand market, acquiring the conveniently sized *Las Palmas de Gran Canaria*, a 1993-built ro-pax ferry belonging to the Armas Trasmediterránea Group. In October last year, the Sicilian Region signed a near €120 million contract with Fincantieri Palermo to build a 14,500gt ro-pax that will serve the routes to Pantelleria, Linosa and Lampedusa. With the concept design provided by NAOS Ship and Boat Design, the 1,000-passenger and 200-car capacity ro-pax shares DNA with *Nerea*. Due to be delivered in 2026, the newbuild contract marks the re-entry of the Italian shipbuilding conglomerate into the ferry niche after a nine-year absence following the delivery of Canada's dual-fuel *F.-A.-Gauthier*. ■

LOBBY LOUNGE. SOURCE: NAOS SHIP AND BOAT DESIGN

MAIN LOUNGE. SOURCE: NAOS SHIP AND BOAT DESIGN

# PAINTS & COATINGS

## HIGH-PERFORMANCE COATINGS LEAD THE WAY IN SHIPPING'S TRANSITION TO NET-ZERO EMISSIONS

By **Nic Lawrence**, global business development manager, Marine Dry Bulk, Hempel

Under the International Maritime Organization's (IMO) updated greenhouse gas (GHG) targets, the shipping industry must reach net-zero GHG emissions by or around 2050. The industry also has to meet 'indicative checkpoints' that will enable a continuous reduction in emissions in the meantime – working for a 20% reduction in total GHG emissions by 2030 and 70% by 2040, relative to 2008 measurements.

These targets are now set, so we know where the goal line is. However, the regulatory agenda is continuing to develop at pace, shifting the scoring system. The most recent IMO Marine Environment Protection Committee meeting (MEPC 81) in March this year showed significant progress towards agreement on legally binding measures on global greenhouse gas pricing – with a clear majority of developed and developing countries now supporting the initiative, and a swift introduction of it.

There is still a long way to go towards reaching a total consensus, but a draft outline of the legislative framework needed for an economic measure like greenhouse gas pricing and a fuel standard that mandates a growing share of green energy used in ships is now being developed. This is all happening while there is still no 'golden egg' future fuelling solution available for meeting net-zero targets.

### Guaranteed gains in emissions reductions

Of course, this reflects necessary progress that should be welcomed. Vessel owners, operators and charterers knowing that they have an obligation to continuously improve emissions performance in the years leading to these target dates should be assessing which technologies, tools and solutions are guaranteed to reduce fuel requirements and lower emissions right now.

One certified and proven solution is the application of a high-performance hull coating, of which silicone-based antifouling systems demonstrably deliver the most notable returns in emissions reductions and return on investment (ROI). The speed of ROI will only increase if, or when, global greenhouse gas pricing schemes are introduced, significantly increasing operational costs for all vessel operators.

The science shows that a high-performance hull coating is one of the single most impactful ways to improve the energy efficiency of a vessel – and one of the simplest and fastest ways to maintain a good Carbon Intensity Indicator (CII) rating as well as increase the reference speed for attained Energy Efficiency Existing Ship Index (EEXI) measurements.

NIC LAWRENCE.
SOURCE: HEMPEL

Hempel, as a leading coatings manufacturer and trusted advisor to the industry, recommends that owners and charterers take a vessel-specific approach to determining which coating system and hull maintenance strategy best meets the commercial and operational needs of their business. Each coating system offers its own unique benefits and restrictions – it is crucial that these are explored carefully before investing in a product that should serve a vessel for five years or more.

### Bulker vessels: a case-study in calculating returns

By looking at one segment of the fleet, the bulker segment here as an example, it is possible to see the impact of a high-end hull coating on energy efficiency and resulting emissions and – crucially – to calculate the costs and potential savings, which are primary concerns for all vessel interests.

Analysis of Hempaguard, Hempel's high-end silicone-based antifouling system, shows variations across the three main bulker types – Ultramax, Panamax and Capesize. Our simulations calculate the impact of likely trading patterns of the vessel types but also consider speed, activity, and water temperature. By combining vessel trading patterns with hull-biofouling risks, an accurate picture of how a coating will interrelate and impact vessel performance over time, can be calculated.

| IMPACT OF HULL COATING UPGRADE – TCO & ROI | | | | |
|---|---|---|---|---|
| | **Elements of cost** | **Hempaguard X7 / Globic 9500** | **Globic 8000** | **Hempaguard 7X / Globic 9500 VS Globic 8000** |
| **Paint** | Paint purchasing cost | $300,000 | $150,000 | $150,000 |
| **Repair yard** | Surface preparation cost | $45,000 | $19,000 | $26,000 |
| | Washing cost | $5,000 | $5,000 | $0 |
| | Paint application | $65,000 | $10,000 | $55,000 |
| | Repair yard rent | $40,000 | $30,000 | $10,000 |
| | Off hire cost | $95,000 | $72,000 | $23,000 |
| **Cleanings** | Diver cost | $0 | $11,000 | -$11,000 |
| | Extra cost for next DD | $0 | $12,000 | -$12,000 |
| | Additional fuel consumption (HSFO) | $0 | $150,000 | -$150,000 |
| | Off hire cost | $0 | $36,000 | -$36,000 |
| **Fuel** | Fuel cost (HSFO) 5 years | $17,000,000 | $19,700,000 | -$2,700,000 |
| | $CO_2$ emission tons (HSFO) | 136,300 | 153,000 | -16,700 |
| **TCO** | Total cost of ownership (HSFO) 5 years | $17,550,000 | $20,195,000 | -$2,645,000 |
| | | Savings over 5 years (HSFO) | | $2,645,000 |
| | | Payback period (months) | | 11 |
| | | Increase in earnings per day (TCE) | | $2,000 |

THE CASE FOR ULTRAMAX VESSELS. DATA: HEMPEL

In turn, vessel performance impacts for EEXI and CII ratings, along with the total cost of ownership (TCO) and ROI, can be extrapolated for vessel owners, operators and charterers. There are also implications for vessels operating in emissions trading areas such as in the European Union, which can also be calculated using this methodology, giving all parties a very clear estimation of the costs of emissions-linked decision-making for vessel charterers in particular.

## Understanding the impact – Ultramax

Ultramax vessels, which sit in the 60,000-65,000dwt range, are most commonly associated with cargo movements across typically medium-warm waters, where fouling risk is higher.

