

# TANKEROperator

JANUARY - MARCH 2024

[www.tankeroperator.com](http://www.tankeroperator.com)

**"OUR AMBITIOUS GOAL IS TO HELP THE INDUSTRY ACTIVELY IDENTIFY, GROOM AND RECRUIT THE NEXT GENERATION OF SHIPPING LEADERS AND BUILD A VIBRANT AND CREATIVE BUSINESS COMMUNITY."**

**Irene Rosberg,**  
Programme Director  
The Blue MBA

## **EXECUTIVE MBA IN SHIPPING AND LOGISTICS (THE BLUE MBA)**

A unique industry needs a unique MBA. Take your career to the very top international level by joining the world's premier Executive MBA designed specifically for shipping and logistics professionals.

**Find out more details about the Blue MBA from Programme Director, Irene Rosberg**  
**Visit [cbs.dk/bluemba](http://cbs.dk/bluemba) or email [ir.mba@cbs.dk](mailto:ir.mba@cbs.dk)**

**CBS**  **THE BLUE MBA  
COPENHAGEN BUSINESS SCHOOL**

 **EQUIS  
ACCREDITED**

 **AACSB  
ACCREDITED**

 **ASSOCIATION  
AMBA  
ACCREDITED**

# Contents

## OPENING

- 01 ■ **Engine room fire** - due to fuel injector pump components being tightened in the wrong order, leading to a tube inside it getting fractured, NTSB investigation found
- 02 ■ **News from OCIMF** - a summit at COP 28, guidance on onshore power, a ship-to-ship forum in Malaysia, maritime security updates
- 03 ■ **Today's tanker market** - Senior executives from d'Amico, Frontline, International Seaways, Navios and Tsakos Energy Navigation discussed in a Capital Link webinar

## TANKER OPERATOR HAMBURG REPORT

- 06 ■ **Reaching the limits of safety improvements from procedures** – to go further we need to help people get better at resolving problems, said Martin Shaw
- 07 ■ **People and systems most critical when seeking to make operations easier** - Phrixos Papachristidis, CEO of Hellespont group



- 08 ■ **Recommendation to participate in SIRE 2.0 Phase 3** - do a trial inspection, because otherwise your first encounter with it will be a live inspection, said OCIMF consultant Steve Barker
- 10 ■ **ABS and the pathway to ammonia fuelled tankers** - sourcing low carbon ammonia, learning from experience carrying ammonia cargo, developing ammonia handling systems, and training, said ABS' Rene Laursen
- 12 ■ **Harren is developing a consistent safety culture across all business units** - to be proactive and pragmatic rather than documentation or compliance driven, and with continual risk assessment
- 13 ■ **How NSB Group is encouraging a learning culture** - shipboard and office staff are motivated to continually develop skills, including problem solving

## DECARBONISATION

- 14 ■ **First four stroke ammonia maritime engine on the market from Wärtsilä** - part of the Wärtsilä's 25 engine "platform"
- 15 ■ **Study on CO2 transport by ship in Europe** - 10-20 vessels will be needed in Europe by 2030, says a study by EU advisory organisation Zero Emissions Platform
- 16 ■ **Wallem's first two dual-fuel LNG tankers** - owned by Viken Shipping and time chartered to TotalEnergies
- 17 ■ **Managing your ETS obligations** - There are many complexities to the maritime industry's requirement to buy emission permits for emissions in the EU. OceanScore's Albrecht Grell explained
- 19 ■ **Can we use 3D models through the lifecycle of a ship?** - The 3D models used for designing ships could also help us operate ships at lower emissions. NAPA explained
- 20 ■ **Using weather forecasting certainty data** - grasping the uncertainty in forecasts can help get more value from them. Weathernews explained

## TECHNICAL

- 21 ■ **Starlink and the evolution in maritime communications** - Marlink gave us an update



- 22 ■ **Developments at Marlink** - now the largest maritime VSAT service provider, and expanding its services as a maritime ICT service provider
- 23 ■ **Making better tools for navigation** - technology could be better designed to support the needs of navigators. A Nautical Institute webinar explored
- 25 ■ **Doing a tank survey by drone** - A US tanker operator used a drone for a 20-year internal survey of a 250m tanker, replacing a human survey using scaffolding or a raft

# Engine room fire “due to tightening in wrong order”

**A fire on chemical tanker Endo Breeze was caused by a fuel injector pump having its components tightened in the wrong order during re-assembly, leading to a tube inside it getting bent and fractured**

**A** fire on chemical tanker Endo Breeze, in Apr 2022 near Staten Island, New York, was caused by components inside a fuel injector pump being tightened in the wrong order during reassembly, leading to a tube inside it getting bent and fractured, an investigation by the US National Transportation Safety Board (NTSB) found.

This led to oil spraying out of the pump and igniting on nearby hot surfaces.

There were no injuries or pollution, but \$1.2m of fire damage to engine cylinders, motor controllers, wiring, main lube oil pumps, main lube oil filters and separator pumps. There was also fire damage to the grating above the starboard engine, the lighting fixtures and fire, smoke and flame detection sensors overhead. There was damage to the engine room exhaust trunk casing.

Investigators examined the pump and discovered a slight offset in the ‘banjo tube assembly’. This is a fitting for routing liquids in high pressure systems, consisting of a pipe (the ‘banjo tube’) held by two hollow bolts known as banjo bolts.

Metallurgical testing on the banjo tube did not find any material or dimensional issues with the banjo tube bolts or other involved parts, but it found that the tube had bent to accommodate the offset, and there were fractures on both ends of the tube, where it connected to the sealing flange and lid.

Stresses associated with the offset likely caused the banjo tube to bend and fracture, causing the oil leak, NTSB said.

They determined it is likely that the

engineer “did not correctly follow the manufacturer’s procedure for fuel injector pump reassembly” when doing maintenance on the pump the day before the fire.

“In this case, not following the tightening sequence described in the diesel engine manufacturer’s manual led to the misalignment and failure of a high-pressure fuel connection on an engine’s fuel injector pump’s assembly,” the report said.

“Due to the high risk of fire associated with pressurized fuel, when working with diesel engine components, it’s critical to carefully follow manufacturer assembly procedures and review manufacturer manuals and guidance on a regular basis to ensure familiarity with correct maintenance procedures.”

NTSB’s report emphasized the need for training to prevent and contain engine room fires, suggesting that seafarers should have “realistic scenario based training, including training that covers engine room emergencies.”

“This training should also cover procedures for effectively shutting down machinery, fuel oil, lube oil, and ventilation systems, as well as boundary monitoring.”

## What crew did

The leak was initially discovered by the second engineer and the fourth engineer, who were conducting a round of the engine room.

They smelled fuel oil and saw a haze in the air near the starboard main diesel engine. They also saw fuel oil on the deck.

The second engineer opened the cover of the fuel injector pump for the No 4 cylinder,

and could see the fuel was coming from near the No 1 cylinder.

When he opened the cover of the No 1 cylinder injector pump, high pressure fuel oil sprayed from the pump banjo tube into the air.

To reduce the spray, he placed a shop rag over the banjo tube, and then went to the control room to notify the chief engineer. They left the pump uncovered.

The chief engineer and second engineer called the master to tell him they needed to shut down the starboard engine, leaving the port engine engaged, which would result in reduced thrust.

The fourth engineer went one deck below the control room and observed a fire near the No 1 cylinder on the starboard engine, which spread quickly.

The flame and smoke detectors activated and the fire alarm sounded.

The chief engineer saw the fire on the closed circuit video monitor in the control room, and told the bridge that all engines would need to be stopped. The propulsion engine emergency stop button was pressed and engine room personnel evacuated.

The second engineer secured all ventilation, pumps, fuel and lube oil quick-closing valves, and some auxiliary machinery to the engine room from the remote panel located outside of the engine room.

The vessel then lost primary electrical power from two diesel generators in the engine room, and an emergency diesel generator started automatically.

Meanwhile the third officer used the ship’s intercom system to notify all crew of the

## TANKEROperator

### Vol 23 No 1

Future Energy Publishing Ltd  
39-41 North Road  
London N7 9DP  
www.tankeroperator.com

### PUBLISHER / EDITOR / EVENTS

Karl Jeffery  
Tel: +44 (0)20 8150 5292  
jeffery@tankeroperator.com

### ADVERTISING SALES

David Jeffries  
Only Media Ltd  
Tel: +44 (0)208 150 5293  
djeffries@tankeroperator.com

### PRODUCTION

Very Vermilion Ltd.  
Tel: +44 (0)1253 812297  
info@veryvermilion.co.uk

### SUBSCRIPTION

1 year (7 issues) - £195  
Subscription hotline:  
Tel: +44 (0)20 8150 5292  
sub@tankeroperator.com

fire and all personnel reported to the muster location in the main deck passageway.

When the watertight doors, engine room ventilation and accommodation ventilation were reported closed, and all personnel were accounted for, the chief engineer activated the engine room's CO2 fire extinguishing system remotely. It had 100 x 45 kg bottles of CO2.

On the bridge, the pilot and master decided to emergency anchor in the Raritan Bay Channel, giving an order to release 4 shots (360 feet) of anchor chain into the water.

The master notified the company's qualified individual, designated person ashore, agent, and the US Coast Guard of the emergency.

The pilot also made notifications and

followed up with local fire boats and available tugs to assist the vessel.

The crew could not determine whether the fire had been extinguished following the CO2 release because the closed-circuit camera lens near the fire was obscured as a result of the fire.

They knew that any attempt to enter the space could potentially admit oxygen into the engine room and cause a reflash.

So the chief engineer and second engineer ensured that all doors, hatches, and ventilation sources remained secured.

**New York Fire Department**  
Government firefighters and equipment

arrived on scene. A vessel operated by the Fire Department of the City of New York (FDNY) provided water to the Endo Breeze's fire main, via the vessel's international shore connection flange.

FDNY deemed the engine room unsafe for entry for about 48 hours to inhibit potential for reflash. Then FDNY personnel and a marine chemist entered the engine room, deemed the fire to be extinguished, and assessed the engine room as safe for entry.

TO

The full report, published in November 2023, is online here

<https://www.nts.gov/investigations/AccidentReports/Reports/MIR2325.pdf>

# News from OCIMF

**OCIMF news from November and December includes a summit at COP 28, guidance on onshore power, a ship-to-ship forum in Malaysia, reports from IMO and maritime security updates**

## Papers and guides

In December, OCIMF published a "preliminary paper" on adoption of Onshore Power Supply (OPS) systems, including design of OPS systems for tankers, terminals, and their interface.

The guidance is supported by a survey of tanker ships that provides insight into each ship's electrical installations, cargo systems and power consumption patterns.

The paper outlines recommendations for standardised OPS system requirements for voltage, frequency, and number of cables. Other design and operational considerations are addressed.

This preliminary paper will be followed by a full OCIMF information paper covering aspects of the safe application of OPS to tankers, the terminals and their interface.

It can be downloaded from the OCIMF website in the Publications / Information Papers section.

Separately, the Jetty Maintenance and Inspection Guide, Second Edition (JMIG 2) is updated to provide current information on the basic function, failure modes, inspection, maintenance, and repair of all key jetty equipment, items and systems. The book was published in December.

## Meetings

OCIMF co-sponsored and attended the Shaping the Future of Shipping conference with the theme of energy transition, which took place



**OCIMF's executive committee meeting at ExxonMobil's campus in Houston on Nov 15**

on 9–10 December during the COP28 climate summit in Dubai.

The conference, organised by the International Chamber of Shipping, was held at the Museum of the Future in Dubai, supported by the UAE Ministry of Energy and Infrastructure.

Key themes included the global challenges of future fuels, supply and availability, technology and innovation, the need for universally applied market-based measures and the need to prepare seafarers for the skills of the future.

Panellists from across industry and government included ministers and officials from the UAE, Philippines, Brazil, UK, and the incoming Secretary General of the IMO, Arsenio Dominguez. OCIMF's Executive Committee Vice-chair Dr Waddah Ghanem was among the panellists.

Also, the Autumn Executive Committee meeting was held at the ExxonMobil campus in Houston, Texas on Nov 15 (see photo). Work included reviewing OCIMF's governance; considering its organisational goals and objectives for 2024; getting an

update on rollout of SIRE 2.0; and reviewing work of OCIMF committees and the Member Engagement plan.

OCIMF's Filipe Santana presented at the Tripartite meeting organised by INTERCARGO in Tokyo, Japan, 9–10 November. The Tripartite is a collaborative annual meeting between classification societies, shipowners and shipyards. Mr Santana presented the development of guidance on applying Onshore Power Supply for tankers and terminals. He was joined by OCIMF Publications and Advocacy Director Saurabh Sachdeva.

OCIMF was invited to attend the Malaysian/Singaporean Regional Ship-to-Ship (STS) Forum, hosted in Johor Bahru, Malaysia on 16 November 2023.

The meeting was jointly hosted by IKMAL (Malaysian STS Community) and Singapore Nautical Institute (SNI) and attended by some of OCIMF's members based in Singapore and Malaysia, the Malaysian Maritime Department, members of IKMAL and SNI and Malaysia/Singapore based STS service providers.

Presentations followed by open discussions took place on STS operational matters including a lawyer's perspective on incidents. There was also incident and best practice sharing.

### Security news

During the 33rd Session of the IMO Assembly, industry representatives took the opportunity to meet with the newly appointed Minister of Marine and Blue Economy of the Federal

Republic of Nigeria H.E. Adegboyega Oyetola and Director General NIMASA, Dr Bashir Jamoh, OCIMF reports.

The group discussed progress made to date with the Nigeria/Industry Joint Working Group, the SHADE-GOG framework and the implementation of the SOLARTA maritime communications tool.

The Maritime Security Committee held its last meeting of the year on 7 December to review progress on key 2023 objectives and take stock on maritime activity in the Black Sea, Gulf of Guinea and Middle East. Due to increased activity in the Red Sea, the committee met again on 13 and 20 December to receive operational updates and review industry guidance.

The US announced plans on Dec 19 to establish a new naval operation, PROSPERITY GUARDIAN under the umbrella of the Combined Maritime Forces (CMF) to focus on security in the Red Sea and Gulf of Aden.

