

# THE NAVAL ARCHITECT

JAN/FEB 2026

## Building on core values

ZeroUSV's Oceanus17 takes proven design to new dimensions



### GREEN SHOOTS

Environmental retrofits drive a surge in yard contracts

### UNITED FORCES

Somtrans' new bunker barge swings into ARA region service



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The International Shipping Exhibition

- » HALLS 1, 2
- » ENTRANCE 2
- » FORWARDER
- » SHUTTLE BUSES
- » TAXI SERVICE
- » TRAVEL AGENT
- » SEMINAR ROOMS 1A, 1B
- » SEMINAR ROOMS 2A, 2B



Posidonia Ποσειδώνια  
The International Shipping Exhibition

**HALL 3**

Posidonia Ποσειδώνια  
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- » HALL 1
- » ENTRANCE 2
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- » SEMINAR ROOMS 1A, 1B
- » SEMINAR ROOMS 2A, 2B

**HALL 2**

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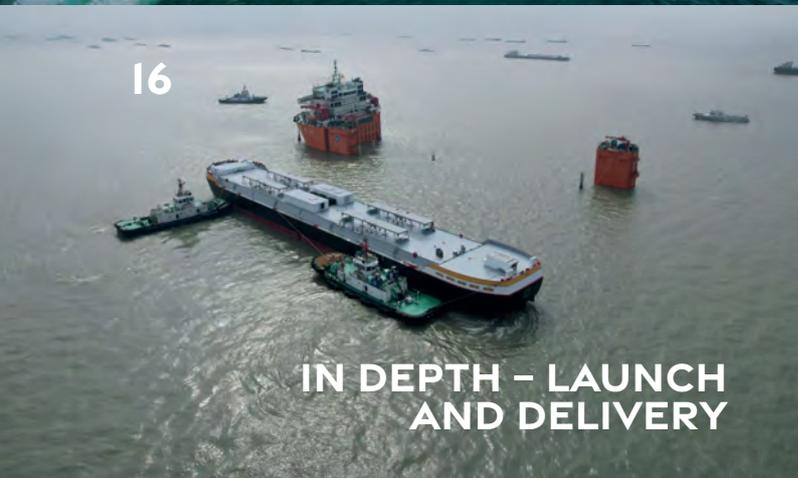
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## EDITORIAL COMMENT

7

7 Expert resilience in the face of policy shifts

## NEWS

8-15

8 NEWS  
11 EQUIPMENT  
14 DRONE TECH

## IN DEPTH

16-23

### LAUNCH AND DELIVERY

16 *United* approach

### SMART SHIPPING

18 Maritime digitalisation in 2026 and beyond

### ENVIRONMENTAL PROTECTION

20 Built to last...hard to scrap

### CLASSIFICATION

22 A connected approach to container safety

## PROFESSIONAL PROFILE

24 James Fowler, Maran Shuttle Tankers

Front cover: *Norbris*, see pp40-44  
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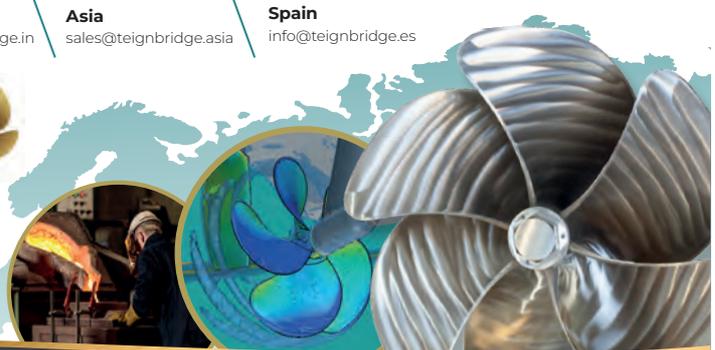
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# CONTENTS

## FEATURES

26-45

### UNCREWED VESSELS

- 26 Building on core values
- 28 AI of the NeedleFish

### NAVAL SHIPS

- 30 New approach to shipbuilding with LSM deal

### GREEN PROPULSION

- 34 Fresh as an *Ocean Breeze*
- 36 Winning the alternative marine fuels race
- 38 Keeping the energy transition safe

### REPAIR AND RETROFITS

- 40 Environmental retrofitting continues to gather momentum
- 45 LR and Carnival undertake first LNG-powered cruise ship drydocking schedules

## HISTORY & HERITAGE

- 46 Old tips for new ships
- 49 166 years of RINA

## WHAT'S ON

Calendar

50



26

UNCREWED  
VESSELS



NAVAL VESSELS

32



34

GREEN PROPULSION



40

REPAIR AND  
RETROFITS

# RINA ANNUAL DINNER 2026

## RINA Prestigious Annual Networking Dinner in the heart of Covent Garden

The RINA Annual Dinner returns on 28th May 2026, bringing together professionals from across the global maritime sector for an evening of conversation, connection, and celebration. Held at the historic De Vere Grand Connaught Rooms in Covent Garden, London, the event is a long-standing tradition in the Institution's calendar and a highlight for those working in naval architecture and maritime engineering.

With guests from industry, academia, defence, and beyond, the dinner offers a valuable opportunity to engage with colleagues in a relaxed and sociable setting. Whether renewing old contacts or making new ones, the evening is a chance to reflect on shared challenges, exchange ideas, and build relationships that continue long after the event.

For anyone in the maritime world, this is an evening not to be missed. Register your interest now and join us in celebrating the achievements, innovation, and people driving the industry forward.



28th May 2026  
London, UK





Technological momentum, including the evolution of wind-assisted propulsion, isn't going away (image: bound4blue)

## EXPERT RESILIENCE IN THE FACE OF POLICY SHIFTS

In the wake of the events of the IMO MEPC extraordinary session in October 2025, the maritime industry appeared to be in a state of shock. Recent executive actions have signalled a rollback on American commitments to IMO's ambitious green shipping targets, which aim for net-zero emissions by 2050.

Similarly, President Trump's vocal opposition to offshore wind development – citing aesthetic concerns, wildlife impacts and economic burdens – has led to paused federal approvals and potential lease cancellations along US coasts. These moves echo his first term's scepticism toward climate-driven regulations, prioritising energy independence and traditional fossil fuels.

Yet, for an industry built on ingenuity, comprising naval architects, shipbuilders, engineers and technology developers, these policy reversals should not provoke panic. Instead, it could be argued, they may highlight the need for adaptive innovation that transcends national politics.

Firstly, major players like the EU and Japan are moving toward compliance: take, for example, the EU's FuelEU Maritime regulation, set to penalise high-emission vessels. At the same time, shipowners worldwide are investing billions in dual-fuel engines, hydrogen propulsion and wind-assisted propulsion (WAP) technologies. This demand for green propulsion solutions has not abated. Not only that, but US-based naval architects could potentially pivot to these active markets, designing vessels that meet the stringent new global standards. For instance, innovations

like air lubrication systems and rotor sails, which have been shown to reduce fuel consumption by more than 20-25% on some retrofitted ships, position US firms well in exportable tech, regardless of domestic policy.

Secondly, it could also be argued that the technological momentum is irreversible. The industry's shift to sustainability predates political cycles, and is increasingly fuelled by economic considerations. Bunker fuel prices make green alternatives like ammonia and methanol increasingly viable. Naval engineers are pioneering carbon capture systems and battery-hybrid ferries, with prototypes already operational in Norway and Singapore.

History shows that, more often than not, adaptation triumphs. Take the fallout of the 1970s oil crises, which prompted shipbuilders to respond with innovative, fuel-efficient designs that defined modern fleets. Today's professionals – equipped with CAD software, 3D printing and computational fluid dynamics – possess tools unimaginable then.

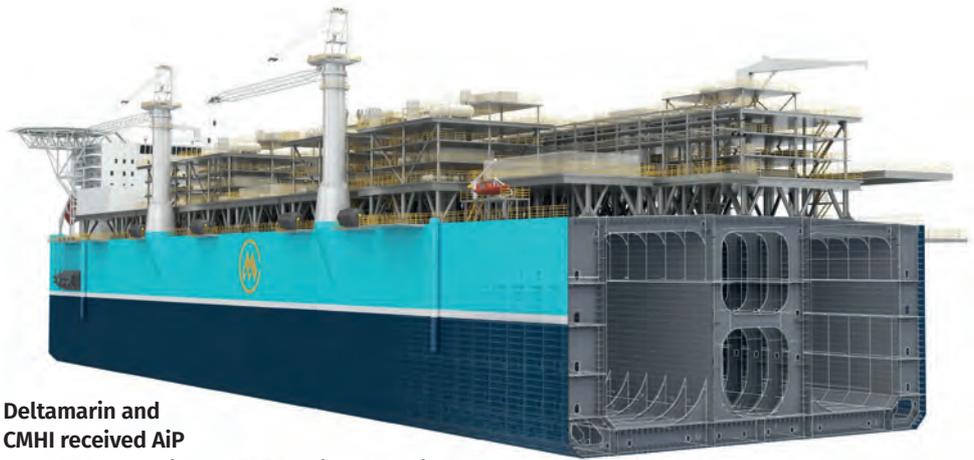
It's worth bearing in mind that last autumn's setback is just one variable in a vast equation. Naval architects and shipbuilders thrive on problem-solving; they design for storms, not fair weather. By embracing global collaboration, adopting new technologies and innovating beyond borders, the industry should not only endure this temporary storm, but emerge stronger. ■

**Martin Conway,**  
Managing Editor

## FPSO VESSELS

## ABS GRANTS AIP TO NEW FPSO HULL DESIGN

Naval architecture firm Deltamarin and shipbuilder China Merchants Heavy Industry (CMHI) have received approval in principle (AiP) from class society ABS for a new floating production storage and offloading (FPSO) vessel hull design. The AiP specifically “recognises the feasibility of a robust, fatigue-friendly FPSO hull optimised for multiple field locations, including deepwater operations west of Africa,” Deltamarin commented in December 2025.



**Deltamarin and CMHI received AiP from ABS for their new FPSO unit hull design**

The planned FPSO unit will feature a length overall of 285.1m, a breadth of 60.97m and a depth of 29.3m, and it will draw 19.6m max. The vessel will also feature a topside capacity of 25,000tonnes, a crude oil storage capacity of 1.5MMBBL and a spread mooring system. Deltamarin says it used parametric hull modelling to develop two additional variants

of the FPSO unit, enabling the storage of 1.0MMBBL and 2.0MMBBL respectively.

The company adds: “The structural design of the FPSO hull is benchmarked against rule loads, enabling the concept to be utilised in different locations around the globe. Depending on the site conditions, the structural design can be further optimised for reduced steel weight, directly translating into lower capex.” ■

## OFFSHORE SUPPORT VESSELS

## DAMEN AND WINDCAT PURSUE INNOVATION

Offshore crew transfer specialist Windcat has signed a contract with Damen Shipyards Group for a new multipurpose accommodation support vessel (MP-ASV), to be built under the

banner of the Innovation Series. This range of commissioning services operation vessels (CSOVs) will measure 102m in length and 20m in beam, and will be able to accommodate up to 190 wind farm

personnel for at least 28 days’ endurance, while enabling them to reach the turbines via a motion-compensated gangway.

The Innovation CSOVs are described as an evolution of the Elevation series, previously developed by Windcat and Damen, but adding an increased deck space of 750m<sup>2</sup>, a subsea crane capacity of 150tonnes and the ability to launch/recover ROVs. Each Innovation vessel will incorporate a 3,981kWh battery pack on a DC grid, to enable peak shaving and reduce fuel consumption, as well as a dual-fuel hydrogen engine and a dynamic positioning system, rated ‘DP2+’, with the necessary thrusters.

**Damen will deliver the first Innovation Series-branded MP-ASV to Windcat in 2028**



Damen aims to commence construction of the first vessel at its Ha Long Shipyard facility in Vietnam in February 2026, with delivery expected in 2028. The order includes an option for an additional five CSOVs of this type. ■

## SHIPYARD TECHNOLOGY

## AI SOFTWARE TO RETAIN YARD STAFF EXPERTISE

Florida-based tech start-up Dolgo has announced the development of a new AI software platform, created to “retain expertise presently being lost as large numbers of workers retire from the sector”, the company says. The software is intended to bypass a situation whereby older workers may be reluctant to pass on valuable shipbuilding and engineering knowledge to younger workers.

Workers who do share information will be “equitably rewarded with bonuses or benefits each time their knowledge is downloaded from the platform”, Dolgo says, adding: “Workers will be able to call each other on the platform to seek advice on engineering problems, with the AI learning on the job.”

Dolgo is currently trialling prototype large language model (LLM) software with the University of South Florida College of Marine Science, in advance of an anticipated product launch date of February 2026. Nithesh Wazenn, Dolgo founder, says: “One of the biggest challenges facing the shipyard industry is the looming cliff edge of large numbers of workers retiring and taking their expertise with them.”

Dolgo claims that, in the US alone, “the average age of the 146,500-strong US shipyard workforce is 55”, and that shipyard demand is “expected to

more than double in the US over the next decade”. ■



**Nithesh Wazenn, Dolgo: shipyards risk losing valuable expertise as workers retire**

## CABLE-LAYING VESSELS

## NEXANS ELECTRA NEARS SPRING '26 SEA TRIALS

Ulstein Verft has launched the hull of the cable-layer newbuild *Nexans Electra*, in advance of its spring 2026 sea trials and subsequent handover to Nexans. The vessel, designed by Skipsteknisk and based on the 2021-delivered *Nexans Aurora*, has been developed to transport and lay Nexans submarine products, including cable bundles, and to carry out repairs.

Measuring 155.2m x 31m, *Nexans Electra* will feature a total cable capacity of 13,500tonnes, spread across a split turntable on deck (10,000tonnes) and an under-deck turntable (3,500tonnes), and will be able to lay up to four cables simultaneously. The vessel is also being equipped with a fibre-optic tank with a 450tonne capacity and a DP3 system, and will transport and install large volumes of HVDC and HVAC cable systems in deep waters.

In December 2025, Ulstein Design & Solutions announced that it had been contracted to develop a high-spec cable-laying vessel, working alongside Lloyd Werft, for Megamas Resources. The vessel will be based on the Ulstein SX228 design, which measures 121.7m x 23m, and will feature a cable capacity of 5,500tonnes, an ROV hangar, a 50tonne A-frame and a bollard pull capacity of up to 120tonnes for subsea ploughing work. ■

**Ulstein Verft has launched the hull of the 155m cable-layer *Nexans Electra***



## TUGS

## INDIAN E-TUG SET FOR LATE-YEAR DELIVERY

India is set to welcome its first electric tug in late 2026. Built by Goa-based Atreya Shipyard, and set for deployment by Deendayal Port Authority (DPA) and Ripley Group in Kandla Port, the tug was devised to support the country's Green Tug Transition Programme (GTTP), which aims to realise a fleet of 16 such green tugs across Indian ports by 2027, expanding to 400 by 2040.

The pure-electric tug will feature a bollard pull capacity of 60tonnes, and will primarily be used for escort, harbour-assist and emergency response work. Sweden-headquartered Echandia will supply the boat's 4.4MWh battery system, which has been developed to deliver 30,000 cycles across a 15-year lifespan with no mid-life replacement.

