THE
NAVAL ARCHITECT
OCTOBER 2025

Britain's warship export boom

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NUCLEAR SHIPS: WHO PAYS?

Attracting investors to nuclear ship projects may prove half the battle

ELECTRIC NEW YORK:

Harbor Charger brings dual-fuel passenger ferry crossings to Manhattan

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Managing Editor: Martin Conway
Contributing Editors
David Foxwell
Clive Woodbridge
Production Manager: Nicola Stuart
Website & Subscriptions Executive: Henry Owen
Publisher: Neil Hancock

Advertisement Manager: Aftab Perwaiz
Email advertising: advertising@rina.org.uk
Telephone: +44 (0)20 7235 4622

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

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Panel discussions at this year's London International Shipping Week refreshingly ditched the 'greenwashing' for open, holistic debate

AN HONEST LOOK AT ALTERNATIVE FUEL OPTIONS

Green propulsion was very much on the agenda at the many panel discussions and presentations that made up this year's London International Shipping Week (LISW 25) in September. The two emerging big clean-fuel technologies – wind-assisted propulsion and nuclear reactors – were well-represented, which shows how far they have come in the space of a few years: from arguably 'fringe' options to preferred solutions among certain sections of the maritime community.

The debate hosted by IRClass on nuclear financing, for example (see pages 16-19), under the banner *Is Nuclear the Missing Piece in Maritime Decarbonisation?*, made it clear that scaling small modular reactor (SMR) technology for commercial maritime applications, and then appeasing the regulators and insurers, is only the start of the battle: the next step will be to get investors on board, and this won't be easy. As Gihan Ismail, director of shipping fund/asset manager and vessel operator Marine Capital, put it: "We all know that the cost [of establishing a nuclear vessel] is huge, so government can't fund it alone – but there are just certain risks the private sector will not take, or will be very unwilling to take." Overturning long-held public suspicion about nuclear energy, and thereby winning the trust of inherently conservative banks and private investors, will be critical milestones for the commercial adoption of SMRs.

Meanwhile, an interactive panel, hosted at Inmarsat HQ and moderated by InterManager VP Raal Harris, asked: "Can maritime decarbonisation be accelerated using the tools we already have?" Three green tech 'evangelists' each stated their case, arguing from the viewpoints of 'hardware' (John Cooper, CEO of WAPS developer BAR Technologies), 'operational change' (Øistein Jensen, chief sustainability officer at Odfjell) and 'business' (Haris Zografakis, partner, Stephenson Harwood). This *Strictly*-themed event saw a panel of stakeholder judges, ranging from representatives of the World Maritime Forum to active seafarers, grill the evangelists to work out which element constituted "the most powerful lever" to decarbonise the existing fleet – and with attendees voting for their preferred pathway.

Interestingly, 'operational change' was deemed the best lever, followed closely by 'hardware' and a good deal ahead of 'business' – a slight reversal on the opinions shared during the IRClass nuclear debate. However, several end user points were raised with regards to WAPS technology, with Joe Furness, chief officer at LNG Ships, expressing that these deck-mounted sails can sometimes be cumbersome and wearisome for crew to manage, and, in some cases, can restrict visibility.

Such feedback is essential if the maritime sector is to continue to develop green propulsion solutions that are practical, cause minimum disruption to daily operations and provide returns. In fact, one refreshing observation was a distinct lack of 'greenwashing' at the majority of this year's discussions – a real relief, having attended a few conferences in the past where presenters made exaggerated claims and skimmed over the drawbacks of applying certain green solutions to particular vessel types and routes. Such honesty can only aid our industry's attempts to hit its decarb goals. ■

Martin Conway,
Managing Editor

ELECTRIC BOATS

ARKSEN AND RAD TO LAUNCH "REVOLUTIONARY" CRAFT CLASS

Boatbuilder/designer Arksen and electric/autonomous propulsion specialist RAD Propulsion have partnered up to jointly develop a "revolutionary class of clean, intelligent and highly proficient marine craft", the companies state.

The partnership has set itself three key development goals. The first is to realise a rugged inflatable boat featuring RAD Propulsion's Power console – described as a "fully integrated, cable-free helm system tailored for eco-tourism and cruise operators and defence applications". The second goal is to develop a next-gen RIB, optimised for RAD Propulsion's latest electric drive systems. Thirdly, the partners aim to produce customised and mission-specific autonomous patrol boats and tactical craft, as well as pontoons for the US market.

The joint development partnership will combine Arksen's vessel architecture and RAD Propulsion's electric drive systems

The intention is to maintain "at least three active development projects at all times, enabling rapid response to market opportunities while keeping capital outlay low", and to produce boats that can handle tasks ranging "from ocean tourism to tactical operations", says Arksen founder Jasper Smith.

In August, RAD Propulsion announced that it had partnered with Pangolin Photo Safaris, operator of the luxury trimaran 'houseboat' *Pangolin Voyager*. With the capacity to carry 10 guests on wildlife photography tours along Botswana's Chobe River, the boat incorporates four RAD40 electric drives, rated 40kW apiece, along with two 61kWh batteries and a spread of solar panels, enabling a speed of about 2.5knots. ■

JACK-UP UNITS

BILL OF CYBER HEALTH FOR JANA MARINE TRIO

Jana Marine Services has secured class society ABS' Cyber Resilience-Ex (CR-Ex) notation for three of its self-elevating jack-ups, *JANA 505*, *JANA 508* and *JANA 509*.

The CR-Ex notation is part of the updated ABS Guide for Cybersecurity Implementation for the Marine and Offshore Industries, CyberSafety Volume 2, which outlines a set of requirements for operational technology (OT) control systems and related IT systems aboard commercial vessels and offshore assets. The notation incorporates elements of the International Association of Classification Societies' (IACS') UR E26 requirements for the cyber resilience of ships, which apply to new vessels contracted for construction on and after 1 July 2024.

ABS notes that the CR-Ex-compliant offshore units also align with Saudi Arabia's Vision 2030 plan, which aims to revitalise the kingdom's economic and tech sectors. Mohamed Alsubaie, Jana Marine Services CEO, says that securing the ABS notation "builds on the SMART notation we attained in 2024, further demonstrating our dedication to technical leadership, cyber risk mitigation and future-ready asset integrity".

The three jack-ups were built by CSSC Wuhan Marine Machinery Plant (WMMP), China and delivered to Jana Marine Services earlier this year. Each features four 95m-long legs, a total deck area of 1,400m^2 and accommodation for up to 150 personnel. ■

Three Jana Marine Services jack-ups now hold ABS' CR-Ex notation for cyber resilience

UNCREWED VESSELS

MARINE AI LOOKS TO GIVE UNCREWED VESSELS A VOICE

UK-based autonomy software developer Marine AI has launched a project to grant uncrewed vessels the ability to "communicate naturally" with other ships, in the manner of a human operator. The project has received the backing of the Defence and Security Accelerator (DASA), a branch of the UK Ministry of Defence (MoD) created to fund the development of innovate tech solutions for the British Armed Forces.

Marine AI will now trial a large language model (LLM), designed for ship-to-ship dialogue, using a ZeroUSV Oceanus12 USV in Plymouth and Portsmouth waters. The USV will communicate with the Royal Navy's testbed *Patrick Blackett* and recently launched extra-large underwater uncrewed vehicle (XLUUV) *Excalibur* (see *The Naval Architect* June 2025). LLMs are types of AI model designed to both understand and generate human language, which could make mixed-traffic operations at sea more viable.

Oliver Thompson, technical director at Marine AI, comments: "Uncrewed platforms can only operate safely alongside conventional vessels if they can be understood. This project is about proving that an autonomous system can use natural language in a way that makes sense to mariners in real-world conditions." ■

Marine AI will deploy an Oceanus12 USV in its large language model testing programme

WORKBOATS

USCG SMALL CUTTERS PRIMED FOR RESTRICTED WATERS

The US Coast Guard (USCG) has ordered 66 cutter boats from Oregon-based shipbuilder North River Boats, in a contract valued at US$11.8 million. The boats will support the USCG's aids to navigation (AtoN) missions, entering restricted and hard-to-reach waterways to access buoys, lighthouses and other navigational aids.

The boats will operate under the Cutter Boats – Aids to Navigation – Small (CB-ATON-S) class designation. They will support the USCG's larger Waterways Commerce Cutter (WCC)-class vessels, which include river buoy tenders (WLRs), inland construction tenders (WLICs) and inland buoy tenders (WLIs).

The CB-ATON-S newbuilds will comprise aluminium monohulls, and each will measure 6.4m in length, allowing personnel to move them to various sites via trailer. The boats will be fully fendered, to protect them from scrapes in shallow waters, especially when towing buoys. Reports state that each boat will feature 4.65m^2 of open deck space and will have a hoisting capacity of 1.36tonnes.

Power will be provided by twin four-stroke outboards, enabling speeds of up to 25knots. Each CB-ATON-S boat will also be equipped with the USCG's Scalable Integrated Navigation System-2 (SINS-2), AIS-2 and VHF radio. ■

The cutters will support the US Coast Guard's WCC-class vessels (pictured) in AtoN-related operations

FERRIES

BIOFUEL FIRST FOR HULL-ROTTERDAM RUNS

P&O Ferries has announced that its passenger cargo and ro-ro ferry *Pride of Hull* has become the first vessel in its fleet to run entirely on biofuel B30, a blend of 30% biodiesel and 70% conventional diesel. As a result of the fuel swap, the 215m x 32m vessel, which services a route linking Hull, UK and Rotterdam, will cut lifecycle greenhouse gas emissions by approximately 20% compared with traditional marine fuel-powered ferries – and without impacting on service reliability.

A spokesperson for P&O Ferries comments: "Following consultation with engine manufacturer Wärtsilä and leading fuel suppliers, biofuel B30 was selected as the most practical transitional fuel – reducing emissions without the need for costly vessel conversions." The spokesperson adds that alt-fuels such as methanol and ammonia were rejected because they would have required expensive and significant engine modifications or replacements.

Completed by Italian shipbuilder Fincantieri and put into service in 2001, *Pride of Hull* features 12 decks and the capacity to carry up to 1,360 passengers and 400 freight vehicles.

Stewart Hayes, P&O Ferries fleet director, comments: "This transition shows that meaningful emissions reductions are possible today – even on one of the largest ferries in Europe." Hayes adds that the move is part of a wider scheme by DP World (which acquired P&O Ferries in 2019) "to cut emissions by 42% by 2030". ■

The 215m *Pride of Hull* has become the first P&O Ferries vessel to run entirely on biofuel

SUPERYACHTS AND MEGAYACHTS

BENETTI PREVIEWS NEW OASIS FLAGSHIP

The Cannes Yachting Festival in September saw Italian yard Benetti unveil its new Oasis 42M superyacht concept, scheduled for launch and delivery to an anonymous client in 2027. Described as the flagship of Benetti's Oasis range, the vessel features an aft deck spanning 100m^2, a 17.3m-long sundeck and an 8.3m^2 pool, the latter claimed as being "among the largest in this size category", Benetti reports.

With a hull and superstructure fashioned entirely from GRP, the Oasis 42M measures 42.5m x 8.5m, has a draught of 2.05m and is capable of a maximum range of 4,000nm at 10knots. An onboard garage accommodates a 6.25m tender, a jet ski and other water toys, while the upper deck houses a 50m^2 owner's apartment, complete with panoramic window views and a private 40m^2 terrace.

The exterior, featuring soft curves and flowing profiles, was managed by UK yacht design house RWD, while the New York firm bonetti/kozerski architecture looked after the interiors, designed with "fluid layouts" in mind, Benetti says. Regarding propulsion, Benetti comments: "The Oasis 42M integrates a data-driven engineering package that reduces fuel consumption and emissions, while a hybrid Siemens E-Mode option offers advanced sustainable cruising without compromising performance." ■

The Oasis 42M features an aft deck spanning 100m^2

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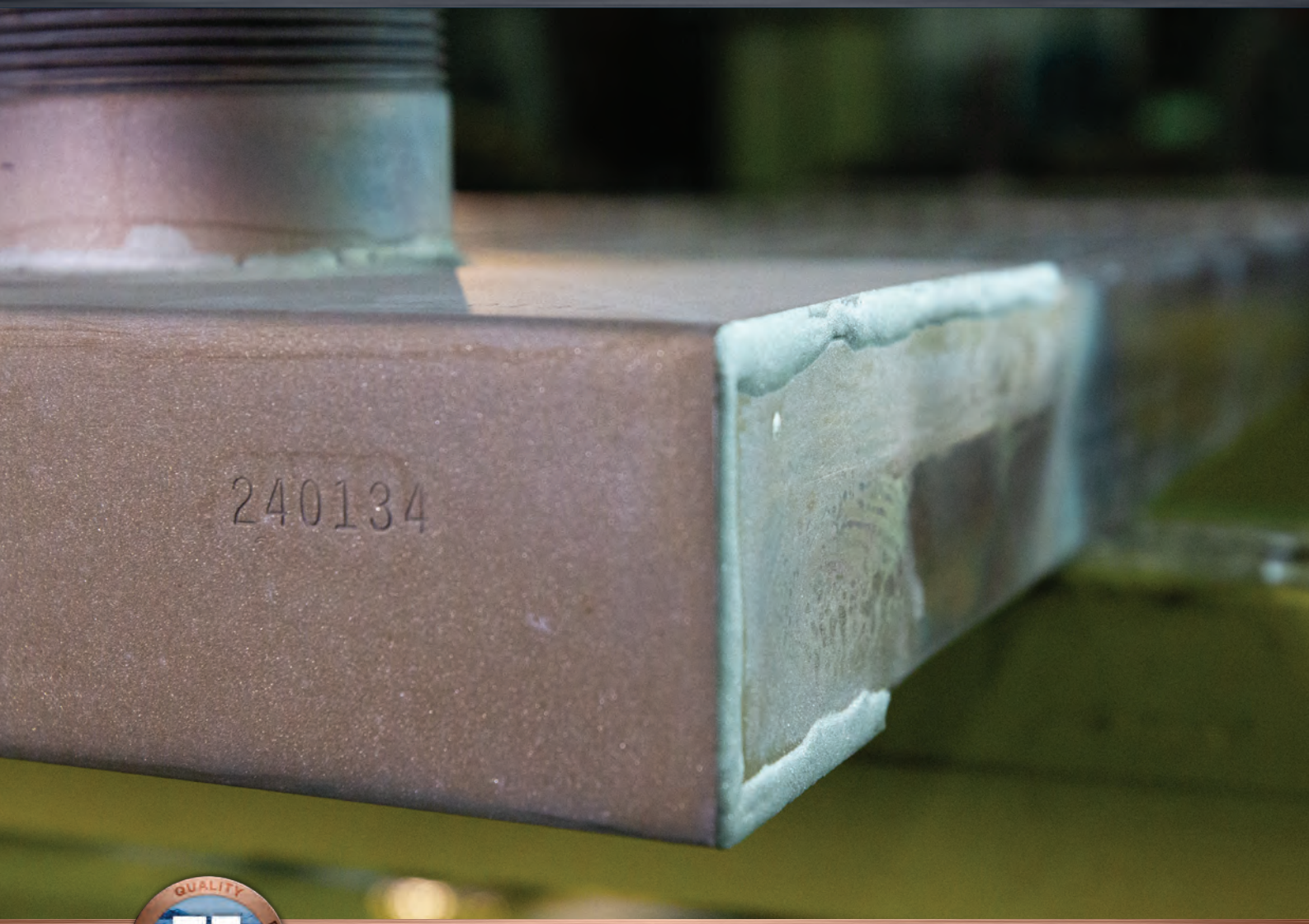

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PROPULSION SOLUTIONS

POD 4900 DEBUTS AT CANNES

Tech specialist ZF has unveiled its new POD 4900 pod propulsion system, aimed at commercial and recreational vessels of between 24-45m in length, and compatible with engines rated up to 2,000hp (1,491kW) at 2,450rpm, covering a typical speed range of 20-35knots.

Launched in September at the Cannes Yachting Festival, the POD 4900 was profiled aboard the debut yacht in Azimut's Grande 30M range (also making an appearance at Cannes), having been integrated into that vessel's onboard powertrain, fuelled by mtu engines from Rolls-Royce. ZF says that the POD 4900 can be installed in a twin, triple or quadruple layout, depending on vessel type and size; the Azimut Grande 30M, for example, features two units, delivering 1,920hp (1,432kW) apiece.