### IMO news

An IMO-ILO joint conference to ensure the rights of seafarers and fishers was held at the IMO headquarters in London on 13 November 2023, OCIMF reports.

It identified gaps in the regulatory framework and suggested how collaboration between governments and industry could drive improvement in legislation, which in turn would address challenges such as crew change, fatigue, mental health support, and fair wages for seafarers.

Connectivity on board ships was highlighted as a key factor in wellbeing and welfare for seafarers, especially in terms of attracting future generations to pursue careers at sea.

It emphasised that the green transition in maritime must consider the human element and must be safe for seafarers.

It emphasised that companies must develop robust measures to monitor and manage crew fatigue under the ISM code, and therefore, fatigue-related incidents and psychological wellbeing must be prioritised.

The IMO 33rd Assembly on Nov 27 to Dec 6 agreed 'strategic directions' for the next six years, OCIMF reports. These include integration of new, emerging technologies in the regulatory framework; response to climate change; supply chain resilience and security of international trade; and addressing the human element.

There was a resolution urging member states and relevant stakeholders to promote actions to prevent illegal operations in the maritime sector by the "Dark Fleet", including unsafe ship-to-ship transfers of oil by ships that appear to be linked to nations against whom sanctions have been imposed by certain countries.

This article is a summary of OCIMF's November and December 2023 newsletters. The full text is online at [www.ocimf.com](http://www.ocimf.com) then click on 'news and events' then 'newsletter'

# Today's tanker market

Senior executives from d'Amico, Frontline, International Seaways, Navios and Tsakos Energy Navigation discussed the state of the tanker market in a Capital Link webinar on Nov 28

A panel discussion organised by Capital Link with senior executives from d'Amico International Shipping, Frontline, International Seaways, Navios maritime partners and Tsakos Energy Navigation (TEN) reviewed today's tanker market.

Topics included the current strength of the market for tanker owners helped by low levels of newbuild ordering; challenges of not knowing the future low carbon fuel; vessels likely to have longer operational lifetimes; the right mix of spot and time charter; Panama Canal vessel limitations and tackling the 'dark fleet'.

### Strong market

Øystein Vaagen, a shipping analyst with Fearnley Securities, moderating the webinar, noted that tanker freight rates are currently "holding on very strong levels, particularly on the product tanker side."

Mr Vaagen had calculated that the market capitalisations of companies speaking in the webinar had risen an average of "over 260 per cent" since the start of 2022.

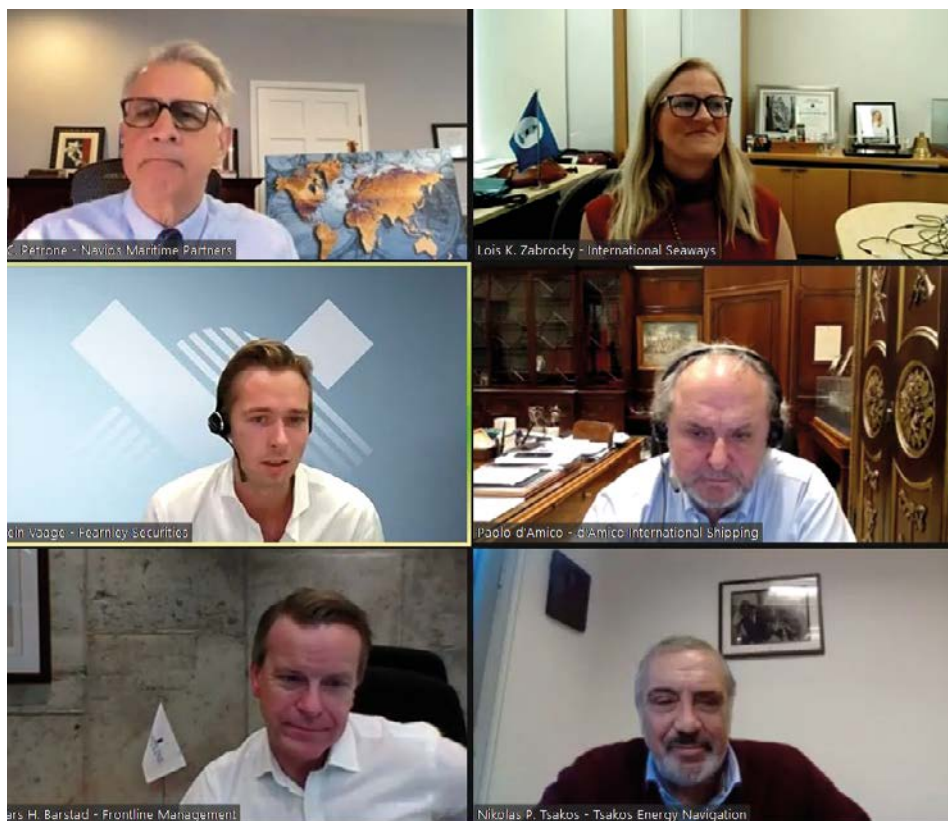
International Seaways is currently seeing very good rates, agreed Lois K Zabrocky, CEO.

The company has a mix of crude and

product tankers. It has 30 medium range (MR) vessels (20 to 55,000 DWT) on the spot market. The rates have been over \$30k a day for nearly 2 years. "Rates are very strong, with the west being particularly strong, high demand and really pulling," she said. "East rates are starting to improve to follow that. We're earning extremely well."

Vessels in the 'mid' part of the fleet, Panamax, Suezmaxes and Aframax, are "earning as well as VLCCs are." Although she is glad to have such a diversified fleet.

"Markets are tight," she said. "Small movements cause a big response in rates."



**Screenshot from the Capital Link webinar. Top:** Ted C. Petrone, Navios; Lois K Zabrocky, International Seaways. **Middle:** Øystein Vaagen, Fearnley Securities (moderator); Paolo d'Amico, d'Amico International Shipping. **Bottom:** Lars H Barstad, Frontline; Nikolas Tsakos, Tsakos Energy Navigation

Paolo d'Amico, executive Chairman and CEO of d'Amico International Shipping S.A, and also chairman of Intertanko, said he is also enjoying "a very strong market".

At the time of the webinar (late November), the winter season, with high demand for oil for heating buildings, was "yet to start," he said.

"We are running at \$30k a day, the expectations are quite positive," he said.

Restrictions on the Panama Canal also add tonne miles to the demand, he said. "This is creating the fundamentals for a strong market to come, so I'm extremely positive."

There are also many cargoes of diesel from India and Europe going West. "These are long trips, they will absorb a lot of LR2s and LR1s," he said.

At the moment, VLCCs are earning the most, Suezmaxes in the middle, and LR2 vessels "hovering around \$30 a day," said Lars Barstad, CEO of Frontline. "This is more like a normalised market."

The pricing for tanker shipping has typically been set in the Middle East, as a region where a large number of cargoes for the world are loaded, he said.

But the region's role in setting spot pricing rates is declining, with many cargoes being lifted by Contracts of Affreightment, where

an overall price is agreed for transporting the cargo, rather than a daily rate. So spot prices are being influenced more by negotiations about cargoes loaded in the US Gulf, Brazil and West Africa.

"We're a little bit disappointed that, with the amount of business and volume being done, we've not moved the market firmer," he said.

## Future oil production

Frontline's Mr Barstad was asked for his company's view on whether OPEC would increase oil production in future. "It's always very hard to guess, I must say," he replied. "There's a high stakes political game being played around OPEC."

"They have been fairly well co-ordinated to try to achieve oil prices in the region we are right now."

"I don't expect any fireworks to be honest. They will probably maintain levels where they are now."

Higher oil production would be good news for tanker operators in multiple ways – it will depress the oil price, so lower fuel costs, while also increasing overall [transported] volume, he said.

Saudi Arabia has proven to be one of the most generous production 'cutters' so far. Its

production is then replaced by oil from the US and Brazil, which may need to be transported much further to the markets.

"When Saudi decided on their voluntary cut, it proved to be positive for bigger tankers," he said.

## Fleet renewal

Tsakos Energy Navigation (TEN) is seeking to renew its fleet and is already building Suezmaxes and shuttle tankers, said Dr. Nikolas P. Tsakos, Founder & CEO.

In the first part of the year, it sold 10 of its first-generation vessels. It was able to sell its first-generation ice class vessels for almost as much as it cost to build them 15 years ago, he said. "It's a good time to take advantage and renew our fleets."

The company only operates tankers, from VLCCs down to MR size, including Suezmaxes, Aframax and Panamax, and also LNG and shuttle tankers.

## Energy transition uncertainty

Speakers were asked if the uncertainty about future fuels is hindering ordering.

"Yes, for us it is a significant deterrent of ordering ships," said TEN's Dr Tsakos.

"If that was not around, the Chinese yards would be putting vessels into the market from VLs downwards."

When contemplating newbuild contracts, every tanker operator has to consider whether you want dual fuel now, or dual fuel later [retrofit]" said Lois K. Zabrocky, CEO - International Seaways.

There is also the question of how many oil carrying vessels will be needed in future. "We have an additional existential factor that has to be overlaid into our business," she said.

Ted C. Petrone of Navios noted that IMO's tightening of decarbonisation targets in 2023 may mean that today's orderbook is half what it would have otherwise been. But a big orderbook could also have led to a decline in freight rates. "IMO has saved us from ourselves," he said.

"This whole issue of the next fuel has really put a cap on construction

I don't see it changing in the next few years. I don't see anybody putting in big orders."

"The regulatory / financial environment is very different from a few years ago, that is also a deterrent."

Another factor is that no tanker clients

are yet willing to pay for low carbon fuels “apart from very few,” said Lars Barstad of Frontline.

In this sense, tanker shipping is different to other shipping sectors. For example, consumer goods companies may be able to ask their customers to pay extra for the costs of transport with low carbon fuels. The car transport industry sees reducing emissions as part of the overall quest for lower carbon emissions in the automotive sector, and so is more willing to pay for it, he said.

### Newbuilds and length of life

There are “virtually no” VLCC new buildings coming into the market, said Frontline’s Mr Barstad. Just 2 planned for 2024, and 5 Suezmaxes. “We haven’t seen a Korean large tanker order for ages.”

Yard capacity in 2025 is fully booked, there may be “berths here and there” in 2026, but there cannot be a ‘significant’ change to VLCC supply until late 2026 and 2027.

Tanker operators normally consider scrapping vessels at about 20 years old. This is because it can be hard to ‘fix’ a cargo for any vessel older than 20 years, Mr Barstad said. For chemical tankers on the ‘clean’ side, it is often 15 years.

But it may be necessary to trade ships longer, if oil demand is continuing to grow into 2025, and new build rates are low. The rates may need to be higher than \$50k to \$60k a day for a VLCC to provide an incentive to extend the lifetime of vessels, he said.

There may be some new yards opening, but tanker operators are unlikely to order a VLCC from a yard which has just opened, added Mr Navione from Navios.

The average price for 20-year-old VLCCs on time charters is “probably around \$40k”, which is not enough to justify the costs of keeping the ship in operation for longer, he said.

“There are a lot of good quality vessels that have been built during the last newbuilding boom 2005-2010,” added Mr Tsakos. “Those were good quality double (hull) ships. They are good for at least another couple of years.”

“I try to visit vessels on a monthly basis. I get pleasantly surprised, ships already 15 years old, they look like vessels that could have been out of the yard a couple of years (ago).”

“When we look at the yards, they have not made the kind of money they were making in the mid-2000s,” said Ms Zabrocky of

International Seaways.

“Arguably they’ve made very little money. It has just been brutal. You see Korea importing labour, a tight labour situation. Steel prices fluctuate based on Chinese demand.”

“A lot of these yards were being supported by government and banks and had to be restructured. They went through an even more arduous period than we did in the tanker world.”

### Spot or time charter

Paolo d’Amico of d’Amico International Shipping said that two thirds of his company fleet are on the spot market, one third on time charter.

The company prefers to keep its handysize vessels (up to 50,000 dwt) on time charter, because it perceives a higher risk of them being underutilised on spot. Most of its MRs and LR1s are on the spot market.

“We still think that it makes a lot of sense to be spot for at least this winter with a big part of the fleet.”

Tsakos has 40 per cent of its tankers on time charter, which gives the company visibility of its earnings in the future. However, it does “profit sharing” agreement with time charter clients, where additional payments are made if the spot price goes to certain levels, to compensate for increased earnings of the vessel (or costs to the charterer) if it had been on the spot market.

Frontline’s Mr Barstad noted that shipowners are very exposed to interest rates. Higher interest rates “increase what we need to put butter on the bread.” The current higher interest rates mean that charterers need to “pay a little bit more before they get our vessels,” he said.

The company would be happy to put more of its fleet on time charter.

Navios’ Mr Petrone said that the company has 11 VLCCs on time charter, and 5 on the spot market. It is comfortable with the spot market vessels because it sees the probability of the market for most of its vessels being worse than today in a year from now as “very small”.

### Panama Canal

Dr Tsakos said that the Panama Canal is mainly impacting larger vessels, with many of them taking the view that it is worth “going around,” so this way requiring significantly more tonne miles. “We’re seeing quite a few

delays,” he said.

“LNGs have priority, but it is the most expensive passage so far in history. It’s costing us a fortune.”

“We can’t afford \$4m to buy a slot,” added Ms Zabrocky from International Seaways. The restrictions can drive changes in cargo patterns. “Product [cargo] can move potentially from the Far East to US West Coast as opposed to Gulf to West coast,” she said.

Taking product carriers through the Panama Canal is “basically not possible,” said Paolo D’Amico of d’Amico International Shipping. The canal is “totally monopolised by container people.”

### No worries?

Speakers were asked if there is anything investors should be more worried about.

Frontline’s Mr Barstad said that big economic events, such as the 2008 crash or COVID, did not make much difference to the tanker industry. For example, in 2008, the tanker order book was 45 per cent of the size of the fleet, now it is 5 per cent. There is not much likelihood of today’s tanker earnings going below operational costs.