Kongsberg Maritime has been appointed system integrator for the project, and the battery system will be delivered to the tug in Q3 this year. Rakshith Sachitanand, senior strategist at Echandia, comments: "As an early leader in India's

maritime electrification, Echandia is proud to play a role in accelerating the decarbonisation of ports and inland waterways, and to collaborate with the nation's shipbuilders as they expand internationally." Echandia previously supplied electric power solutions to water taxis in Kochi. ■



The 60tonne bollard pull-capacity tug will operate in Kandla Port, India (image: DPA)

## AQUACULTURE SUPPORT

## HYBRID OPERATIONS WITH NAOMI JENNIFER

Macduff Shipyards has delivered a hybrid aquaculture support vessel, *Naomi Jennifer*, to Scottish vessel operator Inverlussa Marine Services. Designed by Macduff Ship Design, the 25m-long boat was ordered to meet increasing demand for larger,

heavier equipment at modern fish-farming sites, and for more power and greater bollard pull and lifting capability, including upgraded cranes, additional thrusters and deck equipment supplied by SHM Solutions.

"*Naomi Jennifer* will operate with two crews of three, on a time for time rotation, contributing to Inverlussa's workforce of around 145 seafarers from across Scotland," Macduff Ship Design explains. The vessel features a spacious galley and mess area, and accommodation comprises

five en suite cabins, distributed between the main deck and below deck. All living areas have been engineered to minimise operational noise.

Below deck is divided into five main compartments: the forepeak; crew accommodation area; the engine room; the hold (accessed via a flush deck hatch); and a steering gear space. The vessel is fitted with IMO Tier 3-compliant engines, supported by a hybrid system that stores electrical energy for use during operations. ■



*Naomi Jennifer* has been fitted with IMO Tier 3-compliant engines

## LIFE-SAVING APPLIANCES

## SURVIVAL IS KEY WITH NEW HANDHELD VHF

ACR Electronics has launched a new handheld VHF, the SR303 Survival Radio, which has been engineered to meet IMO and SOLAS standards (including MSC.515(105)) and to comply with the Global Maritime Distress and Safety System (GMDSS).

The SR303 has been made available in two configurations: a dedicated GMDSS-enabled emergency VHF; or a dual-battery kit to support “everyday maritime communication needs”, ACR Electronics says.

The SR303 Survival Radio features automatic distress mode activation on channel 16



The SR303 Survival Radio has been developed to meet IMO and SOLAS standards

via its long-life primary lithium battery, rated for more than eight hours of operation. The product also includes a rechargeable secondary battery for full-channel daily use, as well as glove-friendly controls, a backlit display and IPX7 waterproofing. The radio is near field communication (NFC)-enabled for quick access to battery replacement

schedules and product data using compatible mobile devices.

Each unit comes with a mountable base, a flexible rubber antenna, a belt clip and a wrist lanyard. The radio is primarily aimed at commercial fleets, cargo vessels, fishing operations and offshore platforms among others, ACR Electronics says. ■

## SITUATIONAL AWARENESS

## COLLISION AVOIDANCE WITH WATCHIT EYE



WATCHIT Eye was developed to identify threats from every direction

Marine-tech company WATCHIT and yacht builder Azimut|Benetti Group have developed an AI-based collision avoidance system for yachts and recreational vessels, monikered WATCHIT Eye.

The system uses AI to filter real risks and to combine data from various onboard sensors, together with a customised, fog-penetrating 4D imaging radar, to alert the captain “only when the detected obstacles pose a genuine risk of collision”, Azimut|Benetti Group says. The AI engine has been developed to emulate the decision-making processes of an experienced captain, “acting as a co-pilot who performs real-time risk assessments”, the yacht specialist adds.

The system simultaneously enables continuous data

collection in the cloud and immediate analysis, accounting for different navigation modes such as port manoeuvres, open sea cruising or navigation via congested waters. “The system is able to identify threats from every direction and generate timely alerts that allow for high levels of concentration and rapid decision-making,” says Azimut|Benetti Group. “This approach gives the captain ample time to respond to vessels, tenders, RIBs and small objects like kayaks, marking buoys or floating obstacles, but also [to] yacht grounding risks.”

Azimut|Benetti Group plans to incorporate WATCHIT Eye on its superyacht newbuilds, and has done so aboard its new 24.8m-long Azimut Fly 82 model, which made its debut at the 2025 Cannes Yachting Festival. ■

## ELECTRIC PROPULSION

## TORQEEDO CRUISE OUTBOARDS GET A REVAMP

Electric motor manufacturer Torqeedo has launched upgraded versions of its Cruise 3.0 and Cruise 6.0 outboards, both now boosted from 24V to 48V. Features include a foldable tiller with a high-res display, plus integrated Wi-Fi and Bluetooth, enabling connection to Torqeedo's TorqView app, which is designed to provide users with real-time performance and system data.

The enhanced Cruise outboards are now compatible with larger batteries, including Torqeedo's 5kWh Power 48 battery type, the company says, adding that as much as 95% of the engines' shaft-headed components are manufactured from recycled ocean plastic – a policy announced by Torqeedo in Q1 2024.

The new Cruise models were debuted at the Metstrade show, hosted in Amsterdam in November 2025. This event also saw Torqeedo unveil its new Travel XS motor, which, rated 700W, is intended to power smaller dinghies. It will be



**Torqeedo has launched new 48V versions of its Cruise 3.0 and Cruise 6.0 (pictured) outboards**

made available as part of Torqeedo's Travel Smart package, incorporating a 648Wh battery, from early 2026. The company has also announced that it is expanding its Deep Blue range with new Intelligent Control Unit and Power Distribution Unit components. "The new ecosystem enables intelligent control of all components at 400V or 800V with power levels up to 400kW," Torqeedo says. "[The] plug-and-play design ensures fast, safe installation and seamless integration into existing systems." ■

## GREEN PROPULSION

## HYBRID ENGINES AND SAILS TO POWER LNG CARRIER CONCEPT

Everllence, ABB and OceanWings have signed an MoU to jointly develop an LNG carrier with a propulsive arrangement combining Everllence's and ABB's DFE+ diesel-electric engine concept and OceanWings' wingsail technology.

Romain Grandsart, OceanWings COO, comments: "LNG carriers sail fast and spend typically 70% of their time at sea. This is ideal for harnessing wind and the full potential of OceanWings' rigid wingsails. Combined with optimised propulsion, including a DFE+ variable-speed concept engine, this unlocks high double-digit fuel savings and greenhouse-gas emissions reduction."

Dominik Thoma, global manager for LNG cargo at Everllence, adds: "While WAPS introduces highly variable propulsion demand due to fluctuating wind conditions, DFE+ propulsion offers precise load control and operational flexibility, making it exceptionally well-suited to harness the variable and intermittent power contributions of wind-assisted

systems. In combination with smart power-management systems and adaptive trimming, we see significant potential for reduced emissions and OPEX." The "adaptive trimming" refers to the

capability of OceanWings' wingsail tech to optimise sail positioning by accounting for each vessel's unique aerodynamic profile and all aerodynamic interactions, the partners add. ■

**Everllence, ABB and OceanWings will jointly develop an LNG carrier running on diesel-electric engines and wingsails**



# ICCAS 2026

## International Conference on Computer Applications in Shipbuilding

The International Conference on Computer Applications in Shipbuilding (ICCAS) was first organised in 1973 and has since taken place all around the world. Over the decades, ICCAS has become a well-established and highly respected event within the maritime industry, known for presenting cutting-edge research and fostering in-depth technical discussions. The conference consistently brings together a unique mix of academic experts and industry practitioners, providing a collaborative platform to share knowledge, challenges, and innovations in shipbuilding technologies.

ICCAS focuses on the practical application of digital technologies across all stages of the ship lifecycle. Topics include data capture and management, cybersecurity, digital twin decision support, artificial intelligence, virtual sensors, naval architecture, project management tools, environmental performance including decarbonisation and wind-assisted propulsion, operational optimisation, 3D modelling, and the design of unmanned and autonomous vessels. ICCAS also welcomes research on advanced computing technologies relevant to the maritime sector.

ICCAS 2026 will continue this tradition of excellence, providing an invaluable opportunity for attendees to gain insights from leading experts, engage in meaningful technical exchange, and contribute to the future of shipbuilding innovation. The event will also feature practical workshops designed to showcase hands-on applications, product demonstrations, and interactive training, enabling participants to deepen their understanding of emerging technologies and their real-world impact across the ship lifecycle.



14th - 16th September 2026  
Singapore



SAFETY AND SECURITY

## WATCHING THE WAVES FOR PILOT TRANSFER SAFETY

Logistics provider Peel Ports Group, which manages a network of ports and terminals across the UK and Ireland, is using a smart buoy to gather real-time wave data for safer pilot transfers in the Irish Sea.

The buoy, supplied by UK government agency the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), sends live wave information to a cloud-based platform called Port-Log, developed by marine data specialist OceanWise. This information can then be accessed from any smart device. Port-Log is designed to extract directional and non-directional spectra, and parameters such as significant wave height and period, from a single instrument feed.

**OceanWise's Port-Log platform can process safety-critical live wave data (image: OceanWise)**

Russell Bird, group hydrographic and dredging manager at Peel Ports Group, comments: "Having real-time wave data available in Port-Log has transformed the way we assess pilot boarding conditions. We can now make faster, better-informed decisions that keep our pilots safe and our operations running smoothly." OceanWise adds that the data not only improves pilot safety by reducing unnecessary trips into rough seas but also boosts operational efficiency and sustainability. ■



NAVAL AND MILITARY

## STINGRAY UNVEILS USV FIRST FOR PAKISTAN

Stingray Technologies has unveiled what it claims to be Pakistan's first indigenous USV at the second Pakistan International Maritime Exhibition and Conference (PIMEC), hosted in Karachi in November 2025.

The vessel features a fibreglass hull measuring 7.6m in length,

incorporates an outboard engine and has a reported operational endurance of between four to five hours, and a range of between 20-30km. Although many of the USV's technical features currently remain under wraps, it's understood that the unit has a modular design, enabling the operator to switch payloads

for multiple missions. Payload examples include: an electro-optical/infrared (EO/IR) sensor suite; radar, for navigation and target detection; LiDAR, for spatial mapping and collision avoidance; and an echo sounder, to undertake depth measurements.

Stingray Technologies says that the USV will handle missions ranging from coastal surveillance and reconnaissance to anti-smuggling/trafficking patrols and harbour defence. It's believed the vessel's primary focus will be on strike missions, however, and the unit could potentially be armed with small surface-to-surface rockets or missiles, for example. The USV could also be configurable for littoral attack, including possible kamikaze/explosive payload options. ■



**Stingray Technologies' unmanned vessel, pictured at PIMEC 2025, is described as Pakistan's first indigenous USV (image: Developing Pakistan)**

## ROV SUPPORT

## SONARDYNE USBL TECH AT WORK IN ANGOLA

France-headquartered STAPEM Group has selected Sonardyne's Ranger 2 ultra-short baseline (USBL) technology for its 2024-delivered, 59.6m offshore support vessel (OSV) *STAPEM Boreale*. The Sonardyne tech will be used to track the positions of ROVs and to support ROV operations, including inspection, survey and intervention work, carried out by Film-Ocean, a STAPEM Group division.

The vessel, which operates off Angola, was equipped with a Ranger 2 GyroUSBL 7000 system, developed for precise positioning performance. It replaces equipment previously used on a hire basis.

"The Ranger 2 GyroUSBL 7000 features a single, pre-calibrated transceiver head," says Sonardyne. "Its integrated attitude and heading reference system [AHRS] / inertial



**STAPEM Boreale is using a Ranger 2 GyroUSBL 7000 system to support ROV operations**

navigation system [INS] eliminates mechanical alignment errors, making it easy to deploy, and increases tracking precision. This often requires long layback tracking, touchdown monitoring and precision navigation close to subsea assets – scenarios where the accuracy and reliability of the Ranger 2 GyroUSBL system bring real value."

STAPEM Group had previously equipped the OSV with an SMD Atom work-class ROV, fitted with Sonardyne combined

solid state AHRS and Syrinx Doppler velocity log (DVL) and a wideband sub mini 6+ (WSM 6+) transponder. Jean-Marc Gerber, CEO of STAPEM Group, says: "*STAPEM Boreale* embodies our vision to continuously invest in the future of subsea operations. By combining advanced positioning solutions like the Ranger 2 GyroUSBL system with our new Atom ROV, we strengthen our capacity to deliver safe, efficient and cost-effective subsea services for our clients in West Africa." ■

## MINE COUNTERMEASURES

## MCM MARKET SET FOR FURTHER GROWTH

The mine countermeasures (MCM) market is experiencing "robust growth", with the market size expected to increase from US\$2.97 billion in 2024 to US\$4.05 billion in 2029, achieving a compound annual growth rate (CAGR) of 6.3%, according to a report issued by ResearchAndMarkets.com. The analyst attributes this growth to "heightened maritime security threats, naval modernisation efforts, increased defence infrastructure investments and advancements in autonomous mine detection technologies".

Emerging trends in the MCM market include the development of AI-powered navigation systems, investment in R&D for MCM solutions and integration of multi-sensor platforms, the report claims.

"Nations are increasingly investing in advanced platforms and technologies to bolster their maritime security and protect economic interests,"

the report states. "For instance, the US Department of the Navy's FY 2024 budget request showcases a significant allocation towards enhancing naval capabilities. Moreover, companies are focusing on technological advancements such as AI-driven autonomous systems to improve mine detection efficiency. For example, in March 2025, Thales introduced its AI-driven Maritime Mine Counter Measures [MMCM] system to the [UK] Royal Navy, significantly enhancing operational capabilities in hazardous zones."

The report also notes that the Asia-Pacific region led the MCM market in 2024, and will most likely continue to do so, despite growing demand in Europe, the Americas, Africa and the Middle East. "However, regional dynamics are influenced by evolving global trade relations, particularly the tariffs and customs challenges impacting the aerospace and defence sectors through increased costs and production delays," the report authors write. ■

# UNITED APPROACH

Outfitted in the Netherlands, with a hull built in China, Somtrans' new bunker barge, *United LNG I*, will help the company to extend its LNG bunkering capacity across various Belgian and Dutch seaports

December 2025 saw Belgian shipowner Somtrans christen its latest delivery, the estuary-class bunker barge *United LNG I*, in a ceremony hosted at the Port of Antwerp. The family-run company, which oversees a fleet of 39 vessels, excluding the newcomer, plans to put the barge into service in February 2026, where it will be used to fulfil growing demand for LNG bunkering in various Belgian and Dutch seaports, a spokesperson for Somtrans confirms.

Measuring 135m x 21.46m, the vessel has been designed for both inland waterways and coastal service up to the Port of Zeebrugge. The barge's construction was an international affair: the hull was built in China and then transported to the Netherlands for outfitting. Here, RensenDriessen, a shipyard-independent, Dutch newbuild projects specialist, acted as the main contractor, with Heusden-based TeamCo Shipyard overseeing tank integration, engineering and final outfitting of the vessel.

Additionally, Italian engineering firm Gas and Heat, which specialises in designing and building cryogenic tank systems and LNG-fuel supply systems for maritime applications, supplied the barge's eight cylindrical, single-walled Type C LNG tanks. Each LNG tank features a capacity of 1,000m<sup>3</sup> and has been engineered to store this alt-fuel at -165°C, and with a boil-off rate of 0.30% per day.

The tanks are pressure-rated 400kPa. According to Somtrans, the tanks will remain closed during operations, monitored by pressure and temperature sensors, and will only require direct internal checks during the barge's five-year class inspections. The vessel has also been fitted with eight cargo pumps, and each of these is rated 165m<sup>3</sup> per hour. The barge's LNG bunker arm measures 25m in length and has a capacity of 920m<sup>3</sup> per hour.

