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# THE NAVAL ARCHITECT

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# AVOIDING UNPLANNED OBSOLESCENCE

By Richard Halfhide



DESIGN MAY PROVE THE CORNERSTONE OF SUCCESS WHEN IT COMES TO FUTURE-PROOF VESSELS. SOURCE: DELTAMARIN

If there's a prevailing theme within ship design discussion at the moment it seem to be the extent to which vessels ordered today can be future proofed against the emission regulations of tomorrow. In last month's edition of *TNA* we considered the concept for an MR tanker that could, at least theoretically, eventually be powered entirely by hydrogen reformed onboard the vessel. Approvals in Principle (AiP) for concept designs are, it's fair to suggest, awarded quite liberally by classification societies and don't necessarily confer much in the way of financial or technical viability of the final design. They do however make for eye-catching editorial, which is one reason why this publication and others are probably guilty of gravitating towards such announcements with a little too much eagerness.

But at the more pragmatic end of naval architecture the onus is on optimising today's solutions so they maximised efficiency to complement their operational profile, while simultaneously trying to ensure that the designs have enough built-in adaptability that it can be retrofitted for an alternative fuel later during its lifetime. Needless to say for shipowners it's an unenviable position but one they have no choice but to accept with the industry in unprecedented regulatory and technological flux. While it may be feasible to adopt retrospective measures such as speed reduction or the use of bio and synthetic fuels to reduce carbon intensity, the cost and effectiveness of such steps is simply too uncertain.

Speaking at roundtable event in March, Esa Jokoinen, sales and marketing director at Finnish naval architects Deltamarin, urged shipowners to invest more heavily on controllable factors such as hullform and performance optimisation. He also stressed the importance of fuel flexibility, meaning both prime movers that are capable or burning different fuels and also onboard containment systems that are versatile enough to handle those fuels as and when they are compelled to transition.

"If one desires to have true retrofitability, and readiness for future fuels, then all of these things will need to be taken into account during the design of the future. Doing them afterwards will be highly expensive," Jokoinen cautioned.

Cynically, I'm inclined to believe many owners are still more likely to hedge their bets, for the simple reason that they fear being put at a competitive disadvantage. It's one thing to pay a premium when everybody else is using the same fuel, quite another to have ordered a vessel equipped to run on Fuel X when your rival has opted for the cheaper and more available Fuel Y. Speaking as a child of the 1980's, I know the pain that arises when your parents opt for the (technically superior let quickly obsolete) Video 2000 format over VHS or Betamax – and here the stakes are considerably higher!

But even those bold enough to back innovation solutions could face an obstacle from the yards themselves. Andreas Enger, CEO of Höegh Autoliners, spoke of the challenges his company had experienced in finding a yard to build its multi-fuel and zero-carbon ready Aurora class PCTCs (a contract that was eventually awarded to China Merchants Heavy Industry (Jiangsu)), given the inherent conservatism of some shipbuilders in Asia who would sooner build series vessels. Enger also noted that during the past year there hasn't been a single PCTC order that isn't a repeat of a traditional design.

During the subsequent discussion it was suggested that this could create new opportunities for the European shipyards, who are more accustomed to building more customised or prototype vessels, be it offshore or cruise ships, not to mention a wealth of technical expertise. Granted, it might be a little optimistic to expect British shipbuilders to take a slice of this action, but the publication of the latest iteration of the UK Govt's National Shipbuilding Strategy and its renewed emphasis on the prospects for commercial shipbuilding in the UK (see p.14) suggests its dismissal as a 'sunset industry' may prove to have been premature. ■

## Correction

Due to an editorial error, an article published in the February 2022 edition of *The Naval Architect* – 'As Battery Packs Gain Popularity, Fire Risk Comes Under Spotlight', contained a number of inaccurate quotes concerning DNV's fire safety rules, notations and guidance. We apologise unreservedly to DNV for these errors and any confusion caused. A corrected version of the article can be found in the online edition of the magazine.



# NEWS

## COASTAL VESSELS

### CSL DELIVERS KICK-START TO INDIA'S SHORT-SEA SHIPPING SECTOR



*JSW MIHIRGUD, THE FIRST IN A SERIES OF FOUR 8,000DWT BULK CARRIERS*

"The vessel is tailor-made to suit the requirements of short-sea and river-sea operations," according to CSL.

Designed by SeaTech Solutions International in Singapore, the 8,000dwt, shallow-draft MGCS has an endurance of 1,200nm (2,222km), a cruising speed of 10knots, and is propelled by Wärtsilä 6L20 medium-speed engines in twin screw configuration, each capable of delivering 1,200kW and two auxiliary generating sets of 200kW rating.

The 122m-long vessel has a twin hold wide-hatch design and is intended primarily for the transportation of dry bulk cargoes such as coal, iron ore, dolomite and limestone. The hold has been strengthened to allow for the transportation of steel coils and steel plates.

"As the Indian government makes rapid strides towards the development of coastal shipping along its coastline of 7,500km, these CSL-built MGCS vessels are seen as a major milestone which will kick-start the country's short-sea shipping sector," the shipyard says.

Indian shipbuilder Cochin Shipyard Ltd (CSL) has delivered the fourth and final vessel in a series of mini-general cargo ships (MGCS) to JSW Shipping & Logistics. The *JSW Manikgad* is classed by the Indian Register of Shipping for river-sea navigation between Indian ports and is among the largest cargo ships in the short-sea shipping segment in India.

## AUTONOMOUS SHIPS

### CLASSNK ISSUES AIP FOR FULLY AUTONOMOUS SHIP FRAMEWORK

Japanese classification society ClassNK has granted approval in principle (AiP) for a fully autonomous ship framework (APEXS-auto) jointly developed by Nippon Yusen Kabushiki Kaisha (NYK), MTI, and Japan Marine Science.

APEXS-auto is a framework of the concept for realising a fully autonomous ship by automating a series of processes required for ship operation, including information gathering, analysis, planning, approval, and execution. It has been adopted in the fully autonomous ship demonstration conducted by the Designing the Future of Full Autonomous Ship (DFFAS) Consortium, which is participating in the 'Joint Technological Development Programme for the Demonstration of Fully Autonomous Ships' under the fully autonomous ship project "MEGURI2040" administered by the Nippon Foundation.

ClassNK has been involved in various demonstration projects to support the development and

implementation of automated and autonomous ship operation technologies from a safety perspective and has worked to establish the necessary safety standards.

In 2020, ClassNK issued the AiP for a crewed autonomous ship framework (development code APEXS) developed by NYK and MTI.

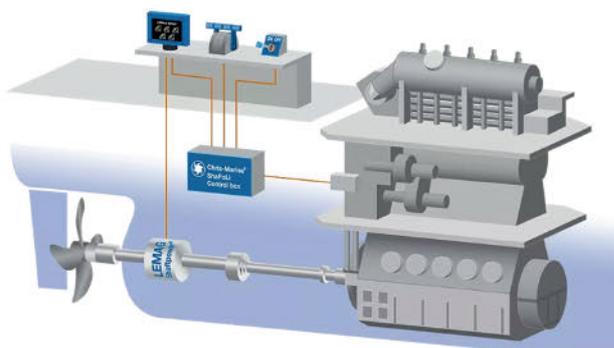
For the concept design of APEXS-auto, ClassNK has also conducted its safety review based on the requirements of the society's 'Guidelines for Automated/Autonomous Operation of Ships'. Having confirmed its compliance with the requirements, including clarification of basic elements comprising the concept of the system, risk assessments, and backup systems, ClassNK issued the AiP.

In collaboration with partners, ClassNK will continue to ensure the environment for applying automated and autonomous ship operation technologies by providing standards and technical verifications for advanced initiatives.



## EFFICIENCY

## SHAFT POWER LIMITATION SOLUTION FOR EEXI COMPLIANCE



Sweden's Chris-Marine has launched a shaft power limitation solution, ShaPoLi, to help shipowners to comply with Energy Efficiency Existing Ship Index (EEXI) regulations and monitor and optimise their ship Carbon Intensity Indicator (CII) ratings in the future.

From January 2023, the revised MARPOL Annex VI will enter into force and all existing ships of 400gt and above must comply with the new EEXI requirements.

Chris-Marine's ShaPoLi, which includes both hardware and software, looks to support this process by enabling

SHAPOLI ENABLES USERS TO LIMIT THE MAXIMUM SHAFT POWER OUTPUT OF THEIR VESSELS, WITHOUT HAVING TO MODIFY ANY OF THEIR EXISTING MACHINERY

shipowners to limit the maximum shaft power output of their vessels, without having to modify any of their existing machinery, thereby overcoming the tight implementation time frame of the EEXI requirements.

According to Chris-Martin, ShaPoLi will allow for real-time logging of power and speed data. In addition, it has an override function accessible through the command panel installed on the bridge, in case of emergencies.

"Chris-Marine has been in the frontline of the energy efficiency field for quite some time now and so far, supported our customers with close to 2,000 shaft power monitoring systems already installed onboard ships worldwide," says Björn-Thorben Porep, technical sales team leader at Chris-Marine. "We are currently engaged in serious discussions with the classification societies to get approval of our technology, a technology that will help our customers not only to comply with EEXI, but to monitor and optimise their ship CII ratings in the future."

## SAFETY

## BUREAU VERITAS ADDRESSES SAFETY OF FUEL CELLS ON SHIPS



BV'S NEW RULE NOTE NR 547 COVERS SAFETY REQUIREMENTS FOR SHIPS USING ANY TYPE OF FUEL CELL TECHNOLOGY

Class society Bureau Veritas (BV) has released a new rule note (NR 547) for ships using fuel cells which provides rules for the arrangement and installation of fuel cell power systems and the delivery of electrical energy.

The note outlines requirements on the design, construction and installation of fuel cells systems to ensure that the safety of the ship is maintained. According to BV, the aim is to identify and mitigate risks to persons onboard, the environment and the structural integrity of

vessels. Fuel cell systems and ship design must limit the risk of explosions, the spread of toxic chemicals and fire outbreaks, it says.

Among the requirements outlined by NR 547, maritime stakeholders developing and using fuel cells must carefully assess the risks associated with their design, from construction to installation and operation. Shipyards and equipment manufacturers have to meet specific safety requirements to earn certification for fuel cell systems. Once fuel cells are integrated onboard, ship operators must safeguard crew and ensure proper handling of fuel cell equipment.

In addition to covering fuel cells using hydrogen, the note addresses fuel cell technologies that are adapted to multiple alternative fuel types, each with their own risk profile. NR 547 is used in conjunction with several other rule notes to address other alternative fuels, including ammonia, methane, LPG, methanol and ethanol.

"For practical purposes, NR547 is therefore to be combined with other Bureau Veritas rule notes, including NR 670 for methanol and ethanol, NR 529 for methane, NI647 for LPG, and NR 671 for ammonia," says BV.



# NEWS ANALYSIS

## NEW FUELS AND PROPULSION SYSTEMS SPARKING INTEREST

By **Malcolm Latache**, Correspondent

Events in Ukraine continue to impact the shipping industry as can be expected. The longer Russia's incursion into its neighbour has gone on, the more decisions have been taken that will doubtless continue to affect global trade for years rather than months.

Sanctions imposed on Russia by EU members, the US, UK and a number of other nations mean that in many ports Russian vessels are no longer welcomed and cargoes originating from or destined to Russia on other flag vessels may also be prohibited. In addition, Ukrainian ports are effectively closed to any vessels because of military activity. One crew member of a Bangladesh-owned vessel has been killed when the ship was in Odessa, while an Estonian ship outside the port was damaged by an explosion and sank (fortunately all crew members were rescued).

The impact on the bulk carrier sector will be significant, as between them Russia and Ukraine account for around one quarter of all grain shipments. Russia may be able to continue exports to states which are not applying sanctions, but Ukraine's 10% share of the world grain trade will be effectively curtailed until hostilities cease. The impact of the harvest in 2022 will likely be significant as normal life in the country is severely disrupted.

Container shipping, which had begun to recover from the port congestion around the globe, now faces the prospect of ports becoming snarled with Russia bound containers offloaded but unable to be transhipped. However, LNG carriers look set to be in high demand as European countries search for alternative sources.

Most of Russian LNG destined for Europe is carried by pipelines so any reduction in the amount delivered by that means will need to be replaced by cargoes shipped from other destinations. But there are obstacles to be overcome, not least the number of LNG carriers available and the lack of LNG sea terminals in Europe.

