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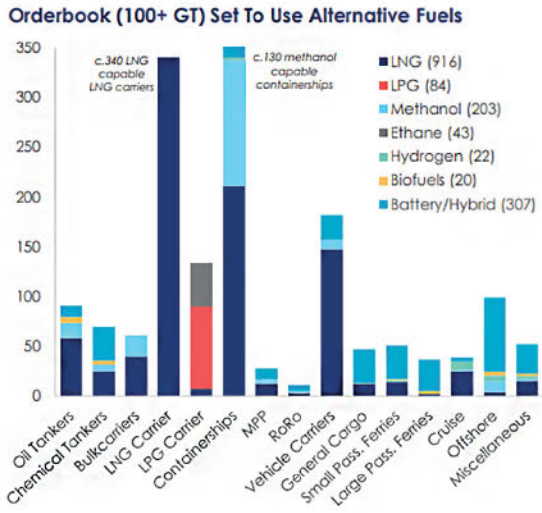
FLEET'S COURSE TOWARDS FUTURE FUELS GETS SIGNIFICANT UPDATE

By **Daniel Johnson**

Speaking at the Greener Shipping summit in November, Christoph Rofka, division president for medium and low speed products at Accelleron, declared that by 2030 all newbuildings will be alternative fuel capable. At the time I thought this a fairly bold assertion, but figures from Clarksons Research's latest Green Technology Tracker report, released in early January, would seem to lend credence to Rofka's prediction. The data indicates that the renewal of the global merchant fleet is continuing apace and that nearly half of newbuild orders placed last year by gross tonnage will be capable of running on alternative fuels.

Summarising the report, which monitors the progress of alternative fuel uptake and investments in energy saving technologies across the fleet, Steve Gordon, global head of Clarksons Research, noted that 2023 had been a hugely significant year in the shipping industry's decarbonisation pathway and revealed that 49% of the current orderbook tonnage is now alternative fuelled.



ALTERNATIVE FUELS: ORDERBOOK UPTAKE BY SECTOR. SOURCE: CLARKSONS RESEARCH

Across the year, Clarksons recorded 539 newbuild orders involving alternative fuels, 45% of all orders placed by tonnage. As would be expected, the largest share of alternative fuelled orders in 2023 was still LNG dual fuel with 220 vessels, of which 152 were non-LNG carriers. However, there was an increase to 125 orders for methanol dual fuel vessels in 2023. There were also 55 new orders involving LPG as a fuel and four vessels that will be fuelled by ammonia.

Reflecting future "optionality", Clarksons statistics show that there are now 579 ships either on order or in operation that have LNG "ready" status, 322 that are ammonia "ready" and 272 that are methanol "ready".

Uptake has also varied across shipping segments, with 83% of container ship newbuild capacity ordered in 2023 – rising to 94% including orders with "ready" status – and 79% of car carriers – rising to 98% including "ready" orders – contracted with alternative fuel capacity. In contrast, there was much lower uptake in the bulk carrier and tanker orderbooks.

Overall, 6% of the global fleet capacity is alternative fuel capable, up from 2.3% in 2017. Clarksons projects that this will increase to nearly a quarter of all fleet capacity (~23%) by 2030.

In addition to fuelling changes, there has been a hastening in the adoption of energy saving technologies (ESTs), with so-called "eco vessels" now constituting 32% of the global tonnage on the water, rising to around 50% in the VLCC and Capesize sectors. Clarksons' figures show that some 7,295 vessels in the fleet have significant ETSs. This includes propeller ducts, rudder bulbs, Flettner rotors, wind kites, air lubrication systems, amongst others. Thirty-one existing vessels are trialling onboard carbon capture technology, with a further 22 ships currently on order.

Despite the acceleration in uptake of green technologies, Clarksons' tracking of vessel performance under the IMO's Carbon Intensity Indicator (CII) in 2023 suggests that thousands of existing vessels will fall into CII categories D or E within the next couple of years. "We estimate that under CII, around 45% of today's tanker, bulk carrier and container fleets will be D- or E-rated if they are still trading in 2026 and have not modified speed of specification," warned Gordon.

He also referenced that the average age of the global fleet is rising, now standing at 12.6 years in gross tonnage terms, up from 9.7 years a decade ago. Clarksons' data shows that 32% of global tonnage is over 15 years old.

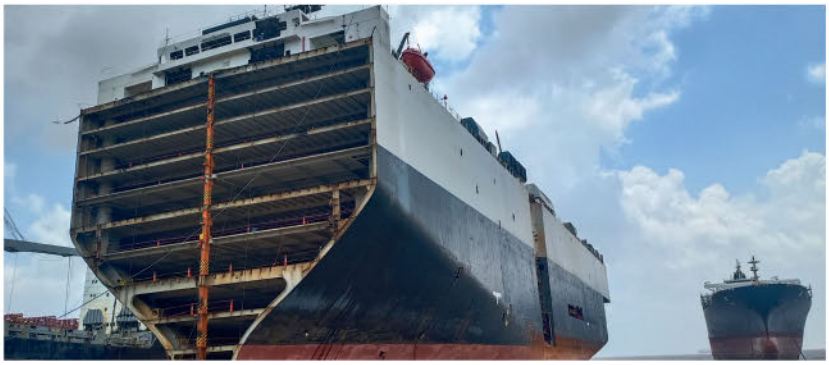
With carbon regulations targeting these older, less efficient ships getting tighter, shipowners are now faced with a daunting choice: either upgrade the vessels to improve their carbon ratings or replace them with new ones – a dilemma recently faced by Norwegian coastal ship operator Hurtigruten (see page 20).

Interestingly, some analysts estimate that up to 30% of those ships built in the decade ahead will need to undergo retrofits before 2050 to meet emissions targets. So the challenge facing naval architects today is not only what to do with existing ships' emission profiles, but also how to make sure that vessels designed and built in coming years can be upgraded both economically and effectively. ■

NEWS

SHIP RECYCLING

PAKISTAN RATIFIES HONG KONG CONVENTION



THE HONG KONG CONVENTION HAS NOW BEEN RATIFIED BY ALL THE MAJOR SHIP RECYCLING COUNTRIES IN THE WORLD. SOURCE: NAYEEM NOOR

Pakistan has become the 23rd country to sign up to the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (Hong Kong Convention).

Iftikhar Ahmad Rao, Pakistan's Maritime Minister and Special Assistant to the Prime Minister (SAPM) on Maritime Affairs, deposited the instrument of accession with then IMO secretary general Kitack Lim at IMO headquarters in London late last year.

The deposit followed an IMO-run national seminar in Karachi, Pakistan, to support the country's implementation of the convention and related guidelines.

All major ship recycling states have now become a party to the Hong Kong Convention. Together, Turkey, India, Bangladesh and Pakistan recycle each year around 95% of the world's recycled tonnage.

The Convention, which will enter into force on 26 June 2025, is aimed at ensuring that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risks to human health, safety and to the environment.

It embraces the "cradle to grave" concept, addressing all environmental and safety aspects relating to ship recycling, including the responsible management and disposal of associated waste streams in a safe and environmentally sound manner.

A significant milestone was reached in June 2023 when Bangladesh and Liberia – one of the world's largest flag states by tonnage – officially endorsed the Convention, paving the way for its implementation.

AUTONOMOUS SHIPS

COSCO SHIPPING TECHNOLOGY JOINS ONE SEA

Chinese software company COSCO Shipping Technology has become the latest company to join international autonomous shipping association One Sea.

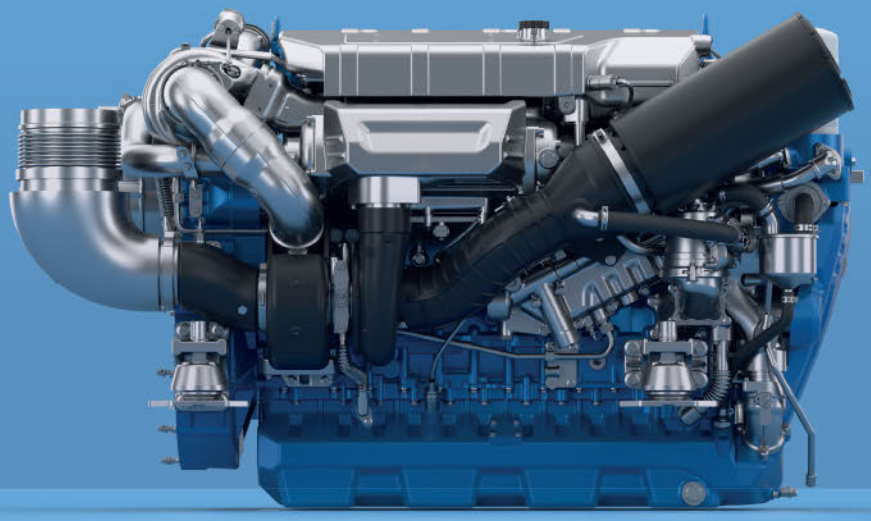
COSCO Shipping Technology, a subsidiary of COSCO Shipping Group, is the sixth company to join One Sea in the past year and is also the first association member from China.

With a strong record of accomplishment in maritime innovation, the company has developed several technologies that support autonomous operations on board. These include a behaviour perception system which aims to reduce navigational errors and a situational awareness system that is currently deployed on several vessels.

"We are delighted to welcome COSCO Shipping Technology to the One Sea Association," says Sinikka Hartonen, One Sea secretary general. "Over the last 12 months, One Sea has continued to grow and as an international association, representation from across the global shipping sector has been key to providing a comprehensive industry perspective to our work related to rule and technology development throughout the maritime transport chain."

"At COSCO Shipping Technology, our mission is to push the boundaries of maritime technology and develop solutions that have the power to enhance safety, sustainability and efficiency," says Liu Jun, COSCO Shipping Technology head of AI applications.

BUILT TO INNOVATE



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ALTERNATIVE FUELS

CLASSNK AWARDS AIPS FOR SDARI'S GREEN FUELS-POWERED VEHICLE CARRIERS

Classification society ClassNK has issued approvals in principle (AiPs) for three vehicle carrier designs developed by Shanghai Merchant Ship Design & Research Institute (SDARI).

The first AiP acknowledges an ammonia-ready LNG dual-fuelled vehicle carrier with a capacity of 7,000CEU, a significant first in China's independently developed design landscape.

The vessel will have an overall length of 199.99m. SDARI plans to integrate the GTT MARK III Flex containment system for LNG and ammonia fuel storage to maximise the cargo capacity efficiently.

Additionally, ClassNK has granted AiPs for both methanol dual-fuelled and ammonia dual-fuelled vehicle carriers, each with a capacity of 10,000CEU, which is envisioned to lead the development of ultra-large vehicle carriers.

According to classification society, SDARI's three models exemplify a new generation of green vehicle carriers that are designed to adapt to various alternative fuel options and cater to future market demands.

AIP HANDOVER CEREMONY: LYU ZHIYONG, PRESIDENT, SDARI (RIGHT), AND HIROAKI SAKASHITA, PRESIDENT AND CEO, CLASSNK

It adds: "ClassNK has engaged in SDARI's development projects and carried out its review in accordance with the relevant standards, including its latest structural rules Part C and Guidelines for Ships Using Alternative Fuels. Marking the AiPs as the milestone, ClassNK is committed to further providing expertise to assist the design firm's initiative in expanding the industry's pathway for the transition to decarbonisation."

OFFSHORE

NOV INTRODUCES FLOATING WIND INSTALLATION VESSEL CONCEPT

NOV, the US-based equipment and technology provider to the global energy industry, has launched a floating wind installation vessel (FWIV) concept designed specifically to meet the unique challenges of the floating offshore wind sector.

Floating wind farms, usually situated farther offshore in deeper and harsher environments, require new and robust installation solutions. According to NOV, its Enhydra FWIV concept, an addition to the GustoMSC Enhydra offshore wind support vessel series, is engineered to operate safely and effectively in such challenging conditions.

RENDER OF ENHYDRA FWIV WITH TRIFLOATERS

The 150.6m vessel's modular and integrated design enables the installation and connection of various floater types, mooring systems and dynamic cables, the firm says.

Development of the concept is the result of extensive collaborations, encompassing not only the NOV's marine and construction business unit but also input from offshore wind developers, EPIC contractors and specialist original equipment manufacturers.

"The GustoMSC vessel design offers a flexible deck layout and specific provisions for mission equipment integration, including electric subsea cranes for lifting and handling and Remacut cable-lay systems," says the company.