ZF states: "Its large gear reduction ratio allows for larger counter-rotating propellers. This helps to increase its efficiency – up to 20% in comparison to shaftline propulsion systems in the same power range. The improved efficiency also means reduced engine dimensions, resulting in more onboard spaces for accommodation." Like ZF's smaller POD 4600, launched at the 2022 Cannes Yachting Festival, the POD 4900 features a housing fashioned from nickel-aluminium-bronze and stainless steel, for corrosion resistance. "The POD 4900 is certified for up to 3,000 hours of operation a year," ZF adds. "In addition to large pleasure and leisure craft, the propulsion system is therefore rated for medium commercial applications, like wind farm or crew transfer vessels and ferries." ■

The POD 4900 pod propulsion system is compatible with engines rated up to 1,491kW

TRAINING SIMULATORS

BSM ADDS AMMONIA TO FUEL SIMULATOR SUITE

Bernhard Schulte Shipmanagement (BSM) is set to launch a new ammonia bunkering simulator at its maritime training centre in Kochi, India, to complement its existing LNG and methanol bunkering simulators at this location.

The methanol bunkering simulator was set up in July to address the increasingly important issue of crew safety training when handling unfamiliar alternative fuels. Utilising Wärtsilä's TechSim 5000 simulator, the methanol bunkering simulator, which has been certified by ClassNK for basic and advanced IGF Code training, offers features such as real-time monitoring of multiple tanks, 3D visualisation of bunkering stations, interactive controls and scenarios including bunkering, troubleshooting and emergency response – providing a "realistic, risk-free environment, preparing seafarers for the complexities of methanol bunkering operations with precision", says Captain Gurpreet Singh, BSM GM for training and development.

The ammonia bunkering simulation module will come online in early 2026, and additional methanol bunkering simulators will be installed at BSM's training centres in Poland and the Philippines. ■

BSM's methanol bunkering simulator at Kochi will be complemented by one dedicated to ammonia in early 2026

PROPELLERS AND THRUSTERS

PROJECT AIMS FOR D.E.E.P. KNOWLEDGE

The D.E.E.P. partners aim to create an AM-produced smart propeller that can monitor its own performance

A new initiative, dubbed the Digitally Enabled Efficient Propeller (D.E.E.P.) project, aims to combine additive manufacturing (AM) with digital twin technology to produce a series of 'smart propellers' that can monitor their own performance throughout their operational lifecycles. Funded by the sixth round of Innovate UK's Clean Maritime Demonstration Competition (CMDC6), and led by Enki Marine Ltd, the D.E.E.P. consortium includes Stone Marine Propulsion, TWI, DEEP Manufacturing, Authentise and ASTM International, with Newcastle University providing hydrodynamic modelling and validation.

The participants state: "The project will investigate the technology readiness of multiple AM processes; benchmark their performance against conventional casting methods; and establish a clear pathway towards classification approval and type certification. This approach will ensure that the project not only delivers technical innovation but also creates a credible framework for industrial adoption and regulatory compliance."

The D.E.E.P. project officially commenced in September 2025, following an announcement at London International Shipping Week, and the first phase will focus on evaluating AM processes. "Subsequent stages will validate the demonstrator on Newcastle University's research vessel, with the long-term aim of enabling type approval and scaling production for commercial adoption by the global fleet," the project partners add. ■

PAINTS AND COATINGS

APC COMPLETES TANKER RECOATING CONTRACT

Advanced Polymer Coatings (APC) reports that it has completed a tanker recoating contract for Madrid-based shipping line Marflet Marine. The job, carried out at IMC Shipyard in Zhousan, China, saw APC apply its MarineLINE protective tank coating to Marflet Marine's 49,999dwt, 2017-built MRII chemical/oil products tanker *Panagia Thalassini*. Previously, APC had completed a recoating contract for Marflet Marine's tanker *Santiago 1*, built in 2022.

APC employs a team of specialist heat curing engineers and inspectors at the IMC facility. The company said it opted for MarineLINE because of the coating's chemical resistance properties and its ability to carry heated and free fatty acid cargoes. The company says it tests its coatings at its R&D facility in Ohio, to ensure that they can provide protection against "thousands of highly aggressive chemicals".

Peter Stoyles, APC European sales manager, adds: "Switching easily between cargoes was very important here, together with faster cleaning times, which can free up sailing days, improving the earning ability of the vessel. Plus, faster cleaning time means fewer emissions." ■

The tanker *Panagia Thalassini* was recoated with APC's MarineLINE tank coating

RESEARCH AND SURVEY

THIRD AND FOURTH *REACH REMOTE* VESSELS ON ORDER

Norwegian operator Reach Subsea has ordered a further two USVs from Kongsberg Maritime for its uncrewed *REACH REMOTE* survey vessel fleet. The order follows the 2025 deliveries of the vessels *REACH REMOTE 1* (see *The Naval Architect* March 2025 and *Significant Ships of 2024*) and *REACH REMOTE 2*.

Jostein Alendal, Reach Subsea CEO (left) and Lisa Edvardsen Haugan, president of Kongsberg Maritime, at the Oslo contract signing for the new *REACH REMOTE* vessels

The vessels will be based on Kongsberg Maritime's purpose-built UT5208 design, featuring a length of 24m. As with their predecessors, the duo will be subcontracted to a shipyard (Kongsberg subcontracted shipbuilder Trosvik Maritime to fabricate *REACH REMOTE 1*). "This new way of working is particularly well-suited to projects with fleet-scale potential, offering greater efficiency, quality assurance and speed to market," Kongsberg Maritime states. Additionally, Kongsberg Maritime will supply the vessels' automation and navigation systems, manoeuvring and thruster control systems and equipment for ROV and hydrographic operations.

Reach Subsea CEO Jostein Alendal comments: "By combining our subsea expertise with the naval capabilities of Kongsberg Maritime and Massterly [the joint Kongsberg Maritime-Wilhelmsen venture, which manages the vessels from shore-based ROCs], we are delivering real-world solutions that are safer, smarter and more sustainable. With vessels 3 and 4 now confirmed, we are entering the scale-up phase." ■

ROVS AND USVS

EXAIL USV COMPLETES 'WORLD FIRST' SIX-DAY TRANSIT

Exail is claiming a 'world first' for its DriX O-16 USV, after the uncrewed vessel type completed an uninterrupted 1,100nm transit between La Ciotat in France and Troia in Portugal.

A DriX O-16 USV completed a 1,100nm journey between France and Portugal in six days (image: Gilles Martin Raget)

The USV was monitored from Exail's remote operation centre (ROC) in La Ciotat throughout its transit, as it sailed past the Balearic Islands and through the Strait of Gibraltar, simultaneously conducting seabed mapping operations with a Kongsberg EM304 multibeam echosounder. The journey was completed within six days. Upon arriving at Troia, the DriX O-16 took part in the NATO co-hosted Robotic Experimentation and Prototyping using Maritime Uncrewed Systems (REPMUS) 2025 exercise, which ran between 1-26 September.

Exail comments: "More than a symbolic crossing, it provides concrete proof that large USVs can be remotely supervised across open waters and constrained sea lanes, arriving fully mission-capable in theater without heavy logistical support." The DriX O-16 features a length of 15.75m, displaces 10.5tonnes and has a range of 3,500nm. The dual-fuel hybrid USV has a fuel capacity of 2,300litres and can travel at up to 16knots. ■

RESEARCH AND SURVEY

FIRST USV FROM SUBSEA EUROPE

Subsea Europe Services (SES) has launched its first in-house-developed uncrewed surface vessel (USV), the C-RECON 13-ES. Developed primarily for hydrographic surveys, environmental monitoring and offshore asset inspection, the 4m, pure-electric USV is intended to enable offshore companies to explore areas that are inaccessible to crewed surveyed vessels, or which pose a threat to crew safety.

The C-RECON 13-ES has a 200kg payload capacity, and can be launched from small vessels, marinas or "even directly off the beach", SES says. The USV has been developed as a modular unit, enabling users to add or remove ready-made hull sections to lengthen or shorten the hull, and to add components such as an additional battery pack and/or an unmanned aerial vehicle (UAV) hangar, SES suggests. The USV relies on battery-powered propulsion for zero-emission operations.

The vessel also comes with a few SES in-house tech solutions, namely: C-KONTROL, described as a 'plug and sail' solution, designed to simplify payload integration and onboard sensor management; C-Lock, a quick-mount deck system; C-Fit, an underwater payload interface; and the C-Caster profiling winch. ■

The all-electric C-RECON 13-ES has a 200kg payload capacity

RESEARCH AND SURVEY

NEW DUO FOR NORDIC USV

Norwegian start-up Nordic USV will receive a further two REAV-47 uncrewed surface vessels (USVs) from HydroSurv, with both units to be deployed in autonomous survey operations along Norway's coastline. The newcomers, named USV *Kuling* and USV *Storm*, will follow Nordic USV's first REAV-47 unit, USV *Bris*, which was handed over in May and is currently deployed at Mo i Rana in northern Norway.

USV *Kuling* (pictured) and USV *Storm* will join Nordic USV's coastal survey fleet

HydroSurv says: "USV *Bris* has been operated entirely remotely from Nordic USV's control centre in Bergen...USV *Bris* recently completed a 320km mission in 41 hours for Aqua Kompetanse AS, sailing between Ranfjorden and Velfjorden to map hydrographic conditions with no field personnel on site." HydroSurv adds that it has commenced on-water trials for USV *Kuling*, and, once complete, that USV will be transported to Bergen. At the time of writing, USV *Storm* was in its final production stages, with delivery set to follow shortly after.

The catamaran-hulled REAV-47 class measures 4.7m loa by 2.23m in breadth, and has a draught of 390mm in lightship mode. The USV type has a 72-hour hybrid-electric endurance capability and a fuel capacity of 76litres, and can achieve a speed of 6knots, aided by 5kW rim-drive outboards. All three USVs come with fully integrated payload systems for deepwater profiling, bathymetric mapping and remote operations. ■

NUCLEAR SHIPS: WHO PAYS THE PRICE?

The technology may be proven, and the regulatory framework may be coming together – but persuading investors to bankroll nuclear-powered commercial ships may prove the biggest hurdle of all. **Martin Conway** reports

As the IMO decarbonisation deadlines creep closer, nuclear energy continues to gain attention as a proven, low-carbon solution. The past few years have also seen regulators warm to nuclear power's potential, but a major challenge remains: persuading investors to fund nuclear-powered commercial ships, powered by small modular reactors (SMRs). Despite the reliability of the technology, securing the necessary investment requires overcoming doubts and building confidence in this transformative, eco-friendly option.

This was the main theme of the roundtable *Is Nuclear the Missing Piece in Maritime Decarbonisation?*, hosted by Indian classification society IRClass during London International Shipping Week in September. In Q4 2024, IRClass joined the Nuclear Energy Maritime Organisation (NEMO), the group pushing for integration of nuclear technology into maritime, which also counts the classification societies DNV, Lloyd's Register, Bureau Veritas, Korean Register and RINA as members. The roundtable provided a useful overview of some of the hurdles that nuclear ship advocates face when it comes to securing funding – but also some suggested courses of action.

Gihan Ismail, director of shipping fund/asset manager and vessel operator Marine Capital, told delegates: "I think that, from a technical perspective, I'm sure we will get there, and it will probably not take decades. But the commercial viability of that technology will take a lot longer. IMO has still to develop a comprehensive regulatory framework for nuclear ships, and this will take time. My understanding is that we're not talking about the entire fleet – nuclear ships are going to be a subsection of the fleet, because of vessel size and suitability."

Shipping + nuclear = ?

A big part of the problem, Ismail emphasised, is that "shipping and nuclear are two areas where institutional investors are very reluctant to invest directly". She continued: "As maritime insiders, we know the risks in our industry and how to manage them – but a financial investor who has no familiarity with our sector just sees, for example, *Ever Given* stuck in the Suez Canal. You can spend whole meetings with the investors just talking about these risks – and, as a result, they tend to ascribe a higher risk premium to shipping.

"Institutional investors are reluctant to invest in shipping because they don't like the construction risk, or the 'first of a kind' technology risk, or the long lead times, because there's then uncertainty over capital deployment and the risk return model. They are also unwilling to invest in nuclear, partly because nuclear energy development is complex and has pretty much always been tied to national security. The project lead time is very lengthy – typically 16 years from regulatory approval to construction – and it's typically beset by significant cost overruns and delays."

Ismail expanded: "Investors are not willing to take that risk – and when they do invest in long-term nuclear energy projects, its going to be on the basis that there's been a guaranteed off-take agreement or some kind of minimum return, like a contract of difference [CfD; see box, page 19]. They have an investment period in mind, which is not infinite,

Gihan Ismael, Marine Capital: "Investors...won't want to take any kind of operational risk where there is no commercial track record"

Anouskha Bachraz, Société Générale (centre): "Banks are conservative – there's always a little bit of apprehension when you're transitioning to new fuels"

so the funds will often have a fund life of, say, seven to 12 years – and you can't really invest in a project where you're not getting to see any income or return come through until after your fund life. These things need to be overcome if we're going to see investment in commercial nuclear vessels – and that will take a lot of education and certainty regarding the regulatory framework.

"Investors want to see that this works in a commercial setting; they won't want to take any kind of operational risk where there is no commercial track record. The issue of funding is obviously key because of the extremely high capex that's going to be associated with this. Yes, you'll have fuel savings, but then there's the issue of the payback period – which is particularly important if you're hoping to secure investment from the institutional market."

SMR lease models

Anouskha Bachraz, director, transportation advisory at multinational banking and financial services company Société Générale, echoed Ismail's sentiments, opining: "Banks are conservative – there's always a little bit of apprehension when you're transitioning to new fuels or new types of engine. Even when you're trying to finance LNG or methanol, banks will raise questions like: 'How will it work? How will you find the methanol? Where are the green corridors?' Banking is probably going to be one of the last sectors to support nuclear being used on commercial vessels."

Given the dauntingly high costs of producing a commercial nuclear ship, it has been suggested that adopting a leasing model for onboard SMRs could spread the upfront costs of nuclear technology, enabling smaller operators to adopt these reactors without massive capital investment. As Bachraz pointed out: "Right now, SMRs are expected to have a lifespan of 40-60 years, which is much longer than that of your average ship" – and their compact, modular nature means they could suit various vessel types, making it possible for one reactor to fuel a small yacht, a bulk carrier and a landing vessel in its lifespan, for example.

Ismail responded: "Leasing is an interesting concept – particularly as an SMR's economic life is much longer than the ship's life, and there could be different financing models for this." All the same, SMR leasing contracts must clearly address end-of-lease responsibilities, such as decommissioning and waste management, which could prove complex and costly.

Green corridors

One concept with the potential to lure investors, and one that has become increasingly popular in recent years, is that of green shipping corridors – specific maritime trade routes where stakeholders collaborate to deploy zero- or low-emission fuels, vessels and infrastructure. The appeal lies in the way these corridors address the shipping industry's decarbonisation challenges while offering financial and strategic incentives. With more than 60 such corridors established worldwide, and more on the way, they seem to be a burgeoning trend.

However, while green shipping corridors look deceptively simple on paper, Ismail warned that, while a number have been announced, relatively few are operational. "These take a long time to set up because of all the additional stakeholders involved," she said. "You've got the shipowners,

"Shipping and nuclear are two areas where institutional investors are very reluctant to invest directly"

Unni Einemo, CORE POWER: "Perhaps it's time to start turning some of this concern about 'public perception' on its head"

the operators, the ports, the charterers, the banks and other financing entities...and they all have to come together and agree to bear the cost together in this green corridor – because that's the whole point. The very few that are operational are operational because there's been some kind of government support that has underwritten some aspect of that which has enabled those parties to take those risks, bear that extra capex and have some kind of certainty that that capex is worth it.

"You've got to have charterers who are willing to enter into duration. It's not as simple as two countries or two ports getting together to enable that."

Public perception

Inevitably, the discussion led to the public perception of nuclear energy, and how this alt-fuel's pariah status may also be scaring off investors. It's easy to understand why nuclear power advocates become frustrated; nobody seems to be as concerned with, say, ammonia, which can cause blindness, severe burns, lung damage and explosions in an accident, and devastate aquatic ecosystems in the event of a spill. Then again, the public hasn't been subjected to decades of books, movies, documentaries, songs and protests about the horrors of ammonia.

Ismail said: "Although governments are now waking up to the role nuclear has to play in global power requirements, public attitudes have still to catch up with that – nuclear is still regarded with a good deal of suspicion. Investors must be convinced that nuclear energy actually is 'green', and I think there's been a great deal of ambiguity.

"For example, the EU has only included nuclear as a 'transitional' energy in its sustainable finance directive taxonomy in 2022, and the UK government doesn't actually include nuclear in its green finance framework – although the Climate Bonds Initiative [CBI] accepts that nuclear does align with green principles – so you need to convince investors that they are actually investing in a green energy source."

For Unni Einemo, marine regulations lead at nuclear energy tech firm CORE POWER, public concerns about nuclear energy are already dissipating. While perhaps an unsurprising point of view, given her company's focus on the development of Gen IV reactors for commercial vessels and floating powerplants, Einemo provided the following example: "I was in Norway in November 2024, at the same time a nuclear-powered US aircraft carrier [USS *Harry S. Truman*] was visiting Oslo.

