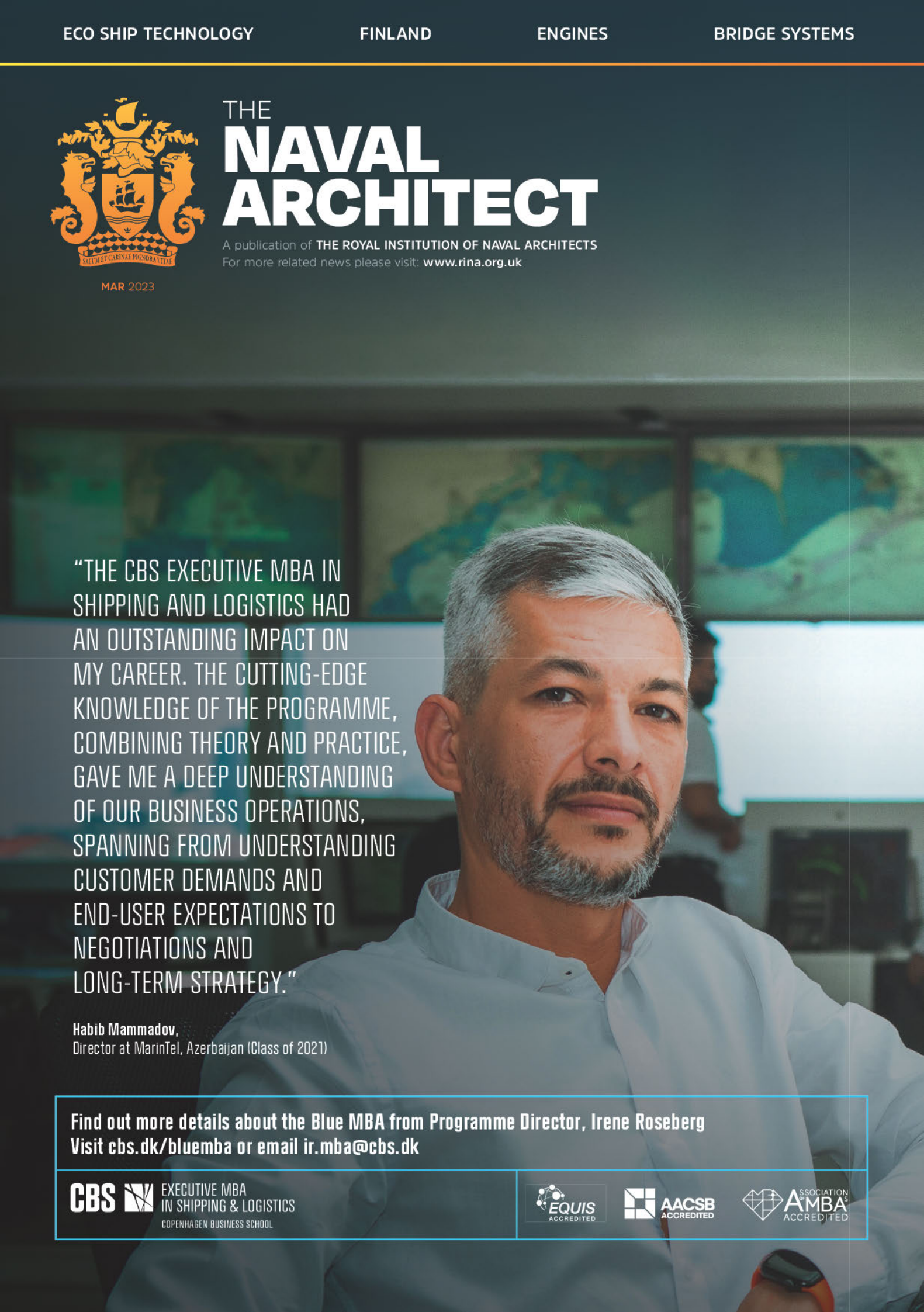
THE
NAVAL ARCHITECT

A publication of THE ROYAL INSTITUTION OF NAVAL ARCHITECTS
For more related news please visit: www.rina.org.uk

MAR 2023



CR Ocean® Engineering

CROE® MARINE SCRUBBERS

BUILT TO SCRUB ENGINE EMISSIONS

THE BEST TOOL AVAILABLE FOR SCRUBBING SULFUR EMISSIONS

For more information go to: **www.croceanx.com**

Or write to us: **dphilibert@croceanx.com**

CR Ocean Engineering, LLC. Six Campus Drive, Parsippany, NJ 07054 USA

CONTENTS

March 2023

FEATURES

THE NAVAL ARCHITECT

Editor: Daniel Johnson
Editorial Assistant: Tom Barlow-Brown
Production Manager: Nicola Stuart
Publications Sales Coordinator: Henry Owen
Publisher: Dmitriy Ponkratov

Advertising Sales: J P Media Services
Email advertising: jpayten@jpmediaservices.com
Telephone: +44 (0)1737 852135

Published by:
The Royal Institution of Naval Architects
Editorial Office:
8-9 Northumberland Street
London, WC2N 5DA, UK
Telephone: +44 (0) 20 7235 4622
Telefax: +44 (0) 20 7245 6959
E-mail editorial: editorial@rina.org.uk
E-mail production: jmorecraft@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

MOMENTUM WITH METHANOL AS INTEREST MATERIALISES INTO ORDERS

By **Daniel Johnson**

Among the various solutions being proposed to meet the challenge of decarbonising the shipping industry, the use of methanol as a bunker fuel is emerging as an increasingly popular choice. 2022 saw a surge in orders for methanol-ready ships and in October monthly orders for the vessels overtook LNG bookings for the first time. Enthusiasm for the fuel shows no sign of waning as we head into 2023 with a record number of methanol-powered ships ordered in February, according to the latest data from DNV's Alternative Fuels Insight (AFI) platform.

Highlighting the new figures on social media, DNV principal consultant Martin Wold wrote: "Alternative fuels came back with a bang in February. We added 10 more LNG-fuelled ships to DNV – Maritime's AFI database, bringing the total to 886 ships for LNG bunkering. However, it was methanol that stole the spotlight last month, with a record 22 ships ordered/confirmed!"

DNV's AFI data shows that there are currently 25 methanol-powered vessels in service, 24 of which are tankers. But orders are swiftly building in the container ship segment with it now up to 68 vessels. Through to 2028 there are currently confirmed orders for 81 methanol-fuelled ships.

While shipping giants Maersk (page 25), COSCO and CMA have been notable early pacesetters in the growing trend to order methanol-ready vessels, there is also budding interest in methanol from other segments. Construction on the first methanol-ready cruise ship, TUI Cruises' *Mein Schiff 7*, began last summer at Meyer Turku in Finland and in November Disney Cruise Line revealed that the partially built *Global Dream* would be powered by methanol when it is introduced in 2025.

In February, Norwegian Cruise Line announced that it was moving forward with plans to begin adapting its newbuilds for future use of methanol as their primary fuel, having agreed design changes with Fincantieri to prepare two cruise ships due for delivery in 2027 and 2028 to accommodate the emerging technology. Also last month, Costa Group, Europe's leading cruise operator, and methanol producer Proman signed an MoU to drive further implementation of methanol as a marine fuel for the cruise industry. The partnership aims to accelerate the energy transition and decarbonisation of the existing fleet by enhancing the supply of sustainable methanol, paving the way for the retrofitting of existing vessels to operate on clean fuel, as well as investment in methanol-fuelled newbuilds.

Those betting on methanol as a future marine fuel say that it has several advantages over other low-carbon or non-carbon fuels. Regulations, rules and requirements for its use are already available and methanol dual-fuel engines are on hand today and proven. Additionally, methanol is liquid at ambient conditions, which simplifies fuel tank design and minimises capex, and as one of the top chemical commodities traded around the world, there is already a significant number of methanol terminals globally which could potentially be used for bunkering.

RENDERING OF *MEIN SCHIFF 7*

However, while its proponents are quick to sing its praises, methanol's use as a low-carbon shipping fuel is not without its challenges. Due to a lower calorific value, it demands around 2.5 times the storage space of the equivalent HFO and 1.3 times more than LNG. The availability of green methanol and hence the cost of sustainably produced methanol is also a serious concern. There are signs that the supply of available green methanol may be ramping up though.

Speaking at the methanol industry group IMPCA's conference in February, Greg Dolan, CEO of the Methanol Institute, said: "With 80 renewable methanol projects already announced, we are seeing clear signs of an incoming wave of bio-methanol and e-methanol production." The Methanol Institute forecasts that supplies of green methanol will grow globally from less than one million tonnes in 2023 to eight million tonnes by 2027, and that overall methanol production will grow from 100 million tonnes to 500 million tonnes by 2050, out of which nearly 400 million tonnes will be bio-methanol or e-methanol.

Ultimately, methanol's success will depend on it becoming cheaper and more available which will require billions of dollars of investment in port infrastructure and fuel-production capacity in the coming years. This may be a particular challenge for cruise lines as often they do not map well on existing bunkering hubs for deep-sea merchant vessels. It also has a long way to go to rival the popularity of LNG, seen by many shipowners as the best intermediate solution to slash emissions. However, the recent swell in interest has certainly been eye-catching and will undoubtedly encourage further momentum in its uptake. ■

NEWS

MARITIME CO-OPERATION

UK AND CYPRUS SIGN MOU TO BOLSTER SHIPPING TIES

BRITISH HIGH COMMISSIONER IRFAN SIDDIQ (LEFT) AND CYPRUS SHIPPING DEPUTY MINISTER VASSILIOS DEMETRIADES

The UK's Department for Transport (DfT) and the Cyprus Shipping Deputy Ministry (SDM) have signed a memorandum of understanding (MoU) to further strengthen shipping relations between the two countries.

The agreement includes a range of commitments designed to address current challenges faced by the shipping sector and aims to stimulate economic development on a mutually advantageous basis.

With a specific focus on driving progress in shipping's response to climate change issues, the agreement will see joint scientific and technical workshops, conferences, training programmes, seminars, and courses, amongst other initiatives, implemented. Core focuses of the agreement also include maritime safety and security, and pollution from ships.

The two states are also committing to jointly address issues around piracy, fraudulent ship registrations, seafarer welfare and training, and the implementation of transport-related sanctions that impact the sector. Both parties pledge to promote co-operation in shipping within the framework of international and regional councils such as the IMO and the Commonwealth.

"Collaboration has always been a cornerstone of Cyprus' vision," says Cyprus Shipping Deputy Minister Vassilios Demetriades. "This MoU aligns with the extrovert pillar of the SDM's strategy, which champions a joint approach to driving positive progress in the greater shipping sector while always safeguarding competitiveness."

The MoU was signed by Demetriades and British High Commissioner Irfan Siddiq. He says: "This agreement marks a new chapter in relations between Cyprus and the UK, both of which have long and rich seafaring histories authorities to support maritime safety and security."

FERRIES

NEW ISLE OF MAN FERRY DELAYED

Delivery of the Isle of Man Steam Packet Company's (IOMSPC) new £78 million ferry *Manxman* has been delayed by "a significant problem in the vessel's systems".

The vessel was due to be delivered in spring 2023, however sea trials have uncovered extensive mechanical faults that need to be addressed.

Constructed at the Hyundai Mipo Dockyard in South Korea, the *Manxman* is powered by two eight-cylinder and two 10-cylinder engines, provided by Wärtsilä, which are recognised for a high level of fuel efficiency which reduces exhaust emissions.

The ferry began sea trials in January 2023, where the mechanical faults were first noticed. According to IOMSPC, additional work is needed to bring the vessel "up to the rigorous specification set out by Isle of Man Steam Packet Company".

"The works will be carried out by the contractors and shipyard IOMSPC has engaged to build the vessel. This will be followed by further sea trials," it added. "These additional works will have an impact on the delivery timeline of the vessel to IOMSPC in South Korea and subsequently its arrival in Manx waters."

THE *MANXMAN* UNDERGOING SEA TRIALS. SOURCE: IOMSPC

SIGN UP TODAY

sea WORK MARINE CIVILS

IN PERSON ONLINE

13 TO 15 JUNE 2023 | Southampton United Kingdom

The 24th edition of Europe's largest commercial marine and workboat exhibition, is a proven platform to build business networks.

Seawork delivers an international audience of visitors supported by our trusted partners.

Seawork is the meeting place for the commercial marine and workboat sector.

- 12,000m² of undercover halls feature 500 exhibitors with over 70 vessels, floating plant and equipment on the quayside and pontoons.
- Speed@Seawork on Monday 12 June at the Royal Yacht Squadron in Cowes offers a sector specific event for fast vessels operating at high speed for security interventions and Search & Rescue.

  Speed@Seawork Sea Trials & Conference
- The European Commercial Marine Awards (ECMAs) and Innovations Showcase.

  ecm awards european commercial marine | In partnership with SIEMENS
- The Conference programme, chaired by industry experts, helps visitors to keep up to date with the latest challenges and emerging opportunities.
- The Careers & Training Day on Thursday 15 June 2023 delivers a programme focused on careers in the commercial marine industry.

For more information visit: seawork.com
contact: +44 1329 825 335
or email: info@seawork.com

#Seawork mercatormedia magazines|events|online

Media partners

MARITIMEJOURNAL COMMERCIAL MARINE BUSINESS

BOATINGBUSINESS THE UK LEISURE MARINE BUSINESS

PROPULSION

EU FUNDS ZERO-EMISSIONS PROPULSION TECHNOLOGY DEMO

The European Union has awarded €15 million (US$16.3 million) to the Norwegian-led Ship-aH2oy consortium to develop and demonstrate a zero-emission propulsion technology onboard ships using green hydrogen from liquid organic hydrogen carrier (LOHC) on a megawatt scale. The project is expected to last five years.

MEMBERS OF THE SHIPAH2OY CONSORTIUM

The concept will combine liquid organic hydrogen carrier (LOHC) and solid oxide fuel cells (SOFC) for propulsion to deliver a significant emissions improvement over conventional internal combustion engines. Once developed, the LOHC/SOFC powertrain will be demonstrated onboard an offshore wind vessel owned by Edda Wind.

Hydrogenious LOHC Technologies will oversee the design of the LOHC release unit and the integration with the SOFC, while Hydrogenious LOHC Maritime will interface with the external SOFC supplier. The company will also be responsible for installing the entire system on the Edda Wind vessel.

Østensjø Rederi as the project manager for the newbuilds is responsible for ship interfaces and machinery space considerations.

Hydrogenious's LOHC technology with the thermal oil benzyl toluene as the carrier material – which has already been proven in stationary systems – enables safe handling of hydrogen in an efficient way at ambient conditions and by utilising existing infrastructure. The gaseous hydrogen molecules are bound to and released from the carrier in a chemical catalytic process, without self-discharge over time.

Due to the non-explosive and hardly flammable nature of the carrier, the hazard potential is much lower than diesel, and superior when compared to the volatile nature of ammonia.

Once successfully demonstrated, the LOHC/SOFC systems will be retrofitted to other vessels by Ship-aH2oy partners. As the project progresses, a replication study for the developed LOHC/SOFC system will be conducted to enable easy replication of the solution for larger ships.

ALTERNATIVE FUELS

TANKER MAKES 'FIRST OF KIND' NET-ZERO VOYAGE ON BIO-METHANOL

CAJUN SUN ARRIVES IN ANTWERP. SOURCE: METHANEX

Methanex of Canada and Japanese shipping firm Mitsui O.S.K Lines (MOL) have completed a net-zero voyage using bio-methanol as fuel for the tanker *Cajun Sun*.

According to the companies, the voyage was the first of its kind and will help assess the viability of using methanol as a marine fuel to attain net-zero emissions.

"As the world's largest methanol producer, we are establishing a network of relationships with leading renewable natural gas suppliers and assessing other pathways, including carbon capture and storage and e-methanol, to provide solutions for the marine industry and other customers," says Mark Allard, Methanex senior vice-president for low carbon solutions.

Run by Waterfront Shipping, a subsidiary of Methanex, and chartered from MOL, the 49,993dwt *Cajun Sun* made the net-zero journey from Geismar, Louisiana in the US to Antwerp, Belgium. The vessel is fitted with a two-stroke, methanol dual-fuel Mitsui-built MAN B&W 7S50 ME-LGI seven-cylinder engine.

