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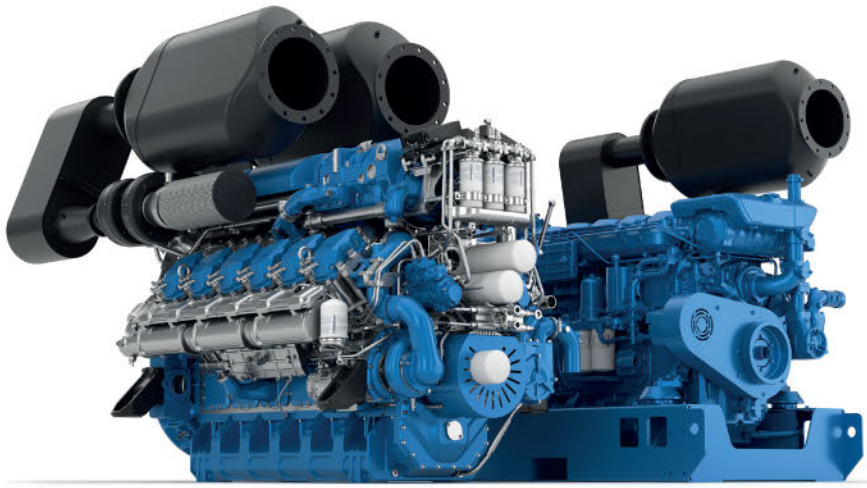

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Published by:
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London, WC2N 5DA, UK
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Telefax: +44 (0) 20 7245 6959
E-mail editorial: editorial@rina.org.uk
E-mail production: marketing@rina.org.uk
E-mail subscriptions: subscriptions@rina.org.uk

Printed in Wales by Stephens & George Magazines.

A 2023 subscription to The Naval Architect costs:

THE NAVAL ARCHITECT SUBSCRIPTION (10 issues per year)			
LOCATION	PRINT ONLY	DIGITAL ONLY	PRINT + DIGITAL
UK	£232	£232	£296
Rest of Europe	£245	£232	£308
Rest of World	£261	£232	£325
	Includes P+P	Inclusive of VAT	

The Naval Architect Group (English Edition)
Average Net Circulation 8,195 (total)
1 January to 31 December 2022
ISSN 03060209

SAVING LIVES AT SEA: TIME TO REINVENT THE LIFEBOAT?

By **Daniel Johnson**

The potential dangers of lifeboat drills are in the news once again, following an intervention last month from the Container Ship Safety Forum (CSSF) calling for "a reinvention" of lifeboats onboard cargo vessels. According to the industry association, which was set up in 2018 with the aim of improving safety performance in the container shipping industry, far too many seafarers are getting injured – some of them fatally – while launching the lifeboat during evacuations or evacuation drills. Not because the lifeboats haven't been compliant with safety standards, but simply because the launch of a lifeboat is such a dangerous task to perform.

"For way too long," noted CSSF chairman Aslak Ross, "we have seen able seafarers being injured when launching lifeboats even though crews have been trained and the lifeboat is modern and fully compliant."

Ross highlighted the 2017 publication '*Lifeboat drills: we need to save lives, not lose them*' from the UK Chamber of Shipping as recognition of the problem. The article identifies 60 fatalities during testing of lifeboats over a 10-year period and suggests that the use of simulation training could improve safety.

Examine the available statistics on lifeboat related accidents further, and a pattern fashioned from an ongoing waste of seafarer's lives begins to emerge. A study published in 2014 by the UK Marine Accident Investigation Branch (MAIB) shows that 16% of all seafarers killed were as a result of lifeboats and their launching systems and notes that an even greater number survived lifeboat incidents but with severe injuries of the spine and lower extremities, and that there were numerous "near misses". MAIB's findings indicate that seafarers are exposed to the greatest risk of injury during the maintenance, launching and recovery operations of lifeboats.

More recently, InterManager raised awareness of the issue last year by releasing previously unseen insights surrounding lifeboat related accidents. An active member of the International Lifeboat Group and a non-governmental organisation at the IMO, the international trade association for ship and crew managers began gathering statistics globally several years ago and now has the largest maritime database of lifeboat accidents.

According to its figures, since 1981 there have been 420 deaths involving lifeboats, 346 serious injuries and 116 minor injuries. Other findings show that human beings were not the primary cause of lifeboat accidents and that a significant number of accidents were due to issues relating to equipment, with the most common mechanism issues being the release mechanism, davit, and wire/rope.

Clearly, the industry has made momentous advancements in developing lifesaving equipment since the lifeboat

SOURCE: SHUTTERSTOCK

debate opened in the aftermath of the *Titanic* disaster, but it's also obvious that the measures taken so far have not had sufficient effect, with lives still needlessly being put at risk.

As Ross observed: "Everyone knows we have a problem; seafarers are scared to launch lifeboats."

He added that to date no one has offered a plausible path towards a solution to the problem for cargo vessels and that a change is needed to provide a safe environment for seafarers and to regain trust in lifesaving equipment.

CSSF believes that there is too much attention on compliance and training and not enough focus on the root cause of the problem, which is that the design of equipment is too complicated and in the case of container ships lags behind other segments of shipping which have focused on improving systems.

"Simulation and use of new technology is one way to conduct drills in a safer environment, and we support the intent to reduce the risk of accidents," said Ross. "However, it does not solve the core of the problem: launching a lifeboat is too dangerous. And even though simulation has its advantages, it should only be used as a supplement to well-conducted onboard abandon ship drills where crews are familiarised with ship specific equipment."

The association points to alternative designs that are already available for offshore installations and for passenger evacuation on passenger vessels through marine evacuation systems and the like and says that such systems should also be made available to cargo vessels without delay.

It is hoped that CSSF's intervention will provide the industry, including naval architects, with fresh impetuous to challenge the current change-resistant environment and innovate to eliminate the risk of lifeboat accidents. With seafarers continuing to lose their lives, it's an issue that can't be ignored. ■

NEWS

DECARBONISATION

GREEN SHIPPING PROJECTS UP 84% OVER THE LAST YEAR

The Global Maritime Forum's fourth edition of the Mapping of Zero-Emission Pilots and Demonstration Projects, launched in May at a Getting to Zero Coalition Workshop in Paris, has identified 373 zero-emission pilots and demonstration projects, an 84% increase over last year's edition.

According to the report, new projects have emerged in Thailand, Egypt, Malaysia, and South Africa and more pilot schemes are taking a collaborative approach, with 70% of the identified projects involving partners from at least two countries.

JOHANNAH CHRISTENSEN, GLOBAL MARITIME FORUM CEO

Partnerships are growing between developing and developed countries as well and there is a global spread with some regions having higher industry activity than others. Most projects are based in Europe (56%), Asia (33%), and North America (9%), and the top three countries by the number of projects are Norway, Japan, and Denmark.

Findings see a continued increase in projects focusing on hydrogen-based fuels with ammonia and hydrogen in the lead. Ammonia is the dominant fuel focus for larger ship types; ammonia-powered ship designs received most of the approvals in principle in the last year.

For smaller ships, the leading technologies remain battery technology, hydrogen fuel cells, hydrogen internal combustion engines, and methanol. More mature methanol technologies have begun to move beyond pilot work to a commercialisation phase.

"It is promising that the number of zero-emission pilot and demonstration projects is increasing each year and impactful projects are being developed in the global South," says Johannah Christensen, CEO of the Global Maritime Forum. "Now we need industry's actions to be backed by an ambitious revised greenhouse gas emissions strategy from the International Maritime Organization."

FERRIES

MANXMAN FERRY FINALLY DELIVERED AFTER DELAYS

The new Isle of Man Steam Packet ferry, the *Manxman*, has finally been delivered after delays due to gearbox problems. The vessels has now begun the long voyage home from Ulsan, South Korea, to Douglas, Isle of Man.

The company says that the issues with the new £78 million ferry have been resolved. A gearbox fault was discovered during sea trials of the *Manxman* in February. However, the government-owned Isle of Man Steam Packet company states the vessel has now "passed its sea trials with flying colours".

MANXMAN DEPARTS ULSAN SHIPYARD, SOUTH KOREA

The delay on the delivery left the Isle of Man with only one operational ferry for the connection to the UK mainland after the *Ben-my-Chee* ferry underwent repairs.

Manxman was put through 10 days of sea trials, testing its handling, manoeuvrability, fuel consumption and speed. Built at the Hyundai Mipo Dockyard it will take over as the island's main passenger and freight ferry.

The vessel will have increased capacity and be able to take about 950 passengers to and from Heysham, 320 more than the current maximum on the *Ben-my-Chree*.

Lars Ugland, chairman of the Board of the Isle of Man Steam Packet Company, signed the official documentation to complete the transfer of ownership on behalf of the company.

FERRIES

STENA LINE BOOSTS IRISH SEA FREIGHT CAPACITY WITH NEWMAX HYBRID VESSELS

Stena Line, one of Europe's leading ferry operators, has announced that it is constructing two hybrid propulsion vessels designed to run on methanol for its Belfast-Heysham route.

The move is in response to increasing customer demand. Construction of the NewMax vessels will begin shortly with launch on the Irish Sea in 2025.

The two new vessels are expected to add 80% capacity to Stena's freight service. Each of the 147m ships has been designed to maximise freight volumes and will provide 2,800 lane-metres of capacity. The vessels will be equipped to carry 26 crew, and 12 passengers, reflecting the growth of freight-only ships.

THE STENA LINE NEWMAX

The vessels will operate on methanol fuel and the company has secured future volumes of e-methanol as part of its strategy of shifting to renewable fuels and cutting 30% of its CO_2 emissions by 2030. Stena Line became the first ferry operator to run a ferry on methanol when the *Stena Germanica* was converted in 2015.

"This investment shows our dedication to sustainability and our strategy of moving towards new sustainable fuels," says Niclas Mårtensson, CEO Stena Line. "The NewMax vessels will also meet the growing demand from customers, adding significant capacity to allow logistics operators to grow their business in the region."

Stena Line is the largest ferry operator on the Irish Sea. The company also offers a direct service from Rosslare to Cherbourg and will be introducing an upgraded ship, *Stena Vision*, to this route for summer 2023.

SHIPBUILDING

SOUTH KOREAN GOVERNMENT EXPANDS SUPPORT FOR LOCAL SHIPBUILDERS

South Korea has pledged to expand financial support measures and invest US$135.9 million in technological development for autonomous vessels and eco-friendly ships. According to the Ministry of Trade, the move aims to secure local shipbuilders' position in the global market.

Trade Minister Lee Chang-yang travelled to Ulsan to inspect shipyards and announced financial support plans to boost the industry. Lee attended the naming ceremony of the country's first liquefied natural gas bunkering ship, *Blue Whale*, equipped with a homegrown KC-2 cargo design. The advanced cargo design was laid down at the dockyard of Hyundai Heavy Industries in Ulsan in 2020.

According to Lee: "The world has a close eye on our shipbuilders' technology and manufacturing capability, and the business environment is changing favourably for us, with ship prices rising and more demand for environment-friendly vessels. At the same time, we are challenged with China's technological pursuits and Europe's strong future mobility technology. The government will spare no effort to support the industry's rebound and for market leadership in the future."

HYUNDAI HEAVY INDUSTRIES SHIPYARD IN ULSAN, SOUTH KOREA

The government investment will help fund ships with alternate energy sources such as hydrogen, ammonia and electricity. The country is leading in the global market for large-scale LNG carriers, securing contracts of 17 out of 19 ships ordered, according to the Ministry of Trade.

South Korean shipyards will need 14,000 additional workers this year. The Ministry says that it has been working with the industry and related ministries to secure about 5,500 workers, including foreigners.

IN BRIEF

DECARBONISATION

AVIATION-SHIPPING COALITION LAUNCHED

A new lobby group, the Skies and Seas Hydrogen-fuels Accelerator (SASHA) Coalition, has been launched to bring together leaders from across shipping and aviation sectors to send the message that green hydrogen and direct air capture (DAC) technologies are integral to decarbonisation pathways, but their limited supplies need to be targeted towards the industries that do not have more efficient routes to decarbonisation. Set up by climate change NGO Opportunity Green, the coalition will be funded by the European Climate Foundation.

CONTAINER SHIPS

CONTAINER SHIPPING RATES PLUMMET

The container shipping industry saw a significant downturn in global long-term freight rates during the month of May, as the contracted cost of shipping containers plummeted by 27.5%, according to the index developed by freight rate platform Xeneta. The fall in the Xeneta Shipping Index (XSI) marks the ninth consecutive month of rate drops and represents the largest monthly fall ever recorded on the platform.