Hempel's analysis revealed some interesting results. The model data (based on a 2020-built Ultramax bulker) presumed a full coating blast followed by full system application during drydock with Hempel's Globic 9500 on the boot top and the company's high-performance silicone-based coating Hempaguard X7 on the flat and the vertical bottom of the vessel, compared to a full blast on the entire hull area with only Hempel's Globic 8000 antifouling solution.

Over a five-year drydocking period, an Ultramax vessel coated in only Globic 8000 would release 153,000tonnes of $CO_2$ emissions, whereas, with the Globic 9500/Hempaguard X7 combination the figure decreased considerably, with 136,300tonnes of $CO_2$ emissions released.

The more advanced Hempaguard X7 coating reduced emissions by 16,700tonnes over the five-year period, representing a reduction of almost 11%. The total savings over a five-year docking period amounted to more than US$2.6 million, and the investment was paid back in less than a year.

## Positive impacts for Panamax

Due to the larger in hull surface, the initial outlay for a hull coat application on a Panamax is considerably more than for that of an Ultramax. Nevertheless, the overall benefits are comparable when considering high-impact coatings.

Panamax vessels are classed as those bulk carriers sitting in the 60,000-80,000dwt range. Like Ultramaxes, these bulkers mainly operate in medium-warm waters.

Over a five-year drydocking period, a 2013-built Panamax vessel coated in Hempel's Globic 8000 antifouling solution would release 171,000tonnes of $CO_2$ emissions, whereas with Globic 9500 and the advanced Hempaguard X7, 151,000tonnes of $CO_2$ emissions would be released. The difference in emissions released between the two coatings scenarios represented a reduction of 20,000tonnes over the five-year period, or approximately 11.6%.

Meanwhile, the commercial considerations remain compelling. The resultant savings outperform the higher initial cost of the premium coating, and in the case of this Panamax bulker, the total savings over a five-year docking period amount to almost US$3 million.

| IMPACT OF HULL COATING UPGRADE – TCO & ROI | | | | |
|---|---|---|---|---|
| | **Elements of cost** | **Hempaguard X7 / Globic 9500** | **Globic 8000** | **Hempaguard 7X / Globic 9500 VS Globic 8000** |
| **Paint** | Paint purchasing cost | $450,000 | $200,000 | $250,000 |
| **Repair yard** | Surface preparation cost | $60,000 | $25,000 | $35,000 |
| | Washing cost | $6,500 | $6,500 | $0 |
| | Paint application | $85,000 | $15,000 | $70,000 |
| | Repair yard rent | $40,000 | $30,000 | $10,000 |
| | Off hire cost | $96,000 | $72,000 | $24,000 |
| **Cleanings** | Diver cost | $0 | $16,000 | -$16,000 |
| | Extra cost for next DD | $0 | $17,000 | -$17,000 |
| | Additional fuel consumption (HSFO) | $0 | $166,000 | -$166,000 |
| | Off hire cost | $0 | $36,000 | -$36,000 |
| **Fuel** | Fuel cost (HSFO) 5 years | $19,000,000 | $22,100,000 | -$3,100,000 |
| | $CO_2$ emission tons (HSFO) | 151,000 | 171,000 | -20,000 |
| **TCO** | Total cost of ownership (HSFO) 5 years | $19,737,500 | $22,683,500 | -$2,946,000 |
| | | Savings over 5 years (HSFO) | | $2,946,000 |
| | | Payback period (months) | | 11 |
| | | Increase in earnings per day (TCE) | | $2,400 |

PANAMAX CASE STUDY. DATA: HEMPEL

| IMPACT OF HULL COATING UPGRADE – TCO & ROI | | | | |
|---|---|---|---|---|
| | **Elements of cost** | **Hempaguard X7 / Globic 9500** | **Globic 8000** | **Hempaguard 7X / Globic 9500 VS Globic 8000** |
| **Paint** | Paint purchasing cost | $750,000 | $400,000 | $350,000 |
| **Repair yard** | Surface preparation cost | $100,000 | $40,500 | $59,500 |
| | Washing cost | $10,000 | $10,000 | $0 |
| | Paint application | $130,000 | $25,000 | $105,000 |
| | Repair yard rent | $40,000 | $30,000 | $10,000 |
| | Off hire cost | $140,000 | $105,000 | $35,000 |
| **Cleanings** | Diver cost | $0 | $28,000 | -$28,000 |
| | Extra cost for next DD | $0 | $29,000 | -$29,000 |
| | Additional fuel consumption (HSFO) | $0 | $215,000 | -$215,000 |
| | Off hire cost | $0 | $52,500 | -$52,500 |
| **Fuel** | Fuel cost (HSFO) 5 years | $24,500,000 | $28,700,000 | -$4,200,000 |
| | $CO_2$ emission tons (HSFO) | 196,600 | 223,000 | -26,400 |
| **TCO** | Total cost of ownership (HSFO) 5 years | $25,670,000 | $29,635,000 | -$3,965,000 |
| | | Savings over 5 years (HSFO) | | $3,965,000 |
| | | Payback period (months) | | 13 |
| | | Increase in earnings per day (TCE) | | $3,000 |

CAPESIZE VESSELS. DATA: HEMPEL

### Compelling data for Capesize

In the case of this Capesize bulker, the total savings over a five-year docking period were calculated to be more than US$D2.8 million. As one might expect, given the size of the vessel, the investment takes a little longer to pay back for a Capesize: the ROI is seen in a little more than one year.

At 110,000-200,000dwt, Capesizes are amongst the largest bulk carriers and have a correspondingly sizeable emissions footprint. Despite the higher rate of emissions overall, notable reductions through a high-end coating could nevertheless be achieved, according to Hempel's data modelling.

The company's data showed that over a five-year period, a 2013-built Capesize coated in its Globic 8000 antifouling solution would release 223,000tonnes of $CO_2$ emissions. With the more sophisticated Globic 9500/Hempaguard X7 combination, 196,600tonnes of $CO_2$ emissions would be released, with the difference being 26,400tonnes over the five-year period – close to 12%.