NOV adds that it believes the nascent floating wind market presents one of the greatest renewable energy resource opportunities of the next decade.

"By ensuring compliance with all relevant regional requirements, including the US Jones Act, NOV has expanded the potential scope of the local supply chain for the Enhydra FWIV, making it possible to build the vessel at proficient shipyards across the globe," it says.

SHIPYARDS

JIANGNAN AND BV SIGN A COOPERATION AGREEMENT ON SHIPYARD DIGITALISATION AND 3D DESIGN REVIEWS

Jiangnan Shipyard (Group) Co., Ltd and Bureau Veritas (BV) have issued a Joint-Declaration on 3D Auditing and Recognition, aiming at accelerating the process of 3D Submission and Approval by shipyards and classification societies. A partnership agreement was signed in December during Marintec China 2023.

The partnership aims to meet the needs of the digital transformation of ship and sea equipment design and construction, promote the deep integration of digital technology, empower the transformation and upgrading of traditional industries, support the emergence of new industries, and enable the use of a single source of data in the ship design and building processes in the future.

The cooperation agreement comprises four main initiatives: strengthening digital transformation; defining interoperability, common standards and data security strategies; assisting full lifecycle digitisation; and creating opportunities for sharing and co-innovation to further enable digital twins to create a larger 'three-dimensional community of application' within the maritime sector.

Alex Gregg-Smith, president of BV Classification France, North Asia & China, says: "In today's world, digitalisation plays an increasingly significant role in the process of ship design, review, manufacture, operation and decommissioning, and it profoundly affects the development pattern of the shipbuilding and shipping world. Among them, 3D digital review, including sending and returning, is an important part of the ship digital ecology and one of the hot spots in the development of today's shipbuilding industry."

SIGNING CEREMONY DURING MARINTEC CHINA 2023

SHIPYARDS

MEYER WERFT LAYS KEEL FOR LNG-FUELLED CRUISE SHIP

ASUKA III KEEL-LAYING CEREMONY

Meyer Werft has held a traditional keel-laying ceremony for the LNG-powered *Asuka III* cruise ship being built for NYK Cruises, a subsidiary of Japanese shipping company NYK.

The event took place at the German shipbuilder's yard in Papenburg, Germany, in December, with the first steel block, weighing 345tonnes, lowered into building Dock I (Hall 5).

NYK Cruises placed the order for the *Asuka III* in 2021.

Jan Meyer, Meyer Werft managing director, states: "All of us at Meyer are proud to build this special cruise ship for the Japanese market. The special feature of designing the ship to meet the needs and requirements of Japanese passengers is unique."

Meyer Werft will use numerous solutions customised for the Japanese market for the new cruise ship. The vessel will feature optimised hydrodynamics for planned Asian routes, contactless controls and onboard amenities specially developed according to Japanese wishes and customs.

The *Asuka III* is the first passenger ship to be built under the supervision of the Japanese flag state in approximately 30 years.

"I appreciate the ongoing collaboration with the Meyer Werft team and am confident that with their continued support we will successfully manage the launch of the *Asuka III* in 2025," says Hiroyuki Endo, president of NYK Cruises.

With a length of 230m and a width of 29.8m, the 52,200gt ship will have capacity for 744 passengers.

NEWS ANALYSIS

COP28 AND GAZA IMPACT SHIPPING AS METHANOL ENDS 2023 ON A HIGH

By **Malcolm Latarche,** Correspondent

December proved quite an eventful month for the shipping industry with COP28 in Dubai, events in Israel and Gaza and new methanol fuelled four-stroke engine developments grabbing headlines.

COP28 was especially interesting, and its outcomes could have consequences for the shipping industry and the IMO's net zero ambitions. The annual circus that the COP meeting has become actually gave the shipping industry an opportunity to boast its green credentials with a side event organised by the IMO.

On a global scale, shipping is the only industry that actually has made GHG reduction mandatory through the use of the EEDI and EEXI rules. CII is also supposed to help but in the opinion of many is so flawed that it was sent for revision after being in operation for less than seven months.

The IMO event and others at the fringe of the main conference resulted in a stream of almost 50 different commitments, pledges and calls for shipping to become greener. There were announcements at a national level of new green corridors, major shippers such as Amazon coming together to form the Zero-Emission Maritime Buyers Alliance (ZEMBA), ports, shipping companies, class societies and more all citing new initiatives.

The CEOs of five of Europe's largest operators – Maersk, CMA CGM, MSC, Hapag Lloyd and Wallenius Wilhelmsen – issued a joint declaration calling for an end date for fossil-only-powered newbuilds and urged the IMO to create the regulatory conditions to accelerate the transition to green fuels. What was noticeable was the lack of initiatives around shipping coming from China.

The most controversial aspect of COP28 was the initial draft agreement of achievements omitting any reference to a phase out of fossil fuels. This was partially addressed – but not to the satisfaction of most environmental NGOs – by a small amendment. The agreement gavelled through at the last session does call for a transition away from fossil fuels in the energy sector but not in transport or agriculture. There was also recognition of the role of natural gas as an enabler of transition to cleaner fuels and also of nuclear as a clean fuel. The latter potentially being a spur to proponents of nuclear-powered ships.

Owners of tankers, gas carriers and bulkers active in the coal trade probably gave a collective sigh of relief at the retreat away from phasing out fossil fuels. Those operators that prefer LNG as a fuel were also likely to have been quite satisfied. Given that fossil fuels for transport are currently not on the transition horizon after COP28, those countries that feel the IMO is moving too fast on net zero might be emboldened to water down or delay future efficiency and GHG reduction targets.

SOURCE: KIARA WORTH/UN CLIMATE CHANGE

Away from Dubai but still in the Middle East, events in Israel and Gaza might not at first have seem to have an immediate significant impact on shipping. However, missile attacks by Houthi rebels in Yemen on merchant ships that may or may not be heading for Israeli ports have seen several operators deciding to route ships around South Africa rather than risk attack by entering the Red Sea on the way to Suez.

Ironically the decision by opertaors to put safety first will mean that those companies whose CEOs' voices were raised loudest in Dubai have in fact made a decision to burn more fossil fuels on the longer journeys.

On the alternative marine fuels front, methanol seems to have been the big success story of 2023 with new orders for methanol-fuelled vessels being added on a regular basis. In late November, MAN ES announced the first reference for its ME-LGIM engine in a VLCC. The order by Dalian Shipbuilding Industry Co (DSIC), is for a MAN B&W 7G80ME-LGIM.

In December MAN followed up with announcement of a retrofit order for COSCO Line's 13,800TEU *Camellia* and 20,000TEU Virgo class vessels. Currently equipped with single-fuel MAN B&W 11S90ME-C10.5 engines, the vessels will be retrofitted to dual-fuel MAN B&W 11S90ME-LGIM10. MAN also announced a new dual-fuel methanol version of its 175D high-speed engine will be available by the end of 2026.

Not to be outdone, Wärtsilä has announced plans to introduce another four methanol engines to its portfolio, with the first deliveries of the new engines expected from 2025. ■

NEWS EQUIPMENT

PROPULSION

ERIK THUN PUTS DYNAMIC DRIVE TECH AT THE HEART OF FUEL EFFICIENCY GAINS

Erik Thun Group has selected Berg Propulsion's Dynamic Drive technology to optimise efficiency on board all 10 of its latest newbuildings.

The Swedish shipping company confirmed its decision after pilot installations exceeded energy efficiency gain expectations, with the integrated drive solution helping to save 10% of fuel, rising to 20% in some operational conditions.

As part of Erik Thun's rolling fleet renewal strategy, the company recently expanded its newbuild programme with Dutch yard Shipsveerf Ferus Smit to include four 5,100dwt 'Troll-Max' dry cargo vessels, as well as six 7,999dwt coastal 'Eco Tankers'. Tanker deliveries started in 2023, with the last of the 10 vessels due in service in 2026.

All 10 ships will feature Berg's complete main propulsion systems and energy optimising control technology, and include Dynamic Drive after trials on *Snow Crystal*, *Nordic Crystal* and *Baltic Crystal*.

Dynamic Drive is an adaptive thrust and fuel optimisation software, offered for inclusion with the Berg Propulsion MPC 800 control system. The software automatically and dynamically identifies the most energy efficient settings for propeller pitch/RPM to produce the thrust to maintain the required speed.

THE 100M DRY CARGO VESSEL *NORDIC CRYSTAL*. SOURCE CHRISTOPHER KULLENBERG ROTHVALL

Jorgen Karlsson, general manager Europe & Americas, Berg Propulsion, says: "Dynamic Drive provides a user-friendly interface which simplifies a key part of operations, allowing crew to set limits more easily to ensure consistent fuel-efficient vessel operation in all operational modes."

ENGINES

WINGD AND ALFA LAVAL PARTNER TO ADVANCE DEVELOPMENT OF AMMONIA-POWERED ENGINES

Alfa Laval and Swiss engine designer WinGD have established a partnership in which Alfa Laval will deliver two fuel supply systems (FSS) for testing WinGD's ammonia-fuelled engine in early 2024.

According to a spokesperson, the partnership is a significant step forward in the development of ammonia as a future fuel for marine vessels.

WinGD is at the forefront of developing ammonia-fuelled engines, with the recent achievement of the first-ever approval in principle (AiP) from Lloyd's Register for its X-DF-A dual-fuel range powered by ammonia.

TEST ENGINE IN WINGD ENGINE RESEARCH AND INNOVATION CENTRE

In the next step of WinGD's ongoing ammonia test campaign, Alfa Laval will provide two customised ammonia fuel supply systems for the company's Engine Research and Innovation Centre in Winterthur, Switzerland.

Alfa Laval will deliver the FSS for the injector test system and FSS for the engine test bench. The project is in the framework of WinGD and Alfa Laval's earlier agreement for cooperation on methanol and ammonia, signed in 2022. This gives both companies the chance to optimise the overall fuel supply and use it for later application on board.

"With each new collaboration we are one step further on the path to running engines with zero-carbon emissions," says Sebastian Hensel, R&D director, WinGD. "Our ammonia testing campaign began in 2021 with extensive research into the combustion characteristics of the fuel. The fuel supply system is an important next step in the technology development, keeping pace with our delivery targets of 2025."

PROPULSION

WÄRTSILÄ HYBRID PROPULSION SOLUTION SELECTED FOR THREE NEW CARGO VESSELS

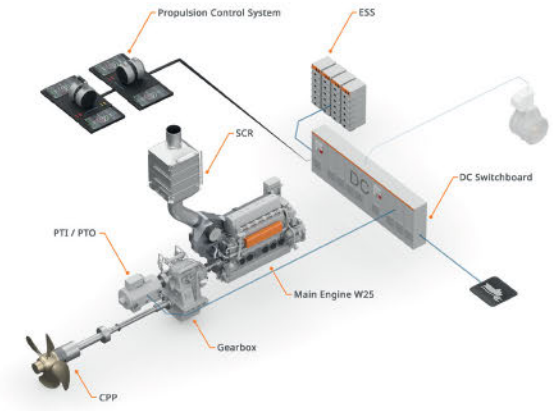
Wärtsilä will supply an integrated hybrid propulsion solution for three new self-discharging cargo vessels being built at the Royal Bodewes shipyard in the Netherlands for Norwegian shipowner Aasen Shipping.

As part of the solution, the ships will feature the latest addition to Wärtsilä's engine portfolio, the Wärtsilä 25, which was launched in September 2022. The engines and vessel are prepared for operation on sustainable fuels in the future.

Wärtsilä delivered a similar hybrid propulsion solution to two earlier Aasen Shipping vessels, the *Aasfoss* and *Aasfjell*.

"We have been very satisfied with Wärtsilä's support and close cooperation in helping us to achieve more efficient and cleaner cargo transport. This is important to us. Plus, the Wärtsilä engines are made ready for us to switch later to sustainable fuels, which will allow us to significantly further reduce carbon emissions in line with our fleet decarbonisation aims," says Torbjørn Torkelsen, CEO of Aasen Shipping.

"We are delighted to have received this repeat order for our hybrid solution, says Stefan Nysjö, vice president of Power Supply, Wärtsilä Marine Power. "The combination of the highly efficient and flexible Wärtsilä 25 engine with batteries provides both optimised operations and environmental sustainability. The ships can use electrical battery power when in harbour and for low-load operations, and then switch to the main engines for transit."