CRUISE SHIPS

ADORA NAMES ITS FIRST CHINESE NEWBUILD

Adora Cruises has revealed the name of its first Chinese-built large cruise ship, *Adora Magic City*, with Shanghai serving as its home port in its inaugural season starting later this year. The vessel's name takes inspiration from great metropolises, combining the best of East and West to create a magical city at sea, according to the company. "*Adora Magic City* is not just a cruise ship, but a captivating experience that presents the best of Chinese hospitality and global cruising practice," says managing director Chen Ranfeng.

INSURANCE

SHIPPING LOSSES HIT RECORD LOW, BUT CLOUDS APPEAR ON THE HORIZON

FIRE RISKS ARE A GROWING CONCERN

Total losses in global commercial shipping hit a record low in 2022, according to the annual safety and shipping review published by insurance provider Allianz Global Corporate & Specialty (AGCS).

Worldwide, 38 ships were lost last year, 35.6% fewer than the 59 vessels lost in 2021. This is the lowest level of loss in 12 years, since the annual review was first published. The figure also represents a 65% reduction from a decade ago: in 2013, 69 vessels were lost.

"Shipping losses have sunk to the lowest number we've seen in the history of our annual study, reflecting the positive impact that safety programmes, training, changes in ship design and regulation have had over time," states Captain Rahul Khanna, global head of marine risk consulting at AGCS.

South China, Indochina, Indonesia and the Philippines accounted for one in four of the losses. This is the result of "high levels of local and international trade, congested ports, older fleets and extreme weather", according to the report.

Although losses declined over the past year, the number of shipping casualties or incidents reported remained consistent in 2022 totalling 3,032, compared to 3,000 a year earlier.

AGCS is concerned about the number of fires with 200 reported last year, making it the third largest cause of maritime casualties. The increased trade in lithium-ion battery transportation generated by decarbonisation poses a significant fire risk for the shipping industry, it says.

Further, AGCS points to emerging challenges from the growing 'shadow fleet' which it estimates could now account for one fifth of the oil transportation fleet.

The number one cause of marine claims by value is fire and explosion.

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NEWS ANALYSIS

AMMONIA GRABS THE HEADLINES AND A RECYCLING RAMP UP IS NEEDED

By **Malcolm Latarche**, Correspondent

Ammonia as a marine fuel was making many headlines in May. In mid-month came news of a consortium of Lloyd's Register, Mediterranean Shipping Company (MSC), SDARI and MAN Energy Solutions signing a MoU for a design for the ammonia dual-fuel operation of an MSC container ship. This is planned to result in the technical specification and associated design documents being developed for a variant of SDARI's twin island 8,200TEU container ship design for a vessel contracted to LR class by MSC.

As part of the project, SDARI will prepare the specification and design documentation of the ammonia dual-fuel variant, whilst LR will verify that the design conforms with safety standards and rules relating to the usage of ammonia as a marine fuel. MAN-ES will deliver data for the engine design and ammonia fuel supply and emission abatement systems.

At the same time another consortium this time from Japan reported it had successfully completed land-based testing of what is claimed as the world's first four-stroke ammonia-fuelled engine. The engine was developed by the consortium comprising IHI Power Systems, Japan Engine Corporation, Nihon Shipyard, NYK Line and ClassNK.

The engine will be installed in a tug next year and more are planned as main engines for coasters. A larger 250mm bore engine is planned for auxiliary use on deep-sea vessels with the first being installed on an ammonia carrier due for delivery in 2026.

In the tests, the engine was run on 80% ammonia and measurements taken on exhaust gases with stable operation being achieved. The amount of N2O and unburnt ammonia emissions were virtually zero, according to the consortium. No ammonia leakage was reported from the systems after shutdown.

Earlier in May, Höegh Autoliners and Norwegian green energy provider North Ammonia announced a partnership for the supply, distribution, delivery, and consumption of green ammonia. The green ammonia is intended for Höegh's ammonia-ready dual-fuel 9,100CEU Aurora class PCTCs, the first of which is scheduled for delivery in the second half of 2024.

Höegh said the partnership will allow it to meet its commitment to powering at least 5% of deep-sea operations with green ammonia by 2030 and its aim of consuming at least 100,000tonnes of green ammonia within its fleet by that time.

HÖEGH AUTOLINERS HAS LINED UP AN AMMONIA SUPPLY FOR NEW AURORA CLASS PCTCS

Towards the end of the month, Qingdao Yangfan Shipbuilding delivered the 5,900TEU *CMA CGM Masai Mara* which it claims is the world's first ammonia ready boxship. The ship is the first in a series of six originally ordered by Belgian operator CMB subsidiary Delphis but taken over by CMA CGM earlier this year. Earlier this year CMB announced a project with WinGD that will see a series of 210,000dwt bulkers being powered by ammonia-fuelled engines being delivered in 2024/5.

As new regulation on efficiency and decarbonisation measures move forward there is a consensus that a significant number of older vessels will soon be making their final voyages to recycling yards. Given the lack of approved capacity by the EU, a new video released by BIMCO might be considered timely. "Ship Recycling: Time for Change", is partly filmed at ship recycling yards in Alang, India, and Bangladesh. The film aims to raise awareness among global regulators, shipowners, and the public of the vast potential for the ship recycling industry to add to a sustainable global circular economy if done safely and urges more countries to adopt the Hong Kong Convention.

"The numbers speak for themselves. The raw scrap steel from ship recycling feeds around 350 re-rolling mills that supply approximately 50% of the annual steel consumption in Bangladesh alone, and the industry creates thousands of jobs for people providing for their families," said BIMCO secretary general and CEO David Loosley. "But ship recycling has for too long been unsafe for workers and the environment at yards that do not live up to the standards of the Hong Kong Convention. It is time for change and for ship recycling to be done the right way."

According to BIMCO Bangladesh has confirmed its commitment to ratify this year, allowing the convention to enter into force. ■

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NEWS EQUIPMENT

ENGINES

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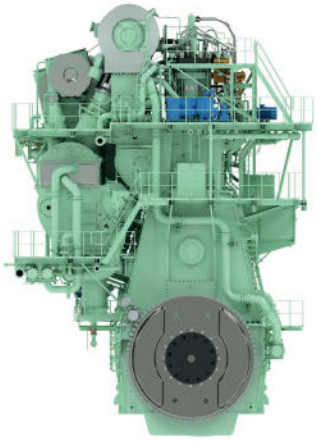


THE ORDER IS THE FIRST GLOBALLY FOR THE S60ME-LGIM VARIANT. SOURCE: MAN ES

MAN Energy Solutions (ES) has been awarded an order to supply the first S60 dual-fuel engines capable of operating on methanol.

The MAN B&W 7S60ME-LGIM dual-fuel engines have been ordered in connection with the construction of 2 × 9,300CEU pure car and truck carrier (PCTC) vessels for Chinese integrated-logistics company China Merchants Energy Shipping (CMES). The order includes an option for four further vessels.

China Merchants Heavy Industry has placed the order for 2 × MAN B&W 7S60ME-LGIM (Liquid Gas Injection Methanol) engines. The order also represents the first order for a methanol-fuelled engine for a PCTC, as well as the first Chinese-built methanol engine. The engines will be built in China by engine manufacturer CSE, with respective vessel delivery set for 2025 and 2026.

The engines will feature MAN Energy Solutions' proprietary EGR (Exhaust Gas Recirculation) system.

"Interest in using methanol in ocean-going vessels is at an all-time high, especially in the container vessel segment but also in the vehicle-transport sector whose main players are moving to expand capacity driven by very strong Chinese car sales and to renew their fleets in response to new emission regulations," says Bjarne Foldager, head of two-stroke business, MAN ES. "Thus, with this order, CMES is simultaneously expanding its business and improving its sustainable profitability."

"While LNG has been the most popular alternative fuel within the PCTC segment, CMES is one of the first movers to methanol, which we expect will figure prominently as a future fuel in the maritime energy transition across all vessel segments," he adds.

SAFETY

KIWIRAIL FIRST MAJOR PASSENGER OPERATOR TO ADOPT NEW VIKING LIFECRAFT

The Viking LifeCraft system is due to be installed on its first series of newbuild vessels. The system will serve as the main evacuation solution onboard the new diesel-electric hybrid Interislander ferry fleet operated by KiwiRail to connect the two main islands of New Zealand

KiwiRail ferries has provided a connection for 800,000 annual passengers between New Zealand's North and South Islands across the Cook Strait. The company is replacing the fleet with two new purpose-built ships, currently in the advanced design phase at the Hyundai Mipo Dockyard in South Korea.

The LifeCraft evacuation system from Viking Life-Saving Equipment has been chosen as the new primary safety system onboard. The system comprises four 203-person self-propelled survival craft. These combine the features of a premium lifeboat, liferaft and evacuation system technology in a novel hybrid solution.

The LifeCraft is also a compact system and all elements of the survival system are stored together in the same unit

VIKING LIFECRAFT AT SEA

which can be either placed on deck or built into the side of the vessel.

Should it be needed, the system is able to evacuate over 800 people within only 30 minutes. After evacuation, each of the craft can take advantage of their electric propulsion to maintain a safe position while awaiting rescue. The four electric engines combined with a high level of seaworthiness means that each craft can use its 360-degree manoeuvrability and acceleration to support SAR operations.

BATTERY SYSTEMS

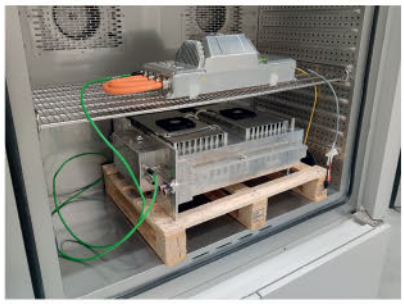
LR AND BV TYPE APPROVAL FOR OCTOPUS ESS

EST-Floattech has announced that its Octopus Series battery system has received Lloyd's Register (LR) and Bureau Veritas (BV) type approval for maritime applications.

Both LR and BV observed the tests that EST-Floattech carried out on the Octopus Series battery system to ensure its compliance with the latest industry standards and regulations. The two classification societies approved the tests the EST-Floatech completed and granted marine type approval that the safety and performance of the system meet their standards.

EST-Floattech, which both develops and manufactures the Octopus Series battery system, says it is proud to receive the type approval from BV and LR. "We are glad that our 'safe by design' mentality has been recognised through this Lloyd's Register and Bureau Veritas type approval for maritime battery systems," says Diederick Stam, CTO at EST-Floattech. "This achievement reinforces our commitment to providing the safest and most reliable battery systems to the maritime industry."

Marine type approval for a battery system from respected organisations such as Bureau Veritas, and Lloyd's Register is important for shipowners and shipbuilders to ensure that the products they are considering meet the highest standards in the industry, he adds.



CLIMATE TEST OF THE OCTOPUS ESS

PROPULSION

BULKSHIP ADOPTS BERG PROPULSION UPGRADE TO ENSURE FLEETWIDE EEXI COMPLIANCE

Oslo-based ship manager Bulkship Management is to implement Berg Propulsion's 'EPL for EEXI' power limitation solution across 10 ships trading in US Gulf and Caribbean waters.

Berg's new engine power limitation (EPL) solution is of particular benefit to ships whose performance requires only moderate adjustment to meet IMO Energy Efficiency Existing Ship Index (EEXI) needs, according to Berg Propulsion.

AN ASSESSMENT ON *OSLO BULK 6* INDICATED THAT EEXI NEEDS WOULD BE SATISFIED BY DERATING ITS MAIN ENGINE TO COMPLY WITH THE NEW REGULATIONS

Rather than using a governor for engine derating or ShaPoLi (shaft power limitation), Berg's EPL is a software-based solution which works with the supplier's MPC800 control system to limit propeller pitch. Requiring no additional sensors, signals are sent by the EPL to the ship's controllable pitch propeller (CPP), where brake torque is reduced until the engine power reaches its approved range. The information can be used to verify that attained EEXI matches required EEXI, once entered into the IMO's Data Collection System (DCS).

Berg Propulsion says a pilot technical assessment of the 8,036dwt, 108m Bulkship vessel *Oslo Bulk 6* indicated that EEXI needs would be satisfied by derating its main engine to comply with the new regulations. Sea trials covering the Berg EPL's limiting effect on the ship's Berg MPP950 CPP brought DNV acceptance of the system's performance as an effective EPL solution.