## High-precision project

Somtrans says that the completion of *United LNG I* not only showcases more than 20 years of collaborative projects between the company and RensenDriessen, but indicates how the model of hull construction in China, followed by final outfitting in Western Europe, is becoming increasingly common in European shortsea shipping.

Reflecting on the project, Wim Driessen, MD of RensenDriessen, comments: "By combining efficient hull construction in China with local outfitting in Western Europe, we are now offering our hull-building expertise more widely to the shortsea shipping segment. These cylindrical LNG tanks take

this project into new territory: integrating them at this scale is unique. It shows what is possible when a shipowner, contractor and yard work as one team." TeamCo Shipyard MD Marcel Zweers adds: "This was not a standard build. The LNG systems, the tank integration, the bunkering equipment, all demanded precision."

*United LNG I* features a moulded depth of 7.5m and a draught of approximately 4m, and is arranged to accommodate a crew of six. Onboard tank capacities include: 5,113m<sup>3</sup> of ballast water; 30m<sup>3</sup> of fresh water; and approximately 39.7m<sup>3</sup> of fuel oil, split between one fore tank (1.7m<sup>3</sup>) and two aft tanks (19m<sup>3</sup> each). This latter arrangement reflects the positioning of the engines, which include four MAN Rollo LNG models, each rated 525kW, at the fore of the vessel and two 800kW diesel generators and a single 117kW auxiliary diesel generator at its aft. The barge also carries two battery packs, each rated 200kWh.

## Second sister

Propulsion-wise, the barge incorporates two main azimuth thrusters, rated 1,305kW apiece and featuring propeller diameters of 1,900mm. These are complemented by a pair of 550kW bow thrusters. In terms of other equipment, *United LNG I* has been outfitted with six mooring winches and two spud piles – one located fore, the other aft. The vessel also carries a hose-handling crane with a SWL of 2tonnes at 21m outreach, six Yokohama-type fenders, a car crane and a man overboard recovery cradle.

Somtrans is now expecting delivery of a second sister barge, also under build at TeamCo Shipyard, aligned to plans to extend its bunkering capacity within the Amsterdam-Rotterdam-Antwerp (ARA) region. "This comes as LNG bunker demand in Northwest Europe continues to expand, driven by new dual-fuel tonnage in the container, tanker, bulk, ro-ro and cruise segments," the Somtrans spokesperson explains. "The global fleet of LNG-fuelled vessels continues to grow by double digits each year, driven by owners seeking cleaner operations and reliable access to alternative fuels."

In addition, Somtrans CEO Ronald Somers was quoted as telling christening ceremony guests: "Shipping companies have to gradually green their fleets...that is an obligation, and we are responding to that with this ship." TeamCo Shipyard's Zweers says that outfitting of the forthcoming sister, *United LNG II*, will commence in March 2026. ■



**United LNG I** has the capacity to carry 8,000m<sup>3</sup> of LNG for bunkering operations in the ARA region

# MARITIME DIGITALISATION IN 2026 AND BEYOND

**Adam Dennett**, CEO of SpecTec, shares his thoughts on what we can expect to see in digital adoption and innovation this year, and in the second half of the 2020s

The maritime sector stands at a crucial inflection point. Over several years, there has been a steady acceleration of digital adoption: from voyage optimisation to predictive maintenance and smart fleet management. This digital transformation is no longer happening at the fringes – it is now a central strategic imperative driven by commercial pressures, regulatory changes and growing recognition that digitalisation offers competitive advantage.

Despite clear momentum, widespread digital transformation remains uneven and constrained by a variety of structural, technical, and organisational barriers. Among these, the lack of common data standards stands out consistently in slowing down the full potential of digitalisation. The result is inefficiency, duplication of effort and missed opportunities for optimisation.

Recent industry studies highlight the paradox of maritime digitalisation efforts: on one hand, many stakeholders signal strong interest in digital tools; on the other, they struggle to implement them in a coherent, scalable way. For example, the Lloyd's Register (LR) *Global Maritime Trends 2025 Barometer* finds that although there is promising traction for digital innovations, only 32–48% of maritime value-chain components (trade, vessels, ports, people) are aligned with 2030 digitalisation goals. The barriers identified – data standardisation, interoperability and lack of digital skills – consistently surface as major obstacles. However, in 2026 and beyond, there is a lot at stake in getting digitalisation right.

For an industry as asset-heavy and operationally complex as shipping, data can mean many things, but also nothing at all. When data is fragmented, it creates inefficiencies. However, when integrated and interoperable between systems that can 'talk' to each other, it can create real visibility and transparency across the entire shipping

supply and value chain. For shipping, this is both a technical priority and a commercial necessity.



**Adam Dennett, SpecTec: "AI is poised to become one of the most valuable enablers of efficiency in maritime operations"**

## Data standardisation

Today, technology is able to play a significant role in helping operators demonstrate compliance in near real time. Data itself is not the issue. Shipping generates vast volumes of operational, engineering and commercial information. However, when data is siloed, recorded in incompatible formats, or inconsistent in structure, its value diminishes. Several organisations are making advances in this direction but there is little agreement on the format this data should take to meet the necessary reporting and functionality requirements.

A surprisingly large blocker in all of this is data standardisation. What may appear as a small discrepancy can have serious downstream consequences when systems are integrated at scale. For example, one system may record a critical engine parameter as a percentage, while another records the same value as an absolute figure, or maintenance intervals may be logged in running hours in one system and calendar days in another. When these datasets are combined without a shared standard, thresholds can be misread, alerts triggered incorrectly, or risks missed entirely. Multiplied across hundreds of assets and thousands of data points, these inconsistencies undermine trust in analytics and prevent systems from reliably 'speaking the same language'.

Regulatory bodies have a critical role – and responsibility – to play in overcoming this fragmentation and move from rule-setting to working with industry towards shared aims, standards and practical implementation. There is a huge opportunity to get this right and promote shared data models and interoperable formats, provide compliance frameworks and reduce uncertainty that currently deters investment.

There are valuable learnings from other industries, like digital healthcare, to help tackle this fragmentation through two parallel efforts. Firstly, there needs to be widespread collaboration and partnership from across the industry where stakeholders and networks get together to agree standardisation and a format of data that can drive the necessary reporting and functionality and enable systems to 'speak the same language'. Alongside this, there needs to be a commitment from regulators

to support and acknowledge the standards that are developed as an industry benchmark.

Regulatory organisations, such as the International Maritime Organization (IMO), with its newly announced maritime digitalisation strategy, are stepping up to the challenge to drive this harmonisation. At its 49th session in 2025, IMO began work on a global digitalisation roadmap that seeks to establish shared standards to support maritime digitalisation.

### The next frontier

Data standardisation will also power artificial intelligence (AI), which is poised to become one of the most valuable enablers of efficiency in maritime operations; however, its effectiveness hinges on standardised data formats that enable reliable predictive algorithms, digital twin modelling and failure modes and effects analysis (FMEA) for proactive risk mitigation. Without the underpinning data standardisation, AI models cannot generate reliable insights.

Once data standardisation is achieved, the transformative potential is significant. Predictive maintenance systems can detect anomalies in engine performance and forecast component wear. Procurement workflows can be automated to trigger spare-parts replacement, while inventory platforms can identify usage trends and optimise stock levels. These capabilities directly improve vessel reliability, reduce maintenance expenditure, and elevate safety by addressing emerging issues before they escalate.

The transition from scheduled maintenance to condition-based maintenance further strengthens these outcomes. With real-time performance insights, operators can focus attention where it is most needed, avoid unnecessary servicing and prevent minor faults from becoming major failures. This shift reduces downtime, mitigates operational disruption and materially improves crew safety by lowering exposure to high-risk repair activities.

Operators can gain a more accurate understanding of asset health, performance patterns and operational efficiency, which helps support more informed decision-making and continuous fleet improvement.

### Empowering seafarers

Digitalisation will succeed only if the people operating ships feel supported by the tools introduced. As onboard systems become more sophisticated, it is essential that they reduce complexity rather than add to it.

Integrated digital platforms already play a meaningful role in reducing administrative burden, automating compliance reporting, and centralising maintenance records. Condition-based maintenance logs, mean time between failures (MTBF) driven alerts and digital audit trails create structure and clarity, enabling crews to focus on critical operational

duties rather than paperwork. This improves safety by ensuring maintenance tasks are completed consistently and issues are flagged promptly.

Technology does not replace human expertise but a strong safety culture remains the cornerstone of effective operations. Leadership that invests in training, provides clear processes and encourages transparent reporting creates the trust necessary for digital tools to be used consistently. When crews understand the value of these systems and engage with them, the combination of human insight and technological visibility becomes a powerful force for safety and reliability.

The maritime industry's digital transformation is gathering pace, but its trajectory will be defined by the choices made today. Establishing shared data standards, integrating AI and supporting crews in effectively adopting tools to make their lives easier will help ensure real impact.

By aligning technology with practical operational needs and human expertise, the industry can unlock safer, more efficient and more sustainable operations. With the right foundations, digitalisation becomes not just an enabler, but a strategic asset capable of reshaping maritime performance for the decade ahead. ■

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# BUILT TO LAST...HARD TO SCRAP

Polymer bearings offer exceptional durability, but their resistance to recycling poses a growing challenge for regulators, writes **Patrik Wheeler**

Shipowners and builders have embraced high-performance polymers in propulsion and steering systems for their durability, low maintenance and oil-free operation. But these same qualities are fast becoming a headache for regulators and recyclers.

The difficulty lies not only in the composition of these materials, which include thermosets, PFAS and vulcanised rubbers, but also in regulatory frameworks. When the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (HKC) entered into force in June 2025, it brought long-needed attention to ship end-of-life practices. But the Convention's approach to hazardous materials remains narrow minded, often misaligned with the reality at recycling yards.

"One of the issues with the HKC," says Robin Townsend, co-founder of ship recycling consultancy Marprof Environmental, "is that, for ships, it deals with individual hazardous materials such as asbestos, PCB and heavy metals, whereas the recycling facilities work in waste streams, such as insulation [asbestos], electrical [PCB], plastic and paints [heavy metals]; so, there is a disconnect that needs to be addressed. The Convention is not specific about many items. The list is rather haphazard."

## Problematic materials

This disconnect leaves significant room for materials to slip through – especially those that don't degrade, can't be conventionally recycled and don't appear in the Inventory of Hazardous Materials (IHM). PFAS (perfluoroalkyl and polyfluoroalkyl substances) and PFOS (perfluorooctane sulfonate), for instance, are highly persistent synthetic substances used in a range of maritime applications.

Some of the most problematic materials are found in the non-metal bearings themselves the very components celebrated for extending vessel life and eliminating the need for oil lubrication.

Companies producing water-lubricated or composite shaft bearings often cite performance and sustainability during operation. But what happens at end-of-life is less frequently discussed.

One bearing manufacturer acknowledged the issue. "They're not made to be recycled – they're made to last," said a marine engineer at the company. "That's the whole purpose of it, due to it being a critical application. But this doesn't mean that they can't be reused on another project or another vessel, because they can machine the

inside and outside diameters. We're not going to be completely against taking them back."

## Environmental drawbacks

In theory, limited reuse is possible but, in practice, most bearings are removed alongside the ship and sent for disposal. Without dedicated recycling infrastructure or regulation that flags these materials, many will end up in landfill or be incinerated, producing dioxins, VOCs and microplastics.

Meanwhile, research has consistently flagged post-use environmental drawbacks. In the *Journal of Materials Science & Technology*, one 2021 paper noted that "conventional thermosets cannot be dissolved, melted, remoulded and reprocessed". Another study in *Green Energy & Environment* found that "thermosetting composites cannot be recycled using conventional processing methods", and warned that advanced techniques such as pyrolysis were either too expensive or not yet technically mature.

Adding to the problem is the marine environment itself. A 2024 investigation by Pacific Northwest National Laboratory revealed that polymers used at sea face biofouling and chemical ageing, which further complicates end-of-life processing. Even outside shipping, these composites pose a persistent problem – and current recycling science isn't keeping up.



There is a growing volume of non-recyclable polymers entering the maritime waste stream (image: James Lee on Unsplash)

**New possibilities**

Still, some materials researchers are exploring new solutions. One promising route is Recyclamine, a chemically cleavable epoxy system that allows cured thermoset composites to be broken down under mild acid conditions. The process recovers clean fibres and converts the resin into a reusable thermoplastic.

So far, Recyclamine has been adopted in sporting goods, surfboards and automotive parts, but not marine bearings, which present more extreme mechanical and chemical demands.

An alternative approach involves Vitrimers. This is a smart polymer that behaves like thermosets in service but can be reshaped when heated, thanks to reversible chemical bonds. These materials are still under development, but early trials in structural adhesives and composites show potential for repeat recycling without harsh solvents or high temperatures.

Whether these next-generation materials can meet the performance standards of marine propulsion systems remains an open question. But the growing volume of non-recyclable polymers entering the maritime waste stream and the

**“Without dedicated recycling infrastructure or regulation that flags these materials, many will end up in landfill or be incinerated, producing dioxins, VOCs and microplastics”**

absence of regulatory measures to address them suggests that something has to change.

A senior materials scientist explains: “As mechanical recycling is impossible for thermoset materials, the only viable option is chemical recycling. The environmental benefit of these recycling technologies is so far not always positive and has to be evaluated for every material individually.

“There is no easy fit for this problem right now and, to be honest, I doubt that there will be a solution anytime soon. A more advanced plastic waste management system is desirable. Incinerating or well-managed landfills are certainly better solutions compared to uncontrolled leaching into the environment.”

If the Hong Kong Convention is to deliver on its promise of safe and sound recycling, it may soon need to reckon with materials that were never designed to die. ■



**BE PART OF THE NEXT EDITION OF SIGNIFICANT SHIPS OF 2025**

The 36th edition of our annual Significant Ships series, Significant Ships of 2025, which now encompasses vessels of all sizes, will include some of the most innovative and interesting commercial ship designs delivered during 2025.

The Editor invites shipbuilders, designers and owners to submit details of vessels for possible inclusion in Significant Ships of 2025. Presentation will follow on the established two-page format, with a colour photograph, descriptive text and tabular details (including major equipment suppliers) on the first page, followed by a full page of technical general arrangement plans. Initial potential entries should comprise a short technical description (100 words) of the proposed vessel highlighting the special features and the delivery date.

**SIGNIFICANT SHIPS of 2025**

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# A CONNECTED APPROACH TO CONTAINERSHIP SAFETY

Japan-based classification society ClassNK explains why it has developed new benchmarks for containership safety and efficiency, taking in weather forecasting and roll reduction among other factors

Increased containership sizes and the growth of container shipping overall have combined to change the pattern of operational challenges in seagoing transport. While greater scale continues to make economic sense, it also exposes more containers to open deck conditions, requires higher stacks and calls for greater resilience in the face of excessive vessel roll motions.

Where traditional approaches to containership safety are based on long-term metocean statistics, they may not always adequately reflect conditions on a given voyage, particularly when assessing roll-induced accelerations and lashing loads.

To help the container shipping sector maintain a robust understanding of real-world stowage and voyage conditions, ClassNK recently prepared a suite of new guidelines that offer an integrated, data-driven approach to containership safety, combining short-voyage weather forecasting, direct load analysis and roll-reduction technologies in a coherent framework. The new

guidelines offer operators, designers and cargo planners a basis for taking a more dynamic view of vessel behaviour to support safer, more transparent decision-making – and also enabling more rational use of loading capacity when conditions permit.