Again the data shows that the economic impact of a high-performance hull-coating upgrade is significant, and that the resultant savings largely outperform the higher initial costs associated with premium-quality coatings. In the case of this Capesize bulker, the total savings over five-year docking period is more than US$2.8 million. Whilst the investment in vessels of this size takes longer to pay back than the smaller vessels, the ROI is seen in a little more than one year.

### Investing in dependable assets

The outcomes of the IMO's MEPC 81 are anticipated to introduce significant shifts in the cost dynamics of fuelling vessels, particularly with the potential introduction of financial incentives like emissions levies and trading schemes possibly coming into effect in the near-term. These mechanisms are poised to play a pivotal role in incentivising emissions reduction efforts, and crucially, to influence the production and supply of greener fuels. In turn, this pressure should create an environment where investing in the cleanest solutions will deliver the greatest financial returns.

What the impact will be on the development of future fuels, or cost parity between fossil fuels with emissions levies versus cleaner fuels with lower levies is yet to be seen, or certainly will not be seen immediately. What we can be sure of is that investing in solutions like premium hull coatings, which can be a powerful solution for reducing fuel requirements and lowering emissions, will result in savings today and in future regardless of how quickly the regulatory agenda moves. ■

# MORE THAN A PAINT JOB: NEW RESEARCH IN HULL COATINGS AND GROOMING COULD REVOLUTIONISE VESSEL EFFICIENCY

By **Tom Barlow-Brown**

In maritime operations the importance of vessel coatings extends far beyond mere aesthetics. The outside layer of a vessel's hull serves as the first line of defence against corrosion, fouling, and degradation, thus playing a critical role in safeguarding marine assets, optimising vessel efficiency, and minimising environmental impact. Traditional standards for paint approvals by class societies have historically prioritised toxicity-free compositions and antifouling attributes. However, a significant shift is underway within the marine coating industry, marked by the emergence of enhanced type approvals that emphasise performance-driven criteria.

Traditional coatings have often relied on biocides such as copper-based products or tributyltin (TBT), which is now banned, in order to deter marine fouling organisms. However, increasing regulatory scrutiny and environmental concerns have spurred the development of alternative formulations that minimise environmental impact while maintaining efficiency.

One such innovation is the use of self-polishing copolymer (SPC) coatings, which release biocides gradually over time, ensuring long-term antifouling performance without the need for frequent recoating. These coatings operate on the principle of controlled leaching, where the release rate of biocides is optimised to provide continuous protection against fouling organisms while minimising environmental contamination.

Another promising avenue is the development of graphene-based hard foul release coatings, such as those developed by Canadian manufacturer GIT Coatings (Graphite Innovation & Technologies Inc). The company utilises the low surface energy of graphene-based coatings to prevent fouling organisms from adhering to the hull surface. Unlike traditional antifouling coatings, foul release coatings do not rely on biocides or silicone oils, making them environmentally friendly and suitable for sensitive marine ecosystems. Additionally, their smooth surface reduces drag, leading to improved fuel efficiency and overall vessel performance.

NEW EVERCLEAN HULL CLEANING ROBOTS AT GREENSEA IQ'S PRODUCTION FACILITY IN MASSACHUSETTS, USA

In recent years, the integration of nanotechnology has further expanded the capabilities of marine coatings. Nanoparticles such as graphene, carbon nanotubes, and nanosilver have been incorporated into coating formulations to enhance strength, durability, and antifouling properties. Graphene, in particular, has attracted attention for its exceptional mechanical strength and lubricating properties, making it an ideal candidate for ultra-low friction coatings that reduce drag and improve fuel efficiency.

## Engineering for proactive maintenance

One notable aspect of this evolution is the redefinition of type approvals to encompass broader parameters beyond mere toxicity and antifouling properties. Enhanced type approvals now place a greater emphasis on performance warranties, scrutinising the enduring efficacy of coatings in dynamic marine environments. Dr Marciel Gaier, CTO at GIT, highlights the development of ultra-low friction coatings, which not only enhance vessel efficiency but also demonstrate a commitment to environmental sustainability through the incorporation of materials like graphene. GIT's coating's which are designed for a variety of vessel types have also been engineered to be resistant to the heavy-duty wear that comes with the intensive regime of cleaning a vessel's hull.

"The industry is moving towards more grooming and proactive maintenance of ship hulls. We engineered this paint to be more resistant to grooming so the whole idea is that if you do groom, you don't damage and or change the paint," says Dr Gaier.

The pivotal role of grooming technology in preserving coating integrity and optimising vessel performance shows that both are two sides of the same coin. Ryan Ingham, GIT's Vessel Performance manager, emphasises that a one-size-fits-all solution is inadequate, necessitating bespoke approaches tailored to each vessel's operational profile.

"First you need to choose your product type based on your operating profile, and then customise a grooming regime for that operating profile with that product type. Other coatings don't work well with certain products,

so we won't supply them if the owner has a certain management plan that," says Ingham.

The company has also designed software to analyse the effects of grooming and maintenance on different coating types, depending on vessel design and operational circumstances. "We are developing performance modelling simulations on a ship specific basis. We are looking at the trade of the vessel, the vessel characteristics, and we are trying to model the effect of different combinations coating technology together with cleaning, either proactive or reactive," says Philippos Sfiris, head of Go-to-Market Strategy and Vessel Performance at GIT Coatings. "This is a very important aspect because it's also something that can help the operator to make the right decision, but this is a very ship specific investigation is needed there."

## Striking a balance between efficiency and ecological sustainability

Owners and operators are now no longer solely selecting coatings based on their antifouling properties but also must consider their environmental implications. The industry is navigating a diverse array of compositions to strike a balance between efficiency and ecological sustainability. The current efficiency of hybrid silicone coatings and the advantages of hard foul release coatings are being explored in detail, reflecting a growing awareness of environmentally conscious coating solutions. However, even biocide coatings cannot prevent a build-up of slime and algae on a vessel's hull. This is where proactive hull cleaning comes in.

"No coating, no matter what biocide you use can prevent slime, which is a big contributing factor for increased fuel consumption," says Ingham. "Therefore, we recommend proactive grooming because with a perfectly clean hull you can have the best performance, and this is reflected in fuel consumption as well.

"So operators can also compare the amount of additional resistance there is when there is fouling. The more fouling there is, the more increase there will be in terms of drag and fuel consumption. If you can keep your hull free of slime and free of any fouling with grooming, that would be the best performance scenario."