MOL and Methanex say a combination of bio-methanol and natural gas-based methanol meant that net-zero greenhouse gas emissions on a lifecycle basis were achieved during the 18-day trans-Atlantic voyage.

Kazuhiro Takahashi, MOL Bunker Business Division executive officer, adds: "MOL, as a pioneering shipping company, is committed to reducing the environmental impact of the shipping sector. The use of methanol, which can be readily adopted today, is one of the very promising alternative fuels."

LNG

LNG EASY, BLUESOUL AND DELTAMARIN DEVELOP NEW LNG CARRIER DESIGNS

LNG Easy, the Singapore-based distributor and provider of LNG infrastructure, has signed a long-term mutually exclusive commercialisation agreement with Shangai-based marine environmental technology provider BlueSoul and Finnish ship designer Deltamarin to develop new LNG carrier designs based on a Type B cargo containment system (CCS).

According to the company, the new CCS, which has been developed jointly by BlueSoul and Torgy LNG using Alu 5083, will be of a prismatic shape and free from sloshing concerns.

The construction and installation method for the cargo tanks will enable the shipbuilder to save an estimated 10-11 months in construction time, overcoming bottlenecks in skilled welders, drydock space, and outfitting quay and gantry-crane capacity, LNG Easy says.

Furthermore, the new designs will focus on bigger sizes which will offer FOB (free on board) buyers or DES (delivered ex-ship) sellers for long-haul LNG trade a better economy of scale, especially from the US Gulf to China.

"The ships built to these designs will be great spot traders/floaters and mother vessels for breakbulk/build-bulk operations through ship-to-ship transfer," states LNG Easy founder and chief executive He Yiyong. "The vessels are capable of loading and unloading in any quantity and sail in partially loaded conditions, catering to the increasing trend of LNG commoditisation and gaining pace for LNG bunkering."

THE DESIGNS WILL BE BASED ON IMO TYPE B CARGO CONTAINMENT SYSTEMS. SOURCE LNG EASY

AQUACULTURE

DANISH CONSULTANCY LAUNCHES INNOVATIVE LIVE FISH CARRIER

Denmark-based Knud H. Hansen has designed, project managed and supervised the construction for a live fish carrier for salmon farming firm Bakkafrost in the Faroe Islands.

According to a company spokesperson, the vessel is one of the biggest live fish carriers in the world at 109.2m in length and 22.2m in breadth and with a cargo capacity of 7,000m^2. With four cargo holds of 1,750m^2 each the vessel can transport about 1,000tons of live salmon from cages offshore to shore-based processing facilities.

The vessel can also take live salmon onboard for treatment for lice in fresh water in the cargo tanks and when discharging to cages, salmon over a certain size can be retained onboard for transport to the processing facility. Capacity for production of fresh water through reverse osmosis is 6,000tons per day.

All equipment onboard is electrically driven. Power is supplied by a hybrid system of diesel generators, electric batteries and whilst in harbour a high voltage shore connection is also available, which in a practical combination can reduce the fuel consumption.

THE VESSEL CAN TRANSPORT AROUND 1,000TONS OF LIVE SALMON. SOURCE: FAROEPHOTO.FO

"The five diesel generators are placed in a deckhouse on shelter deck for easy change to suitable 100% green generators when such technology becomes available," says the spokesperson.

On top of the machinery deck house there is place for 16 x 20ft containers which gives space for future green fuel, the spokesperson adds.

With a dynamic positioning system including 2 x 2 side thrusters of 1,000kW each and far-reaching deck cranes the ship is made ready for operating towards future cages on the open sea.

NEWS ANALYSIS

CII CRITICISED AGAIN AND BOX SHIP BOOM BRINGS HEADACHES

By **Malcolm Latarche**, Correspondent

Even before it took effect in January, the IMO's emission reduction strategy in the shape of the CII was being heavily criticised. Further opposition to it emerged in February at the Union of Greek Shipowners' (UGS) AGM when it was announced that the organisation has formed a working group to demonstrate the weakness of the measure and to put forward proposals for its amendment.

UGS president Melina Travlos described the CII as being 'unfair to all ships' and said "given its shortcomings it is good that ships that fail to comply with it will not be punished during the transitional period until its 2026 revision."

On the same day that the UGS was denouncing the measure, Capital Link's 13th Annual Greek Shipping Forum was also taking place in Athens and with a first session of the conference devoted to CII, more negative comments were expressed. Panos Zachariadis of Atlantic Bulk Carriers Management and vice chair of BIMCO's Marine Environment Committee asked the rhetorical question and answered it saying: "Does a good CII score necessarily mean an efficient ship? As a matter of fact, no, it just shows if the way the ship was operated during a specific period was compliant to what is currently being asked."

Kenneth Aasland MD of Maritime Carbon Solutions, IFCHOR Galbraiths, spoke of geopolitical events and commodity markets not being addressed in the regulations and Andrea Olivi, head of Wet Freight Shipping at Trafigura, said: "CII has the potential to promote bad behaviour instead of contributing to its elimination and it should not be seen as the holy grail that will help us decarbonise shipping, but rather as one of the tools offered to both shipowners and charterers."

Perhaps not what IMO secretary general Kitack Lim wanted to hear but then those are just the latest in a long stream of criticism of the measures that almost nobody believes were well thought through.

Maybe some comfort can be drawn from the words of Dr Harry Conway, chairman of the MEPC Committee, who responded to the criticisms by saying: "At the IMO we are currently receiving proposals with ways to face the concerns that have been raised. You, the members of the industry, should provide us with the necessary data. That way, regulations will not be based on conjectures or speculations. Debating different topics is the way to reach better solutions, and we remain flexible for modifications if the data so indicates."

THE 24,188TEU *OOCL SPAIN*. SOURCE: OOCL

Perhaps it may have been better if more of the criticisms expressed before the measure was passed had been listened to and the IMO would not have been caught in an embarrassing situation once again.

The CII is perhaps not the biggest headache for the container sector given that the majority of ships are operating either on long-term time charters or are owned by the operators directly. It is declining profitability and the imminent prospect of a massive increase in capacity as ships ordered in 2021/22 start to hit the water.

According to sector analyst Alphaliner in its latest market report, starting from March the pace of new container ship deliveries will pick up rapidly especially in the larger segments. Assuming none are cancelled or delayed, a new 23,000TEU ship will be joining the world container fleet every 10 days on average for the rest of the year. Six are due in March alone and in February OOCL took delivery of the 24,188TEU *OOCL Spain*, the first of six due this year. Hapag Lloyd, MSC and ONE are scheduled to take delivery of another 26 ships between them. Dropping down the size league, a further 67 neo-Panamax units of 12,000-16,000TEU will also be delivered this year.

Looking forward to the end of 2027, Alphaliner says the orderbook presently stands at almost eight million TEU or just under a third of the current fleet capacity. Almost certainly some of those ships will need to be cancelled or delayed to avoid a catastrophic impact on rates.

Unfortunately, the sector has a poor record of order restraint so there may well be some casualties along the way. Last December UK-based Allseas Global Project Logistics went into liquidation and in February, Australian start-up Focus Container Line went the same way as the boom proved to be unsustainable. ■

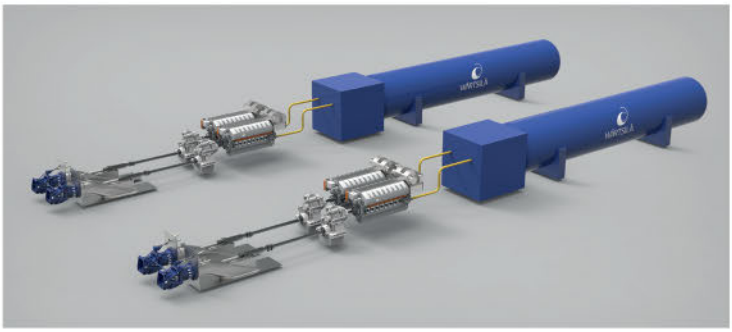
NEWS EQUIPMENT

PROPULSION

WÄRTSILÄ PROPULSION SYSTEM PICKED FOR BALEÀRIA FAST FERRY

Finnish technology group Wärtsilä is to supply dual-fuel engines and axial flow waterjets for Baleària's new high-speed ro-pax ferry.

Margarita Salas is currently being built at the Astilleros Armon Gijon yard in Spain. It will have the same dimensions as its sister vessel *Eleanor Roosevelt*, which at 123m long is currently the longest high-speed ferry in the world. However, the new vessel's engines will provide 10% greater power and increased fuel efficiency.



WÄRTSILÄ 31DF ENGINES, LNGPAC STORAGE AND SUPPLY SYSTEM AND WXJ WATERJETS HAVE BEEN SELECTED BY BALEÀRIA

"This new ship will combine the most competitive features of the *Eleanor Roosevelt* with a series of innovations in its design and engineering to enhance the customer experience," says Pablo Garcia, newbuilds project manager at Baleària.

The Wärtsilä scope of delivery includes four Wärtsilä 31DF dual-fuel engines operating primarily on LNG fuels, four Wärtsilä WXJ steerable-reversible inboard hydraulic waterjets with Protouch propulsion control system, and two LNGPac fuel storage and supply systems. The propulsion system will enable the vessel to reach a service speed of 35knots.

"It is an honour to have been selected as the integrated drivetrain package supplier for this state-of-the-art vessel," says Jesus Puelles, general manager of sales for Spain at Wärtsilä. "We have been able to offer superior technical performance, the best power-to-weight ratio, the best overall equipment efficiency, and enhanced integration support. This represents a value proposition that will make this new ferry superbly efficient.

AUTONOMOUS SHIPS

KR AND LISCR APPROVE HINAS AUTONOMOUS NAVIGATION TECHNOLOGY

The Korean Register (KR) and Liberian Registry (LISCR) have awarded Approval in Principle (AiP) to the Hyundai Intelligent Navigation Assistant System (HiNAS 2.0) for autonomous shipping.

The system, developed by Avikus, a subsidiary of Hyundai Heavy Industries (HHI), uses augmented reality and AI to ensure safe navigation, improve fuel efficiency, and reduce operational burden on bridge teams.

KR and LISCR reviewed classification rules and standards and issued an AiP after signing a joint development agreement with Avikus and HHI. The autonomous navigation system is expected to reduce maritime accidents and air pollutants. The approval is seen as significant in the commercialisation of autonomous ships.

To overcome the limitations on existing rules for examining the new autonomous navigation systems, KR, LISCR, HHI and Avikus and signed a joint development agreement in August 2022 to collaborate on bringing HiNAS 2.0 to market. KR and LISCR have now each confirmed the system's safety and feasibility, having reviewed classification rules, domestic and international standards, and issued an AiP.

"The commercialisation of autonomous ships is highly anticipated by maritime stakeholders. This AiP is significant since it has proven the reliability and safety of AI-based autonomous navigation systems. We will provide our full technical support to enhance the safe and cost-efficient operation of autonomous ships," says Kim Yeontae, executive vice president of KR Technical Division.

Avikus chief executive Lim Dohyeong adds: "The outcome of this joint development research is quite meaningful because it is the first achievement through the collaboration of a shipyard, an autonomous navigation solution development company, a classification society and a ship registry. It proves an autonomous navigation system can be installed on a ship and operated stably. We believe HiNAS 2.0 will drastically improve the safety and economic feasibility of ships, accelerating the commercialisation of autonomous navigation technology."

BWTS

BIO-UV INTRODUCES BWTS CYBERSECURITY SOFTWARE

French UV-based water treatment specialist BIO-UV Group has developed cybersecurity software for its BIO-SEA ballast water treatment system ahead of two IACS Unified Requirements set to enter into force next year.

Like any networked system or control software onboard ship, the ballasting process, including the treatment system, can be susceptible to a cyber-attack, with hackers looking for an entry point to a vessel's operational technology systems.

Concern is such that the International Association of Classification Societies (IACS) adopted in 2021 two new URs to increase the cyber resilience of ships. UR E26 and UR E27 will be applied to new ships contracted for construction on and after 1 January 2024.

The requirements are twofold: to ensure the secure integration of equipment into the vessel's network throughout its operational lifespan; and to make the interface between users and computer-based systems/ equipment more resilient.

"This could be a problem for legacy systems," says Charlène Ceresola, project manager, BIO-UV Group. "It's not the case with a BIO-SEA unit, but older ballast water treatment systems can be susceptible to a cyber-attack. If the ballasting system is hacked and pumps operated remotely, ship stability is at risk; a ship could sink, and lives lost. It's much more than simply an environmental threat."

Ceresola adds: "We are following these guidelines and have developed greater cyber-secure functions to our software ahead of the requirement. In an increasingly connected and digitised world, every component onboard ship has to be cyber-secure."

BIO-UV Group completed testing of the new cyber-secure function in 2022, with full type approval expected later this year.

BATTERIES

AYK ENERGY BATTERIES SELECTED FOR CONTAINER SHIP CONVERSION

Marine battery manufacturer AYK Energy has signed a contract with Holland Shipyards Group (HSG) to supply a zero-emission inland container vessel with two Aries 88 lithium batteries.

AYK will provide the batteries from its production facility in Zhuhai, China, for installation onboard the *FPS Waal*, owned by Dutch shipping company Future Proof Shipping (FPS). The 110m vessel's retrofit involves the replacement of its diesel engines with a propulsion system consisting of PEM fuel cells, hydrogen storage, AYK's battery packs and an electric drive train.

Once complete the *FPS Waal* will be powered by green hydrogen with around 1,200kW of installed power and a cargo capacity of 200TEU. The vessel is the second inland container vessel in FPS's fleet to be retrofitted, following the *FPS Maas*.

AYK Energy founder Chris Kruger says: "This is a landmark moment for AYK Energy and we are very pleased to secure the work with the talented teams at HSG and FPS who share our vision to decarbonise short-sea shipping."

CHRIS KRUGER, AYK ENERGY FOUNDER

FINLAND

ICEBREAKER ORDER EAGERLY AWAITED

By **Kari Reinikainen**, Correspondent

Finland has traditionally been a major builder of icebreakers, but in recent years there has not been much activity in this sector. A long-anticipated order from Finnish and Swedish governments for a total of five such vessels is making slow progress, yet it would be an important contract for Rauma Marine Constructions (RMC) and Helsinki Shipyard (HSY) which are both contestants for the contract.

In Sweden, the government has budgeted SEK3.4 billion (US$325 million) to replace the three Atle class vessels that were built in the mid-1970s with new ships. Finland has three of these vessels as well that were all built by a predecessor company of HSY.

"No decision has been made in Finland to build the ships," Anna Hackley, head of communications at the Finnish Transport Infrastructure Agency, tells *The Naval Architect*. The most important task would be to replace *Voima* that dates back to 1954, but unlike in Sweden, the Finnish fleet includes vessels built both in the 1980s and the 1990s plus the 2016-built *Polaris*, she notes.

Vessel design

Aker Arctic has designed a vessel referred to as IB2020, which has a length of 128m, beam of 28m and displacement of 15,400tons. It would have three azimuthing thrusters and an engine output of 21MW and this is the design both the Swedish and Finnish governments are planning to build.

Before the collapse of the Soviet Union, Finnish shipbuilders, including a predecessor of HSY, built several icebreakers to that country and a steady workload in this field was maintained for years. However, Finnish yards have also built specialist icebreaking tonnage to South Africa and Argentina in the past and Aker Arctic has been involved with a long running Canadian project to build a large polar icebreaker.

The Finnish shipbuilding cluster has been dealing with the aftermath of the Covid-19 pandemic and the Russian attack on Ukraine, but it seems that the worst of that has passed, according to Carl-Gustaf Rotkirch, a board member of HSY. The company lost an order for an icebreaker that had been negotiated with Norilsk Nickel, a Russian company now facing western sanctions as a direct consequence of the war. A steel price that soared by some 50% at the start of the war is now off highs but, together with the prices of many other materials that the industry needs, it remains at an elevated level.