It has been suggested that to replace all Russian gas supplied to Europe would require a doubling of the LNG carrier fleet. In January this year, Lloyd's Register reported that the then current fleet of 610 ships in service and on order would be boosted by 85 newbuild vessels ordered in 2021. Along with orders placed in January, the LNG orderbook stood at 130 ships with a potential tripling of that number needed as other existing projects came to fruition.



EUROPE'S LNG SEA TERMINALS HAVE LIMITED AVAILABLE CAPACITY TO ABSORB EXTRA SUPPLY

It is therefore inconceivable that the requisite number of ships to be able to carry non-Russian LNG to Europe can be met in the near term. In addition, cargoes for new destinations for Russian LNG – primarily in Asia – will mostly be needed to be moved by sea, so even more ships will be needed. While Russia's recently completed Zvezda Shipyard might be expected to build some of the extra vessels in addition to those it already has under construction, the sanctions agreed so far could put supplies of essential equipment from the likes of Wärtsilä and gas containment specialist GTT in question. Similarly, the involvement of South Korean builders, who are supplying expertise and support, could be an issue.

Another impact that cannot be overlooked is that as Europe scrambles to replace Russian gas, where Germany and Austria are already warning of rationed energy supplies, the demand for LNG-fuelled newbuilds has not yet slowed. Operators with dual-fuel engines do at least have flexibility. With the differential between HSFO and LSFO now above US\$200 per tonne, owners that installed scrubbers are probably able to smile a little at their foresight.

Also making the news in March has been the fallout from P&O Ferries sacking of 800 sea staff without consultation or warning. While primarily a matter for UK authorities, if the tough talk by the UK government translates into action, it could be that the company will not be able to continue operations. Two ships have already been prevented from sailing, as the authorities considered the familiarisation processes for new agency staff flown in to take the place of UK seafarers to be inadequate. ■

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# NEWS EQUIPMENT

## LNG

### CONTAINERISED LNG SYSTEM RECEIVES BUREAU VERITAS APPROVAL

Marine Service GmbH, Germany, and Newport Shipping, UK, have received Approval in Principle (AIP) from Bureau Veritas (BV) for a jointly developed containerised LNG solution that provides an alternative to traditional LNG bunkering.

The 40ft ISO LNG Fuel Tank Container System is suitable for LNG-fuelled newbuildings and retrofits of container vessels.

The LNG fuel tank container is a class approved Type C LNG fuel tank in accordance with the IGF-code and



FROM LEFT: CHRISTIAN KRÄMER, MANAGING DIRECTOR, MARINE SERVICE GMBH, ROLF STIEFEL, MARINE CHIEF EXECUTIVE FOR CENTRAL EUROPE AND RUSSIA, BUREAU VERITAS, INGMAR LOGES, MANAGING DIRECTOR, NEWPORT SHIPPING

is based on German TÜV certified IMDG Container. The capacity of the tank is 31gt and approximately 33m<sup>3</sup> of LNG. The containers have a fail-safe dry quick coupling connection and are approved for loading in stacks of up to seven layers high. The stainless-steel double-walled tank is also vacuum insulated and has up to 80 days holding time.

The concept consists of container stowage on free deck in safe area. LNG piping and venting system as well as firefighting systems are integrated in the container cell guides structure. The gas handling room is arranged adjacent to the container storage and separated from the containers by a cofferdam and fire protection means, allowing to feed low pressure and high-pressure fuel gas systems for all known four-stroke and two-stroke dual-fuel engines.

Since LNG containers are portable, the total number of containers can be easily optimised based on the owners' requirements, according to Newport Shipping and Marine Service GmbH.

Ingmar Loges, managing director of Newport Shipping, says: "The global shipping industry faces unprecedented challenges as environmental regulations tighten. The shipping industry needs alternatives. The containerised LNG concept provides an answer to these challenges."

## COATINGS

### EVERGREEN CHOOSES NIPPON PAINT MARINE SYSTEMS FOR WORLD'S LARGEST CONTAINERSHIPS

*Ever Alot*, said to be the world's largest containership by TEU-carrying capacity, has floated out with Nippon Paint Marine antifouling and anti-corrosion systems protecting its 400m-long hull.

When delivered, the 24,000TEU class vessel will be the first of four new A-Class box ships set to join the Evergreen fleet from China's Hudong-Zhonghua Shipyard. Nippon Paint Marine is supplying coating systems to all four of the sisterships in an extensive scope of supply that includes the A-LF Sea antifouling system.

Steven Chang, director of Nippon Paint Marine (Taiwan), says: "With systems and components capable of reducing the operational impact on the marine environment being a key design requirement, the low friction A-LF Sea 150 was considered the only system capable of contributing to the owner's strict environmental sustainability goals."

Chang added that the super-efficient copper-silyl-acrylate



THE WORLD'S LARGEST CONTAINERSHIPS WILL FEATURE NIPPON PAINT MARINE COATING SYSTEMS

antifouling is proven to have a good fuel savings effect, largely through the use of Nippon Paint Marine's patented hydrophilic hydrogel technology, which has been verified to reduce frictional resistance considerably compared to other antifouling paints.

A-LF Sea 150 was applied to the hull during the construction of the *Ever Alot*. In total, Nippon Paint Marine supplied 20 different types of paint for multiple areas of the vessel. In addition to the antifouling system, the company also provided E-Marine anti-corrosion coatings for the hull, cargo holds and decks, and a NOA 60 HS system for the ship's ballast tanks.



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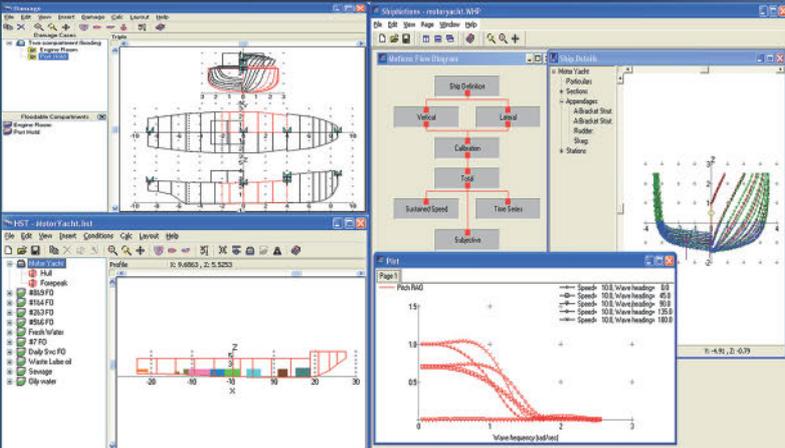
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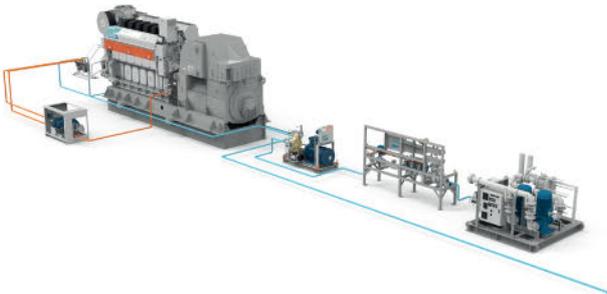
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## FUEL SUPPLY SYSTEMS

## WÄRTSILÄ INTRODUCES DEDICATED METHANOL FUEL SUPPLY SYSTEM



THE METHANOLPAC FUEL SUPPLY SYSTEM AND WÄRTSILÄ 32 METHANOL ENGINE COMPRISE A FULL SOLUTION FOR METHANOL IN MARINE APPLICATIONS

Finnish technology company Wärtsilä has developed a dedicated fuel supply system for methanol that, when combined with the recently introduced Wärtsilä 32 Methanol engine and the company's retrofit and system integration capabilities, enables the delivery of methanol-capable fuel and power systems across a wide range of vessel segments.

"MethanolPac will reassure shipowners who may not know where to turn for help designing their methanol fuel and power system," says Mathias Jansson, director, Fuel Gas

Supply Systems, Wärtsilä Marine Power. "Wärtsilä does not just provide the methanol engine, we have the systems and capabilities to help customers realise methanol-fuelled vessels in full."

MethanolPac includes both the low- and high-pressure parts of the fuel supply system as well as the related control and safety functions. This includes the high-pressure Methanol Fuel Pump Unit, low-pressure pump module, fuel valve train, bunkering stations and tank instrumentation.

The Wärtsilä 32 Methanol engine combines methanol fuel injection technology first developed for the converted Wärtsilä Z40 engines onboard ro-pax *Stena Germanica* in 2015.

Methanol fuel injection can also be retrofitted to any of the conventionally fuelled Wärtsilä 32 engines in operation. MethanolPac means that such retrofits can be dramatically simplified, with one supplier providing both engine and fuel supply system, according to Wärtsilä.

The Wärtsilä 32 Methanol is applicable either as a main engine or auxiliary generator on a wide range of vessel types from offshore support vessels to deep-sea merchant ships, the company says.

## TURBOCHARGERS

## ABB TURBOCHARGING DIGITAL SUITE HELPS SHIPS CUT FUEL CONSUMPTION

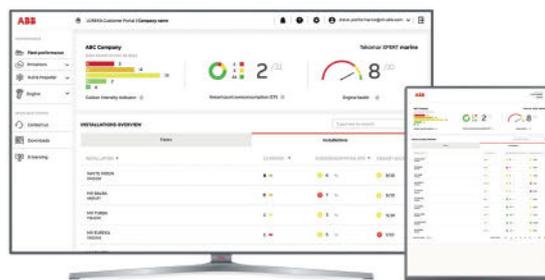
ABB Turbocharging has launched a new digital solution designed to offer shipowners simplified management of propulsion efficiency and emissions reporting, and potentially enable combined emission savings of up to 20%.

Tekomar XPERT marine comprises three modules covering the engine, hull and propeller, and emissions. Combined, these modules provide actionable insights into ship performance, based on which shipping companies can make better operating decisions, which lead to notable fuel savings, according to ABB Turbocharging. This, in turn, enables vessels to achieve improved Carbon Intensity Index (CII) ratings while charter party conformity on emissions reporting is also eased.

"Tekomar XPERT marine raises our digital offering to a new level by adding the hull and propeller, and emission modules to our engine room offering," says Cristian Corotto, vice president Digital Customer Solutions, ABB Turbocharging. "These combined analytics deliver real customer value through enabling greater efficiencies. For example, fuel savings of up to three tons per day can be achieved by optimising performance of the engines alone, which translates to some nine tons of CO<sub>2</sub> emissions per day."

Corotto adds: "Just as important is the system's delivery of information needed to support decision-making related to the optimal timing of cleaning events, and the identification of the root cause of reduced propulsion efficiency. Essentially, with Tekomar XPERT marine customers are ready for the next level of data-driven decision making."

Results of analyses from all the three modules are immediately available to shipowners and operators, and the solution can be integrated to work with existing data collection systems without the need for installing additional hardware.



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# BRITISH SHIPBUILDING

## BRINGING IT ALL BACK HOME?

By **Richard Halfhide**

In the early 1980s, in a letter published in the pages of this very magazine, Margaret Thatcher referred to shipbuilding in the UK as a sunset industry. At the time it was very difficult to dispute that; attempts to revitalise the fortunes of yards under the auspices of the public corporation British Shipbuilders were quickly unravelling. By the end of the decade those yards that hadn't closed completely were sold into private ownership and there was a reluctant acceptance, if not satisfaction, that British maritime was entering a post-industrial epoch.

Forty years on, the rhetoric of Boris Johnson couldn't be more different as he told an assembly of British maritime leaders in Whitehall about the government's plans to 'bring shipbuilding home' at the launch of the National Shipbuilding Strategy (NSbS) in March; a £4 billion Government procurement programme for the next 30 years.

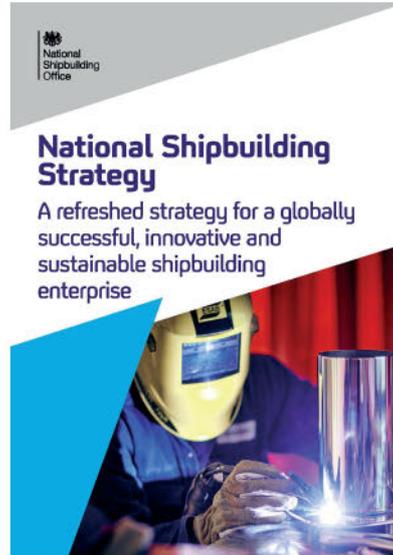
Officially, the whitepaper is billed as a 'refresh' of the 2017 strategy, but while remaining broadly under the purview of the Ministry of Defence (MoD) and retaining a strong focus on naval shipbuilding, the revised strategy is notable for giving significantly more attention to commercial shipbuilding and a closer collaboration with industry than its earlier incarnation. Moreover, the Prime Minister himself has made no secret of his desire to make the UK a green shipbuilding superpower.