As a result, research from grooming specialists, such as EverClean, a service run by US company GreenSea IQ, underscores a holistic approach towards vessel maintenance. By embracing ship-specific performance modelling and predictive analytics, stakeholders can pre-emptively address coating degradation and optimise vessel efficiency, thus aligning with both economic and environmental imperatives.

EverClean's proactive hull cleaning approach represents a significant stride in this direction. By advocating for high-frequency cleaning and actively removing fouling organisms before they proliferate using the company's own design of small, tethered robot. This allows the crew to clean the hull without the need for full drydocking or divers.

"We can do it without interfering with operations, such as running concurrently with loading and offloading or while at anchorage when the ship is sitting idle waiting to pull in," says Karl Lander, director of Regulatory Compliance & Outreach at GreenSea IQ.

"I know we're seeing a lot of just in time arrivals from operators looking for optimal transit speeds so it's not perfect but if ships are sitting idle for a day or two before pulling into port it's a great opportunity for this cleaning to occur," he adds.

By cleaning more regularly using their robot the team behind EverClean aim to disrupt the biofouling lifecycle while minimising the need for harsh chemicals or coatings. Working with coating manufacturers, they are looking to place themselves at the forefront of developing a non-biocidal and durable alternative to traditional hull cleaning methods.

## Getting the right bristles for the job

EverClean also has an aggressive testing regime that allows its team to work out if the cleaning robot's bristles will work with different types of hull coatings. "I think we've probably done about 20 different coatings now that we've tested through varying degrees. One of our main testing processes is what we call our accelerated wear testing, where we submerge test panels down in Florida in a very high growth environment for a couple weeks to get the initial level of fouling on them. This makes sure that we determine our proper cleaning approach," explains Lander.

The evolution of marine coatings reflects a broader shift towards performance-driven and environmentally conscious solutions. As the industry continues to navigate the complexities of coating compositions and grooming practices, collaborative efforts between stakeholders, grooming specialists, and regulatory bodies will play a pivotal role in shaping the maritime landscape of tomorrow. Ultimately, by prioritising efficiency, sustainability, and proactive maintenance, the industry can ensure the longevity and resilience of marine assets while minimising their environmental footprint.

Despite these advancements, challenges remain in ensuring the long-term efficiency and environmental sustainability of marine coatings. Coating degradation due to abrasion, UV exposure, and chemical exposure remains a concern, necessitating ongoing research into novel materials and application techniques. Moreover, the environmental impact of coating leachates and residues requires careful consideration, especially in ecologically sensitive areas.

The proactive approach advocated by companies like GIT and EverClean could become increasingly relevant. By combining advanced coatings with high-frequency cleaning practices, vessel owners can maintain optimal performance while minimising environmental impact.

The evolution of marine coatings reflects a convergence of technical innovation, environmental stewardship, and regulatory compliance. As the industry continues to adapt to evolving requirements and societal expectations, the development of sustainable, high-performance coatings will likely become more important in years to come. ■

WEST ELEVATION OF THE HENRY COLES BUILDING, NOW PART OF THE V&A MUSEUM. SOURCE: ANDY MACDONALD

# MARITIME HERITAGE & HISTORY

## 150 YEARS OF NAVAL ARCHITECTURE EDUCATION BEING PLACED ON A FIRM FOOTING

By **Mark Barton**, RINA historian

The key step towards university degrees in naval architecture, which so many of our members will have completed, took place just over 150 years ago in 1873 when a course was launched at the Naval College at Greenwich. This was largely driven by many of the same individuals who played a role in the formation of the Institution of Naval Architects a few years earlier.

But the story starts earlier and had three main elements that enabled it. One was the decision to create training establishments ashore for the Royal Navy, another was the short-lived specialist school at Kensington and a change in the naval engineering branch. On the first of these in 1863 the Parliamentary Select Committee on Promotion and Retirement made the proposal but it could not be afforded by the RN.

Budget constraints are nothing new, and at this time the Navy was unable to fund a steam tender for the training ship *Britannia*. The Committee plan was a wide move and covered all areas of training which then used hulks based in harbours. Moving to shore establishments meant the Navy – as opposed to individual dockyards – could create a school and provide a national course in naval architecture. While the major barracks did not move ashore until the 1890s the premise was there.

The subsequent year, quite separately, one of RINA's founders opened a Royal School of Naval Architecture and Marine Engineering at South Kensington. This was an independent establishment but did have royal patronage. There had been earlier schools of naval architecture in the dockyards (particularly Portsmouth), but these had all been closed in the retrenchment following the Napoleonic Wars.

This new school was originally situated in what is now the Henry Cole Building within the Victoria and Albert Museum, providing training for some shipwright apprentices from the Royal Dockyards and some

THE HULK OF HMS *MARLBOROUGH* IN PORTSMOUTH ALSO SERVED AS A TRAINING SHIP FOR ENGINEERS FOR A NUMBER OF YEARS. SOURCE: MARK BARTON

students destined to be Assistant Engineers at sea in the Royal Navy. It only operated for part of each year, all teaching being between October and April, this being so students could spend their summer months at their jobs in the dockyards. This course also attracted some from commercial companies as John (later Sir John) Issac Thornycroft was one of the alumni.

THE ROYAL SCHOOL OF NAVAL ARCHITECTURE AND MARINE ENGINEERING CERTIFICATE 1868. SOURCE: V&A MUSEUM

A third element came when in 1868 the position of Engine Room Artificers was introduced into the Royal Navy at the instigation of Vice Admiral Sir Astley Cooper-Key. This was significant for naval architecture teaching in that it split those running the maintenance of a ship at sea into three basic roles: the stokers who provided the heavy labour; the artificers who provided the skilled repair and maintenance; and the engineers who provided the "scientific and practical management of engines". This moved those who were going to be Assistant Engineers both clearly into the officer cadre but also gave the opportunity for them to undertake higher levels of training.

With those three elements in place, in 1873 the buildings that formed Greenwich Hospital were turned into what was in effect a naval university. The aim was simple, to provide training for naval engineers, naval constructors and naval officers. This was the first time trainee naval engineers were given a mess ashore, although they were kept separate from the other junior officers.