Bulkship has now confirmed orders to install across nine more ships.

"On a CPP installation, it is more natural to limit the engine power output by the accurate governance of the propeller than by limiting the engine rpm setpoint," says Magnus Thorén, sales manager of energy and efficiency, Berg Propulsion. "We use the main engine signal interface to limit the brake torque created by the propeller. Although it's for a different purpose, this is based on the well-established practice of using a propeller pitch setpoint for overload protection."

FINANCE

FINANCING THE FUTURE

Jan Ole Huseby, head of Global Ocean Industries at Norway-based DNB, one of the world's leading 'ocean space' banks, discusses the role of finance in enabling the sustainable transition the maritime industry demands

By **Alan Johnstone**, Correspondent

"There's a gap between ambition and reality at present, and if we don't work to bridge that divide we face a grave challenge."

Jan Ole Huseby, DNB's head of Global Ocean Industries, is giving a sober assessment of the "incredibly capital intensive" nature of the energy transition necessary in facilitating a truly sustainable future. Referring to findings from the International Energy Agency (IEA), he points out that annual investments in clean energy need to reach US$4.4 trillion in 2030 (falling to US$4.1 trillion by 2050). Putting that into perspective, the average annual investment between 2016 and 2021 was US$1.2 trillion.

"There's a need for massive investment to transform the ocean industries, both here in Norway and across the world," he says, singling out offshore wind and carbon capture and storage as examples of key 'cash hungry' development areas.

"But, as we can see when we look at capital markets over the last year, uncertainties – ranging from geopolitics and macroeconomics through to questions about which fuels and solutions to invest in – can narrow opportunities to raise funds. So, it is, to say the least, complex."

But, as quickly becomes evident, he's far from disheartened by the challenge.

Firstly, Huseby says the capital hurdles are just that – hurdles rather than permanent blocks – pointing to the fact that DNB has already handled numerous "large bond transactions" this year. Secondly, he argues that a collective approach, across the ocean industries and beyond, can help enable an evolution that, at heart, everyone requires for a profitable, sustainable future.

"We all have a role to play," he states, "and DNB is determined to play its. We want to help finance the future, in partnership with clients worldwide."

Supporting progress

DNB has taken care to position itself at the heart of shipping's sustainable charge, while seizing opportunity within rapidly growing ocean industry segments. Offshore wind is a prime example of the latter point, with the Oslo-headquartered institution providing over US$2 billion in funding to the offshore wind service segment over the last two to three years, cementing its place as number one lender within the niche.

"We don't want to take a 'watch and wait' approach," Huseby notes. "It's our ambition to assume a leading role; exercising a positive influence where we can, building understanding to be a better partner and advisor for clients, and helping accelerate the transition. There's many ways we can contribute here."

Indeed there are – the list he gives is comprehensive. Looking at an industry-wide perspective first, DNB was one of the founding banks in the launch of the Poseidon Principles, the lauded framework for integrating climate considerations into maritime lending decisions. It was also an early mover in supporting the Responsible Ship Recycling Standards (RSRS), introducing requirements relating to ship recycling in all its loan agreements. In addition, DNB is an active member of the Getting to Zero Coalition, focusing on the development and deployment of zero-emission deep-sea vessels, and is working on pilots relating to green technology and sustainable financing with the Norwegian Green Shipping Programme.

But, of course, it's in its everyday lending activities where the bank can make the biggest impact, helping its clients with an approach involving both carrot and stick.

The business of change

"We have our own goal of reducing the carbon intensity of our shipping portfolio by a third from 2019

JAN OLE HUSEBY, HEAD OF GLOBAL OCEAN INDUSTRIES, DNB

to 2030, which is beyond the scope of current industry targets," Huseby states. "So, we need to help our clients meet their goals to meet ours."

As such, sustainability considerations play a growing part in client selection, he says, with assessments based on criteria such as regulatory risk, fleet renewal plans, long-term transition ambitions, and general climate objectives.

"We want to partner with responsible businesses who are working towards the same goals as we are, and that approach feeds into every lending decision," he adds. "Sub-standard practices will not be accepted."

On the carrot front, DNB has been active in developing and marketing sustainably linked loans and bonds and arranged the first sustainability linked bond in shipping, issued by Odfjell SE in 2021. Since then, many more have followed.

"We want to show the opportunity here," Huseby smiles. "Going green isn't just about the environmental gains, it should make good business sense!"

Fresh perspectives

With a lack of silver bullet solutions for fuelling that green voyage, DNB has established its own in-house Energy Transition Solutions function within Ocean Industries, building insight and know-how on the latest innovations, technology and sustainable finance solutions across all the maritime industries.

It's all part of what Huseby calls "active engagement" to better understand, and advise upon, challenges and opportunities.

"There's as many opinions as shipowners out there," he laughs, adding with a more serious tone: "So I think the industry needs a flexible approach – as we can already manifesting itself in the growing orders for dual-fuel vessels – and help with assessments of low- and zero-emissions technology from a financial perspective, building good business cases for adoption. We're here to help in that respect."

Huseby says that with so many solutions on, and emerging from, the "drawing board" – and the need for different solutions for different vessels and trades – DNB has yet to fund many breakthrough alternative fuel vessel projects. However, the bank is following numerous developments with interest (Huseby mentions sails and ammonia specifically) and actively helping clients with funding for optimising existing fleets.

"There's so much that can be done today," he comments, "and we're really encouraged to see the action that our clients and partners are taking. There's real commitment out there." ■

GREEN SHIPS

NYK'S LNG-HYBRID PCTCS 40% MORE ENERGY EFFICIENT

By **Tom Barlow-Brown**

Japanese shipowner NYK Line is increasingly adopting a carbon neutral stance, transitioning its fuel choices to LNG and ordering newbuilds that utilise new environmentally conscious technology. WinGD is the latest to have been picked to provide dual-fuel option for NYK. The Swiss marine power company's X-DF2.0 engines will provide power for two new car carriers.

The partnership is the latest in series of ventures that the Japanese company has made as part of its transition to net-zero. NYK has established an initiative called "Sail GREEN" as part of its ESG brand. This emphasises its efforts to reduce GHG emissions through the transport of goods and contribute to the eco-friendly supply chains of customers.

The 7,000CEU pure car and truck carriers *Jasmine Leader* and *Wild Rose Leader* have been fitted with a wide range of WinGD technology. The names of the two carriers reflect NYK's desire to promote its environmentally friendly strategy by naming its LNG-fuelled PCTCs after flowers. The vessels were delivered from Jinling Shipyard in China, where two remaining sister vessels will also be built.

During their maiden voyages the 199m, 71,846gt vessels transported vehicles produced by Mazda Motor Corporation and Honda Motor Co., Ltd, which is environmentally conscious and is looking to partner with a car carrier that shares the same view. Two other sister vessels, the *Plumeria Leader* and the *Sakura Leader*, were launcher earlier in the year. Both were built at the Shin Kurushima Dockyard. The fleet of ships will be some of the world's largest PCTCs.

NYK Line's deputy manager, Ship Design Team, Technical Group, Mr Keita Fukunaga, says: "These LNG-hybrid vessels are among the most sophisticated and efficient car carriers ever built and are central to our fleet renewal plan targeting net-zero emissions by 2050. With WinGD's engine, energy management and digital monitoring systems onboard, they mark an important step towards delivering decarbonised vehicle transport for our customers."

The switch to LNG will make the four vessels approximately 40% more energy efficient compared to ships using conventional heavy oil-fired engines. The move is also expected to reduce sulphur oxide (SOx) emissions by approximately 99% and nitrogen oxides (NOx) by approximately 86% compared to ships using conventional heavy oil-fired engines.

WinGD's range of technology options onboard

NYK'S NEW PCTCS FEATURE CUTTING-EDGE EMISSIONS REDUCTION TECHNOLOGY

includes an LNG-battery hybrid configuration that uses WinGD's latest 7X62DF-2.1 two-stroke engines coupled with shaft generator, DC-links, batteries and bow thruster drives. System integration and holistic energy management is also provided by WinGD. The increased energy efficiency provided by the LNG engines means that the vessels are ahead of the curve for future CII requirements. This means they are already past International Maritime Organization's (IMO) current greenhouse gas emission target for 2030.

Alongside the LNG-battery hybrid engines, which are at the core of the WinGD's onboard technology suite, the vessels also feature a comprehensive installation of the company's ecosystem of energy reduction and monitoring solutions. The highly advanced technologies which feature in the sophisticated vessels include WinGD's X-DF2.0 iCER (Intelligent Control by Exhaust Recycling), X-EL Energy Manager and WiDE (WinGD integrated Digital Expert).

The *Jasmine Leader* and *Wild Rose Leader* are the first in operation with WinGD's X-DF2.0 iCER technology which is designed to cool and recirculate part of the exhaust gas through a low-pressure path during operation in gas mode. The iCER technology reduces methane slip by 50% while providing significant efficiency gains.

The vessels also showcase the first deployment of WinGD's electrical energy solution, X-EL energy management. This allows for an optimised energy flow to run the main engine constantly at its optimal point while avoiding less ideal energy usage. The X-EL Energy Manager is a new battery-hybrid power integration and sustainability service which integrates the two-stroke marine engine control into the electrified vessel power system.

The PCTCs also feature the WiDE engine monitoring and diagnostics, which uses a digital copy of the unique system to compare simulated behaviour with real-time data, which is based on vessel operation and seafaring conditions. As a result, anomalies from probable performance are identified and diagnosed so the vessel's crew and shoreside support staff can receive advice for troubleshooting and maintenance.

NYK Line has set a long-term net-zero emission target for 2050, and the company is currently positioning LNG fuel as one of the solutions to achieve this in the interim, before more sustainable fuels come on the market. The company aims to switch to zero-emission vessels utilising low-emission marine fuels such as hydrogen and ammonia. NYK currently plans to take delivery a total of 20 new LNG-fuelled car carriers by 2028. ■

EU PROGRESS ON FUEL REGULATIONS SHOWS SHIPOWNERS WILL NEED TO ADAPT QUICKLY

By **Tom Barlow-Brown**

In March 2023 the Council of Europe announced it was moving forward with plans to introduce new regulations aimed at cutting GHG emission from commercial vessels in the bloc. The draft policy, known as FuelEU Maritime, will heavily control the kind of fuels available to power ships travelling to and from EU ports.

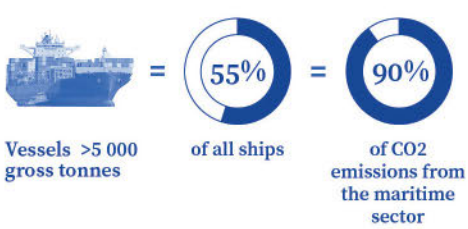
The provisional agreement has the ultimate goal of fully decarbonising the maritime sector by 2050 and is part of the wider 'Fit for 55' package presented by the EU Commission in July 2021. This aims to enable the EU to reduce net GHG emissions by at least 55% by 2030 and eventually achieve net neutrality by 2050. It also aims to promote the use of renewable and low-carbon fuels (RLF) with the aim of these making up 86-88% of international marine transportation fuels by 2050.

Crucially the regulations will apply to all vessels of any flag above 5,000gt travelling between or berthed in EU ports. This will prove yet another headache for shipowners who are already concerned with reporting ship data under several other environmental regulations. Already existing rules established by the IMO mean that 5,000gt ships, which make up 85% of the global source of maritime CO_2 emissions, will have to collect consumption data for each type of fuel they use. Additionally, since January 2023 it has also been necessary for vessels to measure their energy efficiency and report their annual operational Carbon Intensity Indicator (CII) rating.

The yearly GHG limit will be based on the onboard intensity of the EU fleet in 2020. Shipowners will initially be able to breathe a sigh of relief as initial reduction requirements leave room for manoeuvre, with a 2% reduction in GHG intensity between 2025 to 2029 and then 6% from 2030 to 2034. This recognises that there is a limited supply of low-emission fuels available and there is a need to mature the fuel production and certification systems.