Navios’ Mr Petrone noted that the Middle East crisis means that the number of tonne miles is increasing, with more shipments across the Atlantic, from the US Gulf and Brazil.

However, the ‘dark fleet’ is a problem the industry is very worried about, with big potential for accidents, said Mr D’Amico of D’Amico Shipping.

“We’ve been very vocal about this,” said Frontline’s Mr Barstad. “I think it’s kind of sad that IMO, a UN organisation, is handing out ‘license plates’, tickets to trade in a compliant shipping world.”

“Apart from the Pablo [explosion] outside Singapore and Malaysia, we haven’t had any major spills that we know of yet, but it’s only a matter of time.”

The best way to solve the problem could be to allow Iran to export oil freely, so they would use good quality ships, he said. “People would just park these [dark fleet] vessels.”

You can watch a video of the webinar online here

[https://www.youtube.com/watch?v=\\_OS6nAnO0MQ](https://www.youtube.com/watch?v=_OS6nAnO0MQ)

# The limits of what can be done with procedures

**The tanker industry may have reached the limits of how much safety can be improved by procedures. Further improvements may only be achieved by helping people get better at resolving problems, said Martin Shaw**

**T**he tanker industry is becoming more complex and less predictable, said Martin Shaw, president of the Institute of Marine Engineering, Science and Technology (IMAREST) and a tanker industry consultant.



**Martin Shaw, president of the Institute of Marine Engineering, Science and Technology (IMAREST)**

When things go wrong, while there may be familiar elements to the story, there are often unusual elements to them. In other words, “we’re finding different ways to ground ships,” he said.

Companies have generally solved the problem of high probability, high severity risks, and if they haven’t, they shouldn’t be in the shipping industry, he said.

But to improve safety rates further, we need to tackle the remaining risks, which have lower probability or lower severity. As we are successful in tackling them, we are left with even lower probability, or lower severity risks, which take a lot of effort to eliminate, but without providing much benefit, since the risk or probability was not high.

Today we have fewer accidents, but any accidents have few common causes. If companies have had a number of accidents, they are unlikely to find any common causes between them, or things they can fix which will reduce the multiple risks. “Anything you do will only affect the risk of that (specific) accident,” he said.

So we may have reached the limit of how much we can improve safety by implementing more procedures to avoid specific risks. The only way to improve safety further is to



**Marina Roehl, Business & Pool Coordination Manager, UPT United Product Tankers; Carolyn Köhler, Fleet Manager with Bernhard Schulte Shipmanagement during the coffee break of Tanker Operator Hamburg forum**

improve people’s ability to identify and fix emerging problems. “We should be moving more toward the human element,” he said.

Another side-effect of too many procedures can be that people feel that they are safe so long as they follow all the procedures, which is also not the case.

Automation systems can make risks worse. “The irony of automation is that people who use the automation are not generally used to recognising that something is going wrong,” he said.

A further challenge with today’s systems is the limited manuals, he said.

New equipment rarely comes with a “decent manual on how to operate the equipment.” Manufacturers are more likely to provide videos showing how great their equipment is, he said.

On the other hand, Mr Shaw does not see cyber attacks as a major potential source of risk, because digital systems on ships are not normally integrated, or only weakly integrated. A cyber attack is only possible if different systems can communicate with each other, he said.

## Complexity

Life for seafarers is enormously complex, perhaps at the limit of what a person is able to handle. This means that any risk-mitigating method which increases complexity may be

unlikely to work.

The maritime regulatory system is enormously complex, with regulations from IMO, flag, class, requirements from charterers and port state control. That may be manageable, but different flag states and class societies have different ways of doing things.

Onboard ship “it’s even more difficult to keep track,” he said. “Conflicting goals, conflicting requirements, endless communications and dealing with a variety of different systems.

It is still common for accident investigations to determine that the cause was a procedure not being followed. So the accident can be attributed to ‘human error’, without considering that the procedures may have been so complex is it impossible for a person to follow them all, he said. Or there may be so many procedures that people are not allocated enough time to follow them all.

Mr Shaw was asked why he thought there has been an increase in accidents related to machinery shown in recent industry statistics.

“It’s a difficult one,” he replied. “A bit of it is to do with more reliance on automation. You have people not being able to react quickly enough when automation goes wrong.”

“Equipment manufacturers take a large part of the blame. Equipment that is not easy to operate, doesn’t come with instructions,” he said.

# People and systems most critical - Phrixos Papachristidis

**When seeking to make tanker operations easier, the areas to look at are treatment of your people, and your systems. Phrixos Papachristidis, CEO of Hellepont group, shared his perspective**

**P**hrixos Papachristidis, CEO of Hellepont group, asked one of his colleagues in the tanker operations department, what he could say in the Tanker Operator conference about how to simplify tanker operations.

His colleague replied, 'Phrixos, it can't be done. This is complicated, it is getting harder and harder, and it is never going to be easy.'

Mr Papachristidis' perspective is that if tanker operations were to be simplified, two starting points would be people and systems.



**Phrixos Papachristidis, CEO of Hellepont group,**

Mr Papachristidis has a background in the commercial area of tanker operations. But being born into a shipping family, he first went onboard a VLCC when he was 7 years old.

The company has seventeen ships under technical management today, including tankers, containers, PSVs and a rescue boat.

Its main office is in Hamburg, and it has an office in Athens, and a manning agency it owns in the Philippines. The company has a

background in ship owning. It does not own any vessels today, but may do in future.

## People

"The people on the ships, the people in the office are the most important asset that you have," he said.

Spending face time with crew is very important, "really understanding what they need, what they are going through," he said.

"I think I have the best team running the ships," he said. "I do not just mean people in the office, I mean crew. They are an extremely important part of what we do."

"The way we like to think about motivating people is appealing to why they are doing what they are doing, and trying to understand, getting to know these people and understanding what drives them. I think you will get a lot more out of people that way."

"When it comes to trying to work through a problem, the best way to solve it is [through] the collective experience of the people and their ability to work together," he said.

If an incident ever happens, you need people to work together to minimise the damage. This is best achieved if no-one is blamed for the problem. Blaming "is something we do all too easily," he said.

"Most companies try to essentially push out as much responsibility as possible for things on the ship to the master. That kind of thinking will result in more incidents. It will make solving the real problem a lot harder."

If responsibility for something is being delegated to shipboard crew, then it is important to be sure it is being done because that is the most effective way to manage it, not because that takes responsibility away from someone else with more power, he said.

"When you are faced with a real problem your lives will be much easier [if you can] motivate people to work towards a common goal, rather than say "you did this, so it's your fault". That is not the way people want

to be treated."

Another way to simplify tanker operations is having more staff with seafaring experience. There are some ship managers "where the people who are supposed to be running the ships have [spent] very little time on board," he said.

There are many people developing digital technology for ships which also do not have seafaring experience, he said.

## Systems

The other way to potentially simplify tanker operations is to look at your systems. The purpose of systems is to improve safety and efficiency.

Seafarers should be supported with procedures or tools which will mitigate complexities what may arise or could cause an incident, he said.

But this focus easily gets lost. For example, if a shipping company adds an extra checklist because they think it is needed for a vetting inspection, that may not do anything to directly improve safety.

Companies should think more about the readability of their manuals. "You develop manuals that are thousands of pages long that no-one is going to read, let's face it." The goal is to make something "that is really going to make a difference onboard, that is going to help, that is not going to overwhelm," he said.

Mr Papachristidis has concerns that new regulations are being brought to ships faster than they can be adopted, considering how complex everything is already.

You can watch Mr Papachristidis talk on video and download slides at

<https://www.tankeroperator.com/PdfFiles/TOHamb2023.html>

# Recommendation to participate in SIRE 2.0 Phase 3

**Tanker operators are urged to participate in Phase 3 of SIRE 2.0 and do a trial inspection, because otherwise their first encounter with it will be a live inspection, said OCIMF consultant Steve Barker**

**S**IRE 2.0, the second version of the Oil Companies International Maritime Forum (OCIMF) Ship Inspection Report Programme (SIRE), is gradually being implemented.

SIRE 2.0 is being implemented in four phases. The first phase was limited initial testing; the second phase brought in a larger number of operators and inspectors. The third phase was expected to start at the end of Q4 2023, once the tablet computers had been distributed to inspectors around the world. In this phase, all tanker operators will be able to participate in 'mock' inspections.

Captain Steve Barker, SIRE 2.0 Project Transition Consultant, OCIMF, urged tanker operators to participate in Phase 3. Because otherwise they will be doing their first SIRE 2.0 inspection in the final Phase 4, when the results will be used to determine the vessel's fitness for charter. "I would not want to be doing my first inspection in that phase," he said, speaking at the Tanker Operator Hamburg forum in November.

Tanker companies will need to pay a fee for a Phase 3 inspection, the amount of which will depend on discussion with the relevant OCIMF member.

There are many videos and other information about SIRE 2.0 on the OCIMF website, including tools useful for seafarers.

SIRE 2.0 "will take some time to bed in with inspectors, operators, submitting companies," he said. "We're all on a quite steep learning curve."

## Experience so far

The experience in Phase 2 is that "inspections have gone very well, crews have been very well prepared, operators have been prepared, and generally good feedback from captains, crew, and superintendents," he said.

Some tanker companies saw challenges with

the pre-inspection work, mainly because they did not start early enough before the onboard inspection.

"It's very important that you do this in good time," he said. "The days of ringing up [an oil company] saying 'can you fix an inspection for tomorrow' have gone. It takes longer to get things done."

## Background

The first version of SIRE was launched in 1993. "In those 30 years there's not been any great change in the system or format or anything like that," he said.

While the system made a big contribution to improving safety in its early years, most people involved with tanker shipping see that its effectiveness has plateaued, he said. It is not "improving things at the same rate."

SIRE 2.0 aims to take the system to the next step and modernise it, he said.

SIRE 2.0 builds on experience during COVID, when inspectors were not able to visit ships personally, so systems were developed to review the ship remotely using photographs.

The SIRE 2.0 project team have been working hard over the past few years "to get the thing up and running," he said.

## More information upfront

A main difference with SIRE 2.0 is that operators are asked to provide much more information before an inspection, to free up the inspector's time during the inspection itself.

"You will probably find it a bit burdensome in the beginning. Once you're up and running with it you'll find it less burdensome. We'll be working to make it as quick and easy as we can," he said.

Firstly, the Harmonised Vessel Particulars Questionnaire (HVPQ) is completed. This is static data, so does not have to be completed



**Captain Steve Barker, SIRE 2.0 Project Transition Consultant, OCIMF**

again each time, unless there is anything to update. "Make sure your HVPQ is up to date before you do anything else," he said.

Then, the operator compiles an online "Pre-Inspection Questionnaire" (PIQ), which requests up to date information about the ship's current operations, including certificates. You are asked to provide recent or fairly recent photographs of different areas of the vessel, following a template. For example, it asks for photographs of the manifold and the generator. The date of the photographs is less important than whether they reflect the current condition.

The inspector can see the photos before boarding the vessel, and during the inspection, so can verify they show the current condition of the ship.

The photographs should also be helpful to the tanker operator in monitoring vessel condition and any changes over time, Mr Barker said.

The pre-inspection questionnaire includes questions about whether the company engages audit companies, such as to do navigation or cargo audits. This does not infer that external audits are a requirement. "If you don't do private audits, say 'no', we don't do it," he said.

After the PIQ is completed, and a button pressed to declare that everything is correct and up to date, a set of questions is generated by the software which will be asked of the ship crew during the inspector's visit. The software's

rules should ensure that every question is relevant to the ship on that day.

The PIQ includes questions about aspects of the operation being planned, and the cargo, such as whether you will do a ship-to-ship transfer (STS). So (for example) the crew will only be asked questions about STS if this is something the vessel is doing during the voyage.

There is an online tool for booking the inspection, which is similar to the previous system. If you ever need to cancel a planned inspection, for example due to a changed itinerary, you can do that through the website. You are required to select the reason.

### Inspection

In the actual inspection, the inspector will carry a tablet computer with special software running on it, to read the questions, enter the answers, verify pre-submitted photos match reality, and take new photos.

The tablets are specially made for industrial purposes and are intrinsically safe.

If the tablet breaks, or is disallowed by the terminal, it is possible to do the inspection on paper, and type in the information later. This is not expected to happen very often. Only the submitting company (the OCIMF member) can consent to this.

The tablet is ‘locked down’, so cannot be used for any other task or to browse the internet.

The use of photographs reduces reliance on the inspector’s subjective judgement. For example, if the observation is that something is leaking, a photograph of the leak can be included. The person deciding whether to accept the vessel for charter can make a decision based on the photographs.

At the end, the inspector can choose which of the additional photographs taken onboard should be included in the final report.

The software records the timings of different elements of the inspection, how long it took, and what activities were included, in case there is any dispute about this later.

At the end, the software generates a report which is uploaded to the SIRE system.

### Questions of crewmembers

A core part of the inspection is questions which are asked of the relevant crew member.

The list of questions is generated by software after the PIQ is submitted, to be relevant to the ship type and trade. All the possible questions, 325 in total, are published online in the SIRE

Question Library (SQL). Some are similar to previous questions, some are not.

There are “core” questions you are always asked, and “rotational questions” you are asked on a certain periodicity. There are two banks of rotational questions, so questions in bank 1 will be asked more often than the questions in bank 2, because they relate to elements of higher risk.

Each question also has a list of potential answers or ‘observations’ the inspector can make.

The design of the questions is based on a ‘bow tie’ analysis of specific risks, ensuring that risks are mitigated (left side of the bow) and that there are means in place to minimise impact should anything go wrong (right side of the bow).

The reason behind the question is available to the inspector on the tablet. This can also be shown to the person being interviewed, so the inspector can say, “captain, this is why I’m asking you this.”

In the past, inspectors have often followed their own course of what to look for. With SIRE 2.0, the course of the inspection is guided by the software, ensuring that a full understanding of the vessel can be gained in the time available.

In any question there can be responses relating to hardware, processes, and human factors. Some questions have responses in all three categories, others don’t. For example, the question about whether the emergency generator can be started on request is purely about hardware.

