TANKER Operator

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Contents

Safety alert - corroded fire extinguishers

The Bahamas Maritime Authority issued a Safety Alert following a seafarer death on a tanker, from the rupture of a corroded, condemned fire extinguisher being prepared for shore side disposal

The Bahamas Maritime Authority has issued a safety alert following the death of a junior officer onboard an unnamed, Bahamas flagged tanker, due to the rupture of a condemned fire extinguisher during discharge.

The tanker had been alongside at the time of the accident, with repairs being done to the shaft bearing and other maintenance tasks.

Junior deck officers were preparing to dispose of several condemned fire extinguishers to garbage facilities onshore. This preparation work included removing the CO_2 charge cartridge.

The officers successfully removed the cartridge from one extinguisher but were not able to remove the valve assembly from a second.

The senior of the two officers decided to discharge the contents of the extinguisher into some waste rags.

During discharge, the body of the extinguisher ruptured at the base, causing the extinguisher to strike the officer in the chest. Despite immediate first aid from the crew and paramedics the officer died from the injuries sustained.

The fire extinguisher has an internal pressure of 17 bar, and the base was badly corroded.

The fire extinguishers had 'recently' passed an annual inspection by an approved firefighting equipment service provider, without any comment. However, after the inspection, 8 fire extinguishers were identified as being in unacceptable condition during shipboard maintenance checks and removed from service.

The officers were decommissioning the fire extinguishers in order to leave them in a 'safe' condition once disposed of. However, they were not fully aware of the risks associated with handling fire extinguishers where the material integrity was compromised.

The company's generic risk assessment for shipboard operations highlighted the requirement to follow the guidelines contained within its cold and pressurised systems work permit and onboard work instructions.

When the officer could not remove the valve assembly as planned, an opportunity was missed to stop and reassess the plan, Bahamas Maritime Authority said. "Ineffective barriers have been identified in work processes and planning."

Recommendations

Bahamas Maritime Authority suggests the following lessons and recommendations following the accident:

Shipping companies should note that fire extinguisher servicing by shoreside personnel "may not be sufficient to control risks."

Crew should be made aware of the potentially fatal risks associated with handling compromised pressure vessels and systems.

Fire extinguishers should be mounted on brackets off the deck to reduce the chance of water being trapped under the base. Fire extinguishers that are exposed to the elements require particular attention. Where possible they should be rotated with those stored in a controlled atmosphere to reduce the likelihood of corrosion.

Where possible, decommissioning and disposal of fire extinguishers should be conducted by suitably qualified contractors.

When discharging any fire extinguisher, the manufacturer's guidelines on the correct operation should be followed. Where guidelines have not been provided, crew are advised to place the extinguisher on the deck away from the body when operating the trigger.

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Our view on future fuels

While experts still say it is too early to draw conclusions about which future fuels will dominate beyond fossil LNG, it does seem that some strong pathways are emerging while some weak options are being discussed. Here is Tanker Operator's view.

Looking first at the source of the fuel (bio, fossil / blue or electro), biofuels are a strong contender. The big question is whether they can be available in big enough volumes. In Europe, the Ukraine war and subsequent food shortages seemed to indicate for a while that biofuels were no longer an option. But in the US the picture is different. There are much less concerns about the capability of farmers to deliver large volumes, and no consensus about where the production limit is, except that we could produce much more than we do now.

Blue fuels, made with fossil fuels with CO2 sequestration, can fill the gap biofuels cannot fill. Tanker Operator's publishing company has also run a journal on CO2 sequestration for 14 years, Carbon Capture Journal, so we are more enthusiastic about this than many.

Blue fuels are a hard sell to people who believe that it should be possible for the maritime industry's fuel supply to be dominated by green fuels, otherwise known as 'electro' or 'e' fuels, made with renewable electricity.

If green fuels were available at the same price and volume as blue fuels, they would indeed be better. But there are strong reasons why this is unlikely to happen by 2050.

Firstly, the energy comes from renewable electricity, probably wind or solar. We're building it fast, but every industry and household also wants it. And much of the energy in this electricity is lost in the process of making a green liquid fuel with it – we've seen estimates of 50 to 80 per cent energy losses. Wouldn't this put shipping at the back of the queue to receive renewable electricity, when there are other consumers which make good use out of 100 per cent of it, such as in households and electric cars?

Secondly, all green fuels other than hydrogen and ammonia still contain carbon. That includes methanol, diesel or gas. This carbon is supplied to the manufacturing process as CO2, reacted with hydrogen to form the fuel, and then emitted to the atmosphere from a ship when combusted. The argument is that the overall process is 'carbon neutral' because the CO2 emitted from a ship would otherwise be emitted somewhere else, such as a cement plant stack. But all arguments about moving CO2 emissions from one place to another are messy. Wouldn't it be better for the environment if this pure stream of CO2 was sequestered instead of turned into a fuel?

There is much enthusiasm for methanol. It is easier to handle onboard than other options. But if formed from fossil energy it is like LNG in CO2 emissions, and we are trying to look to a net zero future. If it is an 'electro fuel', it is not clearly carbon neutral, for the reason above.

This points to blue ammonia (NH4) or blue hydrogen being the only zero carbon fuel which could be supplied to ships in big volumes, and of these blue ammonia is easier to handle. There are safety concerns but ideas for how to mitigate them, as an article in this issue on risks of future fuels shows.

Another option which, we believe, may be a weak option, is shipboard carbon capture, being promoted by a number of companies at Hamburg's SMM event in September. This is something entirely different to blue fuels, it means separating CO2 from the flue gas onboard a ship, storing it and then giving it to a reception facility onshore. Let's review what this actually means.

It requires shipboard equipment to flow exhaust gas through a solvent using a number of trays in an absorption column, similar to a distillation column. In a separate stage the solvent is heated, so it releases its CO2. The CO2 is stored in an onboard tank. This complex process is do-able on land, where a large scale makes the unit costs lower, and specialist engineers are immediately available. But to do it on a ship, with no specialist experts onboard, the movement of the waves, and acidification from CO2 in the pipes, may sound exciting to a research engineer but not for anyone involved in ship operation.

Then there's the challenge of what to do with the CO2 - you'd need a tank onboard the ship cooled to minus 17 degrees to liquify it, perhaps 200m3 in size. Any reception facility on shore would need to be linked to one of the world's CO2 sequestration sites. While such sites are being planned in many of the wealthier countries, they are not near major ports, and not in most countries.

In this issue you can read about a company developing ship fuels along the lines described here - biofuels, blue fuels, some but much less green fuels, and no discussion of shipboard carbon capture, just enormous volumes of carbon capture on shore. That company's name is ExxonMobil.

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News from OCIMF

News from OCIMF from July and August included work to improve its own efficiency, work to understand implications of engine power limitation, and many meetings around the world

OCIMF has a strategic objective to improve its own operational efficiency. Karen Davis, Director OCIMF, defines this as focussing efforts on "working efficiently to deliver goals, keeping watch that we provide valuable work and avoiding overly complicated solutions, while reinforcing governance across the organisation."

This "will ensure that we consistently perform well to deliver work that is valuable to our members and industry," she said.

For example, when delivering the SIRE 2.0 project, "we will continue to be agile and responsive. This agile approach will form the basis of future OCIMF project management," she said.

"In an ever-changing world, we will keep strengthening our data security, follow a risk-based approach, and strive to be thought leaders in our work, especially in support of climate action."

"Most importantly, we will build our OCIMF culture, developing inclusive habits, and insisting on demonstrating OCIMF values to support our mission."

Captain Charles Abbott, 1957–2022

OCIMF announced the untimely passing of Captain Charles "Chuck" Abbott on 16 August 2022. Captain Abbott has been a key member of the OCIMF inspector 'fraternity' since 2008, having performed over 1000 SIRE inspections, through his own maritime safety and inspections business, Seatech Marine Services, it said.

"Chuck was always willing to pass on his knowledge and experience. He was passionate about safety in the shipping industry. This was apparent during his inspections, his audits of other inspectors and of new inspector candidates. OCIMF, and especially members of the inland barging community in the US, will greatly miss his experience, warm personality and professional enthusiasm," OCIMF said.

Engine power limitation

OCIMF's Engine Power Limitation Working Group is developing an information paper on the health, safety and environmental risks and associated best practices for reduced engine power, due to energy efficiency regulations and regional speed reduction schemes.

This includes the effects of adverse and extreme sea and weather conditions; master/officer/pilot/mooring master lacking familiarity with the impact of reduced power on manoeuvrability, especially in restricted or congested waters; master lacking familiarity with how to unlock reserve power; the effects of continuous operation of equipment outside of its design criteria; the effects of tides or currents in restricted waters; ice navigation; vessel's ability to maintain adequate speed during a piracy attack or when routinely transiting high security risk areas.

Also, OCIMF's Environment Committee meeting in July 2022 discussed its work to develop an information paper on the risks associated with shaft/engine power limitation, minimum power guidelines and speed reduction zones. This Committee is also working to develop information papers on use of onshore power supply and the use of emissions control technologies.

Encouraging piracy figures

OCIMF cited the International Chamber of Commerce International Maritime Bureau's (IMB) global piracy report for the first half of 2022. This details 58 incidents of piracy and armed robbery against ships, the lowest total since 1994. It is down from 68 incidents during the same period last year.

These 58 incidents included 55 vessels boarded, two attempted attacks and one vessel hijacked. While no crew kidnappings were reported during this period, crew continue to be threatened and at times faced with violence. 23 crew were taken hostage and a further five threatened.

Of the 58 incidents, the region with the largest number of attacks was the Gulf of Guinea where 12 were reported. Of these, ten were defined as armed robberies and two as piracy.

New adviser

Abhijit Aul joined OCIMF as a Risk and Regulatory Affairs Adviser in September 2022. He was formerly with Lloyd's Register, which he joined in 2013 as an engineer surveyor. Since 2019 he has been Regulatory Affairs Lead at LR.

Mr Aul has participated in EU-funded research projects. He offers insight into technical and regulatory challenges introduced by new shipboard technologies, such as carbon capture and storage, and various low/zero-carbon fuels.

He has advised flag administrations in developing the IMO interim recommendations for the carriage of liquefied hydrogen in bulk and the recent regulatory developments on the safety of ships using alternative marine fuels such as LPG, hydrogen and ammonia.

New HVPQ

OCIMF and the Chemical Distribution Institute (CDI) have developed and published a 6th edition of the Harmonised Vessel Particulars

Questionnaire (HVPQ6).

The transition from HVPQ5 to HVPQ6 will take six months, and a number of measures ranging from technical support to operational guidance have been provided to help the industry manage the change.

The transition will be completed on 9 January 2023, after which submissions in HVPQ5 format, to either the CDI or SIRE databases, will no longer be possible.

Singapore

Karen Davis, director of OCIMF, visited Singapore in July. "I received updates on regional security issues and heard from members and maritime organisations on their challenges and progress being made with SIRE 2.0," she said.

"Meetings with officials at the Maritime and Port Authority [of Singapore] and Maritime Department in Malaysia provided the opportunity to raise OCIMF's profile after the restrictions of the pandemic."

During the trip OCIMF received maritime security updates from the Singapore Shipping Association, the Regional Cooperation Agreement on Combating Piracy and Armed Robbery Information Sharing Centre (ReCAAP ISC), the Singapore Information Fusion Centre, and the International Maritime Bureau (Malaysia).

WMU

In August, an OCIMF delegation visited the World Maritime University (WMU) in Malmo, Sweden. Karen Davis signed a Memorandum of Understanding (MoU) to strengthen collaborative work in the field of human factors in safety and incident investigation, and to support the IMO's drive for maritime decarbonisation.

OCIMF and WMU already had a strategic partnership. They worked together on a white paper "Towards a Safety Learning Culture for the Shipping Industry," as part of the EU's SAFEMODE project.

Copenhagen

In Copenhagen, OCIMF met senior representatives from the Global Maritime Forum, Maersk Mc-Kinney Møller Center and Zero North, to discuss how the organisations can work collaboratively to support decarbonisation of the maritime industry through furthering technical excellence.

There was discussion on how to share learnings and outcomes from research, a review of lifecycle assessment of new fuels from the perspective of safety and users,

Saurabh Sachdeva (OCIMF), Iman Hill (IOGP), Olav Skar (IOGP) and Karen Davis (OCIMF)

international technical standards on cold ironing, new tools and technology for digital optimisation, and operational efficiencies in the sector.

OCIMF and IOGP

OCIMF leaders met with the International Association of Oil and Gas Producers (IOGP) and agreed to work more closely together in the offshore space.