HSY focuses on expedition cruise ships, icebreakers and mega yachts, but as the owner of the company is Russian, it has not been able to win new orders, although the person in question is not under sanctions. Therefore a group of investors are working to buy the company which is completing the third and final expedition cruise ship for Swan Hellenic at the moment. Rotkirch says the ownership situation should be cleared first to pave the way for new orders, the icebreakers included.

Many subcontractors and service providers to the country's shipbuilding industry report working capital challenges and Rotkirch says he hopes that a new government that

FINNISH LNG-POWERED ICEBREAKER *POLARIS*. SOURCE: CREATIVE COMMONS

HSY BOARD MEMBER CARL-GUSTAF ROTKIRCH. SOURCE: INDAVI

will take office after a general election in March would also understand the needs of the industry as the present one has done and enhance that understanding further.

Investment in R&D needed

This is important, because the Finnish shipbuilding industry focuses on special vessels that are more complex to build than most other ship types and therefore an infrastructure of suppliers and R&D is needed to maintain and develop the base of competence that is required for the industry to retain its position. Business Finland, a public organisation that funds innovation, may take a greater role in ensuring that the high-end competences in the shipbuilding industry can be developed further.

"Provided that the right circumstances are in place, the Finnish maritime cluster has realistic possibilities to become a global leader when it comes to green transition and sustainability related technologies," Rotkirch says.

Given the current situation, orders from Russia cannot be counted on for at least a decade, maybe even significantly longer, Rotkirch points out. However, Finland's pending membership of NATO could open exciting opportunities for the construction of ice-breaking specialist vessels as the organisation itself and many of its member states are paying increasing interest in developments in the high northern latitudes, he says.

Recruitment remains a persisting challenge to the Finnish shipbuilding cluster and an ageing population will probably mean that the situation is here to stay. Hiring people from abroad can alleviate these concerns, but a recent government regulation that demands everyone present at shipyard premises wears a lanyard showing that he or she is a registered taxpayer does not help. The extra bureaucracy is costly and affects shipbuilders particularly at the commissioning stage of a newbuilding, when several specialists are required to be present, many only for a short time, Rotkirch concludes. ■

DESPITE CHALLENGES, FINNISH SHIPYARDS SOLDIER ON

By **Kari Reinikainen**, Correspondent

The past few years have been tough for the Finnish shipbuilding industry as first the pandemic and then the Russian attack on Ukraine with subsequent inflationary pressures have clouded the horizon. While the worst may be over, the landscape for the industry has changed over the years.

Meyer Turku, the biggest shipbuilder in Finland which specialises in cruise ships had 1,323 suppliers and contractors in its network at the end of 2021, which was about 100 more than at the end of 2018, according to a report entitled *Regional Economic Impacts of the Turku Shipyard and its Network in 2022*. Deliveries amounted to €972 million (US$1 billion), an increase of 4% in three yards. The study also found that at 5% of the companies in the yard's network, the shipbuilder accounted for 90% or more of their turnover. For one third, the figure was less than 10%.

Tapio Karvonen, senior researcher at the Centre of Maritime Studies at the University of Turku who was one of the authors of the report, notes that while the expansion of the yards network of suppliers and contractors was positive, the profitability of the business has not been good. Citing senior yard officials, he tells *The Naval Architect* that component shortages and delays in receiving them together was rising costs has weighed on the profitability of the company. Reaching a break-even result would be a good outcome for this year, he says.

The study confirmed the importance of the yard in particular and the shipbuilding sector in general for the wider economy as inputs come from a wide range of companies: domestic businesses accounted for 71% of the number of companies in the yard's network and they generated 60% of the €972 million value of deliveries in 2021.

The principal workload at Meyer Turku come from three 250,000gt ton Icon class cruise liners for Royal Caribbean International. As the vessel currently under construction is a prototype, it will probably not deliver a profit for the yard once it is due for delivery in 2024. However, the subsequent vessels of the class should improve the situation: a learning curve means that a prototype tends to be the most challenging ship in any series.

Economies of scale difficult to reach

The other two shipbuilders in the country, Rauma Marine Constructions (RMC) and Helsinki Shipyard, focus on smaller passenger ships – expedition ships in the case of Helsinki and ferries in the case of RMC. Both also build ice-breaking specialist tonnage. While in the mainstream cruise sector series of ships have sometimes extended to five units or more, this is not usually the case with smaller cruise ships and ferries. Consequently, the yards that build them have to cope with prototypes more often, which places them in a different position compared to Meyer Turku.

TAPIO KARVONEN, SENIOR RESEARCHER AT THE CENTRE OF MARITIME STUDIES, UNIVERSITY OF TURKU

Karvonen notes that RMC had suffered significantly from problems with the construction of *MyStar*, a 50,000gt LNG-powered ro-pax ferry for the Estonian ferry company Tallink. The ship was delivered in late 2022, by which time it was almost a year late: as some 80% of the contact price of a ship is paid on delivery, the problems had placed RMC in a very challenging financial position.

The yard, which is currently building two 55,000gt LNG-powered ro-pax ferries for TT-Line in Australia, has started a restructuring programme that it says aims to bring the yard and its key suppliers and contractors closer to each other to avoid problems like those experienced with *MyStar* that were complicated by the pandemic.

Helsinki Shipyard currently has only one expedition cruise ship in its order book and this is due for delivery in the spring. Together with RMC, it has a track record of building icebreakers and a possible order for three such vessels by the Swedish government and two by Finland is an opportunity both yards are probably interested in, Karvonen says.

Looking ahead, he notes that ferry companies that serve Finland are unlikely to place newbuilding orders in the near future due to recent and forthcoming deliveries. This, together with an apparent lengthening of the lifespan of ferries (Viking Line in Finland recently sold a 42-year-old ferry for further trading), could mean less work from these companies in the years to come.

At the same time, competition from China remains intense. Carnival group has said it would slow down in newbuildings to one ship or two up to 2026, but Royal Caribbean, which has traditionally been Meyer Turku's biggest customer, has not indicated such a slowdown, Karvonen points out. ■

R&D PROJECT LOOKS TO DECARBONISE FERRY SERVICE

By **Kari Reinikainen**, Correspondent

The Finnish shipbuilding industry focuses on passenger vessels and ice-breaking tonnage that are more complex to build than many other types of ships. In addition, the country has substantial competence in R&D of decarbonisation in shipping.

Last autumn, Business Finland granted almost €1.6 million (US$1.7 million) to a project called Decatrip established by the shipbuilder Rauma Marine Constructions (RMC), Åbo Akademi University, charging solutions supplier Kempower and the ferry company Viking Line to set up a green corridor on the roughly 10-hour ferry crossing between Turku in Southwestern Finland and the Swedish capital Stockholm.

Dr Magnus Gustafsson, research director in industrial management at Åbo Akademi University, states that good progress has been made to assess the effects of the use of synthetic methanol as fuel on the cost of freight using the two large dual-fuel cruise ferries, *Viking Grace* and *Viking Glory*, that operate on the route. "The fuel is dramatically more expensive [than LNG or MGO]. However, if the goods carried cost more than €1,000 per tonne, then the incremental cost from the renewable fuel is in the region of 1%," Gustafsson tells *The Naval Architect*.

"When we talk about what kind of freight can sustain a transition to clean fuel, the floor is not iPhones. It's yoghurt: it costs €3,000 to €5,000 per tonne, but the transition will only add 0.2 cents to the cost of a pot on the shelves of a supermarket," he continues.

The lorries that use the ferries carry mainly consumer goods and other high value cargoes, but also some raw materials to industry and these, Gustafsson says, might not be able to bear the added freight cost in the same way as consumer goods, including foodstuffs.

Decatrip is based on the idea that cargo owners agree to pay the higher cost of freight to Viking Line, which again commits itself to buy the green methanol from a supplier that would make the necessary investment to production facilities – this would rise to hundreds of millions of euros, Gustafson notes. Cargo owners would get a competitive edge by having decarbonised the ferry part of their supply chain, which is a key point in the project.

VIKING LINE'S *VIKING GLORY*. SOURCE VIKING LINE

Focus on business case, not just cost of fuel

"It is important that the ferry company speak not to the purchasing department of the cargo owners, but to their sales and marketing people: it is important to get the message out about the competitive edge that the transition will bring to the right people," Gustafsson says. "The debate on the green transition of shipping tends to focus on the technical and cost aspects of new fuels, but in order to succeed it needs to focus on the whole business case instead to make clear how it creates value to all concerned."

One of the findings of the work carried out so far has been that the 57,656gt *Viking Grace* and the 65,211gt *Viking Glory* should be converted to hybrid vessels whereby a battery pack installation would complement their diesel-electric propulsion system. The ships need to adjust their speed frequently on the service that is mostly through archipelagoes, which favours a hybrid solution to optimise the use of the engines.

Another finding has been that charging points for electric lorries could be fitted onboard and their use would not require a significant increase in the use of engine power.

From its beginning, the Decatrip project has been designed to be modular, so that it could be used elsewhere as well. Gustafsson says that about 30% of the ro-pax ferries that currently operate on the Baltic could switch to use a green fuel and operate on the basis of Decatrip with minor modifications onboard. As these vessels often operate at high speeds, their emissions to the air are quite significant. The green methanol on which the two ships are scheduled to run on from 2027 would be produced either in Finland or Sweden, which would mean another gain resulting from the switch, Gustafsson adds.

As the new fuel will be far more expensive than the ones currently in use and due to the significant investment needed to build the new fuel production facilities, commitment to the goals of the project by all parties is absolutely vital. To achieve the commitment, every party must become convinced about the benefit that they can achieve from the transition, the business case must be clear to everyone, Gustafsson points out.

"In the days of cheap energy, it was not profitable to invest in energy saving technologies. Renewable energy will always be expensive; this will be a new normal and there will be no return to how things used to be," he concludes. ■

TALLINK'S NEW *MYSTAR* FERRY. SOURCE: PHILIPPE HOLTHOF

RO-ROS & FERRIES

TALLINK'S SHINING STAR

To help secure its market-leading position on the competitive Tallinn-Helsinki corridor, Estonian ferry giant Tallink recently introduced *MyStar*. Built by Finland's Rauma Marine Constructions (RMC), the LNG-powered vessel is a near sister ship of the Meyer Turku-built *Megastar*, yet boasts all lessons learned from the game-changing latter ship

By **Philippe Holthof**, Correspondent

Concurrent with the introduction of the day ferry *Star* in April 2007, Tallink re-invented ferry travel on the 48-nautical-mile Estonia-Finland capital cities route, resulting in the gradual phasing out of ageing conventional ferry tonnage as well as dedicated high-speed ferries. Offering the best of both worlds, *Star* combined a 1,981lm and 1,900-passenger intake with a 27knot service speed, reducing berth-to-berth transit times to just two hours. The 'Tallink Shuttle' brand was coined with up to six daily return 'shuttle' sailings being offered following the April 2008 introduction of the Fincantieri-built *Superstar*.

Superstar was derived from an off-the shelf design initially developed for Italy's *Moby*, yet adapted to Tallink's requirements. One of the compromises was the ship's vehicle deck configuration which didn't allow for double-deck drive-through handling with a single-lane tiltable internal ramp connecting the upper with the main vehicle deck. *Star* had been similarly laid out but boasted a two-lane tiltable ramp. More importantly, *Star* was future-proofed for double-deck drive-through handling, being converted accordingly in conjunction with the early 2017 introduction of the LNG-powered *Megastar* which displaced *Superstar*.

Built by Meyer Turku, *Megastar* represented a totally new ferry platform with a double-deck drive-through loading arrangement as well as an all-MES solution, being exempted from traditional lifeboat requirements. As an all MES-solution potentially jeopardises the resale value, Tallink future-proofed *Megastar* and *MyStar* to allow later installation of traditional lifeboats.

Back in Rauma

A Meyer Turku in-house design, *Megastar*'s hull form was the result of no less than 35 alternative forms that had been created to determine the best hydrodynamic performance on the one hand while guaranteeing excellent seakeeping capabilities and icebreaking requirements on the other. Chinese shipyards have never been on Tallink's radar and save for the Fincantieri-built *Superstar*, now Corsica Ferries' flagship *Pascal Lota*, the Estonian ferry operator has remained loyal to the Finnish shipbuilding cluster ever since ordering its first newbuild, the ro-pax cruise ferry *Romantika*. Completed by Rauma's Aker Finnyards in 2002, *Romantika* marked the start of a long-lasting romance between Tallink and the yard in Rauma, today known as Rauma Marine Constructions (RMC). Under its different ownerships, RMC has been one of Europe's most successful builders of ro-pax tonnage during the last quarter of a century. The yard succumbed under the ownership of STX in 2013 with RMC subsequently raising out of its ashes. After a few difficult years, the shipyard was back in the game with

the delivery of Bornholmslinjen's 18,009gt *Hammershus* in August 2018, this paving the way to a contract for Wasaline's technically advanced hybrid gas-powered ro-pax ferry *Aurora Botnia*, followed by the €247 million (US$261 million) contract for *MyStar*. The current orderbook includes two 48,000gt ro-pax ferries for TT-Line Tasmania, making RMC Europe's number one builder of large ro-pax tonnage.

Tallink's strong ties with Finland are also reflected in *MyStar*'s interior design which is the work of dSign Vertti Kivi & Co. The Helsinki-headquartered interior design practice made inroads into marine interior design with Viking Line's 2013-built *Viking Grace*. This proved to be the stepping stone to other shipboard design projects, including *Megastar*.

Gas-electric propulsion

Purpose-built for the high-density Tallinn-Helsinki service, *Megastar* quickly proved to be the right ship for the right route so there was no need to re-invent the wheel when conceiving *MyStar*. *MyStar*'s dimensions and general arrangement follow that of *Megastar*, yet with modifications made to the engine package as well as in certain parts of the accommodation. The uppermost crew cabin deck has been extended which, together with more capacious LNG tanks, has added significant weight which prompted RMC to further optimise the hull form, bringing Deltamarin and Elomatic among other Finnish partners to the table. RMC had bought *Megastar*'s 'as built' documentation from Meyer Turku with tank testing performed by Denmark's Force Technology. One of the most distinct features of *Megastar*'s hull form was its ducktail. Extending the effective waterline, ducktails can achieve up to 10% in power reduction and was also added as an extension of *MyStar*'s aftship.

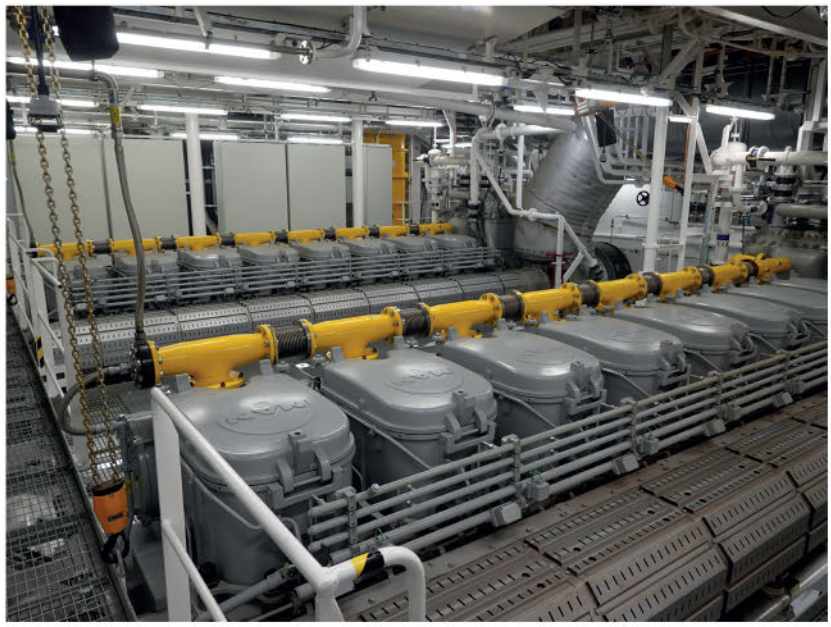
The gas/diesel-electric propulsion which Tallink first introduced on *Megastar*, has been repeated on *MyStar* but rather than a combination of three 12V50DF and two 6L50DF Wärtsilä engines, Tallink opted for five identical MAN 8L51/60 DF engines with an output of 8,400kW each at 500rpm. Despite the higher CAPEX, replacing a combination of main engines and auxiliaries by five large gensets, reduces maintenance and OPEX considerably. Unlike the kind of father-and-son arrangement on *Megastar*, having five engines of the same type and output further improves flexibility with running hours spread more evenly as at least one but mostly two engines remain switched off, allowing for rotating maintenance.