They may be questions about when the superintendent last visited the vessel, and how long the superintendent was onboard.

Inspectors are asked to enter responses using drop down menus as far as possible, to make the data easier to analyse later. For example, they can state that there is a concern with equipment “emergency generator” and the nature of the concern is that “it is broken”.

Some questions allow only a binary response (yes/no), some questions have graduated responses (as expected, largely as expected, not as expected). Questions relating to people have an additional possible answer “exceeds expectations”.

If there were negative observations against core questions in the previous inspection, they are visible to the inspector in the current inspection, as a prompt to ensure issues have been rectified.

A further category of questions is ‘campaign questions’. These are envisaged to be used

if there is ever a series of problems with something specific in the industry, such as a number of enclosed space accidents, and so OCIMF members want to check that every company has measures in place to prevent them.

The question is asked of the crewmember responsible for the relevant task. So, if it is a question about ECDIS, the navigation officer will be asked the question. If it is a question about the manifold, the crewmember responsible for the manifold will be asked.

“These are not meant to be interrogations of people to ensure they are confident. It is meant to be ensuring the task has been completed,” he said. “The system is not designed as a competence test of people. The purpose is not to catch people out.”

The questions check that people know how to do their duties. “If you say, ‘what would you do if there’s a leak’ and the guy says, ‘I don’t know.’ then there would be an observation.”

“The purpose is also to find out the reason the person does not know. Is it because no-one has ever told him?”

### After submission

People with an in-depth knowledge of tankers may find that the photographs provide the most useful information about the condition of the vessel. As someone vetting a vessel, “the first thing I’d do is look at the photographs,” he said. From photos, “you really feel you know what the ship is like.”

There is a feedback portal where anyone with access to the system (shipping company, inspector, oil company) can suggest improvements to the questions or to the process.

If the tanker operator does not agree with something, they can contact the OCIMF member to discuss further. If the OCIMF member agrees that something needs to be changed, they cannot change it themselves, they must ask the inspector if he is willing to do it. There is a 14-day window to do this. Then once the inspection has been published it cannot be changed, only withdrawn.

The information is compiled in a way that is data mineable, although OCIMF has not yet determined how it will be analysing the data, he said.

You can watch Captain Barker’s talk on video and download slides at

<https://www.tankeroperator.com/PdfFiles/TOHamb2023.html>

# ABS - the pathway to ammonia fuelled tankers

**The pathway to ammonia fuelled tankers includes sourcing low carbon ammonia, learning from experience carrying ammonia cargo, developing ammonia handling systems, and training. ABS' René Laursen explained**

If shipping is going to need to be carbon neutral by 2050, today's newbuilds will eventually need the capability to run with zero emissions, even zero carbon fuels which are not yet available, said René Laursen, director of the sustainability group at class society ABS.

He was speaking at the Tanker Operator Hamburg forum in November.

"I spend most of my time discussing this with shipowners and finding out the best way forward," he said.

Ammonia fuel looks to be "a feasible way forward," he said.

But there are many concerns with ammonia safety. "We are forced to overcome that, one way or the other. Ammonia is going to be part of the fuel base in the future, there is no way around it."

Biofuels, the other contender for a low or zero carbon fuel, are unlikely to be available for shipping on a big scale, because biowaste is scarce feedstock and production of biogenic carbon would put too much pressure on food production, Mr Laursen believes.

Mr Laursen formerly worked at MAN developing alternative fuelled engines. He was project manager for developing the first LNG-fuelled ME-GI engine in 2014 and introduced the first methanol engine a few years later. He also introduced the concept of ammonia engines at MAN and has been working with ammonia fuel since 2016.

## Producing ammonia

The ammonia molecule,  $\text{NH}_3$ , does not contain any carbon. But it is traditionally manufactured from methane gas ( $\text{CH}_4$ ), with carbon emitted as  $\text{CO}_2$  in the process. So traditional or 'grey' ammonia is not a low carbon fuel.

The three biggest producers of grey ammonia are Trinidad and Tobago, Russia, and Saudi Arabia, each producing around 20 per cent of all ammonia today.

The long-term vision is that ammonia will be made from hydrogen generated with renewable electricity, known as 'green ammonia.' The technologies to use electricity powered

electrolysers to split water into hydrogen and oxygen, then react hydrogen with nitrogen to form ammonia, have been around since the 1930s and 1940s.

The limit is the availability of renewable electricity, when it may be preferentially used to replace electricity generated by fossil fuels. One idea is that green ammonia could be made from renewable power generation which is not close to electricity consumers, such as solar power in Western Australia, Oman, Saudi Arabia, and northern Chile. For example, Japan and Korea may have power plants running on green ammonia supplied from solar power in Western Australia, he said.

## Ammonia carriers

The maritime industry has experience carrying ammonia as a cargo, which can be seen as a stepping stone to using ammonia as fuel. Around 10 per cent of all production is being transported by ship. Ammonia is the third biggest seaborne liquefied gas after LNG and LPG, he said.

ABS is seeing growing interest from shipowners in building very large ammonia carriers. It is involved in a number of projects, including an order from Maersk to build ten very large ammonia carriers announced in October 2023. Additionally, Capital Gas Ship Management Corp and Eastern Pacific Shipping have each signed orders to build two very large ammonia carriers for delivery starting in 2027.

We are likely to see more demand for carriers to transport ammonia in future, he said. So far, projects have been announced to produce around 150m tonnes of green and blue ammonia by 2032. If half of this is eventually built, that is 80m tonnes a year. Nearly all of it will be transported by ship, Mr Laursen predicts. One very large gas carrier (VLGC) can take 0.5m tonnes a year approximately, he said. So, there would be a need for 160 vessels minimum.

Ammonia is dense enough to be viably transported if it is at high (20 bar) pressure and atmospheric temperature, or liquefied by refrigerating it to -33 degrees C at atmospheric pressure, or something in between ("semi-pressurised").

High pressure tanks on ships are typically up



**René Laursen, director of the sustainability group at class society ABS.**

to 6000m<sup>3</sup> in size but they are extremely heavy.

A semi-pressurised vessel typically has tanks of 5,000 to 30,000m<sup>3</sup>, with a design pressure of 5-7 bar, he said. If the temperature of the ammonia increases to above 20-25 degrees, some liquid will boil off, and this gas will need to be released from the tanks to avoid damaging the tanks. It cannot be released to the atmosphere, so needs to be cooled down in a reliquefaction system and put back in the tank.

The fully refrigerated vessels carry ammonia at -33 degrees C and atmospheric pressure. Large LPG carriers with capacity of 20,000 to 130,000m<sup>3</sup> or larger can carry ammonia in this way. The tank can have a pressure of 0.7 bar, he said.

These vessels have a double wall tank, with insulation between them. One safety issue is that if the inner wall is breached, the ammonia will enter the space between the barriers, which is warmer than -33 degrees, and the ammonia will warm up and gasify, taking up much more space. There is a safety valve (a large rupture disk) on top which can release enormous amounts of gasified ammonia quickly.

One supplier has developed a design with the insulation outside the outer barrier, so the inside of the outer barrier is also kept at minus 33 degrees, avoiding the risk of very fast gas boil off if any ammonia leaks through the first barrier.

Some of the tank designs are similar to LNG tank designs. GTT is developing a membrane tank system which could be used for both LNG and ammonia, so a company could build

an LNG carrier and later convert it to carry ammonia, he said.

### Ammonia handling

Ammonia is very toxic, and this makes it complicated to handle. A person can safely breathe air continuously with ammonia levels only up to thirty parts per million, he said. A higher level can be accepted by the body for a short period, perhaps 140 ppm. So the main safety focus is on avoiding leaks.

Flammability is not a big concern, the risk of ignition is very low. When burning it in a ship engine, a large amount of additional “pilot fuel” is required to make it burn. Burning ammonia will also stop burning by itself if it does not have energy support from another fuel. From a safety perspective, “that makes things a lot easier,” he said.

The overall risks of fire and explosion on an ammonia fuelled tanker are considered higher than the risks with conventional tankers, because any fire could damage the ammonia tank and lead to leakage of the ammonia, he said. So extra safety prevention will need to be implemented to achieve the same safety level for an ammonia fuelled tanker.

Ammonia has a strong smell, making it easy to detect, but of course ammonia is toxic, so if there are higher levels in the air than a person can take, “you just pass out.” In areas where ammonia leak can occur ammonia detection sensors have to be applied.

The difference between LPG and ammonia fuel is that ammonia fuel needs a system to collect all ammonia vapour, during the purging the system after fuelling.

Ammonia will kill marine life if leaked in big quantities into the sea. However, tests found that marine life would begin to recover one to two days afterwards, with fish returning. By comparison, a leak of fuel oil will impact a

region for decades if it is not cleaned up, he said.

It may initially be considered too dangerous to bunker ammonia in a port. Mr Laursen noted that LNG bunkering was initially done outside port, where there were no risks to the public, until people got more experience and comfort levels with it increased.

A study looked at a scenario where there is a leak during ammonia bunkering, and it takes a minute for emergency systems to shut down fuel transfer. In the modelling, during this minute, 26m3 was released, through a 203mm hole, raising vertically upwards.

If there was wind blowing from the supply vessel to the receiving vessel, the ammonia would spread out to cover about 300m2 around the receiving vessel and 50m2 around the supply vessel. With wind in the opposite direction, it would spread about 200m2 around the receiving vessel and 200m2 around the supply vessel. Eventually the ammonia would spread along the water.

ABS has modelled the areas which would have 160 ppm concentration, which is not immediately dangerous, and above 1100 ppm, which would be dangerous.

The model used typical Singapore conditions of a temperature of 33 degrees and humidity of 70 per cent during the day, and temperature of 24 degrees and humidity of 90 per cent at night.

It found that the temperature and humidity made a big difference to how far the ammonia vapour spread if the leak described above would occur. During the day, the cloud with concentration of 1100ppm and above would cover 2.6m m2; during the night, the cloud would cover 811,000 m2.

“You are halving the area which is exposed for toxic vapour if you do bunkering at night. This is already good learning,” he said.

“We are preparing to do some testing to verify that the modelling is working,” he said.

ABS has been developing guidance on leak mitigation methods since 2021, including methods to manage risks of leaks in confined spaces, secondary barriers, locations of outlets, and acceptable ppm levels.

Even at non-toxic levels, the smell of ammonia makes working with it unpleasant. “Once it has been exposed to the steel it sticks in the steel and slowly comes out, you can smell it for a long time,” he said.

### Incomplete combustion

The normal combustion of ammonia (NH3) with oxygen results in nitrogen plus water.

Incomplete combustion could lead to NOx emission in the exhaust. Worse, it could lead to formation of nitrous oxide (N2O), which is 300 times more potent than CO2 as a greenhouse gas. Emissions of N2O of just one gram per kilowatt hour “can destroy your complete effort in making a [carbon] difference,” he said.

Engine systems are designed to minimise the possibility of N2O in the exhaust. “If you keep a high combustion temperature, you should not experience this,” he said.

If any ammonia ‘slips’ uncombusted through the engine, that would also be a problem due to its toxicity.

Testing on an engine by WinGD found that no N2O or limited NOx were produced, and “very limited” amounts of ammonia slip, he said. “It seems those issues can be overcome by engineers.”

### Moving to ammonia operations

So, there will be big changes to how we operate ships as we move to ammonia, and it will make life onboard a bit more complicated, he said.

It is likely to take a long time for ammonia fuelling systems to resolve all problems, based on what we have seen with LNG engines. “The first LNG engine came out in 2013. Today there are still teething problems which are not fully solved,” he said.

There will need to be extra focus on training and personnel. (ABS is running ammonia training courses for crew).

The maritime industry will also need to find better ways to attract workers who are capable of working with the complex requirements of ammonia fuel. “We see already now, we cannot get people. That is going to be a major issue for shipping,” he said.



Captain Steve Barker, consultant with OCIMF, in discussion with the audience

You can see Mr Laursen's slides and watch his talk on video at

<https://www.tankeroperator.com/PdfFiles/TOHamb2023.html>

# Harren – developing a consistent safety culture

**Harren Group of Bremen is enhancing its consistent safety culture across all business units, to be proactive and pragmatic rather than documentation or compliance driven, and with continual risk assessment. Ömer Faruk Bayar explained**

**H**arren Group, an operator of 55 vessels based in Bremen, is continuously developing and nurturing a consistent safety culture across the whole company, which all staff members feel ‘ownership’ in, and with safety measures implemented in the same way in all parts of the company.

Every organisation has a safety culture, but some safety cultures are better than others, said Ömer Faruk Bayar, business unit director of Harren Group Tankers, speaking at the Tanker Operator Hamburg forum in November.

Harren’s fleet includes heavy lift vessels, multi-purpose vessels, bulk, containers, tankers, and offshore wind. The company is summarizing its business units under the single company name of Harren Group.

In the past, business units partly addressed safety differently. With a unified structure, it wanted to ensure that there was a consistent safety culture across the company, he said.

The safety culture program is personally sponsored by the company CEO Dr Martin Harren and is led by three company managing directors and the board safety director.

One way to define ‘culture’ is what people do when no-one is watching, he said. For example, if there is a rule saying not to smoke, and people still smoke when they know they will not be caught, then the organisation does not have a ‘no-smoking’ culture, he said.

A recent move was to conduct a safety perception survey for crew and office staff. The response revealed where room for improvement was given. This could itself indicate for example that some employees do not see safety as part of their role, he said. “This was something we really wanted to change.”

Harren also determined that its company safety culture was slightly reactive in some areas, in that actions were being made after problems occurred, or to comply with new regulation.

It found it was also partly managing safety through documentation, and you could argue that documentation-based safety is not a ‘culture’, he said.

Harren is developing additional visual tools to communicate its expected safety behaviours, which should be easier for staff to understand



**Ömer Faruk Bayar, business unit director of Harren Group Tankers**

than lengthy written manuals and regulations, he said.

It emphasises that people should plan out all work they are going to do, and continually assess its safety. They should check if a task is authorised to be done.

It is seeking to develop additional ways to help people learn about safety than classroom training only, which may not be very effective for all. After a while, “nobody is listening, especially with mobile phones in hand,” Ömer Faruk Bayar said.