"This was big news in Norway: I was wondering, 'Will residents be concerned that this is a nuclear ship, and will we see people protesting in the streets?' But, no – on the news, the main concern was whether Oslo was ready for all the sailors coming on shore leave. Other reports focused on the large number of aircraft on the vessel. And there then was the signalling effect, as Norway is quite close to Russia, so it was perceived as good to see an ally in our waters.

"The issue about it being a nuclear-powered ship didn't come up. Perhaps it's time to start turning some of this concern about 'public perception' on its head. What brings shipping into the news? It's accidents...it's oil spills from tankers."

Fellow panellist Captain Savraj Mehta, CCO at P&I club NorthStandard, likened the public's perception of nuclear energy to a pendulum, describing 2011-2018 as the 'negative reaction' phase. "We're currently in the centre, but I think we'll see the pendulum swing to a more positive view between 2025-2031," Mehta said.

'Big Tech' boost

One driver of substantial change might be the adoption of SMRs by 'Big Tech', Bachraz noted. "Amazon, Microsoft and Google all need higher levels of energy intensity to be able to power the data centres they need for AI," she said. "So, while we're talking about fears of nuclear ships coming into port, people will have to live next to SMRs at these data centres – these will become more prevalent."

Nuclear dominated the debate at the IRClass roundtable, hosted during London International Shipping Week

In turn, this development could break the ice with some previously reluctant investors; Bachraz added that some banks are already showing interest in the feasibility of financing these data centre SMRs on an ongoing basis. "Once you have a framework for financing SMRs on land, you can develop a framework on the shipping side," she said. "If governments judge nuclear as something that's essential for 'net zero', that can drive the financing framework that's needed for nuclear. Is it there now? Not quite. Are people following the topic? Definitely. Data centre powering is probably the first step."

Government assistance

Which brought the panel to the point: can the shipping industry obtain the financing it needs to pull this off without government assistance? In Ismail's opinion, it's an inescapable fact that government has "a very big role to play – not just in nuclear, but in the whole energy transition, because a lot of commercial hurdles are not going to be solved solely by the private sector or the commercial sector". She continued: "You come across the same issues over and over again, regardless of the underlying alternative fuel. Government has a role in de-risking the investment effectively. We all know that the cost is huge, so government can't fund it alone – but there are just certain risks the private sector will not take, or will be very unwilling to take. It's not just the banks that are conservative – it's also institutional equity investors."

Ismail reiterated her earlier point that, when it comes to the maritime field, the questions investors ask, and the risks they focus on, differ significantly from "the risks we would focus on as industry participants". She elaborated: "This means investors have a different perception of what is 'high risk' versus what we actually know to be a risk. It's that differential that often makes it difficult for them to invest, unless they can see some kind of government support." And, even when players are keen to invest, Ismail advised: "Investors will still want government to underwrite the decommissioning and waste management phases, because they won't take that risk themselves." Ultimately, the panel agreed, bridging the gap between industry needs and investor confidence requires government intervention to mitigate risks and unlock the financing essential for commercial shipping's energy transition. ■

HOW CFDS WORK

Building a nuclear-powered ship, featuring an SMR, is obviously expensive and risky. Investors worry they won't get their money back because the tech is new and untested; fuel prices (eg, diesel) might drop, making nuclear less cost-effective; and regulatory roadblocks and other delays could make the project lose money.

An energy contract of difference, or CfD, is a government-backed contract to encourage clean energy projects. Say a company builds a nuclear-powered vessel, powered by an SMR. The government would agree to pay the company a fixed price for the energy it produces – often termed the 'strike price'. If the market price for the energy is lower than the strike price, the government pays the difference to the company, ensuring the company doesn't lose money. If the market price is higher, however, the company pays back the difference to the government. Investors tend to like CfDs because the company is guaranteed steady money, even if energy prices fluctuate.

FUEL CELLS AS A STOP-GAP

Cruise ships are going to have to clean up their act – and soon – to avoid falling foul of environmental penalties. Could fuel cells provide a pathway to longer-term decarbonisation solutions?

For the past five to six years, cruise ships have come under renewed scrutiny, with critics citing their levels of in-port emissions as some of the worst in the maritime sector.

"Sustainability is the main driving force of the Port of Barcelona", that Spanish cruise hub states on its website. However, in 2022, Barcelona recorded more sulphur dioxide emissions from cruise ships, equating to approximately 32,800tonnes, than any other European port. The Italian government's 2021 decision to ban large cruise ship calls in Venice, targeting vessels sized above 25,000gt, led to an 80% reduction in SOx emissions – itself an indictment of the state of the problem. And, in 2023, environmental campaign group Transport & Environmental (T&E) reported a 14% increase in sulphur emissions over the course of three years at the Port of Southampton, UK.

Stig Kallestad, business manager at PowerCell, which supplies fuel cell technology to maritime customers, tells *The Naval Architect*: "Cruise ships are often regarded as state-of-the-art feats of modern engineering, with some even featuring rollercoasters, waterfalls and racetracks. However, most cruise vessels still rely on medium-speed diesel generators and auxiliary engines for onboard power.

Compact fuel cell systems could produce electricity with zero local pollutants when powered by hydrogen or methanol

"These systems are inherently noisy, high in particulate emissions and reliant on fossil fuels. These factors result in elevated concentrations of NOx, SOx and particulate matter [PM], including black carbon, on board and in port cities. The traditional diesel-based auxiliary power model is becoming increasingly unsustainable, technically, economically and reputationally.

"With over 250 million people living near major global ports, the issue of local emissions from ships has moved from a maritime discussion into the domains of urban air quality and human health."

Design alternative

Kallestad suggests that fuel cells could be the best starting point for cruise operators looking to slash their emissions – and perhaps to achieve zero-emissions port operations.

"From a naval architecture perspective, fuel cells present an increasingly realistic design alternative," he says. "Most cruise ships can structurally accommodate the additional volume and weight of containerised fuel cell modules, especially when replacing ageing auxiliary engine systems or integrating new 'hotel load' power sources. For newbuilds, a fuel-cell-ready design can allow future-proofing against fuel supply volatility and regulation."

Hybrid systems, comprising methanol-derived fuel cells with battery-based energy storage systems, supported by limited internal combustion engine (ICE) back-up, could "offer operational flexibility while ensuring against redundancy", Kallestad adds.

Why not opt for onshore power supply (OPS) technology and cold ironing – the act of running vessels on ship-to-shore power while in port – as an alternative means of minimising air pollution? For Kallestad, the problem is that, while cold ironing allows vessels to shut down onboard generators and draw power from the local grid, "retrofitting ships and upgrading port infrastructure is capital-intensive and logistically complex".

For example, Kallestad highlights: "At ports like Hamburg, shore power usage can exceed €5,000 per call, even as many national grids remain fossil-heavy. Additionally, grid capacity constraints limit the number of vessels that can connect simultaneously, introducing scheduling and access

bottlenecks during peak cruise seasons." While OPS is useful, in Kallestad's opinion it remains a "partial solution – particularly when not backed by low-carbon electricity".

In contrast, he continues: "Fuel cells are emerging as a technically viable solution to reduce or eliminate local emissions. As electrochemical energy converters, fuel cells operate silently and without combustion, producing electricity with high efficiency and zero local pollutants when powered by hydrogen or methanol."

Fuel cell options

Maritime customers can pick and choose from multiple fuel cell options. "Proton exchange membrane [PEM] fuel cells are well-suited for variable load profiles in auxiliary power systems," says Kallestad. "These fuel cells are smaller, much more efficient and offer a higher power density to alternatives. With reformer technology, these fuel cells can also convert methanol as a viable energy source."

Another benefit of fuel cells, Kallestad comments, is their modularity. "They can be deployed on board to displace auxiliary engines, or integrated into shore-based systems as mobile zero-emission or net-zero power stations for OPS, removing the need to rely on the fossil-powered grid," he says. Of these options, Kallestad adds, methanol is "gaining traction" as a practical carrier for hydrogen in fuel cell systems.

"The issue of local emissions from ships has moved from a maritime discussion into the domains of urban air quality and human health"

"When paired with integrated reformers, methanol-derived PEM fuel cells allow hydrogen to be generated and consumed in real time, minimising onboard storage and infrastructure complexity," he concludes. "Furthermore, green methanol derived from biomass or renewable hydrogen offers lifecycle emissions benefits. With lifecycle optimisation and emission factors considered, methanol fuel cells can significantly reduce both GHG and local emissions in maritime and port operations.

"Fuel cells offer an engineering solution. Methanol-derived fuel cells offer a practical pathway to decarbonise port operations without waiting for alternative fuels to come into fruition." ■

A DROP-IN SOLUTION FOR SUPERYACHTS?

Could biofuels help the superyacht sector to take small but firm steps away from a reliance on MGO? A Lloyd's Register report lauds biofuels' potential – though availability remains a hurdle

Biofuels, and in particular fatty acid methyl esters (FAME) and hydrotreated vegetable oil (HVO), could help to drive decarbonisation within the superyacht segment, classification society Lloyd's Register (LR) has suggested in its *Fuel for Thought: Biofuels for Yachts* report.

Launched in late September, during the Monaco Yacht Show, the new report argues the case for HVO as a "leading drop-in solution" for superyachts, enabling the owners of these assets to reduce their greenhouse gas emissions without the expense and hassle of engine overhauls. At the same time, these owners can avoid cumbersome fuel cell and hydrogen/methanol tank installations, potentially adding weight to and restricting space aboard the vessel, or ruining the boat's aesthetics.

Engel de Boer, Lloyd's Register: "The challenge is not whether the yachting industry will decarbonise; it's how quickly it can"

"HVO can directly replace marine gas oil [MGO], offering better stability and combustion," LR writes. "Its drop-in capabilities enable ships to cut carbon emissions cost-effectively, even if they can't be fully retrofitted for fuels like methanol or ammonia.

"A drop-in fuel as supplied, with a flash point not less than 60°C, is one that replaces a fuel oil previously used in a ship's fuel oil systems and combustion machinery. FAME and HVO can both be used as a standalone fuel, but FAME is more commonly blended with their fossil-derived marine fuel equivalents, and HVO less so due its premium price."

"Heightened interest"

The superyacht sector has previously come under fire – sometimes unfairly – for a perceived lack of commitment to green propulsion solutions. This picture does appear to be changing, with younger, more eco-conscious yachtowners entering the segment, as LR acknowledges.

Commenting on the report's publication, Engel de Boer, global yacht segment manager at LR, said: "The challenge is not whether the yachting industry will decarbonise; it's how quickly it can. Unlike past transitions driven by technological innovation or commercial advantage, today's energy shift is propelled by environmental urgency, regulatory mandates and rising social expectations."

The report adds: "There is significant evidence of heightened interest in biofuels as a means of reducing yacht emissions, with some leading yacht builders only delivering yachts with HVO as fuel and more captains and management companies switching to this fuel." The report points to stats from the Global Centre for Maritime Decarbonisation, which indicate that demand for biofuels increased from "negligible levels" in 2020 to more than 1 million tonnes in key shipping hubs in 2023 – perhaps still accounting for only 1.7% of global bunker sales in those hubs, but an increase nonetheless.

"Due to the drop-in nature of many biofuels, the intention of a yacht operator to use biofuels cannot be gauged from the orderbook alone," LR writes. "While biofuel-ready notations exist, most marine engines are capable of using biofuels without modification, and so their biofuel capability is not reflected in the orderbook."

All the same, the report optimistically claims: "The volume of biofuels used in yachting is growing rapidly as yachtowners accept the higher fuel price in exchange for lower environmental impact and the regulatory and reputational benefits brought by biofuels."

The report goes on to argue that safety requirements for the transportation, handling and bunkering of biofuels are "broadly similar to those for their fossil counterparts" – "broadly" being the operative word, some might add. Put simply, this should mean "minimal training requirements" for members of crew, especially when compared with other alt-fuels like ammonia, methanol, hydrogen and even nuclear. The report notes that eye protection and chemical-resistant gloves must be worn when handling FAME,

LR's *Fuel for Thought: Biofuels for Yachts* report was launched to coincide with the Monaco Yacht Show

which can cause minor eye irritation, and that the vapours created by heating up FAME can cause dizziness and nausea. HVO is also flammable in liquid and vapour forms, and can cause quite nasty respiratory tract infections.

Limited availability

Bunkering considerations are also assessed, with LR citing the *Safe Bunkering of Biofuels* report, issued by the European Maritime Safety Agency (EMSA) in 2023. "The [EMSA] report found no specific standards or guidelines for bunkering HVO or FAME, owing to their similar properties to fossil-derived diesel," LR writes. The report advises superyacht owners to consult closely with class societies and OEMs, to ensure they stay up to speed with bunkering, storage and operational issues.

However, the report also cautions that the use of biofuels should be viewed as a "practical near-term step", rather than a permanent solution for these luxury vessels. This is partly due to the shortfall in biofuel/biofuel blend availability in the aforementioned key bunkering spots, combined with uncertainty as to the viability and safe use of "unestablished and non-standardised biofuels" – including those that rely on cashew nut shell liquid (CNSL) and even car tyres for feedstocks.

While some of the biofuels in these latter categories may become legitimate alt-fuels, there is no way to know that at present, so caution must be exercised. LR writes: "Under class requirements, engines are to undergo shipboard trials to demonstrate their suitability for burning unestablished/untested special liquid biofuels and other renewable waste-based products, such as rubber tyres processed through pyrolysis. To attain acceptance for a sea trial, a pre-trial onshore assessment of the fuel's suitability for onboard ship use is to be established."

The report also warns: "The volume growth of biofuels in shipping will soon encounter its main near-term challenge, and one that may follow it in the longer term: lack of availability. Production volumes are constrained by feedstock availability, and the pricing of biofuels is sensitive to availability of feedstocks and demand from competing fuel users."

Buyer confidence

Another barrier is the fact that biofuel prices are currently at a premium – though, some might argue, that makes well-heeled superyacht owners and operators ideal early maritime adopters. Still, the report hints, maritime end users can expect to face stiff competition for biodiesel blends from other transport sectors – and especially from aviation.

"The International Energy Agency expects the price of biodiesel blends to rise alongside blending levels as feedstock prices are driven higher by demand," LR writes. "Competition for feedstock from aviation is forecast to rise sharply over the next five years as the sector increases sustainable aviation fuel [SAF] use to meet policy targets." On the flip side, electric power and hydrogen are likely to become the dominant alt-fuels for road transportation, LR predicts. On a more upbeat note, the report suggests: "Depending on future carbon pricing, biofuels could become cost-competitive with traditional fuels within a decade."

End users will also have to be diligent when making their selections: "The sustainability credentials of biofuels are contentious, and, from a lifecycle perspective, some could have worse carbon credentials than the fuels they are replacing, depending on the biomass feedstock used," LR advises. As a result, the report concludes, "trusted certification programmes will be essential in building buyer confidence in biofuels...preparing vessels with the necessary material and system checks is crucial to ensure readiness". ■

US GEARS UP FOR 'ICEBREAKER FACTORY'

The US$1 billion concept could represent the largest increase in new US shipbuilding capacity in decades, writes **David Foxwell**

Davie Defense, part of Inocea, a privately owned British marine industrial group with operations in the US, Finland and Canada, has provided a first glimpse of the 'American Icebreaker Factory' it hopes to build at Gulf Copper shipyard in Galveston, Texas.

The US$1 billion concept was created in collaboration with Florida-based Pearlson, which specialises in shipyard design and programme management that has led projects for leading American shipbuilders, including BAE Systems, Austal USA and Fincantieri Marinette.

Davie Defense said the icebreaker factory project "embodies the Trump administration's priorities, including the Executive Order on American Maritime Dominance, the SHIPS for America Act and the creation of the Office of Shipbuilding". Davie Defense CEO Kai Skvarla said: "Recapitalisation of the US icebreaker fleet and closing the shipbuilding gap with China are now clear national priorities. Our skills and capability are perfectly matched to address these imperatives and deliver the ships America needs to protect our vital interests in polar regions."

Davie Defense's American Icebreaker Factory will produce ships to protect US interests in polar regions

Finnish assistance

If built, the American Icebreaker Factory would be the largest increase in new US shipbuilding capacity for decades. The aim of the purpose-built facility is to build new US Coast Guard ships like the Arctic Security Cutter (ASC). It will be backed by the expertise of Finland's Helsinki Shipyard, Davie Defense's sister company, an icebreaker builder responsible for all of the polar icebreakers built in Finland over the past 25 years. It is currently building the Polar Max, which, when delivered to the Canadian government by 2030, will be among the world's most advanced and powerful icebreakers.

Skvarla continued: "While others run the same old playbook and expect different results, Davie Defense is executing new and innovative ways to deliver world-class outcomes. We would build polar icebreakers to a fixed schedule, investing in US shipyard capacity and recruiting thousands of American shipbuilders.

"The American Icebreaker Factory will deliver Finnish levels of icebreaker production efficiency in the US, helping address vital national security needs and strengthening American shipbuilding."