WÄRTSILÄ DELIVERED A SIMILAR HYBRID PROPULSION SOLUTION TO TWO EARLIER AASEN SHIPPING VESSELS

The three 9,500dwt vessels will each operate with one six-cylinder Wärtsilä 25 main engine fitted with a Wärtsilä NOx reduction system, a Wärtsilä gearbox and controllable pitch propeller with shaft line, a Wärtsilä Pro-Touch bridge control system, the Hybrid system with DC hub and 620kWh battery capacity, the control system, as well as the battery, power and energy management systems.

SHORE POWER

ERMA FIRST SHORE POWER SYSTEM WINS BV APPROVAL

Bureau Veritas (BV) has granted an approval in principle (AiP) to ERMA FIRST for its BLUE CONNECT high voltage alternative maritime power solution.

The system, which can be housed in a 40ft container or provided in a stand-alone configuration, enables most ships to connect with different shore power systems based on their required power. It can be plugged into a port's infrastructure (external connection) and to a vessel's electrical grid (internal connection).

KONSTANTINOS STAMPEDAKIS OF ERMA FIRST (LEFT) AND VASSILIOS DIMOILAS OF BUREAU VERITAS

According to ERMA FIRST, BLUE CONNECT has been designed for a specific maximum load capacity according to individual vessel specifications and to meet specific port requirements. This provides maximum flexibility for access to shore power while at berth, the company says.

BV has confirmed that the BLUE CONNECT system meets its requirements for safety, including structural integrity of the containerised 'box' containing the connection system, allowing the unit to be stored on a ship's deck and deployed when required.

Konstantinos Stampedakis, co-founder and managing director of ERMA FIRST, says: "We are delighted to receive this approval in principle from Bureau Veritas, which confirms that BLUE CONNECT's safety and operational profile meets the in-principle expectations of the classification society. Developing solutions that not only protect the environment, but also have a positive impact on our customers' operations has always been a priority for ERMA FIRST."

BATTERIES

MARINE BATTERY MAKER AYK REPORTS SALES SURGE DRIVEN BY INNOVATION, SAFETY AND COST

By **Ben Pinnington**, Contributor

Andorra-headquartered AYK Marine batteries is emerging as one of the prime disruptors in the marine battery industry thanks to innovation in design, safety and driving down production costs.

AYK, established by marine battery pioneer and electrical engineer Chris Kruger in 2018, is seeing a surge in demand since opening a new state-of-the-art automated manufacturing plant in Zhuhai, China, in July last year. The 5,000m^2 factory ramps up AYK's production capacity to 300MWh a year with ability to expand to 1GWh. Its opening was seen as a significant moment in the evolution of the marine battery industry and saw speeches from Wärtsilä, Fjord Maritime Norway, Vulkan Group, Green Energies E-Ship and the Maritime Battery Forum.

Inventor, pioneer, innovator

Kruger tells *TNA* the company is reporting an immediate return on the investment with a 400% increase in quotations in the second half of 2023.

"All manner of vessels are coming to us looking for battery solutions," he says. "We're winning work to supply container vessels, car and passenger ferries, tugs and barges. There's also increasing demand from the superyacht sector which wants green solutions that are safe and affordable. With the drive to decarbonise inland waterways and short-sea shipping we are planning for 10 years of rising demand, underpinned by our commitment to safety and affordability."

And here is the rub for AYK. Drawing on Kruger's extensive 15 years of experience the AYK team has seen first-hand how battery technology has evolved from expensive and hazardous NMC (nickel, manganese, cobalt) cells to the much less volatile LFP (lithium, iron, phosphate) cells. As a result Kruger, like Edison testing the light bulb, has been witness to much trial and error. He says he wants to bust myths around LFP including its energy density. He says LFP can go toe-to-toe with NMC on energy density and critically be safer, especially using AYK's battery design. NMC on the other hand has already been responsible for fires with one battery bank catching fire on a passenger ferry in Norway due to overheating and thermal runaway. Luckily no-one was injured.

CHRIS KRUGER, AYK ENERGY FOUNDER

'Safe' LFP bests 'volatile' NMC

"NMC batteries are becoming more and more hazardous and an accident waiting to happen in my view," says Kruger. "Density demands are increasing which runs a higher risk of fire due to the violent reaction of NMC. The greater the demand put on the system the greater the risk of cell runaway creating highly flammable chemical compounds. LFP, on the other hand, is a fundamentally safe chemistry. LFP does not create oxygen so the risk of fire is massively reduced."

Kruger has honed AYK's method and approach through multiple roles in both the automotive industry and marine. He believes given the complexity of the technology it is very hard for new businesses, without at least 10 years of experience, to break into the marine battery market. In the automotive sector he led the team that developed the battery for the Fisker Karma, one of the world's first production plug-in hybrid electric vehicles that sold mostly in the US. But in 2010, even before that car went on sale in 2011-12, he had moved on to be director of engineering at Corvus, where he developed and installed the battery for the first NMC hybrid propulsion ferry, *Princess Benedikte*, and the first fully electric ferry, *Ampere*. He says NMC was used at the time as it was the only real chemistry available, but innovation in LFP is proving a game changer.

Chasing innovation dream

With the conviction that LFP batteries are the future Kruger decided to chase his dream and strike out on his own entrepreneurial venture with AYK Energy. With his team of close advisers and engineers the company has a clear view on the future of the marine battery market. Inspired by Edison's wizards of Menlo Park the AYK team is pushing the boundaries of what is possible in LFP marine battery technology.

OPENING OF AYK ENERGY'S FACTORY IN CHINA

"In a conservative industry like maritime you have to prove you are safe and you are affordable," he says. "This is why we set up in China. China is the best place in the world for the battery industry. It has the experience, skills, supply chain and infrastructure. Critically, it understands safety. For me a lot also came down to price. Some of the pricing around batteries is crazy. I want to change that, hence coming to China where we can drive down costs for our customers. We believe we can drive decarbonisation by encouraging faster adoption of battery technology by offering a much more competitive price. This is the excitement of innovation – bringing an invention to a mass commercial market."

Kruger says the AYK team started by designing the battery management system (BMS) from the ground up. Backed by venture capital funding, the team set out to design a battery – both its hardware and software – that would benefit from his experience of both design and installation work during his previous appointments.

"It was not easy going," he says, "but in 2020 I had a piece of luck." That came from making contact with battery cell maker EVE, which was keen to design a battery that could secure marine type-approval from class society DNV and had already devoted two years to the attempt.

After many conversations between the two organisations, Kruger's counterpart at EVE laid down a challenge: "You say you can develop a type-approved battery, now prove it."

Kruger set out to do just that: in exchange for space in EVE's certified lab and the use of its test equipment, AYK would do the rest. Using EVE's cells alongside AYK's BMS, Kruger and his team designed, built and tested a marine type-approved battery in just six months, which was "quite a feat", Kruger says. AYK paid for and sourced all the hardware and retained intellectual property in the final design.

The art of design

That design now forms the basis of AYK's range of eight battery variants, all of them using the same battery technology and safety features. He says the simplicity of the AYK design enables them to innovate at speed with nine new batteries already designed and a further nine in development which could be launched within months.

Part of AYK's design secret and safety is the choice of cell chemistry. All its batteries use LFP cells supplied by EVE, making the company unique in using that cell structure in all its products. It is cheaper than NMC which is the most common battery chemistry, and LFP will eventually be "the bridge chemistry to take us to the next generation of solid-state batteries", Kruger believes.

The Chinese battery industry also shares Kruger's conviction that LFP is safer. China will not allow NMC cells to be used for any application that involves transporting people.

Since LFP is safer the battery design does not have to include structures to improve the safety at a system level. NMC cells have a greater energy density but once they are installed into batteries along with their cooling arrangements, their modular energy density is less than that of an LFP battery, Kruger points out. "We can fill most of the module with actual battery," he says.

They are also less prone to thermal runaway and, should it happen, "it's not a violent reaction that escalates very fast", he says. In case that happens, AYK's battery modules have an automatic water-based response system installed.

Water is used because it has a large phase-change energy value and in the event of a battery overheating, a sprinkler inside the module is activated. This will flood the affected module – not the entire bank of batteries – and because they operate at a low voltage of about 40V, electrical conduction through the water is not a hazard.

CONTAINER VESSEL FPS *WAAL*

AYK has patented this arrangement in China and Kruger says that it exceeds class requirements for battery fire protection, which call only for detectors in the battery compartment. In addition, AYK's batteries have three smoke detectors within each module – two must activate before a response is initiated – and the modules are IP67-rated enclosures, each with a blow-out port to release any gases that build up inside.

This is connected to an extraction duct with a fan to remove any flammable gases from the battery to be vented outside while any water can be drained via a fitting on the duct piping.

Deals drive decarbonisation

AYK's strong pedigree is enabling it to strike deals with the industry's prime integrators including Wärtsilä and Siemens. Meanwhile, shipyard clients include Holland Shipyards Group where its batteries are being deployed on the high profile zero-emission machinery retrofit of the 110m container vessel FPS *Waal*, operated by Future Proof Shipping. At time of going to press the successful integration of the battery system on the FPS *Waal* has led to new orders with Holland Shipyard Group.

Here the FPS *Waal*'s diesel engines will be replaced with PEM fuel cells, storage for their hydrogen fuel, two AYK high-density DNV-approved Aries lithium batteries and an electric drive train. The order is the first time that AYK batteries will be used alongside fuel cells, making it a landmark contract for the company, Kruger says.

Another deal is seeing AYK supply Norwegian aquaculture technology supplier Fjord Maritime to convert an oil platform supply vessel (PSV) to a containerised battery-powered live fish carrier (LFC). Here AYK has worked with Fjord to develop a special containerised battery solution for the vessel which is owned by the Firda Seafood Group, which is also based in Norway.

The DNV Class-approved 1MWh energy storage solution (ESS) will be fitted into a container along with Fjord Maritime's Fjord Hybrid solution. The container is further equipped with all necessary safety and auxiliary systems.

"Containerised batteries are set to be one of the biggest innovations in the maritime industry in the next five to 10 years," says Kruger. "Containerised batteries have multiple benefits. They can be installed easily on deck without taking space below deck and incurring complex battery room safety requirements. Furthermore, the retrofit process is simple and does not require the vessel to be out of service for very long. When operational the batteries can also then be swapped around with fully charged replacements quickly at shore side charging centres. In addition, the containerised power solution is future proof. When a new more powerful battery technology is developed, or a different form of power is introduced, the container can be adapted for that purpose."

US and European factory expansion

Looking to the big picture AYK says its automated manufacturing model can be replicated elsewhere in the world. In the US, where AYK's sales director Ed Carney is based, for example, The Jones Act encourages domestic sourcing for US-built ships, so if that market opens up, an automated production facility could be built to meet it.

In Europe, too, a similar plant could be built quickly. A site has already been identified and an automated production line could be operational just six months after construction begins, Kruger says.

Kruger is proud of what he and his team at AYK have achieved in just a few years. "We have built the safest battery system with one of the highest energy densities in the industry," he reflects. And its cost – already one of the lowest – "will keep going down because of manufacturing capabilities".

But he also stresses his batteries' ease of installation and commissioning. "From the ground up," he says, "we designed our battery to allow remote access which enables remote support during commissioning and remote software updates. Once installed, bugs and faults can be fixed remotely and data can be easily uploaded to The Cloud for storage and processing."

"We believe we are the best and we will work very hard to remain the best," he concludes. ■

DECARBONISATION

INSTALLING WIND PROPULSION IS A MULTI-FACETED DECISION

By **Aude Leblanc**, technology leader – sustainable shipping, Bureau Veritas Marine & Offshore

From wings to sails and kites, we see a new generation of wind propulsion solutions for shipping emerging at an impressive pace. Their adoption by shipowners is also progressing at speed, driven by the need to reduce greenhouse gas (GHG) emissions in the short term. Today, about 30 large vessels are equipped with wind propulsion systems, and the number of installations is set to surpass 50 in 2024, according to the International Windship Association (IWSA). About 30,000 merchant ships are projected to use wind propulsion by 2050.

For naval architects and engineers, making these projects a reality is far more complex than simply adding new equipment on board. Equipping a ship with a wind propulsion system inevitably impacts a wide range of design and operational aspects, from its weight and structural strength to stability and manoeuvrability. Furthermore, each wind propulsion technology is designed for a specific set of conditions, and limitations depend on the technology chosen as well as the characteristics of the ship itself.