Managing Director Karen Davis and Publications and Advocacy Director Saurabh Sachdeva visited the IOGP's London office to meet their Executive Director, Iman Hill and HSE Director, Olav Skar.

They agreed to explore joint work to address issues such as offshore lifeboat safety, management of risks and incidents offshore, seismic and diving vessel operations. Potential collaboration was considered on the emerging risks linked to safe management of offshore renewables and associated standards of operations.

US inland barging

An OCIMF delegation attended the American Waterway Operators Safety Conference in Chicago in August. OCIMF delivered a session on ensuring that safety, compliance and environmental protection are at the heart of inspections and technical standards.

OCIMF also visited BP offices in Chicago, followed by a visit to a barge, a tugboat and a chemical terminal.

Brazil oil terminals workshop

OCIMF took part in a workshop in June on lessons learned in operation of oil terminals, organised by the Society of Marine Oil Terminals and Monobuoy Operators (SLOM), held in Rio de Janeiro, with attendance from 12 oil companies and terminal operators.

OCIMF representatives also visited Transpetro's central control room and the simulator centre; and the Terminal of Angra dos Reis, operated by Transpetro.

Korean Register

OCIMF attended the Korean Register European Committee meeting in London on July 4. Discussions touched upon the challenges that the industry faces with crewing skills and supply of skilled seafarers, review of emerging technological solutions for building green ships, and development of environmental, social and governance (ESG) metrics to support members.

Renewable and Low-Carbon Fuels Value Chain Industrial Alliance

OCIMF was represented at the first General Assembly of the Renewable and Low-Carbon Fuels Value Chain Industrial Alliance, an initiative created by the EU, covering the aviation and maritime sectors.

It will address the availability and affordability of renewable and low carbon fuels and will support the creation of a pipeline of investment projects.

There will be a call for membership in September for four roundtables. These will be on the themes of feedstock / synergies between transport modes, aviation, shipping, and access to funding.

This article is a summary of the July and August OCIMF newsletters. To read the full text see **https://www.ocimf.org/news-and-events/news/newsletter**

Seafarer social interaction, mental health and safety

The International Seafarers' Welfare and Assistance Network (ISWAN) is conducting a study of how supporting seafarer social interaction can lead to benefits for the company, including better mental health and safety

Seafarer social interaction should be good for seafarer mental health, which should lead to benefits in safety and quality of work done. So it is something the company can formally encourage and support.

This is the hypothesis being explored by a study into seafarer social interaction by he International Seafarers' Welfare and Assistance Network (ISWAN). It conducted trials on ways to improve interaction on 21 vessels, over Nov 2020 to Jan 2022. A report from the study was published in June 2022. This article is a summary of that report, with areas of particular relevance to tankers.

Shipping companies involved with trials include Amoretti Armatori (1 vessel), BP Shipping (2), Bernhard Schulte Shipmanagement (3), MF Shipping (4), Seaspan Corporation (1), Scorpio Ship Management (4), V. Group (1), Bahri Ship Management, Northern Marine (number of vessels not disclosed).

The vessels included 7 chemical tankers, 5 crude oil tankers, 2 cargo / container ships, 2 general cargo ships, 1 LNG tanker, 1 LPG tanker and 1 cement carrier, 21 in total. 17 of these vessels participated in the full trials from Nov 2020 to Sept 2021.

In terms of recreational facilities, of the 17 vessels in the full trial, 15 had a gym; 13 had a basketball hoop; 13 had a PlayStation 4; 12 had a karaoke machine; 10 had table tennis; 7 had a swimming pool; 4 had a barbecue pit; 4 had a Nintendo Wii, 2 had a 'giant paddling pool'.

"The trials showed a direct correlation between crew who were able to engage with each other recreationally [such as] through a basketball game, party, or karaoke, and increased good mood and wellbeing," ISWAN said.

The study found that "social interaction is important for seafarer mental health and encourages positive relationships between crew, which form an intrinsic part of a strong on-board safety culture."

It found that positive changes to mood on board are also linked to supportive leadership for social activities, sufficient rest time, reliable and adequate access to Wi-Fi, good food, celebration of special occasions, and a diverse and inclusive environment on board.

Conversely, negative changes to mood on board are linked to frequent port calls, fatigue, bad weather, poor or no Wi-Fi access, and not having enough time to socialise.

Engaged and visible leadership, which displays empathetic people skills, is vital to support and provide 'permission' for crew to participate in social activities, ISWAN said.

There also needs to be clear separation between work and rest or 'play' time. Conversations during off-duty hours often revert to the topic of work, and sometimes the demands of work mean that crew are too tired to interact after their shifts.

The favourite activities on board were barbeques, table tennis, basketball, computer games, and celebrating occasions such as birthdays and religious holidays.

ISWAN recommends a voluntary Social Ambassador should be recruited from the crew of every vessel to help convene social activities and promote crew engagement.

This person could encourage a variety of activities including providing mental and physical stimulation; plan social events in advance; initiate ice-breaker events for new crew members. This person should respect people's preferences for how they use their recreation time rather than push them to participate against their will, it said.

Unplanned social activities can be beneficial such as impromptu get-togethers and coffee breaks. Not all social activities require spending or recreational facilities.

The study found that mandatory safety drills could be enjoyable and create opportunity for social interaction. They bring crew together and provide a sense of satisfaction if the drill is well executed.

One crewmember wrote, "the launching and recovery of the Fast Rescue Craft and free fall lifeboat bring the ships' teams together, which is good for morale."

Another wrote, "after lunch an unexpected live helicopter drill with the Spanish coastguard. [It was] not difficult and always nice for some spectacular pictures for the

Photo by Noel Agustin Gabrido, Master

Photo by John Darrell M Jives, Able-bodied Seaman

family at home. An almost normal working day cheered up by the helicopter drill."

ISWAN's full report, available free online, includes detailed notes of social interactions on vessels. Some tanker related highlights are included here.

Chemical tanker

"Vessel Five" was a 17,567-dwt oil/chemical tanker built in 2010. The crew were of mixed nationalities including Filipino, Korean, Bangladeshi, Indian, Malaysian and Indonesian. At the time of the trial all crew were men, except the master who was a woman.

This vessel made short voyages and averaged 10 port calls a month. This vessel had Wi-Fi available on board and 2GB was allocated to each crew member on a monthly basis. The communal spaces on board included separate mess rooms for the officers and crew.

There was much positivity surrounding the efforts made by both the on board and shoreside leadership with social activities.

The social ambassadors proved that activities could still take place and be popular despite the frequent port calls, if they were well-organised and the crew were well-motivated to participate.

There was clear evidence that social activities helped to lift the mood on board. Examples of activities are TV, table tennis, basketball and karaoke. Other activities, such as dancing and taking afternoon tea together did not require any leisure facilities at all.

The gym equipment was not reported as being used during the trials. Other activities, such as cards, darts and board games, took place using equipment brought by seafarers personally.

A total of 11 planned activities were recorded for this vessel, five of which were competitions, some with cash prizes awarded to the winners.

An additional 13 unplanned activities were logged including cultural cooking, card games, basketball, karaoke, table tennis, darts and lemon tea drinking in a group.

LNG tanker

"Vessel Two" was a 94,500 dwt LNG tanker built in 2019. The crew nationalities included British, Polish and Filipino, all men during the trial. The vessel made deep sea voyages, with an average of 2.5 port calls a month.

All crew were provided with Wi-Fi access and had a set daily data limit (not specified) which renewed every 24 hours at midnight. There was an additional internet café with 4 PCs, which seafarers could use without any data limit.

There were two masters during the trial period, and both took the role of social ambassador. Support and approval for social activities onboard from the vessel leadership was seen as vital in engaging the crew.

Port calls were strenuous, time-consuming, and can be exhausting for all involved. Prior to any port call there is much preparatory work, particularly paperwork, which is arduous for the senior on board team.

So, port operations had a significant impact on sleep and rest time.

The surveys and logs generally showed a noticeable dip in mood both during and after a port call.

The vessel had a separate bar and eating facilities for officers and crew. For communal events all ranks could easily come together.

There was a well-equipped gym which was used by many, a table tennis room, a pool, and the space and equipment to play basketball.

Additional activities with personal equipment included cricket, table top horse racing (with board and dice), and cards. There was no mention in the logs of crew using the vessel's DVDs, table tennis equipment, or darts.

Other activities such as parties, sundowners, photography and celebrations, did not require any leisure facilities at all.

This vessel logged 10 arranged social activities during their trial participation, although more casual interactions also happened on board throughout, including swimming, use of the gym with others, and meeting for coffee. The logged activities also included basketball and barbeques. The crew came together to celebrate birthdays and special dates in the calendar. TO

Much more detailed reports are available online at **https://www.seafarerswelfare.org/resources/publications/social-interaction-matters-sim-project-report-phase-two**

Caption: Photo by Albert Garayev

Q2 Seafarer Happiness Survey shows improvement

The Mission to Seafarers' quarterly Seafarer Happiness Survey shows an improvement in crew happiness, perhaps due to COVID restrictions relaxing, so more certainty about how long people will be on board

The Q2 Seafarer Happiness Survey, published on Aug 1, 2022, by the Mission to Seafarers, showed seafarer self-reported happiness, as a score out of 10, recovering after a record low for Q1. The Q2 number was 7.21, compared to 5.85 in Q1.

24 per cent of the respondents are crew on tankers. Tanker crew were the least happy of crew on all ship types, reporting 4.4 overall; this compares with 7.41 for bulk carrier crew, 6.4 for container ship crew and 6.48 for cruise ship crew.

The survey is supported financially by Standard Club and Idwal.

Mission to Seafarers attributed the rise in seafarer optimism to "more vaccinations, more frequent crew changes, wage rises and new amendments to the Maritime Labour Convention (MLC)."

"After more than two years of uncertainty caused by COVID-19, seafarers are beginning to see the light at the end of the tunnel. While it's still not clear if we are post-pandemic or simply experiencing a COVID lull, restrictions have now eased across the globe," it said. "Seafarers are able to move more freely and have more certainty about whether they can go ashore and when they will next be able to go home. There is a sense of stability returning to the industry."

Seafarers said they are happier with their shore leave and with welfare facilities when they are ashore. More Seafarer Centres are open, as Covid restrictions are being relaxed, the Mission said.

"The biggest contributing factor to the improvement of mood has been that the most fundamental aspect of seafaring now appears more certain – knowing when you are going home," the Mission said.

One per cent of respondents had a trip length of over 12 months; 3 percent were onboard 9-12 months; and 26 per cent 6-9 months. The rest were onboard for less time.

One seafarer wrote, "Not knowing when I was going home was like running a race without end. I was exhausted."

There was an increase in crew satisfaction with activities which contribute to wellbeing. This includes social events that boost morale such as weekly gatherings, quizzes, karaoke, sports, barbecues and movie nights, with increased backing and the support of leadership.

There was an increase in seafarer satisfaction with food on board. "The survey shows that efforts are being made to improve seafarers' quality of life while on board and that this focus is paying off," The Mission said.

Negatives

"For every positive, we see there are many more negatives that still need to be addressed," said Thom Herbert, Senior Marine Surveyor with Idwal and Idwal Crew Welfare Advocate, whose company sponsored the report.

"Hours of work and rest continue to be in conflict, and the individual instances quoted in the report indicate that this issue needs more focus."

"Communication with home remains a major challenge, and although it's good to hear that there is seafarer positivity around the Maritime Labour Convention changes, the reality is likely to be disappointing." These changes include requirements for companies to provide crew with communication facilities.

"It is good to hear reports of an increase in the number of on-board wellbeing initiatives, although, from our experience, this seems to be an exception rather than the rule."

Shore leave is still the area of crew life where satisfaction is lowest, although it is improving, from a happiness score of 4 in Q1 to 4.8 in Q2. One respondent wrote, "I can go, but I feel too tired, and it costs too much". Another said, "agent told us there was a ban on going ashore. We checked with [the] port authority, and no such rule had been made. The agent just wanted an easier life".

Some Ukrainian seafarers said that at the end of their contracts, if they returned to Ukraine, they would be conscripted into the army and not allowed to leave. In some cases, their families were in countries that would not grant them a visa to visit.

"It is clear that Ukrainian seafarers are suffering badly, they are far from home, isolated and disconnected from their families, and dealing with the aftermath of destruction, albeit at a great distance," the Mission said.

Food and health

For food, satisfaction had risen from 6.05 to 7.81. One seafarer noted that the main problem is the ingredients not the cooking. "You can have a good chief cook, but the quality of food is garbage. We do not have control over what we get when we order. On top of that the company [is] trying to reduce costs. We eat garbage that [would not be] sold ashore to people."