Once shipbuilding programmes are secured, Davie Defense could support more than 2,000 skilled jobs at the Gulf Copper facilities in Texas and more than 7,000 jobs statewide. This could generate total state-wide economic impact of more than US$9 billion, according to an independent study by Texas-based specialist Impact Data Source.

"Efficient capacity"

Davie Defense describes its ASC as a "proven fourth-generation design", with seven vessels of the type already in service. "The platform is ready to build and fully aligned with all US Coast Guard mission requirements," said the company, which claims that, working in partnership with Helsinki Shipyard, it can deliver the first ASC in 26 months.

Skvarla concluded: "Our purpose is investing to create new, efficient capacity in the US and rapidly delivering the ships America needs. We have already built the ASC hull seven times over. This means we can build new American ASCs quickly and transfer Finland's unrivalled icebreaker know-how to Texas. This will help the US find a better way to field new naval capabilities via proven shipbuilding solutions based on enduring business models and flexible designs that evolve as the needs of the nation change." He said a ceremony is planned in Texas this autumn to commemorate commencement of construction of the yard. ■

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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The Wind Propulsion 2026 Conference is your opportunity to stay ahead of the curve. The agenda covers the latest technological advancements, innovative ship designs, and policy shifts shaping the future of wind propulsion. Gain insights from leading experts and engage in discussions with 150+ key industry players, including technology innovators, shipowners and operators, industry associations, and leading academics, all contributing to the next generation of sustainable shipping.

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PROFESSIONAL PROFILE

AIDAN ARMORY

DEVELOPMENT NAVAL ARCHITECT
Shell, UK

Words: *Neil Hancock*

Education

Masters
Naval Architecture, **Strathclyde**

Experience

2025 - Present Development naval architect, **Shell**

2024 Innovation and research summer placement, **BMT**

2024 - 2025 Chair, **University of Strathclyde IMAREST Student Section**

2022 Technician, **Glasgow School of Art, Centre for Advanced Textiles**

What academic qualifications do you have?
In June 2025, I graduated with an integrated masters degree in Naval Architecture from the University of Strathclyde. My time at university was challenging, and at times felt like it would go on forever, but looking back I am incredibly proud of the achievement.

I started studying at Strathclyde in 2019, and to be honest, I could have had a smoother start at university. I struggled with my studies in the beginning, failing a class or two, only to be hit with the COVID-19 lockdown, just as I felt I was getting to grips with everything. Being forced into online learning was not helpful for a student struggling to get to grips with university.

Finishing my second year, mid-pandemic, I made the decision to take a step back from university for the year. This allowed me to reframe my priorities. I worked as a technician in a small textile factory during the days, and in the evenings, I studied, sketched and began to learn in a way that suited me. I came out of the pandemic with a real drive for naval architecture, engineering and design that I hadn't had before.

I completed my fourth year in 2024. My thesis, *Superyacht Structural Design: Large Glazed Openings at the Bow*, was awarded a runner-up award in the RINA-BAE thesis award. Following the completion of my fourth year, I shadowed Jake Rigby, the head of innovation and research at BMT. This short placement focused on concept design and hydrodynamics. The experience aided my personal and professional development greatly.

My masters year was a real step change from the now routine engineering classes, which invariably required a black belt in Excel. The classes focused far-more on regulation, safety and economics and this theme continued into my final group design project. My final masters project was a ground up economic and technical feasibility study for an electrical tugboat, catchily named *EcoTug*; unfortunately, *Ziggy StarTug* did not make the cut.

I left the University of Strathclyde with a strong base knowledge of engineering, design, research and the maritime sector. Most importantly, I left Strathclyde with a genuine desire to pursue naval architecture as a career.

Describe a typical working day
I started my first job as a naval architect in September this year, so, I don't think I've had many 'typical' days yet. Outside of the many hours of onboarding and online training courses, I have been part of a few interesting projects. In the last month I've been working on structural

assessments, general arrangement modifications and a few short research pieces on the applicability of energy-saving devices.

The environment at Shell as a graduate has been great. There is such a variance of backgrounds and education, and you get the sense that the team really wants you to succeed. I have been far from my comfort zone at points, but my managers and colleagues have made me feel welcome. Funnily, I've been told by other graduates on several occasions that my job sounds really cool.

Looking forward, I'm excited at the possibility of being able to collaborate on refits and sea trials within the next 12 months. I'll also be working with teams involved in the Northern Lights carbon capture project in Norway, which in August stored its first shipment of CO_2.

Of what are you most proud with regard to your career?
With regards to my professional career, being at the time of writing around 25 days long, my proudest achievement is probably standing outside of the Shell Centre, opposite the London Eye and walking through the front door with the new job title of development naval architect.

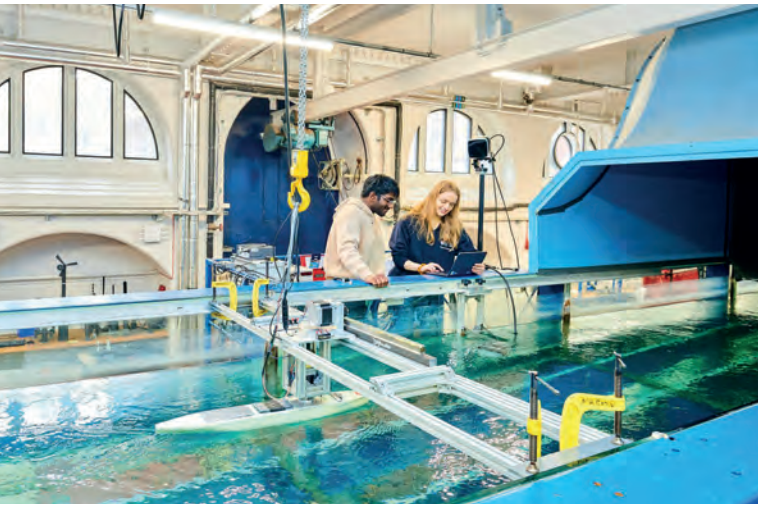
From my time as a student, something that helped me stand out when applying for graduate roles was trying my hand at teaching. It's something I'd encourage any later year's engineering student to try.

Within my final year I ran a lecture series, "Introduction to Sketching for Naval Architects". I was particularly nervous to start – I worried my drawings wouldn't be any good, I worried I'd not be making any sense – but as I worked through the first and subsequent classes it was amazing to see students making genuine progress.

Finally, graduating with a masters in naval architecture, after nearly six years, was a hugely proud moment. ■

SHAPING THE FUTURE OF MARITIME INNOVATION

Dr Maryam Haroutunian MRINA details some of the advantages of studying naval architecture and marine engineering at Newcastle University, UK



Source: John Donoghue/Newcastle University

Naval architecture and marine engineering at Newcastle University stands at the forefront of maritime education and research, offering a dynamic environment that blends academic excellence with industry relevance. Situated within the School of Engineering, the department is internationally recognised for its pioneering work in marine hydrodynamics, marine and offshore engineering, sustainable shipping and digital maritime systems [1].

A key highlight is the newly launched combined Naval Architecture and Marine Engineering degree, available as both BEng and MEng programmes [2] [3]. This integrated curriculum brings together the structural design expertise of naval architecture with the systems and propulsion focus of marine engineering, offering students a holistic learning experience. Through multidisciplinary team projects, hands-on laboratory work and industry-led design pitches, students are equipped with the skills and mindset to become the next generation of maritime engineers.

The department's commitment to sustainability is deeply embedded in both teaching and research. The topic of decarbonisation is now a core part of the curriculum, reflecting the urgent global need to transition to low to no-carbon maritime operations. Students explore cutting-edge technologies such as alternative fuels, energy-efficient propulsion systems and vessel optimisation strategies.

This educational focus is directly linked to Newcastle's world-leading research in decarbonisation, future fuels and smart port infrastructure. The university plays a leading role in the UK's zero-emission propulsion drive, spearheading vessel design and efficiency using advanced simulation tools and real-life sea trials [4]. Projects like the Clean Tyne Shipping Corridor, Retrofittable Propulsion System for Electric Vessels with Hydrogen Range Extender (RESTORE) and Marine Zero doctoral programme are examples of many innovative projects which demonstrate Newcastle's leadership in shaping a zero-emission maritime future [5] [6].

With state-of-the-art facilities – including the Emerson Cavitation Tunnel, hydrodynamics labs and the *Princess Royal* research vessel – the department offers an immersive and impactful learning experience. Collaboration with industry, government, and global research networks ensures that both students and researchers contribute to real-world solutions.

Whether you are an aspiring engineer, a maritime innovator, or an industry leader, Marine Technology at Newcastle University offers a vibrant, future-focused environment where education and research converge to drive the transformation of 21st-century shipping. ■

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Maryam Haroutunian is deputy director of student recruitment in the School of Engineering, marine technology undergraduate degree program director and lecturer in marine technology

THE NAVAL ARCHITECT: MEMBERSHIP EVENT

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The Naval Architect 2025 is the flagship RINA membership event, bringing together naval architects, engineers, and maritime professionals for two days of learning, collaboration, and engagement.

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EXPORT BOOM FOR BRITISH DESIGNS

UK yards are securing valuable overseas wins, in what's been hailed as a turning point for the country's warship-building prowess, writes **David Foxwell**

Frigates designed in the UK for the Royal Navy and exported to Scandinavia could lead to a warship-building boom for UK yards, after decades when UK shipbuilders relied mainly on a shrinking number of domestic orders for the Royal Navy.

In what is seen as a potential turning point in the UK's shipbuilding, Norway recently selected a version of the Royal Navy's Type 26 to meet its new frigate requirement and Denmark – and potentially Sweden – are expected to adopt a version of the Type 31.

Should Denmark – and Sweden – adopt the Type 31, shipyards, subcontractors and suppliers in the UK will secure a considerable volume of work that would stretch well into the next decade. Both designs have already been selected for construction outside the UK, but the Scandinavian programmes are expected to see the Type 26 frigates built entirely in the UK, along with significant sections – and potentially whole vessels – built for Denmark and Sweden.

In late August 2025, the governments of the UK and Norway confirmed that the Royal Norwegian Navy would order five new ships based on the Type 26 vessels. These will be built in their entirety at BAE Systems in Scotland. More recently, as had been widely reported in the British press, Denmark is said to be close to signing a deal that would see Type 31 frigates built at Babcock's Scottish yard.

Sizeable frigate

BAE Systems' Scotstoun yard is building the Type 26 anti-submarine warfare frigates for the Royal Navy, and in May 2025 named the first of the new class of eight ships, HMS *Glasgow*. The first of the somewhat smaller Type 31s, a new class of general-purpose frigates, HMS *Venturer*, emerged from Babcock's shipyard at Rosyth on 27 May 2025.

At 149.9m in length, the Type 26 is a sizeable vessel for a frigate, with a beam of 20.8m and displacement of 6,900tonnes. In addition to being constructed for the Royal Navy, where it

HMS *Glasgow*, the first of the UK Royal Navy's Type 26 frigates, pictured under construction at BAE Systems (source: BAE Systems)

HMS *Venturer*, the first Type 31 for the Royal Navy, emerged from Babcock's building hall in May 2025

will replace the UK's Type 23 frigates, versions of the design have also been selected by the Royal Australian Navy and the Canadian Navy. Construction of Australia's Hunter-class frigates is being led by BAE Systems Australia; in Canada, Irving Shipbuilding is the building a new class of 15 ships for the Royal Canadian Navy.

Based on Babcock's Arrowhead 140 design, itself based on Denmark's Iver Huitfeldt-class, which entered service with the Royal Danish Navy in 2012–13, the Type 31 is a 138.7m vessel with a beam of 19.8m, displacing 6,000-7,000tonnes. In addition to being built for the Royal Navy, the Type 31 has also been ordered by Poland and Indonesia. The Polish ships will be built at PGZ Naval Shipyard in Gdynia, with the Indonesian vessels to be built at PT PAL. Now, both designs are expected to be built in the UK for export.

The new Norwegian, British-built frigates will replace the Royal Norwegian Navy's Fridtjof Nansen-class frigates, of which five were built but only four remain following the loss of one, *Helge Ingstad*, in 2018, after the vessel ran aground. It is anticipated that delivery of the British-built Type 26 frigates to Norway will start in 2030.

Norwegian quintet

Norwegian defence minister Tore Sandvik said the Type 26 frigates will be primarily designed to undertake anti-submarine warfare and to detect, track down and engage submarines.

He said the Norwegian and British vessels "will be as identical as possible and have the same technical specification". He said having nearly

QUESTIONS RAISED OVER TYPE 31 STATUS

Questions have recently been raised in the UK House of Commons about the Type 31 frigate programme. The concerns centre mainly on the cost of the programme, integration challenges and whether it will be completed on schedule. In early September 2025, Conservative MP Mark Francois asked the secretary of state for defence what assessment had been made of the potential impact of the 'red' delivery confidence rating for the Type 31 frigate programme on the overall user requirements and operational readiness of the Royal Navy. A red delivery confidence rating signifies that successful delivery appears unachievable.

Responding, the Ministry of Defence (MoD) said: "In common with other enterprises, the Type 31 programme is experiencing inflationary pressures, which are understood and remain in line with the latest plans and forecasts. The red delivery confidence assessment rating reflects this impact and on completion of full assessment and assurance, formal updates will be provided through official channels at the appropriate time."

The MoD said HMS *Venturer*, the first of class, is currently scheduled to be in service by the end of the decade and all five of the Type 31 ships are planned to be in service by the early 2030s and are forecast to meet the key user requirements. It said three ships are currently in build; HMS *Venturer*, which was floated off a launch barge in June 2025, HMS *Active* and HMS *Formidable*.

The MoD further stated that there has been substantial investment in risk mitigation in the Type 31 programme, including significant investment in Babcock's facilities at Rosyth, which include digitising the shipyard, new manufacturing facilities and a new purpose-built assembly hall. A new shore integration facility at Portsdown Technology Park will mitigate risks to the integration of the combat system.

Based on Babcock's Arrowhead 140 design, the Type 31 is being built for the Royal Navy and has already been ordered by Poland and Indonesia

identical vessels "will enable us to operate even more efficiently together, reduce costs and make joint maintenance easier". The minister noted that it also opens up the possibility for joint training of personnel, "and perhaps even using Norwegian and British crew interchangeably".

The quintet of Norwegian frigates will be equipped with anti-submarine capable helicopters, although a decision on what type of helicopter the Norwegian frigates will operate has not yet been made. The defence minister said Norway also plans to consider rapid technological developments "and explore the possibilities for utilising unmanned platforms". He said this is something that will also be examined with Norway's British partners.

Selection of the Type 26 is a major coup for the UK defence industry, which faced competition from the US and other European shipbuilders. The UK Government said as a result of the deal, which will see BAE Systems build five Type 26 frigates for the Royal Norwegian Navy, billions of pounds will be pumped into the UK economy and 4,000 jobs will be secured, including 2,000 in Scotland.

The programme is also expected to support 432 businesses, including 222 small and medium enterprises, across the UK including 103 in Scotland, 47 in the northwest of England and 35 in the West Midlands.

Scandinavian options

In early September 2025, the *Financial Times* reported that the UK was in advanced negotiations to build frigates for Denmark and Sweden. Both Scandinavian countries had originally favoured local construction, but the project are now expected to take place in whole or in large part at Babcock's Rosyth shipyard.

"The Type 26 frigates will be primarily designed to undertake anti-submarine warfare and to detect, track down and engage submarines"

Up to three vessels based on the Type 31 frigates are expected to be ordered by Denmark imminently, after a change of heart about where the new vessels would be built. Defence minister Troels Lund Poulsen was reported in the Danish newspaper *Berlingske Tidende* stating that the vessels would be built not by Danish yards – which have little recent experience building vessels of this size – but in cooperation with a NATO partner.

The Swedish deal – expected to be for four ships – is not expected to be concluded quite as quickly, although Babcock has for some time been collaborating on the development of four new Luleå-class frigates for the Royal Swedish Navy, working with Saab, which was contracted by the Swedish Defence Materiel Administration for the basic design of the vessels. Babcock's support for the Swedish programme follows a strategic cooperation agreement signed by the parties at DSEI in 2023, under which Saab was responsible for basic design for the Luleå-class and Babcock for engineering, including among other things structural design and auxiliary systems.

The British deal for the Luleå-class is not considered 'nailed on' however, since a June 2025 agreement between the French minister for armed forces and Swedish minister for defence to strengthen cooperation between the countries with regard to air surveillance and air defence, and the potential adoption of the French FDI 'defence and intervention frigate' by Sweden, rather than the British design. ■

OFFENSIVE POWER MEETS AMPHIBIOUS OPS

David Foxwell reports on BMT's new ELLIDA STRIKE design concept, unveiled at DSEI 2025

Ship design agency BMT unveiled the latest evolution of its proprietary ELLIDA multi-role naval platform at the 2025 Defence and Security Equipment International (DSEI) exhibition in London in September 2025. It is a flexible design, aimed at evolving UK requirements for amphibious capability, that will also be able to engage in combat operations using long-range missiles while providing the UK Royal Navy (RN) with capabilities including humanitarian support.