Therefore, these projects require a holistic approach, addressing the safety risks associated with wind propulsion systems, the management of operations in various environments, as well as the broader impact of the system on the ship's structure and weight, and how it will interact with other systems on board. This is a prerequisite to be able to seize the enormous potential of wind propulsion to help decarbonise shipping, while ensuring safety at all times.

Stability, manoeuvrability and visibility requirements

A critical technical consideration for any wind propulsion installation is ship stability. The heel induced by wind propulsion systems, as well as the impact of the additional weight on the ship's load lines

INCORPORATING WIND PROPULSION REQUIRES A HOLISTIC APPROACH THAT ADDRESSES THE SYSTEM'S IMPACT ON VESSEL STABILITY, STRUCTURAL INTEGRITY AND MANOEUVRABILITY

AUDE LEBLANC

and tonnage, must be assessed thoroughly. This is essential, because a ship's stability profile may limit the conditions in which the wind propulsion system can be used. This varies depending on the ship's type and unique characteristics. For example, while tankers and bulkers generally have sufficient stability margins, using wind can be trickier for ferries, which tend to have a smaller stability reserve.

Manoeuvrability is another critical aspect, with the additional load on the rudder potentially affecting the entire steering of the ship. Wind propulsion provides thrust, but can also induce drift and transversal forces, which have to be compensated to ensure the manoeuvrability of the vessel.

Furthermore, a key challenge for the installation of wind propulsion systems is to ensure that any structure placed in front of the ship won't restrict visibility, to ensure compliance with current regulations. This is generally easier to achieve for newbuilds, which offer the option of installing the bridge at the front of the ship.

But this doesn't mean that retrofitted wind propulsion systems can't be an interesting option for shipowners. For those projects, the first step is to determine the number of systems that can be installed on the ship whilst meeting visibility and stability requirements, and the best locations to maximise deck space and ensure the best performance. Once those questions have been answered, the next step is to consider the integration of the system's foundations with the ship's hull, depending on its structure, which may require reinforcing the hull.

With so many requirements to consider, shipowners, shipyards and naval architects and engineers need clear and comprehensive guidance. This is where BV's Rules on wind propulsion systems play a vital role.

A clear framework

Bureau Veritas' Rule Note for Wind Propulsion Systems (NR 206) serve as the key classification framework for wind-assisted propulsion. These dedicated Rules address the safety risks associated with wind propulsion systems, their broader impact on the ship, as well as how they will interact with other systems on board and the management of operations in various environments and sea conditions.

NR 206 provides load cases and coefficients for all types of wind propulsion technologies, including free-standing rigs, wing sails, kite sails, suction sails, and rotors. The Rules detail requirements for risk analysis and hazard identification (HAZID) studies, automation and release systems, and ship strength and safety. Elements as varied as the quality of the materials, lighting protection and the choice of anchor are also covered.

Furthermore, BV is currently updating NR 206 to clarify the stability requirements for ships equipped with wind propulsion systems, as well as reflecting the latest developments, such as the introduction of updated criteria for composite materials.

The Rules provide a framework for two main load cases. The first one details requirements for when the system is in operation. These are set by the manufacturer in the operations manual of the wind propulsion system, detailing the sea state, maximum wind speed and direction, and the different configurations under which the system can be used. As a classification society, our role is to validate that these conditions set by the manufacturer leave sufficient safety and stability margins, in line with our Rules.

The second main load case covers safety in "extreme conditions", defined by the rules as winds over 70knots, when the wind propulsion system cannot be in operation. This section of the Rules outlines the secure configuration in which the system must be set in case of adverse weather or sea conditions, with all sails folded and all systems immobilised, for instance.

The Rules in practice

A recent example of our Rules in action is the *Canopée*, a wind-propelled cargo ship built to transport satellite launcher components from Europe to French Guyana. Jointly chartered by Zéphyr et Borée and Jifmar Offshore Services, the 120m ship has been equipped with four automated articulated vertical wing sails – each covering 363m^2 and supported by a 30m mast. It is one of the first merchant ships specifically designed for wind propulsion and was also the first time that BV's Rules were applied to a real-life newbuild vessel.

As the classification society responsible for the *Canopée*, Bureau Veritas supported the owner and shipyard through all steps of the integration of the wind propulsion system on the ship. In line with our Rules, we validated the vessel's stability, the structural integration of the system on the ship's hull and checked that the weight was compatible with design drawings. The success of the project demonstrates the importance of a holistic approach, with all key aspects including stability, visibility and structure being addressed during the ship's design, leading to the landmark installation in August 2023.

Retrofit projects have also been supported by BV's Rules. We are working with French shipowner Louis Dreyfus Armateurs on the installation of suction sails by bound4blue on its ro-ro vessel *Ville de Bordeaux*. In addition to validating stability, our role was to check

all the modifications that needed to be made to the ship before the installation, including structural deck reinforcement and anchoring and mooring equipment. We also validated the electrical balance of the vessel, including the energy needed for the system's automation and the electric supply required by the rotor sails themselves.

Supporting safe innovation

In this era of fast-paced technology development, our role as a classification society is to independently assess and validate new systems, ensuring safety above all. This is where BV is a key ally for the industry, and where our role goes far beyond just assessing compliance. By developing common sets of standards to ensure safe innovation where industry-wide regulations are yet to be developed, we provide guidance that supports developers of wind propulsion technologies, while giving shipowners confidence in these innovative solutions.

Going forward, a key area of focus will be to support sea trials as more wind propulsion systems progress from concept to reality. This will be essential to ensure that these technologies operate as intended and safely, while also validating performance.

Building knowledge across the industry will be essential. In addition to working directly with a number of developers of wind propulsion technologies, BV participates in partnerships to share knowledge and best practices and develop methods for transparent performance prediction. These include the joint industry project WiSP (Wind-Assisted Ship Propulsion), which concluded in December 2023, focused on reviewing the regulatory landscape to recommend improvements and clarifications, and the development of a basic performance prediction tool to be used by participants.

Another example is the NORVENT project, which aims to carry out an inventory of the needs and approaches used to evaluate the performance of wind propulsion systems for ships. It constitutes the first step in harmonising evaluations in order to give strong credibility to the results produced among users of these services, an issue regularly raised by players in the sector.

Important steps will also take place to update the IMO's regulatory framework to include wind propulsion. As a member of the International Association of Classification Societies (IACS), BV is working to propose standards to incorporate wind in the relevant regulations. This will be a critical step to give more shipyards and shipowners the confidence to harness wind power in their journey to decarbonisation. ■

KONGSBERG DELIVERS CO_2 EMISSIONS CUT FOR HURTIGRUTEN

By **Daniel Johnson**

HURTIGRUTEN'S MS *RICHARD WITH* HAS BEEN CONVERTED TO HYBRID OPERATIONS. SOURCE: HURTIGRUTEN

Back in 2017, the Norwegian government chose to split the country's Kystruten coastal shipping route contract in a move to stimulate competition – for decades the route from Bergen to Kirkenes, with 34 port calls along what is frequently called "the world's most beautiful coastline", had been serviced solely by Hurtigruten's Norwegian Coastal Express fleet. In line with the government's action plan to reduce emissions from domestic shipping, the new licences specified that the vessels operating on Kystruten had to be low-emission.

Under the new arrangements, which started in 2021 and run until 2030, Hurtigruten is now operating seven ships on the 11-day round-trip route, while Havila Kystruten operates four. Vital for freight customers and local passengers, the transport service also draws in tourists from across the globe keen to behold the wonders of Norway's fjords.

To meet the required 25% reduction of CO_2 emissions across its fleet operations, Hurtigruten had a choice to make: commission newbuilds with low-emission characteristics or upgrade its existing fleet to meet the decarbonisation requirements. Following a consultation with Norwegian technology group Kongsberg Maritime, the ship operator decided on the latter option.

"After an initial look at the ships' design and operations and using data from existing sailings we were able to give a rough estimate of a potential 16% to 29% reduction in emissions," Geir Oscar Løseth, Kongsberg Maritime's vice president of sales aftermarket advanced offerings, tells *TNA*. "This was in line with Hurtigruten's expectations so we then offered a FEED (front-end engineering design) package to verify these numbers because obviously 16% to 29% is quite a large range."

Kongsberg's FEED package involved a comprehensive study of Hurtigruten's existing fleet's hull design, power systems, digital controls, engine-on propulsion and more.

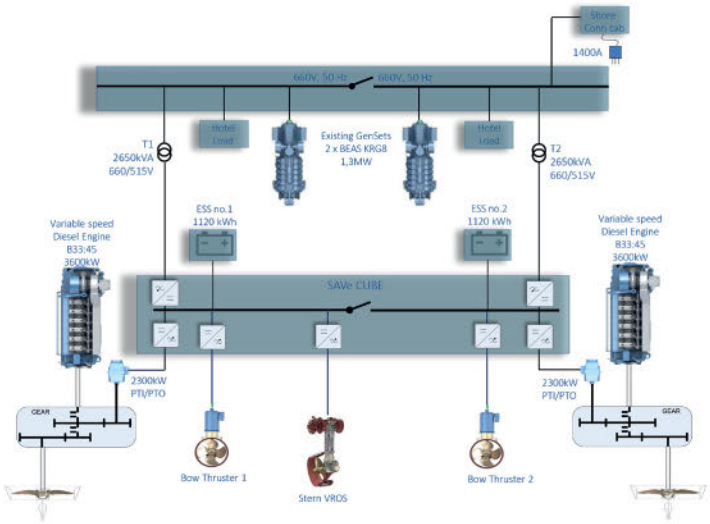
"We have multiple competencies in the different elements that are important for an upgrade like this," explains Løseth. "We have strong skills in structure, in propulsion, in automation and control. And we're the best in the world at combining those skills to achieve customer requirements.

"Our experts have the design and engineering expertise, product and domain knowledge, project lists and advanced computational and design tools to identify, develop and implement the right solutions. That goes hand in hand with analytics and calculations covering everything from fuel consumption to the operational profile of the vessels. With those tools we can accurately predict potential savings and project outcome."

Vessel retrofits

With the FEED study complete, Hurtigruten announced one of the largest environmental upgrades in the history of European shipping, with all seven Coastal Express ships to undergo significant green upgrades in a €100 million programme. It was predicted that across the seven vessels the upgrades, as well as the phasing in of sustainable biofuels, would reduce CO_2 emissions by around 25% and cut NOx emissions by 80% by 2024. The upgrades included retrofitting three sister

MS *RICHARD WITH* SYSTEM LAYOUT. SOURCE: KONGSBERG MARITIME



vessels, MS *Richard With*, MS *Nordlys* and MS *Kong Harald*, to use battery-hybrid power.

The process to retrofit the three vessels began with a consortium agreement between Hurtigruten, Kongsberg Maritime and shipbuilding partner Myklebust Verft. "The consortium model is not new in the business, but it's more common in naval projects than in commercial," notes Løseth.

He adds: "It was the right way to deliver this project. By collaborating, we complement each other to deliver the result our customer wants.

"Throughout the tender process, we spoke about what Hurtigruten needed and how we could achieve it. We had clear tasks: improved capability, stronger wind resistance and, of course, 25% reduction in emissions."

Given the global climate at the time the project was being considered, Hurtigruten didn't enter into the agreement lightly. "Taking the decision to invest €100 million in upgrading our existing fleet in the middle of the pandemic was tough," explains Hurtigruten Coastal Express CEO Hedda Felin. "We had a great deal of financial uncertainty but I'm very pleased with the decision we made.

"We had the opportunity to upgrade the interior of the fleet and give the ships the best of today's technology. Plus, it's more environmentally friendly to retrofit a vessel than to scrap and build a new one. So from a sustainability point of view, and from an economic point of view of keeping very robust ships in our fleet for 10 to 20 years longer, this was the right thing to do."

"From a wider perspective, the upgrade is also a much quicker way to meet the requirement. We can do the full turnover of a vessel in four or five months. An entirely new build takes much longer time. We're already at the stage where the first and second vessels are ready," adds Løseth.

The MS *Richard With*, built in 1993, was the first of the three ships to be relaunched, in the summer of 2022. The second ship, MS *Kong Herald*, returned to service in May 2023 and the final ship, MS *Nordlys*, will be complete in 2024.

The scope of the refit programme for MS *Richard With* included hull optimisation and installation of two hybrid shaft generators, two SaveEnergy 1,120kWh lithium-ion batteries and two new Bergen B33:45V engines. The vessel also has new tunnel thruster motors, a retractable azimuth thruster and controllable pitch propeller blades, plus Kongsberg's digital management system, which includes health monitoring, and SaveCube integrated drive switchboards, including frequency converters, drives and DC system.