Seafarers said they greatly appreciated takeaway meals being brought to them in port to make a change. One respondent wrote, "We asked the Seafarers Center if they could bring us some chicken. They did, buckets of it. We had a great laugh on board eating it. Thank you".

When asked about their ability to keep fit and healthy onboard, the happiness rating rose from 6.45 in Q1 to 7.84 in Q2. Some seafarers noted that while their company had provided facilities, they did not have time to use them. "Some ships have a gym, but you work 12-14 hours a day and you keep watch let's say 0400-0800, 1600-2000, every single day without exception for 4-6 months," one respondent wrote.

Training

Happiness about training rose from 6.3 to 7.79, but there was scepticism. One seafarer wrote, "20 per cent [of training] is beneficial and the rest is garbage. A lot of training and people creating training tools and quizzes."

"It's just done for the sake of the industry and creating work ashore and for the happiness of insurers and brokers."

"In reality, we do not require that much kind of sitting in front of a PC or training while we carry on our job on board."

"Seafarers are busy with their work, they work very hard, and they do not have time for rest. Who wants to lose two hours in front of a computer course when they have only seven total hours of rest before going back to work?"

Social

Satisfaction with interaction with other crew rose from 6.82 to 8.07. One seafarer wrote, "Most seafarers remain isolated. No parties on board, no get-togethers and no incentives. No alcohol and all enjoyment killed by company policies." Another respondent suggested that a controlled, sensible drinking policy may make for a better atmosphere onboard.

Mission to Seafarers did not endorse this idea but suggested instead that with low and non-alcoholic beer and wine becoming much more palatable in recent years, shipping companies may consider providing it as a social lubricant.

Workload

Happiness with workload increased from 5.92 to 7.4. This has partly been achieved by companies reviewing tasks introduced to prevent the spread of COVID, the Mission said. For example, demand for high frequency clothes washing were being relaxed, and some vessels placed more catering staff onboard to help meet demanding food hygiene requirements.

One respondent laid out their day as a Chief Officer and watchkeeper on a tanker. "Watchkeeping 0400-0800, then overtime until noon. Then you have a meeting with other seniors at 1500, then 1600 you go again on watch until 2000 hrs."

"You sleep at noon, 1-1.5 hrs nap, after you were awake from 3 AM until 12 noon. If you want to have a chat with your family after your watch in the evening you go to bed at 21:30-22:00."

"Go figure how much you sleep until 03:30, when you wake up because you are watchkeeping from 0400."

Another seafarer wrote, "I do not know any seafarer that is not speaking about quitting sailing. Young people have better opportunities ashore, people are not interested in going to work at sea anymore."

DNV's 2050 forecast focuses on fuel availability

DNV has released its 2022 "Maritime Forecast to 2050" with a focus on fuel choices. It recognises that shipowner choice will be driven by fuel availability and price, and both may be driven by the necessary investment costs on land

Everybody in the maritime industry wants to know what the future fuel will be. DNV's 2022 "Maritime Forecast to 2050" is not able to answer the question directly, but it is able to give some useful pointers.

The report generated 24 different 'scenarios' for what the future might be, all involving a mixture of fuels, but different fuels being more dominant. It then assessed the costs of land infrastructure and shipboard infrastructure involved in providing them.

Of the 24 scenarios, 12 are based on the current IMO ambition of a 50 per cent reduction in greenhouse gas emissions by 2050, and include around 60 per cent fossil fuels, also considering energy efficiency improvements; and 12 are based on the ambition of complete decarbonisation by 2050.

The options considered include ammonia, methanol, diesel and methane, as the fuel delivered onto the ship; they can be produced from sustainable biomass, renewable electricity ('e-fuels') and fossil fuels with carbon capture and storage ('blue fuels').

Uncertainties around future price and availability of these fuels mean that a clear winner among these options "cannot be identified yet or in the near future," DNV says.

The report is one of a suite of reports published by DNV on the "Energy Transition Outlook", and it is the 6th edition.

Tanker Operator magazine has attempted some crude meta-analysis comparing the estimated costs of biofuels, e-fuels and blue fuels, presented at the end of this article – although you may prefer to do your own analysis by downloading the free report yourself.

Study findings

The study reached the conclusion that the major factor in determining the future low carbon fuel is what is available and its price. Relating factors are the carbon price and the cost of renewables.

The costs of wind, batteries and solar power have decreased rapidly in recent years, said Eirik Ovrum, DNV Maritime Principal Consultant and lead author of the report. And even though the exact decrease over the coming years is hard to predict, we are confident these costs will continue falling.

One big question is whether IMO will change its targets. As of 2022, its target is for a 50 per cent reduction in GHG emissions by 2050. But many national governments have adopted a net zero 2050 target, including the US, and pressure is being put on IMO to do the same thing.

DNV modelling also shows that, in order to reach 2050 targets, 5 per

cent of shipping fuel will need to be carbon neutral by 2030. The biggest factor in achieving that is whether supply chains can scale up fast enough.

It found that the Ukrainian war will not have a big effect on the energy transition over the longer term. Although it has raised the cost of energy today, it will not raise the overall cost of the energy transition.

Over the short term, new sources of fuel supply, such as from Mozambique and Tanzania, will not fill the 'delta' from the withdrawal of Russian gas rom the market.

The study showed that the number of 'alternative fuel' ships on order, including LNG dual fuel ships, tripled between 2019 and 2022.

As of September 2022, 5.5 per cent of ships by gross tonnage in operation, and 33 per cent of gross tonnage on order, are able to run on an alternative fuel, mainly LNG.

The study found that, beyond LNG and diesel, methanol fuel is the most developed shipboard fuel technology, followed by ammonia.

Perspectives

"The real challenge is now to tackle fuel availability," said Knut Ørbeck-Nilssen, president maritime with DNV. "Maritime cannot decarbonise in isolation. That's a really important and strong point."

To move forward, "supply chains must be built through cross-industry alliances. Coordinated plans by all stakeholders, including major energy and fuel providers and ports, is crucial," he said.

"Public incentives must encourage first movers to participate in a nascent global network of green shipping corridors."

There is a broader trend of energy systems everywhere becoming more efficient, costing a reduced portion of a country's income, and supply being more robust, said Remi Eriksen, group CEO of DNV.

The US Inflation Reduction Act, and other regulatory measures that have already been taken, show that "bold action is possible if the will is strong enough," Mr Eriksen said.

Mr Ørbeck-Nilssen was asked if he thought there was anything to learn from the adoption of LNG in the industry, in how it adopts zero carbon fuels.

"It took a while to scale it [LNG], more or less 20 years," he replied. "There was a chicken and egg problem".

Much of the challenge with LNG fuel was about getting the fuelling infrastructure built, and training people how to use it, he said.

Mr Ørbeck-Nilssen was asked about his perspective on large scale CO2 sequestration. He replied that it would make a big difference in the potential to supply low carbon 'blue' fuels. "When it is possible, it gives us possibility for accelerated progress in many areas," he said.

"It seems more logical to do [carbon capture] onshore than on a vessel," he said, referring to the conceptual designs for shipboard systems to separate CO2 out of a vessel's flue gas, store it onboard, and then release it to a reception facility in a port, for later sequestration.

It is possible to make fuels which can be handled the same onboard as current fuels, known as 'drop-in fuels'.

Ammonia and methanol, however they are made, are not drop in fuels, and so will require more investment in infrastructure. So to 'win' in the market, they will need to be available at lower cost than the drop-in fuels, said report author Eirik Ovrum.

The scenarios with ammonia are also modelled on the basis that ammonia powered ships will need at least 20 per cent of their fuel in a different form, as a 'pilot fuel' to get engines running.

Families of fuels

For the longer term decarbonisation options, carbon neutral fuels are categorised into three families in the report, bio, electro and blue, based on how they are sourced. It only includes biofuels made from sustainable biomass. The electro fuels are made with renewable electricity to make hydrogen combined with carbon dioxide which would otherwise be emitted. The blue fuels are made with fossil gas and CO2 sequestration.

The industrial process of making electro fuels is well established. It is similar to the Fischer Tropsch process used in South Africa to convert coal to liquids, to produce vehicle fuels during apartheid when no oil imports were allowed. For maritime electro fuels the coal is replaced by hydrogen from renewable electricity.

A challenge with electro fuels is that shipping will be competing with other consumers of renewable electricity, Mr Ovrum said. There is "some uncertainty" about how much energy needs to be put in, he said.

By comparison, shipboard batteries can be charged and discharged with nearly 100 per cent efficiency.

Of the 12 net zero scenarios, 7 have over 50 per cent of maritime fuel coming from biofuel, either liquid (biodiesel) or gas (bio-LNG). Some commentators have said that the world does not have space to create this biofuel, but Mr Ovrum believes that there is no consensus on this. "It is very uncertain," he says. However, it is "the most crucial question," he said.

It may be very useful for shipping companies to maintain some fuel flexibility, given the uncertainty, he said.

All of the scenarios model about 4 per cent of ship fuel coming directly from electricity, such as to charge shipboard batteries from a port source, or to provide electricity for auxiliary use directly when a ship is in port.

Very few of the scenarios have more than 50 per cent of any one fuel – there are scenarios with just slightly over 50 per cent for bio-marine gas oil, electro-MGO (marine gas oil), electro-ammonia, and blue ammonia, which DNV may consider the most likely outcomes.

Costs and costs analysis

For the 24 different scenarios analysed, DNV estimated the total onshore (infrastructure) CAPEX and shipboard CAPEX needed between now and 2050.

CAPEX is not the only factor driving the cost of a fuel – there is also the OPEX in providing it and market factors. And the OPEX is not the same for the different fuel types. For electrofuels, the energy is almost free after construction. For bio and blue fuels, there is quite a bit of energy and effort going into producing the fuels.

Tanker Operator did some meta-analysis of the cost estimations. To achieve IMO ambitions of a 50 per cent reduction in GHG emissions by 2050, we will need spending of $390bn on land and $250bn on ships for an average of the biofuel driven scenarios; the electro fuel driven scenarios will cost $725bn on land and $275bn on shore; and blue fuels will cost $425bn on land and $350bn on shore.

If we are to achieve net zero by 2050, biofuel driven scenarios will cost $890bn on land and $300bn on ships; electro fuel driven will cost $2.02tn on land and $490bn on ships; and blue fuel driven will cost $975bn on land and $562bn on ships.

So based only on CAPEX, biofuels are the cheapest; blue fuels are 20 per cent more expensive (IMO) or 30 per cent more (net zero); electrofuels are 57 per cent more expensive than biofuels (IMO) or more than double the price of biofuels (net zero).

These numbers sound colossal, although get more palatable if divided by 28, to give investment per year from 2022 to 2050, and then divided by 2,000, if this is the number of ships built each year.

For example the $250bn spending by shipowners for the biofuel pathway to reach IMO's targets becomes $8.9bn per year. If 2,000 new ships are built a year, this means they each need an extra investment of $4.4m, which may be palatable in the context of (for example) a cost of around $50m for a new Aframax tanker. TO

You can download the report and read more at **https://www.dnv.com/maritime/publications/maritime-forecast-2022/index.html**

ExxonMobil – lower carbon fuels and cylinder lube monitoring

ExxonMobil's plans for shipping include the supply of lower carbon fuels (mainly bio and blue) and using digital analytics on condition data about cylinder lube oils

ExxonMobil is making big investments in lower carbon fuels that can be supplied to shipping, largely in biofuels and 'blue' fuels (made from sequestrated CO2).

It is also improving its service to help shipping companies monitor the condition of their engine cylinder lube oils, with a data analytics collaboration with Palantir Technologies.

Across the company, ExxonMobil plans to spend over $15bn on initiatives to reduce greenhouse gas emissions by 2027, particularly on biofuels, hydrogen and carbon capture.

Its objective is to provide more than 40,000 barrels per day (2.3m tonnes) of lower-emission fuels by 2025 and increase this to 200,000 barrels a day (11.3m tonnes) by 2030. Although this is not all for maritime use.

Biofuels

ExxonMobil believes in biofuels as a maritime decarbonisation option. A benefit is their 'drop-in' nature – no major changes needed on the ship to use them, explains Eddie Fish, Market Development Advisor, Aviation & Marine Fuels with ExxonMobil.

"They are straightforward but slightly more expensive. Biofuels are good and strong now," he says.