At the same time facilities in the dockyards were created for the training of engineer officers. Initially this was HMS *Marlborough*, a hulk alongside in Portsmouth, then the Royal Navy Engineering College (RNEC) Keyham at Devonport and finally after the Second World War, RNEC Manadon on a site on the edge of Plymouth.

Initially all the naval engineer officers worked in a drawing office prior to going to sea as Acting Assistant Engineers (Probationary) and selected students were sent to RNC Greenwich for eight months, mainly for theoretical instruction. The education of both naval engineers and naval constructors continued at Greenwich until the constructors moved to conduct their degree training at various universities in the 1980s using Manadon for a foundation year and the masters moved to University College London (UCL).

In 1995, all the engineering masters moved to UCL with the closure of Manadon and the engineers finished their final course at Greenwich in 1998 when the Nuclear School, with its training reactor, finally completed decommissioning. ■

THE ROYAL NAVAL COLLEGE, GREENWICH, INCORPORATING THE NUCLEAR SCHOOL (PICTURED), CONTINUED TO PLAY A ROLE IN TRAINING ENGINEERS UNTIL 1998. SOURCE: MARK BARTON

# PROPULSION

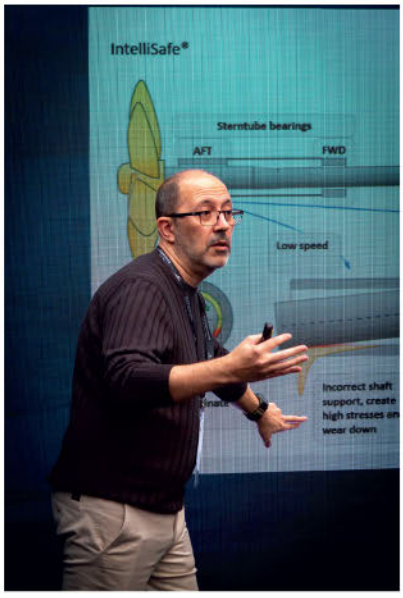
## WÄRTSILÄ INNOVATES NEXT-GENERATION SOLUTIONS FOR SHAFT LINE MAINTENANCE

By **Tom Barlow-Brown**

In the world of maritime technology, efficiency is usually a key driver of innovation. Drive shaft problems on vessels are a significant cause of ship delays and many companies have sought to tackle this issue in the past. Finnish engineering company Wärtsilä has recently put itself forward as the latest to do so with the recent unveiling of Project FuTube. This ambitious endeavour marks a milestone in the evolution of shaft line repairs and maintenance, with the company hoping to revolutionise marine propulsion systems and redefine industry standards.

According to research from the company, the number of vessels that break down due to shaft misalignment is around 200 per year. The new solution is designed to prevent misalignment and can help the vessel's crew detect and react to any issues in real time. The project's monitoring system can be installed as a complete package, or as individual components.

Rooted in years of expertise and technological advancements from Wärtsilä's Shaft Line Solutions' (SLS) team (formerly Wärtsilä Seals and Bearings), the company has launched the project to provide a comprehensive suite of products to customers looking to deal with shaft line issues on vessels. According to the company, this represents the culmination of years of innovation aimed at enhancing operational efficiency, reliability, and safety in vessel drive shaft operations. At its core, the Project FuTube encompasses a suite of cutting-edge solutions, with two key components taking centre stage: the EvoTube System and the IntelliSafe Bearing.




JOSE ANTONIO VAZQUEZ PRESENTS INTELLISAFE. SOURCE: WÄRTSILÄ

EvoTube aims to offer a shift in shaft line technology with a compact design and versatility for both oil and water lube systems. The bearing also boasts a low-risk profile and simplified system architecture which promises improved reliability and performance for vessel operators by freeing up space on board for other systems or cargo.

### Learning from history

Meanwhile, Wärtsilä SLS hopes IntelliSafe, which incorporates lessons learnt from time spent dealing with shaft line issues, will herald a new era of self-regulating bearings, designed to optimise performance and operating conditions. "The monitoring system that we have developed is based on systems we have been using for at least 20 years. We have a lot of data, a lot of history, and a lot of, let's say backlogs to go on. So we know how to handle this data and how to analyse it to come to our conclusions and findings," says Jens Hyrup, manager of Alignment Services at Wärtsilä Shaft Line Solutions.

Equipped with embedded sensors, IntelliSafe can swiftly detect and respond to a range of issues, including misalignment and lubrication deficiencies, enabling real-time problem detection and resolution. "We can also monitor the bearing wear all year round, to see if the bearing is wearing down over time. This way we can give a prediction of the lifetime of the bearing," says Hyrup.

Using this method the company aims to significantly extend the life cycles of bearings and offering substantial cost savings to customers.

Speaking on the innovative features of these products, Jose Antonio Vázquez, technical manager at Wärtsilä Iberica Porriño, highlights the sophisticated monitoring capabilities of IntelliSafe. "The first step was to introduce a new sensor to monitor the system. We created sensors that can detect the position of the shaft at any moment and can tell us what the oil level is. We know depending on which product is being used whether the system needs to lubricate or not. The sensors make a very large number of measurements per second and with this we can estimate different factors," he says.

The comprehensive suite of equipment that Project FuTube incorporates has been engineered to track shaft line vibrations, position changes, and various

operational metrics with precision. These sensors, strategically positioned along the shaft line, enable the continuous monitoring of the system and ensure prompt detection and resolution of problems. By harnessing the power of simultaneous data sampling coming from the system Wärtsilä SLS believes it will provide a holistic view of the shaft line's performance in real time, mitigating the risk of phase shifting and enabling swift, informed decision-making.

"The real-time monitoring means that every second we get a picture from the system we can analyse," Vázquez elaborates, underscoring the system's responsiveness and precision.

The data from the monitoring system is not connected to the cloud for cybersecurity reasons but can be shared with the company for analysis which can provide additional support via its customer support teams. Furthermore, the data collected by these sensors undergoes rigorous analysis and is stored in dedicated databases for further examination and reporting. Leveraging advanced algorithms, the system identifies trends and enables analysis of the root causes of issues in the system, which allows customers to proactively address potential issues before they escalate with the help of the Wärtsilä SLS team.

## Adaptability

One of the system's distinguishing features is its adaptability, which is designed to cater to both newbuild vessels and retrofit seamlessly. The EvoTube's lubrication system is entirely automated system meaning that it can switch between different modes or return to a so-called 'neutral' setting depending on factors such as the speed of the vessel and the alignment of the shaft line.