According to Løseth, as well being much more environmentally friendly, the vessel is now also quieter, safer and smoother. "It gives the crew several layers of reassurance. They can operate on full battery, zero emissions operation, they can run on auxiliary engines and they can run on main engines. So, there's a high level of safety that meets the new requirements for lower-emission travel along the coast," he says.

He points out that the ability for full battery, zero emissions operation will be essential in a couple of years' time when only zero-emission vessels will be permitted to sail in the Geirangerfjord, a World Heritage fjord that lies on the Kystruten coastal route.

Upgrading people, not just technology

The MS *Richard With* has now completed its first full calendar year back in service and the vessel is delivering a 23% reduction in emissions, with that figure expected to rise further by a few percentages.

"We are very pleased with the results of the upgrade says Felin. "Our ship now has dramatically reduced fuel consumption, which we actually expect to reduce even more as we gain experience and get into a good rhythm and routine. It's also significantly quieter, which is a benefit for both guests and crew. Everyone can now experience the world's most beautiful voyage in a much more silent way."

The learnings and data collected in the first phase of the project will, it's thought, contribute greatly to the implementation and future results of the retrofit on MS *Nordlys* and MS *Kong Harald.*

"We need to follow the learning curve to get those most out of the upgrade from an operating perspective. That means upgrading people, not just technology," says Løseth.

"It's important that we work tightly with Hurtigruten to deliver the best operational performance. That means good communication and training with the crew, and analysis of the data this first ship provides. The results we have already achieved will continue to increase alongside the crew's understanding of how to operate it in the best way possible," he concludes. ■

THE NEW TORGHATTEN NORD HYDROGEN-POWERED FERRIES WILL BEGIN OPERATING IN OCTOBER 2025

QUICK WINS TOWARDS A GREENER FUTURE: THE 15% OF THE GLOBAL FLEET THAT'S RIPE FOR DECARBONISATION

By **Johan Burgren**, business manager Marine, PowerCell

To date, the International Maritime Organization (IMO) has focused many of its greenhouse gas (GHG) regulations on bigger ships in the merchant fleet that make up 85% of the industry's carbon footprint. But it is the other 15% – such as short-sea fixed route shipping – where ultra-low- and zero-emission technology is ready to be adopted today. It is only a matter of time before the IMO turns its attention to these quick wins, as many other stakeholders across the global trade value chain are already doing.

Tightening regulations

Starting in January 2024, CO_2 emissions from ships above 5,000gt and transporting cargo or passengers for commercial purposes will be included in the European Union Emissions Trading System (EU ETS). Emitters will have to exchange emissions allowances, incurring additional costs. Initially, 40% of emissions are in scope, but this will quickly ramp up to 70% for 2025 and to 100% for 2026 onwards. The cost of carbon is rapidly becoming significant, and as polluting becomes more costly, the payback period for zero-emission technology will shorten.

The IMO's Carbon Intensity Indicator (CII) rating system is also set to become more relevant. A CII rating is a measure of how efficiently all ships transport cargo and passengers measured in grams of CO_2 emitted per deadweight ton capacity and nautical mile. While many see CII as less impactful in its current state, the IMO is currently iterating upon and improving the regulations. The regulations and thresholds for superior ratings tighten over time, but zero-emission technology offers futureproof long-term compliance.

Class society DNV's analysis of EU MRV data revealed that a significant portion of the existing ro-pax fleet will already have challenges meeting CII requirements within the next two to five years – 47% with CII ratings of D and E. This is not just the case for old ships, but also vessels 10 years of age already rated E. While non-compliance can be fairly straightforward to mitigate, the real risk of an inferior CII rating is commercial.

Changes in the market

Picture this: it's 2035, and the expectations of revenue-generating passengers and cargo owners in the ro-pax market have changed dramatically. As cars and haulage become predominately electric in the near future – will motorists, cargo owners and regulators really accept a CO_2-spewing ro-pax ship? It is realistic to predict that a superior CII rating of A or B

will become a licence to operate in some markets and for the best cargo owners.

Ultimately, a combination of customer pressure and increasingly comprehensive regulations will drive the ro-pax market to decarbonise. Paying a high cost on carbon or receiving an inferior CII rating is sure to impact earning capacity, reputation and, by default, asset values – posing a balance sheet risk. From a financing, commercial and regulatory standpoint, it is key to invest in sustainability now to remain competitive.

Futureproof energy transition planning

The European ro-pax fleet is currently an average of 38 years old, according to PowerCell's analysis. This age profile means that there is a significant need for newbuilds or to retrofit the existing fleet. Companies need capital for both of these endeavours, and fleets with strong sustainability credentials will be better placed to secure financing.

Receiving superior Poseidon Principles-aligned green financing will rely on shipowners and operators providing a viable plan for a 30-year lifespan; but not all solutions are viable in the long run. The risk of investing in assets that become stranded is real. A drop-in fuel, for example, will not be for life, is costly, and will require a plan for ultra-low/zero-carbon alternatives in the future. Effective planning for the energy transition must be long-term and solutions should be futureproof.

A tangible example

PowerCell's recent agreement with Norwegian transport group Torghatten Nord is the culmination of three years of planning for the energy transition. It is delivering hydrogen fuel cells to two 120m, 599-passenger capacity ro-pax ferries, each carrying 120 cars and 12 trucks. These will be Norway's first full-scale hydrogen-powered ferries.

The ferries will be powered by green hydrogen, and the fuel cells are expected to reduce their combined CO_2 emissions by 26,500tonnes per year, which corresponds to the CO_2 emissions from 13,000 diesel cars per year being removed from the roads. Green hydrogen supply infrastructure developer GreenH AS has agreed to provide renewable hydrogen for the ferries from 2025 to 2040.

Fuel cells will also enable the vessels, which will operate on Norway's longest ferry route (a four hour journey, with challenging weather conditions) to produce approximately 6MW of power each. The order has a value of €19.2 million – representing the largest non-combustion fuel propulsion project to date in the global marine industry.

These are not concept designs or demonstrator vessels, they are real ships using hydrogen fuel cells. They are scheduled to operate from October 2025 as part of a replacement programme for similarly sized and operated fossil-powered ferries. This is a statement project that highlights hydrogen fuel cell-powered ferries have now become a realistic option that

JOHAN BURGREN

shipowners worldwide can invest in, and that green hydrogen is increasingly available.

Ships with fixed routes and frequent port calls are a clear place to start as they can really benefit from alternative fuels. A ro-pax needs power from A to B, not for two weeks at a time or longer. This is where the use of fuel cells comes into play as they are perfectly suited for demanding applications where operational reliability, high power density and compact format are important parameters. They also deliver a particularly strong return on investment on these routes.

Norway steering the way

This project, financed by Statens vegvesen (the Norwegian Public Roads Administration), clearly demonstrates that fuel cells are primed to tackle a major source of transport emissions. Beyond regulations, the right financial support from the government certainly helps. Norway is already showing the way for others to follow. The Torghatten Nord project forms part of a Norwegian government initiative that aims to see all ferries crossing the Vestfjorden between Lofoten and Bodø in Northern Norway be emission-free. This is a ground-breaking project for Norway and the marine industry as the country is taking an important step to establish green hydrogen as a clean energy source.

In summary, demands for zero-emission marine transport from customers, regulators and financiers are increasingly strong and only set to strengthen in the future. Ro-pax shipowners and operators must plan for this reality and the longer-term energy transition, and adopting futureproof zero-emissions technology should be central to any sustainability strategy.

The fact that fuel cells can meet the needs of such a long distance route in Norway – and one with challenging weather conditions – shows that a new generation of technology is here. Fuel cells are ready to take on the heavy lifting of marine decarbonisation and there are opportunities to use them. In Norway alone, there are roughly 800 ferry lines and ferries are a segment where we can expect great interest in hydrogen-electric solutions. ■

CONSTRUCTION HAS BEGUN ON A HUGE NEW SHIP BUILD HALL THAT WILL TRANSFORM AND ENHANCE SHIPBUILDING IN GLASGOW. SOURCE: BAE SYSTEMS

UNITED KINGDOM

REVITALISATION OF UK SHIPBUILDING INDUSTRY CONTINUES WITH HARLAND & WOLFF, BAE SYSTEMS AT THE HELM

By **Tom Barlow-Brown**

The UK shipbuilding industry has been experiencing a resurgence lately. This is driven by ambitious developments at iconic shipyards such as Harland & Wolff and the cutting-edge innovations spearheaded by BAE Systems. These key players are reshaping the industry and contributing to the nation's maritime prowess in an era of global challenges and opportunities.

Nestled on the banks of the River Lagan in Belfast, Harland & Wolff, with a storied history dating back to 1861, is undergoing a remarkable renaissance. Once synonymous with the construction of the *Titanic*, the shipyard has faced challenges in recent years. However, a strategic acquisition in 2019 by InfraStrata breathed new life into the iconic facility.

Under the new ownership, Harland & Wolff has diversified its portfolio, expanding beyond traditional shipbuilding to include renewable energy projects. The shipyard is now at the forefront of constructing wind farm components, such as wind turbine jackets and substations. This move aligns with the UK's commitment to sustainable energy and positions Harland & Wolff as a crucial player in the green transition.

"The transformation of Harland & Wolff symbolises the adaptability and resilience of the UK maritime industry," says CEO John Wood.

"We are not just building ships; we are constructing a sustainable future for the generations to come," he continues.

Despite registering a loss of almost £16 million, Harland & Wolff reported a 65% rise in revenues for the first half of 2023, driven by a deal for the mid-life upgrade and drydocking of a large floating production, storage and offloading (FPSO) vessel, the *SeaRose*. A consortium led by the company was also awarded the massive £1.6 billion contract for the Royal Navy's Fleet Solid Support (FSS) Programme. The *SeaRose* will arrive at the Harland & Wolff Belfast dock in 2024 where it will remain for three months. The work will involve around 1,000 workers at its peak.

A commitment to innovation

Meanwhile, BAE Systems, a global defence, security and aerospace company, is also leaving its mark on the UK shipping industry through its cutting-edge technologies. With a focus on innovation and collaboration, BAE Systems is playing a pivotal role in shaping the next generation of naval vessels.

BAE's involvement in the Type 26 and Type 31 frigate programmes for the Royal Navy showcases the company's commitment to delivering state-of-the-art naval capabilities. These vessels incorporate advanced technologies, including stealth features, advanced radars, and sophisticated combat systems, ensuring the UK maintains a competitive edge on the high seas.

"Our commitment to innovation is reshaping the naval landscape. The Type 26 and Type 31 frigates are not just vessels; they represent the pinnacle of technological excellence and strategic foresight," says Dr Jennifer Turner, BAE Systems' maritime sector director, emphasising the significance of these projects.

The increased work of Harland & Wolff and BAE Systems is an example of the currently diverse nature of the maritime industry in the UK. As Harland & Wolff diversifies into renewable energy, BAE Systems continues to push the boundaries of naval technology. A move that is sustaining the UK's industrial base but also positioning the nation as a global leader in maritime innovation.

Elsewhere, other UK-based shipyards have seen their fortunes increase recently. Birkenhead-based shipbuilding and repair company Cammell Laird recently announced a merger with A&P Group to form APCL Group Ltd. In 2022 the company hosted the speech by then Prime Minister Boris Johnson who announced the National Shipbuilding Strategy Refresh. Since then one highlight of Cammell Laird's recent activities is the successful maintenance and refitting of four Royal Fleet Auxiliary (RFA) vessels, reflecting the company's commitment to excellence and innovation.

These four vessels include the UK's first Multi-Role Ocean Surveillance (MROS) ship. RFA *Proteus*, formerly known as the *Topaz Tangaroa*, was a notable project undertaken by Cammell Laird. The ship was purchased by the UK Ministry of Defence for conversion into an MROS vessel. Cammell Laird executed significant modifications to the crane, deck machinery, and applied a full paint scheme and name change.

All the additions to Cammell Laird's RFA cluster will receive ongoing support both domestically and in operational theatres across the globe. Addressing the

company's track record, Cammell Laird's managing director, Mike Hill, states: "Cammell Laird's RFA Cluster Support Team has delivered comprehensive through-life support to 17 RFA platforms since 2008, and it's something we're immensely proud of."