The ELLIDA series of concept designs was launched by BMT in 2019, and has evolved significantly as RN requirements have changed in recent years. The family of multi-role logistics ships was designed to support naval and amphibious forces, and was originally envisioned purely as a multi-role platform able to transport bulk cargo, vehicles and personnel for military operations or logistics support.

In keeping with these roles, the ships had a large internal vehicle deck, a stern well dock for the stowage and loading of landing craft, weather deck stowage and accommodation for embarked personnel, combined with features for amphibious offload by sea and air. The series was designed as a naval auxiliary to IACS requirements and commercial rules, supplemented with naval standards for survivability, including redundant propulsion notation, IMO passenger ship stability regulations and enhanced naval stability requirements where specified.

The original versions of the ELLIDA included the ELLIDA 130 and ELLIDA 150, small amphibious units able to deploy with a small-scale embarked force and supporting lighter vehicles; and the ELLIDA 180 and ELLIDA 200 designs, multi-role platforms intended to deliver amphibious logistics but also able to conduct strategic transportation/logistics re-supply and offer wider fleet support as secondary roles.

Heavily armed

Now, in addition to providing a platform with all of the above-mentioned capability, the ELLIDA STRIKE concept is focused much more heavily on offensive operations and on a platform able to support operations launched from the sea with a strike and air defence capability. It also makes greater use of modularity, and of the ability to be rapidly reconfigured for diverse roles.

The conceptual design for the ELLIDA STRIKE was developed to align with the RN's future amphibious fleet recapitalisation, which aims to replace ageing ships with a new generation of versatile, adaptable vessels. It was created to explore facets of next-generation littoral strike design while drawing on aspects of the evolving UK Ministry of Defence Multi-Role Support Ship (MRSS) programme announced in the 2021 Defence White Paper, which aims to modernise the RN's amphibious capabilities following the UK government's decision to decommission the Albion-class landing platform dock (LPD) platforms.

Given its more wide-ranging capabilities – and the need to ensure that the platform has weight, space and power margins needed for platforms that could serve into the 2060s – the ELLIDA STRIKE platform is reported to have a length of around 213m, a beam of 35m and a displacement of 29,500tonnes. Illustrations released by BMT suggest that it will also be more heavily armed, with, potentially: a vertical launch missile system; an advanced radar system on an integrated mast and combat system; self-defence capability, such as 40mm guns and countermeasures systems; and new technology, such as the DragonFire-type laser-

The ELLIDA STRIKE platform is reported to have a length of around 213m, making it larger than the Albion class

The ELLIDA STRIKE has a large flight deck that could handle Chinook-size helicopters

directed energy weapon system. It is anticipated that the vessel will also be able to embark multiple helicopters, such as the Merlin, and AUVs. Illustrations also suggest it will have a flight deck capable of handling larger aircraft than the Merlin, such as the CH-47 Chinook.

Concept phase

The MRSS programme is currently in the concept phase, with detailed work on key user requirements, conceptual designs, affordability and exportability assessments underway. Hence, BMT describes the ELLIDA STRIKE design as "not representing a specific solution…but demonstrating how modern design principles can address complex operational requirements across missions, ranging from humanitarian aid to high-end warfighting".

Reflecting on lessons from recent defence reviews and the RN's detailed MRSS requirements, ELLIDA STRIKE also emphasises scalable capability, modularity and the integration of advanced technology such as uncrewed systems and flexible well dock operations. The vessel was designed with careful consideration of rapid personnel flow and human factors efficiency, an approach that, BMT says, "resonates with the RN's ambition for platforms that support dispersed, forward-deployed commando forces, robust crisis response and seamless adaptation to emerging threats and operational contexts".

BMT continues: "While not a direct answer to the anticipated MRSS specification, it showcases design elements that are relevant and demonstrates the full range of capabilities which would protect the vessel in demanding conditions and support a wide range of missions."

Enabling rapid reconfiguration for mission-specific roles such as medical support, command and control, logistics or combat readiness through containerised pods, BMT describes the ELLIDA STRIKE's strike capability as "integrating long-range precision missile systems, enhancing fleet lethality and operational reach". The design also supports combined air manoeuvre operations, and is capable of launching and recovering both crewed and uncrewed rotary platforms, which adds flexibility and redundancy to mission planning.

A welldeck facilitates efficient launch and recovery of landing craft and autonomous vessels. ELLIDA STRIKE also has what BMT describes as "a robust digital backbone" that enhances connectivity and supports advanced command and control systems. The design also prioritises human-centric principles, with ergonomic layouts that improve onboard living and working conditions, ultimately boosting crew well-being and mission performance. ■

The new concept's welldeck facilitates launch and recovery of landing craft and autonomous vessels

AIRCAT ON THE ATTACK

Concept work has begun on the first Aircat Bengal MC Modular Attack Surface Craft, which will feature an SES hullform and a modular payload architecture, writes **David Foxwell**

The Aircat Bengal MC uses a surface effect ship hullform, originally developed by ESNA in Norway

Singapore-based shipbuilder Strategic Marine has signed a memorandum of understanding with US-based Eureka Naval Craft to collaborate on the construction of the first Aircat Bengal MC Modular Attack Surface Craft. The vessel has been designed to operate in low-manning mode, or as an uncrewed surface vessel (USV), if required. Versions of the Aircraft Bengal MC could also be developed for use in the offshore oil and gas industry.

The Aircat Bengal MC uses a surface effect ship (SES) hullform, originally developed by Norwegian ship designer ESNA. An SES design has a catamaran hullform borne by a combination of an air cushion between the side hulls and the buoyancy of the hulls. The partnership will use Eureka's modular naval version of the SES design to deliver a new class of non-ITAR, dual-use vessels designed for both defence and civilian applications.

Non-ITAR vessels are not subject to the America's International Traffic in Arms Regulations, which control the export and import of defence-related equipment. This means that the Aircat Bengal MC can respond to evolving requirements, such as the US Navy's Modular Attack Surface Craft programme, and can fulfil the US Navy's and allied nations' requirements for optionally manned combatants. Its non-ITAR status and modular, dual-use design also make it ideal for rapid deployment and operational integration with US and partner forces, and the vessel's high-speed, shallow-draught and modular payload system are optimised for littoral environments, key to Indo-Pacific naval defence and maritime security.

Changing missions

The 36m Aircat Bengal MC is based on the Aircat Crewliner 35 SES, originally designed by ESNA in collaboration with Aircat Vessels and further developed by Eureka. Eureka Naval Craft CEO Bo Jardine says a defining feature of the Aircat Bengal MC is its highly modular payload architecture. "The vessel is designed to rapidly integrate an array of mission modules and payloads, including advanced sensors, unmanned systems, weapons, communications suites and specialised equipment for defence and civilian operations," Jardine comments. "This modularity enables operators to tailor the vessel's capabilities to specific mission profiles, including anti-surface warfare, mine countermeasures, intelligence, surveillance and reconnaissance, humanitarian assistance or offshore energy support.

"In the rapidly evolving maritime threat environment, the ability to reconfigure a vessel to respond to new operational requirements and maximise flexibility without the need for lengthy refits is a significant advantage."

In addition to military/paramilitary roles, says Jardine, the Aircat Bengal MC's large aft deck, approximate 40tonne payload capacity, range and high speed make it a potentially valuable asset for offshore oil and gas exploration and production logistics. "The aft deck is ideal for transporting equipment, supplies and personnel to and from offshore platforms, while the vessel's stability and speed ensure safe and efficient operations even in challenging sea conditions," says Jardine. "The Aircat Bengal MC also enables the movement of time-critical items offshore, supporting urgent maintenance, repairs or supply needs. Its payload capacity allows for the rapid delivery of heavy or bulky cargo that would otherwise require multiple trips or specialised vessels." He says the vessel is also suited to fast and safe personnel transfer, providing a reliable alternative to helicopters in certain scenarios.

Autonomous edge

Another important part of Eureka's offering is the integration into the Aircat Bengal MC of Greenroom Robotics' 'GAMA' maritime autonomy solution, which is compliant with the Unmanned Maritime Autonomy Architecture (UMAA) being developed by the unmanned ships programme office in the US Navy, the aim of which is to promote the development of common, modular and scalable software for USVs.

The GAMA solution allows the Aircat Bengal MC to undertake surveillance, interdiction and rapid response tasks with reduced crew requirements, or in fully autonomous mode. Jardine says that the UMAA-compliant architecture will ensure that the Aircat Bengal MC is easily integrated with other autonomous systems. ■

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WHISTLEBLOWING: DISLOYALTY, OR A DUTY?

Ian Bron, **John Dalziel** and **Ronald Pelot** argue the case for whistleblowing and speak-up culture as a vital component of any safety mindset – and especially so in maritime

This is a significantly edited version of the paper "'Any Fool Could Tell How Bad The Ship Was': The Importance Of Employee Voice In Safety Culture", presented at the RINA/MARIN Human Factors conference in Wageningen, Netherlands in October 2024.

After a disaster, many questions are raised about how the incident could possibly have happened. Weren't there procedures, standards, rules and laws in place to prevent this? Weren't there safety inspectors who were obligated to protect the public safety? Standards, procedures, rules and laws exist to maintain public safety in our increasingly complex world. But, as many maritime disasters and incidents painfully demonstrate, they count for little unless there is a safety culture to ensure accountability.

No organisation or industry is immune to error, mismanagement and corruption. Detecting and correcting such instances is, and may always be, a game of cat and mouse involving regulators, corporate executives/boards and wrongdoers. In the marine sector, the International Maritime Organization (IMO), the International Labour Organization (ILO), national administrations and private regulatory organisations provide a regulatory regime which, if followed, substantially reduces the risk and severity of maritime casualties.

One aspect of this regime is the International Safety Management (ISM) Code, implemented in 1993 in response to the loss of *Herald of Free Enterprise* off Zeebrugge in 1987, in which both design and management flaws played a role. Crew had raised concerns but were ignored. To a degree, the ISM Code addresses this failure by requiring that all operators institute a safety management system (SMS) which must include clear channels for communication (s. 1.4.3) and for procedures for disclosure of accidents and non-compliance with the Code (s. 1.4.4). While the Code never uses the term, this suggests whistleblowing avenues.

The requirements of the ISM Code have also been enshrined in national laws, such as in US 33 CFR 96.100, the UK Port Marine Safety Code and Canada's Safety Management Regulations. Despite the existing, explicit requirements, non-compliance and failure continues – sometimes with fatal consequences.

In other cases, employees opt to remain silent. This is unfortunate, as whistleblowing is an

The paper was presented at RINA's Human Factors 2024 conference

Poster presentation by Dalhousie University / MM&P Union at World Maritime Rescue Congress, 2019. It highlighted that many ship's officers fear the possibility of victimisation if they report safety concerns to their superiors [4; 34]

effective way to detect misconduct and error, benefiting the company and the public interest.

Definitions

Whistleblowing has various definitions, but the most used is "the disclosure by organisation members [former or current] of illegal, immoral or illegitimate practices under the control of their employers, to persons or organisations that may be able to effect action". 'Action' includes the power to investigate, correct or publicise the wrongdoing.

Whistleblowing is a subset of speak-up culture. Speaking up is broader, including expressing unpopular opinions about existing processes, challenging unspoken assumptions, or other forms of dissent. It challenges the status quo and thus may carry some risk, such as damaged relationships, being treated poorly or humiliated, or formal job action. Whistleblowing is more specific and riskier because it identifies misconduct and directly implicates colleagues or superiors.

Whistleblowing is a contentious topic, burdened with cultural and organisational norms on loyalty. Some benefits are obvious, as in the case of *Herald of Free Enterprise*, where acting on requests for restrictions on passenger capacity and a warning light might have saved 193 lives. Others are more subtle, such as improved organisational performance.

Attitudes shifted as preventable disasters revealed that insiders had known of problems but had been ignored or punished – or had not dared to speak up. It is a misconception that whistleblowing is limited to disclosures that become public record – that is, external disclosures to the media or a regulator. Whistleblowing is better thought of as a process. For example, nearly all (98%) external whistleblowers first attempt internal channels before taking their concerns outside the organisation.

Expectations that whistleblowers be morally spotless are also pernicious, as whistleblowers are human and may thus have ulterior motives, such as vindication and revenge against those making reprisals. Given the difficulty in establishing motive, the consensus is that it is the information that matters. Where the information is true, or if the reporter has a reasonable belief that it is true, the disclosure of wrongdoing is whistleblowing.

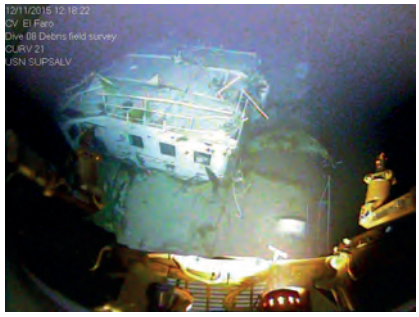
Maritime relevance

Speak-up and whistleblowing are essential components of a sound safety culture in which the actions and intentions of organisational members are oriented towards preventing accidents and minimising occupational hazards. James Reason [1] proposes that it comprises several elements, including being an informed culture, a reporting culture, a learning culture, a just culture and a flexible culture. It requires depth and commitment from leadership to the most junior worker, maximising the likelihood that an error by one individual will be detected and corrected by others.

A maritime SMS should provide a link between onboard safety management and a designated person ashore (DPA) who has access to the highest level of management in the company. The DPA is responsible for monitoring the safety of

Paper co-author Ian Bron: speak-up and whistleblowing are essential components of a sound safety culture

the ship and ensuring that adequate resources and shore-based support are provided. The system places responsibility on the master and the DPA to communicate information related to onboard safety deficiencies and non-conformities and their possible causes, regulations pertaining to corrective actions and record-keeping of such actions. It also calls for the creation of a documented record of deficiencies that could prove negligence. The intent is to make it impossible for the company to plead ignorance of defects and ensure that shore-side management is held liable for the safe condition and operation of the ship.



The loss of the container vessel *El Faro* made headlines: the ship was found to have many deficiencies that were overlooked (image: National Transportation Safety Board)

Where there is any risk of reprisal after speaking up, the chances of reporting diminish – undermining the SMS. One threat to all SMS is regulatory capture. Regulatory capture occurs when industry, or a portion of an industry, gains control over the regulatory body responsible for its oversight. This can occur in several ways, such as 'revolving door' personnel transfers between the regulator and the private sector, excessive influence on politicians or government bureaucrats, or bribery. Once achieved, the regulator cooperates with industry actors to subvert or ignore regulations.

Inherent benefits

Besides compliance with the ISM Code, there are other benefits to speak-up and whistleblowing arrangements. Semi-annual surveys by the Association of Certified Fraud Examiners have found that internal reporting is the most effective means of detecting fraud (42%), surpassing the next closest method (audit, 16%). In this way, it serves as a form of decentralised enforcement that reduces the costs of detecting wrongdoing. This, in turn, facilitates its early detection and correction.

Speak-up culture has been found to increase overall efficacy and efficiency where employees work cooperatively; similar findings have been obtained for ethics and compliance programmes, which also require reporting channels. Other potential benefits for the organisation include aiding recovery of lost assets, ensuring compliance with organisational policies/procedures and legal/social obligations, and attracting and retaining personnel committed to the organisation's values and culture.

Case study 1: *Princess Ashika*

We adopt, as an accurate assessment of MV *Princess Ashika*, the remarks made by a Fijian Maritime Safety Authority surveyor involved in the annual survey of the vessel on 16 December 2008: "The vessel is now 36 years old and the condition it is now in if it is allowed to trade will cause a maritime disaster and will be the cause of pollution. The vessel is beyond repair and is no longer fit for sea services of any nature" [2]. After the foregoing survey report, *Princess Ashika* was sold to Tonga and completed four voyages. The ship survived the fourth voyage because a crew member kicked a hole in the side of the steel-hulled vessel to let water off the car deck. On the fifth voyage, in August 2009, she sank, with the loss of 74 lives.

She had been issued the necessary certificates prior to her fateful voyage. However, senior officers subsequently told police that they knew the 37-year-old ship was unsuitable, unsafe and unseaworthy – but accepted the ship's safety certificate anyway. The master said he knew the ship was old and corroded but did not resign as it was his only way to make a living. The man who surveyed *Princess Ashika* before it left Tonga on its fateful last trip says he was afraid he would lose his job if he told a government minister about the dangerous condition of the ferry. The Shipping Corporation of Polynesia argued that it relied on certificates "issued by the appropriate authority", and operated *Princess Ashika* lawfully.