To comply with SRtP regulations, transverse bulkheads divide the respective main engine and generator rooms. Three engines are located on the starboard of the centreline in the forward main engine room with two engines on the portside of the centreline located in the aft engine room. Protected by the longitudinal B/5 bulkheads, the two Type C LNG tanks are located in a single compartment forward of the forward generator room on Deck 1 as well as the engine control room and one of the main switchboard rooms on Deck 2. Høglund Marine Solutions provided the complete fuel gas supply system (FGSS) with the double wall insulated tanks constructed by Finnish tank manufacturer West Welding.

The combined 770m^3 LNG tank capacity allows for weekly bunker operations in a ship-to-ship bunkering mode but on account of skyrocketing LNG prices, Tallink has temporarily switched to MDO for both *Megastar* and *MyStar*. Eesti Gas, controlled by Tallink Grupp parent Infortar Group, sourced its LNG in Pskov, Russia. The LNG was shuttled by two tanker trucks, requiring truck-to-ship bunkering at least every second night. When switching to LNG again, Tallink will significantly reduce the bunker frequency by making use of Elenger Marine's 6,000m^3 LNG bunker barge *Optimus*.

The holy grail of energy management

Just like on *Megastar*, ABB has been instrumental in *MyStar*'s gas-electric concept. It supplied the five 9,098kVA main synchronous generators, the twin 3kV synchronous propulsion motors with a 20,300kW output at 138-143rpm, the stern and bow thruster motors as well as its



MYSTAR'S MAN ENGINES. SOURCE: PHILIPPE HOLTHOF

proprietary OCTOPUS optimisation software. OCTOPUS collects and transfers operational data from the vessel's onboard systems to the ABB Ability Marine Fleet Portal, providing remote monitoring and a detailed performance analysis. Equally installed on *Megastar* and *Star*, the bottom line is to further reduce the energy consumption and emissions footprint. ABB equally installed a shore power connection system, allowing to plug into the local grid when alongside. Earlier this year, *Megastar* had the same cold ironing system retrofitted. Since *MyStar* and *Megastar* remain overnight in Tallinn and Helsinki respectively, noise and emissions are reduced significantly.

TECHNICAL PARTICULARS *MYSTAR*	
Length oa:	212.4m
Length bp:	192.1m
Breadth, moulded:	30.6m
Depth to main deck:	9.9m
Draught, full load:	7.1m
Gross tonnage:	50,629
Net tonnage: 16,011	30,869
Deadweight:	5,448
Lane metres:	1,983m (+ 920 car lm + 80 CEUs on Deck 7)
Passengers:	2,824
Passenger cabins/ berths:	44/170
Main engines:	5 x MAN 8L51/60 DF
Output:	5 x 8,400kW at 500rpm
Service speed:	22.8knots
LSAs:	6 x Viking VEMC – 3,163 persons + 2 x Palfinger Marine RRB 500 rescue boats + 2 x Palfinger Marine FRSQ 630G fast rescue boats
Class:	Bureau Veritas
Class notation:	I +HULL +MACH Ro-Ro passenger ship, dual fuel, SRTP, Unrestricted Navigation, +AUT-UMS, +SYS-NEQ-1, +SYS-IBS-1, +SYS-COM, CLEANSHIP, GREEN PASSPORT EU, MON-SHAFT, INWATERSURVEY, ICE CLASS 1A
Flag:	Estonia

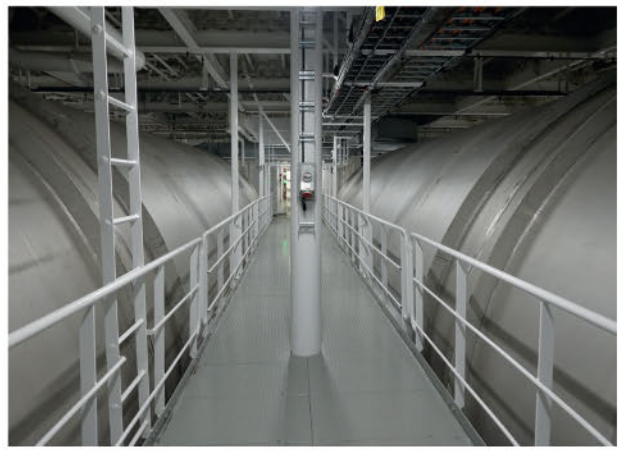
Megastar's twin flapless Becker spade rudders that incorporated a Wärtsilä rudder bulb integrated with the propeller hub has been replaced by Konsberg's integrated propulsion and manoeuvring system, Promas. The twin-screw system consists of a propeller, costa bulb, hub cap and twisted rudder. Besides improved manoeuvrability, it guarantees increased propulsive efficiency as well as a 2 to 6% efficiency gain. While *Megastar* boasted outward rotating fixed pitch propellers, Tallink opted for more effective inward rotating fixed pitch propellers on *MyStar*. Vibration levels are close to zero by virtue of the gas-electric and fixed pitch propeller arrangement. To augment manoeuvrability, Tallink opted for the same bow thruster and stern thruster package as on *Megastar* with two 2,200kW Kongsberg bow thrusters and two 1,200kW skeg-mounted stern thrusters. The ship's fin stabilisers were supplied by Fincantieri.

As befits the latest generation of LNG-powered Baltic ro-pax ferries, *MyStar* comes with the latest technologies to recover both waste heath and waste cold from the use of LNG. A custom-made waste heat system converts heat from the engines' exhaust and cooling water into renewable energy for the ship's central heating system. Similarly, the waste cold from the use of LNG is recycled for refrigeration and HVAC purposes.

Coinciding with the introduction of *Megastar*, a new terminal and berth was opened at Helsinki's West Harbour. Faster, more efficient automated mooring became the new normal through the installation of six Cavotec MoorMaster MM400 units. Directly controlled from the ship's bridge, mooring and unmooring was reduced to just a matter of seconds. Shaving a few minutes off port turnaround times allows to further reduce speed at sea with Cavotec's automated vacuum mooring pads now also installed in Tallinn.

Double-level loading

To keep time in port as short as possible, excellent ship/shore interface remains key. In conjunction with the introduction of *Megastar*, double-level loading was implemented with *MyStar* and *Megastar* loading/ unloading via the bow in Tallinn and via the stern in



THE VESSEL'S LNG TANKS. SOURCE: PHILIPPE HOLTHOF

The Royal Institution of Naval Architects Presents:

Annual Dinner 2023

27 April 2023, London, United Kingdom

REGISTER NOW

The Annual Dinner is a major event in the Institution's diary and is well supported by the maritime industry, as well as members of the Institution. Members and guests represent designers, builders and operators across the entire spectrum of the global maritime industry. It is going to be a great opportunity to network over drinks and a 3-course dinner in a fantastic new venue this year - De Vere Grand Connaught Rooms.
Corporate tables and individual tickets are available subject to availability.

Scan the QR Code for more information

Principal Guest & Speaker

Dr Bas Buchner, President of MARIN

Better Ships, Blue Oceans: The Role of Research in Safer, Cleaner and Smarter Shipping and Sustainable Use of the Seas

www.rina.org.uk/Annual_Dinner_2023

The Royal Institution of Naval Architects Presents:

SURV 11: Creating the Future of Sustainable Fast Boats

21-22 June 2023, Rotterdam, Netherlands

REGISTER NOW

In partnership with the Royal National Lifeboat Institution (RNLI) and Dutch shipyard DAMEN, the conference will provide a forum for discussion about the available resources and requirements to enable a sustainable future in the design, construction, and operation of fast boats (pilot; search and rescue; police; coastguard boats etc.).

We aim to include papers across the full range of vessels, equipment, and methods, used by fast boat operators. Topics include analyses of new designs, applications, and operations of these vessels, as well as a review of existing vessels and their use across all marine environments.

In partnership with:

DAMEN

RNLI Lifeboats

www.rina.org.uk/SURV11_2023

THE ENGINE CONTROL ROOM. SOURCE: PHILIPPE HOLTHOF

Helsinki. *MyStar*'s access equipment and internal ramps, supplied by Cargotec's MacGregor, are identical to that of *Megastar*.

On Deck 3, the main deck, the bow ramp folds out from behind two side-swinging doors, having a length of 20.1m plus 2.0m flaps with a 6.0m clear driving width. Due to the aft ducktail, the twin stern ramps are pretty long at 9.75m plus 2.0m flaps and a 7.0m clear driving width. The 4.6m high main deck has a 1,244lm intake with three freight lanes on the portside and five lines on the starboard side of the offset casing. On the starboard side of the centreline is a side-hinged watertight cover with a single trailer lift that connects the main deck with the refrigerated and dry store compartments forward of the LNG tank compartment. On Deck 5, there are no ship-based ramps with shore linkspans landing on the fore and aft decks. A streamlined visor-type gate is part of the fo'c's'le's bulwark, yet the bow opening on Deck 5 is closed off by a top-hinged door with a six-lane wide roll-down canvas curtain closing off the aft end. For redundancy's sake, a two-lane tiltable ramp has been installed midships starboard. With a length of 41.26m and 3.8m flaps, it connects the upper with the main deck. The upper vehicle deck boasts a fixed car deck along the full length of the casing with hoistable ramps forward and aft.

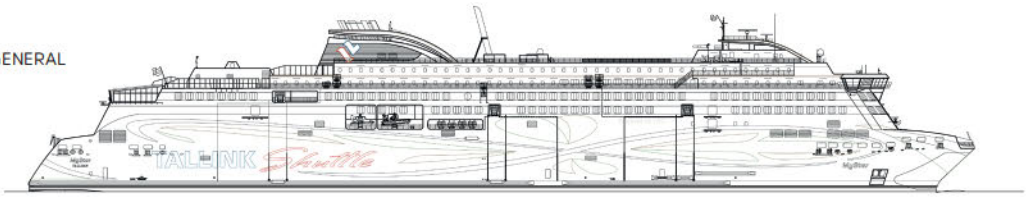
The clear height below the fixed car deck is 2.4m with a 2.1m free height on Deck 6 level. Up to 522lm of cars can be stowed below the fixed deck with another 398m on Deck 6 which comes with dedicated spaces to park motorcycles and charge electric scooters. On the portside of the casing are a pair of 3m wide fixed ramps that lead to Deck 7, being hermetically sealed off by top-hinged doors. The fixed car deck and ramp arrangements reduce the freight intake to 739lm with two outside freight lines on either side of Deck 5.

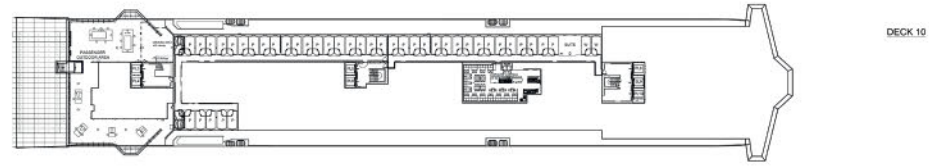
First introduced on *Megastar*, Deck 7 is a heated, well-lit 80-car capacity deck where cars are parked in large individual parking bays. Unlike on decks 3 and 5, passengers can access their vehicles throughout the voyage as Deck 7 is nothing short of a shopping mall car park, complete with trolley bays, charging points for electric cars and large illuminated advertising boards. There is ample space for trolleys to manoeuvre between the parked vehicles but, if need be, cars can still be stowed the conventional way, further increasing the ship's car intake. Once again, lessons have been learned from *Megastar* as the dedicated car deck only spans half the length of Deck 7 (as opposed to ¾ on *Megastar*) with the general arrangement of the two-deck Traveller Superstore shopping mall improved. The shopping mall's surface area on Deck 7 has been extended at the expense of car deck space. Spread across two fire zones, shoppers still enter the walk-around shopping mall on the portside of Deck 8, yet the checkouts are now on Deck 7 as opposed to Deck 8 on *Megastar*. This location allows goods to be carted directly to the vehicles without having to use an elevator.

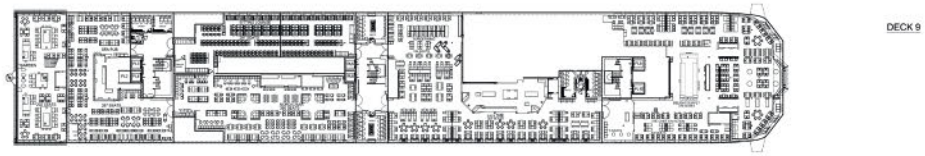
Interior design with a wow

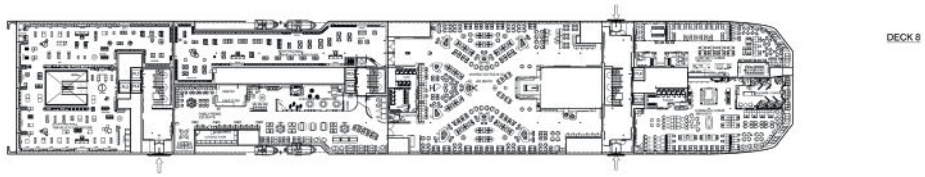
Most of the lessons learned centre around the shopping mall. Besides bringing the checkouts closer to shoppers' cars, the mall's improved layout with additional shopping space on Deck 7 and reduced space on Deck 8, allows for a better passenger flow with a 232-seat Family Picnic lounge on the starboard side of Deck 8 replacing shopping mall space. Occupying the fire zone between the aft staircase and the midship staircase, foot passengers can now also embark via the aft stair hall on Deck 8, something which was not possible in a shopping mall environment. Aimed at families, the Family Picnic comes with a dedicated children's play area, continuing into the full-width 482-seat midship Coffee & Co. Lounge, the ship's beating heart that also holds the reception desk.