All three companies are not only invested in naval technology but are also involved significantly in the next generation of shipbuilders. Cammell Laird's comprehensive apprenticeship scheme has previously allowed 70 apprentices to work on the RRS *Sir David Attenborough*. The company has also partnered with the Engineering College and Wirral Met to encourage young people into the industry.

The surge in activities for Cammell Laird also saw several other RFA vessels undergoing ship repair works at the company's yard. RFA *Tiderace*, a Tide-class replenishment tanker, underwent a major refit and regeneration work, while RFA *Tidesurge* is currently in the midst of an intense contractor support period. Additionally, RFA *Fort Victoria*, a Fort-class combined fleet stores ship and tanker, is undergoing essential maintenance.

"The Cammell Laird workforce knows these ships inside and out," says David McGinley, CEO of APCL Group. "That level of experience is something that the RFA and Ministry of Defence always know they can count on."

Training for the future

McGinley also expresses pride in providing apprentices with the opportunity to learn on these contracts, ensuring the continuity of skills essential for maintaining these vital ships in top operational condition for years to come.

BAE Systems has recently announced that it will be adding 300 more apprentices and graduates to its workforce in Scotland in 2024. This reflects a strategic move to boost shipbuilding capacity at its facilities in Govan and Scotstoun where the advanced Type 26 frigates for the Royal Navy are under construction. The ambitious initiative is part of BAE Systems' broader strategy to recruit almost 2,700 trainees across the UK.

"As the UK's largest manufacturer, we have sites located right across the country, and we're investing hundreds of millions of pounds to equip young people with the skills they need to achieve their full potential," says Charles Woodburn, chief executive of BAE Systems.

Harland & Wolff also offers a comprehensive apprenticeship scheme to young people seeking a career in shipbuilding and related industries. The programme provides hands-on training and mentorship, allowing apprentices to develop practical skills in various trades such as welding, engineering and ship design.

In 2023 the company also welcomed 75 new apprentices as part of its commitment to the National Shipbuilding Strategy. The apprentices will contribute to the company's growth plans across the UK. The move aligns with recommendations from the UK Shipbuilding Skills Taskforce, which stated in a recent report that the sector must address skills shortages in the UK shipbuilding industry.

Modernisation of facilities

Both BAE Systems and Harland & Wolff have also invested heavily into upgrading their respective facilities. The latter has commenced upgrades to its historic Belfast shipyard in preparation for the Team Resolute's Fleet Solid Support (FSS) contract with the Royal Fleet Auxiliary. The improvements, including a 5,000m^2 extension to fabrication halls and advanced shipbuilding techniques, will enhance the shipyard's capability to construct three 40,000tonne vessels for the Royal Navy.

The FSS contract, awarded in January 2023, unlocked £77 million of investment and is expected to generate employment for 1,200 personnel at peak production. The Leader of the House of Commons, Penny Mordaunt, and the Secretary of State for Defence, Grant Shapps, welcomed the developments as positive for the UK's maritime industry and national security. Harland & Wolff CEO John Wood highlighted the transformational impact of the £77 million investment on the shipyard's ability to undertake larger projects using cutting-edge manufacturing technologies.

Additionally, BAE Systems has started a transformation of an unused dock at its Govan shipyard in Glasgow as construction begins on a colossal ship build hall. The hall, measuring 170m in length and 80m in width, is a core component of BAE Systems' £300 million modernisation and digitalisation initiative for shipbuilding facilities at Govan and Scotstoun. The hall, being constructed by McLaughlin and Harvey, will accommodate the simultaneous construction of two Type 26 frigates.

In November 2022 BAE Systems secured a £4.2 billion contract with the Ministry of Defence to build an additional five Type 26 ships, augmenting the initial contract for the first three vessels. The new Type 26 frigates under construction are designed to provide a new warfighting capability for the Royal Navy. It is adaptable for various roles, including anti-submarine warfare, high-intensity air defence, and humanitarian aid missions.

The new ship build hall, which will be constructed from over 6,000tonnes of steel and 20,000m^3 of concrete, will be equipped with two 100tonne cranes and two 20tonne cranes. It will be able to host up to 500 workers per shift.

These new developments signal a new future for the UK shipping industry. As the sector charts a course into a new era, the collective efforts of Harland & Wolff, BAE Systems and the APCL Group will help to position the UK as a leader in maritime innovation. The ongoing investments in technology, talent, and infrastructure not only reflect a commitment to sustainable growth, but also ensure that the sails of the UK shipping industry are set for a bright and prosperous future. ■

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RINA Annual Dinner 2023 was attended by more than 80 companies and 300+ industry professionals. Don't miss out and book your ticket as soon as possible – this will be a great opportunity for you to catch up with your colleagues, clients, guests and friends in the maritime industry.

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Principal Guest & Speaker

Mr Arsenio Dominguez

Mr. Arsenio Dominguez Velasco is Director of IMO's Marine Environment Division. He joined the IMO Secretariat in 2017, first as Chief of Staff to the Secretary-General, Kitack Lim, before being appointed in 2020 as Director of the Organization's Administrative Division.

Mr. Dominguez Velasco was born in the Republic of Panama. He graduated in 1988 with a Bachelor of Science degree from the Fermin Naudeu Institute in Panama. He went on to study Naval Architecture at the University of Veracruz, Mexico, graduating in 1995. Mr. Dominguez Velasco also holds an MBA from the University of Hull, and a Certificate of Higher Education in International Law and European Politics from Birkbeck University, both in the United Kingdom.

His maritime career began in 1996 as a port engineer at Armadores del Caribe in Panama before moving to become a Drydock Assistant Manager at Braswell Shipyard.

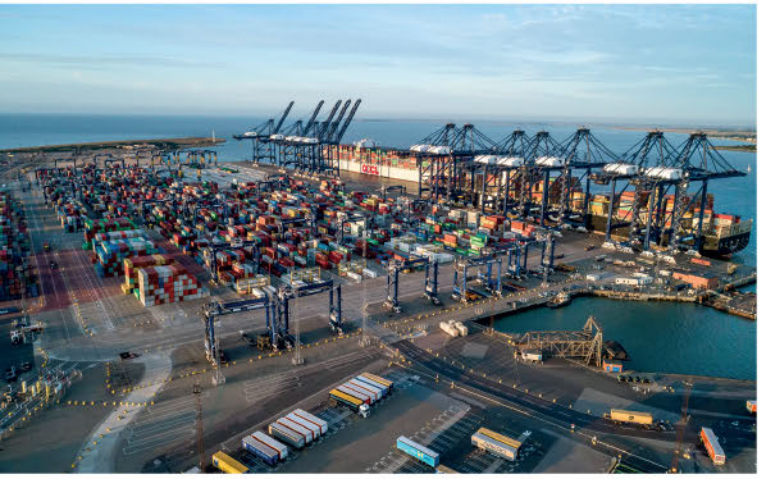
In 1998 Mr. Dominguez Velasco moved to London to join the Panama Maritime Authority as Head of the Technical and Documentation Regional Office for Europe and North of Africa. He went on to represent Panama in a variety of roles at the organization, culminating in 2014 with his appointment as Panama's Ambassador and Permanent Representative to IMO until 2017.

Between 2014 and 2017, Mr. Dominguez Velasco chaired IMO's Marine Environment Protection Committee (MEPC), and in 2015 he chaired the Technical Committee of the 25th session of the IMO Assembly. Prior to this, between 2010 and 2014, he chaired the Maritime Security – Piracy and Armed Robbery Working Group under the auspices of the organization's Maritime Safety Committee.

Mr. Arsenio Antonio Dominguez Velasco (Republic of Panama) has been elected by the IMO Council as the Secretary-General of the International Maritime Organization (IMO). After approval by the Assembly at the end of November, he should start his duties from 1 January 2024, for an initial term of four years.

AMBITIOUS UK GOVERNMENT MONETARY PACKAGE SEEKS TO REVOLUTIONISE GREEN SHIPPING

By **Tom Barlow-Brown**



A CORNERSTONE OF THE INITIATIVE IS THE INTERNATIONAL GREEN CORRIDOR FUND. SOURCE: PORT OF FELIXSTOWE

The issue of greenhouse gas emissions in the maritime world has been one of the most pressing issues in recent months. This came to a head in the summer of 2023 when MEPC 80 concluded with new measures from the IMO to tackle the issue worldwide. Since then multiple countries and intranational bodies, such as the EU, have announced their own packages of regulations. The UK is no different, having lately announced a comprehensive new set of measures to promote investments in a range of green initiatives.

The measures, which total £210 million, were announced by Transport Secretary Mark Harper on Clean Maritime Day in September 2023 as part of London International Shipping Week (LISW). They ultimately will aim to address the maritime sector's significant role as a contributor to emissions while simultaneously stimulating economic growth.

The cornerstone of this initiative is the £1.5 million International Green Corridor Fund, a collaboration with international partners including Norway, Denmark and the Netherlands. The fund, a direct response to the Clydebank Declaration for Green Shipping Corridors at COP26, seeks to establish end-to-end green shipping routes. These corridors will also serve as testing grounds for vessel technology, infrastructure and regulations, promoting decarbonisation and creating new job opportunities within the sector.

"With 95% of the UK's trade happening by sea, the maritime sector is vital to our country's economic output, but it's also one of the biggest contributors to the UK's emissions," Harper noted, speaking at the launch event at the London ExCel Centre. "Today's package helps create highly skilled jobs and supports the levelling up of our coastal communities."

Research hubs

Concurrently, the UK government has also introduced two new research hubs, with the flagship being the Clean Maritime Research Hub led by Durham University. Endowed with £7.4 million in government funding, the hub will bridge the gap between academia, industry and think tanks, fostering collaboration to overcome net-zero challenges in the maritime sector. The Engineering & Physical Sciences Research Council (EPSRC) and the Department of Transport (DfT) will oversee the project and funding.

Included in the package are also plans to create new maritime clusters and green corridors. These are designed to encourage collaboration between industry, academia and government. They will receive a £1 million boost to accelerate their development across the UK.

Other academic bodies in the UK to have joined the initiative include the Universities of Liverpool, St Andrews and Birmingham. The overall research hub includes contributions from 13 universities and is led by Professor Antony Paul Roskilly of Durham University who says the goal of the project "is to create a pioneering research hub providing technically, environmentally, socially and economically informed ways to decarbonise the maritime sector".

"University of Liverpool is delighted to be announced as part of this multidisciplinary consortium," says Professor Dongping Song at the University of Liverpool Management School. Liverpool will play an important part in contributing expertise in maritime supply chains and port operations, as well as digitalisation of the maritime environment.

"In particular, supported by Peel Ports Group, the hub will take the port of Liverpool as place-based scenario to showcase maritime decarbonisation," according to Professor Song. Liverpool has also previously played a role in the creation of localised industry clusters the Mersey Maritime cluster contributing £2.74 billion to the Liverpool City region through business turnover.

Speaking about the establishment of green corridors, Maritime UK CEO Chris Shirling-Rooke states they are an opportunity for the industry to showcase future low-emission fuels and technologies. He adds they will have the potential to create thousands of jobs by creating new engines for regional growth.

Along with the 13 UK universities involved in the project the Clean Maritime Research Hub will also involve over 70 partners with an aim to form a larger consortium. This will ensure the UK maritime industry takes a leadership role in developing and commercialising clean fuels and technologies. It is also envisaged that the hub's efforts will be complemented by a second research initiative, the Net Zero Transport for a Resilient Future Research Hub, focusing on affordable low-carbon transport infrastructure.

Marine jobs and training

The success of maritime clusters to boost economic growth and research has also previously been evidenced elsewhere in the UK. The Cornwall Marine Network, first established in 2002, has proved to be a resounding success. The initiative has created 4,450 new marine jobs and engaged 36,000 young people in marine vocational training and careers.

In a related development the Zero Emission Vessels and Infrastructure (ZEVI) scheme allocated £80 million to winners of the competition in September 2023. This funding was awarded to a broad range of projects to promote electric vessels, shoreside power and alternative fuels.

While it is probable that the need to decarbonise the maritime industry will remain a pressing issue for the time being, the new Clean Maritime Day package announced by the UK government does demonstrate a commitment to revolutionise its maritime industry. The initial impact of the measures will likely take time to materialise but if successful it could play a role in revitalising coastal communities and industry.

