September 2021

MARITIME REPORTER AND ENGINEERING NEWS

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MARINE DESIGN

ABS' Wiernicki says radical tech advances such as Multi-Physics Simulation needed to hit 2050 Emission Reduction Targets

PORTS & SHIPPING

Pandemic-induced supply chain logjams are not going away soon

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Shipping & Ports
Back-ups persist across the supply chain.
Photo Source: Port of Los Angeles

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Chris Wiernicki, CEO, ABS
Cover Photo Credit: ABS

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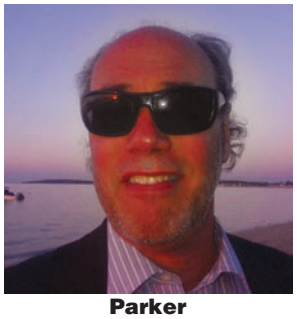

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MARITIME REPORTER AND ENGINEERING NEWS

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ISSN-0025-3448
USPS-016-750
No. 9 Vol. 83

Maritime Reporter/Engineering News (ISSN # 0025-3448) is published monthly except for March, July, and October by Maritime Activity Reports, Inc., 118 East 25th St., New York, NY 10010-1062. Periodicals Postage Paid at New York, NY and additional mailing offices.

POSTMASTER:

Send all UAA to CFS. NON-POSTAL AND MILITARY FACILITIES send address corrections to Maritime Reporter, 850 Montauk Hwy., #867, Bayport, NY 11705.

SUBSCRIPTION INFORMATION

In U.S.:
One full year (9 printed issues) $90.00;
Two years (18 printed issues) $150.00

Rest of the World:
One full year (9 printed issues) $140.00;
two years $180.00 (18 printed issues) including postage and handling.

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The 'Marine Design' edition of 2021 is more than a fair bit different from the ones I produced for this title starting in 1993, and sometimes I find it difficult to put the level of difference in proper perspective.

But all I really need to do is to dip back into the archives and see the MV R.J. Pfeiffer gracing the cover of our September 1993 edition, a "big" 713-ft. long, 1,910-TEU capacity containership built by NASSCO for Matson Navigation, and the juxtaposition between maritime in 1993 and 2021 is hauntingly clear.

For this edition I had the unique opportunity to interview the leaders of three major classification societies in a span of two weeks, including **Chris Wiernicki**, CEO, ABS, featured on the cover. Each provides insightful views on where we are, and just as importantly where we're heading, and to a man all see the emission-reduction targets leading up to 2050 – targets which undoubtedly will grow more strict through the years – as *the driver* for ship design, construction and operation for the coming three decades and beyond.

Wiernicki said "I believe we're going to see more innovation in the next 10 years than we saw it in the last century," contending that the maritime industry needs "radical advances" in technology to cope with the demands of decarbonization. One such radical advance is Multi-Physics Simulation (MPS) and its potential to help unlock the next generation of vessels and technologies. Read this story, plus our interviews with **Hiroaki Sakashita**, CEO, ClassNK; and **Knut Ørbeck-Nilssen**, CEO, DNV Maritime, starting on page 26.

The feature ship this month is Global Mercy, the world's largest civilian hospital ship and the first newbuild ship ever the Mercy Ships fleet. Jim Paterson, Mercy Ships' Marine Executive Consultant, is a maritime professional through and through, sailing first commercially on his Chief Engineer's Certificate before switching gears and joining the Mercy Ships team more than 30 years ago. The story on the quest to build Global Mercy starts on page 18, a story which explores some of the unique attributes of its mission with insights on how they impact ship design. But if you want the complete story, take 20 minutes and watch my interview with Paterson on ***Maritime Reporter TV*** [**bit.ly/2WW8hMz**], as his words provide a depth and breadth of scope – plus a passion for the mission – that is difficult to deliver on page.

Finally, Barry Parker takes a deep dive into the container shipping and logistics mess that has come about due to COVID in our Shipping and Ports annual starting on page 44. With manufacturing, container rates and port congestion all soaring, it difficult to see how and when it might end. But trust, it will!