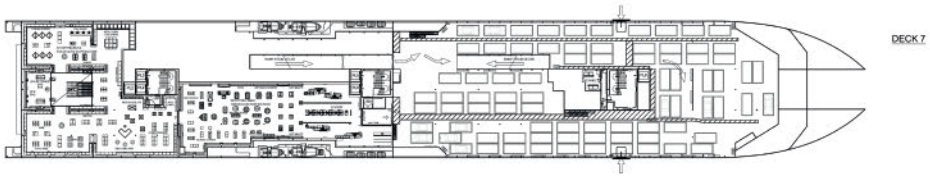
BASIC *MYSTAR* GENERAL ARRANGEMENT

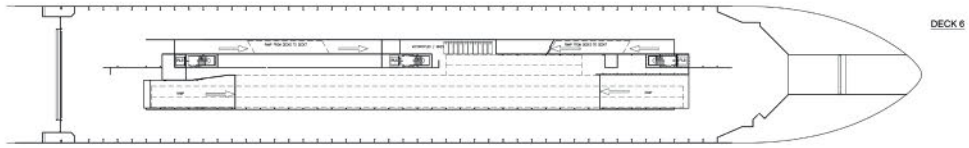


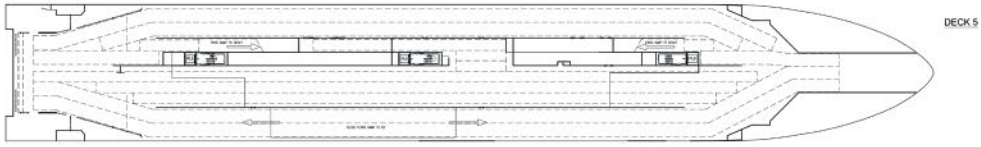


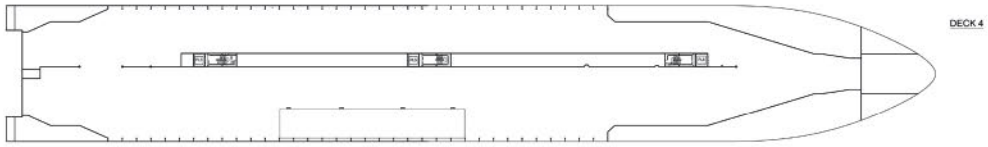


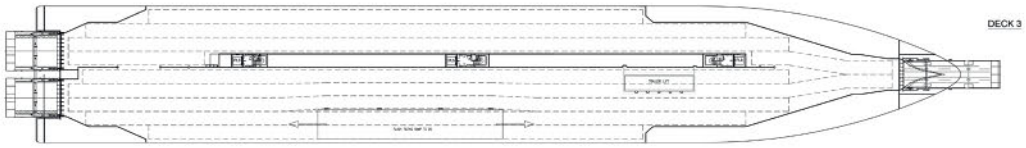


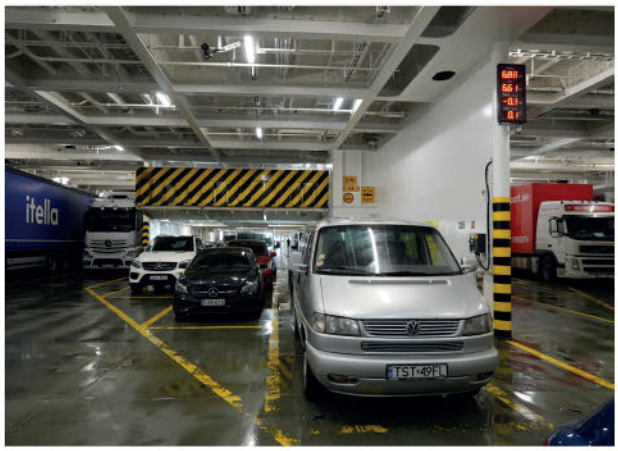












UPPER FREIGHT DECK WITH FIXED DECK 6 CAR DECK. SOURCE: PHILIPPE HOLTHOF

Forward on Deck 8 is the 188-seat pay-in Comfort Lounge on the portside, offering free refreshments, non-alcoholic beverages, newspapers and Wi-Fi. Inboard, it also has a small meeting room, adjacent of which is the exclusive ultra-deluxe six-seat Platinum Lounge. The Platinum Lounge is a new offering, accessed from the starboard all-inclusive Business Lounge. The stair hall just aft of the 160-seat Business Lounge holds the main entrance for foot passengers, yet visitors to the Business and Platinum Lounge can make their way directly to the Business Lounge through a separate entrance that is accessed from the draught lobby in which the gangway lands.

Deck 9 is the restaurant and bar deck with the 376-seat main Delight Buffet occupying the best part of the forward fire zone. The 84-seat Chef's Kitchen à la carte restaurant is located to starboard.

Aft of the forward staircase is the ship's main galley to port with the 356-seat Fast Lane self-service restaurant stretching the full length of the midship fire zone. It segues seamlessly into the portside Burger King fast food franchise. Moving further aft is a quiet, 297-seat reclining seat room on the portside of the engine casing with the Nordic Bar on its starboard side. Yet another change for the better is the repositioning of the bar counter, alongside the engine casing's bulkhead. On *Megastar*, the bar counter was more centrally located which resulted in seating being 'hidden' behind it. The rear section of Deck 9 boasts Sea Pub, the ship's main bar, and the indoor-outdoor Garden. Reminiscent of a greenhouse, the Garden was added as kind of afterthought on *Megastar*, but on *MyStar* it is a lounge in its own right, with plants, high-quality garden furniture, hanging chairs and guillotine-type windows that open up to the sea.

Deck 10, the bridge deck, is the main cabin, with an officer's, crew's and passenger's cabin section. There are a total of 44 passenger cabins, 43 of which are outside, including the single suite. Inboard, connected to the crew's pantry, is a dedicated commercial drivers restaurant deck with a total of 83 seats. Deck 11 holds more crew cabins, bringing the total number of officer's and crew cabins to 136. The SRtP emergency bridge is located in the Deck 12 mast house.

With the introduction of *MyStar*, it was expected that the 2007-built *Star* would be disposed of. Several parties have shown interest and inspected *Star*, but as long as no deal has been struck, she keeps on supplementing the Star class *Megastar* and *MyStar*, bringing the total number of sailings to eight per day in either direction. ■

TRAVELLER SUPERSTORE SHOPPING MALL. SOURCE: PHILIPPE HOLTHOF

ECO SHIP TECHNOLOGY

MAERSK STARTUP PARTNERSHIPS INCREASE GREEN ENERGY STAKE

By **Tom Barlow-Brown**

The shipping giant Maersk is no stranger to innovation. Its recent investment in green energy technology shows the company is looking towards the future when it comes to sustainable technology in shipping. In January 2023 the company invested in German-based startup C1 Carbon, which has developed a new fuel-efficient catalysis technology for synthesising methanol. It's the latest development in Maersk's journey to increase its reliance on green energy and will see it become the leading player in the field of methanol production as a viable fuel for ship propulsion.

The company has set a net-zero emissions target for 2040. This includes a 50% reduction in emissions per transported container across the Maersk Ocean fleet compared to 2020 and a principle of only ordering newbuilt vessels that can be operated on green fuels. Maersk has identified methanol as a priority for achieving its green energy targets, recognising the importance of achieving major technological innovation in the green fuels and methanol space to drive down the cost of reducing emissions considerably.

In October 2022, it announced that it would be ordering a further six large ocean-going vessels that can sail on green methanol, which will be built by Hyundai Heavy Industries and have a nominal capacity of 17,000TEU. This move is intended to upgrade the existing capacity in the Maersk fleet and brings the total number of duel-fuel vessels to 19. Moreover, in late December 2022, Maersk officially announced the launch of the company's first low-emission logistics centre in China. This US$174 million project is expected to start operation in Q3 2024.

Since 2018 Maersk has invested in more than 40 companies across the full scope of the supply chain. The company aims to achieve this by investing in and partnering with talented startups, scaleups and visionary innovators. In doing so the company aims to improve its supplier relationship with startups and in turn gain strategic insights on trends and strategic insights.

Berlin-based startup C1 Carbon was launched in 2022 with the aim to make the chemical industry more sustainable. The company has developed a more efficient and sustainable process for producing methanol. Key to this new technology is a catalyst that makes methanol production quicker and, ultimately, more cost-effective.

This new process allows green methanol to be produced from excess biomass, waste plastic, or CO_2 and H_2, this makes the process much more cost effective. C1 Carbon is also piloting a containerised reactor design. This will allow production to take place where sustainable feedstocks are available or close to harbours where green methanol is needed for bunkering.

"We are proud to have partnered with the global pioneer in green shipping in an industry where many fear a first-mover disadvantage," states Christian Vollmann, one of C1's founders. "The 19 methanol-enabled container ships they have ordered already are a strong advanced buying signal into the market," he adds. "We look forward to joining forces with Maersk to make low climate impact shipping a reality."

The company is the latest methanol producer to receive investment from Maersk. In December 2022 the company signed a Letter of Intent with US-based SunGas Renewables, Inc., part of GTI Energy, for the large-scale production of renewable fuels. The first facility is expected to begin operations in 2026 and have an annual production capacity of approximately 390,000tonnes. Along with SunGas, C1 Carbon is the tenth such company that Maersk has invested in.

Commenting on the new partnership, Jane Creek, marketing manager at Maersk Growth, says: "We back promising technologies within the green fuels space. So, it's partly about bringing capital and credibility to the space and ensuring that the entrepreneurs can continue their developments, ideally at an accelerated pace. It's also for us to learn about challenges in technology development, and ultimately, we hope to be able to help C1 scale commercially." ■

MAERSK HAS ON ORDER SIX 17,000TEU CONTAINER SHIPS TO BE POWERED BY GREEN METHANOL. SOURCE MAERSK

RINA'S WIND PROPULSION 2023 BRINGS TOGETHER TOP SPEAKERS IN FIELD AT IMO

By **Tom Barlow-Brown**

The Royal Institute of Naval Architects held its annual Wind Propulsion conference on the 16-17 February 2023. The event took place at the headquarters of the International Maritime Organisation in London, representing the first time that RINA has organised an event at this location.

The event, sponsored by Yara International and the International Windship Association, was attended by over 100 people and included delegates from a range of different organisations and countries at the forefront of wind-assisted propulsion systems (WAPS) technology. The speakers over the conference's two-day schedule represented organisations from naval architecture firms and ship to designers and research organisations. The delegates also took part in a lively debate each day which allowed for discussion on multiple topics related to wind propulsion. There was also time for crucial networking amoungst industry professionals, allowing individual attendees to share ideas with each other in a more informal setting during coffee and lunch breaks in the IMO's lounge.

Of the papers presented during the course of the conference there were topics ranging from theoretical ideas, to the more practical. Amongst these were things such as the use of CFD in predicting performance of WAPS technology and the use of manoeuvre simulations, as well empirical methods for data collection. These included the team at bound4blue, which has developed the eSAIL. Taking inspiration from the Turbovoile concept, the eSAIL is an autonomous suction sail that combines the positive features of a conventional wingsail but uses an active boundary layer control techniques to prevent flow detachment, thus achieving extraordinarily high values of lift coefficients. This results in a smaller size and lower weight sails for equivalent savings. Using results from CFD the paper showcased bound4blue's journey in using CFD to design the eSAIL, showing details at every step of the way with an increase in performance of up to 20% when compared to the Turbovoile.

Highlighting wind propulsion technology's applications in the field of passenger cruise ships the team from Chantiers de l'Atlantique (CdA) likewise offered some key insights into how this area of shipping could benefit in the future. CdA's team presented their large sailing cruise ship concept design, Silenseas, which would allow cruise vessels to reduce their GHG emissions up to 45% compared to similar conventional ships and is transferable large vessels, resulting in even larger potential energy savings.

Another paper of note presented was from the team at RISE Maritime, whose work concerned the development of standardised ways to express the technical performance of wind propulsion technologies. As the wind propulsion community has not yet agreed on common key performance indicators (KPI), this makes comparison

A PACKED CONFERENCE HALL AT THE IMO FOR WIND PROPULSION 2023

between different technologies difficult. Using an example ship of a 5,000dwt general cargo carrier with a length of 90m, RISE analysed different WAPS technology and how it impacted vehicle performance. The resulting research presented by RISE Maritime at the conference is a crucial step towards regulation within the industry. Also presented during the conference was important work by XP Sea and Semantic TS relating to the effects of underwater radiated noise (URN) on marine life and the possible applications of wind propulsion technologies to mitigate this. Crucially this study highlighted that a WAPS cargo vessel receiving 40% of its propulsion from wind will significantly reduce the disturbance to marine mammals' communication while keeping the same speed as a vessel powered 100% by conventional propulsion.

A further illustration of the practical application of wind propulsion technologies on an existing vessel was presented by the team from Ouchi Ocean Consultant Inc and Mitsui O.S.K. Lines Ltd, whose "Wind Hunter" design is a zero-emission cargo ship powered by wind and hydrogen energy. The research presented on the vessel demonstrated that when a sailing ship with large rigid sails navigates in a sufficiently windy area, the thrusts from sails are strong enough drive the ship at an adequate speed and rotate a large underwater turbine – thus, generating electricity for the water electrolysis to generate hydrogen onboard. The Wind Hunter design is equipped with the Wind Challenger sail, a large rigid wing sail capable of powering a large merchant ship with the potential to run the ship at at cruising speed by generating the proper amount of hydrogen from the kinetic energy of the wind via electricity.

Many more papers were presented during the conference which will be made available to RINA members, showcasing the cutting edge of industry research in wind propulsion technology. Following the success of the conference at the IMO RINA looks forward to an exciting year showcasing work by individuals and organisations in the naval architecture field. ■

COLLABORATION AND VERIFICATION THE KEY TO WINDSHIP PROGRESS

By **Richard Halfhide**

During the 1950s, sociologists in the United States looking at agricultural practices first coined what's known as the technology adoption lifecycle, the bell curve by which new products and innovations gain wider acceptance. Innovators give way to early adopters, which in turn grows into a majority before finally through normalisation the laggards finally embrace the technology. Given maritime's conservative ethos, it's more common for technologies to be adopted through regulatory mandates, such as ballast water treatment or scrubbers, but there are some notable exceptions.

"When I was at ABB I worked a lot with the azipod propulsion system, which was introduced to commercial shipping in the late 90s. For the first three or four years most shipowners wanted to wait and see how it worked. I was involved with the first five [installations] but now there are more than 750," Jukka Kuuskoski, chief sales officer for Finnish rotor sail specialists Norsepower, tells *The Naval Architect*.

"That was a critical piece of ship propulsion, whereas rotor sails are non-critical in the sense that if there is a problem it won't compromise a ship's safety or operation. But of course improving fuel consumption and reducing emissions is the key performance indicator."

Just over a decade after its formation, Kuuskoski is confident that Norsepower is beginning to enter a period of rapid growth, something that might also be applied to windship technology adoption more generally. Currently there are six ships operating with the company's rotors, all of these retrofits, but that number should be doubled over the next year as other projects are completed (announcements concerning further agreements are said to be pending) while expansion into newbuildings should be consolidated by the creation of a Chinese manufacturing hub. Moreover, he notes the quality of enquiries Norsepower receives from shipowners has changed markedly over the last two years, from casual interest to direct questions about matters such as configuration and lead time.

But with that comes a growing need to build more meaningful collaborations, both with rival windship companies on areas of common interest and other stakeholders such as owners, shipyards, charterers and classification societies. As part of RINA's recent Wind Propulsion conference in February 2023, Kuuskoski presented on some of the challenges associated with wind propulsion projects and the hurdles towards wider technology acceptance.

Kuuskoski explains: "There are quite a few aspects of ship design and shipping traditions that are not thought through from the wind propulsion point of view. Many regulatory aspects are disrupted by energy saving emission reduction by wind and it requires a negotiation process between different parties. With Norsepower we can say in good conscience that we are market leaders in our field; that's largely down to the references that we have and third party-verified performance measurements that we can provide to our customers."

Because wind is a fluctuating power source it's important to be able to prove the reliability of a system and offer performance guarantees, something that's critical to matters such as charter contracts where a specified level of performance becomes legally binding. Kuuskoski comments: "Luckily we have customers like Vale and BHP who recognise it's a mutual benefit of the shipowner and charterer that these sorts of solutions are implemented and can figure out how to make the investment and share the benefits. The message we get from shipowners is that the charterer gets the benefits of reduced fuel consumption but there are no guarantees of a better day rate. So some kind of formula needs to evolve."

One principal method of demonstrating that performance is of sea trials and in the case of Norsepower's earlier installations, such the cruise ferry *Viking Grace* in 2018, they adopted programmes whereby the rotors sails would be switched on and then off for 70 minutes, repeating this process thousands of times to build up performance curves that demonstrated the benefits. Such exhaustive trialling wouldn't be possible without the benefits of subsidies, but were essential in laying the foundations.

Third party verification, be it from classification societies or data analytics specialists such as Finnish company NAPA, with which Norsepower has forged a close partnership in developing a voyage optimisation solution, are also a crucial ingredient in winning wider acceptance. Another is providing reassurance on matters such as crew training on how to operate the rotor sails.

But with estimates suggesting that more than 10,000 vessels will have some form of wind assistance by the end of this decade it's increasingly a question of when, rather than if, profitable collaboration is realised. ■

JUKKA KUUSKOSKI
SOURCE: NORSEPOWER

WEATHER ROUTING

DIGITALISED PLATFORM COULD LIGHTEN THE BURDEN OF HEAVY WEATHER

By **Richard Halfhide**

Climate change is causing issues for the shipping industry. Sea surface temperatures and sea levels are rising, becoming a catalyst for major weather events. Tropical cyclones, which carry the potential to develop into hurricanes and typhoons, are becoming stronger while precipitation is intensifying. Rising sea levels are changing tidal circulation in shallow waters, leading to loading and unloading problems in ports, while the increased ocean energy is causing stronger waves and problems such as parametric rolling. All of this against the backdrop of ongoing efforts to improve fuel efficiency and reduce CO_2 emissions.