Eddie Fish, Market Development Advisor, Aviation & Marine Fuels with ExxonMobil

Some container shipping companies are starting to look at using them, but not so much tanker and bulker companies, he says.

They would be used more in shipping if people had more incentive to use them rather than waiting until they are forced to, he says. "The marine industry is very good at waiting until the last hour."

A challenge with biofuels in shipping is that the emission reduction happens 'upstream' of the ship, in that CO2 is absorbed from the atmosphere when growing the plant-based feedstock.

If shipping only considers emissions on a 'tank to wake' basis, then biofuels do not offer any improvement, because they emit the same amount of CO2 as a similar fuel made from fossil sources, if you are only looking at the ship exhaust. "We believe in looking at things on a 'well to wake' assessment," he says.

In Canada, ExxonMobil has a majority stake in Imperial Oil, which is developing plans to produce renewable diesel at its Strathcona refinery in Edmonton. In the US, it has an agreement to purchase up to 5m barrels per year of renewable diesel from Global Clean Energy's biorefinery in Bakersfield, California from 2023.

Green and blue fuels

Further into the future, ExxonMobil is developing plans to provide fuels made from green and blue hydrogen, "mainly blue", Mr Fish says. These can then be used to make ammonia or methanol for ships.

It has a number of green hydrogen projects, including at the company's Slagen terminal in Norway. Here, it plans to produce 20,000 metric tons of green hydrogen per year, and use that to make up to 100,000 metric tons of green ammonia per year. This sounds like a lot but is much less than the 2.3m tonnes a day of all lower emission fuels it is planning to provide by 2025.

E-methanol may be the preferred solution of ship operators, because it can be most easily handled as a liquid fuel. But with the amount of renewable energy generation required to make it, it is probable that "there's not going to be enough", Mr Fish says.

For short sea ferries, batteries may be an option, taking electricity directly from the grid.

Ammonia fuel "is a bit of an uncertainty in marine combustion", he says, although it is already being moved around on ships as a cargo. Hydrogen will be "quite tricky" for vessels to carry.

In comparing these options, whilst the shipping industry would dearly like a prediction of the prices per ton of fuel, it is too soon to be able to provide this, he says.

The resulting dominant fuel will be decided by a range of factors, not just limited to the maritime sector, says Saurav Ghosh, Brand Manager, Aviation & Marine Lubricants with ExxonMobil. For example, the available biofuels may be purchased by the aviation sector.

Carbon capture

Behind the plans to develop 'blue' fuels are a number of carbon capture and storage (CCS) projects around the world that ExxonMobil is involved with, using its oil and gas production expertise to separate CO2 from flue gases and sequester it permanently deep in the ground.

In the US, ExxonMobil is one of 11 companies that are supporting plans for a large scale carbon capture and storage hub in the Houston industrial area which could store 100m tonnes CO2 a year from refineries, chemical plants and power generation facilities.

It is expanding CCS capacity at its natural gas and helium production site in Wyoming.

In Europe, it is working to develop CCS hubs in Scotland, France, Belgium and the Netherlands.

In Dec 2021, ExxonMobil signed a MoU with UK gas distribution company SGN and Green Investment Group (a subsidiary of financial services company Macquarie) to 'explore potential' for a hydrogen hub in the Southampton industrial cluster, UK, including carbon capture. ExxonMobil's Fawley refinery and petrochemical complex is part of the cluster. There are no planned sites for CO2 sequestration connected to the cluster by pipeline, so the CO2 would need to be transported to a storage site elsewhere by ship.

In Southeast Asia it has a vision for a CCS hub to serve heavy industry areas around Singapore. It has signed MOUs with Indonesian state energy company Pertamina, and Malaysia state owned energy company PETRONAS, to explore carbon capture and storage projects and deploy low carbon technologies.

Cylinder Condition Monitoring Service

In September, ExxonMobil announced new data handling features for its Mobil

Saurav Ghosh, Brand Manager, Aviation & Marine Lubricants with ExxonMobil

Serv cylinder lubricant condition monitoring service.

These were developed together with organisational data analytics company Palantir Technologies, based on Palantir's Foundry platform.

As a result of working with Palantir, ExxonMobil says it is able to improve the "power, precision and speed" of its cylinder condition monitoring system.

As input, the software uses data from analysis of lube oil samples, including of iron content, water content and base number (level of alkalinity).

Using ExxonMobil's software, companies can quickly see trends in their engines, such as the rate of degradation of lube oils. They can see how this compares with other vessels in their fleets. They can benchmark their engines against other similar engines in ExxonMobil's database, without knowing the identity of the owner of the other engine.

They can compare today's data with detailed historical data sets. The historical data can be used to generate insights and provide recommendations.

The end goal is to get a better understanding of vessel operations and to better protect engine components from premature wear. This may be even more important when companies are switching to low carbon fuels, when there may be many more operational uncertainties.

"We want to give you something useful that helps you to run the fleet better," says Saurav Ghosh, Brand Manager, Aviation & Marine Lubricants with ExxonMobil.

New cylinder oil

ExxonMobil's new Mobilgard 540 AC cylinder oil will be available from November 2022, in ports around the world.

This is approved by MAN Energy Solutions as having Category II status and so recommended for use in its MAN ES Mark 9 and higher two stroke marine diesel engines.

The most important Category II requirement is piston and ring pack cleanliness.

It is described as having "excellent detergency", so delivers very good cleanliness to the engine, including with low sulphur fuel. This means it can better fight against deposits and scuffing related engine wear, which has been seen to be a bigger problem with low sulphur fuels, ExxonMobil says.

It is a 40 Base Number (BN) oil (a measure of its alkalinity).

It has "excellent thermal and oxidative stability", so can be used in more extreme operating conditions.

Yannis Chatzakis, Global Marine Technology Program Manager at ExxonMobil, says that many shipping companies are currently using a combination of Category I 40BN and Category II 100BN cylinder oils in alternating patterns, based on guidance from MAN ES, to meet the required cleanliness performance. But this makes life more complex.

If they use Mobilgard 540 AC there is no need to switch between different oils, he says. TO

Becker Marine – dagger boards, Mewis Duct award

Maritime propulsion equipment specialist Becker Marine is developing 'dagger boards' to stabilise ships with wind propulsion. It has won a major environment award for the Mewis Duct, and continues working together with its majority owner Nakashima Propeller

Maritime propulsion equipment specialist Becker Marine is developing "dagger boards" for future vessels with wind propulsion, to keep them moving in the right direction, without drifting sideways. The dagger board is basically a retractable flat board which sticks out from the sides of ships into the water.

Sailing ships have different manoeuvring behaviours to ships with a propeller. They don't move in the direction the rudder points. "Not going straight ahead but a bit aside," is how Henning Kuhlmann, managing director, Becker Marine Systems describes it. The dagger board will keep the vessel moving in the desired direction.

Becker is examining a number of wind propulsion systems, including rigid, foldable wing sails. It sees this as "a very promising technology for propulsion of merchant vessels," Mr Kuhlmann says.

Becker Marine is also working on an air lubrication product for ships, using government research funding, which will be released later in 2022.

Mewis Duct award

In September 2022 it was announced that Becker Marine is joint winner of the "German Environmental Award", presented by the German Federal Environmental Foundation (DBU—Deutsche Bundesstiftung Umwelt), described as "one of Europe's most prestigious awards", for the invention of the Mewis Duct, introduced to shipping in 2008.

The award is Eur 500k cash, which is shared between two Becker engineers and also a co-winner, biologist Dr. Christof Schenck, for his work as executive director of the Frankfurt Zoological Society. The award will be presented by Frank-Walter Steinmeier, president of Germany, on October 30.

Becker Marine has a website at mewisduct.com with a regularly updated figure of cumulative CO_2 savings from the device, as of Sept 22 it said 12.3m tonnes CO_2.

The Mewis Duct consists of two fixed elements mounted on the vessel. These are a duct positioned ahead of the propeller, which straightens and accelerates the hull wake into the propeller, and an integrated fin system, which provides a 'pre-swirl' of water into the ship wake, reducing losses in the propeller's slipstream. Power savings of up to 8 per cent for tankers and bulkers are promised, although it is dependent on the propeller thrust.

Nakashima Propeller partnership

Becker is moving ahead with its partnership with Japanese propeller manufacturer Nakashima. It announced that Nakashima had purchased a majority stake in the company in April 2021. This followed the two companies working together for 40 years.

As a result of the merger, Becker is able to offer a complete package including steering, rudders and propellers, and help companies reduce fuel consumption by ensuring the components work well together.

Both companies have specialists in Computational Fluid Dynamics, using computing power to model the flow of water over their products.

The two companies are working together to develop a digital evaluation and monitoring system for motion control of ships. It will take data from propulsion and manoeuvring systems, including Becker's rudder monitoring and bearing wear measuring system.

All shipyards can fit rudders and propellers to ships, but they do not usually consider how they work together hydrodynamically, Mr Kuhlmann says. But by considering this, you may identify ways to reduce fuel consumption. TO

Operational risk of future fuels

An industry coalition published an assessment of operational risks and competence requirements of future fuels. Methanol was found safer than LNG or hydrogen; ammonia had more risks, but they could be mitigated.

The shipping industry safety coalition 'Together in Safety' has published a "Future Fuels Risk Assessment", addressing operational risks and the resulting competence requirements for the safe handling of future fuels, looking at LNG, hydrogen, methanol and ammonia.

A broad summary is that ammonia has bigger risks than LNG, hydrogen and methanol, but there are ways the risks can be mitigated. Methanol can be less dangerous than LNG and hydrogen. This article is a summary of the report, the full report is available free online at the link below.

Together in Safety is chaired by Dr Grahaeme Henderson, former head of shipping with Shell and former chairman of OCIMF's executive board. The working group consisted of representatives from APM Terminals, Carnival Corporation, Chevron, Euronav, Lloyd's Register, Mærsk, MSC Ship Management, OCIMF and Shell.

Together in Safety describes itself as a "non-regulatory industry consortium connecting the maritime sector with the common purpose of working together to improve safety performance."

Together in Safety comprises all of the shipping industry groups including the International Chamber of Shipping, BIMCO, OCIMF, Intertanko, Intercargo, Interferry, Cruise Liners International, World Shipping Council, in addition to major shipping companies, Classification Societies, P&I insurance, and country representatives.

To research the report, Together in Safety carried out a series of hazard identification workshops, to identify risks and prioritise recommendations to the industry to ensure the safe deployment of future fuels.

The fuels considered were LNG, methanol, ammonia and hydrogen, on the assumption that these are likely fuels to be used. The workshops were based on a tanker design using LNG as a fuel.

The study did not include technical discussions about specific items, such as specific pressure and timing settings for pressure relief valves.

It assessed risks on the basis that there would not be any simultaneous operations taking place during the bunkering process such as a cargo operation, because this would need a special hazard identification study.

Risks of criminal and terrorist activities were also not considered.

Risks and scenarios

Risks were classified as unacceptably high, tolerable and low. This was based on the likelihood of a certain event happening, and the injuries or fatalities which may result.

So, an 'unlikely' event which would lead to '2-10 fatalities' was considered an unacceptably high risk.

The following "what-if" scenarios were considered. Loss of manoeuvrability at sea; excessive motions at sea; a [power] black-out at sea; an excessive trim or list developing at sea or in port; a requirement for tug support or 3rd party vessel attendance at sea or in port; a ship grounding in way of the future fuel tanks and system; the vessel needs to be abandoned; a ship collision in way of the fuel tank; cargo operations are required in way of fuel tanks and system components; there is a crew change; there is a completely new crew after vessel handover; onboard access is required by personnel not managed by the ship's operator; there is a misalignment of the bunkering stations; there are excessive motions during bunkering.

Risks summary

The results showed that all LNG risks, without additional mitigation steps, were classed as "tolerable' or 'broadly acceptable'. Hydrogen risks were very similar to LNG risks. Methanol risks were also all tolerable or acceptable, with more risks classed as acceptable than with hydrogen and LNG.

However, ammonia fuel had 6 risks classified as unacceptably high.

One was a vessel grounding, leading to large heel / trim angles, leading to liquid fuel coming from the vent mask. This was classified as "C5-L3" meaning that while considered 'very unlikely' it could lead to high fatalities. A "C4" consequence was defined as over 11 fatalities, a "C5" consequence was not defined in the report, but worse.

Also, a vessel collision, leading to a breach of the hull, and liquid fuel coming out of the vent mast, was similarly classified C5-L3.

These risks could be mitigated with trim / heel alarms, training for crew into how to handle large heel /trim angles, dedicated design guidelines on how to 'engineer out' 'credible liquid release scenarios' which result, the report stated.