Central to the shaft line monitoring system's efficacy is its user-friendly interface, providing operators with intuitive access to critical data and insights. Designed to be housed within a dedicated cabinet in the engine room or bridge, the interface can equally be attached to a portable smart pad. This allows the crew to promptly to alarms or anomalies. Furthermore, the system also features a data processing unit equipped with state-of-the-art cybersecurity measures to safeguards against unauthorised access.

While the monitoring system offers a comprehensive suite of features out of the box, its modular design allows for further customisation to accommodate specific needs and preferences. From additional sensors to enhanced analytics capabilities, customers have the option to augment the system according to evolving requirements, thereby future proofing their investments and maximising value.

In terms of installation, the system is versatile, with options available for both newbuilds and retrofits, however the company recommends is targeting the former as a priority. Wärtsilä SLS also aims to deal with the customer directly and will liaise with them about what they want. "We'd prefer to sell it as a complete package, but sometimes the builder or owner will want to reduce costs. So our recommendation would be to have all the sensors installed during the build phase because then you don't need to dismantle anything to connect the sensors. Then they can decide if they want to have everything included into the system, or if they want to have it as any optional features. We have cases where all the sensors have been installed and the shipyard don't want to have any responsibility for the monitoring system itself. In that case everything is then prepared by us and during the handover of the newbuild to the customer we complete the installation," says Hyrup.

Vázquez reveals the operational challenges faced by vessel crews and operators, highlighting the need for transparent, user-friendly solutions. "The crews and the operators, they're all under heavy pressure. They're forced to make their vessel's equipment work outside of its usual parameters but they're not really aware of what the consequences will be because they're not experts. They know how to operate the vessel but this kind of bearing care is important, and that should be transparent for them," he remarks.

## Ease of use

Wärtsilä's Project FuTube represents a stride towards addressing one of the longstanding challenges in vessel operations. Nonetheless, potential customers may ask questions regarding its real-world efficacy. The system's reliance on sophisticated technology could introduce complexities and operational challenges for vessel crews and operators, especially those unfamiliar with such advanced systems. However, Vázquez asserts that the automated nature of the system will allow for ease of use.

"Our system will help by creating an additional oil field that make a strong separation between the bearing metal and the shaft. The additional oil will produce this separation and will deal with the permanent situation of continuous misalignment. If the system cannot correct this, it will arise an alarm," he says.

Moreover, concerns about cybersecurity and data privacy may arise, considering that the monitoring system's data is not connected to the cloud for security reasons but can be shared with the company for analysis. This raises questions about data integrity, privacy safeguards, and the potential implications of data misuse or unauthorised access. But Jens Hyrup addresses this arguing that the shaft line monitoring system is separate from the cloud and data is only transferred when the vessel arrives in port. "The shaft line monitoring has its own controller which acts independently. We will just be monitoring the data, the overall performance and the changes in the system," he says.

The modular design of Project FuTube represents a key step towards transforming marine propulsion systems. However, its true impact and long-term viability hinge on ensuring seamless integration, and prioritising user experience and data security. As the maritime industry embraces technological advancements, critical evaluation and collaborative efforts will be essential to harness the full potential of innovations like this. ■

# LIFE CYCLE ASSESSMENT

## ANTICIPATING THE FUTURE: DEVELOPING LIFE CYCLE ASSESSMENT FOR SHIP PROJECTS

Former postdoc researcher Shqipe Buzuku has been working for the Finnish ship design firm Deltamarin for the past 18 months, pioneering Life Cycle Assessment (LCA) for ship projects amid growing interest from key industry stakeholders. Here she explains what LCA involves and how it can empower shipowners to reduce emissions at the early design stage. And it soon may be obligatory

By **Roderick Craig**, Contributor

Since joining Deltamarin in 2022, Shqipe Buzuku has worked on the three formal Life Cycle Assessment projects as well as related in-house studies. At the time, the company had just embarked on a three-year, EU-funded project called CHEK, which aims to contribute to decarbonising shipping by enabling key technology symbiosis on real vessel concept designs.

"My job was to develop LCAs for the two bespoke vessel cases – a Kamsarmax bulker and a cruise ship – as part of a work package in collaboration with World Maritime University in Malmö. The results are now with the European Commission and will be published later in the spring. We have also written two scientific articles, one already published* and the other currently under peer review," she says.

Her third case was calculating an LCA at the request of a client covering the operational phase of a Trans-Shipment Vessel (TSV) as part of a design contract, estimating life-cycle emissions for carbon dioxide, methane and nitrogen monoxide. The results are subject to an NDA.

### Raising awareness

"The main driver for LCA is a growing interest among industry stakeholders – especially financiers investing in new vessels – even though it is not yet required by the IMO. Most of our clients are aware of the concept, and some early movers are approaching us for help as they don't really understand what it entails. We aim to offer, in the first instance, operational LCA – meaning environmental impact/carbon footprint assessment of the operational phase of a vessel – as part of the design process, as it can guide owners in their choice of fuel and propulsion technologies."

Fuel LCA is something the IMO is already addressing and Buzuku is sure that performing operational LCAs for new ship designs will be the regulatory norm within 10 years. "That will likely be extended to cover construction and recycling, including all the materials and equipment that go into a vessel. This is positive as it will ensure responsible behaviour and banks may refuse to finance ships without an LCA detailing their full impact."

### In the LCA vanguard

"Deltamarin is doing this up front because we want to be optimally prepared," says Buzuku. "Setting up all the background information is challenging and time consuming. We will also need to properly evaluate and plan for the construction and scrapping phases. While shipowners are right now consumed with upcoming regulations such as the ETS and Fit for 55 package here in Europe, we will be ready to help them when the time comes."

Buzuku sees LCA coming first in offshore shipping serving renewable energy production, where there are more enquiries than from mainstream owners. "Nobody is using it right now as a basis for decision making but there is a lot of potential," she says.

### Fuel choice

Fuel selection is critical because the operational phase represents 80% to 90% of the vessel's life-cycle environmental impact. Taking operational LCA into account at an early stage of the design process could produce better opportunities to potentially influence the result. "Fuel availability and cost remain the core drivers, but LCA and the well-to-wake footprint of

BUILDING LCA EXPERTISE: SHQIPE BUZUKU. SOURCE: DELTAMARIN

each possible fuel will be increasingly important as banks typically prefer to fund sustainable vessels."