Small wonder then that weather routing solutions are becoming an essential tool in mitigating risks and optimising savings, but it's often a time-consuming and costly process. Traditionally, most weather routing is conducted by shore-based consultants, often themselves former seafarers, who will engage in protracted email exchanges with a ship's captain to devise a suitable route, frequently with little input from other stakeholders, such as operators and charterers. Moreover, the expense involved often means that weather routing is often reserved for long-haul journeys, despite the potential benefits for shorter routes.

But with increased digitalisation and the application of Artificial Intelligence (AI) a new generation of cheaper, flexible and more user-friendly routing tools are starting to emerge. In late 2022, New York-headquartered voyage performance specialists OrbitMI officially launched Orbit Weather+, a cloud-based digital solution that allows users to generate as many automated alternative routes and scenarios as they please in a matter of moments, utilising dynamic weather data to obtain an immediate estimate of the potential cost and emission savings.

Orbit Weather+ is intended to serve as a scalable single-source-of-the-truth and speed up decision making. Powered by an array of Application Programme Interfaces (APIs) provided by compatriot weather data analytics company DTN, that utilises data from an array of different sources, including partner companies, third parties and publicly available information. With the current iteration of the product, users are able to optimise their route for speed, time and cost, although future releases will extend this capability to allow for optimisation of earnings, Carbon Intensity Indicator (CII) and other parameters.

Suitable for both tankers and dry cargo, it has already been extensively tested on several fleets during a pilot phase, including those of operator Western Bulk. After essential vessel data has been entered, a straightforward interface allows customers to input the point of departure and destination, along with the optimisation and calculation types (e.g. vessel speed). During a demonstration exercise shown to *TNA*, Orbit Weather+ was able to generate a route from Rotterdam to Houston in less than a minute.

SOURCE: PIXABAY

This information can then be emailed to the ship's master with a single click of the button and can be provided in RTZ file format that can theoretically be entered into the ship's voyage planning software as an ECDIS overlay. While these routing capabilities are powered by the AI, users still have the option of consulting with a human analyst at any stage of the journey, although it's not clear what this might add to the basic cost which the company says is around US$400 per month per vessel (on a subscription model that's cancellable at any time). It's envisaged that users will experiment with differing degrees of automated and analyst-based insight according to their particular needs.

OrbitMI is keen to stress the captain would remain the ultimate decision maker in routing decisions, but one of the tool's biggest benefits, according to the company, is the ability for route information to be easily shared with operators and charterers. It adds that many charterers have enthused and expressed their wish to see even more capabilities added to Orbit Weather+ in the future. Nevertheless, this does raise the perennially thorny problem of undue commercial pressure being exerted over masters with regard to their routing choices, potentially undermining not only a vessel's safety but also its emissions profile.

Still, as an economical option that negates the hassle of software installation and updating, while easily paying back its cost through the potential fuel savings, it seems more than likely that Orbit Weather+ is just the first of many automated routing solutions likely to emerge over the next few years. ■

CALL FOR ABSTRACTS

imc 2023

INTERNATIONAL MARITIME CONFERENCE

7–9 NOVEMBER 2023
INTERNATIONAL CONVENTION CENTRE
SYDNEY, AUSTRALIA

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.

KEY DATES FOR IMC 2023:

Call For Abstracts	**Wednesday 25 January 2023**
Abstract Submission Deadline	**Friday 28 April 2023**
Author Acceptance Notification	**Friday 19 May 2023**
Refereed Paper Submission	**Monday 14 August 2023**

IMC 2023 is held in conjunction with INDO PACIFIC 2023
For more information: **www.indopacificexpo.com.au/IMC2023**
Contact the IMC Secretariat: **imc@amda.com.au**

INDO PACIFIC 2023
7 - 9 NOVEMBER
INTERNATIONAL MARITIME EXPOSITION
INTERNATIONAL CONVENTION CENTRE, SYDNEY, AUSTRALIA

BRIDGE SYSTEMS

HUMAN ERROR OR TECHNICAL FAILURES – WHAT CAUSES SHIPPING ACCIDENTS?

By **Tom Barlow-Brown**

A major safety incident at sea is any crew or shipowner's worst nightmare. Collisions, groundings and fire can all lead to a serious loss of life and cargo, and potentially cost companies millions of dollars in damages. Additionally, the environmental impact that can result from bulk carriers or tankers spilling their cargo into the ocean, is something that in this increasingly eco-conscious world companies would rather avoid.

There are multiple reasons for these accidents, but human error can be broadly defined as the key cause in many of them. Either through the failure of the crew onboard ship to recognise safety hazards or through improper utilisation of navigational tools available to them in the first place. Insurance company Allianz estimated in 2019 that 75% to 96% of marine accidents involved some level of human error. This is often compounded by inadequate training for the crew onboard who are not always well versed in the systems they are using.

According to Intercargo's 2012-2021 trends report the total number of carriers larger than 10,000dwt lost was 27. Given the size and cost of these vessels this is a high number. Intercargo identified that 48.1% of all total losses in this period were caused by ships running aground. The highest number of these were in the range of 10,000 – 49,999dwt vessels. The report also found that human error both operationally and in navigation was a major factor. One of the largest of these was the VLOC *Stellar Banner*. The 328m vessel ran aground on a sandbar as crew were not monitoring bridge systems adequately. It was eventually scuttled in the Atlantic at the cost of millions of dollars.

In theory crew members on watch should be assisted by the Electronic Chart Display and Information Systems (ECDIS). Usage of the ECDIS is now mandatory for all ships under regulations laid out by the International Maritime Organization (IMO). Formal standards to enforce this came into force in 2011. However, despite the fitting of the system onboard all vessels. Some crew members are either not properly trained to use it or prefer to rely on older paper charts. Inadequate monitoring of the ECDIS was also found to have played a role in the loss of the Newcastlemax bulk carrier *Wakashio* in 2007, as the crew was distracted by their search for a phone signal and therefore not paying attention to the system.

More recently the failure of the crew to correctly check their ECDIS and other bridge systems effectively was found to be the cause when the cargo vessel *Kaami* grounded on the Sgeir Graidach shoal in the Little Minch strait, Scotland. The 4,293dwt vessel ran aground on the morning of 23 March 2020. Investigations carried out by the Marine Accident Investigation Branch (MAIB) highlighted that the crew had not sufficiently identified the hazard posed by the shoal or been sufficiently trained in use of the ECDIS. Other findings showed that there were not sufficient crew members on the bridge at the time of the grounding, meaning that bridge lookouts were fatigued and not able to corroborate or audit data from the ECDIS effectively. Luckily the crew were all rescued, but

NEWCASTLEMAX BULK CARRIER *WAKASHIO*

THE *STELLAR BANNER* SINKING

the ship sustained such damage that it was declared a total loss. Recommendations by MAIB upon conclusion of their investigation were that shipowners needed to provide proper training in the use of the ECDIS.

On 1 October 2015 the 241m ro-ro *El Faro* sank with all hands in Hurricane Joaquin off the coast of Florida. An investigation by the National Transportation Safety Board (NTSB) found a litany of safety errors, amongst them was inadequate Bridge Resource Management and failures by the shipowner, Tote Maritime, to properly train the crew in the use of the vessel's BonVoyage System (BVS). This software optimises weather routing and damage control of a vessel's cargo holds and its proper use could have been key in keeping the crew alive by preventing them from sailing straight into the path of Joaquin.

Incidents like the *El Faro* sinking represent an extreme and tragic example of what can go wrong and the loss of all crew members during the sinking of a vessel is, thankfully, rare. Yet, companies have recently begun to think even more seriously about further means to mitigate vessel losses and crew injury. This is helped by the rise in new innovative tech products on the market and efforts by naval architects to work together to provide solutions for the problems facing the industry. Answers to this have been helped by the expansion of the move towards the so-called 'Shipping 4.0' concept, and the overall digitisation of the industry at large. Companies are embracing new technologies such as augmented reality and linking up with the burgeoning artificial intelligence sector in order to provide solutions to navigation and safety issues onboard ships.

One such example is Mitsubishi O.S.K Lines (MOL), which has recently implemented the Fleet Optimal Control Unified System project (FOCUS). This is intended to collect and apply Big Data to optimise the navigation and maintenance of their vessels through two apps, the 'Fleet Viewer' and the 'Fleet Performance' app. Part of the work on this project includes research towards enhanced safety procedures through use of an Automatic Identification System, whereby images from the bridge can be shown on tablets overlapping with augmented reality software and allowing crew members to build up an enhanced picture of hazards ahead. Another Japanese company, Fujitsu, has also made progress in producing innovative software to prevent navigational errors. The company has recently been collaborating with the Japanese Coast Guard to provide artificial intelligence assisted technology which can support vessel navigation in Tokyo Bay. However, the wider application of such software is yet to be fully explored. There is also the question of whether crews will operate newer technology effectively if issues with the ECDIS system onboard are still the cause of many accidents.

Adding yet more technology that crews need to use may also be detrimental, as recent studies have shown that an over reliance on personal electronic devices, such as smartphones and tablets, can be distracting for crew members. When the 334m container ship the *Ever Forward* grounded in the Chesapeake Bay on 13 March 2022 an investigation by the US Coast Guard concluded that the cause for the accident was the pilot failing "to maintain situational awareness and attention while navigating." This was due to the pilot being sufficiently distracted by using his PED that he was unable to respond to hazards effectively. A Canadian Transportation Safety Board investigation into the collision between the vessels *Florence Spirit* and the *Alanis* on 11 July 2020 in the Welland Canal, Ontario, also found that while not a direct contributing factor to the incident use of PEDs will jeopardise navigational safety if policies around their use are not properly enforced.

A further case of crews not maintaining a proper lookout or making the full use of the ships systems comes from the collision between the yacht *Utopia IV* and tanker *Tropic Breeze*, 20 miles northwest of Nassau in the Bahamas on 23 December 2021. The collision occurred due to crews of both vessels not using the full range of resources available to them, including electronic equipment. The total damage sustained by both vessels was US$7.9 million and 156,500 gallons of petrol from the tanker were released into the ocean.

Prompted by the grounding of the *Kaami*, MAIB began serious audits of the procedures for using onboard navigation technology. The final report, published in 2021, while not providing any concrete safety recommendations is intended as a catalyst for wider change in the industry. It asserts that the ever-changing nature of ECDIS use and the different levels of integration of it into various vessels systems makes it difficult to adequately train all mariners in its use. This brings into question the generic training provided by IMO and if navigators can 'learn on the job.' As newer technologies become available for ship navigation the stress place on crew members to learn new skills with older crew members delegating responsibilities. When this becomes the new normal crew members and ship owners will need to take a proactive approach to enforcing safety procedures or the risk of future serious accidents is more than likely. ■

ENGINES

CROSS-INDUSTRY TEAM TACKLES METHANE SLIP

By **David Tinsley**, Correspondent

REDUCING THE RELEASE OF METHANE INTO THE AIR IS CRUCIAL FOR CLEANER SHIPPING WITH LNG. SOURCE: CREATIVE COMMONS

Methane is a potent greenhouse gas, estimated to have a global warming potential (GWP) of 27-30 over 100 years, while CO_2 has a GWP of 1 regardless of the time period used.

The low-pressure, dual-fuel concept has proved to be the most popular LNG engine technology, but it is also most closely identified with the phenomenon of methane slip, the unburned CH_4 that is released into the atmosphere.

Although natural gas currently represents only about 3% of total fuel consumption by the global fleet, and notwithstanding the technological advances that have limited such fugitive emission factors from various engine designs in recent years, methane emissions have grown steeply over the same period. The acceleration in the nomination of LNG dual-fuel installations for newbuilds necessitates ever-closer attention to the issue.

A further, large-scale European collaborative endeavour addressing ways of abating or moderating methane slip was launched during 2022 under the co-ordination of VTT Technical Research Centre in Finland. The five-year GREEN RAY project is focused on low-pressure, dual-fuel technology in both two-stroke engines and high-powered four-stroke engines.

The 12 research partners provide cross-industry representation, from the shipowning, shipbuilding, fuel supply, marine engineering, and classification sectors together with academia. As the initiative chimes with EU climate ambitions, GREEN RAY has qualified for a grant of nearly €7 million (US$7.6 million) out of the European Commission's Horizon Europe research and innovation programme, towards the overall budgeted cost of €10.5 million (US$11.4 million).

Technologies development

The consortium has the remit of tackling the problem from multiple angles, by developing three solutions applicable to both existing vessels and newbuilds.

The on-engine solution for two-strokes involves a patented LNG injection system, conceived to significantly cut fugitive emissions from propulsion installations on deep-sea vessels such as tankers and container ships. The parallel four-stroke development aims to reduce slip at all engine loads from wide-bore machinery as used to power cruise vessels, ferries and gas carriers.

The third sphere of investigations entails aftertreatment plant in the shape of a sulphur-resistant catalyst system designed to convert the remaining methane emissions into a less potent GHG. The intention is to

achieve an overall reduction of up to 95% in such emissions and ensure that slip is kept below 1g/kWh.

All three developed solutions will be demonstrated at sea, to Technology Readiness Level (TRL) 7, aboard two newbuilds and one existing vessel. TRLs are different points on a scale for estimating the technical maturity or progress of a particular technology during its acquisition or take-up stage.

Technologies and methodologies emanating from GREEN RAY will also be fully capable of utilising bio-methane or synthetic methane, instead of fossil LNG, so as to assist the industry in making the energy transition to "climate neutrality".

Measuring the scale of emissions

Moreover, the consortium will contribute to climate data collection via the study of methane levels, which will allow for a more global assessment of GHG emissions from LNG marine fuel. The information will be combined with onboard experiments and modelling to provide a more comprehensive overview of the climatic impact of shipping.

Ascertaining the true scale of methane emissions is fraught with difficulties, not least a lack of globally recognised methods or consensus, aggravated by shortcomings in availability of data and suitable tools.

Accurate gauging and understanding as to how such emissions can be managed to negligible levels will signal if liquefied bio-methane (LBM) and liquefied synthetic methane (LSM) are viable pathway fuels to help achieve 2050 decarbonisation targets.

The ascription to GREEN RAY not only constitutes a broad church but also one which includes high-profile, expansion-minded members of the shipping community, the technology users. The Swiss-headquartered MSC Group is participating through its London-based company MSC Cruise Management and its fleet maintenance specialist MSC Malta Yard, while the French organisation CMA CGM is enrolled by way of the Marseilles fleet operating arm CMA Ships.