## Predictive metocean data

A centrepiece for the new framework is the document *Guidelines for the Safety of Maritime Cargo Based on Weather Forecasts*, which develops short-voyage assessments from long-term scatter diagrams as real-time deterministic forecasts. By focusing on voyages of 72 hours or less, the guidelines allow operators to base stowage decisions on forecasted wave heights, wind conditions and associated uncertainties, rather than static statistical envelopes that diverge from near-term expectations along a planned route.

ClassNK's methodology quantifies forecast uncertainty by treating metocean parameters, particularly significant wave height, as probability distributions. This enables the calculation of short-term voyage loads representing a 25-year return period, adjusted to reflect forecasted weather without underestimating risk. These corrected loads can then feed directly into hull response predictions and lashing strength assessments.

The guidelines go further. Annex A introduces a sea route correction factor that ties the maximum forecasted significant wave height to roll angle, pitch angle and acceleration adjustments. This allows planners to apply weather-sensitive correction factors to container-securing calculations, providing a more rational basis for determining allowable stack weights and arrangements. By aligning stowage planning with forecast-based load modelling, the guidelines offer a path to optimised loading on routes where conditions allow, while strengthening safety margins in more severe scenarios.

## Reducing roll

Alongside weather forecast guidelines, ClassNK has issued the first edition of its *Guidelines for*

***Guidelines for the Safety of Maritime Cargo Based on Weather Forecasts* forms the centrepiece for ClassNK's new framework of safety guidelines for containerships**



CHARTING THE FUTURE **ClassNK**Guidelines for Anti-rolling Devices  
(Edition 1.0)

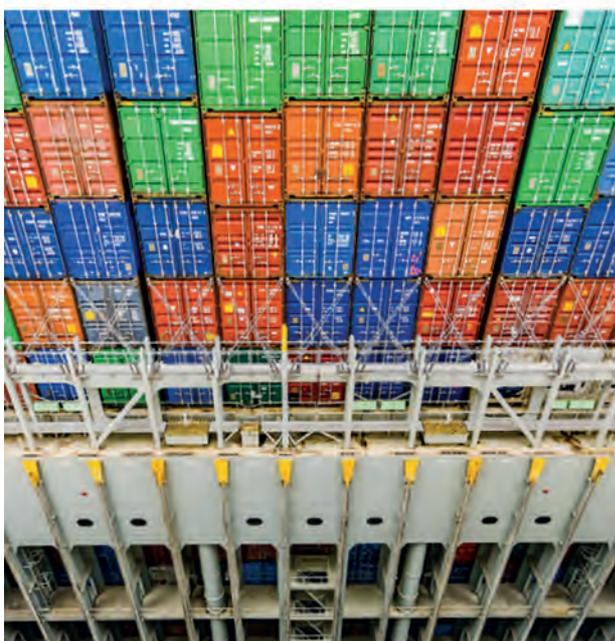
[ English ]



**Anti-rolling technologies, commonly used by passenger and research vessels, are now gaining prominence on large container carriers**

CHARTING THE FUTURE **ClassNK**Guidelines for Container Stowage  
and Securing Arrangements (Edition 3.3)

[ English ]



**The new guidelines reference and reinforce ClassNK's Guidelines for Container Stowage and Securing Arrangements**

## “Traditional approaches to containership safety...may not always adequately reflect conditions on a given voyage”

*Anti-Rolling Devices*, recognising the increasing adoption of anti-rolling tanks and stabilisers on large container carriers. Historically used on passenger and research vessels, anti-rolling technologies are now gaining prominence on large container carriers, reflecting growing concern about incidents considered to have been caused by excessive roll and parametric roll.

The new guidelines formalise the technical, operational and survey requirements for such systems. They define the class notation 'Anti-Rolling Device' (ARD) and outline expectations for power stability, environmental resistance, control integration and emergency operation, including the need for manual isolation or drainage of anti-rolling tanks in abnormal situations.

Annex A introduces a comprehensive procedure for evaluating roll-reduction effects through non-linear direct load analysis. This includes modelling ship response in irregular waves, accounting for loading conditions with the largest and smallest metacentric heights (GM) and assessing the impact of tank dynamics across multiple sea states and headings. In practice, it allows operators of ARD-equipped ships to demonstrate quantified roll reduction, which can be reflected in container stowage and securing evaluations.

### Safety framework

These initiatives form part of a broader effort by ClassNK to produce an integrated safety framework that links environmental prediction, hull response, cargo securing and motion-control technologies. The guidelines reference and reinforce ClassNK's *Guidelines for Container Stowage and Securing Arrangements*, ensuring that weather-derived load factors and ARD reduction coefficients are fully compatible with existing structural and lashing assessment methodologies. By creating this interoperability, ClassNK is enabling a more vessel-specific, data-rich approach to securing cargo, and one that accounts for actual route conditions, real-time weather intelligence and ship-specific motion characteristics.

The implications for operators are manifold. Weather-based load assessments offer the potential for more confident decision-making and better use of vessel capacity on short voyage legs. Anti-rolling devices provide a measurable contribution to reducing roll-induced hazards. The combined framework strengthens the industry's ability to manage motion and load risks on today's large container carriers and intensive service patterns. ■

# PROFESSIONAL PROFILE



## JAMES FOWLER

STRUCTURAL INTEGRITY MANAGER

Maran Shuttle Tankers

### Education

**Masters** Naval Architecture at  
Newcastle University

### Experience

**2018 - present** Structural integrity manager at  
**Maran Shuttle Tankers** (formerly Teekay Offshore,  
later Altera Infrastructure)

**2016 - 2018** Structural superintendant at  
**bp Shipping**

**2013 - 2015** Graduate naval architect at  
**bp Shipping**

### When did you first develop an interest in the maritime sector, and more specifically, in naval architecture?

My interest in engineering started at a young age. I always enjoyed understanding how things worked and finding practical solutions to problems.

When choosing a career path, I knew I wanted to become an engineer, but I also wanted something connected to the sea. Naval architecture offered the ideal balance between technical challenge and my passion for being by the coast and enjoying water sports.

After graduating from Newcastle University with a master's degree in naval architecture, I was more certain than ever that a career in the commercial shipping sector was the direction I wanted to follow. The scale, complexity and international nature of the industry were exactly what I was looking for.

### How did you get a placement on the bp Shipping Graduate Programme? And what were the main skills, experiences and benefits you gained from the programme?

Between my third and fourth year at Newcastle University, I secured a summer internship with bp Shipping. After completing the 11-week placement and the final interview process, I was offered a permanent role as graduate naval architect the following year.

After graduating with a master's degree in naval architecture in 2013, I joined bp Shipping's development programme, a scheme designed to prepare engineers for key technical roles within the company. The programme comprised rotational placements across all areas of the business, from office-based project work to shipyard and fleet support assignments around the world, including an overseas secondment to a classification society. It provided broad exposure to both the technical and operational sides of commercial shipping while building the competencies needed for chartership.

After completing the development scheme, I took up the role of structural superintendent supporting bp's Vetting and Clearance team. This involved vetting third party vessels proposed for bp Group business by carrying out structural assessments against classification society rules, flag regulations and bp policies and procedures.

### What kind of work do you do day-to-day, and what are the high and low points (if any)?

Now in my current role, as structural integrity manager for Maran Shuttle Tankers (part of the Angelicoussis Group), I am responsible for all aspects of naval architecture and structural

## “No two days are the same, which is part of what makes the work so rewarding”

integrity management for the company’s shuttle tanker fleets operating in some of the most demanding offshore regions in the world. This includes the North Sea, offshore East Coast Canada and offshore Brazil.

I implement and manage structural inspection strategies, oversee and carry out inspections, conduct structural risk assessments and maintain anomaly management systems. Dry dock and repair support is a large part of my work, and I am frequently on board the vessels and in shipyards overseeing structural and coating scopes of work. All of this ensures the vessels remain safe, efficient, compliant with the rules and regulations and aligned with charterer requirements and expectations.

My role has also included involvement in newbuild, conversion and life extension projects where I provide discipline specific technical support.

No two days are the same, which is part of what makes the work so rewarding. The high points come from seeing technical decisions translate into safer and more efficient operations. The main challenges usually relate to managing time and priorities across a busy fleet, but that variety is also what keeps the role engaging.

### **Can you tell us more about some of the projects you're involved with? And what are your main roles/responsibilities on these projects?**

Throughout my time in the role, I have led a wide range of major projects, from large docking campaigns and retrofit programmes to life extension work, conversion of shuttle tankers to FSO units and support to newbuild projects across all three regions where we operate.

A significant part of my focus has been on improving the quality of structural information available to us and strengthening the way we collect and use that data. This has led me to drive several initiatives to advance our structural integrity management capability. Working closely with DNV Maritime Advisory, we have developed and implemented one of the most advanced wave-loading and fatigue-monitoring tools currently in use on a commercial vessel, an initiative called Nerves of Steel.

Nerves of Steel uses operational and structural data to understand how our shuttle tanker hulls behave over time in harsh environments such as the North Sea and offshore East Coast Canada, and presents hull structure utilisation through a

customised dashboard. My responsibilities include interpreting vessel data, working with class and inspection providers and integrating the findings into practical maintenance and inspection strategies across the fleet.

In parallel, I have represented the company in several industry research and development projects focused on autonomous drone technology for both water ballast and cargo oil tank surveys. These projects aim to improve safety, reduce downtime and provide reliable structural data from areas that are typically difficult and costly to access. My role has been to ensure the technology fits real operational needs so it can be incorporated into our maintenance systems.

In 2025, we completed a pilot study, approved by class and flag, to carry out a fully remote overall and close up survey of a cargo oil tank using autonomous drones without man entry. The pilot successfully achieved all objectives and marked the first time an ESP tanker completed a survey of this nature.

Together, these projects support a shift toward more intelligent and data driven maintenance with stronger links between design, operation and digital technology.

### **Finally, what advice would you give to young students or trainees looking to move into naval architecture as a career? What's the best way to go about this, and can you recommend any other disciplines/training to facilitate this?**

Naval architecture is a rewarding career because it blends engineering, problem solving and real-world impact. My main advice to anyone considering the field is to stay curious and keep a broad outlook. The industry is small, so stay in touch with your classmates and colleagues as you progress. Those networks often become the people you work with again later in your career.

The step from university into your first role is significant. It is a different environment, and the learning curve is fast. The practical experience I gained early in my career has been invaluable in reaching the point I am at today. I would encourage students and trainees to take every opportunity to spend time in shipyards and on board vessels. Those experiences will accelerate your understanding far more than anything you learn from a textbook.

If you enjoy travel, naval architecture also opens the door to parts of the world you might never otherwise see. My career has taken me to all corners of the globe, often to places that are well off the usual tourist path. ■

# BUILDING ON CORE VALUES

ZeroUSV's forthcoming Oceanus17 USV will incorporate most of the components and design features that characterised its earlier Oceanus12 model, speeding up the design, engineering and build phases, writes **Martin Conway**

If 2025 proved a busy year for UK-based uncrewed surface vessel (USV) manufacturer ZeroUSV – what with three international sales of the company's 12m Oceanus12 uncrewed vessel completed, and participation in NATO's REPMUS exercise, off the coast of Portugal – 2026 promises to be no less hectic, with ZeroUSV preparing to launch its new, larger Oceanus17 model.

Already under construction at Manor Marine, with a scheduled launch date of June 2026, the first Oceanus17 will “have a flavour of the military about it, but be very much a dual-role vessel,” Matthew Ratsey, founder and MD of ZeroUSV, tells *The Naval Architect*. “The feedback we're getting from wind farm service operators is that they want to increasingly use remote-operated vehicles [ROVs], and the Oceanus17 can function as a ‘mothership’ to launch and recover ROVs, and as a ‘comms node’, tracking the ROVs’ positions when they are deployed – which has massive benefits in not losing a single ROV.”



**The Oceanus17 is primed for launch and certification in summer 2026 (image: Chris Blount)**

Ratsey adds that ZeroUSV was recently approached by a company that manages the offshore facilities for several energy majors, with a view to using a fleet of USVs to deliver post and spares to these sites, as a cost-efficient alternative to expensive helicopter hire. This is a task the forthcoming Oceanus17 could easily handle given its aft deck payload capacity of 4tonnes, Ratsey points out.

## Spiral development

More than 1,500 hours have gone into the development of the Oceanus17, which will comprise an all-aluminium, 16.97m x 3.17m monohull (see Technical Particulars) with the ability to maintain range for more than 50 days.

One of ZeroUSV's goals was to “compress traditional defence acquisition timelines”, where the journey from design to prototype can roll on for years, Ratsey notes. So, for the Oceanus17, ZeroUSV chose to use a ‘spiral development process’, accelerating the design, engineering and build phase by basing the new model heavily on the Oceanus12 – essentially treating the existing USV as a ‘building block’ for the newer, bigger model.

Ratsey elaborates: “We've taken most of the core engineering we used for the Oceanus12 – what we

**The Oceanus17's payload bay will measure 9m x 2.8m, with the capacity to accommodate a 20' container (image: Chris Blount)**



know works and is reliable – and asked ourselves, what is the biggest vessel we can build with this engineering package? This includes the engines, the batteries, the battery chargers and the generators used in the Oceanus12 – we designed enough capacity into those components the first time around, we can reuse them in the Oceanus17.

“This approach will help us bring the Oceanus17 to market as quickly as possible. We didn’t have time to ‘go back to scratch’ and design a brand new electric-hybrid propulsion system... if we had, we’d probably be another year away from commercial launch. We put together the propulsion systems for the Oceanus12 range ourselves, with no off-the-shelf solutions available. You have to do it the hard way; if you have a 400V power system, you need to find the right DC-to-DC 400V charger. Getting everything to match and work together took a bit of time, certainly for the Oceanus12.”

Another benefit of the spiral development process is that, by using the same components as the Oceanus12, end users can utilise the same spares packages with the newer model. USV familiarisation is another bonus. The biggest boon, though, from a USV manufacturer’s perspective, is perhaps the ability to speed up necessary certification. Ratsey explains: “The fact that we’re using 95% of the same equipment from the Oceanus12 on the Oceanus17 means that, when we come to enter the Maritime and Coastguard Agency [MCA] Workboat Code 3 process, all our current mitigations and submissions are transferrable – they just apply to a slightly larger version of the vessel.”

**Naval arch know-how**

The Oceanus17’s payload bay will measure 9m x 2.8m, and will have the capacity to accommodate a 20’ container, with power and data connection points. The USV will also feature Starlink and Iridium connectivity and will incorporate an autonomous software package provided by ZeroUSV’s long-term partner Marine AI – rated to level 4 autonomy, but future-proofed for further upgrades. In addition to the boat’s primary sensors, customers will be able to select FLIR thermal IP cameras and W-band HD radar, among other options.

While Manor Marine puts the USV together, working with materials and components pre-issued by ZeroUSV, an independent contractor will oversee the boat’s electrical fit-out. If all goes to plan, the Oceanus17 will be launched in time for this year’s Seawork expo, to be hosted in Southampton, UK between 9-11 June. Then, in July, the boat will be certified by MECAL to meet the MCA Workboat Code 3, Annex II requirements for uncrewed vessels and unlimited operations.