However, the evidence as to the unseaworthiness and appalling state of the vessel was overwhelming. Mr. Sione Mafi Kavaliku, a marine officer in the employ of the Ministry of Transport, when asked by the acting director of Marine and Ports as to his opinion about the vessel, responded by advising that "any fool [could] tell how bad the ship was". Tonga's Royal Commission of Inquiry into the sinking of the *Princess Ashika* stated: "There were many causes of the disaster. The tragedy is that they were all easily preventable and the deaths were completely senseless."

Case study 2: *El Faro*

On 1 October 2015, the US ro-ro container ship *El Faro* sailed directly into Hurricane Joaquin and was lost with all hands. Why did Captain Davis ignore the warnings, by the weather services and by his junior officers, that the hurricane had changed its track, and he was heading straight into it? Was it that some years previously he had lost his position as captain because he was careful, and someone in the office thought he was too careful? Once bitten, twice shy. Notwithstanding the master's decision, why did the 30,000tonne ship not survive the hurricane? It had recently passed both class and flag state inspections. The subsequent investigation revealed that *El Faro* had many deficiencies which allowed the ship to flood, list, lose power and eventually capsize. It is noteworthy that the *El Faro* sinking took place 22 years after the introduction of the ISM code!

As a consequence of this event, six fully certified ships were scrapped outright, and another 50

(roughly half of the US-flagged merchant fleet in 2018) were flagged for high-priority inspections. Monitoring the performance of the recognised organisations (ROs) under the US Coast Guard's Alternative Compliance Program (ACP) increased.

Case study 3: John Dalziel's story

In the early 2000s, John Dalziel, MRINA, a professional engineer and marine surveyor in the Halifax office of a class society, was ordered to falsify reporting on a bulk carrier about to make a winter trans-Pacific voyage to China for special survey repairs, and to delete safety concerns from the ship's file. This included issues such as leaks in the tank top and plywood installed in the ballast tanks to prevent personnel from falling through internal structure.

Diminution of ship structure exceeded class allowances to the point that the thickness measurement technician had knocked holes through the engine room bulkhead. Despite this, other surveyors had reported that the ship was satisfactory. The superintendent expressed serious concerns to him about the safety of the voyage, based on about 800tonnes of steel needing renewal. Dalziel was told that class had sided with the owner so that the ship could sail to China, presumably to save money, and later learned that about 2,800tonnes of steel were eventually cropped and renewed: more than a quarter of the ship's total. When he refused to falsify records, he reported this internally, then was constructively dismissed.

He reported to his professional society, which initially supported his complaint, concluding that his employer had acted improperly. Despite this, it did not take any other action. His subsequent claim under the Canada Labour Code was met with protests by his former employer arguing that the Canadian federal government had no jurisdiction, in that it (a classification society) was not an "essential part of shipping". This lengthened the process by years as it went through three levels of the legal system. Ultimately, the Federal Court rejected his employer's arguments, and the case was eventually settled. The reasons, Dalziel argues, were that his former employer "had run out of delaying tactics, and my lawyer and I had run out of money". He believes his case did send a clear signal to professional colleagues – do not challenge management.

Later, as acting national manager of small vessels at Transport Canada Marine Safety, he, other safety inspectors and senior regional management raised concerns about the effectiveness of Canadian safety inspection programmes. Their concerns fell on deaf ears or were met with pressure to remain silent. He believes that he and like-minded colleagues were passed over for promotion as a result.

Later, as head of the on-site team for a Canadian Government vessel construction project, Dalziel and the on-site team identified non-compliance with collision regulations, faulty electrical equipment, inadequate fire protection and other structural deficiencies, but were ordered not to report them. After concurrently becoming union local president, he formally raised these concerns under the Canada Labour Code – yet most issues remained unaddressed, and his employment was terminated.

Dalziel is a knowledgeable professional, but he was unable to succeed in a country with a reputation for government excellence, low levels of corruption and strong rule of law. This suggests that risks to ordinary sailors may be unsurmountable.

The common thread

The logic of whistleblower protections is not complex. First, develop and implement a policy legitimising the disclosure of wrongdoing outside the chain of command. Second, conduct investigations into disclosures of wrongdoing and act constructively on the findings, while at the same time protecting the whistleblowers. This will create trust in the regime, which will increase use, facilitate the quick correction of wrongdoing and deter future wrongdoing.

To be effective, a speak-up system should include a code of ethics accompanied by training and consistent communication, accountability policies, monitoring and auditing, investigation and correction policies, a dedicated ethics officer providing advice, an ethics report line and policies to incentivise ethical conduct. Robust whistleblowing systems have hard (structural)

Paper co-author John Dalziel and his work colleagues raised concerns about the effectiveness of safety inspection programmes – but their concerns fell on deaf ears

Paper co-author Ronald Pelot: "If it is not safe to speak up internally, [observers] may choose to remain silent or to blow the whistle externally"

and soft (cultural) components. Although this paper cannot cover all the hard components of an effective disclosure system, standards and guides have been developed by non-governmental organisations. Also helpful is *The Whistleblowing Guide: Speak-up Arrangements, Challenges and Best Practices* [3]. All address two key principles: a broad scope of protection, and ensuring that any worker (even contract personnel) can raise a concern on any issue without interference or penalty.

Leadership commitment to open communication is important because leaders provide (or withhold) resources for any reporting mechanism, as well as training in its use. When perceptions of organisational culture and organisational justice are positive, internal whistleblowing is more common. Weaker ethical cultures, on the other hand, are associated with external whistleblowing and inaction. Organisational leaders should note: observers of wrongdoing take cues from their environment to determine whether there is an open culture in which they can speak truth to power. If it is not safe to speak up internally, they may choose to remain silent or to blow the whistle externally. External whistleblowing is more likely if the individual has already suffered reprisals or is angry about inaction by management.

Common flaws

Several risks can undermine even the best policies. The first is perhaps the most obvious: "If the weakest link…is an unwilling manager, corrupt CEO or incompetent board, then any kind of low-courage whistleblowing channel will remain ineffective" [4; 55]. Even where leadership is not directly implicated, however, leadership can neglect the regime or apply it inconsistently.

Operational pressures can also be a significant threat. Not all companies are managed well or staffed with the resources necessary to support the master in maintaining a safely operated ship. In these cases, the reporting of deficiencies may be looked upon as a problem rather than as an opportunity to improve safety. In such companies, a master who brings safety management problems to the company is himself a problem and risks being replaced. This can have a chilling effect on other masters who then become reluctant to bring their own safety concerns to management. [4;34, p. 3]

Pressure may also be applied to government regulators by industry associations; this is exacerbated by the fact that the IMO is not a regulatory body, and flag states compete with one another. Flag states may then delegate most of their responsibilities to ROs such as classification societies, creating two levels of conflict of interest: the RO class societies are employed by companies but act on behalf of flag states in implementing and enforcing international regulations. Companies, in turn, employ RO class societies to prepare their ISM Code safety management systems and conduct audits of SMS documentation and performance.

The result is that companies are regulated by private organisations that they themselves employ and have a choice in selecting.

Recommendations

There are three key areas where the need for change is urgent: prevention of regulatory capture, whistleblower protection and legal accountability for senior management and government. For all the diversity of their technical causes, the root cause of all these disasters is the same: corporate negligence facilitated by regulatory failure, and worse, regulatory capture. Considering evidence that the ISM Code is not achieving its goals, and to help preserve life, the environment and the public interest, the authors recommend that:

- IMO revise the ISM Code to include an effective whistleblower protection regime; and that national legislation be updated in accordance with the ISM Code. Stakeholders must include unions and professional societies to ensure that resulting regimes reflect reality faced by workers.
- Port State Control regimes look for evidence of an effective whistleblower protection regime, and

AUTHORS' BIOGRAPHIES

Ian Bron, M.Ed., PhD., is a Senior Fellow at the Toronto Metropolitan University Centre for Free Expression with experience as a government regulatory specialist, educator, evaluator and naval officer.

John W. Dalziel, M.Sc., P.Eng., MRINA, is an Adjunct Professor in the Department of Industrial Engineering, Dalhousie University, Halifax, Canada. He has also taught naval architecture at the technical college/university level. Most of his career was spent in ship construction/repair supervision and marine surveying/safety inspection.

Ronald Pelot, PhD., P.Eng., is a Professor in the Department of Industrial Engineering at Dalhousie University and co-lead of the Maritime Risk and Safety Group (MARS).

when one is not found, take appropriate action.
- The International Transport Workers Federation (ITF) and professional societies provide guidance to their members and, if necessary, legal and financial support (they should endeavour to recover the cost of such support from the companies involved).
- The International Association of Classification Societies (IACS) require its members have an effective whistleblower protection regime.
- Insurers look for an effective whistleblower protection regime when establishing insurance rates.
- Governments establish and enforce criminal statutes, backed by effective enforcement regimes, that expand accountability from companies to the individual executives, managers and supervisors **unless** they can demonstrate that they had no prior knowledge of the factors leading to the incident and have an effective whistleblower protection regime.
- Civil courts allow financial claims to be heard against the responsible executives, managers and supervisors.

Conclusion

Experience has shown the cost of failing to implement robust whistleblower protections: problems fester, unreported, until the piper must eventually be paid – the bill may include reputational damage, millions in repairs, billions in environmental damage and lives lost. Flag and port states must also recognise that when that failure comes, it may be in their waters or ports, and it may be their citizens. Accordingly, it is in their interests to ensure that they use the best resource at their disposal: loyal employees and other workers, who know where hazards lie and want them corrected – not least because their lives may depend on it. ■

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***Harbor Charger* brings hybrid diesel-electric operations to the Trust for Governors Island's ferry fleet, replacing an older, diesel-fuelled veteran**

ELECTRIC TO THE CORE

The Big Apple has welcomed hybrid diesel-electric ro-pax *Harbor Charger* to its waters, and especially its capability to slash carbon dioxide emissions by hundreds of tonnes annually

New York State is about to breathe a tad easier, following the launch of the appropriately named, hybrid diesel-electric public ferry *Harbor Charger* – a 58m-long, double-ended ro-pax with the capacity for up to approximately 1,200 passengers.

Ordered for a reported US$33 million, the vessel was built domestically by Conrad Shipyard and delivered to NYC-based non-profit the Trust for Governors Island (TGI), which has deployed the ferry on a route between the Battery Maritime Building in Manhattan and Governors Island – the latter a former base for the US Army and US Coast Guard, and now a public park managed by TGI, offering tourists views of the Manhattan skyline and activities ranging from biking and glamping to jazz lawn parties.

Harbor Charger replaces TGI's diesel-powered ferry *Lt. Samuel S. Coursen*, which has been active in Manhattan since it first hit the water in 1956, and which, at the time of writing, was about to commence its well-earned retirement.

The new ferry was designed by Seattle-based naval architecture firm Elliott Bay Design Group (EBDG), this project constituting EBDG's first battery-hybrid electric ferry concept to have made it to the delivery stage. David Turner, EBDG project manager, tells *The Naval Architect*: "*Harbor Charger* is a new design from the keel up. The only aspect required to match *Lt. Samuel S. Coursen* is the geometry of the ends, which is necessary for terminal compatibility."

Space allocation

It became clear, however, from the earliest phases of the design process, that allocation of space on board *Harbor Charger* was going to be a challenge. Take, for instance, the vessel's hybrid-electric set-up, which includes: Siemens Energy's BlueDrive Eco hybrid propulsion system; two energy storage spaces (ESS), or battery rooms, each housing approximately 435kWh of Siemens BlueVault batteries; and two CAT C18 gensets. The powertrain is topped off by a pair of Schottel SRP 210 azimuthing thrusters, enabling 360° steering, and the ferry boasts sufficient tankage for approximately 24,225litres of diesel fuel.

Regarding the hybrid propulsion system, Turner elaborates: "When TGI determined it was interested in pursuing the Siemens system, we were initially looking at the BlueDrive PlusC. We didn't get so far with it to really appreciate the challenges the BlueDrive would present with space allocation, but the batteries were going to require an increase in hull depth.

"When Siemens presented as an option the BlueDrive Eco, the battery stacks got shorter, which solved that issue. We did an initial layout of the various cabinets in the machinery space, demonstrating everything would fit – and then, in detail design, Conrad Shipyard shuffled things around to make things work better." Related to space allocation was cable routing – *Harbor Charger* relies on a significant 23,000kg of internal cabling – which merited "a more front-loaded effort than has been

necessary in the past", as well as the prudent use of 3D ship modelling software, Turner adds.

Shoreside boost

To enable recharging, TGI, supported by US$7.5 million of funding from the US Federal Transit Administration, plans to install shoreside charging facilities at Soissons Landing on Governors Island (plans to create a similar shoreside charger within New York Harbor have been suggested, but remain unconfirmed at the time of going to press). Once installed, shoreside charging will permit *Harbor Charger* to run on battery power all day, taking on a rapid recharge each time the vessel docks on Governors Island.

The 58m, steel ferry draws on a combination of CAT diesel gensets and Siemens BlueVault battery packs

TGI forecasts that the vessel operating in battery-assisted hybrid mode could reduce CO_2 emissions by nearly 600tonnes annually. However, once the shoreside charger is up and running at Soissons Landing, the ferry's operations could cut emissions by an additional 800tonnes per year.

Turner continues: "The generators on board allow the vessel to operate in a hybrid mode until the shore charging is installed. The generators, which were also used for the delivery trip, will be used for periodic travel to shipyards, and are available in the case of shoreside power loss." *Harbor Charger*'s resultant cruising speed is 12knots – reportedly making this hybrid vessel 66% faster than TGI's current ferries, on average.

TECHNICAL PARTICULARS

HARBOR CHARGER

Length	58m
Breadth	19m (approx.)
Depth, hull	4m
Design draught	2.59m
Main engines	2 x CAT 18
Propulsion	2 x Schottel SRP 210
Batteries	2 x Siemens BlueVault, 435kW each
Passengers	1,200 (approx.) / 600 with a vehicle capacity of 200LT / 30 vehicles
Crew	5-8 min, depending on number of passengers
Service speed	12knots
Classification / notations	US Coast Guard Subchapter K (for small passenger vessels)

Steel build

The new ferry has been built in steel, and features a full displacement hull divided into seven watertight compartments, with the engine room located amidships. "Crew can move securely from the engine room to the pilothouse, while passengers have two lounges, each with a WC, along with outdoor viewing areas on both the main and first decks," says Turner, adding: "Although the second deck exterior is part of the vessel's designated refuge space, it will not be open for regular passenger use."

Although *Harbor Charger* represents EBDG's first fully realised hybrid-electric newbuild, it is unlikely to be the group's last. "Most of our designs are one-of-a-kind and I expect that will be the case here as well," says Turner. "If Governors Island develops to the point where a second vehicle-capable ferry is needed, however, we would welcome the opportunity to partner with TGI again.

"In that scenario, TGI's requirements would likely call for a vessel with different capabilities. We often joke that much of our work feels like building prototypes – and in many ways, it truly is."

EBDG also provided the design for three new hybrid-electric ferries for Washington State Ferries, soon to enter the construction phase at Eastern Shipbuilding in Florida, the first of which is earmarked for delivery in 2029. "We also have three other designs at different stages, from concept to out-for-bid," Turner says. From a naval architectural perspective, this involvement and accumulated expertise in hybrid-electric ship design led to EBDG providing advice to teams that entered the Worldwide Ferry Safety Association's 10th annual student design competition, whch ran from 2022-2023, and specifically called for an electric powertrain for a proposed ferry for the Pasig River in Manila (see *Ship & Boat International* September/October 2022). ■

HYBRID, BUT HIGH-SPEED

Australia's Incat Tasmania is in the process of delivering an extensive all-aluminium fast ferry building programme, with a focus on electric and hybrid designs. **Clive Woodbridge** reports

Hull 096, the world's largest electric ferry, on the water at Incat's Hobart shipyard as construction nears completion

Incat Tasmania is consolidating its position as one of the world's leading builders of high-speed ferries, with five large aluminium vessels, all featuring highly sustainable designs, in production at its Hobart shipyard.

Work is at an advanced stage on Hull 096, which is claimed to be the world's largest battery-powered electric ferry. Commissioned by Buquebus, the 130m-long aluminium catamaran, which has the provisional operating name of *China Zorrilla*, is designed to carry 2,100 passengers and 225 vehicles across the River Plate between Argentina and Uruguay.

With a 40MW energy storage system (ESS) comprising more than 250tonnes of batteries, Hull 096 is said by Incat Tasmania to have quadruple the battery capacity of any existing ship operating worldwide. The ESS, supplied by Wärtsilä, is connected to eight electric-driven waterjets. Following the launch of the vessel in May this year, the yard has been working to complete the interior fit-out and install the battery system. Once fully equipped, Hull 096 will undergo sea trials in Hobart's River Derwent later this year, prior to delivery to Buquebus in early 2026.

Work is also gathering pace on Hull 100 and Hull 101, a pair of 78m ferries capable of operating in fully electric or hybrid modes, to meet a range of different service requirements. The first of these two vessels is on track to enter service for a Northern Hemisphere client in the first half of 2026.