Among the plans announced were a shipbuilding pipeline for more than 150 naval and civil vessels (including the much-publicised National Flagship, steel cutting for which is due to take place at the end of this year); a further government office for tackling shipping emissions (UK SHORE) with £206 million of funding, and a new UK Shipbuilding Skills Taskforce to address skills gaps. The government's own procurements are seen as providing a baseline level of security to promote industry investment in R&D, people and facilities, particularly with regard to the emerging markets created by green shipping.

### Expanded scope

The 2017 iteration of the strategy was heavily informed by a report by industrialist (and former RINA president) Sir John Parker. Those recommendations also included the formation of a new Industry-led Maritime Enterprise Working Group (MEWG) that would bring together industry, government and academia in addressing recommendations which fell outside the Navy's remit.

"An early realisation was that the NSbS was too limited in its scope as it was only considering naval warships. There were brief references to the civil side, but they were very brief," explains Peter French, former chief executive of BMT Group (also a past RINA president), who chaired the MEWG between 2017 and 2022.



THE 'REFRESH' OF THE 2017 WAS PUBLISHED IN MARCH

"One of the first things we undertook was a market evaluation and competitiveness study to identify sectors of the shipbuilding market, both naval and commercial, in which the UK capability is likely to be most competitive. The study provided an indication of the type of vessels that we were best suited to build, the areas of the market we should look into and the gaps in our competitiveness that would need to be addressed."

The MEWG would go on to make a series of recommendations to the government's Shipbuilding Tsar (the Secretary of State for Defence), which in turn led to MoD funding for a so-called Rich Picture exercise led by the MEWG, in effect a series of iterative workshops with industry stakeholders that coalesced into a shared vision for British maritime. This work in turn served as the basis for the refreshed NSbS.

French points to the creation of the National Shipbuilding Office (NSO), formally launched separately late last year, as a key demonstrator of the government's commitment to the strategy. Although housed within the MoD and reportable to the Shipbuilding Tsar, the NSO will eventually comprise 30 staff from an array of Governmental departments with an interest in shipbuilding.

In addition to the NSO, a new Maritime Capability Campaign Office (MCCO), accountable to the Department of Trade, will be tasked with targeting an estimated £600 million of expert opportunities over the next five years. A further body, the Shipbuilding Enterprise for Growth (SEG) has replaced the MEWG, but with a similar remit to engage closely with the industry and academia. It will be co-chaired by the NSO's CEO,

Rear Admiral Rex Cox, and John Howie, president of the Society of Maritime Industries.

### CoE's and clusters

Fostering research and innovation is a major tenet of the refreshed strategy. As part of its remit to improve the competitiveness of UK shipbuilding, the MEWG engaged Maritime Research and Innovation UK (MarRI-UK), the vehicle created to facilitate closer cooperation between UK industry and academia, to explore whether Centres of Excellence might be a means to improve productivity. Part of the SEG's work will be to identify those parts of the shipbuilding value chain where they could deliver the greatest benefits. It will also have responsibility for creating a model for the Shipyard of the Future, utilising advanced manufacturing technologies including robotics and digitally integrated with the broader supply chain.

Under the Government's Clean Maritime Plan, published in 2019, all new vessels ordered to operate in British waters from 2025 onwards are expected to have zero carbon emission propulsion 'capability', apropos achieving net zero emissions for the entire fleet by 2050. Unsurprisingly then, research into green shipping is a major focus, with many of the usual suspects among alternative fuels identified as possible pathways (although reference to nuclear power is conspicuously absent throughout the strategy).

Last year, it launched the Clean Maritime Demonstration Competition (CMDC), a one-year initiative with £23 million of funding for the design and development of zero emission technologies, an example being Dover Clean Ferry Power (see *TNA* Nov/Dec 2021). The NSbS notes that the competition was heavily oversubscribed and will be extended into a multi-year event. However, there is no detail on how much funding will be allocated nor the extent to which the Government will invest in these projects beyond initial studies.

Clustering of industry and academia in certain regions is considered a way of creating what the report describes as a "critical mass of expertise and skills". The Solent and South West regions, by way of example, are noted as hubs for autonomous technologies, while the Clyde region in central Scotland is noted in the strategy for its expertise in naval and civil shipbuilding and engineering.

### Skills gap

A persistent problem, one by no means restricted to British shores, is a lack of skilled labour, with the annual shortfall of STEM graduates and technicians estimated at around 59,000 per year, according to the Institute for Engineering and Technology. In collaboration with the NSO, the Department for Education will establish a UK Shipbuilding Skills Taskforce to build a picture of industry's skills needs and "provide solutions" where there are shortages.

One recent innovation referenced is the introduction of T Levels, two-year courses developed in collaboration with employers and businesses that were launched in 2020 and are equivalent to three A levels, and would allow students to achieve vocational training in specialist subjects.



A PET PROJECT OF THE PRIME MINISTER, THE DESIGN OF THE NATIONAL FLAGSHIP IS DUE TO BE ANNOUNCED SHORTLY, WITH CONSTRUCTION COMMENCING AT THE END OF THIS YEAR

French says the skills gap is an issue the MEWG explored, although without much in the way of solutions, particularly with regard to forecasting the skills shortages of the future. However, he highlights shipyard apprenticeships as an ongoing area of success for the industry, while pointing to projects like the Artemis Technologies-led consortium currently developing zero-emission ferries for Belfast Harbour as the sort of eye-catching, high-tech work that can attract young people.

### Next steps

Although the NSbS contains many reasons to be positive about the direction of British maritime it's plain that the Government's investment in the naval sector dwarfs its commitment to commercial shipping.

Even with its refresh, the provenance of the strategy remains with the MoD and there never appears to have been any question of the Secretary of State for Defence, Ben Wallace, relinquishing his position as Shipbuilding Tsar. However, Peter French notes that Wallace has taken to heart the importance of the supply chain, much of which is common to both the commercial and naval sectors.

French, who will attend SEG meetings for the purposes of continuity with MEWG, thinks the NSbS refresh – which aims to increase exports by 45% by 2030 and for British civil yards to achieve productivity on a level with their northern European counterparts – is highly ambitious but attainable.

The extending of the 30-year government shipbuilding pipeline to include all government vessels will encourage industry to invest," he comments, noting also that "There are other demand signals that are not included, specifically the offshore energy sector, where when you look at the number of vessels that are forecast to be required, the non-naval government programme pales in significance. We need to find some way of competing in that sector and we're not doing so at the moment."

"But I can't think of a time when the industry has enjoyed more government support and if we can't grab hold of these opportunities then frankly, we deserve to fail," he concludes. ■



# DENMARK

## DFDS'S WORKHORSE FOR ALL SEASONS

*Aura Seaways* represents DFDS's first ro-pax newbuild in 40 years. Operating on the Karlshamn-Klaipeda overnight service, *Aura Seaways* is a utilitarian workhorse that incorporates all lessons learned from Apuania and Visentini class ro-pax ferries that DFDS has operated in the Baltic

By **Philippe Holthof**, Correspondent



AURA SEAWAYS.  
SOURCE: PHILIPPE  
HOLTHOF

Together with Grimaldi Group and Stena Line, DFDS belongs to the 'big three' pan-European operators of ro-pax and short-sea ro-ro tonnage and, like its peers, DFDS has been rather sceptical about LNG propulsion. To comply with the 0.1% SECA, the Danish shipping giant retrofitted most of its existing fleet with SOx scrubbers and rather than switching to LNG propulsion for its first ro-pax newbuild in 40 years, it opted to burn IFO 380 cst in combination with seven hybrid ME Production scrubbers – four on the main engines and three on the auxiliaries.

When *Aura Seaways* and its soon-to-be-introduced sister ship *Luna Seaways* were still on the drawing table, battery-hybrid technology on large ro-pax ferries was not yet widespread and to comply with EEDI on the one hand, and keep the emissions footprint as low as possible on the other, DFDS focused on hull optimisation with model testing carried out by SSPA in Gothenburg. As *Aura Seaways* has no bow access, much attention has been paid to the slim bow shape with a vertical stem and integrated bulb. This increases the length of the waterline considerably and has proven well on DFDS's Jinling-built ro-ros.

For quite a long time, DFDS has remained faithful to European yards and its popular Flensburger-built Flower class series, which have formed the backbone of its North Sea operations for many years, are probably the best example of this. Yet, for its next-generation of

6,695lm mega ro-ros, DFDS turned to Jinling Shipyard, China's most prolific builder of short-sea ro-ros. In 2007-10, the shipyard built the 3,322lm MSG 113 class quartet that DFDS chartered through Macoma Shipping and subsequently Ellingsen Shipping Group's Leomar RoRo Shipping. Part of China Merchants, Nanjing Jinling Yizheng's shipyard has meanwhile diversified into the ro-pax segment, having recently delivered TT-Line's first 'Green Ship', the LNG-powered *Nils Holgersson*. One more sister ship, *Peter Pan*, will follow in Q4 2022 and the German ferry operator reportedly holds an option for two more vessels of the same class.

With Jinling already building its 6,695lm ro-ros, DFDS didn't want to put all its eggs in one basket and following a worldwide tender process, which included European shipyards, it signed the two-ship contract with Guangzhou Shipyard International (GSI) in February 2018. Besides being price-driven – the DKK 1.8 billion or US\$268 million price tag also covered yard supervision and delivery of the ships to Europe – the choice of GSI was equally based on the yard's track record. Back in 2018, GSI was the sole Chinese shipyard that had built complex ro-pax ferries for European interests, notably Rederi AB Gotland.

The concept design of *Aura Seaways* was executed by OSK ShipTech, the Danish naval architecture consultancy that was also in charge of the ship's interior design through its Steen Friis Design affiliate.

The contract, basic and detailed design was in the hands of Finland's Deltamarin.

### Simple design

'Keep it simple' has been the mantra throughout the project, something reflected in both the powertrain system and the ship's general arrangement. Per requirements, the vessel complies with the Safe Return to Port (SRtP) regulations, with two separate engine rooms that are divided by transversal bulkheads. The forward engine room holds two main engines on the starboard side of the centreline with two auxiliaries to the port.

The four-stroke Wärtsilä main engines follow the father-and-son principle with the eight-cylinder W8L46 engine having a 9,600kW output at 600rpm. Fuel consumption for the eight-cylinder engines is about 34.3 t/day with the smaller six-cylinder W6L46 engine, which has a 7,200kW output at 600rpm, consuming about 25.7 t/day. The aft engine room has the similar father-and-son arrangement, yet the engines are mounted on the portside of the



AS PER SRTP STIPULATIONS, *AURA SEAWAYS* IS EQUIPPED WITH A SECOND BRIDGE

centreline with a single auxiliary on the starboard side. Each of the three Wärtsilä W6L26 auxiliaries has a 2,040kW output, while the twin input, single output gear boxes each have a 3,000kW PTO, one being sufficient to provide the hotel load during navigation.

To enhance manoeuvrability *Aura Seaways* has two powerful bow thrusters, each with a 2,800kW output, so the auxiliaries are typically activated when approaching port. Although future-proofed to connect to shore power, *Aura Seaways* relies on its own auxiliary engine power until cold ironing facilities will be in place. Wärtsilä provided the ship's whole propulsion package, including its two-in-one Energopac system which integrates the ship's twin propellers with the Becker full-spade flap rudders, guaranteeing reduced fuel consumption and excellent manoeuvrability. The vessel's engines are not of the dual fuel type, yet they can be adapted to burn alternative fuels, including LNG/biogas.

The ship has an LNG-ready class notation from Lloyd's Register and LNG tanks could potentially be installed in the lower, six-lane hold which has a 3781m capacity. Located within the B/5 longitudinal bulkheads, it is accessed from the main deck via a 4.1m-wide fixed internal centreline ramp which is closed off by a 43m-long two-section flush side-hinged cover on Deck 3.