Another 'unacceptable' risk with ammonia was operational activities leading to damage of the equipment and vent mask. For ammonia this was categorised "C3-L5", meaning a "likely" event which could lead to "one fatality or multiple major injuries".

Ways to mitigate these risks could be training on EX (no spark) equipment; training for harbour personnel on how to handle damage to the fuel system such as dropped objects or crane interactions; training for harbour personnel in fuel system safety devices; and the fuel system to be designed to be adequately protected against normal cargo operations.

Further risks considered unacceptably high for ammonia relate to the bunkering - if a tank is accidentally overfilled, or leaks, or has defective level readings. These three risks were all categorised as "C5-L3" for ammonia fuel.

A mitigation method for an ammonia vessel could be a fuel overfill control plan to be in place and part of the ship's emergency response plan. There could be crew training on impacts of fuel density differences when bunkering.

While the likelihood of tank overfilling was considered the same for LNG, hydrogen or methanol fuelled vessels, the consequence, "minor injury", for LNG, hydrogen or methanol, was considered an acceptable risk.

Methanol fuel was considered safer than LNG or hydrogen in the event of a build-up of tank pressure or excess motion of the vessel - being a liquid the consequence would not be so big. TO

The report can be downloaded here **https://togetherinsafety.info/wp-content/uploads/2022/06/Future-Fuels-Report.pdf**

Considering nuclear power for shipping

Nuclear power is used onboard 100 naval vessels today, but is not being seriously considered for commercial shipping in many places, despite being zero emission. Should it be?

One tonne of thorium can produce the same energy as 3.5m tonnes of coal. It is claimed to be 'significantly safer' than uranium, because splitting atoms makes no plutonium. Is this a future fuel for shipping?

Naval vessels powered by nuclear power have been calling at ports around the world since 1955. Today there are around 100 maritime reactors in use, on a wide variety of naval vessels including submarines, aircraft carriers and icebreakers, says Robert McDonald, Principal Engineer at the Institute for Energy Technology (IFE), based near Oslo, who has been working with nuclear power since 1985.

A Small Modular Reactor (SMR) can have a power output of between 10 and 300 MW. A nuclear reactor on one ship could charge the batteries on a fleet of ships travelling together.

The commercial maritime industry could follow the same regulatory processes followed by the military, to keep reactors safe and ensure no unauthorised access.

The maritime reactor sits in a sealed, self-contained, lead lined compartment that is built for complete security and containment. Anyone who gained access to the actual reactor would not survive exposure, but there is no reason for anybody to need access, Mr McDonald says. They automatically shut down if there is a loss of power.

Thorium reactors do not produce any plutonium (unlike uranium reactors). This is good because plutonium can be used to make nuclear weapons if it falls into the wrong hands.

Mr McDonald says that the reactors are "efficient, easy to install – typically built in factories with the last 10 per cent assembled on site, easily scalable, safe, with very few moving parts and almost zero maintenance."

There are over 70 small and micro designs under development, with typical uses for applications such as district heating, desalination, general electricity generation and hydrogen production, he says.

Thorium Molten Salt Reactors (MSRs) almost never need to be refuelled, he says. The salt is removed from the reactor only every 3 to 7 years, dependent on its specifications. The work can be planned for the most suitable time.

The waste, or 'old salt', is then processed to remove by-products, mainly Uranium 235, which can be sold as new reactor fuel.

There isn't any supply chain for thorium, but it is about three times more abundant in the earth than uranium, so a supply chain could be developed if there was a market, he says.

"I see this as the most viable, and potentially the only credible, solution for a zero-emission fleet that can operate under commercial terms and cost levels," said Jan Emblemsvåg, Professor at the Norwegian University of Science and Technology, an expert in the field of Thorium and nuclear power generation.

Ulstein and MSR

In April 2022, Norwegian ship design and shipbuilding company Ulstein presented a concept for a 149m long vessel powered by a Thorium molten salt reactor. It said the concept "may be the missing piece of the zero emissions puzzle for a broad range of maritime and ocean industry applications."

Ulstein also developed a concept for a 100m ice class cruise ship which could take 160 people onboard including crew, with a nuclear reactor charging batteries onboard, which then run the propulsion system.

The reactor is called a 'molten salt reactor' because Thorium is dissolved in liquid salt. The salt is heated from a radioactive reaction. This makes steam to drive a turbine and create electricity.

ABS research project

In August 2022, classification society ABS reported that it had won a $800k research contract with the US Department of Energy (DOE) Office of Nuclear Energy to "research barriers to the adoption of advanced nuclear propulsion on commercial vessels."

ABS will develop models of different advanced reactor technologies for maritime applications and develop an industry advisory on the commercial use of modern nuclear power.

Support will be provided by the Department of Energy's National Reactor Innovation Center (NRIC), based at Idaho National Laboratory. NRIC will provide the advanced reactor framework to help propose how a maritime nuclear demonstration could take place.

The DOE has also contracted ABS to support research into molten salt reactors being carried out by the University of Texas in a separate award.

"Modern nuclear technologies are increasingly suggested as a potential solution to shipping's decarbonization challenge," says Patrick Ryan, ABS Senior Vice President, Global Engineering and Technology.

"The technology certainly has potential both in terms of its contribution to emissions reduction and for U.S. shipyards and their supply chains to leverage national investment in terrestrial nuclear energy development.

"Nevertheless, many questions need to be answered and it is critical the industry is able to evaluate these technologies with a laser focus on safety. ABS is up to the challenge to support the DOE in these efforts."

ABS has history with maritime nuclear energy sources dating back to 1959 with the NS Savannah, the first merchant ship powered by a nuclear reactor, approved under ABS Rules.

"When we partner with industry, we can jointly apply [our capabilities] to our energy challenges. NRIC was created to make that happen faster," says Ashley Finan, director of the Department of Energy's National Reactor Innovation Center (NRIC).

"There's a tremendous opportunity to reduce emissions in shipping, as well as growing interest from both the maritime and advanced nuclear sectors." TO

For an alternative view, a scientific paper from 2006 noting disadvantages of the Thorium Molten Salt Reactor is online here **https://hal.in2p3.fr/file/index/docid/30952/filename/TMSR.pdf.**

Rolls Royce focussing on methanol

Maritime engine manufacturer Rolls Royce Power Systems is focussing on methanol as a major fuel of the future, as part of a range of projects to help reduce its customers' carbon emissions

Maritime engine manufacturer Rolls Royce Power Systems is planning to develop a methanol engine for shipping in 2026, and a fuel cell running methanol converted to hydrogen in 2028.

The work is part of reaching its broader goal of adjusting its product portfolio by 2030 so that its customers have 35 per cent reduced greenhouse gas emissions, compared to 2019 levels.

It is keen on methanol because an engine running methanol fuel can achieve a similar power output to an engine running diesel. As a liquid at normal temperatures it is much easier to handle than LNG, hydrogen or ammonia. Methanol is also less toxic than ammonia.

There is no equivalent of 'methane slip' – unburned gas entering the atmosphere through the exhaust – with methanol.

It has a workable energy density of 15.6 MJ/L, just under half of the energy density of gasoline (33 MJ/L) meaning that the fuel tank needs to be more than double the size of a gasoline or diesel tank. By comparison, liquid ammonia has a similar energy density of 15.6 MJ/L; liquid hydrogen has a much worse energy density of 8 MJ/L. The energy content of LNG ranges from 24 MJ/L to 21 MJ/L.

There is also an existing infrastructure providing methanol in large volumes around the world, so to some extent the 'chicken and egg' problem is overcome.

However it does differ from diesel in many ways including density, evaporation properties, ignition energy, viscosity and lubrication behaviour. This is not a 'drop-in' fuel.

So many changes are needed to convert a diesel engine design to a methanol engine, including all the associated systems – fuel injection, turbocharging, cylinders, lubrication and control systems, Rolls Royce says.

There is an overlap between the requirement of methanol engines and natural gas engines, so some of the work to develop a natural gas engine can be applied. Both are fuels with a low flash point.

"We have realigned our offering for the maritime industry to actively support ship operators on their journey to net zero," says Denise Kurtulus, Vice President - Global Marine with Rolls-Royce Power Systems.

Rolls Royce maritime engines use the brand name 'MTU', from a company Rolls Royce Holdings acquired in 2011, MTU Friedrichshafen. MTU derives from Motoren- und Turbinen-Union meaning 'Motor (Engine) and Turbine Union' – a way to describe an internal combustion engine in 1909.

Fuel supply

Rolls Royce anticipates that by promoting methanol fuel, it will create demand, and give suppliers more incentive to provide it, and costs will come down.

The methanol could ultimately be supplied by a number of routes, initially from fossil fuel (natural gas), but then we may see bio-methanol, blue-methanol and electro-methanol.

Asked about whether Rolls Royce envisages future maritime fuels to be supplied via the blue route [fossil with CO2 sequestration], a spokesperson said, "to be realistic, we need them. The measure we count is lifecycle GHG emissions. We are not against blue fuels."

Methanol is not zero carbon – its chemical formula is CH3OH. So each molecule of methanol combusted releases one molecule of CO2, the same as methane (CH4). But the emissions are lower than for conventional liquid fuels.

Rolls Royce envisages that ships would eventually use 'e-methanol' (or electro-methanol) formed from using renewable electricity to electrolyse water into hydrogen and oxygen, then reacting the hydrogen with Co2 to form methanol. This CO2 is released in combustion. So for the whole process to be arguably zero carbon, it would need to be CO2 which would otherwise have been emitted elsewhere.

It envisages that methanol will initially be used on ships which use the same ports repeatedly, and when there is a reliable methanol supply in those ports. This can include tugs, fast ferries and coastal shipping,

Methanol engines and fuel cells

Rolls Royce's S4000 engine, one of its most popular ship engines, is being converted to methanol use, and expected to be available in 2026. The methanol engine runs using the Otto cycle, which is also used in many other of its gas engines.

The first pilot installation will be on a 70m yacht.

Rolls Royce is also working on a hydrogen fuel cell, which will generate electrical power without any moving parts. The advantages of fuel cells are the low noise and vibration, high modularity (one fuel cell is the same as another, and they can be made at any size). They are low maintenance. They have a higher efficiency than

41,000 operating hours on HVO biofuel in a Rolls Royce engine since 2019 – California's Golden Gate Ferry

generators. There are no particulate emissions.

Fuel cells for shipboard use are expected to be available from 2028.

The fuel cell can use methanol fuel if the methanol is first run through a reformer, a device which reacts methanol and steam to form hydrogen and CO2.

The idea is that shipboard fuel cells would initially be used to generate 'hotel load' or auxiliary power such as for lighting and pumps, but ultimately they could be used to make power for propulsion by electric motors.

The challenges are integrating the electrical power into the ship systems, cooling the fuel cell, and storing / handling the fuel. You need a power system including a battery, direct current switchboard, and control system.

A combustion engine, by comparison, does not need cooling, because its waste heat is released through the exhaust.

Biofuels

Rolls Royce is also testing biofuels. The company's "mtu Series 2000" and "Series 4000" engines for ships, its most popular engines, are expected to be approved for use with biofuels to EN15940 standard from the beginning of 2023.

EN15940 is a diesel fuel specification for future fuels, such as fuel from hydrotreated vegetable oil, other forms of biodiesel, fuels made through 'biomass to liquid' processes and electro fuels designed to replace diesel.

Hydrotreated vegetable oil (HVO) fuel has been tested in a Rolls Royce engine on 6 ferries operated by Golden Gate Ferry in California, with 41,000 operating hours since 2019. The tests confirmed that the fuel works as well as conventional diesel in terms of maximum power, load acceptance and fuel consumption, and the visible smoke was much reduced. There was also a reduction in nitrogen oxide and particulate emissions when using HVO instead of fossil diesel.

Electric propulsion

Another low carbon offering planned from Rolls Royce is its "Hybrid PropulsionPack", expected to be available for its mtu Series 2000 and 4000 engine from 2023, which will allow a diesel engine to be combined with electric propulsion modules, batteries, gearboxes, control and monitoring systems. This can run with a diesel engine of up to 4.3MW, plus up to 743 KW of electric motors. TO

How ClassNK is supporting liquid hydrogen and CO2 carriers

Classification society ClassNK is supporting the development of ships which carry liquid hydrogen and carbon dioxide, and sees it as one of the most promising areas for maritime innovation

As an active contributor to advanced initiatives targeting decarbonization within and beyond the shipping industry, ClassNK is supporting the development and safe operation of liquid hydrogen (LH2) and liquid carbon dioxide (LCO2) carriers.