Key specifications of this design include: ESS sizing up to 12MW; a top speed of 27knots; capacity for 600 passengers; flexible vehicle deck configurations, including optional mezzanine decks; and two 230kW bow thrusters designed to deliver high levels of manoeuvrability.

Incat Tasmania views the new 78m series as being the ideal size to replace the first generation of high-speed craft, some of which are now approaching 35 years in service. Their introduction is also part of the yard's broader strategy to deliver multiple smaller, electrically powered vessels every year. The sister ship to the inaugural vessel in the series is also in the production pipeline, the yard reports, and could be available in early 2027.

Capacity expansion

Incat Tasmania was also recently contracted to build two 129m battery-powered electric ferries for Molslinjen of Denmark. The vessels, which feature 45MWh battery systems, will operate on the Kattegat route between Jutland and Zealand. Early-stage construction of the vessels will begin in the coming months, with delivery of the first vessel scheduled in late 2027.

Work is now underway at Incat Tasmania's facility on Hull 100, a 78m-long hybrid fast ferry

Once operational, the ferries will each carry up to 1,483 passengers and 500 cars, operating at speeds over 40knots. The propulsion system consists of eight Wärtsilä WXJ 1100 waterjets, powered by eight electric motors. Wärtsilä's scope of supply further includes the DC power conversion system, and energy management and automation systems, as well as its Protouch propulsion control systems.

The builder is currently scaling up its workforce and expanding its shipyard capacity to meet growing demand for electrically powered ferries and to sustain this momentum in the years to come. Incat Tasmania chairman Robert Clifford says: "With multiple vessels under construction and a strong pipeline ahead, we are positioning ourselves to deliver several sustainable, commercially viable aluminium ferries each year to international operators. Our build programme demonstrates how aluminium shipbuilding can achieve zero-emission goals without compromising speed, reliability, capacity or commercial viability." ■

ELECTRIC EXPORTS

Meanwhile, Incat Crowther has supplied the designs for electric ferry newbuilds for Spain and Tanzania, writes **Clive Woodbridge**

Underlining Australia's strong position within the fast ferry segment, two new all-electric ro-pax fast ferries, designed by New South Wales-based Incat Crowther, will be built at Astilleros Armon's Gijón shipyard for operation by Spanish shipping company Baleària.

The new vessels, *Espana 2030* and *Maroc 2030*, will connect Tarifa in Spain with Tangier in Morocco, with operations expected to commence in 2027. Both will feature an electric power capacity of 16MW with four electric propulsion units powered by 11,500kWh-capacity batteries. Each ship will have the ability to transport up to 804 passengers and 225 vehicles at a maximum speed of 26knots, and will also have four diesel back-up generators, with a total capacity of 11,200kW.

Robotic charging

Charging will be carried out by two autonomous robotic arms installed in each port, which will be connected to the ship via an onshore power system (OPS) connection. Each vessel will be capable of recharging the energy needed for the route in just 40 minutes. The design also features a T-foil system to dampen vertical movement, two bow thrusters and four rudders. The ferries will also have two stern ramps, to optimise operations and manoeuvres in port.

Incat Crowther also designed the recently launched *Kilimanjaro IX*, a 53m fast ferry for Azam Marine, built at the AFAI Southern Shipyard in Guangzhou. The vessel is the 12th high-speed ferry designed by Incat Crowther for the Tanzanian operator and will service Azam Marine's routes to and from Dar-es-Salaam on the Tanzanian mainland and the islands of Zanzibar, Pemba and Tanga. Capable of transporting 679 passengers at speeds of up to 37knots, *Kilimanjaro IX* will undergo sea trials in late 2025 and enter service in early 2026. ■

***Kilimanjaro IX* is scheduled to enter service in early 2026**

INDIA TURNS THE CAMERAS ON

India's new CCTV rule coud see situational awareness systems become a mandatory requirement globally, writes **Patrik Wheater**

India has become one of the first maritime nations to introduce new rules requiring merchant ships to carry closed-circuit television (CCTV) systems as a way of improving navigational safety, reducing man overboard (MOB) fatalities and optimising accident investigations. The mandate, issued in February by the Directorate General of Shipping, applies to Indian-flagged vessels and to foreign ships engaged in coastal trade under a Specific Period Licence, although foreign-flagged ships are only "encouraged", not compelled, to comply.

The ruling was prompted by a pattern of accidents and MOB fatalities in which investigators struggled to reconstruct events, including the Singapore-flagged *Wan Hai 503*, which caught fire off Kerala. Four crew were reported missing and not found alive. Another incident resulted in *MSC Elsa 3* sinking offshore Kochi with hazardous cargo in its holds, threatening a spill but leaving few clues as to how the vessel was lost. Both incidents exposed how the absence of onboard surveillance delayed search and rescue and hampered investigators.

For Indian-flagged vessels, the rules require high-definition cameras capable of capturing images at 30 frames per second, with wide dynamic range to cope with glare and shadow. On exposed decks, housings must be weather-proofed to at least IP66, while tankers must use intrinsically safe models to prevent sparks in hazardous zones. Installations are expected to withstand vibration, corrosion and temperature extremes, complying with international surveillance standards such as IEC 62676. Every ship must carry at least one monitoring station, usually on the bridge, cargo control room or in a secure muster area, where feeds can be switched and reviewed. Recordings must be kept for a minimum of 14 days.

Vessels between 500gt and 3,000gt are required to install a minimum of four cameras, increasing to six for ships between 3,000gt and 5,000gt. Eight cameras are required for 10,000gt ships and 12 for larger tonnage. Newbuilds must be delivered with CCTV already fitted, while existing Indian-flagged ships and foreign-flag vessels licensed for Indian coastal trade (SPL) must comply by 12 February 2028 or at their next renewal survey, whichever comes later.

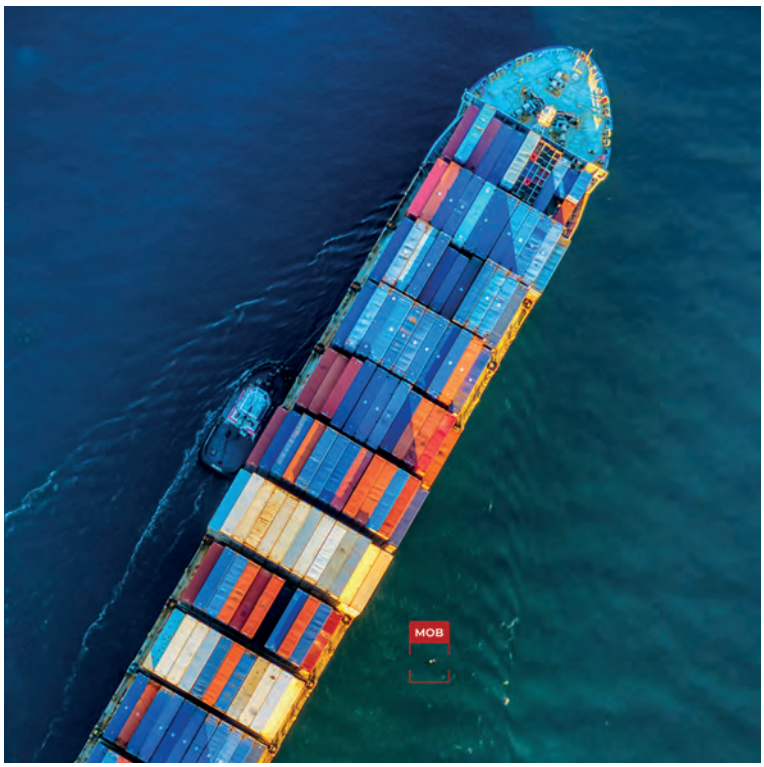
Privacy concerns

While cameras on board can improve safety by providing instant confirmation of MOB incidents – improving rescue response times, and giving bridge teams and investigators a visual record of a collision, fire or security threat – not everyone is comfortable with the prospect.

Seafarer groups have voiced concerns about surveillance extending into accommodation areas, arguing it risks eroding privacy and morale. Even though surveillance can protect seafarers and employers by providing evidence in disputes over injuries or alleged misconduct, the International Transport Workers' Federation (ITF) has warned that indiscriminate monitoring can leave crews feeling "watched rather than supported."

The Indian rule, however, endeavours to mitigate these concerns by confining mandatory coverage to operational zones and requiring signage in common areas, but the debate underscores the need to draw clear lines between legitimate safety monitoring and intrusive surveillance.

For shipowners and shipyards, faced with the prospect of the



Cameras on board can improve safety by providing instant confirmation of MOB incidents – improving rescue response times

Indian initiative being swiftly adopted by other nation states, there are practical challenges in retrofitting their fleets. Running cables through older hulls, ensuring data storage is cyber-secure and finding space for monitors takes time and money. Costs can vary widely, but industry figures suggest sums from tens of thousands of dollars for small ships to six-figure investments for large tankers and container vessels. But the investment could also provide another level of protection, given P&I clubs have already pointed out that video evidence can cut through disputes, defend against fraudulent claims and shorten the path to settlement.

Today's offerings

Technology companies are responding with systems that not only record but also actively reduce navigational, safety and security risks. UK-based Zelim has its AI-based ZOE platform and cameras installed on a number of passenger, merchant and offshore vessels. So too has Orca AI's SeaPod digital lookout system, which combines video with radar and AIS to highlight potential risks earlier than bridge lookouts might spot them.

Thermal imaging technology, pioneered by companies such as FLIR, adds visibility in darkness and fog, enhancing both navigation safety and MOB detection. Tecnovideo's explosion-proof housings, meanwhile, make it possible for cameras to be placed close to cargo tanks or other hazardous areas, while Zenitel integrates CCTV with public-address and comms systems to ensure that warnings reach crews instantly.

Bosch, Axis and Pelco, long-standing names in industrial surveillance, are also marketing advanced camera technologies capable of withstanding marine conditions. Hanwha Vision, formerly Samsung Techwin, has introduced ruggedised PTZ and thermal units aimed at offshore operators, while Honeywell continues to adapt its oil and gas video systems for marine customers.

Voluntary adoption is already happening outside India. Several major owners have trialled camera and AI systems to improve bridge safety. Ambassador Cruise Lines has installed Zelim's ZOE system (see *The Naval Architect* June 2025); Nippon Yusen Kabushiki Kaisha (NYK) Group has confirmed it will install the Orca AI platform across its fleet following two years of collaboration; and Boston-based Sea Machines Robotics signed a contract with A.P. Moller-Maersk in April to trial its situational awareness technology aboard the newbuild boxship *Winter Palace*.

European terminals have begun to require CCTV coverage of mooring stations to reduce injuries, creating ***de facto*** obligations for visiting ships. Insurers are exploring incentives for fleets that can provide video evidence in casualty investigations. All suggest a trend that is moving in India's direction, even without a binding international rule.

Indeed, Seaspan, one of the world's largest containership operators, credits Orca's technology with "improving safety culture and vessel performance and giving crews and officers on board better tools to operate their vessels safely". Seaspan COO Torsten Holst Pedersen said in March that the collaboration with Orca "leverages AI to deliver enhanced performance, sustainability and safety."

India: global template?

While AI-based situational awareness systems are by and large still new to the industry, the technology is becoming more readily available and is proven to help reduce collisions and MOB fatalities.

According to a 2020 study published in the *Journal of Marine Science and Engineering* (JMSE), Katsamenis, I, *et al*. found that thermal infrared camera technology combined with RGB imagery improves detection of a person falling overboard, even in poor visibility, significantly improving detection time, increasing survival rates and reducing false positives.

A University of Portsmouth team found that fusing camera feeds with AIS data increases the accuracy of vessel detection, particularly in poor visibility. And more recent projects have introduced benchmark datasets to train AI systems specifically for maritime rescue scenarios. Reviews of electro-optical sensors confirm that cameras add critical situational awareness when combined with radar and satellite tracking.

India is not the only country to experiment with compulsory surveillance, though it is the first to apply such standards across its merchant fleet. The EU has adopted remote electronic monitoring, including cameras, for some high-risk fishing vessels to enforce landing rules. Panama has introduced electronic monitoring programmes that include onboard cameras for transshipment. In the US, lawmakers have debated camera use in the Jones Act fleet to address misconduct cases. And Australia has sharpened its regulatory focus on mooring safety, though has not mandated CCTV. None match India's requirement for frame rates, storage times and precise coverage zones.

Internationally, IMO has yet to make situational awareness technology a mandatory requirement. It does of course have CCTV rules for passenger vessel car decks (fire), and the ISPS Code has security monitoring rules but stops short of prescribing whole ship systems. That said, IMO often begins with guidelines and recommended practices, then moves towards amendments to SOLAS or the ISPS Code when consensus builds. If India's model delivers measurable improvements, it could become the template for global adoption. ■

FROM CAMERA TO KILLING MACHINE

Drone technology is forcing a rethink across the maritime sector when it comes to securing vessels against attack, writes **Patrik Wheater**

The threat posed to global maritime trade by rogue states and terrorists has not changed much over the past 10 years, but the tools they use have. Mines, missiles, IED-ladened skiffs and RIBs are being replaced by drones – and, in little over three years, the drone has evolved from a flying camera used to take ship pics into a mass-produced, inexpensive killing machine.

The first time a drone was used to target shipping was in July 2021 when the tanker *Mercer Street*, managed by an Israeli-linked company, was struck off Oman by an unmanned aerial vehicle (UAV), killing two members of crew. A year later, Ukrainian forces were modifying jet skis into remote-controlled surface drones, packing them with explosives and steering them towards Russian naval targets. By late 2023, most of the attacks on ships in the Red Sea, especially round the Gulf of Aden, used drones.

Houthi rebels used drones alongside missiles in a string of attacks, including in the 2023 hijacking and seizure of the car carrier *Galaxy Leader*. In the same year, the product tanker *Swan Atlantic* was hit in the southern Red Sea, with a drone approaching from astern and damaging a freshwater tank. In April 2024 containership *MSC Orion* was targeted by a HESA Shahed 136 drone in the western Indian Ocean, and in July 2025 the bulker *Magic Sea* was damaged in a combined attack using drones and remote-controlled boats before being boarded and abandoned.

For Fredrik Preiholt, senior analyst at the Norwegian War Risk Club (DNK), these incidents indicate a shift in method rather than motive. "It is a new tool, not a new threat," he says. "The actors who use drones against shipping have always targeted shipping. If they didn't have drones they would have used something else. The danger is that drones are cheap, easy to access and increasingly reliable."

Drone types

There are typically two types of drones: airborne UAVs and unmanned surface vehicles (USVs), which are essentially remote-controlled boats adapted from commercial jet skis or speedboats. UAVs are usually used for surveillance and intelligence-gathering purposes, to assess target suitability for attack, but they can be developed, according to Preiholt, as "one-way kamikaze drones".

At their crudest, commercial quadcopter drones have been adapted to drop grenades or mortar rounds. At their most sophisticated, Iranian-made Shahed drones, which cost between US$20,000-40,000 each, are now widely used by Russia in Ukraine and supplied to Houthis in Yemen. But crude line-of-sight USVs, such as speedboats packed with explosives, are also being used to target ships. These waterborne IEDs are the main weapon against merchant vessels navigating the Red Sea and Indian Ocean.

Ukrainians have also used jet-ski-based USVs to defend commercial shipping from Russian attack. For example, in September 2022 it was reported that a Ukrainian USV washed up near Sevastopol after a malfunction, its hull packed with explosives and a Starlink antenna.

"Houthi USVs are limited to line-of-sight control," says Preiholt. "But the Ukrainian designs, with Starlink communication links and better payloads, are closer to cruise missiles."

Although drone attacks are relatively new, agitators and terrorists can block important shipping lanes, disrupt global trade, cause terror and sink a US$100 million asset for as little as US$10,0000. By contrast, a guided missile can cost north of US$500,000. The drone has resulted in sea traffic around the Red Sea dropping by half since 2023, according to DNK analysis.

In the Black Sea, meanwhile, Ukrainian grain and fertiliser exports continue under constant risk of a drone attack, with most vessels switching off their AIS transponders. Tanker captains have reported drones buzzing around off the Syrian coast, and UAVs have been seen near LNG terminals in the Baltic as part of intimidation tactics.

Iranian-made Shahed drones, which cost between US$20,000-40,000 each, are now widely used by Russia in Ukraine and supplied to Houthis in Yemen

The tanker *Mercer Street* (now named *Spring Street*), was struck off Oman by a drone in July 2021 (source: Roland Delhaxhe, Marine Traffic)

"There is a psychological effect, but missiles are actually scarier because they come with no warning," says Preiholt. "With drones, you at least see them coming, which gives you a chance to react. But the sight of a UAV circling overhead has a clear effect on crew morale."

Counter-solutions

For DNK, which insures some 3,500 ships in the Norwegian fleet, the role is to provide intelligence and analysis rather than prescribe defences. "Good affiliation checks can help establish if the vessel is likely to be on any potential target list, and access to reliable intelligence is more important than expensive defensive technology," Preiholt explains, going on to advocate employing private security companies.