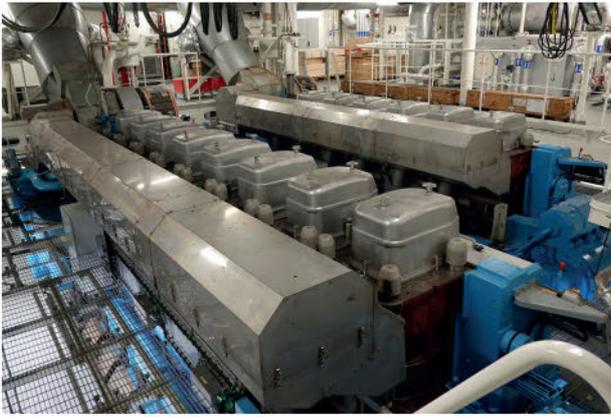
### Ramp arrangement

A stern-only loader, all access equipment, including the three hydraulic stern ramps, were supplied by TTS, now part of MacGregor. The ramp arrangement follows that of the Jinling sextet with the central ramp giving direct access to the 4.9m-high main deck which has a 1,241m intake. Decks 1, 5 and 7 have a 4.7m free height with 53m-long twin-lane fixed ramps on the starboard and port side leading to Deck 5. On Deck 3, three lanes are sandwiched between the side ramps, becoming nine lanes midships, forward of the side casings which hold the staggered funnel uptakes and aft of the forward centre casing. Unlike earlier ro-pax generations, Deck 5 has no ventilation side openings and is hermitically sealed off from Deck 3 and 7 by top-hinged doors on either side.

The ramps' threshold heights at the stern are slightly higher than the Deck 3 centre ramp and the seven-degree slope of the fixed ramps guarantees smooth

TECHNICAL PARTICULARS	
DFDS Baltic class: <i>Aura Seaways</i>	
Length oa	230.00m
Length bp	224.50m
Breadth, moulded	31.00m
Depth to main deck	9.85m
Draught, design	6.80m
Gross tonnage	56,043
Net tonnage	29,708
Deadweight	12,750t
Lanemetres	4,105 1m trailers + 419 1m cars or 3,939 1m trailers + 819 1m cars
Passengers	600
Passenger cabins/ berths	250/690 (500 lower berths)
Main engines	2 x Wärtsilä W8L46 + 2 x Wärtsilä W6L46
Output	2 x 9,600 kW + 2 x 7,200 kW
Service speed	18knots (Karlshamn-Klaipeda), 23 knots (Kiel-Klaipeda)
LSAs	2 x 150-person Viking Norsafe lifeboats + 2 Viking MES
Class	Lloyd's Register
Class notation	✱100A1 Roll on-Roll off Passen- ger ship, ShipRight(SDA, CM, ACS(B)), *IWS, LI, ECO(BWT), Ice Class 1C FS LMC, UMS, IBS, NAV1, PCAC 2.2 Descriptive notes: GR(A), Shi- pRight (BWMP(T)), MPMS, SCM, SERS, SRtP, IHM
Flag	Denmark (DIS)





THE WÄRTSILÄ W8L46 FOUR-STROKE MAIN ENGINES

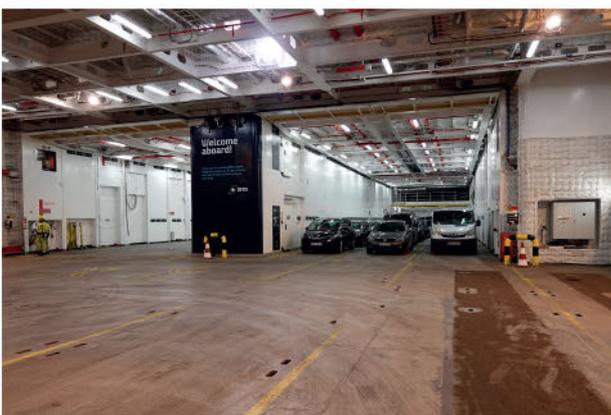
cargo operations, further enhanced by a Bimagrip high-friction anti-skid surface. On Deck 5, the ramp narrows to a single lane that continues to Deck 7, the aft part of which is open, allowing for the stowage of certain IMDG categories.

The ship's average lane width is 3.1m and with the hoistable car decks in stowed position, *Aura Seaways* has a total freight intake of 4,105lm (plus 419 car lanemetres below and on the dedicated fixed car decks). With the introduction of the Fincantieri-built *Selandia* class back in the late 1990s, DFDS initiated the innovative SAT trailer trestle, a trailer lashing system with integrated twistlocks. The trailer trestle system was also adopted on later generations and *Aura Seaways* too has SAT lashing pots welded flush with the deck, even though DFDS will rather use LOT trestles. Unlike the SAT system, LOT trestles have no hydraulic deck locking, yet thanks to its rigid design the required number of lashings are highly reduced.

The ramp layout allows for a two-way traffic flow, considerably improving cargo handling efficiency, something which would come in handy on the Kiel-Klaipeda route with limited turnarounds of just four hours. Most trailers are shipped accompanied and notwithstanding the low number of reefer trailers, *Aura Seaways* boasts no less than 150 reefer plugs.

### Crew and passenger facilities

Built in compliance with the Danish International Ship Register (DIS), the Lithuanian crew is accommodated in 62



DECK 7, THE MAIN CAR DECK.

single outside cabins which are spread over decks 7 and 8 forward and just aft of the bridge on Deck 11. Directly aft of the crew's accommodation on decks 7 and 8 is the dedicated fixed car deck. The 3.1m headroom below the fixed deck allows the stowage of (camper) vans or MPVs.

The free height on Deck 8 level is 2.2m and with the hoistable platforms on either side of the central casings down, the car intake can be increased to 819lm, reducing the trailer intake to 3,939lm. The car decks are conveniently located close to the accommodation with a Hyundai elevator and two flights of stairs leading to the spacious reception hall on Deck 9. The general arrangement of the public spaces is reminiscent of the *Apuania* class ro-pax ships with bar and restaurant facilities forward and a cosy Lighthouse Café and adjacent shop and children's playroom aft of the full-width reception hall.

The aft end of Deck 9 holds 74 cabins, including ten De Luxe double-bed cabins and two cabins for physically

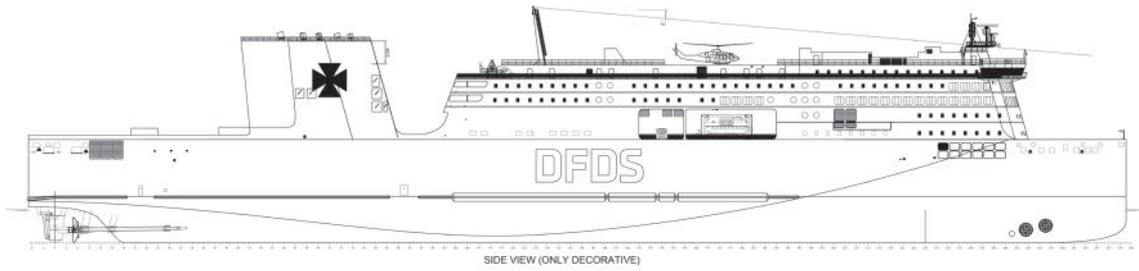


THE ROAD KINGS RESTAURANT ON DECK 10

challenged passengers. All 176 cabins on Deck 10 are standard two or four-berth inside and outside cabins, seven of which being pet friendly and twelve so-called family cabins with connecting doors. The prefabricated cabins and wet units were manufactured by Shenzhen-based Huanan Building Materials (HBM).

A central galley on Deck 9, supplied by Aluminox, feeds the forward 198-seat *Seven Seas* self-service restaurant and the starboard 70-seat *Mare Balticum* à la carte restaurant. To port is the *Navigator's Bar* which gives access to the self-service restaurant. Freight is king with commercial drivers benefiting from DFDS's signature *Road Kings* restaurant forward on Deck 10. It comes with its own bar and seating corner at the entrance to the port.

*Aura Seaways* has plenty of outside deck space and although a non-smoking ship, two smoking cabinets are available aft on the semi open decks 9 and 10. The navigation systems on the fully enclosed state-of-the-art bridge were supplied by Wärtsilä. Last but not least, to comply with SRTp rules, the mast houses the emergency bridge. ■



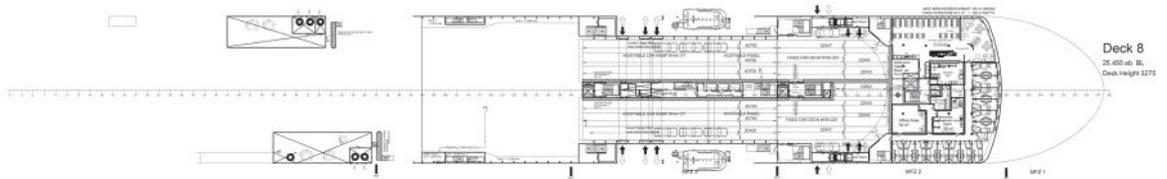
SIDE VIEW (ONLY DECORATIVE)



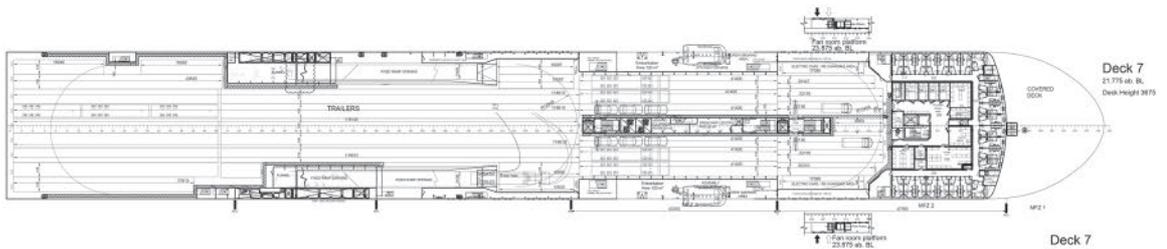
Deck 10  
31.725 ab. BL.  
Deck Height 2900



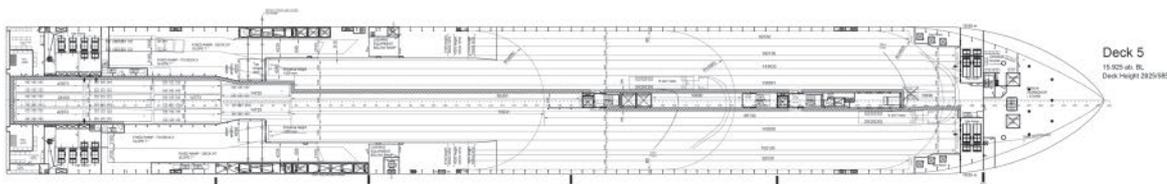
Deck 9  
28.725 ab. BL.  
Deck Height 3000



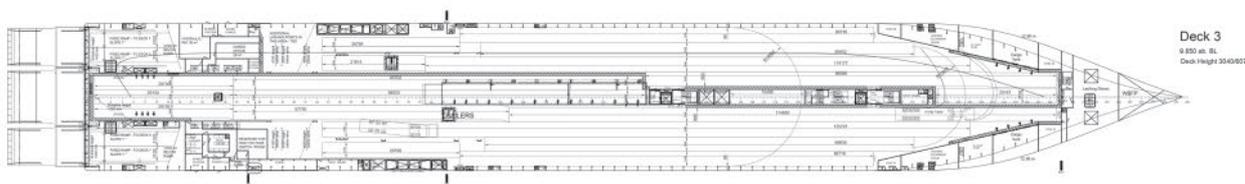
Deck 8  
25.650 ab. BL.  
Deck Height 3275



Deck 7



Deck 5  
19.825 ab. BL.  
Deck Height 2925/5850



Deck 3  
9.850 ab. BL.  
Deck Height 3540/6275



# NEW DANISH OPERATOR TARGETS EMERGING CCS SECTOR

By Richard Halfhide



DAN-UNITY'S CO<sub>2</sub> TANKERS COULD TAKE TO THE SEAS AS EARLY AS 2025

The rapid growth of the carbon capture and storage (CCS) market, not to mention its transportation, is opening up a wealth of business opportunities and becoming a major driver of innovation within northern Europe. And it should come as no surprise that Denmark is among the frontrunners.

Having pledged in December 2020 that it would ban all new oil and gas exploration within its waters, the Danish government announced 12 months later that it was turning gamekeeper with plans to invest US\$2.4 billion in two projects to capture CO<sub>2</sub> from the energy and industrial sectors. Both CCS projects, the Ineos-led Greensand and Bifrost, which is spearheaded by TotalEnergies' Danish Underground Consortium, propose storing the CO<sub>2</sub> in geological formations that had previously held fossil fuels, using offshore transportation and existing pipelines from mainland Denmark respectively.