However, Tore Longva, decarbonisation director, Regulatory Affairs at DNV, states: "From 2035 and onwards, the requirements will become more and more significant. For shipowners, the critical thing to do now will be to consider how to handle compliance

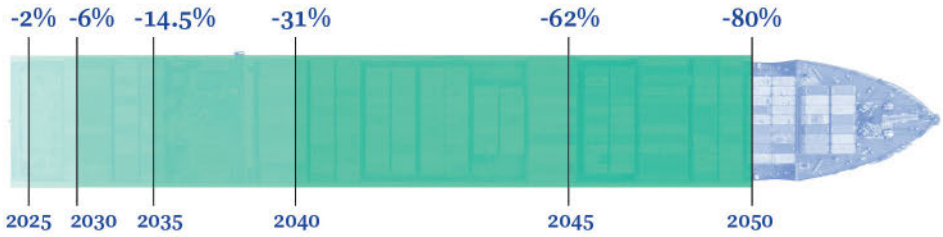
The FuelEU maritime regulation will oblige vessels above 5 000 gross tonnes calling at European ports (with exceptions such as fishing ships):



SOURCE: COUNCIL OF THE EUROPEAN UNION, 2023

→ to **reduce** the **greenhouse gas intensity** of the energy used on board as follows

Annual average carbon intensity reduction compared to the average in 2020



→ to connect to **onshore power supply** for their electrical power needs while moored at the quayside, unless they use another zero-emission technology

in the short term for the existing fleet – this is either using a small amount (2%) of sustainable biofuels or e-fuels, to join a pool of other ships, for example including one or more ships running on LNG, or simply to pay the penalty."

Shipowners will face steep fines for non-compliance once the regulations come into force, equivalent to €2,400/tonne LFO (energy equivalent) of the fuel that would need to be replaced by bio/e-fuels. This means in the long term shipowners will need to create a fuel strategy on how to bring existing ships and newbuilds into compliance with the regulations going forward.

The regulations also cover ships at berth in EU ports, stipulating that all ships in port will need to connect to shore power rather than keep their engines on. Again, the regulations allow some wiggle room. From 2030, only container and passenger vessels berthed in Trans-European Transport Network (TEN-T) ports will be required to connect to shore power. From 2035 this will apply to all ports where shore power is available.

Nevertheless, investments will be needed by various states in order to develop the necessary infrastructure. Some are already ahead of the curve such as Sweden which has just begun what has been described as Europe's largest e-methanol project. The FlagshipONE facility, which is being developed by Ørsted, will begin production in 2025 and produce 50,000tonnes of methanol annually. The company aims the facility will act as one of the first steps to support the large-scale use of methanol in the shipping industry. DNV has estimated that there are 89 methanol dual-fuel vessels due for delivery by 2028.

According to Tore Longva: "With the relatively low requirements initially, the supply of fuels should not be a problem and the regulation gives ample time to prepare and scale up fuel production. In an estimate DNV did for the IMO, there is sufficient potential supply of low-emission fuels beyond 2030 to achieve a decarbonisation by 2050. The time to 2030 should be used to develop fuel production and bunkering infrastructure projects to prepare for upscaling beyond 2030."

While the new regulations give plenty of time to adapt, shipowners will still need to act quickly to secure an adequate supply of green fuels, and place orders for new vessels in what will surely become an increasingly busy market space. However, energy producers and equipment manufacturers will likely welcome the uptick in sales. The future for European shipping looks increasingly much greener and it is a question of when, not if, shipowners will fully embrace the change. ■

HEAVY LIFT

OFFSHORE WIND STEERS HEAVY LIFT SHIPPING TOWARDS GREENER FUTURE

By **Daniel Johnson**

NEW ORCA CLASS VESSELS ARE SET TO OFFER CARBON-NEUTRAL TRANSPORT SOLUTIONS

Currently the second-largest renewable source of electricity following hydropower, wind power is one of the cornerstones of the green energy transition. Offshore wind in particular holds enormous promise to tackle the climate crises – including, according to some studies, the potential capacity to power nearly every home and business on the planet. Installed global capacity is expected to reach 380GW by 2030, up from 57GW in 2021, and as the industry prepares for the massive and necessary build out of offshore wind farms to reach this target, it also has its sights set on driving down the environmental footprint of their installation.

Earlier this year, work began at Wuhu Shipyard in China on a new generation of ultra-efficient heavy lift vessels slated to be the new yardstick in terms of emissions and technical capabilities. The two Orca class vessels under construction form part of a fleet of four ships being built in Wuhu for Germany-based SAL Heavy Lift, one the leading maritime heavy lift and project cargo carriers, and joint venture partner Jumbo Shipping of the Netherlands, another heavyweight in the sector.

Scheduled for delivery in July 2024, the first pair of ships will be exclusively involved in the transportation of offshore wind turbine components in a long-term commitment with Spanish-German wind engineering company Siemens Gamesa Renewable Energy. The two additional sister vessels will enter the premium heavy lift shipping market to serve the clients of the Jumbo-SAL-Alliance in the first half of 2025.

"The Orca vessels are setting new standards in global heavy lift shipping. They represent the new benchmark both in terms of their technical capabilities and modern climate-friendly propulsion systems," says Martin Harren, owner and CEO of SAL Heavy Lift. "The ships will be the most efficient vessels in their class with consumption and emission figures far superior to any existing heavy lift vessel today."

Harren adds that the vessels were developed in-house in close co-operation with Jumbo Shipping and that the partners also conducted discussions with Siemens Gamesa Renewable Energy from the very beginning of the newbuild programme to develop the capabilities of the new vessels.

The vessels will each measure 149.9m x 27.2m and provide a capacity of 14,600dwt. According to SAL Heavy Lift, despite their compact outer dimensions, the vessels have a box-shaped single cargo hold with the largest dimensions in its class. Provided the hatch covers with a capacity of 10tonnes/m^2 are utilised for stowing super-heavy deck cargoes, such as 3,000tonne cable carousels, the vessels can accommodate over-

height cargo in the hold and sail with open hatch covers up to full scantling draught.

Ice class notation 1A, a Polar Code certification and the reduced design temperature of the hull and equipment allow the ships to safely operate in cold conditions.

Jakob Christiansen, head of retrofit and newbuilding R&D at SAL Heavy Lift, comments: "We developed and optimised various vessel details, especially in relation to the hull form and propulsion system, in close co-operation with the renowned Naval Architecture faculty at the Hamburg University of Technology. Tank performance tests revealed that we have created one of the world's most efficient hull forms for a vessel of this size – outmatching all existing heavy lift and MPP vessels."

Hybrid propulsion system

In addition to the optimised hull design, the Orca class vessels will have an innovative hybrid propulsion system supplied by Finnish technology group Wärtsilä that will minimise CO_2 emissions.

The system will feature a variable-speed Wärtsilä 32 methanol dual-fuel main engine, making the ships among the first to be prepared to operate on methanol and, according to Wärtsilä, also the first methanol capable ships to employ a variable-speed main engine. If green methanol becomes available in key ports as anticipated towards the end of the decade, the Jumbo-SAL-Alliance will be able to offer its customers carbon-neutral transport solutions.

The hybrid system also includes energy storage, a PTO/PTI generator and motor, a multidrive converter, and the Wärtsilä energy management system for controlling and optimising the hybrid operations. The energy storage system (ESS) will be based on lithium-titanium-oxide (LTO) batteries, which Wärtsilä says can handle higher amounts of deep cycles than normal lithium-ion-based systems. It is anticipated that the ESS will significantly reduce fuel consumption and minimise engine load fluctuations through peak shaving during operations in rough seas.

At a service speed of 15knots, SAL Heavy Lift expects the Orca class vessels to consume significantly less than 20tonnes of fuel oil per day – similar to far smaller-sized and geared MPP vessels. Alternatively, the company says, the vessels will be able to trade at a slow, ultra-efficient speed of 10knots at 6tonnes while still being able to reach a maximum speed of 18.5knots for pressing deliveries – if a wind farm installation vessel is waiting for an urgent component delivery, for example.

For each vessel, Wärtsilä will also supply the gearbox, the controllable pitch propeller (CPP), the bow and stern thrusters, air shaft seals, as well as the sterntube and bearings.

Smart cranes

Two all-electric 800tonne Liebherr LS 800 E cranes specifically designed for this ship type can handle cargo items weighting up to 1,600tonnes in tandem. Apart from fulfilling the demanding operational requirements and different cargo scenarios, the cranes enable significant savings in smart interaction with the innovations on the ship side, according to SAL Heavy Lift. The LS 800 E actively communicates with the ship's energy management system and thus enables intelligent energy utilisation. Recovered energy is fed back into the ship's ESS so that it can be released when energy consumption is high again. This leads to a noticeably reduced fuel consumption and a considerable reduction of CO_2 emissions.

The entire power electronics of the drive system are installed inside the cranes. This allows the limited space below deck to be used for other purposes and facilitates the integration of the crane into the ship's design. The integration of the drive concept inside the crane also significantly increases the durability of the components, as they are protected from the weather. "The reliability of the cranes is extremely important for heavy lift vessels. They must function for the entire life of the vessel," points out Harren.

And despite extremely high crane pedestals of more

TECHNICAL PARTICULARS ORCA CLASS	
Length oa	149.90m
Length,bp	142.27m
Breadth, moulded	27.20m
Moulded depth	16.70m
Draught	8.5m
Deadweight	14,600t
Cargo gear	2 x low noise, fully electric cranes; each 800t SWL (in combination 1,600t); auxiliary hoist 60t; sling hoist 10t, man-riding certified
Hatch cover	Pontoon type, heavy duty, floatable, quick acting spreader handled
Tweendeck cover	Pontoon type, water ballast-able, quick acting spreader handled, 4 adjustable heights
Number of holds	1
Dimension of hold	107 x 18.5 x 13.3m
Volume of hold	23,600m^3
Free deck space	3,330m^3
Permissible deck loads acc. DNV STN-001	Weatherdeck 10t/m^2; tween-deck 8t/m^2; tanktop 18t/m^2
Main engine	1 x Wärtsilä 32 (methanol dual fuel)
Service speed	15knots
Class notations	Ice Class 1A (Finnish / Swedish), strengthened for heavy cargo

THE ALL-ELECTRIC LS 800 E HAS A LIFTING CAPACITY OF UP TO 800TONNES

than 11m, the overall crane height and thereby the vessel's air draft remains at just about 38m, making it possible for the vessel to enter strategically important ports worldwide.

Siemens Gamesa Renewable Energy reports that it is impressed with the flexibility these new vessels represent, noting that its business is a complex one, challenged by rapid globalisation as well as the increasing size and weight of turbine components.

"The Orcas meet several of the company's anticipated medium- to long-term transportation challenges," observes Christian Johansen, global commodity manager at Siemens Gamesa Renewable Energy, "and we see their ultra-efficient profile and carbon-neutral potential as a perfect fit with our aim of decarbonising our supply chain." ■

'SMARTER' MONOPILE INSTALLATION

With the offshore wind industry facing significant installation challenges due to the increasing size of monopile foundations, Rotterdam-based ship designer Ulstein Design & Solutions BV says that it has introduced a safer, smarter and more competitive solution for their transportation, upending and installation using dynamic positioning.

According to the company, its U-STERN system enables longitudinal storage of monopiles and upending in the ship centreline. This allows the ship to head into the waves during the installation process, thereby minimising ship motions and fuel consumption, while still providing shielding from waves.

Ulstein adds that by combining the U-STERN with transverse and longitudinal skidding systems, offshore lifts for monopiles are eliminated, as the main crane is only used to support the upending and lowering of the foundation.

Finely tuned

The U-STERN looks like a simple recess in the stern. "But it is much more than that," explains Ko Stroo, lead naval architect at Ulstein Design & Solutions. "The shape and location of the recess are finely tuned with CFD and motion analysis to make it work in harmony with the crane and mission equipment."

Stroo adds that more than two years of R&D have enhanced Ulstein's understanding of how to improve the dynamics associated with DP monopile installation. This, he says, has resulted in the U-STERN having significant benefits over 'traditional' monopile installation on the side of a vessel, including increased operability due to a 25% reduction in motions and 50% power reduction in DP operations.

The U-STERN is not a 'one-trick pony' however, as the vessel is also suitable for jacket installation and other heavy lift installation work. ■

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DECK & CRANE MACHINERY

DRYDOCKING PRE-INSPECTION AVOIDS FUTURE PAIN

Pre-docking inspections provide an increasingly powerful means of ensuring a successful drydocking, according to MacGregor

Sometimes costly, periodically mandatory and ultimately inevitable, the drydock is part of the normal life of a ship. However, with days in dock also experienced as lost earnings, the stakes are high for what is a rare opportunity to deal with the safety, environmental and efficiency issues that cannot be handled in service.