Technology companies are, however, developing technologies to counter the threat. Rheinmetall in Germany and Elbit Systems in Israel are testing directed-energy weapons and drone decoy systems. The Israeli Navy has already trialled its Iron Beam system, and scaled-down versions are being pitched to commercial operators.

UK-based MARSS Group is pushing its NiDAR Counter Unmanned Aerial System (CUAS), which integrates radar, cameras and jammers and has already been installed on a 120m yacht and its 70m support vessel. QinetiQ in the UK and Dedrone in the US are also offering modular detection and jamming systems, while DroneShield and Hensoldt have unveiled a range of portable and fixed detect-and-disable solutions.

Risk assessments

The insurance market has had to adjust to tools and systems used to disrupt shipping. For instance, war risk premiums for Red Sea passages surged between 2023 and early 2024, compelling the Lloyd's Market Association to start drafting clauses that explicitly list UAVs as a "named peril". Additionally, P&I clubs such as Norway's Gard are offering premium incentives for owners who invest in counter-drone technologies.

The UK Department for Transport (DfT), meanwhile, has warned shipowners to take the drone threat seriously and published guidance on how to assess and mitigate the risk and decide whether counter-drone systems are appropriate. The 2024 guidance covers drones under 20kg, the class most often adapted for surveillance or attack, as well as weaponised loitering munitions such as the Shahed series seen in Ukraine and the Red Sea.

The DfT urges companies to carry out a vulnerability assessment to better understand how a drone might be used against a ship. The guidance also reviews technologies currently on the market, including radar, optical sensors, acoustic detectors, RF jammers and directed-energy systems, but stresses that each has limits. Radar may miss small low-flying drones or interfere with existing ship radars. And jamming is tightly controlled under the UK Wireless Telegraphy Act, meaning most commercial operators cannot legally deploy such equipment without a licence.

Operators are advised to weigh costs carefully and ensure any counter-UAS equipment delivers a net benefit. The DfT stops short of prescribing specific systems, instead warning against "over-reliance on expensive technical measures" without parallel investment in crew training and operational readiness.

The document marks the UK's first attempt to codify a response to the aerial drone threat at sea, and signals that regulators expect shipowners to engage with the problem now rather than wait for an incident. Still in its infancy, analysts warn of a maritime future where swarms of autonomous drones coordinate attacks without human input, or UAVs pair with cyber intrusion technology and deepfake Mayday calls to confuse crews. Unmanned underwater vehicles (UUVs), not yet part of the threat picture for shipping, are another emergent threat. ■

The DfT guidance can be read at: https://www.gov.uk/government/publications/countering-drone-threats-to-shipping/countering-drone-threats-to-shipping

MANAGING THE CYBERATTACK

Cyber risk management moved from guidance to mandatory requirements this year, writes **Patrik Wheater**

Maritime cyber risk management moved from guidelines and best practice to tangible rules this year, with regulators in the US, the EU and beyond moving to mandatory requirements. Class societies have tightened their cyber rules for newbuilds, and charterers, insurers and P&I clubs want proof that IT and OT systems are resilient to hacks.

"Cyber risks should be appropriately addressed in safety management systems," stated IMO in its revised Guidelines on Maritime Cyber Risk Management (MSC-FAL.1/Circ.3/Rev.3), issued in April 2025. The revision means that cyber risk mitigation is now an integral part of a ship's safety management system, and shipowners must now ensure that cybersecurity is embedded into their ISM and ISPS frameworks.

While the IMO requirement is extensive, the most prescriptive requirements come from Washington, when the US Coast Guard introduced a minimum cybersecurity standard under the Maritime Transportation Security Act. The rule, which entered into force on 16 July 2025, mandates a designated cybersecurity officer, cyber training, incident reporting to the National Response Center, regular assessments and the integration of findings into a formal cybersecurity plan. By 2027, every ship calling at a US port will have to prove compliance.

The EU, too, has implemented rules, with the bloc implementing Regulation (EU) 2024/2690, stipulating measures on access control and patching and monitoring. And the UK has refreshed its 2017 Cyber Security Code of Practice for Ships, treating cyber as a "strategic risk".

Rules and developments

Aside from the introduction of new and revised rules, the industry continues to self-regulate. For example, OCIMF's newly updated Ship Inspection Report Programme, SIRE 2.0, now includes cybersecurity questions in its vessel inspection regime. OCIMF's Tanker Management and Self Assessment 3 (TMSA3) likewise obliges tanker owners to demonstrate policies, training and implementation of cyber controls.

Unusually, given the typical regulatory lag, maritime cyber rules are keeping pace with the developments and risks associated with IT-/OT-based systems. For instance, navigation, cargo handling, engine monitoring and dynamic positioning systems – all heavily reliant on integrated digital systems, connected via satellite – can increase the number of easy-to-penetrate access points for hackers to take control.

This was recognised in the NIST Cybersecurity Framework 2.0, published in 2024 and widely implemented by ship operators, largely because it now included a clause placing the onus on senior executives to take ownership and manage the cyber risk. Class societies have also adopted the NIST principle. IACS now enforces Unified Requirements E26 and E27 on cyber resilience of ships and onboard systems, mandating verified network segmentation, secure software update mechanisms and formal documentation across the supply chain.

Industry action

Speaking in May, at the 2025 Maritime Cybersecurity Summit, hosted by the Maritime Transportation System (MTS) Information Sharing and Analysis Center (ISAC), Michael DeVolld, director of maritime cybersecurity at ABS Consulting, said: "Between expanding attack surfaces and increasingly sophisticated threats, the stakes have never been higher. It is essential for the maritime industry to not only understand its cyber risk but also translate that knowledge to decisive action that protects lives, operations and assets." Heeding the call is offshore wind service vessel owner North Star, whose Vard-built *Grampian Kestrel* and *Grampian Eagle* last year became the world's first CSOVs to be built according to Lloyd's Register's Cyber Resilience certification.

For equipment suppliers, type approval against cyber standards is becoming essential. Danish manufacturer Danelec, for example, announced DNV cyber approval for its DM100 and DM100 (S) voyage data recorders solutions, demonstrating secure update mechanisms and hardened configurations in line with IACS UE E27 requirements. The company's new Onboard Insights platform, which gives crews real-time system performance data, also achieved DNV E27 Certification.

Bureau Veritas (BV) is also offering E27 type approval certificates to system providers and, in January 2025, confirmed Marlink's IoT data collection solution is compliant. Indeed, Marlink reported a rise in sophisticated attacks in its 2025 SOC report and has expanded its CyberGuard managed detection and response service.

Kongsberg is another OEM moving quickly to align its onboard systems with the new standards. The company secured BV type approval for its K-Chief marine automation platform and K-Safe safety and control system, both verified against IACS UR E27 requirements. For owners, this means critical control functions can now be specified with built-in cyber resilience, reducing the compliance burden at vessel level. The move reflects a broader trend among suppliers to ensure products are "secure by design," with class-approved protections such as verified software updates, encrypted communications and hardened configurations. ■

DRY DOCK TRAINING 2025

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DM Consulting is the world leader in dry dock training. Past participants have included representatives of shipyards, engineering companies, consulting firms, ship owners, and government agencies from six continents. The course has accreditation with both the Society of Naval Architects and Marine Engineers and The Royal Institution of Naval Architects. Both experienced and inexperienced dry dock personnel have benefited from attending the training, and over 75 per cent of all course attendees rate the course as excellent.

Due to high demand, this edition returns for the second time this year, now in an online format, giving the global network of members the opportunity to take part.

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THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

NAVIGATING THE CYBERSECURITY THREAT LANDSCAPE

The challenge of dealing with maritime cyberattacks is growing, but technical and operational solutions are available, a seminar hosted during London International Shipping Week heard

Ageing technologies, jamming and spoofing and a wider range of tech infrastructure vulnerabilities all came under the spotlight during the *Navigating the Future: Maritime Cyber Defence & Risk Intelligence* seminar, co-hosted by maritime security specialist Dryad Global and law firm Norton Rose Fulbright during London International Shipping Week 2025.

The event comprised two panel discussions – one looking at current threats, the other assessing emerging solutions – and highlighted not just how rapidly the maritime threat landscape is evolving, but how vital it is for the maritime sector to adapt with resilience and foresight. According to the event facilitator, Dryad Global CEO Corey Ranslem: "We know these are not theoretical risks. They are live, urgent and demand a layered, strategic response."

Key messages from the event included the fact that cyber threats are increasingly the first line of attack, with both state and non-state actors targeting infrastructure and fleet operations; vessels are still running legacy operating systems such as Windows XP, which present serious vulnerabilities; global supply chain dependencies mean that one disruption – such as a vessel stalled as a result of a cyberattack in the Suez Canal – could cascade into having a worldwide economic impact; and that legal, regulatory, environmental and cyber compliance issues are converging, meaning that, for shipowners and operators, anticipating and adapting to evolving cybersecurity rules globally is now essential.

Lord Mountevans, MSAG (with mic), welcomed the fact that the UK Royal Navy now has specialised undersea protection capabilities

"Great vulnerabilities"

The first panel of the event assessed the 2025 maritime threat picture and featured Lord Jeffrey Mountevans, chair of the Maritime Security Advisory Group (MSAG) and a former Lord Mayor of London, who described cyberattacks as a "growing problem internationally, with shipping being a sector with great vulnerabilities".

MSAG has, he said, raised concerns with both government and business, and was gaining traction. He noted there has been a profound change in the geopolitical landscape, with fewer state and non-state actors prepared to abide by the 'old rules'. He welcomed the fact that the UK Royal Navy now has specialised undersea protection capabilities, as well as a greater ability to protect crucial shore-based infrastructure against cyberattacks, reflecting the particular challenges the UK faces as an island nation.

Phil Davies, senior systems engineer at Arctic Wolf, suggested that the maritime sector was well behind others in terms of cyber protection, even though cyberattacks are predicted to become the biggest threat faced by shipowners and operators over the next few years. Davis said: "Both state and non-state actors are starting to target maritime more than in the past, as they see it as a sector that has more weaknesses."

Speakers on this panel also highlighted the need for shipowners and operators to view the problem not just in terms of threats to individual vessels, but to the entire supply chain. The costly disruption recently faced by Jaguar Land Rover, which was hit by a cyberattack in August-September this year, was cited as an example of how problems in one part of a supply chain can have knock-on effects in others, including shipping and logistics. Ranslem added: "Shipping companies need to assess the threat to their wider supply chains and identify vulnerabilities not just within their own organisations, but within the companies they work with."

Also speaking on this panel, Philip Roche, partner at Norton Rose Fulbright, pointed out that stronger regulatory focus on cybersecurity is necessary, but that the evolving regulatory situation could also hold up progress in the maritime sector.

Corey Ranslem, Dryad Global CEO (foreground): "[These risks] are live, urgent and demand a layered, strategic response"

"Companies are worrying about implementing measures that could be quickly overtaken by fresh initiatives from IMO, national governments and flag states," Roche cautioned.

Practical solutions

The second half of the seminar looked at practical solutions to the threats to resilience posed by cyberattacks. Jonathan Ball, partner (specialising in IP and technology disputes) at Norton Rose Fulbright, further highlighted the importance of increased levels of regulatory oversight coming from both the EU's NIS2 Directive and the UK's Cyber Security and Resilience Bill. Ball pointed out that big changes are on the way, with senior managers likely to be held personally liable if they fail to manage cyber threats effectively. This is particularly important as the UK shipping sector, which encompasses ports, shipping lines, logistics firms and related infrastructure, is classified as 'critical national infrastructure'.

Drew Jackson, a satellite communications specialist and director of operations at Ground Control, underlined the fact that the jamming and spoofing of navigational signals was becoming more prevalent, with state actors gaining more capabilities to disrupt shipping from the air, and even from space. "A lot of onboard systems depend on GNSS positioning and timing data to function," Jackson explained. "There is an urgent need to look at integrating alternative timing and navigational systems into bridge networks – which should be possible given the trend towards modular bridge systems – in order to flag up attacks and threats earlier."

The insurance industry's role in addressing the consequences of cyberattacks was set out by Tancred Lucy, vice president, Acrisure. Cyberattacks, he pointed out, can cause physical damage to the ship – through grounding, for example – but there is also a need to cover any ongoing business losses that might arise – for instance, while a vessel is out of service, being repaired. "The challenge is to create products for the maritime industry that reflect the specific threats and consequences that it faces," said Lucy. "We need to quickly develop products that are fit for purpose in a rapidly changing threat scenario."

Arctic Wolf's Davies, who also sat on the second panel, flagged up some of the challenges that arise from the fact that many shipping companies still use older technology, like Windows XP, that is considered inappropriate in other sectors due to security concerns. This is largely because the cost of replacement is a major obstacle. Davies said: "We need to find a way of protecting older systems with a high level of efficacy given the nature of the threats we now face. It is not a question of simply starting afresh, but working out how to protect existing systems."

Ranslem suggested that regular audits from an outside, independent agency could be beneficial in this context. "There is no need to audit an entire fleet," he suggested, "but auditing a sample of vessels is a useful way of identifying things that can be put in place to protect existing systems."

Fast-changing landscape

A number of panelists highlighted the changed nature of onboard IT vulnerabilities post-COVID, with crew members increasingly demanding to be more connected and often bringing multiple devices with them onboard. This is making it more complex to ensure internal security and compliance with required procedures and regulations, it was suggested.

The regulatory context was further stressed, with regulators putting more focus on the need to use 'state-of-the-art' technologies. As Ball pointed out: "Shipowners and operators will soon have to start using AI and other advanced technologies as part of their cyberdefences, to ensure regulatory alignment. The contractual matrix with customers and other stakeholders is different but, even in this regard, the required standards are rising. Certainly, shipowners and operators cannot stand still, especially as the threat landscape is changing so fast."

Ball added: "Regulators, insurers and counterparties increasingly expect evidence of robust controls and governance. Contract terms, incident readiness and dispute-avoidance measures have to align with today's risk environment."

The Royal Institution of Naval Architects (RINA) is playing an increasingly important role in developing maritime cybersecurity, having established a Maritime Cybersecurity Task Force in the past year. The group aims to bring together RINA members with world-leading expertise, to share information and make cyberspace safer for everyone in the maritime environment. More information about RINA's initiatives in this context can be found in the August 2025 edition of *The Naval Architect*. ■

A COMMITMENT TO SPEED

Mark Barton sheds some light on the builder of Malcolm Campbell's world water speed record-breaking vessel *Bluebird* – Commander Peter Du Cane CBE (1901-1984)

The UK company that, alongside Thornycroft, was renowned for fast boats was Vospers. The two would eventually merge. While named after its founder Herbert Vosper, who concentrated on improving the engines, its designs are far more associated with Peter Du Cane, its MD from 1931 to 1963, who unusually retained his role as chief designer in the company while MD and was a Fellow of RINA (FRINA).

Having joined the Royal Navy as a cadet in 1914, Du Cane became an engineer and, eventually, senior engineer of the light cruiser HMS *Emerald*, before resigning as a commander in 1928. He then joined the Royal Auxiliary Air Force and learnt to fly privately, before being asked to join Vospers by a naval colleague, Commander Glen Kidstone. A year later, he found himself MD, having invested in the company following the death of Kidstone.

Du Cane changed the company's direction to the construction of high-speed vessels and introduced both stepped and unstepped planing hulls. The company had a rivalry with the nearby British Power Boat Company, and this made the area a hub of expertise, and drove development.

Bluebird and *Crusader*

From this, Du Cane worked closely with Sir Malcolm Campbell and built *Bluebird*, which took the world water speed record just one week before war was declared in 1939, with Bluebird reaching 141mph. During the war, he designed a high-speed torpedo boat, MTB 102, 350 of which were procured by the Royal Navy, and which were used extensively during D-Day. He also designed and produced many of the air-sea rescue launches, and the production of fast patrol boats continued after the war, with Du Cane responsible for the Bold, Gay and Brave classes during the late 1940s and 1950s.

Du Cane also returned to high-speed civilian power boats and worked for Donald Campbell's rival for the world water speed record, John Cobb, building *Crusader*. While *Crusader* achieved 207mph on its first run, on the return run it crashed and killed Cobb. Du Cane decided to never work on another such venture – but he did continue with high-speed yachts, being responsible as the naval architect and exterior designer for *Brave Challenger*, a superyacht with a top speed of 60knots (69mph), and the powerboats *Tramontana* and *Tramontana II*, with the former winning in the inaugural Cowes–Torquay race in 1961.

Peter Du Cane was also involved in designing vessels for the UK Royal Navy

An archive photo of Bluebird (image: Wikipedia)

In 1958, the company became a subsidiary, becoming owned by David Brown's in 1963 when Du Cane's role changed to be part of the bigger company, and then, in 1973, it merged with Thornycroft. ■

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