"There is no doubt this emerging CCS industry is seen as important to Danish shipping as it is an opportunity for Denmark to cement its position as one of the largest maritime nations, underline our leadership within innovation and sustainability, and an opportunity to create jobs and exports – and not only from a shipping perspective but also in repurposing some of the oil and gas industry," a spokesperson for Dan-Unity CO<sub>2</sub>, one of the partners in Greensand, tells *TNA*.

Dan-Unity was jointly formed in May 2021 by Danish shipping corporations Evergas and Ultragas for the specific purpose of liquid CO<sub>2</sub> transportation. Considering the long gestation period for CCS projects, given the huge infrastructure investments and systemic innovations they

require, the company says it's conscious there is no quick fix but working to a long-term strategy.

"Going from an idea to developing a concept and strategy to actually having our own CO<sub>2</sub> ship designs – two of which have received Approval in Principle from ABS – entering into a number of partnerships across the entire value chain and being involved in several projects all within a year is something we are proud of," Dan-Unity comments.

"But the most important milestone is yet to come in ordering our first vessel, which is what we are working towards and something we are ready to do."

## Concepts

Dan-Unity unveiled concepts for two 12,500m<sup>3</sup> and 22,000m<sup>3</sup> CO<sub>2</sub> carriers, developed in collaboration with naval architects TGE Marine, in November last year, following a grant from the Danish Maritime Fund (Den Danske Maritime Fond) to support the development of new ships for CO<sub>2</sub> transport. According to a press release at the time, it's thought that a single 22,000m<sup>3</sup> vessel could transport around 500,000tons of CO<sub>2</sub> annually between north-west Europe and the Coda Terminal near Reykjavik, a CCS hub run by Dan-Unity's partners Carbfix that is expected to begin operations in 2026. Under the Carbfix process CO<sub>2</sub> is dissolved into water and injected into subsurface basalts, where it reacts with the host rock and becomes permanently stored.

A notable specification of the Danish Maritime Fund's grant was that the pre-design would incorporate 'CO<sub>2</sub> neutral' propulsion, although exactly which of the

alternative fuel options has yet to be determined. The company explains: "Our goal is to make these ships 'the greenest in the world' as it would hurt the overall proposition if we were emitting a lot of CO<sub>2</sub> whilst trying to get rid of it. So, our ships have been designed with this in mind to accommodate all sorts of features with the main one being engines that run on sustainable fuels.

"We feel this is very important, but it is a tough task trying to read and predict the future fuel landscape; is it going to be methanol, ammonia, or something third? And whilst methanol engines do exist, and we expect ammonia engines to be ready at around 2025, it is still a bit of a chicken and egg situation with the supply of these fuels."

Dan-Unity cites the recent activities of compatriot Maersk within this space as an example of how difficult it is to source adequate sustainable fuel supplies. For that same reason, green fuels come at a premium, and it's a dialogue the company must continually engage in with potential customers who also aspire to limit the environmental footprint of their vessels.

"We are essentially evaluating all options – including if it is feasible to sail on a more 'conventional' fuel and combine it with onboard carbon capture," it adds.

Of the cargo itself, the company notes that handling it is actually easier than other products given that CO<sub>2</sub> is neither combustible nor toxic. Rather, the challenge is one of keeping it away from the triple point and maintaining cargo conditions down to a decimal level.

"A part of the challenge in this regard is also that we are dealing with customers and counterparts who do not have any experience with shipping or cargo operations, so it is important we work together and help guide them as to what we need from their side. This underlines the need for collaboration to a much higher degree than any 'usual' commercially traded gas cargoes," it states.

Shoreside infrastructure, and ensuring that storage tanks will match the conditions found on the vessels themselves, is something the company discusses with

prospective clients on a case-by-case basis, but notes that interplay between the different links is an important part of the CCS value chain.

### Awaiting orders

The company says it's ready to push the button and start building the vessels at any moment, depending on when the projects reach a final investment decision and shipbuilding contracts can be signed.

"We get feedback from the yards that the approximate lead time is 28 months from signing, so we try to emphasise as much as possible that the shipping solution should be thought into the entire project as early as possible. The actual ship construction is possibly the item with the longest lead time and hence it is not something which can be solved as an afterthought. So, for all the projects wanting to store CO<sub>2</sub> at the beginning of 2025, a decision will have to be made soon if we are to be ready in time for that."

As to whether those vessels might be built in European or Asian yards, Dan-Unity is keeping its options open, however discussions have been held on both continents. "In general, we are seeing a lot of interest from yards wanting to be involved in bringing these first-of-a-kind ships to life, which is great to experience. It is conceivable they could be built in Europe, but a final decision has not been made yet, and if this really takes off it is possible we will use more than one yard to meet the demand."

### The future

Although launched as a joint venture between two Danish gas shipping companies, Dan-Unity's ambitions extend far beyond Denmark and its current project portfolio covers much of Europe. In March, it announced a collaboration with Belgian inland waterways operator Victrol that would offer end-to-end CO<sub>2</sub> transportation via rivers and sea.

Generally however, given the most progressive regulation, incentive schemes and industry support to make CCS is to be found in northwest Europe – and these projects gain the most traction – it has become the company's main focus. "But we are in no way restricting ourselves to one country and region," it concludes. ■

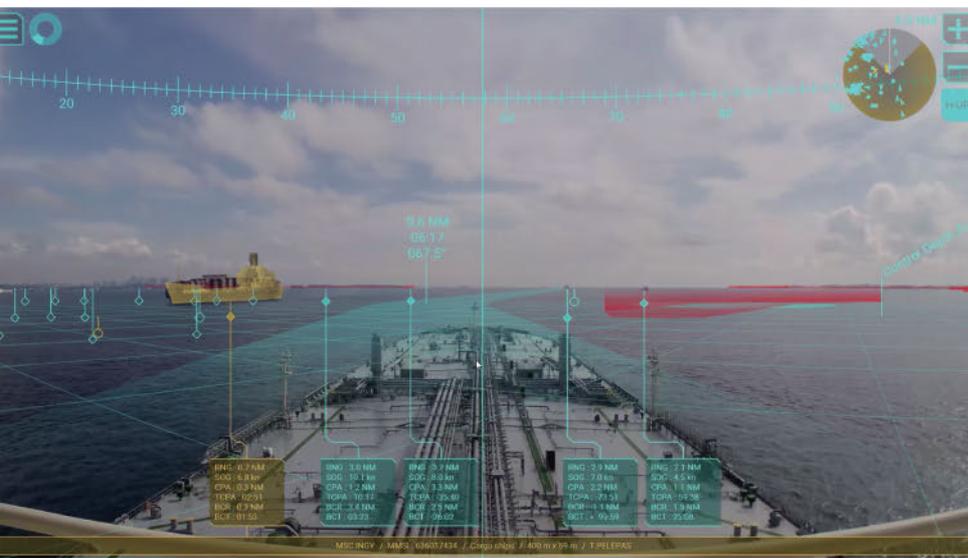
THE COMPANY COLLABORATED WITH GERMAN-BASED NAVAL ARCHITECTS TGE MARINE ON A SERIES OF DESIGNS, TWO OF WHICH HAVE BEEN GRANTED AN AIP BY ABS



# BRIDGE SYSTEMS

## AR: A NEW REALITY FOR NAVIGATION?

By Daniel Johnson



FURUNO'S ENVISION AR-100M SYSTEM OVERLAYS RELEVANT NAVIGATIONAL INFORMATION ON STABILISED VIDEO IMAGES FROM A FORWARD-FACING CAMERA. SOURCE: FURUNO

Navigating a ship is becoming progressively more complex as crew on the bridge have to deal with an ever-expanding amount of information available from a range of devices. This increased volume of data does not necessarily increase situational awareness, one of the cornerstones for ensuring the safety of the ship and the crew.

Poorly designed bridges, with equipment installed in inconvenient positions, and interface design can significantly affect situational awareness. "When you are in front of screens in different sizes and colours with different graphs and texts, you lose the overview," explains Abresh Ujkani, a research associate at the Fraunhofer Center for Maritime Logistics and Services (CML) in Germany. "Too much information in a short time leads to the opposite of what you want. People get distracted and can't really focus on the essentials. Even more so, if you have to physically move between different locations. Fatigue and distraction are possible results."

### Enhancing the situation picture

Maritime safety, the situational awareness of shipping personnel and the improved presentation of the situation picture to increase safety at sea are core research topics for Fraunhofer CML. In cooperation with Memorial University of Newfoundland, Canada, the organisation has developed a novel approach to assess situational awareness of navigational officers based on the Situation Awareness Global Assessment Technique (SAGAT) which can evaluate whether modern ship bridge designs can enhance the situational awareness of watch-keeping officers. Other work undertaken includes the development of a test field, test procedure and evaluation capability to identify situational awareness in user interfaces for bridge equipment.

"We are attempting to explore which screens/information are accessed most frequently through the use of a simulator ship bridge and eye-tracking. With the data, we can evaluate how long it takes to understand certain data sets and in what order they are processed. The results also show whether a test person jumps back and forth between screens a lot. This allows us to create an optimal interface," Ujkani tells *The Naval Architect*.

Through its research, Fraunhofer CML has identified augmented reality (AR) as a key technology that can be harnessed to ensure high situational awareness by presenting information in a more intuitive way. The Centre's recently published whitepaper 'Increasing Maritime Situational Awareness by Augmented Reality Solutions' gives an overview of the potential for AR in maritime navigation.

The basic concept of augmented reality is to blend computer-generated information into a human's perception of the real world, either on a screen, a projection or a head-mounted device.

"It offers a lot of improvements to the downsides of traditional HMIs [human-machine-interfaces]. Due to the immersive character of AR, information about an object in the environment can be placed near the corresponding physical entity. When done right, this can enhance the situational awareness, because it reduces the mental workload of the participant," says Ujkani.

Another positive effect of being able to position information in the field of view of the user is the increased time AR lets users spend with their eyes on objects of interest in the environment, allowing them to focus on the 'big picture' – traditionally, the user would have to split their

attention between heads-up observation and information input from other sources. In the case of the navigator, for whom a high heads-up time is regarded as crucial, a variety of navigational data, such as radar, automatic identification system (AIS), electronic chart display information system (ECDIS), gyrocompass and route information, can be checked at a glance while keeping watch out of the window.

### Early developers

One early pioneer of the technology in the maritime industry is Japan's Furuno Electric. The company presented the concept for the first time at a maritime exhibition in 2017, where it attracted the interest of compatriot shipping company Mitsui OSK Lines (MOL). The pair embarked on a joint development project and a prototype system was installed aboard MOL's Flexie series car carrier, *Beluga Ace*, in March 2018. Later that year MOL began demonstration testing of the system onboard its very large crude carrier (VLCC) *Suzukasan*.

After a year and a half of development and feedback from navigation officers, the product – the Furuno Envision AR-100M – was launched in October 2019. The system has now been installed on 24 MOL-operated VLCCs, a vessel type MOL notes that requires the highest level of operating safety. "Due to its deep draft, VLCC operations require special care when navigating on waters such as the Straits of Singapore and Malacca, a heavily trafficked sea lane that has limited areas," the company explains.

MOL has plans to expand the installation of the system to more vessels in the future, and is proceeding with trials on ships in its energy transport fleet including LNG carriers, as well as dry bulkers.

### Envision AR-100m

The Envision AR-100M system has been offered to shipping companies worldwide since 2020 and outside of Japan has been installed on a number of vessels both in the US and Europe. "It's not something that's mandated by the market or required by regulation, so at the moment it's very much an exploratory kind of thing," Paul McKenzie, sales & deep sea manager at Furuno (UK) Ltd, tells *The Naval Architect*. "Early adopters have tended to be forward thinking shipping companies who are looking at it to see how they can use the technology and how they can go forward with it."

Furuno offers a complete AR system with forward-facing IP camera, ECDIS, radar, GPS, heading, satellite compass, Doppler speed log and satellite Doppler speed log. At present, those technologies are merged into a heads-up display at the front of the bridge. "With all of the installations so far, they're looking straight out of the window where you would go and stand with a pair of binoculars. They're not there for the crew to stand back at the helming position. I think that's quite an important point, there's a difference between this being part of an integrated bridge at this point in time and being an assistant to the guy with the binoculars to help enhance what he's doing," says McKenzie.