MacGregor recently created a new drydocking superintendent function within its organisation to provide internal and customer-facing focal points for project delivery. The load handling specialist says that adding new oversight changes the nature of its drydocking service relationship with clients and offers a chance to increase mitigation against the risk of late ship redelivery.

Among those filling the newly formalised 'Drydock Superintendent' role are Luca Andreozzi and Kai Büsing, two individuals with long industry experience who have been appointed from within the MacGregor ranks. Both superintendents co-ordinate drydocking to support MacGregor's broad portfolio of cargo access and load handling equipment, liaising with the supplier's teams of locally based experts who support shipyards and owners in maintaining OEM-based equipment performance standards.

Büsing says that MacGregor is now offering to start planning as much as a year ahead of a scheduled drydock, to ensure that all parts are fully tested, approved and in position for timely installation.

"It's no secret, with supply chains routinely disrupted, that ordering steel parts that must be fabricated or sophisticated electronic parts should be done on a 'sooner the better' basis," comments Andreozzi. "Late redelivery after a drydocking is counted in off-hire time and resulting costs."

With Andreozzi covering ships drydocking around the Mediterranean, and Büsing mainly focusing on Germany, the superintendents offer different accounts of customer attitudes and expectations where repair services are concerned. However, both emphasise pre-docking inspection (PDI) as an increasingly powerful tool for ensuring that drydock work is planned for relevance, thoroughness and time efficiency.

Formal approach

"Crew report maintenance issues to the ship's owner or manager on continuous basis, while marine engineers are renowned for their resourcefulness in getting machinery working," says Andreozzi. "However, checking equipment prior to drydocking against the operating manual to establish condition, based on safety parameters, potential operating risks and repair requirements need a formalised approach."

"After the engine, the readiness of the handling and access equipment to do its job will determine whether the ship itself can work," adds Büsing. "In simple terms, if the quarter deck is stuck in the open position, then the ship can't leave port, but suboptimal equipment performance is also of relevance to the charter party

MEN AT WORK ON A HATCH COVER. THE PDI ALLOWS MACGREGOR TO IDENTIFY CURRENT ISSUES LONG BEFORE THE DRYDOCKING AND MAKE ITS RECOMMENDATIONS AHEAD OF TIME

agreement, or the vessel's attractiveness for future hire. Our focus is to maximise our operational availability and to minimise unplanned downtime."

Where the conventional approach will see planning based on experience, owners will wait for the drydock to take full stock of requirements. The PDI allows MacGregor to identify current issues long before the drydocking and make its recommendations ahead of time. "We are not in direct contact with individual ships as such, but as ex-service engineers we are fully aware of the nuances involved in the dialogue," says Büsing.

Once the PDI is underway onboard, capturing digital images is a key part of establishing the real condition of equipment in service, he says, so that effective maintenance can be planned for – "not just general requirements based on its age".

Planning resource

In a complementary part of the process, MacGregor's newly framed pre-inspection service is reflected by new drydock functionality in its CRM that is helping it make better use of records, according to Andreozzi.

"We are anticipating forthcoming surveys and liaising directly with customers to share our insights with them on what their needs will be and the advantages of planning for potential solutions. We already have the service reports for our equipment in the system to access before we go onboard."

Sometimes, customers use competitor services so MacGregor may not have access to all documentation, Büsing acknowledges, while Andreozzi says that customer records may not always be exhaustive.

Nevertheless, the PDI is a "value add" just because it works from the most comprehensive records available to the OEM and provides a platform for better drydocking management for the client.

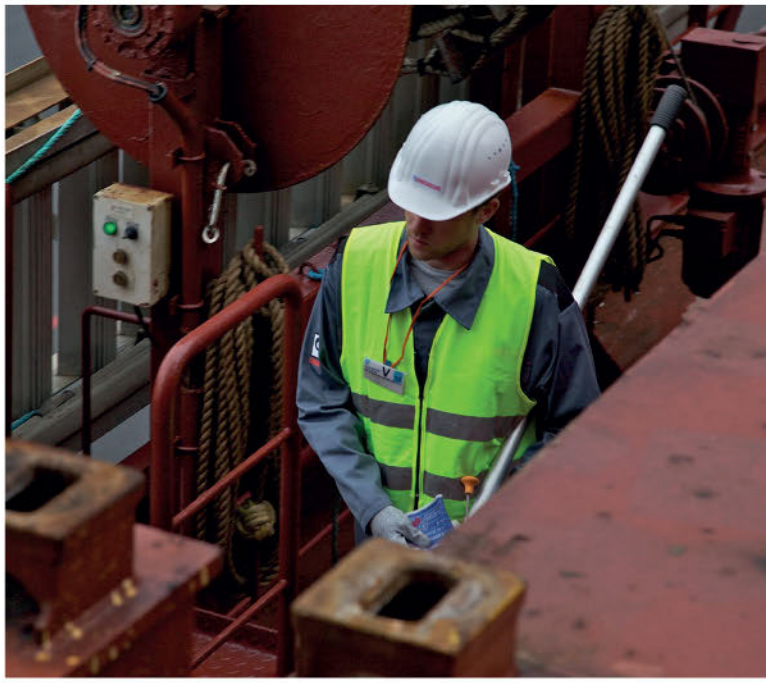
"Over the years, MacGregor has supplied equipment for installation onboard something like 30,000 commercial ships, so you can see that pre-inspection service capability is significant for drydocking efficiency – for us but also for a reasonable slice of commercial shipping," Andreozzi observes.

Andreozzi says around half of the drydocking projects he has been involved in over the last 12 months have taken advantage of the PDI approach. Büsing says that customers quickly appreciate the PDI service when planning for complex jobs.

However, Büsing adds that customers can overlook benefits where straightforward maintenance is concerned. "Customers will feel comfortable taking care of hatch cover renewal or deck machinery maintenance and see the PDI as only relevant when they know that cranes or steering gear need to be repaired or upgraded."

Simplicity itself

"The pre-docking inspection gives MacGregor the opportunity not only to assess and co-ordinate parts



SERVICE MAN CARRYING OUT AN INSPECTION IN PORT OF BREMERHAVEN

dispatch, but also to co-ordinate where and when those parts are most usefully delivered, and at what point MacGregor personnel should attend the docking project," adds Andreozzi. The PDI also offers an opportunity for MacGregor to give clients fair warning of obsolescence or any approaching non-compliance issue where their shipboard systems are concerned.

"In a recent case involving a post Panamax container ship, we identified that steering gear pumps were obsolete four months ahead of drydocking. While the system was still functional, our health check led on to pump exchange and refurbishment being included seamlessly in the drydocking. That project led on to another with the same owner."

Andreozzi points out that an owner ordering well in advance of a drydocking is also less vulnerable to price inflation than one seeking parts for immediate delivery, adding that the moderate costs associated with a PDI can be quickly dwarfed by a hard to find spare.

But so convinced is MacGregor that the PDI approach works that the company is offering daily inspection prices that are not only fixed but deductible from the cost of spares over a pre-agreed minimum.

"I think it's fair to say that once we get the PDI service in front of customers they immediately see benefits," adds Büsing, "but perhaps they still don't recognise the full potential. They see that doing this now and saving two weeks off-hire later is a clear win, but still struggle with the cost of travel for a service engineer. That's why we came up with the fixed day rate offer that is also deductible."

"If you bought a certain number of spares, I suppose you could look at it as a free pre-inspection," comments Andreozzi. "But I think it's really more of an acknowledgement that the PDI has mutual benefits for both sides." ■

PAINTS & COATINGS

MARINE COATINGS ARE VITAL TO ENABLE SHIPPING'S FUTURE FUELS TRANSITION

By **Hirokazu Kaji,** technical division director, Nippon Paint Marine

There is no 'silver bullet' to secure shipping's decarbonisation, but it's fair to say that future fuels dominate much of the sustainability conversation in the industry and across the supply chain. Whether it's discussion of increasingly common LNG, methanol, and biofuel solutions, or less developed alternatives, such as hydrogen and ammonia, the delivery and uptake of viable low- and zero-carbon fuels will be essential to meeting the industry's decarbonisation targets.

Of course, decarbonisation efforts have a regulatory imperative now, following this year's implementation of the CII and EEXI rules, the expected revised greenhouse gas (GHG) strategy and interim targets from the International Maritime Organization (IMO) in July, and the impending inclusion of shipping in the EU's Emission Trading Scheme (ETS) next year. All these regulations require action today to begin decarbonising the industry.

However, the road to viable future fuels will be a much more long-term process. It will require the development of a sophisticated green shipping value chain, including the development of new bunkering infrastructure, the associated regulatory standards, as well as the collaboration of all industry stakeholders to manage the transition. What's more, the cost of fuelling a vessel in the future with an alternative fuel may be – in some cases – 300% more than today.

Both these factors highlight the importance of adopting proven clean technologies that can enable shipowners and operators to reduce emissions in the immediate term, as well as manage the fuel transition to in the future, by driving operational efficiencies that mitigate the exponential increase in the cost of future fuels.

Exponential cost increases are coming

The World Shipping Council identified six critical regulatory and economic pathways to achieving net-zero shipping, all related to zero greenhouse gas fuels. Pathways that need to change or be created include a full well-to-wake lifecycle analysis of fuels, incentivising

IMAGE TAKEN IN MAY 2023: APPLICATION OF NIPPON PAINT MARINE'S FIVE-YEAR AQUATERRAS SYSTEM ONTO A CRUISE SHIP

adoption of alternative fuels, newbuild standards for ships using low- or zero-carbon fuels, and research and development into shipboard and shoreside systems to ensure the safe use of alternative fuels.

Developing the green shipping value chain will be exponentially more expensive than the current bunkering supply chain. The co-chair of the World Shipping Council estimates that the maritime industry will need to spend around US$3 trillion on new ships and fuel systems if it is to reach the goal of zero-emissions shipping.

There are also still significant uncertainties over the availability and price of future fuels. A lack of confidence in greener fuels impacts demand at present, with concerns around the potential for health, safety, and environmental concerns, higher costs, lower energy density and limited availability at ports.

However, some companies are forging ahead with their future fuel plans; Maersk is a notable example. Last year, the company placed an order for six methanol-fuelled 17,000TEU vessels continuing its green transformation by adding to a previous order of 12 15,000TEU ships which are due to start delivery in Q4 2024. However, Maersk has stated that it could cost US$1,000 per tonne for the vessels to operate using methanol and many of the ships will not run on methanol for the foreseeable future of their operation.

Considering that it takes two tonnes of methanol to get the same calorific value as one tonne of HFO (19.7 MJ/kilogram compared with 41.8 MJ/kilogram for HFO), the 'real' price to operate one of these methanol-fuelled vessels is more likely to be US$2,000 a tonne; over 300% more than current VLSFO prices, and over 200% more than MGO prices.

Considering this market dynamic, shipowners and operators need solutions that can reduce fuel consumption and the cost of operation to account for the exponential price increase of low- and zero-carbon fuels above current fuels. Charterers and cargo owners also want to charter the most efficient vessels and so there is a wider commercial imperative for shipowners to demonstrate higher levels of operational, environmental, and cost efficiency.

Marine coatings drive impact

Vessel marine coatings are one of the oldest and most widely used clean technologies to improve operational performance, provide greater fuel efficiency and reduce emissions in the maritime industry. Every vessel must have a hull coating, which provides the shipping industry with a unique and ubiquitous opportunity to reduce fuel consumption, its associated costs and emissions through the latest anti-fouling technology. Implementing an effective, proven low-friction antifouling coating can reduce fuel costs and emissions in service by up to 10% when compared to the use of conventional antifouling paints without biomimetic Hydrogel technology. Companies can then redirect this saving towards further decarbonisation initiatives and improve CII ratings.

These operational efficiencies can help companies to manage the costly transition to alternative fuels in the future. Laying the groundwork by adopting clean technologies like a marine coating will help improve operational performance and free up money to spend elsewhere in the business – for example on bunkering future fuels. However, while the diversity and availability of clean technologies is wide, it is important that shipowners and operators look to adopt proven solutions based on thorough due diligence and analysis, to ensure the claimed efficiency savings will become a reality.

The importance of robust R&D

Despite the urgency to reduce emissions, shipowners remain sceptical about the impact and viability of clean technology. This is largely based on a lack of R&D, leading to disputed verification of efficiency claims made by some companies, plus other concerns around investment of cost, time and energy when it comes to installation.