EU funding allocations to the foregoing, however, are minimal (and zero in the case of the UK company). The Wärtsilä Group is the recipient of the largest amount of grant, nearly €3 million (US$3.3 million) going to its Finnish and Italian participants in GREEN RAY, while Shell Global Solutions of the Netherlands has qualified for €1.39 million (US$1.5 million). VTT has been allocated €1.11 million (US$1.2 million), while Chantiers de l'Atlantique – whose Saint-Nazaire workload features a high volume of newbuilds for MSC – has received €0.68 million (US$0.74 million). The project consortium also includes DNV and Ilmatieteen Laitos (Finnish Meteorological Institute). ■

SETTING A NEW BENCHMARK IN DUAL-FUEL EFFICIENCY

By **David Tinsley**, Correspondent

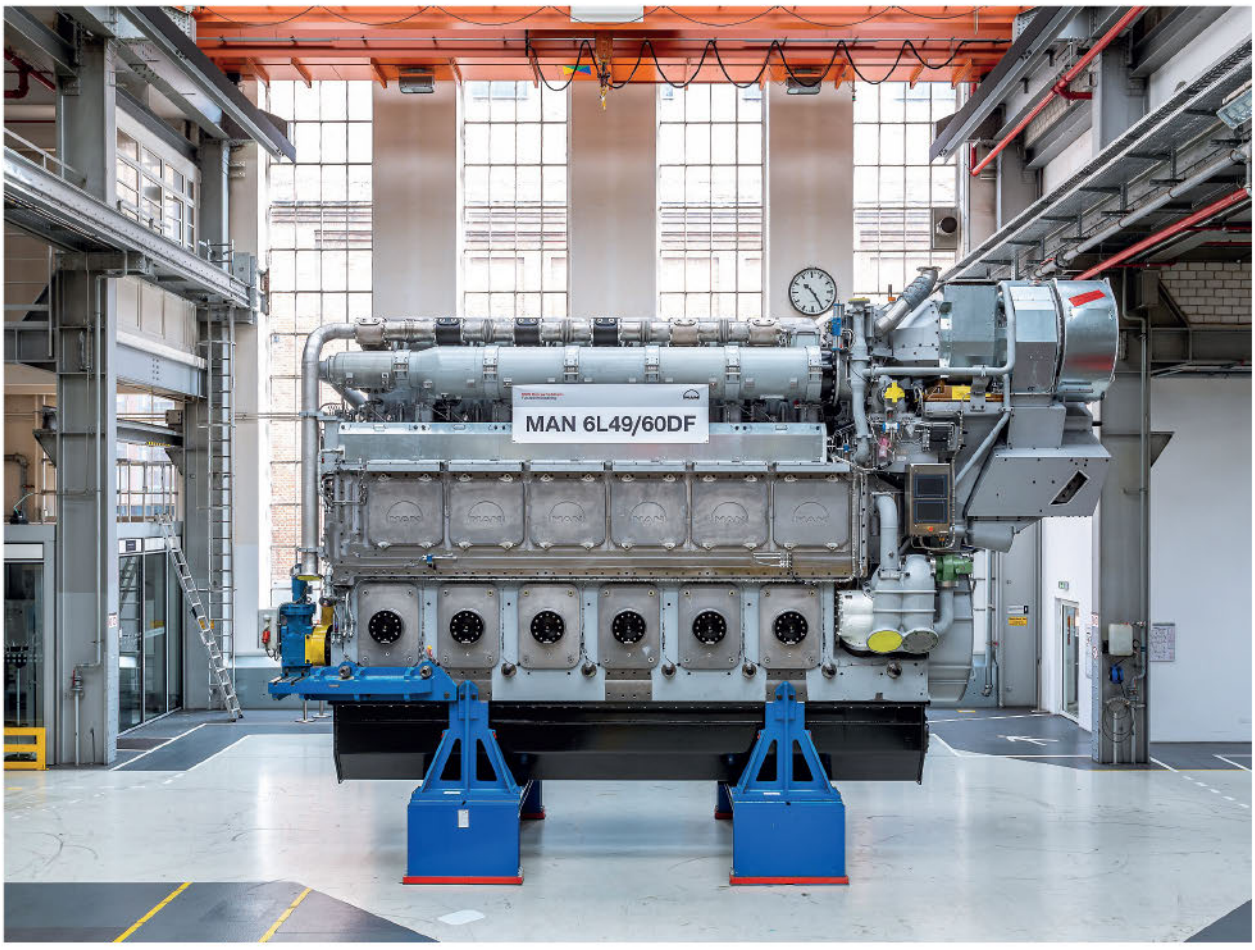
Raising its game in the wide-bore, medium-speed engine stakes, MAN Energy Solutions has introduced its most powerful dual-fuel, four-stroke engine to date. Spanning the 7,800-18,200kW maximum output range, the 49/60DF design exceeds the larger 51/60DF in potency, while consuming less fuel, such that it is claimed to achieve a class-leading standard of efficiency in both gas and diesel modes.

The technological progression implicit in the latest addition to the Augsburg portfolio is testament to the intensity of competition in the market segment, notwithstanding the very few players involved. The 49/60 platform on which the dual-fuel engine is based embodies long-term thinking in bestowing a multi-fuel capability and adaptability, a concept which is also pivotal to the similarly powered 46TS-DF four-stroke developed by Wärtsilä.

The MAN 49/60DF has a maximum continuous rating of 1,300kW per cylinder at 600rpm, compared to the 1,150kW/cyl of the high-power variant of the 51/60DF running at 500/514rpm, and is superior in terms of fuel-burning performance. The output is, however, on a par with that of the 45/60CR diesel engine announced a few years ago, but above that of the 1,200kW/cyl at 500/514rpm of the 48/60CR design, which the 45/60CR was intended to eventually supersede.

In terms of fuel efficiency, the 49/60DF is described as setting a new benchmark. At 85% maximum continuous rating (MCR), fuel consumption is quantified as 6,990kJ/kWh in gas mode and 171g/kWh on liquid fuel, making for a significant differential in relation to its dual-fuel predecessor, the 51/60DF, which was developed from the 48/60 diesel engine.

For example, vee-type models of the 51/60DF in its 'High Efficiency' version are catalogued as offering 175.5g/kWh and 7,150kJ/kWh in diesel and gas modes, respectively, at 85% MCR, while the 'High Power' variant in vee configuration (slightly less fuel-hungry than the in-line models) burns 181.0g/kWh and 7,250-



POTENCY IS MELDED WITH LONG-TERM FUEL ADAPTABILITY IN MAN'S LATEST OFFERING, THE 49/60DF FOUR-STROKE DESIGN. SOURCE: MAN ES

TECHNICAL PARTICULARS MAN 49/60DF ENGINE	
Cylinder bore	490mm
Stroke	600mm
Cylinders	6L, 7L, 8L, 9L, 10L, 12V, 14V
Max output per cylinder	1,300kW
Engine MCR range	7,800-18,200kW
Speed	600rpm
Power-to-weight ratio (L models)	15.0-16.7kg/kW
Power-to-weight ratio (V models)	13.5-13.9kg/kW
Main fuels	LNG, MDO/MGO, B40 biodiesel, HFO
Fuel consumption, @85% MCR	
• liquid fuel mode	171.0g/kWh
• gas mode	6,990kJ/kWh
Applications	D-M (CPP); D-E (constant/ variable speed)

7,300kJ/kWh in respective diesel and gas operation, at the 85% output level.

Vessel versatility

The configuration versatility afforded by the 49/60DF across its in-line and vee-form layouts, and suitability for either diesel-mechanical or diesel-electric applications, makes for a broad market reach including cruise ships, ro-pax ferries, ro-ro vessels, LNG carriers and special-purpose types such as large dredgers.

The IMO Tier III standard is achieved in gas mode without secondary measures, while compliance in diesel mode can be met by adopting the proprietary, selective catalytic reduction (SCR) low-pressure system. Soot emissions when running on oil are halved, thanks to the effectiveness of the company's latest common-rail fuel injection technology. Moreover, methane slip when gas-fired will be considerably reduced, by 40% or more, compared to the 51/60DF engine.

In companion with the efficiency underpinning the platform, the 49/60DF is distinguished by the extent of fuel flexibility and hence the various emission and decarbonisation paths it offers operators to maintain vessel emissions compliance through to 2050. It is capable of running on LNG, marine diesel oil (MDO) and heavy fuel oil (HFO) as well as a number of more sustainable fuels including biofuel blends and synthetic natural gas. In addition, retrofit solutions for methanol are in the planning stage at Augsburg.

While the MAN TCT/TCX two-stage turbocharging is pivotal to the power upgrade encapsulated by the 49/60DF, the new Adaptive Combustion Control (ACC) 2.0 technology is a key enabler for the improved efficiency and operational performance, allowing automatic engine adaptation to changing ambient conditions, varying bunker quality, and engine wear. ACC 2.0 is pivotal to the way in which the 49/60DF pushes the bounds in dynamic engine running, allowing vessels to operate in gas mode in the most challenging situations such as manoeuvring.

Cybersecurity compliance

The proprietary Safety and Control System (SaCoS) encapsulated by the 49/60DF is the latest iteration (designated SaCoS 5000) of the proven SaCoS One system, focusing on reliability, robustness and comprehensive functionality. It embodies a performance upgrade in all components, and offers the added benefit of facilitating the new engine's compliance with rigorous cybersecurity requirements.

SaCoS 5000 was initially brought to bear on the MAN 45/60CR diesel engine launched in 2017, and has been subsequently further refined for roll-out in other units of the four-stroke range. The system offers an improved interface for data transfer, facilitating remote analysis and support functions in technical management. While the primary focus to ensure the safety and availability of the engine and the ship, SaCoS 5000 has also been conceived with cybersecurity in mind.

The 45/60CR engine is equally as potent as the 49/60DF, turning out 1,300kW per cylinder at a crankshaft rotation of 600rpm. The 450mm-bore 45/60CR was unveiled with SFOC at just 166-167g/Wh. Significantly, in the next development of the 49/60 platform, the OEM plans to introduce a diesel version during 2023, and this will be retrofit-ready for running on LNG and methanol.

Dual-fuel engine

Meanwhile, type approval testing for the new dual-fuel engine is anticipated in March this year, and the company cited a 15-month order-to-delivery timeframe for the first production engine, which would realise an at-sea newbuild installation in 2025.

The validation programme had started in 2018 with a single-cylinder prototype, leading to over 1,000 operating hours with a six-cylinder model on the testbed from April 2021 onwards, including an extreme condition test conducted last year at 120% load.

The launch of the 49/60DF was followed by the signing of an agreement between ABB and MAN Energy Solutions to collaborate on the development of dual-fuel electric power systems for LNG carriers. The memorandum of understanding envisaged propulsion plant based on the new dual-fuel engine and ABB's Dynamic AC (DAC) power distribution and control system.

The DAC concept combines the merits of conventional AC with variable frequency, whereby generator loads can be adjusted to engine speed, thereby optimising fuel consumption continuously and over the ship's complete operating profile. ■

UNERRING MARKET DRIVE BY KOREAN BRAND

By **David Tinsley**, Correspondent

NEW PRODUCTION CAPACITY FOR HYUNDAI'S HIMSEN RANGE HAS BEEN INAUGURATED. SOURCE: HHI-EMD

Against the backcloth of the dynamic expansion of the HiMSEN four-stroke brand, unequalled by any other manufacturer over the past two decades, Hyundai Heavy Industries (HHI) formally opened a new factory last October on the Korean peninsula.

Under the auspices of the group's Engine & Machinery Division (HHI-EMD), the production centre at Daebul National Industrial Complex, in the Samho area of South Jeolla province, is equipped to meet growing demand for the expanding array of dual-fuel models in the HiMSEN medium-speed portfolio.

The capacity of the new plant equates to around 100 sets per annum. Hitherto, the home-grown HiMSEN range has been turned out by the Ulsan works, complementing the world's most prolific output of large, two-stroke propulsion engines, in which HHI-EMD has a 36% share of the world market. The rise of the HiMSEN brand has a signal influence on the company's complementary 28% share of the mid-sized four-stroke sector.

The Daebul factory occupies a land area of 61,000m^2 and a building area of 19,000m^2, and is close to the parent group's Hyundai Samho Heavy Industries (HSHI) shipyard. Its commissioning coincides with the ramp-up of HHI-EMD's product development programme focused on the use of alternative fuels, including a new series of methanol dual-fuel engines.

Type approval testing of the H32DF-LM methanol-capable four-stroke in eight-cylinder configuration was completed by HHI-EMD at its Ulsan technology centre during September in the presence of seven classification societies. Subsequently, the factory acceptance test for the first production engine, a six-cylinder model in a genset aggregate for a Maersk containership newbuild, was undertaken in mid-December. The recipient 2,100TEU vessel under construction at Hyundai Mipo Dockyard will have the distinction of being the world's first methanol-fuelled boxship, specified with MAN 6G50ME-LGIM low-speed, two-stroke dual-fuel propulsion machinery, as well as two HiMSEN 6H32DF-LM auxiliaries.

The H32DF-LM covers a maximum output band of some 3,000-4,500kW in six- to nine-cylinder formats at the 320mm-bore size, one of the most populous and fiercely contested segments of the four-stroke engine market. By enabling firing on either methanol or diesel, the design confers operational flexibility and the means of complying with existing and future emission edicts. The application of diesel cycle combustion and electrically-controlled fuel injection in methanol mode ensures stable running at high loads, corrosion risks have been obviated through the use of special materials.

A further strand of the company's R&D programme entails the development and evaluation of a 1.5MW prototype capable of burning an LNG/hydrogen fuel

mix. The merit of hydrogen usage at a 25% mixing ratio is the consequent reduction in CO_2 emissions. The hybrid four-stroke machine represents the first step towards a 100% hydrogen engine, and has been tested to confirm combustion performance and stability. The prospective addition to the HiMSEN range is targeted at propulsion, marine auxiliary and stationary power generation applications.

The initial test campaign afforded positive results, demonstrating the prototype's ability to meet the IMO Tier III NOx emission standard, and effectiveness in curbing CO_2 and methane slip. As hydrogen is lighter and combustion speed is six to nine times faster than natural gas, a higher level of engine control technology and design safety was required. Stable combustion was achieved as a consequence of the lean-burn principle employed in conjunction with an enhanced compression ratio.

The machinery offers particular opportunities for maximising ship efficiency in liquefied hydrogen carriers, since the boil-off gas emanating from the hydrogen cargo during the voyage can be used as fuel in the hybrid engine. The LNG/hydrogen engine concept is claimed to be more beneficial than a hydrogen fuel cell plant in terms of lifespan.

The next goal of HHI-EMD is to take the hybrid engine's development to a stage where a higher proportion of hydrogen figures in the fuel mix, to be accomplished during 2023. Completion of an engine fuelled solely by hydrogen is envisaged for 2025.

The drive for technological self-reliance and in-house or otherwise national sourcing permeates Korean industry, and one expression of this disposition is the application of the Hyundai Intelligent Machinery and Equipment Control System (HiMECS) to HiMSEN dual-fuel machinery.

The Hyundai Mipo Dockyard (HMD)-built, 2,400gt passenger ship *Ulsan Taehwa*, the first vessel to feature HHI-EMD's Hi-EPS hybrid electric propulsion system, was formally named at the end of November 2022. The Hi-EPS installation is based on a nine-cylinder model of the HiMSEN H22CDF dual-fuel engine, rated at 1,900kW, and a battery pack.

The system and its application is a product of an initiative entitled ICT Convergence Electric Propulsion Smart Ship, conducted by HHI in co-operation with the Korean Ministry of Trade, Industry and Energy, the Korea Institute for Advancement of Technology, and Ulsan City. Benefits claimed for the Hi-EPS setup, through trials at sea, include a 40% reduction in CO_2 emissions relative to conventional diesel-electric power and a 6% gain in fuel efficiency through optimal engine control.

The HiMSEN brand's dual-fuel offering recently gained a reference in the northwest European short-sea traffic by way of the propulsion machinery in a new UK coastal tanker. The 6,100dwt *Sir John Fisher*, constructed by China Merchants Jinling Shipyard in Yangzhou, is powered by a seven-cylinder HiMSEN H27DFP engine rated for 2,170kW and allowing full operation on LNG as a cleaner alternative to conventional marine gas oil (MGO).

The nomination of an LNG-capable installation was influenced not only by the course of environmental legislation, but also by the increasing focus of energy groups and industrial users on the issue of carbon footprint exerted on logistic chains. A sistership newbuild, *Lady Maria Fisher*, is due this year. ■

TYPE APPROVAL TEST FOR THE HIMSEN H32DF-LM METHANOL-CAPABLE ENGINE COMPLETED AT ULSAN. SOURCE: HHI-EMD

ERUDITE DESIGN OFFERS FUTURE FUELLING OPTIONS

By **David Tinsley**, Correspondent

BELGIAN-DESIGNED AND BELGIAN-MADE, THE MULTI-FUEL 20EV23 IS A VERSATILE ADDITION TO THE MEDIUM-SPEED ENGINE SECTOR. SOURCE: ABC

Powering options available to ship designers, owners and builders in the output range up to around 7,000kW have been augmented by Anglo Belgian Corporation (ABC) through the unveiling of a versatile 20-cylinder, medium-speed engine. The 20EV23 four-stroke, targeted principally at passenger ship, ferry and naval applications, is distinguished by its adaptability and ease of conversion to different fuel types.

Based on ABC's Evolve platform, first brought to market towards the end of 2021 in a four-cylinder, in-line configuration (the 4EL23), the new vee-type achieves high potency within a compact, modular form conceived for long-term viability through the industry's energy transition. At the top end of its rating diagram and model variants, the 20EV23 produces a continuous 360kW per cylinder at a crankshaft speed of 1,200rpm.