**TO**



# NSB Group – developing a learning culture

**Ship management company and maritime service provider NSB Group is encouraging development of a learning culture in the company where shipboard and office staff are motivated to continually develop skills, including problem solving**

**N**SB Group, a ship management company based in Buxtehude, Hamburg, is seeking to foster a “learning culture” in the company, where both shipboard and office staff are motivated to continuously develop their skills and understanding, including their ability to solve problems.

Caroline Baumgärtner, VP People and Talent Development with NSB Group, explained how it works, speaking at the Tanker Operator Hamburg forum in November.



**Caroline Baumgärtner, VP People and Talent Development with NSB Group**

NSB Group manages roughly fifty vessels, including container ships and tankers. NSB operates its own Maritime Training Center, NSBacademy, open to own and third-party seafarers. The academy has two newly updated Ship Handling Simulators in the headquarter of NSB in Buxtehude. The company also cooperates with a cadet training centre in Constanța (Romania) and in Subic Bay on the Philippines.

In the past, staff were provided with traditional training, which could be interpreted as a ‘we know better’ approach, Ms Baumgärtner said.

Now, the basis of the learning program is a description of competencies which NSB considers essential that someone in a certain role should have to do their work. NSB then tries to help people identify where their gaps

are in this list of competencies and fill the gap.

“We have crystal clear goals of what skills people at NSB should attain,” she said.

These competencies include both technical skills and “job-related skills,” such as how leaders can create a team and a healthy working atmosphere where people are motivated to contribute.

Such job-related skills are sometimes known as “soft skills,” although Ms Baumgärtner discourages use of this term, because it might suggest that these skills are less important.

Other job-related skills included are problem solving and analytical skills, and the ability to be accountable for a task.

Ms Baumgärtner noted that the German language does not have an equivalent word to the English ‘accountable,’ the closest in German is like the English for ‘responsible,’ which may have a different meaning.

NSB leaders are also expected to be able to show empathy and to reflect on their own performance. They are expected to show adaptability and resilience, and the ability to influence others.

“Mindset is so important, a positive mindset helps you,” she said. “Sometimes you hire people due to their mindset.”

NSB also aims to support people in developing problem solving skills, since this is a very desired competency, she said. One way to do this is to invite seafarers to the office and invite them to imagine themselves in a certain scenario and determine what they would do. It is a joint activity which some may find enjoyable. The scenarios are put together by NSB together with its training partners, she said.

## Not training

Most maritime colleges around the world, in contrast, provide ‘rote learning,’ otherwise known as ‘training,’ which does not support problem solving at all, she said.

People cannot learn simply by being spoken to. A typical attention span for a person today

is just 75 seconds, she said. “You can talk and talk, and nobody is listening. The attention span is decreasing all the time.”

Rote learning may have worked in the past, when junior ship crew were expected to accept decisions made by senior officers without question. But the increasing complexity of shipboard operations today makes this way of working unviable, even if it were desired.

Just having a rank does not necessarily make someone a ‘leader,’ she said. True leaders treat people with respect and do not assume they are the only person who knows the right answer.

## Connection

Learning is usually better if people are learning with other people they like personally, and feel connected to them, she said.

NSB involves some of its fleet captains in training younger shipboard staff, if both are off ships at the same time. NSB also runs crew conferences for cadets. “Most of them are really keen to be the spokesperson of the table,” she said.

“We try to keep this learning atmosphere in the office and onboard and get the people with us,” she said. It is a change happening over a period, not something which happens in an instant.

## Remote learning

NSB is developing remote learning systems, so someone’s learning can be supported by a human instructor. This can be more engaging than purely computer-based training. This can include the use of augmented reality, where a learner ‘walks’ around a ship and the instructor explains things to them.

Such learning programs can be adapted to the desires and working practises of the younger generation, including wanting flexible working times, having stronger personal relationships, providing instant feedback, and supporting multi-tasking, she said.

# First four stroke ammonia maritime engine on the market

**Wärtsilä has placed the world's first four stroke ammonia engine for ships on the market. It is available as part of the Wärtsilä's 25 engine "platform"**

**W**ärtsilä has placed the world's first four stroke ammonia engine for ships on the market, with the first engines expected to be delivered "in the time frame of 2024 to 2025."

Viridis Bulk Carriers has already signed a "letter of intent" to use the ammonia engine, intended to lead to a commercial contract in early 2024. It plans to use the engine to offer a carbon free transportation service in the European short sea.

"We are releasing the first four stroke ammonia fuel engine to market. It is a big milestone for us in Wärtsilä, and I would say, in the whole industry," says Juha Kytölä, Director of R&D and Engineering at Wärtsilä.

It will be provided as part of Wärtsilä's "25" engine platform, so named because the cylinders are 25cm in diameter. There are engines available on the platform combusting conventional diesel, LNG and biofuels.

They have a modular structure. The idea is that (for example) if a shipowner has a 25 engine for diesel, it will be relatively easy to convert it to burn ammonia. The base engine

and many of the components are the same. So it is intended to be a future proof system.

The ammonia engine can also run LNG and conventional liquid fuels, so also biogas and biodiesel.

Wärtsilä also provides the 'AmmoniaPac' fuel gas supply system, which includes systems for bunkering, storing and managing ammonia fuel onboard, with all containment within a double wall for safety.

It is providing the Wärtsilä Ammonia Release Mitigation System (WARMS), which mitigates the impact of any ammonia which is released. Also, the Wärtsilä NOx Reducer (NOR), which helps clean exhaust gases with a catalyst.

There is also a 'highly sophisticated' automation system, and a maintenance plan, seafarer training, and 24/7 support, Wärtsilä said.

This is based on the automation, maintenance, training and support plan developed for Wärtsilä's LNG engine system.

Ammonia fuel is expected to have a very high purity. The fuel itself keeps the engine clean, Mr Kytölä says.



**Juha Kytölä, Director of R&D and Engineering at Wärtsilä**

Interest in ammonia fuelled engines is coming particularly from shipping companies in Northern Europe, Japan and Singapore, he says.

## Need for pilot fuel

Ammonia can be considered a 'lazy fuel', because of the large amount of additional pilot fuel needed to get it to ignite, Mr Kytölä says. Hydrogen by comparison ignites extremely easily and requires more precautions to stop it from igniting.

The need for pilot fuel means that a vessel running on the maximum amount of ammonia, with ammonia sourced from renewable electricity, will have its overall carbon impact reduced by "more than 70 per cent" compared to diesel fuels, if the pilot fuel is itself conventional diesel.

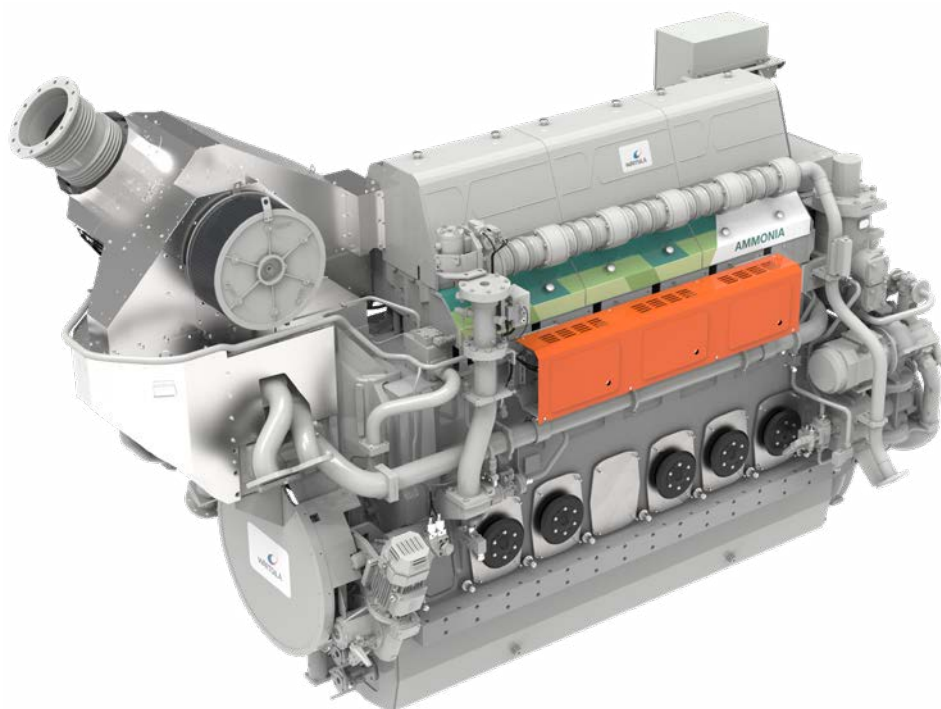
This is calculated on a well to wake basis, taking into consideration the amount of pilot fuel needed (with the pilot fuel being conventional fossil diesel) and emissions made in the production and delivery of the fuel.

This exceeds the IMO target for 2040, although is some way from being net zero.

The amount of pilot fuel needed in the mix is "below 30 per cent", Mr Kytölä said, although he declined to reveal the actual amount.

It is possible to improve the carbon footprint by using biofuel as the pilot fuel.

Wärtsilä plans to continuously research ways to reduce the amount of pilot fuel required, which may mean releasing new engine designs, he said.



**Wärtsilä's 4 stroke ammonia engine**

# Study on CO2 transport by ship in Europe

**EU advisory organisation Zero Emissions Platform has published a report about the potential for maritime transport of CO2, estimating 10-20 vessels will be needed in Europe by 2030**

**T**he Zero Emissions Platform, a EU advisory organisation, has published a report into the potential for maritime transport of CO2 between emitters and storage sites.

It estimates that 10-20 vessels will be needed by 2030 to serve projects which will be in operation by then. Far more carbon capture and storage projects are planned for the 2030s, so far more vessels will be needed over the longer term, but this was outside the scope of the study.

The study looked at the planned CCS projects, potential shipping routes, suitable vessel capacities and fleet sizes, potential interoperability issues, and regulatory and commercial barriers and enablers.

Companies represented in the working group included Storegga, Carbon Collectors, Energy Transition Advisory (co-chairs / authors); and Northern Lights, Harbour Energy, Slaughter and May, SIGTTO, Ecolog, Shell, Knutsen NYK, Equinor, Prime Marine, Neptune Energy, BP, and Navigator Terminals.

Shipping might not only be used to carry CO2 from a source to a sink; it may be used in future to carry CO2 from terminals to stores, or from one terminal to another. CO2 is more likely to be delivered from emitting sites to terminals by pipeline.

There are 'low volume' and 'high volume' transport scenarios, where high volume could be up to 40m tonnes CO2 transported a year.

For a comparison, the Northern Lights project of Norway, Europe's first CCS project, handles up to 1.5m tonnes CO2 a year in its first phase, so is 'low volume'.

The shipping service could be operated by the storage provider like a waste collection service.

Alternatively, the emitter could provide a 'drop off' model, an example being an emitter selling and delivering CO2 for food use.

Three 'shipping conditions' were explored: low pressure (5-10 bar and -50 degrees C); medium pressure (15 bar and -27 degrees C); and high pressure (40-45 bar, 5-10 degrees C). The medium pressure option was chosen by Northern Lights.

The lower the temperature, the more energy needed for cooling, and more insulation needed. But higher pressure needs much thicker walled tanks, and lower temperature means higher density. The tolerances for impurities are also different at different pressures and temperatures.

## CO2 specifications

The CO2 specifications for shipping are generally more stringent than pipeline specifications, said Haije Stigter, technical director of consultancy Carbon Collectors, and a co-chair and co-author of the report. So, it makes sense to do CO2 conditioning at the point the CO2 is loaded onto ships.

If there is a small amount of water mixed with the CO2, it will be corrosive; any hydrogen present can have an impact on material integrity. Sulphur and nitrogen oxides, oxygen and hydrogen sulphide are also corrosive.

If the CO2 contains methane, nitrogen, or hydrogen, they will not condense at the temperatures where CO2 condenses, so will remain as a gas.

To find the best solution might require a "complete techno economic analysis - source to sink," he said.

It will be desirable to keep the specifications

as broad as possible, because the more restrictive they are, the more potential CO2 shipping options will be restricted out, and some emitters may find CO2 shipping cost prohibitive.

## Challenges

SIGTTO, the Society of International Gas Tanker and Terminal Operators, is asking for international regulations for gas transport to be changed, because they were designed for carriage of flammable gases, while CO2 is inert.

There will need to be very reliable methods for metering and allocating the CO2 which is permanently stored, if it is used to enable emitting companies to avoid paying for emissions credits.

It may be necessary for governments to provide higher levels of subsidy to CO2 emitters which require maritime transport, because their costs will be higher than emitters who can connect to a CO2 pipeline network.

It would be helpful if EU-UK transport regulatory barriers could be overcome. These are the lack of integration between EU and UK emission trading schemes, and the London Protocol prohibiting transport of waste between countries without a special agreement between them, Mr Stigter said.

To download the report, go to <https://zeroemissionsplatform.eu/>, navigate to news and resources / reports, and download "Achieving a European market for CO2 transport by ship" (Jan 9, 2024). This article was based on a webinar which is online here : <https://www.youtube.com/watch?v=JptJxWbqREU>

## Prime Marine perspective on CO2 shipping

**Prime Marine, an Athens tanker operator, has been exploring the market for CO2 transport in Europe. Stavros Niotis shared his perspective**

**P**rimé Marine is a tanker operator based in Athens, with long experience on oil product tankers and Ammonia/LPG carriers. It has

been studying carefully how it could enter the CO2 transportation business and ensure that it can be profitable.

Stavros Niotis, Chief Sustainability Officer, Prime Marine, explained how the company is looking at it, in a webinar organised by Tanker Operator's sister magazine Carbon

Capture Journal in May 2023.

Prime Marine has got to know the CCS business through its participation in the Prinos carbon capture project in Greece.

A primary inhibitor is that tanker operators are unlikely to commit millions of euros to building them without being sure of their returns, he said.