### Energy use and material flows

Buzuku is sure that LCA will become be the ultimate measure of a ship's total environmental performance. "In construction this will include measuring the impact of electricity usage at shipyards and the footprint of materials and equipment, including energy use in steel production and materials' logistics. LCA will likely also introduce a lot of new environmental impact considerations – for example, acidification of land around shipyards. Very little consideration is given to such things today."

Buzuku says LCA may show a bias towards Northern Europe, where yards have access to cleaner energy, but the reality of shipbuilding is 60% in China, 25% in Japan and 20% in Korea. "Some Asian yards will certainly have to clean up their act to stay competitive," she notes.

Deltamarin is in a unique position because its mother company shipyards in China are the first in the country to have started measuring these kinds of inputs. "They are sending us aggregated data on the type and amount of electricity they use but are working to break that down to individual workstations in order to assess the exact energy use per ship. The same goes for material flows. This will help us make the LCA models of ships more accurate," says Buzuku.

### Mapping suppliers

In terms of equipment and hardware, within the EU it is very likely all vendors will have to supply Environmental Product Declarations (EPDs) in the coming years, which can be included in LCAs. "This will be a tough job, especially regarding supply chains, because in complex equipment there are components from sub-suppliers all over the place and all their energy use and material footprints will have to be calculated or otherwise taken into account," Buzuku says.

She adds: "Regulating this all at once is impossible but, in the future, you should only need to do one full LCA at the design stage, so modifications to the environmental impact of a ship can still be done. That is the logical end of the environmental path. The ideal approach will be to create a shipbuilding specification that clarifies which type of materials/ equipment are best for the ship's environmental performance."

### Build new or upgrade?

Another application for LCA is in deciding whether to replace an older vessel with a new one. Is replacement the better option given the challenges in quantifying the building and scrapping phases properly, or is it best to upgrade the vessel with a new engine to run on a new fuel?

"One should also be mindful of the overall environmental impact if we build more (and often bigger) vessels. We can now provide high-level operational LCAs for both options, however, the drivers remain cost and compliance with current IMO rules. As long as that is the case, the interest in and prioritisation of environmental performance will remain on a second plane," Buzuku notes.

### Practical steps in LCA creation

Buzuku's team generate the first level of LCA based on data from reports, scientific articles and equipment manufacturers' data, for example engine performance measurements and specifications. "In addition to the databases we are building in-house, including for the building phase, we also use the global standardised databases, such as Ecoinvent, integrated into our LCA software application. You need dedicated software to pull everything together – it's not a job you can do in Excel," explains Buzuku.

She adds that if this analysis is done during the ship design stage, the data regarding the ship's fuel and energy utilisation during its operational stage is generated by Deltamarin's ship system-level energy simulations using its in-house DeltaKey tool. Otherwise, measurements can obviously be taken from the existing ship.

The task is then to match a ship LCA with LCA models in the software, calculating all the information for steel and other materials, fuels (well-to-tank results require data on refining, manufacturing and transport) and electricity usage. All stages are covered. According to Buzuku: "The software provides a standardised way to develop the LCA model and the emission types you want to consider in the scope. We then we run the model and extract the results in a standardised format."

### Need for a global standard

As yet, there is no global standard for ship LCAs to ensure unbiased results. There are no existing shipping-specific databases, which is why Deltamarin has started to build its own. "Our results are pretty objective, but for credibility in future all LCAs will have to be validated by a third party. Implementing a global a standard with guidelines and instructions from class and/or the IMO would be very helpful," Buzuku says.

Buzuku's background is in industrial and environmental engineering and she learned about LCA methodology and tools during her postdoc research. "It's already common in land industries and I'm happy to be developing LCA for real marine cases. Developing a profitable service together with my colleagues is exciting because it's completely new. It's intense but very rewarding, knowing that even in a small way we are helping to make the industry more sustainable," she concludes. ■

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**Environmental Performance of Bulk Carriers Equipped with Synergies of Energy-Saving Technologies and Alternative Fuels* (Tuan Dong, Shqipe Buzuku, Mia Elg, Alessandro Schönborn and Aykut I. Ölcer; J. Mar. Sci. Eng. 2024, 12(3), 425; https://www.mdpi.com/2077-1312/12/3/425 (free full text).

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**EURONAVAL 2024**
International exhibition
Paris-Nord Villepinte, France
www.euronaval.fr

NOVEMBER 19-21, 2024
**METSTRADE 2024**
International exhibition
Amsterdam, the Netherlands
www.metstrade.com

DECEMBER 3-6, 2024
**EXPONAVAL 2024**
International exposition
Port of Valparaíso, Chile
www.exponaval.cl/en

IF YOU HAVE A CONFERENCE OR EVENT YOU WOULD LIKE TO BE CONSIDERED FOR THIS PAGE PLEASE CONTACT: TNA@RINA.ORG.UK

The Royal Institution of Naval Architects Presents:

# Human Factors 2024 Conference

8-9 October 2024, Wageningen, The Netherlands

## REGISTER NOW

In Partnership With:

MARIN

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for more information

The conference will provide an opportunity for human factors experts, naval architects, bridge officers and others to get together and discuss the recent developments. It will focus on lessons learned from interventions and applied research that were successful, or even more interesting, unexpected or bad results. For example, implementation of new automation on board that worked out differently or behavioral interventions that had unexpected effects. It is all about applied research that provides learned lessons for future Human Factor research, specifically for the Maritime domain.

As part of the conference, the delegates will have a unique opportunity to visit the new Seven Oceans Simulator centre of MARIN on 10th October 2024, where the attendees will have a chance to:

- Tour in the brand new Seven Oceans Simulator centre
- A workshop on how to design a bridge layout for special purpose vessels with physical mock-ups.
- A workshop measuring human performance covering eve-tracking, emotion recognition, heart rate variability and galvanic skin response.

..... and more!