The combined data displayed on the real-time video imagery includes the ship's position, route, speed and gyro compass location information, in addition to AIS and



CAMERA AND AR DISPLAY AT THE FRONT OF THE BRIDGE. SOURCE FURUNO

radar tracking information, the fixed ECDIS route and chart information. A pitch and roll sensing device keeps the AR objects aligned with the actual targets.

"All this allows you, even in the case of adverse weather conditions or visibility, to clearly see the routes and data related to your ship and other ships. At night, rather than having total darkness with maybe a few lights in the distance, you've got vessels, marks and towers laid down in front of you. Even when the ship is pitching or rolling, the overlaying AR information remains stable and will not drift away from the real elements of the live imagery, providing reliable data in all circumstances," McKenzie notes.

He adds that based on the closest point of approach (CPA)/time closest point of approach (TCPA) value, AIS and radar targets change colour according to their threat level, and users can increase or decrease range and take bearings. The system can also automatically display borders between deep-sea areas where vessels can navigate safely and shallower areas that may pose risks.

McKenzie has recently participated in the technical specification on a number of newbuild projects for UK-based owners where they have elected to have the Envision AR-100M to be installed and is confident that technology will continue to take off.

Given AR's capacity to help the navigator to make sense of the great amount of data available on the ship's bridge and therefore increase situational awareness while decreasing cognitive load, and its potential to reduce navigational accidents, it's hard to disagree.

### Picturing the future

For Fraunhofer CML, guiding the navigator's attention to points of interest in the environment is only the first step for augmented reality. In combination with artificial intelligence, an AR system could even visualise the consequences of actions. "For example, the movement of the participant and other objects in the environment can be projected into the future and displayed in a way that gives the participant the possibility to avoid dangerous situations beforehand. Even the consequences of planned actions could be visualised before they are acted out," the Centre suggests.

Companies that are interested in AR but are still cautious to implement it onboard should understand that AR is already well-established in other industries and brings very real benefits, concludes Abresh Ujkani. ■



# INLAND & COASTAL VESSELS

## THE 'GREENEST' SHIPS ON THE NORWEGIAN COAST

By Daniel Johnson



HAVILA CAPELLA

When the *Havila Capella* embarked on its maiden voyage in December 2021, the plug-in hybrid ferry became the first new ship to sail on the 1,650-mile (2,655km) Norwegian coastal route between Bergen and Kirkenes in 18 years. The event also made headlines as the 'greenest' voyage along the Norwegian coastline. Using liquified natural gas (LNG) and battery power for propulsion, the vessel boasts of cutting CO<sub>2</sub> emissions by 25% and reducing NOx emissions by 90%.

Delivered by Turkey's Tersan shipyards in October 2021, the 124m loa vessel is the first of four new coastal ferries with the same design and technology ordered by Havila Kystruten to enter service on the historic Bergen-Kirkenes route: *Havila Castor* will begin operations from May 2022 with *Havila Polaris* and *Havila Pollux* arriving in Q3 and Q4 of 2022 respectively. The ships are designed by HAV Ship Design and will be operated by Havila Voyages, both sister companies of Havila Kystruten and part of the Havila Group.

The newbuilds will operate as part of a 10-year contract from the Norwegian government that runs until 2030; in 2018, the Norwegian Ministry of Transportation and Communications opted to end the decades-long monopoly of the famous Hurtigruten brand and split the route service. Under the new arrangement, Havila Voyages will operate four of the 11 ships that sail the route, with Hurtigruten operating the remaining seven.

The 12-day round-trip journey, which serves a combination of international tourists and fjord-crossing locals, calls at 34 different coastal ports. It also passes through four UNESCO World Heritage sites and crosses the Arctic Circle twice, and in line with Norway's requirements for increasingly environmentally friendly operations, the

Havila vessels are being promoted as among the greenest passenger vessels ever built.

### Technological innovations

*Havila Capella* contains several technological innovations to ensure the lowest possible operating costs and emissions. "Tailored hull and equipment, developed with simulator-based ship design that, amongst other things, takes into

PRINCIPAL PARTICULARS	
Shipbuilder	Tersan Shipyard Inc.
Vessel's name	<i>Havila Capella</i>
Length, oa	124m
Gross tonnage	15,776gt
Speed	16knots
Passengers	640
Crew	75
Beds	468
Cabins	179
Cars	9
Owner/Operator	Havila Kystruten/Havila Voyages
Flag	Norway
IMO number	9865570
Designer	HAV Ship Design
Total number of sister ships on order	3



account weather, wind and wave conditions along the route, has resulted in a vessel that is significantly more energy efficient and environmentally friendly than what Norwegian authorities specified in the tender qualifications to operate the coastal route," states Havila Kystruten.

The 15,776gt vessel is powered by Bergen LNG engines driving two Azipull thrusters in a diesel-electric configuration. There are four C26:33L engines – two nine-cylinder units and two six-cylinder units – that provide a total 8,100kW between them. The vessel is also equipped with what is said to be the world's largest battery pack, which can be charged with clean hydropower from the quay.

Supplied by Norwegian Electric Systems, the pack weighs 86tonnes and has a capacity of 6.1MWh, allowing for four hours of sailing without noise and emissions. This approach not only improves the passenger experience, says Havila Kystruten, but will also be essential to meet the strict zero emissions regulations for the fjord region to be introduced by the Norwegian government later this decade.

As well as the battery pack, Norwegian Electric Systems also supplied the integrated navigation system Raven INS, generators, complete switchboard system, transformers, frequency converters for thruster engines and the ship's energy management system. The ship is equipped with a waste energy recovery system that

makes use of 65% of fuel energy that is normally lost through the exhaust cooling systems.

### Hydrogen prepared

A further 5% fuel saving is made possible by the use of a Wavefoil retractable device and the the onboard propulsion system has been prepared for future retrofitting of hydrogen and fuel cell technology. With hydrogen energy, the ship will be able to sail emission free for significant parts of the coastal route.

*Havila Capella* has a capacity of 640 passengers, of which 468 can be accommodated in cabins while 172 will be day passengers. The vessel also has capacity for nine cars and some palletised cargoes. To further reduce the operational CO<sub>2</sub> footprint, a buffetless food concept onboard means that guests are served at their tables for all meals, which is expected to cut food waste by a total of 60tonnes per year.

According to Havila Kystruten, around NOK500 million (US\$58 million) was spent on making the newbuilds environmentally friendly. CEO Bent Martini says the company was willing to make the investment because the ships "sail among the world's heritage and priceless nature and should do so in such a way that even those who come after us can experience it in the same way". ■

*Havila Capella* is further profiled in RINA's *Significant Ships of 2021*.

## MOL-LED ALLIANCE TO DEVELOP JAPAN'S FIRST METHANOL-FUELLED DOMESTIC TANKER

As the shipping industry looks to transition away from traditional heavy fuel oil, interest in methanol as a commercially and technically viable alternative is growing. Japan's largest shipowner, Mitsui OSK Lines (MOL), has been an active explorer of the fuel for a number of years and currently operates just under a quarter of all the dual-fuel methanol ships in service around the world today. In a move to further advance the commercialisation of methanol, the firm has partnered with five compatriot companies to develop Japan's first methanol-fuelled domestic tanker.

The vessel development project, which targets delivery of the ship in 2024, has been selected to receive public funding from the Japanese Ministry of Economy, Trade and Industry (METI) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT) through projects designed to support energy-saving ship designs, high-efficiency propulsion systems, and systems and equipment to enhance cargo-handling operations.

Joining MOL in the strategic alliance are MOL Coastal Shipping, Murakami Hide Shipbuilding, Hanshin Diesel Works, Tabuchi Kaiun and Niihama Kaiun. Each partner will draw on their own technologies and experience to support the development of the new tanker. MOL, as the vessel owner, will share its operational experience

with methanol-fuelled vessels, while Murakami Hide Shipbuilding will contribute its expertise in building tankers. Hanshin Diesel Works is to develop the ship's engine having recently developed the world's first methanol-fuelled low-speed four-stroke diesel engine. Tabuchi Kaiun and Niihama Kaiun will be in charge of vessel management.

Methanol can reduce emissions of SO<sub>x</sub> by up to 99%, particulate matter by up to 95%, NO<sub>x</sub> by up to 80%, and CO<sub>2</sub> by up to 15%, compared to vessels using conventional fuel oil, according to MOL. It also has similar properties to current marine fuels in that it is liquid at normal temperatures and normal air pressure, meaning that current marine fuel storage and fuelling infrastructure would require only minor modification to handle methanol.

In addition, MOL notes that methanol can be produced with CO<sub>2</sub> and hydrogen as raw material, so in the future, it can be produced by utilising the CO<sub>2</sub> capture and transport business to synthesise hydrogen, which uses electricity derived from renewable resources such as offshore wind power and wave power. "If this methanol can be used as fuel, it can establish an environmental circulation-type business model, enabling a reduction in net CO<sub>2</sub> emissions," the company states. ■



# FUTURE-PROOF CARGO VESSEL POISED TO REVITALISE SHIPBUILDING IN NORTHERN EUROPE

By **Daniel Johnson**

The shipbuilding industry in Northern Europe is under pressure, and the region's high costs mean that potential orders have been lost to Asia. However, a new design concept from Dutch design and engineering company Conoship International Projects (CIP) looks set to give the industry a boost, while also reducing CO<sub>2</sub> emissions from shipping.

Based in Groningen in the Northern Netherlands, CIP has developed what it calls a new standard for low-air draught sea-river coasters. The innovative, future-proof general cargo ship design is the result of an extensive research project carried out by CIP, working with Province of Groningen authorities, potential customers and shipyards. The research showed that with small savings on steel production and the use of production-friendly construction principles and optimised logistics, the 3,600dwt vessels could be built in series at a variety of shipyards in North Western Europe at comparable prices to China, according to CIP's managing director, Jan Jaap Nieuwenhuis.

"We are very proud of this ultra-fuel-efficient cargo vessel," he tells *TNA*. "It's a step away from how we usually operate. Normally, we design specifically for one shipyard or one owner. This we developed as a project developer at our own cost and our own risk, and now we are free to sell it to a number of shipyards and a number of owners."

"It has been developed according to our philosophy to build in series in the North of Europe, with particular respect to the northern part of the Netherlands and also just across the border in Germany, and we've seen a huge amount of interest in the ship."

Construction on the first series of six of these diesel-electric powered cargo vessels is scheduled to start in the coming weeks at Fosen Yard Emden, Germany, with the entire series expected to be delivered in 2023. Each vessel will have a length of 88m, a breadth of 13.2m and a draught of 5m, and have a hold capacity of approximately 5,100m<sup>3</sup>.

## Fuel-saving design

In addition to an efficient diesel-electric propulsion system, the vessels are designed with an enlarged propeller in combination with a fuel-saving ConoDuctTail® aft-ship design and optimised hull lines. Nieuwenhuis says the design will produce best in class fuel consumption, especially in wind and waves, and meets Phase 3 requirements for the EEDI calculation.

To further improve its performance, the design is also ready for wind-assisted propulsion, as it is prepared for the placement of two rigid Econowind VentiFoil® in the forward area of the ship. Based on the turbosail system developed by Jacques-Yves Cousteau in the 1970s, the



CIP'S 3,600DWT GENERAL CARGO VESSEL IS SUITED FOR COASTAL OPERATIONS AND IS READY FOR WIND-ASSISTED PROPULSION AND THE USE OF FUTURE FUELS

foils can reduce fuel consumption and CO<sub>2</sub> emissions by about 10%, depending on the sailing area and routes.

Additional elements of the design arrangement facilitate a switch to future fuels. "It's very easy to take off the generators and replace them with a methanol power generator set and then put in methanol tanks as well, or take them off completely and put on liquid hydrogen tanks and fuel cells," explains Nieuwenhuis. "All these redesign possibilities were taken into account from the beginning of the conceptual design process."

## Shared facility

CIP is working on a number of variants of the ship, including a slightly larger 5,800dwt version. The company is also involved in a feasibility study for a shared facility for the shipbuilding industry in the Northern Netherlands province. The project, headed by the Groninger Maritime Board, will investigate how robotisation can be applied in order to improve the productivity of the entire chain.

"It is possible to be competitive, but only if we work together," says Nieuwenhuis. "Combined with a more efficient production chain and the local realisation of the required reduction technology of CO<sub>2</sub> emissions, we can anticipate an increased replacement demand for innovative fossil-free and low-emission ships, which can be built in the Northern Netherlands instead of in China."