Development of the Oceanus17 has been encouraged by the National Shipbuilding Office (NSO) of the UK Government: a fitting reminder of the fact that USVs

TECHNICAL PARTICULARS	
<b>OCEANUS17</b>	
<b>Length</b>	16.97m (oa)
	16.68m (wl)
<b>Breadth, max</b>	3.17m
<b>Draught, max</b>	1.85m
<b>Displacement</b>	13.7tonnes (at full load)
<b>Power</b>	2 x 61kWh 400V RAD lithium batteries
<b>Propulsion</b>	2 x 40kW electric stern drives
<b>Fuel capacity</b>	3,000litres
<b>Survey speed</b>	4knots
<b>Cruising speed</b>	7knots
<b>Sprint speed</b>	12knots
<b>Endurance</b>	5,000-11,000nm (with external fuel tanks)
<b>Primary sensors</b>	X-band 20” radar
	Daylight HD camera
	TransponderTech R6 Class A AIS
	Airmar 200WHX weather station
	Echomax XS active radar
	Nvidia GPU
<b>Sea state operational envelope</b>	Garmin Marine satellite compass
	Survey 4
	Launch and recovery of mission equipment 6
	Transit 7
	Survival 8

are sophisticated and complex vessels in their own right, and not just floating drones.

“I see myself as a naval architect and a boatbuilder who understands this new technology, rather than a tech person trying to build a boat,” Ratsey says. “That’s a really critical difference, because a lot of USVs out there are technical solutions first. Some developers haven’t a clue about the maritime or boating world, and the result is that you end up with something that is not necessarily fit for purpose.” With plans to bring the Oceanus17 to the 2026 REPMUS exercise, making this unit ‘fit for purpose’, and beyond, is high on the agenda. ■

# AI OF THE NEEDLEFISH

Six months since the first NeedleFish units entered service, SRT Marine Systems and the Kuwait Coast Guard are looking to the future with renewed ambitions and new projects in the pipeline, writes **Bruno Cianci**

The 'Project Vigilant' system, whose US\$213 million contract was signed in October 2024, is set to reach full operational capacity in 2026. The deal in question sees the Kuwaiti Ministry of the Interior as the client and UK-based SRT Marine Systems, specialising in technological solutions for maritime surveillance, as the supplier.

The system, designed specifically for the Kuwait Coast Guard, includes integrated command centres, 12 radar towers, 100 buoys and mobile surveillance platforms, including four brand-new USVs named 'NeedleFish'. Project Vigilant ensures real-time detection, tracking and identification of activities such as smuggling, piracy, pollution and unauthorised fishing, using radars, ultra-high-definition cameras, next-generation sensors and dynamic AI.

It can also be used for search and rescue, vessel escort, collision avoidance and similar tasks. Project Vigilant, the supplier says, is a system capable of detecting anything moving on the surface of the water, be it small craft, single individuals, a surfacing periscope or an oil slick: all for the benefit of a country that aims to become a global leader in digital maritime surveillance supported by AI.

The economy of Kuwait is undergoing a major transformation, with authorities committed to implementing long-awaited reforms to develop non-oil sectors and diversify income, similar to those already undertaken by other monarchies in the region. According to a Global Finance report dated March 2025, Kuwait has US\$121 billion in infrastructure projects underway, covering housing, infrastructure, public services and security.



**A rendering of the NeedleFish, which was developed by SRT for the Kuwait Coast Guard**

coastline, but also approximately 7,600km<sup>2</sup> of the Persian Gulf under the kingdom's jurisdiction, including nine islands and large swaths of shallow, treacherous waters, some of which are off-limits to conventional navigation.

Although the NeedleFish units are just the tip of the iceberg of this sophisticated surveillance system, they play a fundamental role thanks to their speed, manoeuvrability, range and, of course, the advanced technology that allows for their deployment. To this end, SRT has selected Texas-based company Ocean Infinity for the vessels' remote-control technology. The company, which has a UK branch in Southampton, is a young firm specialising in the development of robotic systems for large-scale marine and underwater data acquisition.

Built in high secrecy at two separate UK sites, the locations of which have not been disclosed (some clues point to the southwest of the country), the four NeedleFish units were delivered by specially chartered Antonov aircraft (likely An-124s) and officially began operations in July 2025.

A few days earlier, on 30 June, the first two units, designated CGX-03 and CGX-04, were presented to guests and officials, including Commodore Sheikh Mubarak Ali Yousuf Al Sabah, director general of the Kuwait Coast Guard and a staunch moderniser. During a briefing on the operational capabilities of the USVs in question, Al Sabah explained that they "can function autonomously for days without direct human intervention", noting that "their pivotal missions include surveillance, continuous monitoring, interception of suspicious maritime



**Project Vigilant**  
In practical and geographical terms, the Project Vigilant system allows 24/7 patrolling and monitoring not only of the waters off Kuwait's 499km of mainland

**Commodore Sheikh Mubarak Ali Yousuf Al Sabah: the USVs "can function autonomously for days without direct human intervention"**

targets, support for search and rescue operations, monitoring environmental pollution, protecting natural resources and overall maritime security enforcement within Kuwait's territorial waters".

### Intelligent catamarans

Technically, the four vessels are catamarans constructed from aluminium and other lightweight materials, featuring aggressive negative bows and powered by Volvo Penta diesel engines combined with waterjet propulsion systems. Measuring 14m x 6m, these futuristic vessels can operate even in adverse weather and sea conditions, and have a rated speed of 35knots and a range limited only by the fuel they carry.

Painted in grey military livery, the NeedleFish feature the distinctive slash of the Kuwait Coast Guard's international orange stripe, a stylistic feature introduced in the US in the 1960s and subsequently adopted by nearly all agencies and armed forces engaged in search and rescue (SAR) operations worldwide.

Despite being cutting-edge in terms of design and overall appearance, these marine vessels do not rely on stealth technology, which is easily deduced from their vertical sides, which are incompatible with the characteristics of low-radar signature. They are not even armed vehicles, but SRT CEO Simon Tucker states that future USVs, currently under development at SRT, will include both stealth technology and the option of armament, adding: "SRT is working on a new USV called Sea-Tiger which will sit alongside the NeedleFish and offer much greater surveillance mission capability."

Another task, initially planned for the NeedleFish but not yet implemented on this platform, will enable the development of accurate seabed mapping, updating in real time the cartographic and bathymetric data of the waters visited and scanned by dedicated sensors. Tucker says: "The NeedleFish is the first of a number of USVs that SRT is now offering to various sovereigns, where the physical design and source of the vessels will vary according to the needs of the specific project. Thus, SRT will be bringing a number of new USVs to our projects which we will commission from various providers, and then look into

the market for the best remote and autonomous technology to implement onto them, and each will always host a range of sensor systems.

"NeedleFish has been a good first start to this, but our new range coming out next year, which we are developing with different partners, will take this to a new level."

On the subject of AI, Tucker says: "The sensors on the towers and Needlefish stream into the SRT system, where it is fused with other data. That data on detected vessel movements is analysed by the SRT Dynamic-AI system to detect potential events and create spot areas of interest for close up surveillance."

With the implementation of Project Vigilant, Kuwait's future in this arena is officially underway: "In a single leap," Tucker concludes, "Kuwait has become a global leader in maritime surveillance. Its new fleet of ground-breaking USVs demonstrates the speed at which Kuwait is modernising and investing in, adopting and deploying a new generation of marine technology." ■

**The 14m catamarans were developed for 24/7 patrols within Kuwait's waters and the Persian Gulf**





In addition to the LSM programme, Damen's LST100 has been selected by the Australian Defence Force (source: Damen)

## NEW APPROACH TO SHIPBUILDING WITH LSM DEAL

The US Navy's 'build to print' strategy will get ships into service cost-effectively and on time, writes **David Foxwell**

After decades of building purpose-designed and built ships that sometimes failed to meet requirements and often experienced significant cost overruns, the US Navy is pioneering a new approach to shipbuilding with its Landing Ship Medium (LSM) programme, an approach it hopes will enable it to quickly bring large numbers of newbuilds into service on time and on budget.

Weeks after the US Navy cancelled another high-profile naval shipbuilding programme – the Constellation-class frigate – because it had fallen significantly behind schedule, US Navy secretary John Phelan said the new approach adopted for the LSM procurement would be based on a “non-developmental design” that will not require significant adaptation.

The design selected by the Naval Sea Systems Command (NAVSEA), Damen Shipyards Group's LST100, has already been adopted by the Royal Australian Navy, for whom eight examples will be built in Australian yards, and will, said the Naval Sea Systems Command, “enable rapid fielding of this urgently needed capability... and shorten acquisition timelines”.

The LST100 was selected by NAVSEA after a ‘side-by-side’ analysis of existing designs that had the potential to meet the LSM requirement. NAVSEA's analysis of the designs was informed by technical data packages, augmented by hands-on ship visits. Up to 35 LSMs will now be built at US yards that will compete with one another for contracts to build the landing ships.

### Construction manager

Speaking at the time that selection of the Damen design was announced, chief of naval operations Admiral Daryl Caudle said: “A year ago, the US Navy cancelled the LSM request for proposals, when the conceptual design produced bids that were simply unaffordable. We applied common sense, went back to basics, and reassessed the programme.

“We identified existing, proven designs that meet the concept of operations requirements, and then scrutinised them for producibility.”

Secretary Phelan said with the LSM decision the US Navy is “fundamentally reshaping how the Navy builds and fields its fleet”, making what he called an “operationally driven and fiscally disciplined choice”. He said with the LSM the US Navy has – for the first time – adopted what he described as a “build to print approach” that drives down cost, schedule and technical risks.

Phelan also said that, working with Congress, the US Navy is “adopting commercial practices” and will also appoint a vessel construction manager to oversee the LSM programme, “drive execution and facilitate genuine competition between multiple shipyards”. As of late 2025, authorisation for the US Navy to build ships using a vessel construction manager was pending congressional approval.

Commandant of the Marine Corps General Eric Smith said: “For the Marine Corps, the LST100 will provide an organic littoral capability in the Indo Pacific and

# WARSHIP 2026 SUBMARINES

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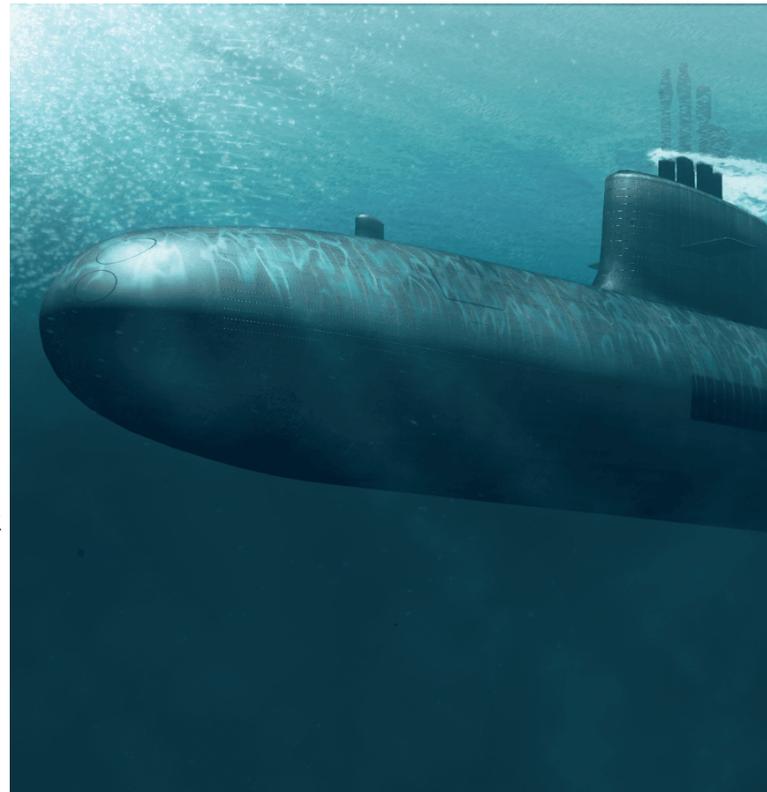
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- Survivability and evacuation (escape and rescue)
- Stealth Technologies
- Sustainability
- Quantum Technology



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around the world. It will provide us with a critical, inter-theatre manoeuvre asset that is able to embark and transport marines, weapons, supplies and equipment, without requiring access to a pier.”

The Secretary of the Navy described the LST100 as a 4,000tonne design, with a range of more than 3,400nm “that gives us the right balance of affordability, capability and speed”. General Smith said the LST 100’s cargo capacity, helicopter capacity and crane “make it an excellent choice for the Marine Corps’ requirement of no less than 35 medium landing ships to support naval expeditionary forces.”

Admiral Caudle said the US Navy “is incorporating a disciplined set of class standard equipment, so that the ships will be maintainable, repairable and able to meet operational availability targets”.

NAVSEA released a request for information to the industry for the LSM at the beginning of 2025, not long after the request for proposals was cancelled. In July 2025, Damen received a technical data package award from NAVSEA for the LST100, and that design has now been selected as the basis for the LSM, all of which will be constructed at American yards.

**Highly flexible**

The Dutch company describes the LST100 as 100.68m in length with a beam of 16m and a draught of 3.58m. Able to support a wide range of operations, with the ability to transport personnel, vehicles, equipment

and cargo, the design has accommodation for 282 Marine Corps personnel. Cargo can be transported on a 500m<sup>2</sup> ro-ro deck, 400m<sup>2</sup> vehicle deck and on the ship’s helicopter deck.

The vessel can transit at speeds of up to 14knots, with an endurance speed of 10knots, providing it with a range of up to 7,530nm. The LST100 is also a highly flexible unit, with a modular design that enables straightforward adaptation and upgrade without compromising the benefits of standardisation.

Information provided by Damen about the LST100 describes a vessel with a diesel-mechanical propulsion system based on the use of two Caterpillar 3516-C main engines (1,800rpm, 2,350kW) driving controllable pitch propellers, augmented by two fixed-pitch bow thrusters. The auxiliary machinery takes the form of three Caterpillar C18 gensets, each of 601kW, and one Caterpillar C18 emergency/beaching genset of 601kW.

The standard LST100 design has a flight deck intended for one medium-size helicopter. It incorporates 250m<sup>2</sup> of space for stores and 35m<sup>2</sup> for ammunition. Accommodation is provided for a crew of 18 and 14 additional personnel. The LST100 has a 70tonne capable bow door, 70tonne capable bow ramp and a 70tonne capable stern ramp. Optional equipment includes a 25tonne cargo crane, a hoistable 30tonne ramp and a 1.5tonne provisions crane. The design incorporates four davits with landing craft, an ammunition elevator and a ballast water treatment system. ■

**USCG CUTTERS CONTRACT**

Contracts have been awarded to Rauma Marine Constructions (RMC) in Finland and Bollinger Shipyards in the US to build a new class of Arctic Security Cutters (ASCs) for the US Coast Guard (USCG). RMC will build the first two ASCs, a new class of medium polar icebreakers that will expand America’s operational presence in the Arctic.

Construction of the Finnish-built vessels will begin immediately. US-based Bollinger has signed a contract with the USCG for the construction of four ASCs. Work on the four Bollinger-built ASCs will take place at the company’s shipyard in Houma, Louisiana. Construction will be supported by the company’s workforce at multiple facilities in the Gulf Coast region. Bollinger president and CEO Ben Bordelon describes the ASC programme as “one of the most time-sensitive shipbuilding programmes in USCG history.”

The icebreakers built at the Finnish shipyard will be completed in 2028. The first of the icebreaking vessels to be built at Bollinger is due to be delivered in 2029. The vessels will be based on the Multi-Purpose Icebreaker design by Seaspan Shipyards of Vancouver, Canada, developed with Aker Arctic Technology in Helsinki, Finland.

The ASC newbuilding programme is described as “one of the most time-sensitive” programmes in USCG history



# WIND PROPULSION

## Conference

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As the maritime industry moves towards a greener future, wind-assisted propulsion is taking centre stage. In the last six months of 2024, 54 large vessels were equipped with wind propulsion systems, with a further seven constructed wind-ready. With over 80 wind-powered vessels set for delivery in 2025 and 2026, the industry is on course to surpass 100 wind-assisted ships by the end of 2026.