Finding proven solutions amidst a diverse market of clean technologies is achievable and it is important to work with manufacturers that demonstrate rigour in the R&D and testing processes and can verify the efficiency savings and impact that they claim to deliver. For example, Nippon Paint Marine operates at the forefront of technical innovation, investing in state-of-the art R&D facilities and blending learnings from the pharmaceutical industry with consideration for the environment to develop new solutions. One such solution is AQUATERRAS, the world's first completely biocide-free and proven self-polishing underwater foul-resistant coating that uses the science and materials used in medical anti-thrombogenic polymer technology, where hydrophilic and hydrophobic micro-domain structures actively combine to naturally repel any biological adhesion onto the hull's surface. AQUATERRAS's surface is smooth and flat due to its biocide free formulation, as biocides such as copper or cuprous oxide are often comparatively rough.

Taking advantage of proven clean technologies will help companies be more competitive, drive greener operations, help recoup costs and ensure their compliance with future regulations. Making a start on these aims today will help pave the way for a greener industry tomorrow and enable shipping to meet its 2030 and 2050 decarbonisation targets.

Fuel efficiency will be crucial on the road to net zero, as the industry moves towards alternative fuels, which will have much higher cost implications. Marine coatings will play a key role in helping organisations to meet their sustainability goals, whilst also remaining profitable. What's more, with significant uncertainties remaining over the wide availability of future fuels, established and proven clean technologies like marine coatings can ensure that companies are able to begin driving meaningful emissions reductions today, regardless of what the future may hold. ■

INDUSTRY COLLABORATION IS KEY TO KEEPING HULLS CLEAN

By **Catherine Austin**, I-Tech AB and International Antifouling Conference moderator

Today, marine antifouling coatings play a more important role than ever in shipping's decarbonisation journey. The adhesion of microbial slimes, macroalgae and hard-shelled organisms such as barnacles on the underwater surfaces of a vessel can significantly increase a vessel's fuel consumption if operating at a set speed, or significantly reduce a vessel's speed if operating on fixed shaft power.

Biofouling prevention isn't a new challenge. It is something that the operators of vessels have faced for hundreds of years. The bad news is that it's a challenge that is not going away any time soon. In fact, with ocean temperatures rising on a global scale, marine biofouling risk will only increase further as global biofouling "hotspots" increase in size and severity. This means that vessels are increasingly at risk of the negative impacts of biofouling on ship efficiency and operating costs.

Antifouling coatings provide the first line of defence against marine biofouling prevention on underwater surfaces. This remains to be the technology of choice for protection against unwanted marine visitors looking to set up home. Antifouling coatings have been used with great effect, their complex chemistry providing ways and means for active agents to leach out to prevent organisms from attaching, or through the use of slippery compounds that do not allow organisms to get a grip on the coated surface.

However, with intensifying biofouling pressures in the marine environment comes greater pressures on antifouling coatings to deliver continuous protection, regardless of varying levels of biofouling pressure that a vessel might encounter when trading. For large, ocean-going cargo ships this time period could be up to 60 months. This means that antifouling coating technology must continue to evolve to meet the changing needs of vessels now, and in the future.

Coating systems that make use of biocides are the most common type utilised today. However, the number of approved biocides available to paint manufacturers has significantly decreased during the past decade. Therefore, finding novel ways to utilise the current biocide toolkit available is a core component of the evolution of antifouling coatings. Collaborative R&D work between suppliers and between suppliers and antifouling coatings developers is key to this evolution. It's a very exciting time to be in the biofouling prevention community.

When this community came together in late 2022, gathering at the inaugural International Antifouling Conference, they voiced the belief that collaboration between technology providers and their suppliers is key if the required evolution of antifouling coatings to meet the industry's needs is to be realised. The conference marked the first time that the marine biofouling prevention community had gathered, in person, for four years.

Competitors in the commercial space, academia and end users agreed that working together to develop the best line of defence against biofouling is essential. They also agreed that the expansion of the antifouling toolbox to include emerging novel solutions is essential to ensuring that antifouling coating solutions offer the best protection in intensifying biofouling conditions.

The success of the inaugural conference put it on the map as one of the key platforms for anyone working in the field of marine biofouling prevention, particularly wet antifouling coatings, to meet and exchange ideas and insights into novel concepts.

As such, I-Tech and RISE (Research Institutes of Sweden) will bring the best minds in the antifouling coatings industry, ship operators and academia together in Gothenburg, Sweden, for the 2nd International Antifouling Conference this September to explore collaborative pathways and novel approaches towards marine biofouling prevention.

For I-Tech, our interest in organising and hosting this conference sparked from our belief that collaborative R&D efforts between biocide suppliers play a key role in supporting the optimisation of future antifouling coating technologies by providing proof of concept and initial R&D findings. We believe this can enable coating manufacturers to fast track product development and improve antifouling performance.

THE INAUGURAL INTERNATIONAL ANTIFOULING CONFERENCE WAS HELD IN 2022

HULL COATING SPECIALISTS WILL MEET AGAIN IN 2023 TO DISCUSS THE FUTURE OF ANTIFOULING

Our technology, Selektope, is added into marine paints to deter barnacle attachment to vessel hulls and niche areas. Therefore, evolving and enhancing the ways that our technology can be used in the coatings technologies developed by our customers across as many different potential application scenarios as possible is the only way forward.

To support this, our R&D team continues work across successful collaborative projects undertaken with fellow antifouling technology developers. In December 2022, we announced that our R&D team and the global specialty chemical company LANXESS had successfully combined their respective antifouling technologies for the first time with promising results. Static tests of antifouling coating formulations containing Selektope and the SEA NINE™ family of biocides were conducted in multiple marine environments worldwide with differing biofouling risk. Positive results obtained have provided proof of concept. Additionally, a data pool of coating formulations has been developed that can be used by antifouling coating manufacturers to support the trialling of new combinations of existing, available biocides without the need to conduct initial R&D exploration activities.

Also, over the past five years, our R&D team and scientists from the Research Institutes of Sweden have undertaken a series of projects to improve the use of Selektope in biocidal antifouling coatings, looking to the past for inspiration on what elements made antifouling coatings successful, or not.

In the past, superior antifouling efficacy was also achieved when a biocide was attached to a polymer chain with a covalent bond that was hydrolysable upon contact with water. This was the release mechanism that gave tributyltin (TBT)-containing coatings their success before the ban on the use of TBT came into force in 2008. Although the controlled release of Selektope in SPC coatings has been proved successful with multiple products commercialised and over one thousand vessels using Selektope-containing coatings to-date, researchers from I-Tech and RISE set out to develop a way of attaching Selektope to a co-polymer chain via the creation of Selektope-containing monomers that could be polymerised.

Static in-water tests confirmed the successful creation of a Selektope-containing monomer that was then polymerised to create the co-polymer chain with Selektope attached. This marked a significant achievement in the antifouling coatings sector as it expands the antifouling biocide toolbox. Proving this concept in silicone-based foul release coatings will be the next focus for I-Tech.

This is just one small corner of innovative, collaborative approaches underway in the field of antifouling coating chemistry that we are involved in. There are many more, many of which will be explored in September at the International Antifouling Conference. Join us!

The International Antifouling Conference 2023 will be held on 12-13 September in the iconic Eriksberg shipyard area in Gothenburg. The conference is sponsored by Stena Bulk, Stena Teknik and LANXESS. The charity partner for the conference in Mercy Ships and the esteemed media partner for the conference is the Royal Institution of Naval Architects (RINA). ■

For more information on the International Antifouling Conference 2023, please visit https://antifouling-conference-2023.confetti.events

SHIPBUILDING TECHNOLOGY

MANAGING COMPLEXITY: WHY SHIPBUILDERS NEED PLM TO UNLOCK THE POTENTIAL OF DIGITAL ASSETS

By **Ludmila Seppälä**, business development director, Cadmatic

Cadmatic has been at the forefront of solutions for ship design and shipbuilding since the early 1980s, advancing the field along with the IT-enabled capabilities of CAD and digitalisation. Earlier this year, Cadmatic and CONTACT software entered into a strategic OEM partnership, aimed at delivering a significant industry-first to the market – the first shipbuilding-specific PLM (product lifecycle management) solution. This is the start of a major transition within the industry to fully realise the value of digital assets and the digitalisation of processes. It's also the first step on a mission to develop digital transformation expertise and capacity that's specific to our industry – rather than transferred in from other disciplines such as automotive or process engineering.

LUDMILA SEPPÄLÄ, CADMATIC'S DIRECTOR OF BUSINESS DEVELOPMENT

Why is this such as big deal? As we all experience on a daily basis, ship design and building are already complex processes, requiring collaboration between hundreds – if not thousands – of people, across the world, in different languages, over the course of several years, millions of parts, thousands of drawings and millions of dollars. For some smaller nations with significant shipbuilding industries, the delivery of a big vessel can be detected in an annual rise in GDP – such is the scale of these projects.

Managing the information within these projects is essential to their success, both in terms of commercial performance, delivering vessels to specification and budget, and delivering the performance and safety the industry needs. It's also becoming a tougher challenge as time goes on, as new vessels need to integrate new fuels, new green technologies, and do it all faster than ever thanks to accelerating regulations and sustainability goals. Digital transformation is what keeps these gargantuan, sprawling projects on track.

Why do we need a shipbuilding-specific tool? Product, data and processes

PLM is most commonly known as product lifecycle management, but when applied to the shipping industry, it might be better known as process lifecycle management. Tools for the automotive or airline industries, for example, operate on a product basis. In the example of a car, there is extensive research, design, and prototyping, and then once the design is complete, millions of the same car can then be produced. Aircraft design follows a similar pattern.

When it comes to shipbuilding, however, every vessel is a one-off, designed to fit a specific commercial need or brief. Even between sister vessels, there is a limited amount of design information that anyone can copy across. At the same time, because of the pressures to keep shipyards fully utilised, a yard may well be designing and beginning to cut steel for a vessel at the same time; a shipyard cannot afford to have a slipway empty, losing money. This is a fundamentally different dynamic, and a much less linear trajectory, to how these projects function in other industries – and a reason why we need dedicated software and processes for shipping.

Having control of the product data and processes can significantly affect the time of execution, workload, and commercial profitability of the shipyards.

Document-driven versus data-driven

It can take between one and five years for a ship to go from concept to steel cutting. Over that time, there might be anywhere between 500 to several thousand people working on the project, handling 1-5 million separate parts, each of which has a separate data trail and set of documents attached.

Much of this complexity is handled within a 3D CAD design, and associated documents. It's essential that project managers can access both the design and the associated documents for each part, and can track who has signed off what, when and how.

For example – if someone decides that a certain pump is unsuitable, and the vessel needs another one from another manufacturer with different characteristics. This then creates a chain. Someone needs to check the

new specification of the pump, to see if it is what is needed, and then replace the pump in the 3D model. Someone else needs to ensure the connections to the pipe fit – then someone needs to sign off on all of this. In a typical shipbuilding project, there could be 50,000 of these situations going on simultaneously. From a project management point of view, it's essential to have visibility of what's going on and who approved what; which then creates points at which managers can control the process.

In addition to being highly complex, shipbuilding is a document-driven industry. When a project is first agreed upon with the shipyard, they will make a project delivery timeline, outlining which drawings etc. will be received by which date, the first of many, many more interrelated documents to come. Matching up these documents with each other and with rapidly evolving 3D model is no easy task. Thanks to the number of variables involved, there can often be significant deviations between designs 'as engineered', 'as visualised', 'as designed', and 'as built' if projects aren't carefully managed. Cutting down on this variation is one of the major challenges of data and process management.

Making intelligent connections

So how can we build a framework that works for shipping, and turns this complexity into some sort of order? The essential challenge isn't simply to put all the data in one place – it's to build meaningful connections between the data model and documents, and all the information involved.

Building these meaningful connections is the focus of our strategic OEM partnership. CONTACT's Elements platform offers a wide portfolio of future-proof, PDM-specific applications. Cadmatic will build on this to add shipbuilding specific expertise to make the best use of this technology, flexibly expanding and adapting solutions according to shipbuilding requirements. If the sheer amount of information in each product is a data lake, it will require shipbuilding-specific knowledge to fish in it and catch the most useful insights.