He adds: "We have seen a shift to focusing on things locally again, a trend that started with Covid, where it was difficult to go to China, and now with the war in Ukraine. This will not only help our shipbuilding industry, but it will also be a big push for short-sea shipping. With more things produced locally in Europe, there will be a need for more ships to transport it all around." ■



# MARINE 4.0

## GETTING TO GRIPS WITH IMO'S CYBER RESOLUTION

By **Richard Halfhide**

With the entry into force of MSC.428(98), Maritime Cyber Risk Management in Safety Management Systems, at the start of 2021 IMO mandated that member states should take into account cyber protection and safeguards for every vessel over 500gt, consistent with the requirements of the ISM Code and reflective of the reality that most modern ships are, to or greater or lesser extent, connected. But what does this actually require of shipowners and operators?

Conscious of the ongoing uncertainty within the industry, and in collaboration with the IASME Consortium, cybersecurity experts Infosec Partners recently launched the Maritime Cyber Baseline scheme. As the name suggests, the objective of the scheme is to establish an affordable and certified baseline level of cyber control for maritime applicable for all ship types.

Infosec has a long involvement with maritime but also partners with businesses in many other industries. Mark Oakton, the company's security director, says that MSC.428 follows a typical pattern for cybersecurity regulations, in that it avoids being too prescriptive, but he thinks shipowners might have benefitted from a more defined support framework.

He comments: "There was likely to be several years of confusion, in my experience, with consultants taking as much money as possible to try and help them but not actually demonstrating any alignment or compliance... so we had to introduce and create the guideline."

### Basic level of control

The Maritime Cyber Baseline is broadly similar to the longrunning Cyber Essentials scheme developed by the UK's National Cyber Security Centre (NCSC) and used by thousands of organisations. Oakton explains: "There's a specific list of controls that need to be present and implemented. We've looked at what the threats are and the things that are having an impact on vessels all the time, and then make sure there's a very basic level of control in place for those vessels."

While this encompasses more elementary aspects of cyber protection, such as ensuring people change their passwords, and that organisations and vessels have firewall antivirus software, it also addresses more ship-specific vulnerabilities. "One of the key parts of the scheme standard is to document your assets, determining which ones are IT and which are OT [operational technology], then making sure there

are specific controls in place for both sides and that there's an owner for the security of each of those," says Oakton.

He adds that very often IT systems are well controlled but OT systems, which may run the operation of the vessel, have either been forgotten about entirely or outsourced to a third party with little oversight or control. To address this there is an asset management component to the scheme, including a self-assessment questionnaire, which delineates the IT and OT assets and which of these are deemed critical systems, with a series of checks to ensure that crew have a basic level of control across these systems.

The process ends with a series of 10 short technical tests, conducted by an accredited assessor and typically taking around two to four hours, that validates the specified controllers are in place and consistent with what has been attested. Upon completion the operating company is issued with a certificate stating it is deemed to be compliant with MSC.428(98).

Oakton points out that unlike some more generalist IT companies, Infosec has not only cyber experience but many years of working with the marine industry with, critically, an understanding of OT environments, which has earned the scheme the approval of the notoriously cyber-wary insurers. "It's a very select group of very accredited assessors that are allowed to run these audits across vessels in the industry," he says.

Moreover, he believes that there's a pressing need for the shipping industry to start getting its cyber affairs in order. "The rationale for doing this is ultimately that cyber in maritime is 30-40 years behind every other industry we work in. The level of control and protection across very sensitive marine vessels is very, very low and the reason for creating this scheme is to bring the general level of security up to a good baseline level."

### Pervasive problem

Although precise figures are hard to come by, given the reluctance of companies to admit to falling victim, US-based security firm Naval Dome reported in 2020 that cyber attacks on maritime OT systems had increased by 900% in the previous three years, a figure that Oakton thinks is a conservative estimate and likely to be much higher.

"The number of vessels openly talking about having had an actual cyber breach where something significant has happened has grown enormously," he

comments. Moreover, the inherent transparency within the industry, and the availability of tracking platforms such as AIS makes it particularly vulnerable. A number of outlets have suggested that a cyber attack may have been responsible for the container ship *Ever Given* losing power and grounding in the Suez Canal last year which, if correct, serves as a stark reminder of the potential impact.

Cargo shipping tends to be a particular target for cyber criminals and Oakton cites one incident in which the temperature controls for a shipment of bananas were tampered with and the goods spoiled by the time they reached their destination. However, even similar vessels can have very different threat profiles depending on the owner or management company and whether they are likely to be targeted.

Despite this, existing cyber compliance standards have tended to put the cart before the horse and gauge the required level of security control on the basis of ship type without factoring in the specific risk of malicious intent. "It's an important part of risk management, which is ultimately what IMO are enforcing," he remarks.

### A simpler solution

At the moment, the strongest interest in the scheme is coming from management companies and fleet owners that are seeking to demonstrate a reasonable level of control across multiple vessels simultaneously. In many cases Oakton says they have been looking for a cybersecurity solution for some time where the

only options were either ad hoc consultancy, a formal security standard such as ISO 27001 (which can be difficult to achieve), or a class specific cyber notation.

Of the latter, Oakton says that the feedback Infosec receives from owners suggests the number actually seeking a class cyber notation is actually quite low. "People are worried about getting into it because they think it's too complicated, too expensive, and they may not be able to achieve a pass. From an insurance perspective it doesn't really fit because across each class society the cyber notations are wildly different; some are very complex and difficult to attain, others are really easy and not very valuable.

"Because this baseline is common across all vessels, across all parts of the industry, it should help people as a first step to a cyber notation as then they know they've got the basics covered and can progress onto the next level."

Reception to the scheme has been overwhelmingly positive, with many questioning why such an initiative wasn't put in place sooner. "We've got a lot of our competitors in the industry saying 'What did you do that for? It's going to stop us from receiving consulting fees from clients we'd counted on for the next three years!'"

"We see that as a positive. There are a lot of third party service providers, who look after specific parts of the vessel under remote service contracts, quite concerned because it's shining the spotlight on them." ■

## RINA APPROVAL FOR THE SCHEME

More than 50 different companies and organisations were consulted during the development of the Cyber Maritime Baseline, including departments of NATO. But one of the strongest supporters has been the Royal Institution of Naval Architects itself.

"Infosec Partners have been working with RINA for nearly two years now, helping with internal systems and some educational meetings for members globally," explains Oakton. "Ultimately RINA has a desire to help the industry improve and was keen to back it. Some of the resources that RINA have are far reaching and we can help spread the word to the membership."

Commenting on the benefits of the scheme to members, RINA chief executive Chris Boyd adds: "The cyber baseline provides an accessible and affordable platform for many companies to understand the gaps and potential risk within their own vessel safety management system, moreover, to understand the pathway to compliance working within the IMO Maritime Cyber Risk Management guidelines. The Institution drives innovation, and we take cyber safety and security extremely seriously, so it's imperative that we champion leading initiatives that support the community and get ahead of the threat actors and the cyber criminals.

"Like many I was caught up in the mystique and noise surrounding cyber, so I wanted to cut straight to the point and understand what can be done to improve security for everyone, and the baseline offers a starting point. I look forward to receiving your feedback on the baseline and areas of support you've needed to achieve IMO MSC428 (98) cyber risk management compliance."



SOURCE:  
SHUTTERSTOCK



# STABILITY

## TOWARDS MORE RELIABLE INCLINING EXPERIMENT OUTCOMES

By **Rob Gehling** FRINA

The lightship characteristics measured by inclining experiment are a fundamental input to managing a ship's intact and damage stability throughout its service life or until it is re-inclined. In the latter case, considering that stability may deteriorate during the lifecycle, informed decisions based on accurate metacentric height (GM) measurements could feed back into design and operation for better stability management or indeed better designs.

It is timely to re-examine the traditional inclining experiment analysis methods, taking account of the technological developments and tools now available to naval architects compared with those when I first inclined a ship in the early 1970's. My experience back in the 70's and 80's in inclining and reviewing reports for merchant ships could be summarised by the lightship vertical centre of gravity (VCG) of bulk carriers and single hull tankers up to 150,000dwt having a range of up to 10% depth, with no particular reason for the variation.

These vessels were inclined in as light draught as practicable and under very tight checks on the consistency of GM measurements resulting from each weight movement. While these ships were generally very stiff from an intact stability perspective, the accuracy of measuring the lightship VCG from the inclining experiment may have been marginal from a damage stability perspective. The importance of an accurate VCG with regard to damage stability has increased in recent years through amendments to SOLAS and MARPOL.

### Tracking the metacentre

The wall-sided assumption that underpins the traditional GM method of analysing outcomes of experiments can be disproven by calculating the location of the transverse and vertical centres of buoyancy and applying the  $BM = I/Vol$  formula as the vessel is inclined. A plot of the vertical and transverse position of the metacentre shows that the metacentre can move both above and off the centreline.

We now have computer modelling and calculation tools available to us for accurately tracking hydrostatic characteristics at all stages of inclining. Most hydrostatic packages are no longer limited to moulded lines but can take account of hull thickness to provide more accurate hydrostatics. We no longer have to use free surface moments to track the centres of gravity for liquids on-board as the vessel heels, as computer models can similarly track these.

Commencing with his paper *'Up Against the Wall'*<sup>(1)</sup> presented to the Pacific 2013 International Maritime Conference, and an expansion of that paper entitled

*'Back Against the Wall'*<sup>(2)</sup> published in IJME in 2014, Richard Dunworth has been advocating for almost a decade for a change in the analysis of outcomes of inclining experiments to be based on KN values rather than GM. A further paper *'Beyond the Wall'*<sup>(3)</sup> in 2015 used the hull section model (HSM) to explore a range of inclining experiment scenarios on a hard chine craft, a theme that was further extended, including experiments with inclining in air, in the most recent Dunworth paper<sup>(4)</sup> published in November 2021.

Smith, Dunworth and Helmore presented a paper<sup>(5)</sup> in 2015 in which they proposed adoption of Dunworth's 'generalised method' of inclining analysis.

In 2018 this work was extended by "Karolius and Vassalos"<sup>(6)</sup> who reviewed Dunworth's papers in relation to commercial inclining experiments, reported on a wider series of model experiments and proposed the 'Polar' method.

Apart from demonstrating the above-mentioned point with regard to movement of the metacentre, the paper provides an analysis of the accuracy of the various available methods of determining lightship characteristics, showing that the traditional ('classical' or GM) method was at least an order of magnitude less reliable than the generalised, polar and graphical methods.

### Too general?

The papers referred to above, when taken together, conclusively demonstrate that the classical method of analysing the outcome of an inclining experiment "will generally result in an incorrect VCG", as stated in Dunworth's latest paper. He notes that IMO's Intact Stability Code (IS Code)<sup>(7)</sup> specifies in paragraph 2.22 of its introduction that the VCG can be determined: "by applying basic naval architecture principles" to the information from the inclining experiment. Further guidance might be expected from the IS Code's Annex 1<sup>(8)</sup> but this document is only written in general terms.

So paragraph 2.22 is likely to be interpreted to refer to the classical (GM) method. But in light of the information provided in the referenced papers and the assumptions involved in the classical method, paragraph 2.22 should more correctly be taken (and amended) to refer to the generalised (KN) method as it more correctly reflects "basic naval architecture principles".

Accordingly, in his latest paper Dunworth questions whether continued use of the classical method would be consistent with RINA's Code of Professional Conduct requirements, which are specifically for each member to:

"so order his/her conduct as to uphold the dignity and reputation of his/her profession: and to safeguard the public interest in matters of safety and health and otherwise".

Since the generalised method has been proven much more accurate on a wide variety of hull forms, I would expect it would in time be proven to produce good results on a vessel such as a trimaran with surface-skimming side hulls, where the immersed body varies markedly as the vessel heels.

On the other hand, I would also expect that the generalised method might not produce markedly better results on a large catamaran high-speed craft, where the GM value may be in excess of 100m, since the variability of the point where the KN line intersects with the centreline is likely to be substantial compared with the vessel's depth.

In conclusion and based on the above summary of papers on this subject, there are compelling reasons for all naval architects and regulators to adopt the generalised method, particularly for vessels whose waterplane may change to any significant extent across the range of heel experienced during an inclining experiment. Even in such cases where the wall-sided assumption remains valid, the generalised method should be treated as at least equivalent to the classical method.