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Delivered in Q3 2025, *Ocean Breeze* runs on LNG, MDO and VLSFO

## FRESH AS AN OCEAN BREEZE

A series of six LNG-enabled pure car and truck carriers are set to play a crucial role in Sallaum Lines' efforts to decarbonise its transportation operations

Ocean transportation company Sallaum Lines has come a long way since its inception in 2010, having shipped well over 4 million car equivalent units globally since. While the company initially relied on second-hand vessels for its PCTC fleet, it has shifted toward ordering LNG newbuilds as part of an ambitious goal to achieve net-zero operational emissions by 2050.

“The decision to order newbuilds was driven by technical and environmental performance objectives, not by cost alone,” Charbel Khoueir, maritime sustainability manager, tells *The Naval Architect*. “Sallaum Lines required vessels that could fully comply with IMO Tier III, the IGF Code, EEDI Phase 3 and forthcoming CII targets, while integrating dual-fuel LNG propulsion,

electric vehicle-ready cargo decks and advanced hydrodynamic features.

“These parameters would have been impossible to achieve through retrofit without extensive structural and machinery compromises. Newbuilds designed from the keel up provide optimised hull efficiency, lower emissions and long-term lifecycle compliance with current and anticipated regulations.”

Consequently, Sallaum Lines is adding six large, dual-fuel LNG PCTC newbuilds to its fleet. The first duo in the series – the 199.9m, all-steel sister vessels *Ocean Breeze* and *Ocean Explorer* – were designed by Shanghai Merchant Ship Design & Research Institute (SDARI) and constructed by Fujian Mawei Shipyard, with *Ocean Breeze*

### PUSHING BACK ON METHANE SLIP

In May 2025, Mitsui O.S.K. Line's (MOL's) 235m, LNG-fuelled coal carrier *Reimei* began full-scale sea trials of a methane-slip reduction system developed by MOL, Kanadevia and Yanmar Power Solutions, with the support of Japan's NEDO Green Innovation Fund. The system combines EGR – which recirculates part of the exhaust back into the engine to lower combustion temperature and burn more methane from the start – with a dedicated methane-oxidation catalyst, placed downstream, that converts nearly all remaining unburned methane into CO<sub>2</sub> and water.

In sea trials aboard *Reimei* on its Japan–Australia routes, the system was shown to cut methane slip by 98% at a 75% engine load: exceeding the original 70% target and beating earlier land-based results of 93.8%. Trials will continue throughout 2026 to confirm long-term catalyst durability, the partners say.

TECHNICAL PARTICULARS <b>OCEAN BREEZE/OCEAN EXPLORER</b>	
<b>Length</b>	199.9m (oa) 195.6m (bp)
<b>Breadth</b>	38m
<b>Depth</b>	14.8m
<b>Draught</b>	8.65m (design)/10m (max)
<b>Air draught</b>	46m
<b>Deadweight</b>	11,000tonnes / 18,500tonnes
<b>Main engine</b>	1 x MAN B&W 7S60ME-C10.5-GI-EGRBP
<b>Output of main engine</b>	12,614kW@99rpm; 10,722kW@93.8rpm
<b>Auxiliary engines</b>	3 x Wärtsilä 9L20DF
<b>Output of each aux. engine</b>	1,600kW
<b>Emergency generator</b>	200kW
<b>Speed</b>	18.5knots@NCR
<b>Onboard capacities</b>	
<b>LNG</b>	2x1,768m <sup>3</sup>
<b>MGO</b>	611m <sup>3</sup>
<b>VLSFO</b>	1,234m <sup>3</sup>
<b>Fresh water</b>	383m <sup>3</sup>
<b>Ballast water</b>	6,680m <sup>3</sup>
<b>Lube oil</b>	187m <sup>3</sup>
<b>Crew</b>	25 + 1 pilot
<b>Classification society</b>	ABS

delivered in Q3 2025 and *Ocean Explorer* scheduled for delivery in Q1 2026. A further four PCTCs, designed by Deltamarin – namely *Ocean Express*, *Ocean Legacy*, *Ocean Navigator* and *Ocean Triumph* – are currently under construction at China Merchants Heavy Industries (CMHI) and scheduled for delivery throughout 2026-2027.

**“Low-emission pathway”**

*Ocean Breeze* runs on LNG, MGO and VLSFO, and can operate in LNG-only, fuel oil-only or dual-fuel modes, depending on prevailing voyage or port conditions. Regarding the choice of alt-fuel, Khoueiry explains: “We selected LNG because it offers a proven, commercially available and technically mature, low-emission pathway that complies with current environmental regulations. It eliminates SOx and PM, reduces NOx by up to 80%

through exhaust gas recirculation [EGR] and lowers CO<sub>2</sub> by approximately 20–25%.”

At a continuous sailing speed of 17knots, the vessel is estimated to achieve a range of approximately 12,600nm when operating on LNG, 3,000nm on MGO and 7,800nm on VLSFO. Taken together, the vessel’s total potential sailing range with full tank capacity is approximately 23,400nm.

The powertrain aboard *Ocean Breeze* incorporates a MAN B&W main engine, rated 12,614kW at 99rpm, and three auxiliary Wärtsilä 9L20DF engines, rated 1,613kW apiece, in addition to a 200kW emergency generator. “All machinery is installed in an aft engine room with segregated LNG and ventilation spaces, in accordance with the IGF Code and ABS requirements,” says Khoueiry.

The ship is also fitted with two Type C LNG storage tanks, each featuring the capacity for about 1,768m<sup>3</sup> of LNG. The tanks are designed to operate at a temperature of -165°C and at a maximum working pressure (MAWP) of 0.36MPa (approximately 3.6bar), and feature a boil-off rate of approximately 0.45%.

LNG is vaporised and supplied to the engines via a dual-pressure fuel gas supply arrangement, providing high-pressure gas at approximately 315 bar to the main engine and low-pressure gas to the dual-fuel generator engines.

The PCTC is equipped with a single fixed-pitch propeller and a semi-balanced twisted rudder with bulb, developed by SDARI to enhance propulsive efficiency. The vessel is designed for a service speed of 18.5knots at design draught, allowing for a 15% sea margin.

**Arranged for EVs**

*Ocean Breeze* features 13 car decks – nine fixed, four liftable – and one garage deck. “Internal fixed and moveable ramps link the decks, for efficient flow,” Khoueiry says.

The vessel is fitted with two vehicle access ramps: a stern ramp with a minimum width of 12m, a clear height of 5.4m, a load capacity of 200tonnes and a maximum axle load of 55tonnes; and a height-adjustable starboard side ramp with a minimum width of 6.5m, a maximum clear height of 5.4m, a maximum load of 20tonnes and a maximum axle load of 15tonnes.

All decks permit the carriage of electric vehicles (EVs), while the upper decks, from Deck 11 upwards, are also certified for hydrogen-/compressed natural gas (CNG)-powered vehicles.

The ship was classed by ABS, achieving full IGF, ENVIRO and operational notations (see Technical Particulars). “Safety features include gas-tight LNG spaces, independent ventilation, double-walled gas piping, ESD systems, CO<sub>2</sub> fire protection



The vessel is the first of six China-built, dual-fuel LNG PCTCs scheduled for handover to Sallaum Lines by 2027

low-friction antifouling coating, developed to keep the hull continuously smooth, reducing hydrodynamic drag and fuel consumption and enabling higher vessel speeds.

The four forthcoming PCTCs – *Ocean Express* currently scheduled for a Q2 2026 handover, at the time of writing – will feature “further hydrodynamic refinements”

and a shaft generator, Khoueiry reveals. As well as significantly slashing emissions and helping Sallaum Lines to progress towards its 2050 net-zero target, the six newcomers should prove instrumental in the company’s drive to create a China-focused global logistics network, including planned long-term collaborations within the country, the company hints. ■

and EV fire zones with continuous detection for the hydrogen/CNG vehicle areas,” says Khoueiry. This was accompanied by crew training in LNG handling, carried out in line with IMO/IGF Code competence standards.

As another green bonus, the ship has been treated with Chugoku Marine Paints’ SEAFLO NEO SLZ

## WINNING THE ALTERNATIVE MARINE FUELS RACE

Will 2025 go down as the year hydrogen and ammonia emerged as shipping’s favoured energy sources? **Patrik Wheeler** reports

Hydrogen and ammonia are no longer fuels of the future. They are fuels for today, with 2025 now regarded as the year these fuels began to feature in ship designs, class rules and firm newbuild contracts.

Hydrogen in particular is now being specified for a range of vessel types, from shortsea containerships and bulk carriers to cruise ships and ro-ro ferries, with projects moving beyond the concept stage to firm contracts and construction. In April 2025, for instance, Viking confirmed a contract for the world’s first hydrogen-fuelled cruise ship, the 54,300gt *Viking Libra*, which is currently under construction at Fincantieri’s Ancona shipyard and scheduled for delivery in late 2026. A sister ship, *Viking Astrea*, will follow in 2027.

Both ships will feature a state-of-the-art hydrogen propulsion system combined with advanced fuel cell technology to produce up to 6MW of power. Hydrogen, which will power polymer electrolyte membrane (PEM) fuel cells, is loaded and stored directly onboard in a containerised tank unit.

### Short-sea demand

Hydrogen is also being applied in the small-bulk segment, particularly in Norway, where public funding mechanisms and short-sea operational profiles have supported early adoption. This is indicative in Møre Sjø’s order for a pair 4,000dwt hydrogen-powered bulkers scheduled for a 2027 delivery from the Gelibolu Shipyard in Turkey.

Designed by Naval Dynamics, the vessels will each feature hydrogen systems developed by Germany’s eCap Marine. A fuel tank with the capacity to hold 2tonnes of compressed hydrogen will be permanently installed aft, supplying 7MW PEM hydrogen fuel cells sited below deck. eCap Marine’s scope of supply also includes an onboard hydrogen bunkering station, marine-approved power electronics, the controller and safety system and all interfaces to the ship’s power management system. The vessels will operate along the Norwegian coast, transporting aggregates and asphalt, with hydrogen supplied by GreenH.

Similar kit will be supplied to Cochin Shipyard, India for installation on hydrogen-fuelled

**Hydrogen-fuelled cruise ship *Viking Libra* will be delivered in late 2026**



short-sea container vessels under construction for Netherlands-headquartered Samskip. Two 'SeaShuttles', set to be the first in the world to use green hydrogen, will be powered by 3.2MW PEM fuel cells, with fuel supplied again from a containerised fuel tank system on the aft deck.

In July 2025, when the orders were announced, eCap Marine said there are numerous developments but very few suppliers, manufacturers and shipyards willing or able to take full responsibility for delivering energy from hydrogen. "The reason we take on full responsibility is [we] believe hydrogen will be the energy source of the future for shipping," the group said.

### Retrofit fuel

Alongside newbuilds, hydrogen is being assessed as a retrofit fuel for existing tonnage, with recent work focusing less on headline emissions reductions and more on integration, safety and class approval pathways. Two papers presented in May 2025, at the 31st CIMAC World Congress in Zürich, addressed this directly.

A joint study by H2 Energy and DFDS examined the theoretical conversion of the ro-ro ferry *Magnolia Seaways*, which operates between Esbjerg and Immingham, from a 20MW internal combustion engine to a hydrogen-electric propulsion system. The study proposed replacing the main engine with fuel cells, electric motors and batteries, supported

by approximately 27tonnes of compressed hydrogen stored at 250bar. High-pressure hydrogen installations would be located above deck and supplied to low-pressure 15MW fuel cells and other equipment installed in the former engine rooms.

Average hydrogen consumption was calculated at 18.8tonnes per round trip, with bunkering designed to take place during cargo operations at a rate of around 10tonnes per hour. Such a retrofit, which has Lloyd's Register (LR) approval in principle (AiP), is estimated to cut CO<sub>2</sub> emissions by up to 95% on a well-to-wake basis. Despite initial industry concern that the complexity of a hydrogen power train precluded retrofit application, the study found "no technical or regulatory issue could be identified that is not solvable with reasonable effort".

Indeed, according to a LR paper presented at the same CIMAC forum, authors Matteo Roiaz and Mark Penfold state that retrofitting will be unavoidable for a significant proportion of vessels operating beyond 2050, but there are technical challenges relating to hydrogen's wide explosive range and low ignition properties.

"For a safe integration of the fuel cells, the ship requires a major upgrade and additional installation of components and systems to meet the applicable safety requirements for fuel cells and the used fuel," the authors note, adding that retrofitting diesel-electric ships to fuel-cell electric propulsion is considered less complex than converting ships with traditional engine propulsion. However, "safety and practical challenges will vary in dependence on the scale of retrofitting [partial retrofit versus full retrofit] as well as the target vessels".

### Ammonia options

While hydrogen projects in 2025 are increasingly defined by vessel-specific layouts and approvals, ammonia is advancing through a different pathway, centred on engine development, interim regulations and early infrastructure readiness.

In May 2025, Wärtsilä reported results from testing of its Wärtsilä 25 four-stroke ammonia engine, showing substantial greenhouse-gas reductions compared with equivalent diesel engines when operating with a 95% ammonia energy share. The

**Naval Dynamics has designed a pair of hydrogen-powered bulk carriers for Norwegian shipping company Møre Sjø**



engine builder believes “ammonia has emerged as a promising alternative fuel and will play a significant role in enabling the shipping industry to reduce its emissions”.

Classification society DNV has described ammonia as moving from concept to early-stage implementation within a five-year period. In its report *Ammonia in Shipping: Tracing the Emergence of a New Fuel*, DNV said that 39 ammonia-fuelled vessels are currently on order, commercial engines are available and the first demonstrations have been completed.

“The groundwork for ammonia as a fuel is being laid, and the orderbook proves it’s no longer just a theoretical fuel,” said Knut Ørbeck-Nilssen, CEO of DNV Maritime. “Ammonia’s toxicity and high cost remain a challenge [but] with targeted financial support mechanisms for a pioneering fleet, supply

and infrastructure developments and robust safety regulations, we can progress. While we have seen great progress recently, the next years will determine the role of blue and green ammonia in the future fuel mix.”

Linda Hammer, principal consultant at DNV and lead author of the report, said the next phase would depend on regulatory alignment and infrastructure. “The current risk-based approval framework must be replaced by prescriptive regulations mandated by the IGF Code; production needs to be increased; and more ports must be able to supply green and blue ammonia,” she said.

While neither fuel yet offers a universal solution, both are now shaping ship design in ways that are measurable, reviewable and, increasingly, contractually committed. ■

## KEEPING THE ENERGY TRANSITION SAFE

The DBI’s new METAFUEL tool has been designed to help the industry navigate the safety and regulatory challenges associated with alternative fuels

A new digital safety tool developed by the Danish Institute of Fire and Security (DBI) aims to remove one of the key obstacles to shipping’s green transition by helping the industry navigate the safety and regulatory challenges associated with methanol, ammonia and hydrogen as marine fuels.

“The green transition will be impossible without safety,” says Leonard Sang Tvei, project leader for METAFUEL at DBI. “You want to be able to load your cargo or passengers without thinking twice if it is a methanol-powered ship. The entire value chain needs to make sure that, regardless of fuel, it is ‘just a ship’”

METAFUEL is a matrix-based decision tool designed to support real-world design and retrofit decisions. Users define their role (shipowner, shipbuilder, equipment supplier, insurer or authority) and then choose a specific fuel-handling zone, including bunkering, storage, fuel preparation or the engine room. Based on those inputs, the tool identifies relevant safety considerations, applicable IMO and class requirements and known regulatory or knowledge gaps. It also highlights recommended actions and risk-reduction measures to help users address those gaps early in the design or conversion process.