Evolve engines have been optimised to run efficiently on diesel, achieving low emissions using proprietary exhaust aftertreatment system (EATS) technology, until other fuels become economically and logistically feasible.

Pivotal to the engine's long-term fuel flexibility and viability is its exchangeable power unit. The cylinder heads are adaptable to various firing arrangements for different fuels, be it common-rail or pump-line-nozzle (PLN) fuel injection for liquid fuels, micropilot liquid fuel combined with gas injection for dual-fuel capability, or spark ignition for 100% gaseous fuel.

This circumspect, anticipative design approach means that the engine's operational scope extends from marine diesel oil (MDO), marine gas oil (MGO), heavy fuel oil (HFO) and biodiesel to LNG, CNG, hydrogen and methanol. The Evolve generation is accordingly proposed as an affordable engine that de-risks the investment through its preparation from the outset for new fuelling solutions. Adoption of the open-ended fuel usage technology constitutes a hedge against uncertainty with regard to the cost and availability of future fuels, the manner in which environmental regulations may develop, and the impact of geopolitical events on supply chains.

The exchangeable power unit (cylinder head, cylinder liner, piston and conrod) also offers advantages insofar as technical management is concerned, by facilitating maintenance, overhaul and replacement procedures, maximising uptime.

Turbocharging

While single-stage turbocharging will be incorporated as standard in models specified at 720, 750 and 900rpm maximum speed settings, the 1,000 and 1,200rpm-rated engines will be offered with the choice of either single- or two-stage turbocharging. The power gain achieved with the two-stage option is significant, at nearly 10%, taking the 1,000rpm engine from 5,500kW to 6,000kW, and the 1,200rpm variant from 6,600kW to 7,200kW.

This gives an added edge to the responsiveness attributed to the 20-cylinder Evolve engine, even at

TECHNICAL PARTICULARS ABC ENGINE 20EV23	
Cylinder bore	230mm
Piston stroke	310mm
Cycle	4-stroke
Cylinders	20, vee-form
Nominal power range	3,960-7,200kW
Max speed range	720-1,200rpm
Speed, idling	400rpm
Power range, single turbo	3,960-6,660kW
Nominal torque, single turbo	52.5kNm
Power range, 2-stage turbo	6,000-7,200kW
Nominal torque, 2-stage turbo	57.3kNm
Length	7,600mm
Width, overall	2,790mm
Width, without air filters	2,360mm
Height	3,300mm
Swept volume per cylinder	12.9L

heavy load pickup, necessitated by the operating profile and particular demands of vessels such as ferries and naval units. The ability to deliver power when immediately needed is a safety factor. It allows for fast and decisive manoeuvring in high winds or heavy weather, steady close-to-quay approaches, and direct reaction to standstill or astern commands. Engine agility is not compromised by possible use of future fuels.

Modular EATS exhaust aftertreatment applied to Evolve engines features a diesel particulate filter (DPF) and selective catalytic reduction (SCR) unit with an integrated mixing pipe, ensuring IMO Tier III and EU Stage V compliance when running on diesel.

ABC keeps its technology and manufacturing in-house and within Belgium, at the Ghent factory, and contends that this complete orientation to Belgian production, using local and European components, infers a reliable, independent and EU-anchored supply chain.

Besides extending and rejuvenating its own portfolio, ABC is also engaged with Antwerp-headquartered shipowning organisation Compagnie Maritime Belge (CMB) in the development of a hydrogen engine range under the BeHydro banner. ■

AMMONIA ENDORSED FOR DEEP-SEA SECTOR

By **David Tinsley**, Correspondant

The start of 2023 has seen the laying of a further building block in the CMB Group's strategy of implementing the use of alternative fuels across its extensive and varied fleet. The latest expression of the Antwerp-headquartered organisation's commitment to fostering the energy transition in a pragmatic, viable manner has taken the form of an agreement signed between CMB.TECH and Winterthur Gas & Diesel (WinGD) relating to the development of ammonia-fuelled, wide-bore two-stroke engines.

The pact has particular significance for the deep-sea sector, where there are limited net-zero carbon fuel options offering the requisite energy density for feasible onboard storage. The initiative has a specific objective and timeline, since CMB's requirement is for ammonia dual-fuel propulsion installations, based on the X72DF engine, in a series of 10 Newcastlemax bulk carriers ordered in China and due to be delivered during 2025 and 2026.

Construction of the 210,000dwt newbuilds, which will be deployed by the CMB company Bocimar, has been entrusted to Qingdao Beihai Shipbuilding Heavy Industry. The vessels will be the first of their type with such powering arrangements, demonstrating the scope for zero-carbon fuels in large, ocean-going ships. The new ammonia-capable variant in WinGD's X-DF portfolio will be based on the X92B engine, rated among the market's most efficient, wide-bore two-strokes.

BOCIMAR'S NEWCASTLEMAX NEWBUILDS WILL HAVE AMMONIA DUAL-FUEL PRIMARY POWER. SOURCE: CMB

Shared insights

CMB.TECH's role within CMB is the development of low-carbon technologies and infrastructure in support of the decarbonisation of the parent group's fleet and portside operations, and the company has progressed a range of schemes and also investments involving both hydrogen and ammonia. It will thereby bring significant insights to the partnership with WinGD, complementing the latter's increased research endeavours over recent years into alternative fuels.

The shipowner's closer focus on future pathways was indicated by the recent statement from CMB chief executive officer Alexander Saverys: "We believe that ammonia is the most promising zero-carbon fuel for deep-sea vessels. Our intention is to have dual-fuel ammonia-diesel engines on our dry bulk vessels, container vessels and chemical tankers. Collaboration with WinGD on the development of the first ammonia-fuelled two-stroke engines for our fleet is a pioneering partnership on the road to zero emissions in shipping."

The 300m-long Newcastlemax newbuilds in China were specified with 14,400kW of main engine power, and with provision for ammonia fuel tanks fitted on each side of the aft superstructure. In addition, the group has six ammonia-ready, 25,000dwt stainless steel chemtankers and 12 ammonia-ready containerships of 6,000TEU on order in China.

WinGD made its intention known some time ago that it intended to be able to offer two-stroke engines running on methanol and ammonia from 2024 and 2025, respectively, and implemented a €30 million (US$32.5 million) R&D programme in mid-2021 addressing combustion solutions.

The Swiss-based, Chinese-owned designer and licensor announced an order in March last year for 920mm-bore, X-DF2.0 engines to power a series of ammonia-ready 14,000TEU boxships booked in China by Pacific International Lines. Subsequently, in June, the company entered into a collaboration with Hyundai Heavy Industries' Engine & Machinery Division (HHI-EMD), to deliver a first, ammonia-capable two-stroke by 2025. ■

RINA PUBLICATIONS ORDER FORM

All prices include postage & packaging and include VAT.

MAGAZINES

(Yearly subscription)	PRINT	DIGITAL	PRINT + DIGITAL
THE NAVAL ARCHITECT (10 issues)			
United Kingdom	£232	£232	£296
Rest of Europe	£245	£232	£308
Rest of World	£261	£232	£325
SHIP & BOAT INTERNATIONAL (6 issues)			
United Kingdom	£172	£172	£209
Rest of Europe	£181	£172	£220
Rest of World	£207	£172	£246
SHIPREPAIR & MAINTENANCE (4 issues)			
United Kingdom	£80	£80	£105
Rest of Europe	£87	£80	£113
Rest of World	£95	£80	£123

CONFERENCE PAPERS

	NON-MEMBERS	MEMBERS
ICCAS 2022	£130	£65
Scaling Decarbonisation Solutions 2022	£130	£65
Waterjet Propulsion 2022	£80	£40
Warship 2022	£100	£50
Autonomous Ships 2022	£110	£55
Wind Propulsion 2021	£130	£65
Warship 2021: Future Technologies in Naval Submarines	£120	£60
Ships' Life-Cycle 2021	£15	£10
Maritime Innovation/Emerging Technologies 2021	£80	£40
Warship 2021: Future Technologies in Naval Submarines	£120	£60
Full Scale Ship Performance 2021	£20	£10
Ship Conversion, Repair and Maintenance 2021	£15	£10
Surveillance, Search, Rescue and Small Craft 2020	£70	£35
Historic Ships 2020	£70	£35
Ice Class Vessels 2020	£30	£15
Smart Ships Technology 2020	£110	£55
High Speed Vessels 2020	£70	£35
Influence of EEDI on Ship Design & Operation 2020	£35	£17.50
International Conference on Autonomous Ships 2020	£60	£30
Damaged Ship V 2020	£70	£35
Human Factors 2020	£130	£65
Marine Design 2020	£140	£70
LNG/LPG and Alternative Fuel Ships 2020	£70	£35
Marine Industry 4.0 2019	£60	£30
ICCAS 2019	£140	£70
International Conference on Wind Propulsion 2019	£140	£70
Power & Propulsion Alternatives for Ships 2019	£110	£70
Design & Operation of Wind Farm Support Vessels 2019	£60	£30
Propellers – Research, Design, Construction & Application 2019	£90	£45

Payment Details:

Payments must be made in pounds sterling to RINA by sterling cheque drawn on a UK bank, International Money Order or Credit Card, we accept Visa, Mastercard, or AMEX.

Address:

The Publications Department, RINA,
8-9 Northumberland Street, London WC2N 5DA, UK.
Tel: +44 (0)20 7235 4622 or Fax: +44 (0)20 7259 5912.
Please allow 30 days for dispatch and delivery.

Privacy

Personal data held by RINA will only be used in connection with RINA activities, and will not be passed to third parties for other use.
Full details of RINA's Privacy Policy are available online.

RINA PUBLICATIONS ORDER FORM

Name: _____

Address: _____

_____

Country: _____ Postcode: _____

Tel: _____ Fax: _____

Email: _____

Please fill the boxes with the quantity wanted

PRINT	DIGITAL	PRINT + DIGITAL	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
☐	☐	☐	
			ICCAS22 ☐
			ICSDS22 ☐
			WJP22 ☐
			WS22 ☐
			AS22 ☐
			WP21 ☐
			WS21 ☐
			SLC21 ☐
			MIET21 ☐
			WS21 ☐
			FSSP21 ☐
			SCRM21 ☐
			SURV10 ☐
			HIST20 ☐
			ICE20 ☐
			SST20 ☐
			HSMV20 ☐
			EEDI20 ☐
			AS20 ☐
			DS20 ☐
			HF20 ☐
			MD20 ☐
			LNG/LPG20 ☐
			MI19 ☐
			ICCAS19 ☐
			WIN19 ☐
			PPA19 ☐
			WFV19 ☐
			PRO19 ☐

Please check the relevant boxes

☐ I'm a member

☐ USB format is required

☐ I enclose a cheque for _____ payable to RINA.

☐ Credit Card No: _____

Expiry date: ___/___/___ Security code: _____

Signature: _____

Print name: _____

☐ I wish to receive information on technical developments in or related to the maritime industry and on future RINA events.

☐ I understand that I may stop receiving such information at any time.

CALENDAR

What's happening next?

APRIL 27, 2023
ANNUAL DINNER
London, UK

MAY 31 - JUNE 1, 2023
WARSHIP 2023
RINA conference
Bath, UK

JUNE 13-16, 2023
DRY DOCK TRAINING 2023
RINA training course
London, UK

JUNE 21-22, 2023
SURV 11 - CREATING THE FUTURE OF SUSTAINABLE FAST BOATS
RINA conference
Rotterdam, Netherlands

NOVEMBER 28-29, 2023
HISTORIC SHIPS 2023
RINA conference
London, UK

For more information please visit:
www.rina.org.uk/RINA_Events

APRIL 25-27, 2023
SEA ASIA
International exhibition
Singapore
www.sea-asia.com

MAY 23-25, 2023
COMPIT 2023
International conference
Drübeck, Germany
www.compit.info

MAY 24-26, 2023
62ND INTERNATIONAL CONGRESS OF NAVAL ENGINEERING AND MARITIME INDUSTRY
International symposium
Bilbao, Spain
https://62congreso.ingenierosnavales.com

MAY 24-26, 2023
HYDRONAV 2023
International symposium
Sopot, Poland
www.prs.pl/hydronav2023

MAY 31 – JUNE 9, 2023
MARITIME SAFETY COMMITTEE
IMO meeting
London/Online
www.imo.org

JUNE 5-9, 2023
NOR-SHIPPING
International exhibition
Oslo, Norway
www.nor-shipping.com

JUNE 12-16, 2023
27TH INTERNATIONAL CONFERENCE ON PORT AND OCEAN ENGINEERING UNDER ARCTIC CONDITIONS (POAC 2023)
International Conference
Glasgow, UK
www.peridynamics.org/poac2023

JULY 3-7, 2023
MARINE ENVIRONMENT PROTECTION COMMITTEE (MEPC)
IMO meeting
London/Online
www.imo.org

JULY 12-14, 2023
OSES 2023
International symposium
St. Julian's, Malta
www.osessociety.com/oses2023

JULY 17-21, 2023
IMO COUNCIL
International forum
London/Online
www.imo.org

AUGUST 28-30, 2023
8TH HULL PERFORMANCE & INSIGHT CONFERENCE
International conference
Pontignano, Italy
email: volker@vb-conferences.com

AUGUST 28 – SEPTEMBER 1, 2023
IWSH 2023
International symposium
Aalto University, Espoo, Finland
https://iwsh2023.com

SEPTEMBER 11-15, 2023
LONDON INTERNATIONAL SHIPPING WEEK (LISW)
International maritime event
London, UK
https://londoninternationalshippingweek.com

SEPTEMBER 12-13, 2023
INTERNATIONAL ANTIFOULING CONFERENCE 2023
International conference
Gothenburg, Sweden
https://antifouling-conference-2023.confetti.events

OCTOBER 15-18, 2023
25TH NUMERICAL TOWING TANK SYMPOSIUM
International symposium
Ericeira, Portugal
https://blueoasis.pt/nutts-2023

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

ADVERTISERS INDEX

If you would like to receive further information on the advertisers featured within The Naval Architect please contact:
JP Media Services at **jpayten@jpmediaservices.com**

Sea ASIA

25-27 APRIL 2023

MARINA BAY SANDS
SINGAPORE

Organised by Informa Markets and Singapore Maritime Foundation, Sea Asia is recognised globally as the leading platform for the maritime industry to interact, explore business opportunities, hear the latest insights, and source new products and services. Since its inception in 2007, Sea Asia has grown exponentially to position itself as the leading maritime business event in Asia for industry players seeking to establish a footprint by penetrating the dynamic and growing port centered in Singapore.

Top 3 reasons to attend Sea Asia 2023

Engage with 300+ renowned global companies

Meet an unrivalled exhibitor line-up from: ABS & Affiliated Companies, Bureau Veritas Marine, DNV, Korean Register, SCHOTTEL GmbH, Shell, Thuraya and many more

Build business connections with maritime professionals

Connect with 12,000+ attendees and expand your network with industry peers from over 70 participating countries

Networking and development opportunities

Join the Sea Asia Academy for a solution-orientated academy providing dedicated development opportunities and Executive Networking Sessions* for top-level networking with high-profile influential

** Participation is strictly by invitation only*

Unlock new opportunities with Sea Asia 2023

Widely recognized as Asia's anchor maritime and offshore event, Sea Asia provides a high-level collaborative platform to connect visitors with leading industry stakeholders. Sea Asia 2023 is set to welcome:

12,000+ Attendees

10+ National Pavilions

70+ Participating Countries

300+ Exhibitors

For Exhibitor Enquiries:

Singapore and Asia

Jonathan Kiang
T: +65 9278 1701
E: jonathan.kiang@informa.com

Putri Wulandari
T: +65 6727 5548
E: putri.wulandari@informa.com

Rest of the world

Chris Adams
T: +44 1206 201557
E: chris.adams@informa.com

Visit **www.sea-asia.com** for more information. Contact **SAmarketing@informa.com** for general enquiries.

Register for your free visitor pass today!

Organisers

SMF Singapore Maritime Foundation | informa markets

Held in conjunction with

SINGAPORE maritimeweek 2023

Part of

MARITIME SINGAPORE