TRANSPORT SECRETARY MARK HARPER ANNOUNCED THE NEW SET OF MEASURES DURING LISW. SOURCE: DFT

"Domestic shipping emits more polluting gases than buses and rail combined," notes Professor Miles Padgett, interim executive Chair of EPSRC. He concludes: "A maritime research hub will bring together world-leading expertise and support the sector to develop and commercialise clean maritime fuels and technologies." ■

SURVITEC LOOKS TO TRANSFORM CRUISE SAFETY AND UNLOCK DECK SPACE

By **Daniel Johnson**

The sinking of the *Titanic* was a tragedy that shook the world. The widespread outrage over the disaster led to sweeping changes on the requirements of lifeboats on board a vessel and the establishment in 1914 of the International Convention for the Safety of Life at Sea (SOLAS) which still governs maritime safety today. It was perhaps fitting, then, that *TNA* was invited late last year to the Port of Belfast – home of the famous Harland & Wolff shipyard and the very place where the ill-fated luxury liner was designed, built and launched – for a demonstration deployment of a new safety innovation that promises to redefine evacuation at sea.

Seahaven, developed by UK-headquartered survival technology company Survitec, is said to be the world's largest inflatable lifeboat. The self-propelled craft has been designed to replace the established rigid-hull lifeboats found on cruise ships and, according to Survitec, solves the challenge of being able to evacuate an increasing number of cruise passengers quickly and safely, while freeing up additional existing lifeboat deck space for greater passenger experiences.

Speaking at the demonstration, Stew Gregory, Survitec's head of manufacturing transformation, tells *TNA*: "Based on years of research and successful trials, we expect Seahaven to not only revolutionise the way in which passengers evacuate in an emergency but also how cruise ships are designed."

The two-craft, 1,060-capacity system is stored in a container with a footprint of 16.3m x 3.6m that fits onto a single deck. A single-release button – either on the bridge or locally at the station where the lifeboats are stored – unrolls, lowers and inflates each lifeboat in under four minutes, eliminating the complexities associated with the traditional davit and release-hook system. Seahaven is served by multiple helical slides, a solution pioneered and evolved by Survitec for more than 20 years.

DEPLOYMENT OF SEAHAVEN IN BELFAST. SOURCE: DANIEL JOHNSON

Once deployed the 27m-long, 9m-wide lifeboats can sail independently, powered by SOLAS approved twin diesel outboards, at 6knots for 24hours.

Years in the making

Survitec's roots trace back over 160 years, with Gregory having worked on some of the most game-changing and successful projects in the company's recent history. He explains that Seahaven has been more than six years in the making and is borne from the collaboration of Survitec's aerospace, defence and maritime survival technology expertise.

"The technologies that we've used are slightly different to our normal liferaft technologies," he notes. "For example, we're using higher pressure so have gone for a drop-stitch technology similar to that used in inflatable SUPs (stand up paddleboards). This results in a much more rigid and water efficient structure.

"And because of the amount of gas and inflation we've got in there, we've also had to develop our own inflation system and composite cylinders. So there's lots of new and firsts for Survitec and the industry."

The helical slide system has been adapted from Survitec's Marin Ark marine evacuation system (MES) and for those attending the demonstration – a mix of representatives from cruise operators, yards, Class and Flag – there's an opportunity disembark down it once Seahaven has been deployed. The system integrates the benefits of a fully enclosed evacuation chute with the natural descent of a spiral slide and is easy to navigate, with evacuees able to control their rate of travel as they descend.

The slides have been proven to allow quick evacuation for both able bodied and mobility impaired persons, of all ages and sizes, and also permits family groups to descend together, reducing stress during the evacuation process, according to Robert Kledal, Survitec's chief executive officer. "Seahaven is reliable and more importantly safer than current evacuation arrangements," he adds.

Approved and ready to go

Seahaven was awarded type approval by classification society Lloyd's Register in September 2022. This followed on the heels of the successful completion of heavy weather sea trials (HWST), carried out in line with the SOLAS requirements for Novel Appliances which require the test to be performed in conditions that do not drop below six on the Beaufort Scale, and the International Maritime Organization (IMO) A.520 physical tests as required by Lloyd's Register. An evacuation time of under 22 minutes was achieved during the A.520 tests.

"It's now ready to be installed on cruise vessels and we're getting very close to the first installation," Kledal tells

SEAHAVEN'S DROP-STITCH TECHNOLOGY ALLOWS FOR HIGHER AIR PRESSURE AND A STIFFER STRUCTURE. SOURCE: DANIEL JOHNSON

TNA, highlighting current plans to have the system as the primary means of evacuation on board an upcoming newbuild and ongoing talks with a number of other cruise operators about future applications.

The operators see numerous benefits in installing Seahaven on board their vessels, he says, not least its innovative space saving design. Typically, notes Kledal, a 4,000-passenger capacity cruise ship would require at least 12 to 16 lifeboats and up to two MES with liferafts. Just four Seahavens would be required to evacuate the same number of passengers. Research undertaken by Survitec shows that replacing conventional lifeboats with Seahaven can free up to an additional 85% of existing lifeboat deck space, yielding up to around US$8 million in increased revenue per year for cruise operators.

The system not only redefines safety at sea but also takes cruise ship design to another level, says Kledal, adding that operators and cruise ship designers are already looking at remodelling the space normally given to conventional lifeboats and davits for additional cabins, public spaces and revenue generating opportunities. The challenge of finding extra storage capacity for the new generation of lower carbon fuels on the horizon may also be in their thinking.

"We believe the cruise industry is ready for an alternative, safer solution to the traditional lifeboat/davit arrangement and based on increased enquiries we anticipate a significant number of Seahaven-equipped ships to enter service within the next decade," concludes Kledal.

More than one hundred years on from the *Titanic*, it would appear that Survitec's inflatable proposition is making a compelling case for another major evolution in passenger ship safety. ■

PROPELLERS & THRUSTERS

OPTIMISING SHIP PERFORMANCE SOLUTIONS FOR A SMOOTH DECARBONISATION JOURNEY

By **Guido Schulte**, managing director, Elomatic Maritime Technologies

Decarbonisation isn't just a matter that needs to be addressed for newly built ships; it's an urgent issue for the existing fleet. Exposure to EU ETS or other carbon pricing, and CII ratings, will be essential commercial considerations for any shipowner or operator. Decisions made at the design stage today will impact an owner for decades to come – and could well determine whether an owner will still be operating in the future, given the typical lifespan of a ship. It is therefore essential that at the design stage, a design partner thinks beyond immediate concerns and thoroughly evaluate all options, and model how they will perform.

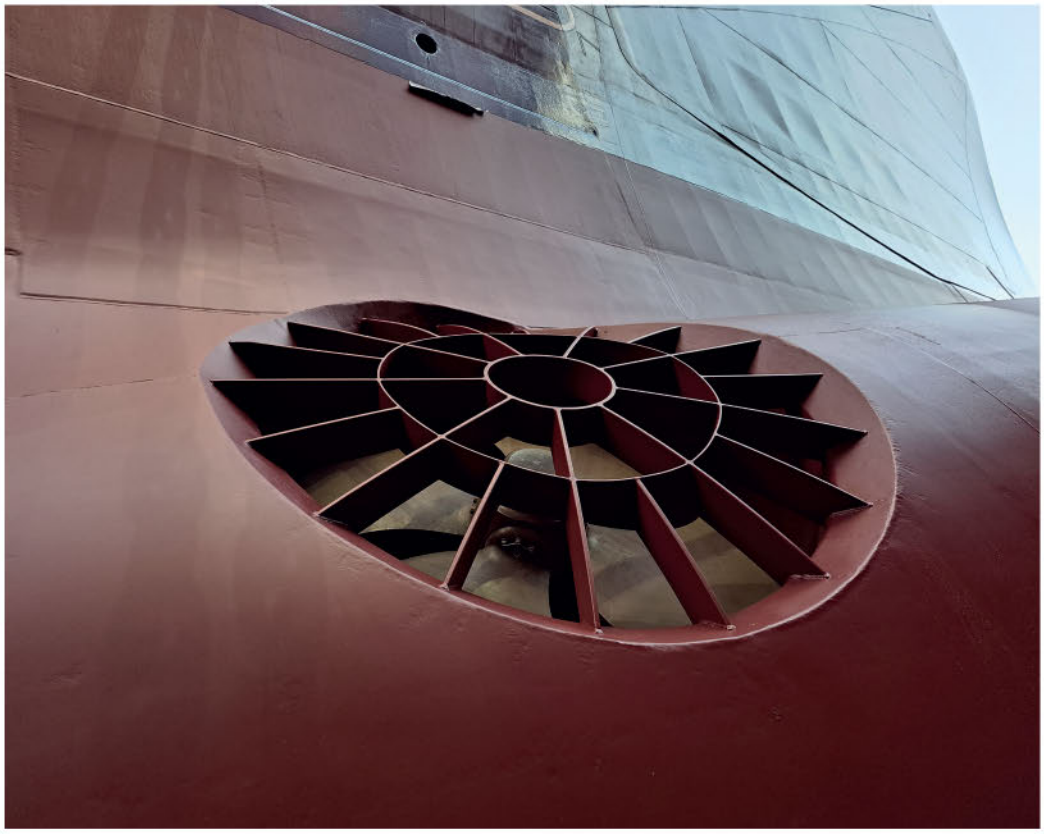
Shipowners are faced with a multitude of design decisions and uncertainties, including choices regarding future fuels, efficient technologies, compliance with new regulations and incentives. Despite these new challenges, the primary goal remains optimising the ship's performance, whether it's a cruise ship, ferry, or any type of vessel. Superior ship design is the key to securing the necessary revenue potential to enhance competitiveness and cover the costs associated with transitioning to cleaner energy sources.

Maximising energy efficiency is one of our most important focus areas for the Elomatic Marine & Offshore business at Elomatic. There are many energy saving solutions available, and if properly designed and optimised, they can improve vessel performance significantly. At Elomatic we work out what fits best for your individual vessel by using advanced engineering methods – at the same time making sure that the revenue potential is maintained or even enhanced.

At the end of the day, even a small piece of equipment, when developed using advance modelling, can make a difference and deliver a notable impact on GHG emissions.

Improving thrust performance

One small but fine example is Elomatic's Elogrid, a solution which reduces the additional resistance of tunnel thruster openings and in parallel considerably improves the side thrust. This enhances slow speed manoeuvring as well as reducing tunnel thruster noise and vibrations. This unique integration of qualities marks a remarkable enhancement in ship performance, overcoming the classic dilemma between those formerly contradicting



ELOGRID CAN MAKE AN IMMEDIATE IMPACT ON GHG EMISSION AND CII PERFOMANCE

GUIDO SCHULTE

factors. Typically, improvements in one area negatively impact the other, but the Elogrid solution effectively optimises both.

Any vessel can benefit significantly from the improvement in thrust performance provided by Elogrid, especially ships that are long periods in dynamic positioning operation. The device is set in tunnel openings to prevent water entrance into the tunnels when the ship is sailing at sea, and when manoeuvring the Elogrid operates as stator decreasing swirl and increasing jet axial thrust.

Additionally, the Elogrid solution reduces fuel consumption. Fuel savings of 1% to 4% can be achieved depending on the vessel design and speed, as well as location and number of thrusters. This means a meaningful reduction in carbon dioxide emissions and an immediate impact on the Carbon Intensity Indicator (CII).

First piloting

Our Elogrid solution achieved excellent results when first tested on the Viking Line MS *Gabriella* back in 2022. The project scope included CFD (computational fluid dynamic) calculations, dimensioning, design, production, supervising of the installation and measurements with data analysis.

The experiences of installing this solution on the *Gabriella* exceed all expectations, achieving a significant improvement on ship performance by lower vibrations and improving manoeuvrability. The fuel saving potential and other benefits seen in *Gabriella* has led Viking Line to invest in this technology for the next drydocking vessel, *Viking Cinderella*.

Recently, the Denmark-based transport and logistics company DFDS has also selected Elomatic to develop and deliver its solution on the MS *Crown Seaways* ro-pax ferry, which currently operates on the Denmark-Norway ferry route between Copenhagen and Oslo. Installation will be carried out in January 2024 during the vessel's normal drydocking.

The Elomatic scope for this project involves the design, manufacturing, and installation supervision of four grids for two tunnels on the MS *Crown Seaways*.