In their gaseous forms, both hydrogen and carbon dioxide can be transported over short distances via pipeline.

But liquid states offer greater energy density per cubic meter and facilitates storage.

Hydrogen and CO2 must be transported in tanks, either in trucks or aboard ships. Over long distances, the most efficient means of transporting LH2 and LCO2 is by sea.

The development of LH2 and LCO2 carrier vessels has therefore emerged as one of the most promising areas for innovation in the maritime sector.

Since hydrogen is liquefied at the extremely low temperature of -253 degrees Celsius and presents hazards including flammability and permeability, handling the substance requires the observance of intensive safety procedures.

Large Liquefied CO2 (LCO2) Carrier developed by Mitsubishi Shipbuilding and NYK Line

In 2017, to contribute to the safe seaborne transportation of LH2, ClassNK published its "Guidelines for Liquefied Hydrogen Carriers", which are based on the International Maritime Organization's (IMO) Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk.

Through its active role in the verification of LH2 and LCO2 carriers and related technologies, ClassNK is facilitating the development of two fast-growing markets that

Large Liquefied CO2 (LCO2) Carrier developed by MOL

promise to make a significant contribution to realizing a carbon-neutral society.

First LH2 carrier ship

ClassNK has applied its guidelines in surveying, at the construction phase, the hull structure, machinery, onboard equipment and other components, with the world's first LH2 carrier ship.

Built by Kawasaki Heavy Industries, Ltd. (KHI), a member of the CO2-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA), Suiso Frontier was added to ClassNK's register on 3 December 2021.

The Society continues to support the vessel's safe operation through in-service surveys, utilizing the knowledge gained through these surveys to keep its guidelines up to date.

Earlier this year, ClassNK issued an approval in principle (AiP) for another vessel, a forthcoming large LH2 carrier from KHI.

The Society had previously granted the company an AiP for the design of the cargo containment system, at 40,000 m3 per tank.

Four of these tanks will feature on board KHI's forthcoming large LH2 carrier. So, the vessel has a total LH2-carrying capacity of 160,000 m3.

For the same ship, ClassNK granted AiPs for cargo-handling systems, which are key design elements of the vessel, and dual-fuel main boilers that use hydrogen boil-off gas as fuel.

CO2 carriers

ClassNK has been active in its support of the CO2 economy, recently issuing an AiP for LCO2 carriers developed by Mitsubishi Shipbuilding and Nippon Yusen Kabushiki Kaisha (NYK Line).

The Society executed the design review based on Part N of its Rules for the Survey and Construction of Steel Ships, which incorporate the IMO's International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).

The AiP confirms adherence to the rules regarding the design of each cargo tank system, hull form and other components, accounting for different tank-pressure settings for medium- and large-scale vessels.

Also, ClassNK granted an AiP for the design of a large-scale LCO2 carrier by Mitsui O.S.K. Lines, Ltd. (MOL) in August 2022, applying the same set of rules incorporating the IGC Code.

MOL had launched research and development (R&D) on the adoption of a large-scale LCO2 carrier in response to a call for proposals by Japan's New Energy and Industrial Technology Development Organization (NEDO) to complete the conceptual design, under a project entrusted by NEDO to Japan CCS Co., Ltd (JCCS).

The vessel design is one element of NEDO's initiative "CCUS R&D and Demonstration Related Project/Large-scale CCUS Demonstration Project in Tomakomai/ Demonstration Project on CO2 Transportation".

CCUS means carbon capture, utilization and storage.

The MOL ship is intended as a practical solution to the need for the long-distance transportation of 1 million tons of CO2 a year, based on NEDO's vision to implement CCUS technology by 2030.

Shipboard carbon capture

ClassNK has been directly supporting advancements in CCUS since 2020, when the Society joined the "Carbon Capture on the Ocean" (CC-Ocean) project to test a small-scale ship-based CO2-capture demonstration plant.

It was conducted in collaboration with Kawasaki Kisen Kaisha, Ltd. ("K" Line) and Mitsubishi Shipbuilding Co., Ltd. part of the Mitsubishi Heavy Industries (MHI) group. The world-first demonstration resulted in the successful separation and capture of CO2 from the test ship's engines.

Earlier this year, the project received the "Marine Engineering of the Year" award from the Japan Institute of Marine Engineering. TO

Large Liquefied Hydrogen Carrier developed by Kawasaki Heavy Industries

Developments at Alfa Laval

Developments at Alfa Laval relevant to tankers include Hansa Tankers using Alfa Laval's 'StormGeo' routing and CII software, acquisition of BunkerMetric, tools to ensure ballast compliance remotely, a new freshwater generator, and developments at its test centre

In September, Norwegian pool operator Hansa Tankers announced a partnership with StormGeo (now owned by Alfa Laval), to use its fleet performance management software "s-Insight" on all vessels in the pool.

The software integrates weather, voyage reporting, sensor data, performance improvement 'levers', expert assistance and analytics.

Hansa Tankers' pool has 50 chemical tankers of between 19,000 and 33,000 DWT.

HansaTankers will use the StormGeo software to simulate the CO2 impact on the estimate and voyage levels to provide an overview of pre-fixture and post-fixture emissions results.

It can calculate the Carbon Intensity Indicator (CII) for any ship based on data per voyage and year, including projections for future compliance.

It can simplify and streamline the Sea Cargo Charter reporting process.

With all vessels using the same system, Hansa tankers will have a unified data collection system for its pool operators and partners to document and assess environmental performance of all the vessels.

It will use StormGeo's tools to transfer voyage data from vessels to the office in an integrated way, supporting shore staff in "managing the environmental and commercial performance of our entire fleet in one dashboard," says Torfin Eide, COO at Hansa Tankers.

"We gain new and actionable insights that enable [understanding of] CO2 impact on our trade, which in turn will positively enhance the pool's financial performance and environmental footprint in the coming years."

"The earlier we integrate CII simulation into our daily operations and decision making, the better we can manage the impact on CII performance and thereby enhance our competitive advantage in the market."

Bunker Metric

In September Alfa Laval announced that it has acquired Bunker Metric, a software company from Denmark which has developed online tools to provide fuel procurement recommendations and assist with compliance with sulphur regulations.

BunkerMetric supports ship operators in finding the best bunker procurement plan and improving voyage margins using algorithms.

The acquisition is part of Alfa Laval's strategy to expand its digital marine service offering.

BunkerMetric's procurement optimization tool will become a subscription service within StormGeo's existing offering. StormGeo is a company providing weather intelligence software and decision support services, also recently acquired by Alfa Laval.

The optimization tools, together with StormGeo's advanced route services, will enable ship owners to streamline operations to help them improve their bottom line.

BTWS remote monitoring

Alfa Laval has developed an online portal for shipping companies using its ballast water treatment systems to monitor the systems onboard their fleet.

The company employs 40 engineers who provide remote support services. It sees providing remote support as a means to differentiate itself from other providers.

Fresh water generation

In early 2023, it will launch the two stage "AQUA Blue E2" fresh water generator. This device removes salt from seawater using waste heat from the ship's engine, with a vacuum distillation process.

The water evaporates, separates and condenses on the same titanium plate.

Compared to the single stage AQUA Blue E1, it produces twice as much fresh water using the same amount of waste heat – or the same amount of fresh water using around half the waste heat.

This aligns with decarbonisation aims. Companies may want to use some of the 'saved' waste heat to generate electricity onboard. If a vessel is slow steaming so it uses less fuel, there may be less waste heat available.

Both the E1 and E2 devices have gaskets which do not require any glue, so are easier to maintain onboard.

Test and training centre

At Alfa Laval's test and training centre in Aalborg, Alfa Laval is testing the use of ammonia fuel, including in boilers and fuel cells.

It has an EU funded project to develop a 200 KW fuel cell running ammonia, using 10 x 20 KW modules in a rack.

A fuel cell is more efficient at generating electricity from ammonia than a generator, but it is also more expensive.

TO

Using StormGeo software - Hansa Tanker's vessel Sun Ploeg

Waste management – through an international broker

Top Glory Marine Services, based in Hamburg and Tianjin, can act as a global broker for your waste management, rather than you having to form relationships with individual providers.

Tanker operations generate a lot of waste, and operators have to work with many waste reception facilities around the world.

Top Glory Marine, based in Hamburg and Tianjin, China, is offering services to act as a broker for your waste services globally, through its network of verified providers.

The service covers "MARPOL relevant waste" – including physical items (plastic, oily rags); liquids (bilge water, slops from tank washing) and pyrotechnics (from flares which have been set off).

Working with Top Glory gives shipowners reassurance that they will get an environmentally friendly disposal job, says Cathrin Prikker, director of business development and sales with Top Glory.

Cathrin Prikker, director of business development and sales with Top Glory; Silke Fehr, managing director and founder, Top Glory

It should also make it easier to work with the best available providers. Technical superintendents often build up informal personal networks of waste companies around the world, and then use these companies all the time. But then they do not go beyond them to see what else is on offer in the market, she says.

But it is very hard for tanker company staff to keep up to date with the services available. "The sludge and garbage market is so dynamic," she says.

Some tanker operators use a port agent to arrange their sludge and garbage disposal. But they can have less incentive to manage costs, she adds.

Top Glory has 400 vessels on contract for its waste reception management, of which 30 per cent are tankers, she says. It has relations with 250 waste management suppliers (as of September 2022), in 400 ports around the world.

It arranged 8500 waste collection services in 2021, comprising 18,800m3 of garbage ashore, and 4,750 m3 of sludge ashore.

Top Glory employs 19 people. Today it has main offices in Hamburg and Tianjin, China and representative offices in Dubai and Cristóbal (Panama).

The company was founded in 2013 by Silke Fehr, a former sales manager with German industrial recycling, cleaning and disposal company.

The service

Top Glory employs HSEQ specialists who check the licenses and certificates each supplier holds. They audit and rank the participating waste management companies, and count the number of successful services they have carried out, when deciding who to recommend for the next job.

Tanker operators have a choice of paying Top Glory through an annual fee, or a fee for each service which is arranged.

Top Glory's staff can work directly with crew onboard. The crew can send an e-mail describing what they need in the next port, and Top Glory can arrange it at the most cost effective, quality verified, facility available.

Top Glory provides shipowners with documentation about all services performed, through an online tool. This includes data about the waste streams from individual vessels or fleet over different periods.

Shipping companies can see the MARPOL receipt for waste collection services via this tool.

The tool provides data which shipping companies can include on their ESG report, such as the level of plastic waste. They may want to use this data to set and see progress with waste reduction targets, such as for the use of single use plastic bottles onboard.

Additional services

Top Glory also works with 1,100 ships as the designated Ship Pollution Response organisation (SPRO) contractor, as required for any ship entering a Chinese seaport or doing a ship-to-ship transfer 20 miles offshore. This is arranged through its Tianjin office.

Top Glory is developing a network of tank washing service providers, so it can act as a broker for tank washing. This can also help find a provider to meet a specific need, such as tank washing with non hazardous chemicals.

When a surveyor finds Hazardous Materials (IHM) on your ship, TGM can assist with disposal as required under the European Union Ship Recycling Regulation guideline and the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships. **https://topglorymarine.de/**

WinGD – digital tools to assist crew in operating engines

Maritime engine technology company WinGD is developing digital tools to provide diagnostic advice to crew on how to operate its engines, supported by remote experts

Maritime deep sea engine technology company WinGD is providing crew with digital tools which gives them advice about how to better operate engines and solve problems. These are supported by remote experts.

200 vessels are using this service, with crew being provided with regular recommendations. This includes container ships, gas carriers and bulkers, says Dominik Schneiter, head of research and development with WinGD.

It has taken some initial effort to get crew acquainted with it, but so far there has been very positive feedback, he says.

WinGD offers this service to its clients for no additional cost during the warranty period of the engine. The only shipowner expense during this time is for a computer to run the software on. After the warranty period, the service is offered on a subscription basis.

The business benefits include reduced unplanned stoppages, reduced fuel consumption, extended time between overhaul of components and predictions of when this needs to be done, better connection with remote support and online training tools, and gaining access to spare parts and field services.

The software should be particularly useful as equipment starts aging, and recommendations get more important and useful, he says.

It can also prove particularly useful on dual fuel engines, which are starting to be installed, but something not many seafarers have experience with, Mr Schneiter says.

As ships are asked to carry more complex fuels, it will get more difficult for crew, and so services like this will become more important, he says.

This service may also help shipping companies move towards not requiring engineers onboard, in the same way that an aeroplane no longer has any engineers onboard. This could be a midway step to the autonomous ship.