Prime Marine has calculated that a large proportion of the total cost of CO<sub>2</sub> shipping will be the cost of building the ships. The increase in CAPEX per additional tonne of capacity gets lower as ships get bigger, up to a certain point (roughly, a 40,000m<sup>3</sup> vessel).

This means that the transport cost per tonne of CO<sub>2</sub> carried will decrease greatly with larger volumes being carried. The cost does not increase with the length of voyage as much as you might expect.

It has evaluated several CO<sub>2</sub> shipping project propositions, to determine the

ultimate price per tonne CO<sub>2</sub> carried. This showed that pricing on real projects can vary from \$45 a tonne down to \$10 a tonne or even sometimes lower, depending largely on the volumes to be transported per year and the distance between the loading and discharging points, but also to other project specific parameters.

The company envisages that CO<sub>2</sub> ships will have capacities of 7,500m<sup>3</sup> to 40,000m<sup>3</sup>, and the larger the ship, the lower the per tonne cost.

Looking at the CO<sub>2</sub> transport projects on the drawing board in Europe, Prime Marine has identified that the single point source / single point storage projects are likely to carry smaller CO<sub>2</sub> volumes than the cluster projects.

Also, the cluster/hub projects currently planned, such as in Teesside, UK, and Aramis in the Netherlands, target on having

large maritime terminals connected to the cluster/hub, capable of accommodating very large vessels. The ship design parameters for single point projects, however, will highly be affected by the space availability, infrastructure and any operational restrictions on the emitter's site.

In terms of vessel design, CO<sub>2</sub> has higher density than LPG (1101 kg/m<sup>3</sup> for liquid CO<sub>2</sub> vs 510 kg/m<sup>3</sup> for LPG, while it also needs to be stored under higher pressures compared to fully refrigerated LPG. Therefore, CO<sub>2</sub> vessels need heavier tank structures than LPG carriers.

There have been concepts for gas carriers carrying both LPG and CO<sub>2</sub> in separate tanks, but you cannot optimise a vessel for both LPG and CO<sub>2</sub> at the same time, he said, but a multi-gas/combination carrier may still be an option for specific project applications.

TO

# Wallem's first two dual-fuel LNG tankers

**Ship management company Wallem reports that it is providing technical and crew management to two of its first LNG dual fuel tankers, owned by Viken Shipping and time chartered to TotalEnergies for 4 years.**

**T**he vessels were also constructed under Wallem Group supervision at Guangzhou Shipyard International, China.

The first vessel, Angleviken, was brought into the Wallem fleet at the end of June 2023. It was Wallem's first dual fuel newbuilding.

The second vessel, Ashviken, is identical. It was brought into the fleet in mid-August 2023. Wallem has plans to take a further five dual fuel car carriers during 2024.

"Today, decarbonisation heads the sector's agenda, and these ships embody Wallem's continuing drive to offer expertise where it counts," said Ioannis Stefanou, managing director of ship management with Wallem.

For the newbuilding supervision, Wallem deployed a team of 11 staff, including a site manager, hull and coatings supervisors, machinery specialists and electricians.

"With the exception of two of the junior staff, all of the yard personnel assigned to this project have been with Wallem for six or more years," Mr Stefanou said.

The vessels have 3,600m<sup>3</sup> fuel storage tanks on board, sufficient for 6-8 weeks at sea. With bigger storage tanks onboard, the operational costs and risks, of not finding fuel when it is needed, are lower.

### Training

Crew and onshore personnel need additional training to handle LNG. The 44 crewmembers on Angleviken and Ashviken were given extensive simulator and onboard training in dual fuel operations through the Wallem Training Platform.

There was also training onshore. Wallem's maritime HR team in Mumbai oversaw the process before the crew joined ship.

The Advanced IGF Guidelines Certificates of Proficiency course was completed by each tanker's Master, Chief Engineer, second engineer, and third Engineer.



**LNG powered tanker Angleviken**

They also undertook full LNG bunkering training, including 30 days under sailing conditions. All ranks undertook the basic IGF course.

Wallem is seeking to provide training in dual fuel safety and operating processes to as many of its seafarers and shore staff as possible, giving priority to masters, engineers and shore staff who already have experience of liquefied gas cargoes, Mr Stefanou said.

TO

# Managing your ETS obligations

**The maritime industry in the European Union has been required to buy emission permits for its emissions since January 2024. There are more complexities to this. OceanScore's Albrecht Grell talked us through it**

If you have vessels calling in EU ports, you are probably already aware that you have obligations under the EU's Emission Trading Scheme (ETS) from Jan 2024 to buy emission allowances for your carbon emissions. But you may not be aware how complicated it can get.

The expectation is that the costs of these permits will be covered by the charterer, in the same way as the charterer pays for the fuel costs under many vessel contracts.

But the initial burden of purchasing permits falls on the owner of the vessel, who can (if agreed) delegate this responsibility to the holder of the vessels' "Document of Compliance", which is normally the technical manager.

Eventually, all charter contracts will probably specify that the cargo owner pays the ETS costs, but it has not fully happened yet, said Albrecht Grell, managing director of OceanScore, a Hamburg company running services to help companies manage their ETS obligations.



**Albrecht Grell, managing director of OceanScore**

And while this concept is increasingly understood in Europe, especially smaller charterers and vessel owners based in Asia still have some way to go.

EU has implemented regulations which state that the costs are ultimately paid by the party responsible for purchase of the fuel and operation of the ship, i.e. the charterers and sub-charterers. But these have not come into force yet.

Meanwhile, ship managers and owners need to consider the risk of the charterer simply

not paying for the EU emission allowances (EUAs), if it is not included in the contract, Mr Grell said. And while the regulatory framework has been put in place to enforce this payment even without a specific ETS clause in the charter party, some shipping companies are insisting that some of their customers make pre-payments.

Also, the charter parties developed so far which do cover ETS obligations the times specified for when funds or purchased EUAs should be required from the charterer differ widely. Some charterers plan to buy their own EUAs monthly, some plan to do it quarterly.

Shipping companies (i.e. Owners) will need to buy their own EUAs when the vessel is 'off hire', for example for fuel consumption re-positioning the vessel.

## How EU ETS works

Under the EU's Emission Trading Scheme (ETS) there are costs associated with emissions. But it is not a fixed cost (like a carbon tax). The emitter is required to purchase an "EU Allowance" (EUAs) to emit, where each allowance allows the emission of 1 tonne of CO<sub>2</sub>.

The ETS was developed for all industries, but there is a special variation for the maritime version, in that you only need to buy allowances for half of your emissions for any voyage which starts or finishes outside the EU. There are also discounts for the first years of operation (phase in).

The number of EUAs in circulation across industries is limited and reduced by 4.3 per cent every year, so there will be none in circulation by 2050, when emissions are intended to be eliminated.

The EUAs were initially issued to companies with large industrial emissions. The idea is that emitting companies trade them. The company with the lowest costs of reducing emissions, and the biggest difference between these costs and the EUA cost, will be motivated to reduce their emissions the most. So, the overall cost

to European industry of reducing emissions is minimised.

Companies with the highest cost of reducing emissions will still be able to continue operating but will have the cost of buying the EUAs added to their costs. If customers want to continue buying their products, they will probably see these emissions costs pushing up their price.

This also means that the cost of an EUA goes up and down, until it finds the 'market cost' of reducing emissions for all industries.

This cost may be lower than shipping's cost of reducing emissions, if it turns out that other industries can avoid emissions at lower cost per tonne than shipping can, such as power generation.

The price volatility means an additional complexity to managing compliance with the system.

If an emitting company does not surrender enough EUAs to cover their emissions in a given year, they will have to provide them in the next year at that year's going price, plus a fine of Euro 100 per tonne.

## Costs to shipping

OceanScore's modelling shows that the costs to the shipping industry in 2026 will be Euro 6.5bn.

The container sector of the maritime industry is "most exposed", having to pay 28 per cent of total costs, Mr Grell said. This is because container vessels are both large and sail at high speeds. The average payment for a European ship will be 0.5m euro a year, but the average for a container ship will be Euro 1.2m a year.

Cruise and other passenger vessels will also have high costs, because of the "hotel emissions" – CO<sub>2</sub> emitted from services used by passengers. The costs can be over 10m euro per year per vessel.

OceanScore's modelling shows that 40 per cent of EUAs in shipping will be purchased by owners from outside the EU. China and

Singapore owners will each need to buy 5m EUAs (costing 400m Euro at the current price of 80 Euro each) and UK and Norwegian owners will each need to buy over 3m EUAs.

There are exemptions for passenger vessels supplying islands in the EU with no road link to the mainland, and a population of under 200,000, due to concerns that the costs may make these vessels uneconomic to run. There are also exemptions for ice class vessels

### Revenues from ETS

80 per cent of the revenues from sale of the EUAs go mainly to the respective national government; 10 per cent is redistributed around the EU according to a formula; and 10 per cent goes into an EU fund to support sustainable shipping.

The applicable 'national government' is the government of the country where the ship operator is based. If the ship operator is not based in the EU, the national government is the one where the shipping company has the most EU port calls over the previous 4 years. If it did not have any EU port calls over the past four years, it will be the government of the country where the vessel first arrives.

According to OceanScore's modelling, the biggest recipients in terms of amount will be Greece and Germany based on having the most shipping companies. The biggest winner in terms of amount respective to the national budget is Cyprus, which will receive funds equivalent to 4.5 per cent of its national budget, due to so many vessels being operated from Cyprus. Netherlands will be a winner from having so many port calls of vessels with operators based outside the EU.

### How it can change the industry

Will the EUA requirement have any material changes on the industry? In many areas, probably not, Mr Grell believes. For example, the Euro 1,2m paid by an average container ship per year will not work out very much per box carried, probably not enough to deter anyone from shipping to the EU or changing the mode of transport.

ETS may provide further incentive to operate, build or charter more efficient (less emitting) ships, use energy saving devices or reduce speeds. This is the intended outcome.

Cruise lines may choose itineraries which start or finish outside the EU, so they only need to pay half of the cost.

There is a possibility shipping companies could 'game' the system, for example a vessel from one EU port to another will discharge

one container in a UK port along the way, so the voyage counts as only half in the EU. But "clients so far are not obsessed with avoiding the fees," Mr Grell said.

For a port visit to be designated a "port call", there will need to be some cargo transfer. It will not count as a port call if the vessel is bunkered, or crew are transferred, or spare parts delivered.

### OceanScore's tool

You need to ensure that sufficient EUAs for the voyage have been purchased, either by the charterer directly or by the shipping company, with costs claimed back. And you need to buy EUAs separately for emissions made when the vessel is off hire, maybe just for a few tonnes.

Shipping companies will probably need software tools to manage their ETS obligations. "We're pretty sure Excel won't do it," Mr Grell said.

Even if it can be done in a complex spreadsheet, that would mean that the knowledge of what the spreadsheet describes is held in the head of the person doing it, whereas if you use software, the knowledge is in the software, he said.

OceanScore provides software to manage the obligations, with tools to 'ingest' data about the vessel's fuel consumption for past voyages, assess the number of EUAs needed to be purchased, and inform charterers about how much they need to pay.

It keeps track of the EUA "account" for different vessels, and whether the EUAs have yet been acquired.

The software can be used to predict what your EUA exposure will be, if you know what your fuel consumption is expected to be over the next year or the next voyage.

If you want to "store" EUAs, this has to happen directly in the European Union system, the Union Registry. The online system to manage these accounts does not offer integration with any other software, or any other way to manage purchases, such as by linking via APIs.

However, OceanScore does offer an alternate means of buying EUAs, by trading with power company RWE, which has become one of Europe's leading EUA traders – offering the flexibility and preferential prices of over-the-counter trades. This purchasing can be done from within OceanScore's software and is then fully captured in the software's monitoring and transparency modules.

RWE also sells EUA 'forwards, where you can agree a price today for an EUA for delivery

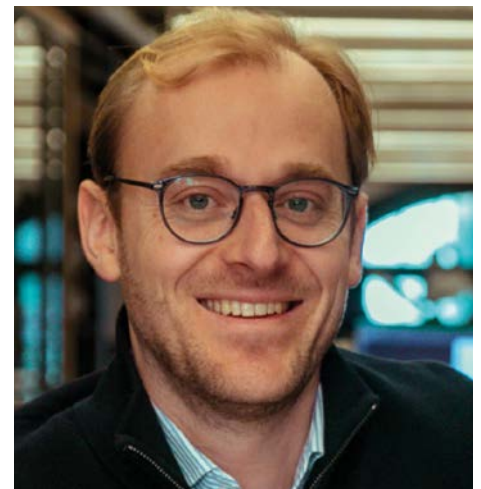
and payment at a date in future, so you fix your future costs.

OceanScore's service is charged per vessel per year, with a discount for 10+ vessels.

OceanScore started in business in 2020 and has been gathering data since then. It has a customer service and data team in Madeira, an island off the coast of Morocco owned by Portugal, which is on the UK time zone. IT and web services development are in Gdynia, Poland.

Shipping companies using OceanScore to manage their ETS obligations include Döhle Group, which manages 600 vessels; container and cruise giant MSC; and OKEE Maritime, a Hamburg company operating seven feeder container/general cargo vessels and two MR2 product tankers.

Matthias Blöte, Director Finance and Corporate Development with Döhle Schiffahrts said, "We have looked at different approaches to manage our ETS exposure. OceanScore convinced us not only with their workflows – their service centre has proven to be extremely helpful. We know OceanScore's team and feel comfortable using their software solution."



**Matthias Blöte, Director Finance and Corporate Development with Döhle Schiffahrts**

Marnie Merillon, OKEE Maritime said, "Being a smaller shipowner, we had to look for a holistic and an efficient solution to properly manage our emissions. OceanScore partnering with StormGeo, we found their solution best suited to prepare for the upcoming challenges on our path to a more sustainable and greener future."

Harren Group also plans to use it. Nils Aden, managing director, said, "Harren Group plans to offer its ship management customers the OceanScore solution, to manage the complexity of the EU ETS regulation and to avoid unnecessary risks."