## Keynote Speakers

**Job Brüggen, LVNL**

Job Brüggen holds a masters degree from Delft University of Technology in Aerospace Engineering. In 1986 he started working for the National Aerospace Laboratory where he later became the head of the Air Transport Division. His particular interest in safety led him to Air Traffic Control the Netherlands, to become their first safety manager in 2002. He is particularly known for his activities in Just Culture developments and was one of the first to demonstrate the detrimental effect of prosecution of air traffic controllers on incident reporting. In 2003 he re-created the CANSO Safety Standing Committee and chaired it for six years. He also advises in the health care industry on safety matters with a particular focus on safety leadership. From November 2014 he was co-chairman of the Eurocontrol Safety Team, until 2019. For the Air Traffic Controllers academy of LVNL, he is the chairman of the examinations committee.

**Dr Rafet Emek Kurt, Reader, in Maritime Safety and Human Factors, Department of Naval Architecture Ocean and Marine Engineering, University of Strathclyde**

Dr. Kurt also serves as the Director of the Maritime Human Factors Centre, further demonstrating his commitment to advancing research in this field. Additionally, he holds the position of Associate Editor in Ships and Offshore Structures, showcasing his dedication to the dissemination of knowledge within the maritime community. Dr. Kurt is also a member of the International Ship and Offshore Structures Congress (ISSC), where he collaborates with peers to develop ship design criteria informed by human factors, further highlighting his commitment to the advancement of maritime safety practices.

Over the years, Dr. Kurt has worked on many research projects aimed at integrating human factors, safety, and risk into maritime practices. His work has been published in respected journals and conferences, igniting essential discussions in the maritime community.

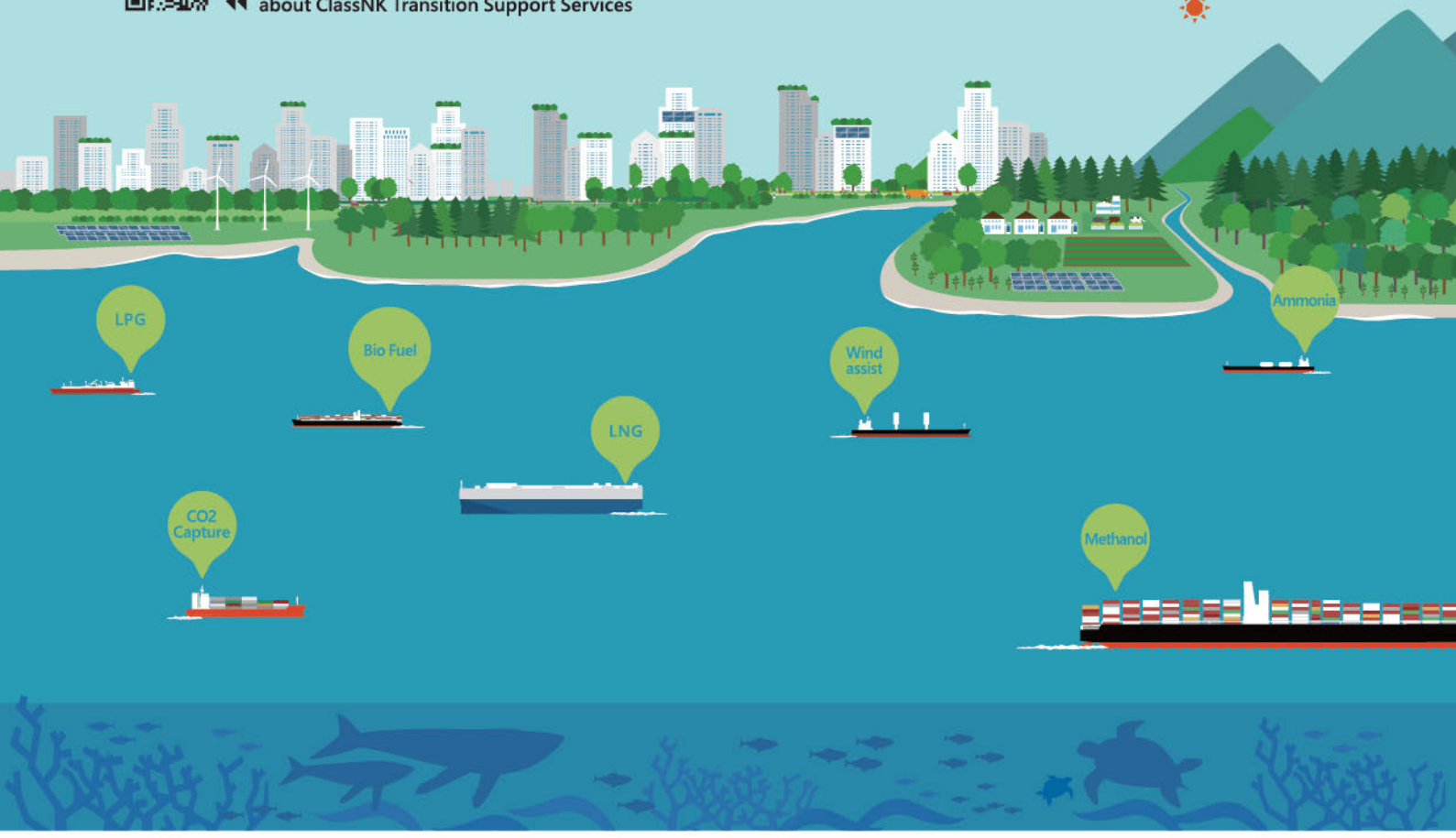
https://rina.org.uk/events/events-programme/human-factors-2024/

# Charting Transition to Zero-Emission

Revised IMO targets to reduce GHG emissions and the EU's expanded climate policy package are driving increasingly stringent regulations for shipping. In the meantime, the infrastructure for supplying zero-emission fuels is still under development. In the immediate term, shipping stakeholders seeking to make progress towards zero-emission need to select GHG reduction measures based on their circumstances and the specifics of their individual vessels.
To support its clients' ongoing efforts to reduce GHG emissions, ClassNK is extending its "ClassNK Transition Support Services." Based on a holistic assessment of customer needs and implementation strategies to achieve optimal solutions, the expanded service focuses on three types of GHG emissions reduction measures: the introduction of alternative fuels for ships; energy efficiency improvement technologies; and the use of onboard CCS.

ClassNK is committed to making a full contribution to charting a course towards zero-emission for our clients and society.

For more infomation
about ClassNK Transition Support Services




ClassNK CHARTING THE FUTURE

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