Handling this data is where shipping-specific expertise is so essential. Shipbuilding CAD is very specific – individual parts aren't stored together, but instead as topological relation between parts, in which every element is linked with many others. Only by creating a solid platform for storing the data – and adding industry-specific intelligence on how to fish in the data lake – can we maximise the benefits and create the solution the industry needs.

Adding lifecycle management into the picture

The benefits of dedicated PLM go beyond project managing the design and construction of a vessel. Currently, beyond the sea trials and first year of a vessel's operation, a yard bears little responsibility for a vessel's performance. After that first year, for the next two or three decades of a vessel's lifetime, owners and operators need to painstakingly reconstruct a vessel's design data to handle services like hull cleaning, retrofits or other maintenance activities. Whole industries have sprung up to recreate datasets that already exist at the design stage. Building a shipping-specific PLM system enables the creation of a digital twin that owners and operators can then use effectively throughout the lifetime of their ship – creating another way that yards can add value to the process. PLM allows yards to be more agile in adopting these technologies or delivering retrofits to future-proof fleets. In parallel, managing PLM on one platform helps shipyards adapt to the industry-wide digital transformation – digitising key processes to extract insights and manage them more closely.

This, again, is distinct from other industries. In process manufacturing, the party designing a factory will often be the same one that manages its entire lifecycle, from production all the way to decommissioning. In the automotive industry, car manufacturers are using digital twins to better service cars for longer, throughout their lifecycle. Dedicated lifecycle management for shipping enables the industry to do exactly that – to manage a vessel effectively throughout its lifecycle, in a way shipping has been unable to before.

Shipyards are hubs that house a range of dedicated expertise and skills – engineering, IT, project management and more. PLM systems designed for shipbuilding will be the foundation for making the most of these skills as yards deliver the fleets of the future. ■

SMARTER AND MORE PRODUCTIVE SHIPBUILDING WILL HELP DELIVER THE FLEETS OF THE FUTURE

SOURCE: SHUTTERSTOCK

SHIPBUILDING TECHNOLOGY

SUSTAINABILITY IN SHIPBUILDING: PROMOTING CLEAN AND GREEN SHIPYARDS FOR A ZERO-EMISSION MARITIME FUTURE

By **Capt. Dr. Seyedvahid Vakili**, research associate, World Maritime University (svv@wmu.se) and **Professor Dr. Aykut I. Ölçer**, director of research, World Maritime University (aio@wmu.se)

Shipyards are usually placed near to cities and act as an economic driver for their development, while cities provide the necessary resources and infrastructure for shipyards. However, shipbuilding is a polluting industry that threatens the sustainability of cities. There is a lack of research looking at the interconnectedness of shipbuilding and cities, and less attention is paid to the sustainability of the shipbuilding industry. Shipbuilding produces waste, pollutants and air emissions, all of which have negative impacts on human health and the environment. To minimise such negative impacts it is crucial that shipyards promote sustainability and follow the "sustainable concept" within their portfolio.

A shipyard is an industrial production facility that uses materials and energy to design, build, repair, maintain and decommission ships. Shipbuilding processes include cutting, bending, welding, sandblasting, painting and coating, which are complex, energy-intensive and have significant environmental and climate impacts. The industry accounts for about 4-8% of the lifecycle carbon dioxide emissions of ships and 29% of carbon monoxide emissions. There are also emissions of volatile organic compounds (VOCs) that form tropospheric ozone, which is dangerous to humans and nature.

Shipping is becoming a "green", "zero-emission" industry, in line with the commitments made in the IMO's initial strategy to reduce greenhouse gas (GHG) emissions from ships. International regulations currently focus on the operational phase of the industry, which has the largest climate impact during the lifecycle of a ship. As the environmental impact of this phase decreases, the contribution of the shipbuilding

industry to climate change is expected to increase. It is therefore important to reduce the negative impact of energy consumption during shipbuilding. With a view to reducing air emissions from the operational phase, considering the emissions from shipyards during the stages of construction, maintenance, and disposal is crucial in effectively mitigating air emissions across the entire lifecycle of ships. These emissions can account for over 50% of the total emissions produced throughout a ship's lifecycle. For example, a battery-powered ferry using electricity from the Norwegian grid has a higher carbon footprint throughout its lifecycle than during its operational period. Given the above, one can imagine the future with a complete "cradle to grave" approach, covering the entire lifecycle of the ship from the construction phase to the scrapping, for reducing CO_2 emissions in the maritime industry.

In light of the above there is no comprehensive approach to reducing CO_2 emissions from shipbuilding and to managing air emissions from ships throughout their lifecycle (construction, operation and dismantling), and all IMO regulations are focused on the operational phase of ships. However, if the aim is to promote "green", "zero-emission" and "sustainable" shipping in order to reduce air emissions from shipping, the cradle to grave approach to reducing air emissions from shipbuilding must be taken into account. In order to promote green shipping in the context of the lifecycle approach, the World Maritime University (WMU) conducted research and established new definitions and taxonomy for a sustainable shipyard. The research divided the sustainable shipyard into two categories, clean and green shipyards, and in order to promote green shipping from a lifecycle perspective, the study developed a holistic, systematic and transdisciplinary approach to energy management in shipyards.

Clean shipyard

Shipyard activities have negative impacts on water, land and soil. A clean shipyard applies a systematic approach and complies with international, regional and local regulations to assess environmental aspects and prevent, reduce and minimise the ecological impact of its activities on land, soil and water. The key elements of a clean shipyard in the shipbuilding industry are three Rs, namely:

- Reduction of demand in resources,
- Recycling, and
- Reuse of materials and resources.

CAPT. DR. SEYEDVAHID VAKILI, WMU

PROFESSOR AYKUT ÖLÇER, WMU

Taking into account the sustainability of materials, the lifecycle aspects of the selected materials and their dismantling challenges at the early stage of the ship design are key factors to promote a clean shipyard. The main objective of the clean shipyard is to eliminate waste in the production and support processes at the yards. If the waste is generated, these wastes should meet the requirements of environmental friendliness, recyclability and reusability. Based on this approach, a clean yard can be defined as follows: "A yard is considered to be absolutely clean when all production and supporting processes in the manufacture of a ship have zero environmental impact." However, in order to achieve a clean shipyard, the responsible entities in the shipyard need to design, develop and implement some management frameworks, such as waste management, water management, air and underwater noise management, sweat management, waste-to-energy management, industrial symbiosis and circular economy frameworks.

Green shipyard

Consumed energy in shipyards can be divided into three branches serving the production process, support process and intermediate process (such as transportation in the shipyard). Due to the energy-intensive nature of shipyards, the level of energy consumed plays a crucial role in promoting shipyard sustainability. With this view, highlighting the role of energy and the importance of reducing/eliminating polluting emissions can raise awareness among society, shipyard managers and policy makers. Green shipyards should undeniably strive to minimise energy consumption and related pollutant emissions as well as emissions of non-energy related resources, such as volatile organic compounds from coatings and paints and dust from surface treatment, cutting and welding. For this reason, green shipyards should consist of three main principles in the energy chain, namely production, consumption and conservation.

The key element of the 3E approach, i.e. Trias Energetica or one based on Energy, Environment and Economy (see Figure 1), not only reduces air emissions but also contributes to the design and implementation of a transdisciplinary EnMF (Energy Management Framework) to promote socio-economic criteria for sustainable development. To achieve such green shipyard strategies, energy sources must be used as

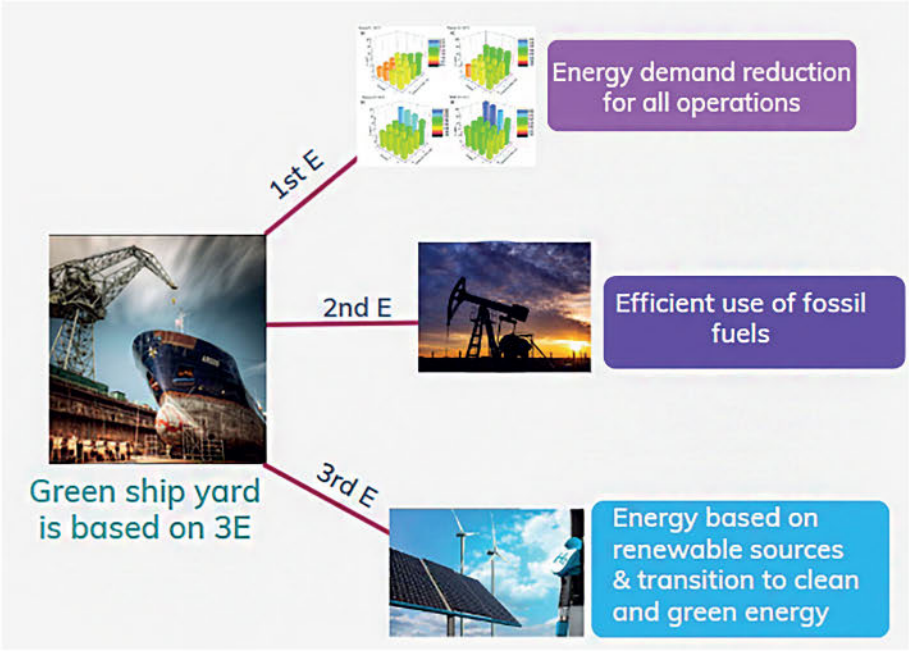


FIGURE 1. 3E CRITERIA FOR THE GREEN SHIPYARD

efficiently and sustainably as possible to minimise air emissions and improve air quality through a near-zero or zero-emission pathway. Based on the 3E criterion, the definition of a green shipyard could be the following: "A shipyard is considered to be absolutely green when all production and supporting processes in the manufacture of a ship have zero air emissions."

To attain a green shipyard, it is essential for the decision-makers (DMs) of the yard to formulate, create and execute a comprehensive energy management framework. This framework should encompass various measures and tools, collectively known as an Energy Management System (EnMS), which comprises energy production, energy performance and auditing, energy conservation, energy monitoring systems, air pollution monitoring systems, alternative clean fuels and smart micro grids. By adopting this EnMS, the shipyard can effectively achieve its strategic goals in the realm of sustainability.

On the basis of the above analysis, it can be concluded that improving the operational efficiency of a yard, e.g. through lean manufacturing, could contribute significantly to promoting clean and green yards. In addition, each single operation in individual clean and green shipyards should be carried out efficiently in order to increase competitiveness and to develop the economy. Complying with local, national, regional and international standards and adopting best practices is also a task for clean and green shipyards to be prepared for unforeseen consequences of climate change and related negative impacts. However, the process of preparing a scenario to respond to such consequences and related impacts should evaluate climate resilience, take into account the legal framework and analyse the quality and risk of the system to propose appropriate management policies and solutions. A sustainable shipyard could therefore be defined as follows: "A shipyard is considered sustainable when all production and supporting processes in the manufacture of a ship have both zero environmental impact (clean shipyard) and zero air emissions (green shipyard)."

Energy Management Framework in a green shipyard

To promote sustainability, economic and ecological values must be combined to achieve a win-win result. This needs improving in resource and energy efficiency and developing innovative solutions such as management frameworks and clean and renewable technologies. To tackle climate change, which is the priority of this century, as well as to promote human health, considering a holistic approach in sustainable energy production and energy policy are crucial, and by referring to the ramifications of climate change can justify having such a policy in the maritime energy sector. An example of such an energy policy at the regional level is the recently agreed EU Green Deal, which is based on four pillars: carbon pricing, sustainable investment, industrial policy and transition.

The EU strives to address pollution from heavy industries such as shipbuilding by adopting related policies consistent with climate change, energy and circular economy policies and by focusing on energy measures. At the industrial level, the primary concern of industrial managers is the economic prosperity, competitiveness, profit, safety and stability of their business. Due to increasing awareness about environmental aspects, stringent environmental regulations and Corporate Social Responsibility (CSR), businesses pay increasing attention to the environmental elements and strive to reduce their negative impacts by managing energy consumption. To achieve efficient energy use, every shipyard needs to have a long-term energy strategy and fulfil an energy management programme. It is clear that only a holistic and integrated approach to renewable, clean and zero-emission energies can mitigate air emissions – it is considered as a sagacious strategy

CALL FOR ABSTRACTS

imc 2023

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Organised by The Royal Institution of Naval Architects, The Institute of Marine Engineering, Science and Technology and Engineers Australia, the International Maritime Conference 2023 Program will focus on the latest developments in naval architecture, marine engineering and maritime technology; both in the areas of defence and commercial shipping.