TO

# Using 3D models through the lifecycle of a ship

**Ships are designed today using 3D modelling software. These 3D models would be useful during the ship's operational lifecycle, including to help them operate at lowest emissions. NAPA suggested how it could be done**

**S**hips are normally designed today using 3D modelling computer aided design (CAD) software. These models could also be useful during the ship's lifecycle, including to help work out ways to reduce operational emissions, and plan retrofits.

The models are generally owned by the shipyard, because they are used as a plan for building the ship. Also, if you have access to the file, it can normally only be viewed on proprietary software.

But it still could be possible to make agreements to share the models in a way which satisfied all parties. Mikko Forss, executive vice president, design solutions with NAPA shared some ideas about how this could be done.



**Mikko Forss, executive vice president, design solutions with NAPA**

NAPA has a very strong position in the ship design software market, claiming that 90 per cent of the world's newbuild ships are designed using its software.

It may be easiest to secure an agreement to share the model as part of the initial negotiations with the shipyard about building the ship, even if an additional fee is agreed for this. So, this is something shipping companies may wish to think about as they

plan newbuilds, Mr Forss says.

## Vessel performance

Having a 3D ship model could be most useful in improving vessel performance, Mr Forss says.

With our increased focus on vessel performance now and in coming decades, we are likely to see more complex ship designs, more use of wind power, and higher fuel costs. Having access to the original 3D model would be useful in helping people understand how the ship will 'perform' in different conditions, and help people make decisions faster.

So far, vessel performance models have been built using operational data such as fuel consumption, the vessel's speed, and other operational conditions such as weather and cargo loading, and building an understanding of how they relate. With this model it is possible to work out, for example, how much fuel would be saved by reducing speed.

But with a 3D model, it could be possible to understand this from first principles, with a digital model of how the vessel moves through the water. The 3D model can be adjusted slightly over time to take into account factors such as hull fouling or corrosion.

The shipyard could benefit from having performance data connected with its original 3D model, if it can gain more insights into how the ship is performing at sea and identify ways the design can be improved.

## Operational benefits

The 3D model could lead to operational benefits. It could be used to plan loading of the vessel and see how large the safety margin is.

The model could be useful in training seafarers, if they could familiarise themselves with the ship via a computer simulation which looks identical to the actual ship.

It could be used to plan dry dock work and plan retrofits, such as adding different fuel tanks. It can be used to compare options and see how the ship would perform in different weather conditions after the retrofit was done.

It could be useful in keeping track of any corrosion or other factors relating to the condition of the hull. It could be used with computer tools to assess the likely condition and fatigue of the hull structure.

## Getting access to the model

There are technical challenges in getting access to the model. Even if a shipyard would agree that the model could be used by the shipping company, there would be concerns that the model would find its way to another yard who could then build ships to the same design.

There are various standards for 3D data exchange, but no single platform and format which can support all use cases effectively, thus limiting the possibilities, NAPA believes.

NAPA's proposed solution is that the shipowner negotiates access to the 3D model with the shipyard but does not get access to the actual file. The shipping company's software 'speaks' to the model which is hosted separately by NAPA on cloud software.

Where the model is used for digital twins or other simulations, the digital twin / simulation software could be run directly on the model hosted by NAPA, without releasing the model file itself. Alternatively, a less granular model could be shared, which is enough for a simulation, but not granular enough to build a ship with.

It has been proven possible for 3D models to be shared with surveyors during the design process in a similar way, with surveyors being provided access to 3D models stored on the shipyard's servers and accessible through the cloud, Mr Forss says. Class societies exploring working in this way include BV, DNV, ClassNK and KR.

# Using weather forecasting certainty data

**Not all weather forecasts have the same level of uncertainty in them – and grasping the uncertainty can help get more value from them. Weathernews explained the issues to us**

**F**orecast uncertainty is a maritime weather forecasting measure which could be given more attention.

Not just knowing the forecast predicts rain in 5 days time, but knowing how likely the forecast is to be correct.

The forecasting process can measure and communicate the uncertainty level along with the forecast.

As an example, a forecast showed a low pressure system developing in 5 days time. After 2.5 days, it showed the low pressure system would not be as bad as previously predicted. On the day, the weather was worse than the first forecast.

But if all of the forecasts had been viewed together with the uncertainty level, the ‘signal’ for the bad conditions could have been seen from the start. The original forecast did not have a high probability of accuracy.

To illustrate what this means for shipping in practise, consider that most weather routing uses a ‘wave threshold’, where a route is avoided if it means wave height is expected to be above a certain level.

This might be based on the company’s risk tolerance for the maximum size of waves it wants the ship to encounter.

But if you know the likelihood of the forecast being correct, you might make a different decision.

You may judge that it is better to risk taking the ship through waves forecast to be high, if you know that the forecast of the high winds has a high uncertainty, and taking that route would mean you can have a better route for the rest of the voyage.

Or you may choose a route where high waves are predicted with a high uncertainty level, but plan to re-route the vessel when certainty level of the forecast increases if they

are still predicted to be high.

Probabilistic forecasting is done using “ensemble forecasts”. This could be explained as using computers to make multiple forecasts using the same input data. If the models are in good agreement, you have high confidence in the model and vice versa.

You can assess the probability of wave height exceeding a forecast by 2 metres, or by 5.5 metres, by seeing how many of the multiple forecasts show this wave height.

Working with uncertainty data also means you can find ways to reduce the “volatility” of the forecast as you get closer to the date the forecast refers to, because factors which change the most are going to be the ones which were least likely to happen.

It sounds complicated, but ultimately it all helps shipping companies make better decisions about the risks and rewards of different options with route, speed and voyage time.

Weathernews has 400 certified meteorologists. Amy Buhl, general manager of Marine Group Operations (Europe and Americas) for Weathernews is based in the Weathernews Innovation Centre in Norman, Oklahoma, on the campus of the University of Oklahoma, just outside Oklahoma City.

The University’s School of Meteorology “is at the forefront of meteorological research worldwide,” Ms Buhl says. The US National Weather Service is also based in Norman.

## Always uncertainty

We will probably never have a weather forecast with no uncertainty. While forecast accuracy has been improving in recent years, “uncertainty is a reality we have to live with,” Ms Buhl says.

We never have full information about the current state of the atmosphere, so it is impossible to model perfectly what will happen in future. For example, there are large areas of ocean with no weather data gathering systems.

Weathernews has 6,000 vessels providing daily weather reports, and is gathering weather data from aeroplanes, balloons and satellites.

Weather forecasts are developed using all of the data available. But that doesn’t mean you start with a complete understanding of the

situation.

Sometimes models are adjusted so the modelled outcome fits better with the observed outcome so far, for example changing an input temperature a few degrees.

## Why we need people

Weathernews envisages we will always need skilled people to make decisions relating to vessel routing and weather forecasting, including to improve or check recommendations made by the technology.

“We believe in a human in the loop to determine how we should handle things,” she said. “We’re having our voyage planners look at the output and say, ‘that doesn’t look good,’ or, ‘I agree with that.’”

Algorithms will give you output based on how they have been programmed, coming up with the best solution based on input parameters, but they can’t make a judgement, she said.

A person can more easily assess various different possible benefits and risks together than a machine can.

“The combination of having a human being and technology can give you a better optimisation and a better outcome,” she said.

## Weather getting more risky

Climate change is causing weather overall to become more dangerous, with more “unusual weather events” around the world, she said. For example, maximum wave heights have been increasing every year (although average wave heights have remained steady), she said.

It also means that weather forecasting is getting more difficult in some areas. Volatility means the ‘window’ of weather forecast accuracy is sometimes shorter.

If climate change is making weather itself more volatile, that may mean that the value of accurate weather forecasting, and knowing the uncertainty in it, also increases. Or it may also mean that weather itself is harder to forecast. “This is our biggest challenge,” she says.

Some studies have shown that low pressure systems are developing more quickly. This means that shipping companies may be more likely to take a longer route.



**Amy Buhl, general manager of Marine Group Operations (Europe and Americas) for Weathernews**

TO

# Starlink and the evolution in maritime communications

**The big topic in maritime communications is the move to low earth orbiting satellites (LEOs), particularly Starlink. Marlink, probably the world's biggest maritime communications provider, gave us an update**

**S**hipping companies around the world are increasingly trying out Starlink, the satellite communications service from Elon Musk's SpaceX, and many of them are very happy with it.

Starlink has an active constellation of 5700 satellites as of January 2024 according to Wikipedia.

Starlink is not the only new low earth orbit satellite provider relevant to shipping. Eutelsat OneWeb has launched a constellation of satellites and is expected to offer a commercial service from mid-2024. Amazon is shortly to launch a service it calls "Project Kuiper."

There have been low earth orbiting satellites for communication since the launch of the Iridium network between 1997-2002. But the new services have many more satellites with much higher capacities able to carry much more data.

## Starlink

Starlink promises communications which are much higher bandwidth than typical VSAT communications, cheaper, and faster in latency (see next section). But it is important for maritime users to know that there is no guarantee of either quality of communication service or its availability.

It may be excellent for crew, who are happy to communicate at low cost and high bandwidth when the service is available. But "it may not be good as the only connectivity means for business applications," said Tore Morten Olsen, President Maritime, Marlink.

The tanker sector is moving faster to Starlink than the container sector, he said.

Shipping companies may use Starlink to 'dump' data onto cloud services, since this can be done when communications are available, it does not require always-on connectivity, he said.

It could also be used for transferring Windows software updates. "We used to teach people not to update Microsoft computers onboard because of the cost of data transfer," he said. This can now change.

Starlink is not available in every country's territorial waters. There are some countries

where it may never be available, such as China, which wishes to screen its population's access to the internet, and Russia, due to the war. Some of the availability around the world may be decided personally by Elon Musk.

There is a list of the countries where service is currently available in the 'support' section of the Starlink website, if you search for "where can I use Starlink." At the time of writing, it shows good coverage in Europe, the Caribbean and North America, limited coverage in South America, but very limited coverage in Africa, Asia and the Middle East (only Australia, Japan, Kenya, Malaysia, New Zealand, Philippines, Zambia).

Japanese-flagged vessels may only use it in Japanese waters and not anywhere else, we heard at the press conference.

Mr Olsen added that bandwidth availability will be lower in areas with many cruise ships, which can be particularly heavy users, and where there are many recreational boating or residential users. Communications of US government and defence employees have a higher priority meaning that Starlink users 'compete' with others for the bandwidth available.

Some shipping companies are concerned about crew members not getting adequate rest when they have fast and affordable internet connections available in their cabins.

The Starlink 'terminal,' the device on the ship which communicates with the satellite, is a small flat panel antenna, costing 10-15 per cent as much as a traditional geostationary satellite terminal.

It is not yet known how long it will last in the maritime environment, but it may be comparable with the 7-10 years lifetime of a geostationary antenna. It is expected to be replaced if it breaks, rather than repaired.

Using Starlink will require additional focus on cybersecurity since a high bandwidth connection to the ship could potentially make life much easier for hackers.

## Other satellite services

The service from Eutelsat OneWeb is expected to be launched commercially in summer

2024. Amazon is also preparing to launch a constellation it calls "Project Kuiper."

"There will be a great deal of choice, which benefits the maritime market," Mr Olsen said.

OneWeb's service currently requires two traditional curved "parabolic" antennas on a ship but is expected to provide flat panel antennas later.

Mr Olsen suggests that companies seeking reliable access to cloud software over the internet may prefer OneWeb, which they may find more orientated towards business use. The future satellite service from Amazon may also be more of a business service, since it may have a focus on supporting customers accessing data stored on Amazon Web Services cloud servers.

For example, seismic vessels wishing to communicate enormous data volumes (terabytes per day) may find a suitable offering with a Ku band satellite service or could combine VSAT with a LEO service for additional access or redundancy.

In addition to satellite, there are also around 3,500 vessels in the world using 4G and 5G communications, because they are always close enough to shore, or only using inland waterways.

We can expect further generations of cellular communications (6G) and wi-fi over coming years," Mr Olsen said.

Altogether, maritime data communications are expected to grow 40 per cent a year in data volume.

Meanwhile, communications on a backup service such as Inmarsat Fleet Broadband may be "dropping to zero," he said. Inmarsat is unlikely to ever see growth rates that it has seen in the past.

The radio communications technology of VSAT means that it cannot communicate using flat panel antennas, and the satellite design means it cannot carry high bandwidth or low latency, said Eric Ceuppens, CEO of Marlink.

However, we should not call this the end for geostationary satellite-based services. For any company launching a new satellite service with global coverage, it will be much cheaper to provide this with three geostationary satellites, than hundreds or thousands of LEOs, he said.



**MOL crew doing videocalls with family over Starlink (screenshot from their YouTube video)**

### MOL and Starlink

Shipping company Mitsui O.S.K. Lines (MOL), one of the world's largest shipping companies and a client of Marlink, tested out Starlink's technology on its vessels.

It found it could get more bandwidth to ships (212 mbps) than it could get to its office in

Tokyo, reported Yuya Inoue, digital marketing manager with MOL, speaking at the Marlink press event.

MOL has produced a short YouTube video about its experiences (title MOL Conducts Sea Trial of Starlink Onboard Ocean-going Vessel, online at <https://www.youtube.com/watch?v=jNIH5dkZQbQ>)

watch?v=jNIH5dkZQbQ)

In October 2023 it decided to install Starlink on all its 233 vessels, Mr Inoue said.

MOL has a contract with Starlink for 1TB of data communications a month for the entire fleet. It may provide individual crewmembers with 1GB a month for their personal use.

Comparing Starlink to VSAT is like comparing a telephone booth to a smart phone, he said. VSAT typically offers 2mbps, and the latency (communication transfer time) is much longer with VSAT.

On some of its vessels, the Starlink antenna was installed onboard by crew, rather than specialists.

Crew have seen a wide range of benefits. As well as doing video calls with family, they could make much more wide-ranging use of the internet, using it to find new food recipes, for example, he said.

The company has concerns that crew may be using their smart phones too much, carrying personal devices while working and in work areas, and there could also be cybersecurity risks, he added.