Goodbye to windmilling

Elomatic's Elogrid is a simple yet powerful solution that notably enhances thrust and manoeuvrability while also cutting down on hull resistance, noise and vibrations. Vessel operators will also notice that windmilling of thruster propellers is no longer an issue once the Elogrid solution has been installed. This overall enhancement in ship performance consequently aids in reducing fuel consumption, demonstrating how advanced modelling and even small-scale equipment can make cost-efficient differences in greenhouse gas emissions and CII performance.

Finding the right solution for each individual ship requires us to look out for the best options, analyse possible resolutions and select the most suitable one for a customer's fleet today as well as future proofing for tomorrow. This entails assessments of the current state of technology on board individual ships, the requirements for the future and the overall condition of the ship and its systems. Whether we are envisioning the ships of the future or enhancing those of today, there is no one-size-fits-all solution. However, by keeping our gaze fixed on the horizon, we can continue to discover solutions that will help to solve the complex challenges that lie ahead. ■

ELOGRID SOLUTION WAS FIRST PILOTED ON VIKING LINE'S MS *GABRIELLA*. SOURCE: CREATIVE COMMONS

WATER TREATMENT

WILL ECONOMIC IMPACT DRIVE A PARADIGM SHIFT IN BALLAST WATER COMPLIANCE?

By **Steve Marshall**, Contributor

The 'polluter pays' principle is starting to hit shipowners where it hurts – in the pocket – when it comes to ballast water pollution of our oceans. Ships plying US waters have recently been slapped with heavy penalties and this can be the shape of things to come for shipping with wider regulatory enforcement to protect marine ecosystems.

Several industry players have paid the price for non-compliance in recent months with substantial fines dished out by the US Environmental Protection Agency (EPA) for violations of the Clean Water Act in relation to ballast water discharge, recordkeeping, inspection, monitoring and reporting. In August 2023 CMA CGM, one world's largest shipping container companies, suffered penalties totalling US$165,000 for four ships calling at US ports, after Swire Shipping Pte. Ltd and MMS Co. Ltd were hit with respective fines of US$137,000 and US$200,000 over violations involving two vessels for each company.

Call for tougher port state controls

"Shipping has an ethical responsibility to mitigate the harmful environmental impact of its operations in this area through proper ballast water treatment, and non-compliance will ultimately also have serious commercial consequences," says Birgir Nilsen, co-founder and director of Norwegian ballast water treatment specialist Optimarin and also president of the Ballast Water Equipment Manufacturers Association (BEMA).

But he says there has been variable port state enforcement at the global level of the IMO's Ballast Water Management (BWM) Convention, implemented in 2017, that requires every vessel over 400gt to have on board an approved ballast water management plan, a ballast water record book and an International Ballast Water Management Certificate.

Furthermore, all ships will need to have installed a compliant ballast water treatment system (BWTS) meeting the so-called D2 standard for the maximum amount of viable organisms that can be discharged by September 2024 under the BWM Convention.

"We see very little movement when it comes to port state control of ballast water treatment systems. Furthermore, if inspections are only based on logbooks and reporting protocols, there is no confirmation of whether the BWTS actually works as it should," Nilsen explains.

"Therefore, we want port states to be more active on testing systems, but so far we do not see that happening. It is really only in the US that we see consequences for non-compliance and this has been mainly on the administrative side."

US taking lead in enforcement

The US, which is not a party to the BWM Convention, has shown the way in acting on ballast water regulation after developing its own stringent regime –

RESPONSIBLE BALLAST WATER MANAGEMENT IS VITAL TO PROTECT OUR OCEANS THAT ARE A VAST REPOSITORY OF BIODIVERSITY AND MARINE LIFE. SOURCE: ADOBE STOCK

based on the National Invasive Species Act and Clean Water Act – in response to serious incidents of ballast water pollution in its national waters.

This entails annual port state control examinations of around 10,000 foreign-flagged vessels, including reviews of vessel documentation and visual monitoring of the BWTS condition and operation enforced by the US Coast Guard (USCG).

As well as hefty fines, further costs can be incurred with non-compliance if a vessel is prevented by the USCG from discharging ballast water in port. This may require a ship to divert its voyage, modify cargo operations and sail outside 12nm to discharge ballast water, which could result in additional pilotage and launch fees, extra fuel fees, demurrage and other financial repercussions.

Nilsen has been working vigorously through BEMA to push for stronger port state enforcement of ballast water regulations, mainly by raising the issue with the IMO's Marine Environment Protection Committee (MEPC). BEMA has, for example, submitted documents that have been approved by the MEPC calling for port state inspection and testing of systems.

Counting the cost to our oceans

And the reason that BEMA is calling for a tougher port state crackdown on ballast water treatment is simple: the transfer of invasive aquatic species in ballast water carried by ships is seen by the UN as one of the four biggest threats to the global environment.

Conservation and sustainable use of oceans, seas and coastal areas, which cover about two-thirds of Earth, is listed as one of the UN's Sustainable Development Goals – and disruption of finely balanced marine ecosystems due to ballast water discharges is a major concern.

According to the UN, oceans contribute to poverty eradication by creating sustainable livelihoods and decent work, and over 3 billion people depend on marine and coastal resources for their livelihoods. It states that oceans are crucial for global food security and human health, while also hosting huge reservoirs of biodiversity.

But ballast water pollution has resulted in major damage to the ecology of coastal regions that support local economic activity, and the problem has escalated with the dramatic increase in world trade and ship traffic volumes over the past two decades.

It is estimated that around 35,000 ships are sailing the seas laden with 10 billion tonnes of ballast water at any given time, with more than 3,000 species being transported in their ballast tanks.

'Invisible pollution'

Non-indigenous organisms carried in a ship's ballast water tanks, such as bacteria, microbes, small invertebrates and other pathogens, can have an extremely harmful ecological impact on the marine environment when transferred from one sea area to another.

This can lead to a loss of biodiversity as native species are wiped out by the invaders, destruction of marine habitats, imbalance in coastal ecosystems and damage to vital resources needed to sustain fisheries and aquaculture, while also posing a public health hazard.

Nilsen says invasive species can have "devastating effects" on fisheries, a staple industry of his native Norway. But he points out this is considered "invisible pollution" as the impact from the introduction of such species via ballast water may not be evident until years later, unlike CO_2 emissions that are more visible and therefore have higher priority in the shipping industry.

"As a result, this has made it more challenging to communicate to the world the vital role of ballast water treatment in eliminating underwater pollution," he says.

Nilsen claims there has been a lack of industry action on ballast water treatment because installing a BWTS has typically been seen by shipowners as having little economic benefit, unlike say removal of hull biofouling that reduces drag in the water and can therefore cut fuel consumption.

System reliability a key factor for trading

But the regulatory ground is now shifting for shipping.

Having a reliable and well-functioning BWTS installed on board for effective ballast water treatment is necessary to ensure the oceans are protected – and this will be a ticket to trade in future as the regulatory net tightens, Nilsen underlines.

It is here that port state intervention is needed as there is no guarantee that a system labelled as compliant with the D2 discharge standard actually functions consistently without adequate monitoring and maintenance, he says.

"System reliability, proper crew training and effective maintenance with a global support network and availability of spare parts are key factors in ensuring consistent ballast water operations," he explains.

"We have unfortunately seen an increasing number of cases with the requirement to replace unsupported systems that have become inoperable, which obviously makes it impossible to maintain a ballast water record book in line with IMO regulations."

Nilsen believes that having an inefficient or non-compliant BWTS on board can limit future trading opportunities for vessels, given that most port states have ratified the IMO's BWM Convention – and it is only a matter of time before stricter global enforcement kicks in.

"A stricter regulatory regime, combined with the heightened focus on ESG reporting and green accountability to stakeholders, represent compelling commercial reasons for efficient ballast water management aside from the overriding factor of ethical responsibility for the industry," he concludes. ■

SAFETY

DESIGNING A DUAL-FUNCTION FLOAT FREE SURVIVAL CRAFT FOR CARGO SHIPS

By **Tom Barlow-Brown**

A forthcoming project scheduled for 2024 seeks to redefine the standards governing survival and rescue craft on cargo ships. The primary objective of this initiative is the conceptualisation and realisation of a dual-function float free survival craft or module, engineered to furnish a secure environment for up to 40 crew members during emergencies such as fires or other scenarios, whilst being able to ultimately float free in the event of the parent vessel sinking. The project's scope encompasses the development of a solution capable of withstanding varied weather conditions, ranging from Tropical to North Atlantic and Polar Summer environments.

Central to the project is the recognition of the hazardous implications posed by the embarkation, launching, and recovery of survival and rescue craft on modern cargo ships. The amplification of these challenges arises from the substantial growth in the size of seagoing vessels since the latter half of the 20th century. The resultant increase in height above water accentuates the displacement and movement survival or rescue craft, necessitating a comprehensive re-evaluation of safety measures. This is particularly pertinent for the pendulous movement of the survival craft as the length of the falls reach periodic synchronism with the rolling of the parent vessel, which is, as yet, not considered in any regulatory criteria.

The survival craft envisaged by the scope of the project is not only designed for safety but is also engineered to navigate the complex dynamics associated with cargo ship movements, which with the increase in beam to depth ratios (because of limitations of draught) can include much higher accelerations than in earlier, smaller vessels. The objective is to design a craft that accommodates a broad spectrum of rolling conditions, allowing occupants to embark when the vessel is rolling 2.5degrees either side of a static heel angle, with a five-second period. These parameters consider the dynamic nature of the parent vessel, characterised by a static heel angle of 25degrees and a trim that varies due to the diverse metacentric height of different cargo ship types.

A pivotal feature of the project is the aim to implement a float free launching procedure, premised on the assumption that the parent vessel sinks or capsises before the craft is released. This procedural innovation augments the likelihood of successful deployment during emergency scenarios, underscoring its critical importance in time-sensitive situations. Furthermore, the craft is designed to endure adverse weather conditions,

SOURCE: SHUTTERSTOCK

with prescribed design parameters accounting for wind force Beaufort 6 and waves attaining a significant height of 3m during embarkation, launching, and while awaiting rescue.

In adherence to industry regulations, the craft will theoretically be engineered to meet all stipulations outlined in the alternative designs for a lifeboat, as permitted in Regulation 5 of SOLAS Ch.I and articulated in the LSA Code 2017. Considerable attention has been given to seat space augmentation to accommodate contemporary anthropometric data, with seating arrangements meticulously devised to accommodate the inclined attitudes of the module during the release phase, ensuring optimal safety for occupants.

Beyond its safety attributes, the craft will also incorporate a flat top with stretcher-compatible access. Additionally, it includes, at a minimum, a winch only helipad, furnishing a means for evacuation by helicopter or crane to high-sided ships. This multifaceted approach positions the project as a comprehensive solution for the safety and rescue operations of modern cargo ships.

As the project unfolds, universities are invited to actively collaborate, offering students an opportunity to contribute to the forefront of maritime safety research and development. It is essential to note, however, that the Royal Institution of Naval Architects (RINA) is currently engaged in evaluating the project's viability, with a final decision on whether to proceed pending. The project organisers remain optimistic about its potential impact and anticipate navigating a transformative journey towards a safer maritime future. Updates will follow as the project progresses through the evaluation phase with RINA. ■

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Wind Propulsion 2024

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Since the inaugural conference in 2019, the annual event has attracted a high level of interest in the maritime community. Attending speakers and delegates span the technology companies, academia, ship owners and industry associations. Over 100 delegates gathered at the IMO HQ for the Wind Propulsion 2023 Conference to hear presentations from companies including MOL; bound4blue; Anemoi Marine Technologies; Norsepower; Wärtsilä; RISE; Bureau Veritas Solutions M&O; MARIN and many more.

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SEPTEMBER 10-12, 2024
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RINA conference
Genoa, Italy

OCTOBER 8-9, 2024
HUMAN FACTORS 2024
RINA conference
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OCTOBER 22-23, 2024
WIND PROPULSION 2024
RINA conference
London, UK

NOVEMBER 20-21, 2024
AUTONOMOUS SHIPS 2024
RINA conference
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IMO SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC 10)
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Southampton, UK
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The Royal Institution of Naval Architects Presents:

Autonomous Ships 2024

20-21 November 2024, Copenhagen,Denmark

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In December 2024, the International Maritime Organization (IMO) will host 109th session of the Maritime Safety Committee (MSC) where the Maritime Autonomous Surface Ships (MASS) group will meet again. The Royal Institution of Naval Architects and the Danish Society of Engineers (IDA Maritime) are organising the 3rd Autonomous ship conference on 20-21 November 2024 ahead of the IMO meeting.

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