Finally, our profession should thank Richard Dunworth and Prof Dracos Vassalos for their perseverance in bringing this important practical subject to attention. ■

- i) *Dunworth RJ, Up Against the Wall, Pacific 2013 International Maritime Conference, Sydney, Australia, February 2013*
- ii) *Dunworth RJ, Back Against the Wall, International Journal of Maritime Engineering no.163, RINA, London December 2014*
- iii) *Dunworth RJ, Beyond the Wall, 12th International Conference on the Stability of Ships and Ocean Vehicles, Glasgow, June 2015*
- iv) *Dunworth RJ, Scaling the Wall; Inclining Experiment Analysis on Vessels with Chines, Hull Discontinuities or Asymmetry, The Australian Naval Architect, Sydney, Australia, November 2021*
- v) *Smith AC, Dunworth RJ & Helmore PJ, Towards the Implementation of a Generalised Inclining Method or the Determination of the Centre of Gravity, Pacific 2015 International Maritime Conference, Sydney, Australia*
- vi) *Karolius K B & Vassalos D, Tearing down the wall – The inclining experiment, Ocean Engineering no.148, Jan 2018*
- vii) *International Maritime Organization: International Code on Intact Stability 2008, IMO Res. MSC.267(85)*
- viii) *ibid, Annex 1 - Detailed Guidance for the Conduct of an Inclining Test*

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# BALLAST WATER TREATMENT

## UNDER THE HOOD OF D2 STANDARD IMPLEMENTATION

By **Dr Stelios Kyriacou**, chief Technical officer, ERMA FIRST

The Ballast Water Management Convention (BWM) was finally ratified by the IMO over four years ago. This crucial piece of legislation provided a pathway and framework for all vessels to install and operate treatment systems to manage ballast water discharges, which minimise the transfer of aquatic invasive species.

Following the ratification of the BWM, it was deemed pertinent to initiate the Experience Building Phase (EBP). This was formulated with a view to gather experience-based information from Ballast Water Treatment Systems (BWTS) installations operated in real-life situations. The EBP planned to use data and information gathered during inspections of systems and contribute valuable information to shape its implementation.

But several years on the EBP is yet to be finalised and its progress has been insufficient. The paper MEPC.77/4/7 presented by shipowner groups ICS, BIMCO et al, outlines the nature of the issue. At MEPC 73 (Autumn 2018) and MEPC 74 (Spring 2019) no EBP data was submitted. MEPC 75 was subsequently postponed to MEPC 76, which saw four states submit data.

Shipowner groups in their paper MEPC.77/4/7 propose the extension of the EBP to at least autumn 2024 and it's easy to understand why. The start of the COVID-19 pandemic – and restrictions that followed – caused major delays to the entire EBP process. The logistical practicalities of getting inspectors on and off ships was a restricting factor and as a result the data gathered has been limited. The MEPC secretariat has on 3 March 2022 submitted document MEPC.78/4/1, Report on the experience building phase associated with the Ballast Water Convention. In this report there is a review of available data including analysis carried out by the WMU.

It is evident in this report that the data gathered has not used the same data presentation or organisation and this introduces an additional degree of complexity in the analysis and drawing conclusions is made even harder. It is stated that Flag States reported 512 deficiencies out of 45,710 surveys conducted on 16,199 ships. Thus 1.1% of reported surveys were non-compliant. On another level, 53.3% of deficiencies were classified as "other" and hence the data does not provide any details on the type of deficiencies encountered in this group. Specific, more thorough survey reports, highlight deficiencies such as mechanical 15.6%, electrical 12.5% and treatment process related 9.6%.

Port state control (PSC) have reported 74,957 inspections and 4,429 deficiencies and it is likely that more than one deficiencies could be attributed to an inspection. From

STELIOS KYRIACOU



this it is inferred that circa 89-94% of inspections were satisfactory. And where detail has been captured 72% of issues relate to ballast water record book entries, 11% related to crew not designated or unfamiliar with BWMS and invalid certificates accounted for 6.6%.

It is unclear how much value can be drawn out of the EBP data due to the lack of consistency in the data on hand as highlighted in MEPC.78/4/1. There was hope that this latest report on EBP would add further clarity on the data previously reported (MEPC.75/INF.11 and MEPC.76/INF.56) but it seems that although more data is made available the data analysis again fails to lead to clear conclusions.

### Inconsistent data?

The way in which samples have been taken is also riddled with inconsistencies. There is an ISO Working Group looking at sampling device standardisation. However, it is still reported that there are cross section of different sampling methods being used. It is essential that a robust framework, dealing with sampling for compliance, is properly established. Today, a host of devices are employed for swift compliance evaluation. Nevertheless, such Compliance Monitoring Devices (CMDs) must be subject to third-party verification and approval. This is to ensure there is a scientific and statistically robust basis for their use and an ISO standard is currently in preparation.

### Manufacturer data?

One fundamental source of data for the EBP was initially missed. The manufacturers, represented by the Ballast Water Equipment Manufacturers Association (BEMA), compiled its members' data, but there was no mechanism or channel for this information to be submitted. However MEPC.78/4/1 mentions that the BEMA members' comprehensive data set submitted to the EBP has been used in the latest report. My firm, ERMA FIRST Group, has installed around 3,000 systems on 2,600 ships and we have contributed to the BEMA data submission as we firmly believe in the benefits of sharing

our operational experience with the regulatory authorities.

### Changing picture?

ERMA FIRST Group is increasingly seeing ship managers and their crews growing in confidence when it comes to managing BWTS well. The operational experience, as systems are operated regularly, is substantially contributing to the development of a more complete picture linked to practical 'real life' operation. Installation design, quality of project execution and selection of appropriate BWTS are all emerging as factors that have a bearing on system operability. Swift identification of operational issues has been possible through commissioning testing of installations. Such testing has been implemented due to the early adoption of such requirement by a small number of flag states (Australia, Cyprus, Greece, Panama, Singapore). As of 1 June 2022, however, this requirement enters into force and every newly installed system should be subject to commissioning testing per BWM.2/Circ.70, as mandated in the Ballast Water Code MEPC.300(72) and before the issuance of the ship specific International Ballast Water Management Certificate.

### Universal inspection standards

The biggest shortcoming has been the lack of universal guidelines for the port state control inspections. A BWTS is very different to the many other systems and processes onboard ship under the inspector's responsibility. A system can be spread across a ship and involves processes which are not common to any other type of equipment on the vessel. With around 70 Type

Approved BWTS available, utilising different principles of water treatment and comprising multiple and different components, it is debatable whether truly effective PSC inspections can take place. It's not unreasonable to suggest that some Port State Control Officers are somewhat uneasy in undertaking BWTS inspections as it is likely they are not confident with their understanding of BWTS operation.

The PSC inspection system is still lagging behind the implementation of the BWC. There is an urgent need for the IMO to focus on the development of the appropriate guidelines for inspections. Flag states have a collective responsibility to formulate a framework and training system for inspectors that ensures a global level-playing field.

### The market impact this year?

With 2023 D2 Standard deadline for retrofits firmly on the horizon, 2021 was a busy year for yards and equipment manufacturers. There were some reports that manufacturers faced supply-chain issues and difficulties securing components for their systems. However, the ERMA FIRST supply chain remains robust, reliable and excellently managed.

Our advice to clients, both old and new, remains the same. Plan in advance, select a BWTS that meets the ship requirements and review the system design limitations (SDLs). Align with an experienced yard, select a proficient engineering firm and competent installers. Must not ignore the fact that comprehensive planning will be the key to a successful and streamlined project. ■



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# CAD/CAM

## PRIMESHIP-HULL UPGRADE PROMISES ENHANCED NAPA COMPATIBILITY

There's little doubt now that 3D CAD software is the future of ship design and construction, with a growing number of shipyards adopting 3D technology to help streamline their operations. Finnish software solutions provider NAPA's 3D modelling tools have long been at the vanguard of this field, but what's often been lacking is a compatibility with class society verification tools.

ClassNK has recently announced an upgrade to the data linkage system between its design support software PrimeShip-HULL and NAPA's 3D CAD platform NAPA Designer with the aim of streamlining this process. It follows the completion of a joint study on the feasibility of 3D model-based approval with shipyard Japan Marine United (JMU) which examined the technical developments required for each process of plan approval.

During the project a trial evaluation was conducted on a 3D CAD model of a 30,000dwt ore carrier designed and created by JMU using NAPA Designer. Plan submission, storage, and notification of examination results were made through NK-PASS, ClassNK's electronic plan review system. The results of the survey confirmed NK-PASS's compatibility with 3D CAD models.

The PrimeShip-HULL upgrade means that users are able to fully carry out prescriptive calculations and direct strength calculations on NAPA Designer, via NAPA's Application Programming Interface (API). Combined with additional enhancements, in particular the ability

to directly reflect dimension amendments in NAPA Designer, it's estimated the time required for data linkage tasks has been reduced by nearly a third.

While the new function is currently only available for bulkers and oil tankers, which are required to abide by the harmonised requirements of IACS' common structural rules (CSR), it is anticipated it will be rolled out for additional shiptypes in the near future.

"As the capabilities of 3D computer-aided design software improves, we see an acceleration in the use of 3D technologies in the shipbuilding industry. At ClassNK, we are dedicated to support this transition with powerful software environment that puts 3D models at the forefront to facilitate approval and collaboration between all partners," comments Toshiro Arima, corporate officer and director of ClassNK's rule development and ICT division.

NAPA has been a wholly owned subsidiary of ClassNK since 2014, but the company has continued to operate with a significant degree of autonomy. Tapio Hulkkonen, NAPA Design solutions director for product management, says: "At NAPA, we are proud to drive this vital transition forward, by developing solutions that enable all stakeholders to collaborate on the same 3D model, instead of wasting time and resources on multiple conversions to 2D drawings. This makes the design process more efficient, saving time and money, and reduces the risk of errors." ■

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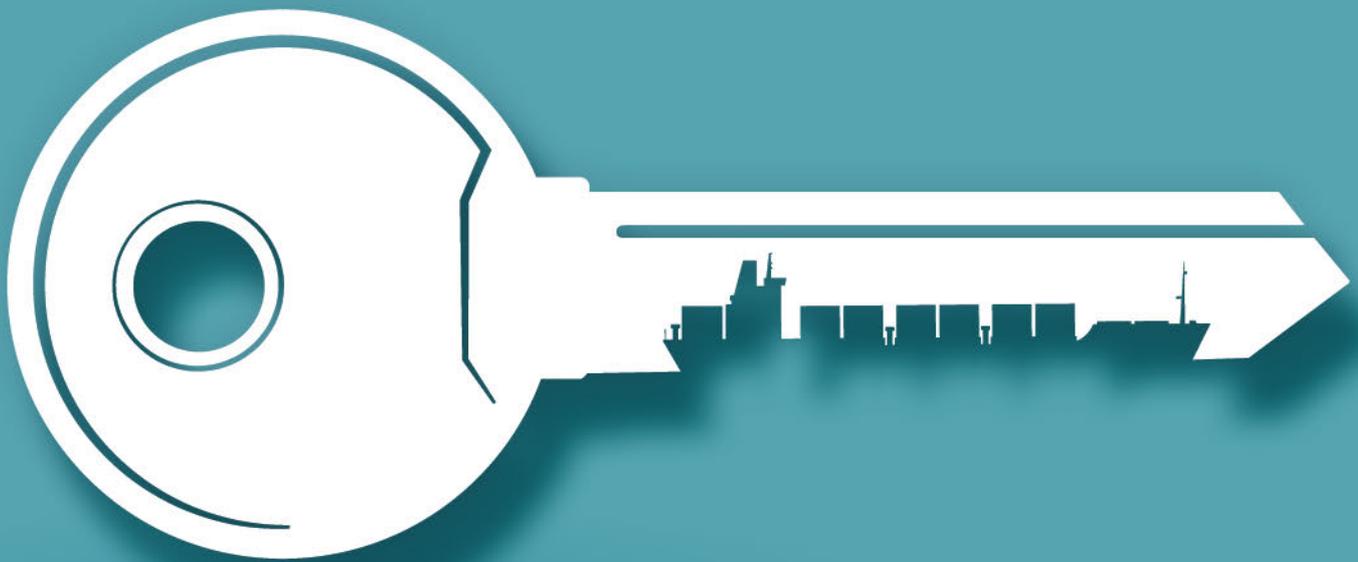
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