“Let’s say you are a shipowner looking to retrofit a cargo vessel to methanol,” says Sang Tvei. “Once that scenario is selected, the tool highlights regulatory gaps affecting areas such as the engine room and fuel preparation space. What makes it particularly

useful is that it also points to actions that can help close those gaps.”

### Different approaches

The analysis reinforces that alternative fuels cannot be treated as a single category from a safety perspective. Ammonia’s toxicity drives requirements for segregation, ventilation and emergency response. Methanol fires with their almost invisible flames, present detection and firefighting challenges. Hydrogen introduces hazards linked to high-pressure storage, rapid dispersion and long jet flames.

To reflect these differences, METAFUEL benchmarks each fuel against four shipboard zones using a safety-focused adaptation of NASA’s Technology Readiness Level framework. The results show methanol closest to commercial maturity, ammonia at an intermediate stage and hydrogen, particularly for combustion-based propulsion, remaining at an early prototype level.

DBI’s conclusions are supported by experimental and modelling work carried out during the project. “We have simulated ammonia leak scenarios in the Port of Rønne, tested watermist configurations for methanol pool fires and carried out research into hydrogen jet flames,” says Sang Tvei. “We can’t say all gaps have been closed, but this work brings the industry significantly closer to safe implementation.”

The METAFUEL project was financed by DBI and the Danish Maritime Fund. It began in May 2024 and concluded in December 2025. ■

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# ENVIRONMENTAL RETROFITTING CONTINUES TO GATHER MOMENTUM

Recent months have witnessed a number of important initiatives which are likely to accelerate green upgrades to vessels in service, writes **Clive Woodbridge**

Driven by the need for shipowners and operators to maintain regulatory compliance, as well as the financial imperative to cut costs by reducing fuel consumption, environmental retrofits have become a significant driver for business growth at many ship repair and maintenance shipyards worldwide. There is no sign that this element of vessel retrofitting and upgrading is slowing down. Indeed, all the signs are that it is gathering momentum and has still to reach its peak.

Nonetheless, despite the positive trends, securing finance for environmental retrofits has been seen by many observers as a significant curb on investment of this kind. In recent weeks, however, there has been an important breakthrough which could help underpin the implementation of many more environmentally inspired vessel retrofits over the next few years.

The Global Centre for Maritime Decarbonisation (GCMD) has introduced the world's first pay-as-you-save vessel retrofit fund, a pioneering initiative designed to accelerate maritime decarbonisation. The newly established Fund for Energy Efficiency Technologies (FEET), aims to remove financial barriers to retrofitting vessels with energy saving technologies, enabling shipowners to upgrade their fleets and reduce emissions without having to make substantial capital expenditure upfront. This approach, offering leases without vessel-related collateral being required, and incorporating a repayment mechanism linked to verified fuel and regulatory savings, is expected to further unlock retrofit opportunities and support global sustainability goals.

According to GCMD, energy efficiency technologies such as wind-assisted propulsion systems (WAPS) and air lubrication systems (ALS) can deliver immediate fuel savings, helping shipowners to stay competitive against a backdrop of tightening environmental regulations. However, even with a buoyant environmental retrofit market, uncertainties around Energy Efficiency Technology (EET) performance continue to limit uptake by restricting access to funding by lenders who can be sceptical the benefits claimed will be realised in practice.

A primary difficulty restricting adoption, GCMD states, is the inherently variable fuel savings from EET retrofits, which depend on operational and environmental factors, such as routing and weather conditions. The lack of standardised methodologies to accurately measure fuel savings further challenges uptake.

This uncertainty has made the return on investment period difficult to predict and has exacerbated the so-called split-incentive issue, where shipowners are expected to invest in retrofits, whereas charterers realise the savings.

A pay-as-you-save repayment mechanism addresses payback uncertainty with EETs by directly linking repayment to quantified and verified fuel and regulatory savings. Deploying this mechanism, GCMD points out, requires more robust data collection and analysis to isolate the retrofit's contribution to overall fuel savings.

## Performance pilots

To this end, GCMD has undertaken several EET performance pilots, equipping vessels with additional sensors to acquire very precise, high-resolution data and applying rigorous data analytics to quantify fuel savings with statistical confidence. As more data is collected across diverse operating and environmental conditions, these datasets can be used to model and predict savings under varying scenarios, the organisation adds.

Commercial vessels are typically financed through loans which have a first priority mortgage over the vessel. As the cost of EETs is small relative to the vessel's value, it is not practical for shipowners or the existing secured financiers to provide vessel security to prospective retrofit financiers. Consequently, unsecured financing solutions are needed to accelerate the uptake of EETs, GCMD points out.

FEET decouples retrofit financing from vessel mortgages by offering unsecured leases. Under



**Professor Lynn Loo, CEO of GCMD, which has recently launched its FEET initiative to boost environmentally inspired vessel retrofits**



**A common change to the vessel configuration within Maersk's ongoing retrofit programme is the replacement of the propeller or bulbous bow to reduce drag and enhance hydrodynamic efficiency, ultimately lowering fuel consumption**

this structure, FEET provides up to 100% financing for the equipment and associated installation and sensorisation costs, and leases the hardware to shipowners. In return, shipowners make repayments linked directly to verified fuel and energy savings. At the end of the lease, ownership of the EET is transferred to the shipowner for a nominal fee.

According to GMCD, several projects have already been identified under the scheme, and have progressed to the final investment decision stage, while the fund remains open to shipowners and ship operators seeking support for adopting EETs.

GMCD was established as a non-profit organisation in 2021, with a mission to support the decarbonisation of the maritime industry, by six industry partners – BHP, BW Group, Eastern Pacific Shipping, Foundation Det Norske Veritas, Ocean Network Express and Seatrrium. Since its founding, BP, Hanwha Ocean, Hapag-Lloyd, NYK Line and PSA International have joined as additional partners.

Professor Lynn Loo, CEO, GMCD, said: "This is exactly the kind of collaborative, problem-solving mindset needed to move the needle on maritime decarbonisation. My hope is that FEET will accelerate the uptake of shipboard energy efficiency solutions and help unlock the scale of action needed to turn the industry's decarbonisation ambition into tangible progress."

### **Container tonnage retrofits**

Another positive trend in terms of environmental retrofits has been the growing willingness of major shipping companies to accelerate retrofitting

within their time-chartered fleets as well as those vessels that they own. Most notably, perhaps, in a large-scale programme involving 50 different shipowners, A.P. Moller – Maersk is working closely with these owners, retrofitting around 200 vessels in its time-chartered fleet.

Ahmed Hassan, Head of Asset Strategy and Strategic Partnerships at Maersk, says: "Our medium- and long-term chartered fleet makes up a significant proportion of our operations as well as of our total fuel consumption. By working closely with our partners, we aim to implement solutions that not only reduce emissions but also enhance the overall competitiveness of our fleet."

In total, Maersk and time-charter partners have so far carried out more than 1,500 individual projects across 200 vessels involving around 50 shipowners, and an additional 1,000 projects are in the process of being executed and are scheduled to be finalised by 2027. The investment cost for these solutions is being split between Maersk and the vessel owners.

Hassan adds: "We have from experience found that this model is a win-win. At Maersk, we can reduce both emissions and fuel costs, while the owners get the long-term value of a modernised vessel."

Of the around 200 vessels being retrofitted, a common and significant change to the vessel configuration is the replacement of the propeller or bulbous bow. The integration of an optimally designed bulbous bow reshapes water flow around the hull to reduce drag and enhance hydrodynamic efficiency, ultimately lowering fuel consumption.



**bound4blue and Amasus Shipping have recently completed the retrofitting of a 22m eSAIL on the general cargo vessel *Fluvius Tavy* at Astander Shipyard**

Alongside this, the replacement of propellers combined with pre-swirl devices is another core retrofit within the programme, maximising thrust while minimising energy loss.

Other retrofit solutions, such as auxiliary engine waste heat recovery systems, allow steam production from auxiliary engine heat, reducing the reliance on fuel oil-fired boilers. Similarly, the installation of shaft generator systems cuts down auxiliary engine usage, contributing to significant fuel savings.

Cargo carrying capacity is also being enhanced by the Maersk-led programme through a range of structural and technical improvements. These include: elevating the wheelhouse to improve line of sight and increase cargo intake; raising the lashing bridges; strengthening the vessel's deadweight capacity for deeper draughts; and upgrading both lashing systems and loading computer functionalities.

Another leading container shipping company that is accelerating environmental retrofits across its fleet is Seaspan, which has achieved positive results from its Seaspan Action on Vessel Energy Reduction (SAVER) programme launched in 2013. Through this programme, the company has implemented a series of vessel retrofits and upgrades, working closely with customers to enhance vessel performance and reduce environmental impact. According to a company statement: "Retrofitting and upgrades are effective ways to extend vessel life while also delivering emissions abatement and fuel flexibility to customers."

Seaspan has to date completed 552 individual upgrades, with another 85 projects either planned or underway. These initiatives encompass a wide range

of improvements, including upgrades to electrical, thermodynamic and hydrodynamic efficiency, as well as comprehensive retrofits. In total, 86 vessels have been upgraded, while an additional 10 others are currently being modified or scheduled for upcoming enhancements, including a series of methanol main engine conversion retrofits scheduled for completion in mid-2026.

Seaspan reports that the total investment in these retrofit projects has now exceeded US\$226.5 million, covering both those that have already been completed and the initiatives in progress or planned.

Seaspan's SAVER upgrade programme can be separated into three main categories. One is a series of fuel-saving and efficiency enhancements, including the renewal of propeller and cap fins, bulbous bow modifications, main engine derating and energy recovery systems. In addition, Seaspan has taken steps to optimise cargo capacity on its vessels. This has included the elevation and extension of lashing bridges, increases to container stack weights and enhancements to lashing patterns. Seaspan has thirdly focused on green fuel and emission reduction initiatives which have covered retrofits to enable conversion to dual fuel operations, the installation of exhaust gas scrubbers and shore/ alternative marine power (AMP) upgrades.

### **Wind-power retrofits**

One of the fastest growing elements within the environmental retrofit sector is the installation of Wind Assisted Propulsion (WAP) technology, with a number of projects completed, and contracts signed over the course of 2025. In one of the most

recent projects, bound4blue and Amasus Shipping have completed the installation of a 22m eSAIL on the general cargo vessel *Fluvius Tavy* at Astander Shipyard in Santander, Spain. This latest adoption of bound4blue's autonomous suction sails follows a previous installation on board Amasus' *Eems Traveller*, where two 17m eSAILS were installed. The latest installation is particularly noteworthy as it is believed to be the largest suction sail ever fitted to a general cargo vessel.

The retrofit was completed in a single visit to Astander, with all of the preparatory and installation work carried out within the vessel's scheduled maintenance period. Structural and electrical adaptations were made to the deck to accommodate the sail's foundations, after which the fully pre-commissioned unit, manufactured in Spain by Haizea-Tecnoaranda, was lifted into place in a streamlined, plug-and-play process.

Anemoi Marine Technologies, the UK-based designer of rotor sails, has completed a major retrofit on one of the largest vessels in the world, installing five 35m tall units on the 400,000dwt ore carrier *NSU Tubarao*. The vessel, owned by bulk owner/operator NS United Kaiun Kaisha (NSU) and chartered by mining giant Vale International, is expected to reduce fuel consumption by 6-12% annually using the wind-assisted propulsion system. This marks the fourth installation of Anemoi rotor sails on large ore carriers chartered by Vale.

The rotor sail installation on the five-year-old vessel, currently operating under a long-term charter to transport iron ore for Vale, was completed during a scheduled drydocking in October 2025 in Zhoushan Xinya Shipyard China. NSU has opted to combine rotor sails with digital solutions that optimise power usage and vessel routing, enhancing fuel efficiency as well as maximising the use of wind energy.

During the scheduled special survey, *NSU Tubarao* was also equipped with a new shaft generator designed to enhance the efficiency of the vessel, not only by improving the ship's own energy performance but also by optimising fuel consumption when operating Anemoi's rotor sails. Anemoi has integrated its rotor sail technology with the vessel's shaft generator through control system enhancements, ensuring improved coordination between wind propulsion and onboard power supply.

While the shipping industry's uptake of WAPS is increasing, the lack of verifiable data on energy savings is nonetheless holding back investment decisions in this sector, according to GCMC. To address this issue, GCMC and Eastern Pacific Shipping (EPS) recently implemented a WAPS performance monitoring method to measure the performance of retrofitted suction sails on the EPS vessel, *Pacific Sentinel*. This program included

high-frequency data collection; an on-off testing and data screening protocol to identify stable transitions; and statistical analysis to isolate and quantify energy savings from the sails.

Over four months of testing, GCMC says it observed a range of power savings across different wind conditions with mean instantaneous power savings of 7.2% and peak savings of up to 28.1%. According to GCMC: "Rather than relying on a single aggregated value, this analysis captures the full distribution of observed power savings linked to wind conditions. This provides a more realistic and confidence-based understanding of suction sail performance on *Pacific Sentinel*."

This pilot is said to have demonstrated how much, and under what conditions, WAPS deliver savings. As it runs more pilots, GCMC believes larger datasets will enable modelling and fuel savings predictions across diverse operating conditions, helping to provide greater confidence in investing in wind-power retrofits.

### Propulsion systems

A key element of environmental retrofitting work remains upgrading propulsion technology onboard. As an example, confirmation that a propulsion system retrofit is achieving fuel savings of 10% has persuaded Norwegian shipowner Arriva to go ahead with a second project with Berg Propulsion.

In January 2025 Arriva upgraded the general cargo vessel *Norjarl* to include Berg's MPC800 control system and Dynamic Drive. Monitoring over several months to track *Norjarl's* performance in the North Sea and Baltic Sea has confirmed overall fuel savings of above 10% according to Arriva. The results have led the owner to contract a second Berg retrofit involving the 4,183gt general cargo carrier *Norbris*.

Installed with a MAN 6L32/40 engine, *Norjarl* previously featured propulsion control from another supplier. In the case of *Norbris*, built in 2002, the MPC800 control unit and Dynamic Drive will supersede existing Berg Propulsion ERC2000 technology to work with the ship's MaK 6M32C engine.

Magnus Thorén, energy and efficiency sales manager, Berg Propulsion, says: "The *Norjarl* retrofit involved close collaboration through installation and performance evaluation, so it is especially pleasing that the owner is confirming that the thinking behind the first project has been borne out by experience to drive a second."

### Classification societies

The role of classification societies continues to be crucial in providing confidence and guidance for environmental retrofitting. Underlining this reality, ABS has recently published a new report, *Retrofits for Energy and Emissions Improvements*, which provides valuable insights into the impact of

## FEATURE REPAIR AND RETROFITS

retrofitting, including classification and statutory requirements, as well as best practices for implementation. With an array of retrofit options available, each offering potential improvements dependent on a range of factors, the report aims to provide comprehensive analysis and scenarios to guide shipowners in their decision-making.

“The maritime sector is navigating an increasingly complex web of not just regulations but also solutions aiming to support compliance and drive new efficiencies. Shipowners must view their vessels as interconnected systems and consider how various retrofitting options can impact operations and each other. ABS is well placed to support these decisions with industry-leading insight, standards and guidance,” said Vassilios Kroustallis, ABS executive vice president, business development and chief commercial officer.