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Author Acceptance Notification	**Friday 19 May 2023**
Refereed Paper Submission	**Monday 14 August 2023**

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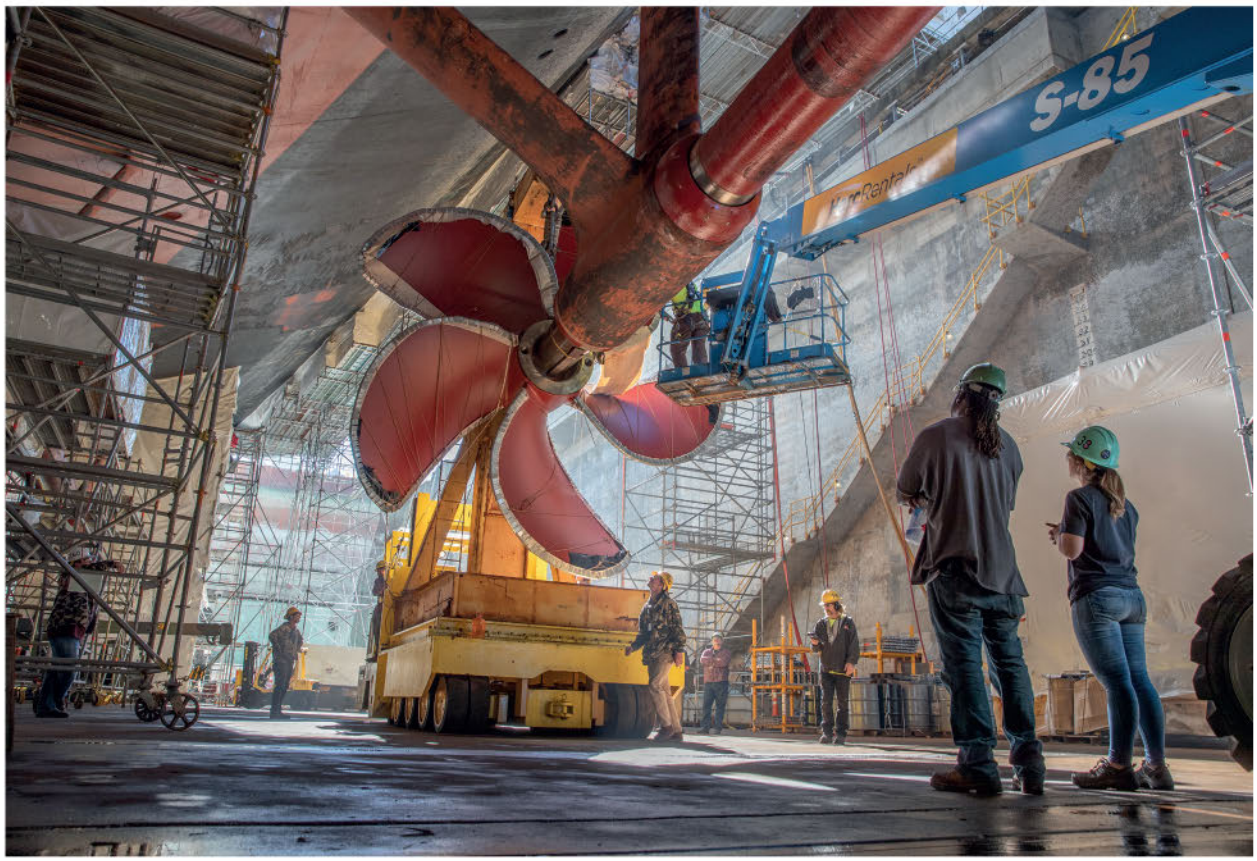
towards the clean and green processes in shipyards. Alternatively, to fulfil zero air emissions from the shipping industry, the role of lifecycle analysis in the mitigation of emissions should be taken into account. Relating to the EnMF of shipyards, it could be utilised to determine the procedures aiming to have a long-term strategy associated with energy production, consumption and conservation.

The framework provides the shipyards' managers with an opportunity to make a simple and rational decision in a complicated situation. However, in order to support the EnMF in the shipyards, the related EnMS must be appropriately adopted in the shipyards' organisations. The framework, by considering a holistic and interdisciplinary approach, could be applied to break the silos and provide depth (knowledge extent), breadth (knowledge criteria) and synthesis (integrating different knowledge/perspective into uniform knowledge/experience) to optimise the decisions of DMs. Employing the framework leads to mitigating industrial air pollutants and GHG emissions from shipyards. This type of approach promotes the "Green Shipyard" concept and supports sustainable shipping. In addition, the framework, with the lifecycle analysis of the procedures in shipyards taken into account, would support the zero-emission shipbuilding industry, green products and mitigation of emissions.

To reach the EU's ambitious goal (a climate neutral continent by 2050), developing, implementing and complying with an EnMF within shipyards can be part of industrial policy in alignment with the EU Green Deal for decarbonisation of transportation. Moreover, applying the EnMS leads to the improvement of energy efficiency and air quality and a reduction of air emissions within the shipyards which makes it a cost-effective measure in relation to the Emission Trading Scheme (ETS). Meanwhile, shifting to green technologies and using renewable sources of energy to power the shipyards is a sustainable investment that fosters job creation and promotes innovation, as well as assisting in the transition process and export of the EU Green Deal.

The EnMF can be designed and developed for different sized shipyards and other industrial sectors. Shipyard size, location and type of operations play an important role in selecting priorities for improving energy efficiency in shipyards. As flexibility is one of the key features of the framework and as there is no "one-size-fits-all" approach to improve energy efficiency, the framework could be adapted based on the shipyards' portfolio and DMs' priorities, as well as trading off between issues to adjust the framework to any size and type of shipyard. The final EnMF and EnMS for each shipyard could be designed and developed by comparing the present case and alternatives concerning the defined criteria. Multi-Criteria Decision-Making (MCDM) methods could be used to identify the best alternatives to support a Decision Support System (DSS) and assist the DMs in making more rational and optimised decisions in multi-criteria and fuzzy domains. Moreover, the



SHIFTING TO GREEN TECHNOLOGIES AND USING RENEWABLE SOURCES OF ENERGY TO POWER THE SHIPYARDS CAN BE A SUSTAINABLE INVESTMENT THAT FOSTERS JOB CREATION AND PROMOTES INNOVATION

design, development and implementation of such a holistic framework could raise policymakers' awareness to adopt policies by considering energy management to enhance energy efficiency potential and create a movement to meet the zero-emission goal in the lifecycle of ships.

An Energy Management Framework for shipbuilding, an energy-intensive industry, can improve economic competitiveness and benefits through reduced energy costs and enhanced industrial capacity in the ETS, as well as reduced socio-economic costs. It also enables capacity building and staff training in shipyards and beyond. This approach enhances the reputation of the yard in the competitive market and can act as a brand for the yard and give the yard a better bargaining position to access the required financing.

Implementation of the framework

The proposed EnMF has been implemented at selected yards, each of which has a different size and portfolio. The results show that the implementation of the framework can lead to socio-economic and environmental benefits and promote the sustainability of the shipyard cities. In addition, the results of the yard surveys show that large yards in developed countries are more sustainable than small and medium-sized yards in developing and less developed countries. In terms of reducing air emissions, large yards in developed countries had short-, medium- and long-term energy options, taking into account the priorities of the different stakeholders, that could make them energy hubs by using renewable energy and producing green hydrogen and ammonia. They also introduced sustainable business models and insisted on the long-term survival of the yard. However, small and medium-sized shipyards in developing or less developed countries focused more on the economic pillars of the business model to maximise profits for shareholders as the traditional stakeholder.

Taking the above into consideration, the potential use of solar cells, wind turbines and generators in stand-alone and grid-connected hybrid systems has been assessed for a large European shipyard. As a stand-alone system, a solar PV system yielded a levelised cost of electricity (LCOE) of 0.053($/kWh), an internal rate of return (IRR) of 11% and a discounted payback period of 6.2 years. As a grid-connected hybrid system, a solar PV, wind turbine and diesel generator configuration yielded an LCOE of 0.109($/kWh), an IRR of 28.9% and a discounted payback period of 3.53 years. The sensitivity analysis showed that cases with a configuration of generators were more sensitive to the diesel price than to the cost of renewable energy technologies. ■

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CONFERENCES

22ND CONFERENCE ON COMPUTER APPLICATIONS AND INFORMATION TECHNOLOGY IN THE MARITIME INDUSTRIES

By **Ludmila Seppälä**, business development director, Cadmatic

COMPIT 2023 INCLUDED A BROAD SPECTRUM OF ISSUES, FOCUSING PRIMARILY ON DIGITALISATION, SUSTAINABILITY, AND ADVANCED SOFTWARE SOLUTIONS IN MARITIME APPLICATIONS

The conference on Computer Applications and Information Technology in the Maritime Industries (COMPIT) is a significant international event that serves as a forum for professionals, researchers, and experts in the maritime sector. Since its inception, COMPIT has played a crucial role in providing an insightful exchange of knowledge and innovative ideas concerning the maritime industry's application of information technology (IT) and computer-based systems.

Participants at COMPIT 2023, held on 23-25 May at the Abbey Drübeck in Drübeck, Germany, hailed from various maritime industry sectors, including ship design firms, shipping companies, classification societies, software vendors, research institutions, and universities. The conference brought together these diverse perspectives to drive the development of novel solutions that can tackle the challenges faced by the maritime industry, thus enhancing efficiency, sustainability, and safety in operations.

This year, COMPIT included a broad spectrum of issues, focusing primarily on digitalisation, sustainability, and advanced software solutions in maritime applications. Traditionally, the first two days of the conference include topics revolving around design, simulation, and engineering, and the last day is focused on operations at sea.

At COMPIT 2023, the first day included presentations on the topics of collaboration platforms for vessel design, the selection of the best tools for ship design, the use of data from design to operations, model-based systems engineering methodology, OCX standard for data exchange and classification approval, CFD calculations and optimisation, practical applications of digital twins and calculation models for ice building.

On the second day, discussions revolved around integrated ship design and data management, the evolution of ship design, applicability research on using ChatGPT in ship design, European project SEUS for development of computational tools in shipbuilding, decarbonisation projects, use of advanced simulation, route optimisation and the overall use of IT solutions in shipbuilding.

On the last day, discussions were opened about the AI-based tools to guide vessel's limits in a rough sea, route optimisation for sail-assisted vessels based on environmental factors, machine learning applications for driving behaviours of electric ferries, 3D scanning for obtaining 3D hull models, use of drones to perform a hull survey, digital twin for propulsion of polar vessels and much more.

Real-world applications

One of the essential aspects of COMPIT is its emphasis on real-world application and practical relevance. The presentations and discussions often revolve around innovative solutions and their implications in actual operational settings. This pragmatic approach encourages participants to explore and understand the practical challenges and benefits of adopting these advanced technologies. In addition to presentations and discussions, COMPIT provides ample opportunities for networking and collaboration. This global gathering of maritime professionals fosters an environment of collaboration, enabling the exchange of ideas and paving the way for potential partnerships.

Over the years, COMPIT has proven itself as an essential platform for keeping up with the rapidly changing landscape of technology in the maritime industry. COMPIT is not just about current technology; it's also a venue for forecasting and discussing future trends and demystification for hype. In conclusion, COMPIT is more than just a conference – it catalyses technological innovation in the maritime industry. It encourages knowledge sharing, fosters collaboration, and promotes the adoption of advanced computer technologies, propelling the maritime industry into a more efficient and sustainable future. ■

The proceedings for this year's conference can be found on the following link: data.hiper-conf.info/compit2023_drubeck.pdf

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Historic Vessels - Sustainable Futures

28-29 November 2023, Greenwich, London, UK

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The 34th edition of our annual Significant Ships series, *Significant Ships of 2023*, will be published in March 2024. As in previous editions we shall be including up to 50 of the most innovative and interesting commercial ship designs (of mostly 100m length and above) which will be delivered during the forthcoming year.

The Editor invites shipbuilders, designers and owners to submit details of vessels for possible inclusion in *Significant Ships of 2023*. Presentation will follow on the established two-page format, with a colour photograph, descriptive text and tabular details (including major equipment suppliers) on the first page, followed by a full page of technical general arrangement plans. Initial potential entries should comprise a short technical description (100 words) of the proposed vessel highlighting the special features and the delivery date.

All entries should be addressed to:

Editor, Significant Ships of 2023,
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