"That's a big ambition we have," Mr Schneiter says. "We see this as the future."

How it works

The system uses data feeds from sensors on the engine which have already been installed for the alarm system. Some shipboard systems have as many as 500 data signals, Mr Schneiter says.

There is an Engine Diagnostic System (EDS) which analyses the data onboard the vessel, based on a 'digital twin' type digital model of the engine.

Simulation models can be built individually for each engine, running both onboard the ship and in WinGD's onshore support facility.

There are analytics tools which show crew any trends in operating parameters of the engine, and tools which guide crew onboard through the steps they should take in fixing any problem.

If there is some specific problem with the engine, the software can gather high frequency data from sensors, and send it to shore for analysis, including by data scientists.

WinGD offers remote support 24 hours a day. Its remote staff are able to monitor alarms happening on the ship. The remote specialists can also have chat exchanges with the crew.

In a number of cases, WinGD specialists were able to pinpoint the root cause of a problem, such as something which has broken, Mr Schneiter says.

The data is also useful to WinGD in better understanding how its engines are performing, particularly new engine designs.

"The digital world allows very quick feedback. We can provide ship specific advice," Mr Schneiter says. "We really understand the engine as a system, we have a lot of models."

In future, the simulation system will be developed to try to predict remaining life of equipment.

The data is owned by the shipowner, who agrees that WinGD can access it.

At the moment the data only flows between sensors on WinGD engines and WinGD's data centres. But if the maritime industry had a more open 'data ecosystem', with data standards, it would be possible for more people in the industry to make use of the data, so long as the data owner, normally the shipowner, agrees. "Every ship should have an open data ecosystem," Mr Schneiter says.

Carbon calculations

An open data ecosystem may be helpful in making carbon emission calculations for ship operations in a more holistic way, Mr Schneiter says.

For example, there has been much attention in recent years on 'methane slip' – the argument that LNG fuel is not very useful in decarbonisation if a small amount of LNG 'slips' through the engine unburned into the atmosphere, since it is a much more potent greenhouse gas than CO2.

But this debate focusses only on one of many different components of emissions associated with ship operations, Mr Schneiter says. A more system-wide approach may reveal a different picture about the pros and cons of LNG fuel. "We have to move away from pure methane slip [analysis]".

For example, this analysis could consider whether it is better to continue with an old ship and engine, retrofit a new engine on an old ship, or build a new ship. While a new ship or engine would be more efficient, there are carbon emissions involved in scrapping the steel, and building the new ship. "Converting an old ship may be a better solution than new build," he says. To answer questions like this is "why you need a system approach."

About WinGD

WinGD is an engine technology company based in Winterthur, Switzerland. Its engines are manufactured under license by other companies, but WinGD owns the customer relationship.

The company is owned by China State Shipbuilding Corporation (CSSC).

It was formerly the 2-stroke engine division of engine manufacturer Wartsila. Today it has designs for both diesel and low speed gas (dual-fuel) engines.

The engines are used on all kinds of deep sea ships including tankers.

While not doing manufacturing, the company is involved in research and development (R&D), design, operational and manufacturing support, marketing and sales, and runs a training facility.

RWO's new oily water separator

RWO of Germany has released a new oily water separator designed for large vessels, where the pump is a separate unit, so ship designers can make a separate decision on where to place the pump.

In September 2022 RWO announced a new oily water separator for international shipping, the "OWS-PT" (Oily Water Separator – Pressure Type).

It is specially developed for large vessels, such as VLCCs and very large ore carriers (VLOCs), handling bilge water.

The OWS-PT system differs to the previous version in that the pump is not installed within the system so ship designers can make a separate decision on where to place the pump .

Until now, RWO offered only oily water separators as a unit containing the pump between the two separation stages. This has proven not to be practical in recent ship designs for large vessels, because they do not have space next to the bilge water holding tanks for the OWS, where it was traditionally installed, says Stratos Papamichalis, managing director of RWO.

Stratos Papamichalis, managing director of RWO

Often, space is only available to install the OWS on higher decks, several metres above the tank. But the higher the pump is placed above the bilge tank, the more suction power it will need – so some yards needed to install a secondary supply pump, in addition to the pump contained within the OWS unit. With the new design, they just install one pump separate to the OWS unit.

The first separation stage of the RWO OWS is called the 'coalescer', where minuscule oil droplets agglomerate and form larger droplets. Then these larger droplets will float to the top of the water, rather than be carried along within it. In the second separation stage, remaining emulsified oil is adsorbed on the surface of activated carbon.

The oily water separator reduces oil content in water to under 15 parts per million, which is the level defined by IMO where water can be safely discharged into the sea. It can achieve water quality of 5 ppm oil, which is the standard for some shipping companies. The separated oil can be sent to a sludge reception facility on shore.

The OWS-PT also has an advanced control system which is "PLC based", which should make it easier to integrate with the ship's controls and alarm management system, RWO says.

RWO's most common oily water separator is called "OWS-COM", which is 'suction type', with a pump embedded in the unit, between its two stages, sucking the water from the bilge holding tank into the coalescer. The suction strength is up to 5m vertical height of water. This unit has been available for 8 years.

RWO also provides a unit "OWS-COM+", a version with an integrated control panel, which is designed for unmanned operation of up to 42 days. This opens the market for the future of shipping including autonomous ships. On conventional vessels is gives owners more peace of mind that the system is operating correctly, in order to avoid fines during Port State Control inspections.

RWO (www.rwo.de) says it has sold 16,000 oily water separators for ships altogether, including selling to 'most' Chinese yards.

RWO is headquartered in Bremen, Germany. The company provides a range of water management systems for shipping, including for bilge water, sewage, fresh and process water, and ballast water. RWO stands for the founders' family names, Riewer, Werle and Otto.

It was acquired by the Erma First group of companies in 2021. Other companies in Erma's portfolio include cybersecurity company Metis, and ballast water provider oneTANK.

TO

Next generation of AIS with more data capacity

Automatic Identification System (AIS) transponders have been required carriage on ships since 2000. Is it time for an updated system, which allows much more data to be exchanged?

Automatic Identification Systems (AIS) – radio transponders on ships – have been required carriage on ships since 2000. They enable seafarers to see where other ships are on their electronic charts, including their speeds and destinations. The data is also shown on vessel tracking websites.

Today, no seafarer would want to be without it, says Stefan Karlsson, sales manager with Saab TransponderTech of Sweden, one of the world's leading AIS equipment manufacturers since the system was first introduced.

The current system has limits. There are no safeguards if a vessel is broadcasting incorrect AIS data, either maliciously, to hide what the vessel is doing, or because its GPS signal is being spoofed. Cybersecurity was not a concern when the initial AIS was designed.

Current AIS has capacity limits. This is due to the way the AIS communication system is designed, with time chopped up into slots for different transponders to communicate at the same radio frequency. In waters with many vessels, there are not enough time slots for each vessel to communicate data regularly – so updates are sent less often, or the coverage area shrinks so you just see data for the closest vessels.

And the amount of data which is broadcast is limited. Currently it is just the ship's number, name, type, dimensions (static data) and its destination, current position, speed and navigation status (dynamic data).

If more data capacity was available, we could include tools to double check the GPS position; there would be no limit to the number of ships.

Ships could exchange data describing their planned route, not just their current position and destination. If this was imported into navigation systems and displayed on screens of other vessels, it would avoid misunderstandings about what another vessel's intention was. These can be common when routes are described by voice communication over radio, as it is now.

The system could be used to broadcast useful information such as about location of sea ice, chart updates and DGPS corrections; it could be used to co-ordinate a rescue with messages all vessels involved could see; it could be used for private company specific data, such as messages and sensor data.

VDES

So far, an international standard has been agreed for a second generation of AIS, carrying 32 times as much data.

It is called 'VDES' (VHF Data Exchange System), alternatively known as AIS 2.0.

Estonia will be the first country in the world with a nationwide VDES installation, with a system of base stations being delivered in 2022.

14 radio channels have been assigned to the VDES by the International Telecommunications Union (ITU), compared to 2 channels assigned to AIS. The maximum bandwidth is 302 kbps. There may be more channels offered at the next ITU World Radio Conference in 2027.

The radio communications uses what is known as "software defined radio", where components that have been traditionally implemented in analogue hardware are instead implemented by means of software on a personal computer or embedded system. This includes mixers, filters, amplifiers, modulators / demodulators and detectors.

Saab is establishing a trade association to develop and promote VDES, called the VDES Alliance (www.vdes-alliance.org) . Membership as a contributor is Eur 1,500 / year, and membership as an observer is Eur 750 a year. The difference is that 'contributors' get voting rights, can participate in certain workshops, and access confidential documents.

Saab sees the alliance as like the industry alliances which developed Wi-Fi, Bluetooth, 4G and 5G.

VDES supports what is known as "Application Specific Messaging". Shipping companies can use this to send their own data from ship to shore free of charge if it was in small data packets, for example sensor data from devices on the ship. There could be a paid service providing additional bandwidth.

The system could be used for 'Virtual Arrival' systems. This is where a port or charterer communicates to a vessel when the berth or terminal will be available for cargo discharge, so the vessel can aim to arrive at the right moment, rather than continue the voyage at normal speed and then wait for a few days outside the berth. This means there is the possibility of reducing speed and so fuel consumption in getting there.

There can be tools to verify GPS data sent by ships, so you can be sure the GPS system has not been hacked (or 'spoofed').

It would all add up to a "unified maritime communications platform," says Magnus Nyberg, Director of Sales with Saab TransponderTech.

Satellite

AIS data can already be carried by satellite. It would be useful if AIS 2.0 data could also be carried by satellite, although it would need more satellite communications capacity because there is more data to carry. So, plans are being explored to develop a 'nano satellite' constellation for VDES.

Saab has a plan to do a proof of concept with satellite operator Orbcomm to develop how VDES data can be communicated on a 'nano' (very small) Low Earth Orbiting satellite, planned to be in orbit in the beginning or middle of 2023.

The satellite orbits the earth in 90 minutes and provides radio communication coverage to the entire earth's surface every 24 hours through going around the earth 16 times with a different circle each time.

A ship could not wait 24 hours before broadcasting its data, but if there were many more satellites, the waiting time would be much reduced. Saab estimates that around 100 satellites would be needed for low latency communication.

There would be a cost to launching these satellites. Saab envisages that shipping companies sending higher volumes of VDES data by satellite might agree to pay more, covering the cost of the satellite launch.

Saab Equipment

Saab has developed VDES products for shipboard and shore use. For shipboard use, it offers the "R6 Supreme" AIS/VDES system with a user interface like a smartphone.

For use, it offers a VDES compliant base station with AIS and ASM functionality, It is designed as a successor to its R40 AIS base station.

It can receive and transmit data with AIS / VDES equipped vessels within its coverage area.

TO

Lubmarine - a new lube approach for today's engines

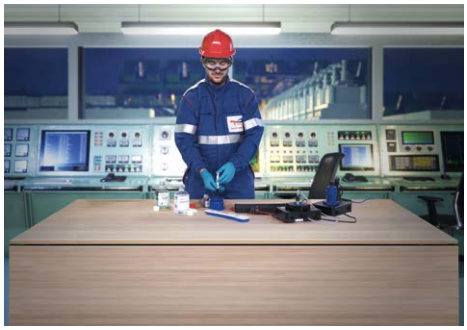
Today's high performance engines and low sulphur fuels need a different approach to lubricants, with more advanced formulations and onboard testing practises. This is how Lubmarine, a division of TotalEnergies Lubricants, approaches it

Today's new marine engines need better and better lubricants and better ways to monitor the condition of lubricants involved.

For example, maritime engine manufacturer MAN ES has created a new classification for lubricants which can work well with its latest engine designs, called "Category II lubricant".

To be designated a Category II lubricant, it needs to have improved deposit control performance.

The most critical areas for deposit control are around the piston and ring pack, the area at the top of the engine cylinder where combustion occurs. If the piston is dirty, especially in the ring pack area, there can be damage.



Testing lubes onboard

The challenges can be exacerbated by use of low sulphur fuel blends, since these fuels are often inconsistent in quality, says Serge Dal Farra, marketing manager of Lubmarine.

New lube oil

To meet the demands, Lubmarine has developed a new lubricating oil Talusia HD 40. It has a base number of 40 (a measure of its alkalinity). Talusia HD 40 delivers "required wear protection and acid neutralization plus superior piston and ring pack cleanliness equivalent to 100BN," [100 base number lubricants], the company says.