TO

# Developments at Marlink

**Marlink is now the largest maritime VSAT service provider, and the largest satellite provider to energy in Europe. It is expanding its services as a maritime ICT service provider**

**M**arlink, one of the world's largest maritime communications companies, expects \$750m in revenue for 2023, and is growing 20 per cent a year.

75 per cent of Marlink's business is in the maritime sector, said Erik Ceuppens, CEO.

Analysis from Euroconsult (2022) found that Marlink is by far the largest maritime VSAT service provider, with a 35 per cent market share by revenue, more than double the share of the number two (Speedcast with 17 per cent). It found the company provides services to 26 per cent of the market by vessel.

In September 2021, a US private equity company, Providence Equity Partners, acquired a majority stake in Marlink, from Apax Partners, a private equity firm based in Paris. It said the transaction valued the firm at \$1.4bn. Apax continues to hold a minority stake. Apax first acquired Marlink in 2016 from Airbus.

In November 2017, Marlink acquired a superyacht communications specialist company called Omni Access. In January 2021 Marlink acquired ITC Global, a satellite communications company specialising in energy markets, from

Panasonic.

Marlink claims to be the leading company for energy industry satellite communications in Europe, Middle East and Africa, and "we are slowly but surely becoming the global leader," said Erik Ceuppens, CEO.

As a communications provider, Marlink's strategy has always been to be 'agnostic,' without aligning itself to any satellite operator. It enables the company to offer its clients the best combination of technologies to meet their needs, becoming an "network of networks," said Mr Olsen.

Marlink can provide independent advice because it does not have any ownership in any communication system, Mr Olsen said. "Everybody who owns something will tell you it is the only thing you need. We can be on the side of the vessel."

### ICT service provider

Meanwhile, Marlink is expanding its services as an ICT solutions service provider, also offering "device management," cybersecurity services and consultancy services.

Cybersecurity risks increase the more communications bandwidth you have, said Eric Ceuppens, CEO. "The bigger the pipe the bigger the threat."

Rather than just rely on a firewall, Marlink offers services which continually monitor systems for hacker communications, which is known as "enhanced cyber detection."

Marlink is putting together a portfolio of managed ICT solutions for shipping, provided in modules. Over one thousand ships use its cybersecurity detection tools; six hundred ships use its Unified Threat Management Solution; and it manages 10,000 PCs onboard multiple vessels.

To optimise communications, Marlink provides a "Software Defined Wide Area Network" or SD-WAN, where software determines which routing any given piece of data should take, including both satellite communications and cellular options.

It also provides digital services to help shipping companies manage communications over multiple networks, identifying problems and switching quickly.

TO

# Making better tools for navigation

**Navigation technology could be better designed to support the needs of navigators, providing the situation awareness they need to make decisions. A Nautical Institute webinar explored the issues**

**A** recent study from the European Maritime Safety Agency (EMSA), of navigation accidents over the past 10 years, found 8,800 maritime ‘occurrences’ of which 573 were classed as ‘navigation accidents’. 447 of these involved some kind of ‘human action’, said Margareta Holtensdotter Luthoft, a professor at Western Norway University of Applied Sciences (HVL) and a former deck officer.

She was speaking at a Nautical Institute webinar on Dec 11, “Digital Shipmate - A unique opportunity.”

Of these 447 navigation accidents involving human action, 227 were related to ‘observation’. Of these, 132 were classified as ‘overlooked cue’ (there was information about the problem emerging, but it was not acted upon). 95 were classified as ‘incorrect / partial observations’ (accurate and complete information about the situation was not available).

This means that 60 per cent of observation and navigation related incidents involved information being available to people, but it was not used in the decision (the ‘overlooked cue’).

That suggests improvements are possible in the way information is provided to people, or in people’s ability to find it, she said.

Perhaps system developers need to take more into consideration the limited time navigators have to make decisions, she said.

In real life, the only time someone might have all the time they want to make a decision could be when they are buying a house or selecting a university place.

The usual means of decision making is when people try to understand a situation, recall if they have seen something like this before, develop mental evaluations and simulations of what is happening, or whether their action will achieve their desired effect. They may choose an option which seems ‘good enough’, rather than the best possible option.

Onboard ships, there can be incomplete information, shifting goals, time constraints, high risks, multiple participants, a gap between what someone would personally like to do and

the organisational norms, and multiple events happening at once, all changing the current situation.

People’s “performance” relates to their understanding of the task and the situation, their general knowledge and their experience.

A well-designed procedure encapsulates the experience of the past, so you do not make the same mistakes again, she said.

## Fatigue and depression

The analysis also found that accidents were often caused by work and living conditions leading to fatigue, depression and low motivation. Also, seafarers having to balance conflicting pressures. This has an impact on situation awareness and professional culture, she said.

This was somewhat different to what researchers had expected, which was that navigation incidents were commonly caused by “inappropriate standards / professional culture, organisational and operational drivers and pressures, improper and insufficient training, lack of information, inadequate technology, lack of situation awareness, poor

planning,” she said.

The impact of ICT on navigation is emerging as something which is “under-estimated and under researched”, she said. Researchers found that technology can both help and hinder, sometimes simultaneously. Complex systems project trustworthiness and hide weaknesses. Alarms are both a barrier and a nuisance, because they can disrupt concentration, she said.

## Improving usability

A good starting point may be to consider

## PROF. LECH KOBYLINSKI FOUNDATION FOR SAFETY OF NAVIGATION



### Our Training Centre offers you: SPECIALIZED COURSES IN HANDLING OF LARGE TANKERS!

- Two fully equipped manned models representing tankers of capacity 150 000 DWT and 280 000 DWT are available;
- STS operations, approaching SBM and FPSO are included in the programme;
- Harbour manoeuvres are supported by manned models of large ASD and tractor tugs.

For further information please contact:  
Prof. Lech Kobylinski Foundation for Safety of Navigation  
Ilawa, Poland  
tel./fax: +48 89 648 74 90 or +48 58 341 59 19  
e-mail: [office@portilawa.com](mailto:office@portilawa.com)  
[www.ilawashiphandling.com.pl](http://www.ilawashiphandling.com.pl)



**Screenshot from webinar. Clockwise from top left:** Jaquelyn Burton, Kongsberg Maritime; David Patraiko, Nautical Institute (moderator); Erik Styhr Petersen, HVL; Margaret Holtensdotter Lutzhoft, HVL

how we can make navigation displays more ‘usable’, said Erik Styhr Petersen, Senior Researcher at Western Norway University of Applied Sciences (HVL) & Norwegian University of Science and Technology (NTNU) and a former head of product management with SAM Electronics.

“Usability” can be defined as how suitable something is for human use, such as whether our shoes fit us well. All of us have things around us which we find difficult to use, he said.

The International Standards Organization has a specific definition of usability as “the extent to which a product can be used by specified uses to achieve specific goals with effectiveness, efficiency and satisfaction in a specific context of use.”

For a navigation display to be defined as “usable”, we might expect readability, intuitiveness, consistency with how the user thinks about the problem, data presented based on its importance, logical grouping of information and clarity of language.

Information should be grouped based on the ‘logic’ of the user, not the designer, he said.

“Clarity of language” means that the system uses the terminology used in the domain.

“Readability” means the font size, type, reading distance.

Ergonomics may be a subset of usability, covering issues relating to human wellbeing only – such as readability and console heights.

Making a system “intuitive” is not easy, because it requires knowing what someone will expect, based on what they have encountered before, something a designer

would not know.

Having said this, the biggest change needed is perhaps recognising the need for more human centred design, he said. Then more effort will be made, such as to test out different designs with people and find the best one.

### Multiple vendors

One challenge with bridge system design is that it normally involves components from multiple manufacturers, said Jaquelyn Burton, head of creative design with Kongsberg Maritime, and a master mariner.

If a single vendor makes the system, it can determine which information is placed on which screen. For example a telecom system could be linked to a computer system, so people can call by pressing on a screen, rather than entering numbers into a phone written on a piece of paper.

It is more common that multiple manufacturers have been asked to provide specific systems, each with their own screen. Vendors meet the requirements they have been given, but these are not necessarily the requirements of the users, she said.

This might mean that the critical information may be displayed on a screen which the crewmember isn’t looking at, she said.

Designers able to take a system wide view can think more about systems to provide the best information in the event of a crisis such as a fire or piracy attack, and systems which provide better awareness of the vessel’s surroundings, such as other vessels, obstacles

or marine mammals.

They can design systems which better help crewmembers to understand the behaviour of other vessels, and their movements relative to their own vessel, and ensure other vessels understand their own intention.

If there is a possibility of a difficult situation occurring, a useful navigation system could calculate whether the vessel’s operational capabilities (ie engine power) would enable it to extract it from the situation if it does occur, or if it would be safer to get out of the situation now.

Ms Lutzhoft added that the aviation sector has just 3 or 4 major manufacturers of navigation equipment. “Shipping has in excess of 30 different brands making systems,” she said.

### Spending most time

The audience was asked what tasks they spend most time on in building their situation awareness at sea. 54 per cent said knowing the vessel’s current and future position; 81 per cent said assessing other vessel’s behaviour and intentions; 17 per cent said gauging position and speed of non-vessel objects / static objects (like buoys, no go areas); 13 per cent said maintaining vessel in its operational capability (not changing speed, make sure you have enough power); and 43 per cent said keeping the vessel in safe navigation areas.

### Researching better tools

The Nautical Institute is running a project funded by the European Union and UK government to develop better tools for navigators to support their decision making.

The project is called “Ocean” and has its own website at <https://ocean-navigation-awareness.eu>

The goal is to provide navigation awareness orientated around the vessel operator, with information presented in a way that makes the most sense for supporting decision making.

So doing this with people, technology and organisational processes working together.

The project team aim for a display which integrates multiple forms of information, and is uncluttered, providing information about nearby threats.

One goal is to develop a 3D display showing how the ship is navigating.

Another goal is to develop a system for sharing data between ships about observed floating hazards, such as floating containers. The project also aims for better engagement between navigators and manufacturers of navigation equipment.

TO

# Doing a tank survey by drone

**A US tanker operator used a drone operated by UK company C-Bird for a 20-year internal survey of a 250m tanker, replacing a human survey using scaffolding or a raft, leading to savings of \$1m and reduced safety risk**

**A**n unnamed “US oil tanker operator” recently did a 20 year internal tank survey using a drone, operated by UK company C-Bird, involving big savings in safety and cost, C-Bird reports.

20 year surveys of tanks are typically done by building scaffolding in the tank which a surveyor can walk on, or filling it up with water so the surveyor can survey the tank from sitting in a small boat.

Using scaffolding has safety risk, both to personnel erecting it and to personnel working it, working at height in a confined space.

There is a risk of scaffolding clips or tools being accidentally left in the tanks and getting later sucked into cargo pumps, causing extensive damage and downtime. The cost of erecting and dismantling scaffolding can be as much as \$1m.

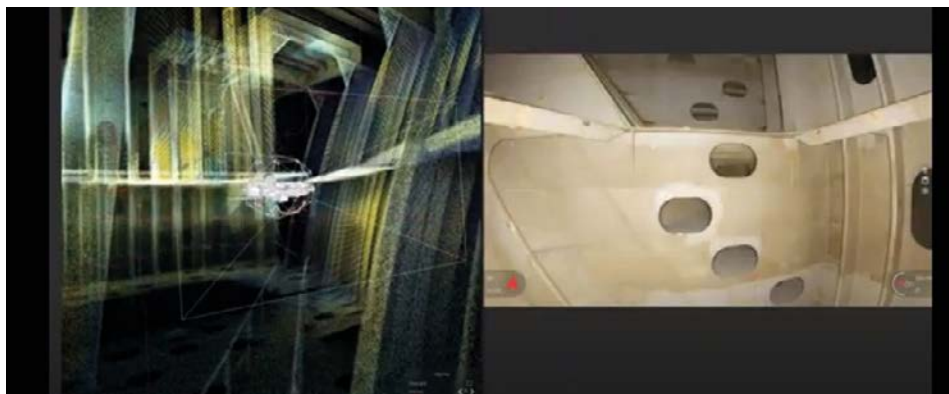
If rafting is used, there are also safety challenges, and the cost of disposing of a large volume of oil contaminated water.

By using the drone, there was “minimal to no” personnel entry into the hull required, including the need to carry drone equipment into and out of tanks.

C-Bird said the vessel was 250m long (the size of an Aframax) classed by American Bureau of Shipping (ABS), and dry docked in Southeast Asia, doing a 20-year periodic survey.

Class inspectors confirmed that the drone data was sufficient to agree to renew class certificates.

The client was described as a “robotics



**Data from the Elios 3 inspection - laser scan and visual video**

innovation champion in the marine industry,” having also worked with C-Bird’s hull inspection services and drone inspections for a number of years.

The drone pilot was Malcolm Connolly, CEO and founder of C-Bird.

The temperature in the tank reached 45 degrees C during the survey, but it did not trouble the drone.

## **Elios 3 and Inspector 4**

The drone used was the “Elios 3” manufactured by Flyability, headquartered in Switzerland. The Elios 3 is described by Flyability as “the first mapping and inspection indoor drone”.

Mr Bird had previously used an earlier drone model, the Elios 2, for tank inspections.

The advantage of the Elios 3 was that it could offer a live LiDAR (laser scanning) map

for navigation. This is useful where the pilot is unable to see the drone. The ‘live map’ also helps ensure that all areas of the tank are covered.

The laser records high resolution video and a 3D laser scan of structures simultaneously.

The data is processed using Flyability’s “Inspector 4” software, which removes any uncertainty about what has been surveyed, or the location of any anomalies.

By being able to accurately pinpoint the location of the drone when images were being taken, and taking multiple periodic scans, it is possible to monitor the change in condition over the time, repeating the survey precisely. By knowing the rate of change in condition it may be possible to predict how fast the condition will degrade.

**TO**



**THE POWER OF WATER!**

Onboard Water Blasting made easy

**Den-Jet...There is no substitute!**

+65 6268 1238
| denjetmarine@denjet.com
| www.denjet.com

# **POWERING AHEAD**

**Posidonia 2024**  
**3-7 June, Athens Greece**

[www.posidonia-events.com](http://www.posidonia-events.com)