The report concludes that, when considering retrofits, shipowners must never compromise on safety; need to understand the applicability of current regulations and those coming into force and assess the present performance of shipboard systems; and identify energy savings from specific improvements based on a vessel’s operational

characteristics. Additionally, shipowners should predict the savings of additional energy saving technologies for anticipated operating conditions through modelling and simulation and evaluate the savings based on in-service measurements through vessel performance modelling and analysis; and optimise the energy demand by deploying mathematical techniques ranging from CFD, such as bulbous bow optimisation studies, to non-heuristic optimisation algorithms like voyage optimisation studies.

Furthermore, ABS notes the field of vessel performance relies on both advanced technological systems and a skilled workforce to support effective implementation, with the latter consideration often being relegated to a lesser priority. Consequently the report concludes: “The need for continual training and staying updated on the latest techniques and methodologies for this emerging workforce cannot be overstated. Successful retrofits require a holistic approach that integrates advanced tools, skilled professionals and a commitment to safety and regulatory compliance.” This is a message the industry clearly has to take heed of, along with the focus on EET installations. ■

**Berg Propulsion has secured a second Arriva retrofit project on *Norbris* (pictured) after a more than 10% fuel saving was confirmed for an earlier upgrade of *Norjarl***



# LR AND CARNIVAL UNDERTAKE FIRST LNG-POWERED CRUISE SHIP DRYDOCKING SCHEDULES

Experiences gained during these initial projects will guide the way forward for maintenance work on other dual fuel ships, writes **Clive Woodbridge**

As part of the shipping industry's drive to achieve reduced carbon emissions, a number of vessels have entered service with engines designed to utilise LNG as a dual fuel option. This has included several large cruise ships and other passenger vessels. A number of these vessels are now entering their first drydocking maintenance schedules, which is inevitably a challenge as the shipboard systems are significantly more complex than those found on conventionally fuelled vessels.

Recently LR, Carnival UK and Carnival Cruise Line have successfully completed Europe's first major LNG drydockings of large LNG-fuelled passenger vessels including Carnival UK (CUK)'s *Iona* and Carnival Cruise Line (CCL)'s *Mardi Gras*. LR's Cruise Ship Centre of Expertise (CCoE) orchestrated the technical alignment, planning disciplines and global survey coordination required for such complex projects.

Drydocking a LNG-fuelled cruise ship is a fundamentally different exercise from a conventional refit, LR points out. With vessels spending only a brief period out of service, LNG system maintenance windows are correspondingly narrow, requiring "unprecedented" levels of forward planning.

Spare part procurement alone demanded long-range forecasting, with lead times of up to 12 months for items such as LNG pumps. OEM specialist availability had to be locked in early, and survey sequences aligned around delivery schedules and the operational constraints of the vessels themselves. This collaborative planning effort included shipboard visits, risk assessments, technical workshops and a number of joint sessions with Carnival's technical teams in Miami, Southampton, Marseille and at the Carnival training centre.

## Full redundancy

Both *Iona* and *Mardi Gras* feature three fuel tanks and dual fuel trains designed for full redundancy, supported by sophisticated control logic and an extensive cryogenic piping network. "Managing the inspection, testing and recommissioning of these systems within the confines of a passenger ship's operational profile required not only expert knowledge but tight integration between the shipboard team, the technical office and the attending class surveyors," says Remco van Ee, senior surveyor, LR.

One of the biggest operational challenges emerging from these projects is that many inspections cannot wait for drydock. LNG tank inspections and elements



The LNG dual fuel cruise ship *Iona* during its first drydocking

of fuel system testing had to take place while the vessels were in service and carrying passengers. These in-operation inspections required careful orchestration between ship staff, Carnival engineering teams and LR surveyors to avoid disruption, while maintaining the highest safety standards. Isolation arrangements, venting plans and access procedures were codified in detail, to make sure every step had been risk-assessed and validated by all parties.

On *Mardi Gras*, inspections took place during a transatlantic sailing, in drydock, and during the subsequent voyage from Barcelona. For *Iona*, the sequence spanned a voyage from Southampton, a Rotterdam drydock, and a final commissioning voyage that completed the renewal survey cycle.

For Carnival Cruise Line, these renewal surveys represented an opportunity to refine LNG maintenance strategies across its LNG-fuelled fleet. "These first-generation LNG cruise ships have highly complex systems and requirements," says Andrew Bennett, machinery survey policy manager in LR's Technical Directorate.

As operators expand their LNG-powered fleets and begin adopting methanol, biofuels and future synthetic fuels, LR believes the procedural groundwork established through the two projects will serve as the foundation for a broader shift in how the industry approaches alternative-fuel ship maintenance. Inspections during passenger service, multi-location survey planning, long-lead spares preparation and early-stage risk modelling are all likely to become the norm, the classification society suggests. ■

# OLD TIPS FOR NEW SHIPS

**Maurice Napier** FRINA offers a selection of classic vessel design tips, neglect of which could create problems for modern newbuilds

Modern ships are much more efficient than old ones, but details remain critical in determining whether a design is good. New regulations or requirements can prevent adopting desirable aspects, and many designers deserve fulsome praise for excellence – but conversely, voyaging recently aboard a ferry built by a well-known yard showed that window heights prevented dozens of seated passengers of average height from seeing the horizon.

This was just annoying, but other issues were potentially dangerous: a paucity of handrails; an athwartships main passenger stairway, and a handrail on only one side of it; a gap in that rail, near the top of the stairs; a lavatory with six wide WC cubicles lying athwartships (without handrails); and a passengers' external doorway above a step in the deck. These risk travellers' safety – and claims for injuries. Many naval architects know to avoid these, and much is dictated by common sense, but how common is common sense? Such examples bring to mind details addressed in past teachings or training, for example:

- Since rolling is more pronounced than pitching, items to lie fore-and-aft include: (1) WC and shower cubicles, to let occupants brace themselves against the sides; (2) baths, to minimise spillage; (3) berths, to minimise rolling effects (but inboard lest collisions cause injury); and (4) stairs, to minimise vertical movement of steps when rolling, risking stumbles when the next step is not where expected.

- Items to lie athwartships include: (1) cookers, sinks and washbasins, to make spillage when rolling less likely to affect users; (2) drawers; (3) fishing vessel freezers, to let crews brace themselves by spreading their feet instead of spending time holding something; and (4) rungs of vertical or nearly vertical ladders (especially emergency escapes), because climbing an overhanging ladder on a listing ship is difficult.

Adhere to practical measurements. Often, metric dimensions are unrealistically shown with many decimal places due to converting from feet. One vessel operator's website gives her length as 81.0188878768513m! Another ship's length was stated to a billionth of a millimetre – but was inaccurate by about 50m! Dimensions and weights in stability data may need three decimal places to satisfy regulatory requirements, but often cannot be determined to that accuracy even in flat calm water.

## Aim for accuracy

At inclining experiments, measuring heels after transferring some of the weights means that any error is cancelled on moving the rest (eg, a +5mm inaccuracy after moving half causes an error of -5mm on shifting the other half, giving exactly the same average). Doing that once is sensible, but repeated partial movements are usually pointless. Moving all weights twice to each side ensures greater accuracy.

Equating the longitudinal centre of gravity (LCG) position to the longitudinal centre of buoyancy (LCB) remains common, but applies at zero trim only. Any trim necessitates a correction because the LCG is vertically above the LCB relative to the trimmed waterline.

Accurately allow for deck covering thicknesses when deciding top or bottom stair riser heights, and ensure uniformity of tread depths (top steps shallower than the others should be taboo) to minimise fall risks (oldies were also taught to arrange an even number of steps at ferry stairs, since people taking two at a time find an odd number annoying, but health and safety now frowns on that.)



**Picture 1: An odd seaboot rack; these racks should preferably accommodate even numbers of boots (image: Maurice Napier)**



**Picture 2: Bulbous bows seldom increase speed on small craft (image: Maurice Napier)**

Increased breadth is regarded as detrimental to speed, which is correct if nothing else changes – but it can beneficially permit lower block coefficients. Water can be pushed in front without affecting speed seriously, but dragging it behind slows ships. For shallow water, avoid buttock flow lines, since little clearance under the hull reduces water flowing to the propeller(s).

### Interior considerations

Seaboot racks should preferably accommodate even numbers of boots (see Picture 1). Headrests on rows of ferry seats should be narrower than the backs, otherwise they block views for passengers behind and can be claustrophobic.

Unless usually trimming by the bow, heads of berths should be forward to avoid blood flowing to occupants' heads, and because superstitious seafarers regard the only time to be carried feet-first as their final journey. Make treads of ladders to upper berths deep and horizontal (not perpendicular to any slope) for comfort when being climbed barefoot.

WC cubicles wider than about 900mm should have handrails on each side. Shower cubicles of any width need rails. Fit shower controls on one side, accessible from outside the shower since any at the back necessitate reaching through hot or cold water to adjust temperature. Use heavy shower curtains since convection currents may uncomfortably wrap lightweight curtains round users. Ventilators should not be over cubicles, subjecting users to unwelcome drafts. Especially on passenger ships, WC cubicles should have coathooks but these are often absent (as in many public lavatories ashore.)

Mark ships' centrelines on the central wheelhouse window frame to help helmsmen judge position and turning rate. Minimise alleyway lengths, which waste space and increase maintenance.

Access anchor cable cotter pins outside chain lockers. Collisions can make anchors drop to the seabed, preventing movement, whereupon ability to release chains from outside the lockers saves time.

Dogs securing hatches, doors, etc need split pins or hammered ends to prevent falling off. In cold or temperate climates, arrange clearance behind handles for people with cold hands and thick gloves. Two strong hinges suffice – with three, two do the work and the third twists the cover unless all are perfectly aligned. Do not attach padlock hasps using screws that thieves can remove.

### Hull tips

Bulbous bows can reduce speed. Trial results usually match model tests, but both are normally in calm conditions and water flow in waves can negate predictions. They may significantly improve poor hulls, whereas good ones have less scope for improvement. On small craft, they seldom increase speed since riding over waves varies water flow. Bulbs should be underwater (see Picture 2).

Before bulbous, vertical or backward-raked bows became fashionable, an official notice stipulated forward-raked stems so that most collision impact occurs above the waterline, minimising underwater damage. Suing designers, builders or owners because the bow of a colliding ship extended forward of the stemhead seems unlikely, but it does make collisions more serious.



**Picture 3: Visibility from the wheelhouse needs extra care (image: Maurice Napier)**

Measure draught marks from the underside of keel or its projection (not from the underside of the rudder solepiece if it slopes). Draughts in stability data for raked keel vessels should match marks for easy usage, since figures from the baseline necessitate potentially inaccurate corrections by people whose expertise is in other spheres (some inclining reports for raked keel vessels wrongly regard marks as measured from the baseline, creating errors).

Since trim is the difference between forward and aft draughts, hydrostatics, etc should state trim related to the same datum as draught marks, or, on raked keel vessels, state that plus relative to the baseline. Trims relative to the baseline only risk misinterpretation/mistakes and make vessels with identical draughts but differing rakes appear to have different trims, incurring risky complications.

If overboard discharges or suctions have intermediate piping between valves and shell, its fracture prevents resistance to water entering the ship. Rounded deckhouse and furniture corners minimise injuries from bumping into them.

**Glass and glare**

To reduce glare/reflections, wheelhouse front windows should slope well forward after allowing for any trim. Windows on ships carrying deck cargoes should preferably not face the cargo.

Wheelhouse aft end windows should be deep enough for good aft views of the horizon, or better from its forward end. Lounge windows should give good views for standing and sitting occupants. Walkways in front of/beside observation lounges necessitate raising the internal deck if significant numbers of people may stand outside, obstructing views. Raise toprails outside lounges or on cruise ship balconies if they impede seated passengers' views. Visibility from the wheelhouse needs extra care if cargo-handling gear varies (see Picture 3).

Navigation light positions (eg, the heights of all-round lights above others) do not always meet regulations, risking accidents. Transposing masthead and stern lamps produces erroneous arcs, but this happens.

To avoid taking one's hand off handrails, they must have as few gaps as possible, especially at stairs, and should have 'L'-shaped supports (not horizontal ones) to permit holding the rail continuously.

**Picture 4: Venetian gondolas have asymmetrical hulls, to avoid turning in circles when propelled at one side (image: Maurice Napier)**



Jogging levers at conning positions on an aft wheelhouse bulkhead risk accidents because people are unsure which way to move the lever. It is normal to fit them fore-and-aft at one side, but this is not universal.

Mooring pipe heights/arrangements should let crew reach ropes lying on the bottom by reaching easily over rails or bulwarks since people may need to lean overboard dangerously if pipes are just above the deck.

### Estimating weights

Venetian gondolas (see Picture 4) have asymmetrical hulls (to avoid turning in circles when propelled at one side), but studying conventional wooden boats also showed some surprisingly big differences between port and starboard sides (up to 200mm in the bilge area).

If proposing ballast on keels to rectify deficient stability, never consider its beneficial weight without allowing also for its buoyancy, which (although small) creates a detrimental capsizing moment. Adding ballast there can worsen stability at dangerous

angles. Ballast on a wooden or fibreglass keel should be under it, or 'U'-shaped, secured by vertical bolts integrated into structures, since horizontal bolts through the keel risk leaks or the keel breaking off.

Crew accommodation at the fore end is becoming common for efficiency, but a freefall lifeboat on the stern then forces crew to try escaping by walking aft on a ship that is perhaps on fire or sinking with low freeboard and bad weather sweeping waves onto the deck. Sometimes an underdeck passage connects the accommodation and engine room, but using a confined space below deck is not sensible aboard a sinking ship.

The most important part of design is estimating weights plus centres of gravity, and mistakes/omissions often necessitate remedial action. On checking and querying one high-tech consultant's design, whose estimated lightweight was about half the likely figure, they apologised to us, saying they had lifted it wrongly from the hydrostatics. I, however, was not taught how to derive a lightweight from hydrostatics, which would have saved considerable time! ■

## 166 YEARS OF RINA

January 1860 saw the foundation of the Institution, which continues to champion the art and science of naval architecture today

It's unlikely that the founding members of the Royal Institution of Naval Architects (RINA), established on 16 January 1860, could have imagined a maritime world featuring solar-powered ferries, uncrewed minesweepers, AI-enhanced situational awareness and tugboats with bollard pulls exceeding 80tonnes. Yet without the dedication and vision of those 19th-century pioneers, today's shipping industry would almost certainly be far less technically advanced than it is.

The parallels between RINA today and its founding 166 years ago are striking: the Institution remains a learned society dedicated to advancing the art and science of naval architecture, encompassing everything from small pleasure craft to massive tankers, bulk carriers and heavy-lift vessels. In 1860, the Institution's inaugural statement called on "shipbuilders, ship repairers, marine engineers, shipowners, seagoing officers, yachtsmen and others in kindred professions" to unite and collaborate on pioneering work in safety, ship stability, engine efficiency and overall performance - a mission RINA continues to pursue today.

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**RINA remains dedicated to advancing the art and science of naval architecture**

together naval architects, maritime engineers and associated professionals across more than 140 countries, RINA is committed to carrying the torch forward in tackling key challenges such as decarbonisation, autonomous operations, cybersecurity and the adoption of alternative fuels. RINA extends its sincere thanks to all members, past and present, for their invaluable contributions and dedication, and we look forward with excitement to the innovative vessel designs of tomorrow. ■



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22-24 APRIL, 2026  
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12-16 JULY, 2026  
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