A lubricant contains alkali to neutralise acids which can be formed from sulphur in the oil. The more sulphur, the higher base number you need in the lubricant.

Talusia HD 40 is approved by MAN ES as a category II lubricant. Engine designer WinGD has also validated Talusia Universal for use on its dual fuel engines.

Lube oil testing

Lube oils can be tested to find out what condition they are in, if their properties are still within the safety limits or need replacing.

Lubmarine is making it easier for seafarers to analyse lubricants onboard for iron content, BN, viscosity and water content. Its shipboard equipment is called "LubInsight neo".

To test the oils, a crew member goes to a lube sampling point on the vessel and lets a sample flow into a flask. There is a tag and scanner system to ensure that the sample is correctly tied to its data.

There is a rugged handheld device which Lubmarine calls the "Portable Digital Assistant" for entering data about the samples. The system's software has step by step instructions, so no specific training is needed.

LubInsight neo includes an onboard portable lubricant analysis laboratory, to measure and monitor. A device gently stirs the oil sample mixed with reagent, and shows the result of the test on a screen, allowing crew to take action if needed.

If the device is connected to a shore network, then the data can be seen by remote experts who can provide additional support.

All of the equipment is designed to sit within a box, so it can be easily folded up and put away.

Lubmarine also offers "XRF neo", an onboard X-ray device for analysing drain oil samples by fluorescence. This is a way of measuring iron content, Base Number (BN), as well as fuel sulphur content additives in a sample.

There is a markup to get XRF technology which is justified by improved engine performance as a result, the company believes.

If the lube samples need to be sent to a laboratory, Lubmarine offers its "LubDiag" service for laboratory oil analysis.

Serge Dal Farra, marketing manager of Lubmarine.

Lubmarine also offers the "LubPortal" to access data online. It includes "MyLubmarine Monitor" where you can see results from your onboard testing or laboratory reports.

A further service is "LubSkills", for training, and working with Lubmarine experts for assistance and investigation. Dedicated Marine Lubrication Engineers can visit the vessel and deal with specific problems, or review your working practises.

70 years

2022 marks the 70th anniversary of Lubmarine. The company was founded in 1952, providing 300 tonnes a year of lubricants to 40 steam cargo ships in France, which had been used in the Second World War.

The company leaders wanted to develop cylinder lubrication oils for diesel engines using heavy fuel, which was not widely available at the time, and also provide an international distribution network.

The company was acquired by oil company Elf in 1980, which was itself acquired by oil major Total (now called TotalEnergies) in 2000. Today its products are used on over 8,000 vessels.

TO

Shooting out a towing line by rocket

A concept for a towing line which can be automatically 'shot out' from a ship by rocket, so a stricken vessel can be connected to a tug, even if there are no people onboard or on deck

Imagine a vessel in distress, the crew have evacuated, salvage tugs are on scene and they need to attach a tow line to the vessel to avoid the risk of vessel loss or pollution.

Despite all the new technology, currently there is no means of attaching a tow line if there are no crew onboard.

Even with crew onboard, it can be very difficult and dangerous in adverse conditions due to the conditions, physical weight of the equipment and huge forces involved.

The Remotely Activated Towing Solution from RATS Marine aims to solve this problem.

It has a rocket launched towing line, which can be activated remotely without any crew needed on deck.

On deployment, a two meter gas propelled rocket and floating heaving line is propelled 200+m from the stricken vessel, landing in the sea.

The rocket has a high intensity strobe that is visible from two miles for easy identification and location.

The salvage vessel safely retrieves the floating heaving line at a safe distance with a grapple hook. Once the heaving line is recovered, the salvage vessel can withdraw the 200+m messenger line from the speed-controlled reel installed on the stricken vessel, followed by 100+m of towing cable which finally engages in the dedicated towing strong point.

The tow cable can then be connected to the salvage vessels main towing cable and paid out to begin the tow.

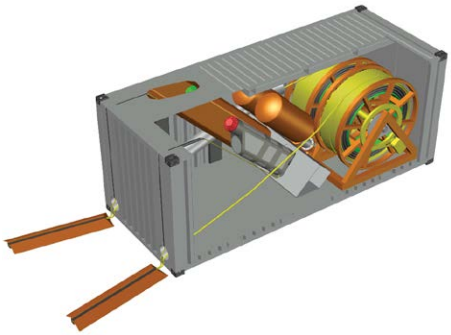
So it allows a tow line to be established quickly and safely without any persons being on the stranded vessel.

One or more tow lines can be established from port / starboard / bow / stern to a salvage tug at a safe distance within minutes, even in extreme conditions.

This reduces risks to crews and salvage operators, whilst increasing the overall certainty of a successful salvage operation.

The system can be configured in an ISO 20-foot modular deck mounting, enabling faster integration to fleets.

The system can be activated remotely, whether from the bridge of a stricken vessel, a panel close to the equipment or from another vessel, with appropriate encrypted security.



The Remotely Activated Towing Solution stowed in a box container on deck

One example of an oil tanker that ran aground and broke up when attempts to establish a tow line were unsuccessful was the MV Braer off Shetland, Scotland in 1993 during a cyclone causing massive pollution after the vessel lost power.

The company is now looking for interested parties and partners in the marine industry to take this project forward.

Further information is at **www.ratsmarine.co.uk**

TO

Tanker waste heat recovery system

Donsötank has installed a system on two new product tankers which generates electrical power from waste heat

Donsötank of Sweden has installed waste heat recovery systems on two new 22,000 dwt product tankers.

The system is supplied by Orcan Energy AG of Munich, Germany. Orcan specialises in devices which convert waste heat into electricity, and sells its products to a range of industries, not just marine. It has sold over 500 plants around the world. It aims to offer customers a "simple, economical and efficient energy solution".

The same systems are used in geothermal power plants – one client is a geothermal project in Kirchweidach, Bavaria, Germany.

Its devices are called "efficiency PACK". The system is suitable for all marine engines. The system is particularly suited to large seagoing vessels, the company says.

Heat sources which can be used include exhaust gas up to 550 degrees C, saturated steam at 120 to 180 degrees C, thermal oil (for transferring heat around the ship) at 120 to 180 degrees C, and warm water, such as from jacket cooling, at 75 to 109 degrees C.

Sometimes using low sulphur fuel leads to a surplus of steam, Orcan says – the technology can now use this to generate power.

A new version of the system was launched in April 2022, called efficiency PACK M 150.200. It has 2.1MW heat absorption capacity, twice as much as the previous version 50.100. This will generate up to 200 kW of power, although the power generated will depend on the temperature of the waste heat. The unit has dimensions of 2.2m x 1.6m x 2.1m. It is also possible to have several modules in a stack.

By using waste heat to generate power, the fuel consumption by the generators can be reduced, and so a ship can reduce its carbon emissions.

Alfa Laval has made a licensee agreement to market the system, which it will sell under the name "E-PowerPack".

The efficiency PACKs operate independently and automatically with little maintenance required.

TO

A new design for supporting the propeller shaft

The standard way to support a propeller shaft is with a 'stern tube' running between the engine and the sea, with oil lubricated bearings inside. It can leak 6 litres of lubricating oil per day into the sea

By Dr Chris Leontopoulos, Director Global Ship Systems Center, ABS

lubricated stern tube bearings. There can be oil leakage through the aft stern tube seal.

The action of the ocean, bad weather and vessel behaviour mean stern tube aftmost seals have an inherent propensity to leakage. By some estimates, ships with oil lubricated bearings can lose six litres of oil a day.

The introduction of biodegradable lubricants in stern tube bearings has not eliminated the oil pollution problem. Such leakages are still regarded as a regulatory violation.

This issue, once considered as part of the normal operational consumption of oil, has become a greater concern and is now considered to be pollution, with associated legal consequences.

A new approach is needed to the stern area design to permit easier maintenance, reduce pollution and increase vessel efficiency.

In response, ABS, the Shanghai Merchant Ship Design And Research Institute (SDARI), Thordon Bearings and the National Technical University of Athens have collaborated to bring new thinking and new materials to the topic.

Recent innovations in materials science have enabled water lubricated bearing manufacturers to create solutions combining wear-resistant materials with improved designs and software. This can optimise shaft alignment and prolong the operation life of the shaft bearings.

This enables ship designers to re-think the stern area layout, potentially eliminating the stern tube casting itself and instead using purified seawater for bearing lubrication.

The installation of aft bearings using water as lubricant is not new; many naval and commercial vessels have already successfully installed water lubricated bearings using seawater as the lubricant.

The new design

The proposed design proposal is novel in that it involves removing the stern tube casting itself altogether, substantially decreasing the shaft line length. Also adding a torsional vibration damper to eliminate the Barred Speed Range (the shaft speed range where torsional vibration is the greatest). Most importantly, the creation of an irregularly shaped chamber behind the bulkhead of the engine room.

This chamber provides several benefits for inspection of the shaft line and bearings throughout the operational life of the vessel.

The traditional arrangement of a vessel's power train means that the existing sterntube bearing area is all but completely inaccessible in case of failure or need for maintenance.

The consortium's approach enables engineering staff to access the tailshaft area through the irregularly shaped chamber from within the engine room from the aft bulkhead, inspecting the shaft, the aftmost bearing and stern seal as well as observing the structural condition of local steel plate and stiffening members.

Ultimately, it will be possible to replace a worn-out water lubricated bearing from inside the vessel for the first time. It can be done using lockable keys to release the upper and lower cylindrical bearing parts that slide along the shaft. This enables bearing replacement from inside the vessel, without a visit to dry dock, shaftline disassembly or propeller removal.

By some estimates the off-hire time required would shrink from two weeks in dry dock to one day of repairs while afloat.

The installation of a torsional damper could, as an add-on benefit, eliminate the undesirable Barred Speed Range, present in the vast majority of direct-drive diesel engine vessels.

Testing the design

The project partners built 3D models to test the impact of the changes on the ship structure as well as on vibration and shaft alignment.

Testing in extreme scenarios demonstrated that shear and reaction forces on the shaft line would still be within the manufacturer's and classification approval limits.

A sensitivity analysis, considering maximum wear-down on the aftmost bearing, found no issues. It found that condition monitoring requirements were similar to using a traditional oil-lubricated shaft bearing, with tail shaft survey maintained at the maximum 15-year interval if the ABS TCM-W Notation is adopted.

This novel design proposal complies with all classification society rules and regulations, such as those governing torsio-axial vibration, shaft alignment and structural integrity including basic SOLAS requirements.

To create the model, the consortium revisited an existing container vessel design from SDARI and made a number of design interventions.

In June 2022, ABS awarded Approval in Principle to SDARI for the novel design.

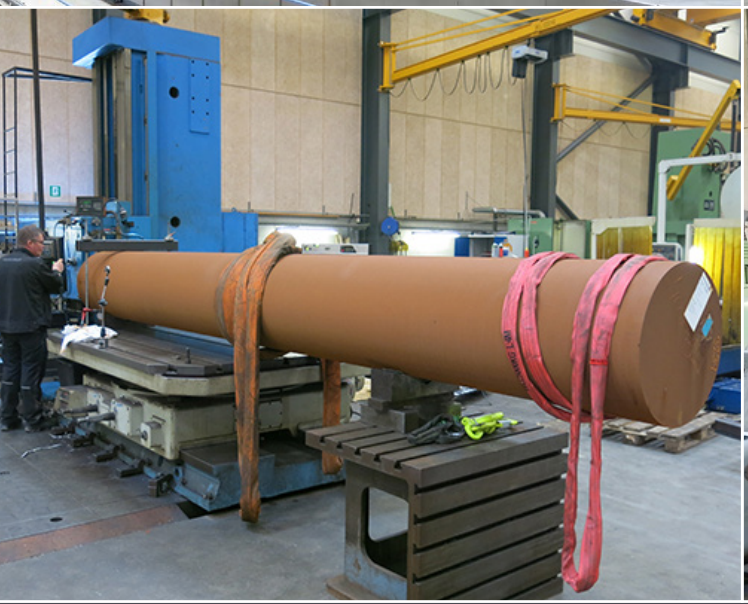
To best illustrate this proposed design concept using the latest technology facilities, a full-sized 3D CAD file has been generated to provide a virtual reality-based guided tour through the shortened engine room space and most importantly inside the newly invented irregularly shaped chamber.

The ABS TCM-W Notation can be applied, giving the same benefits as the traditional oil lubricated bearings arrangements.

The granting of the notation and associated design and engineering work means that vessel operators now have the option to consider this new approach to stern design.

TO

IN URGENT NEED OF A REPAIR / REPLACEMENT?



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