Gregory R. Trauthwein
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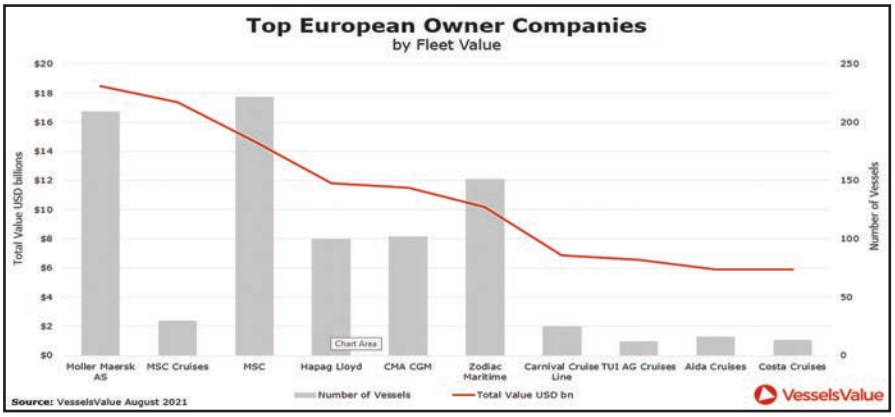
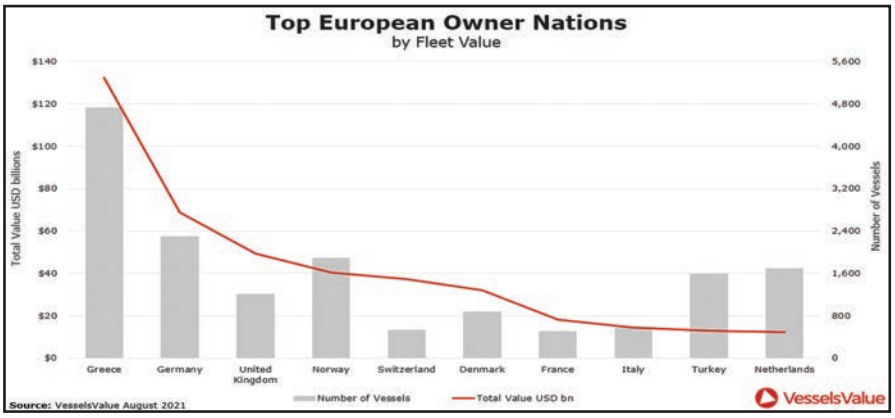
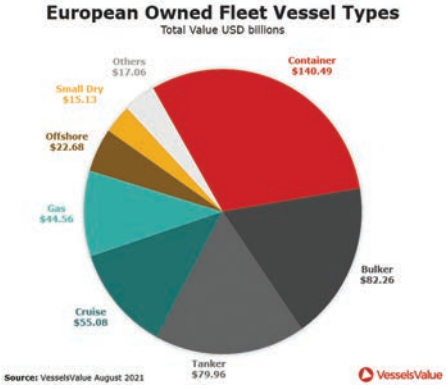
Powered by VesselsValue

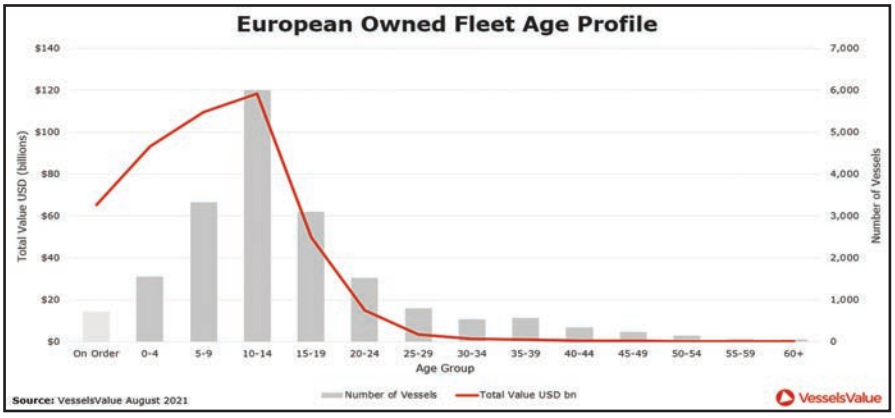
Europe to the fore

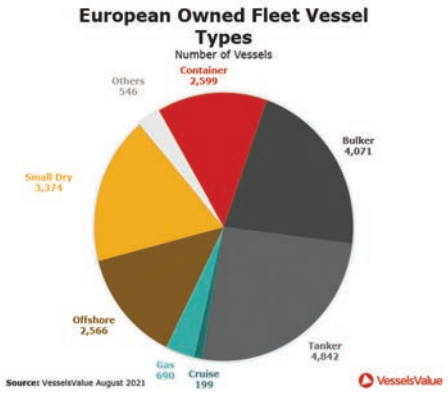
As European shipowners have led – in terms of vessel design, environmental outfit and operations – oftentimes the world has followed. Courtesy of our friends at VesselsValue, we provide here a snapshot on the trends in owning and operating ships from owners in and around Europe.

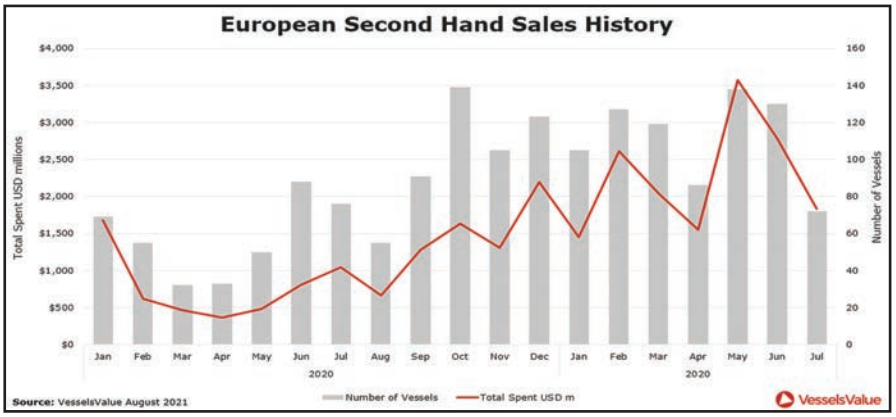












Quotable

"When it comes to alternative fuels, I'm a big fan of the French philosopher, Voltaire: **'Let's not make perfect the enemy of good.'** *Maybe, we don't have the perfect solution, but it's certainly important to start moving in the right direction."*

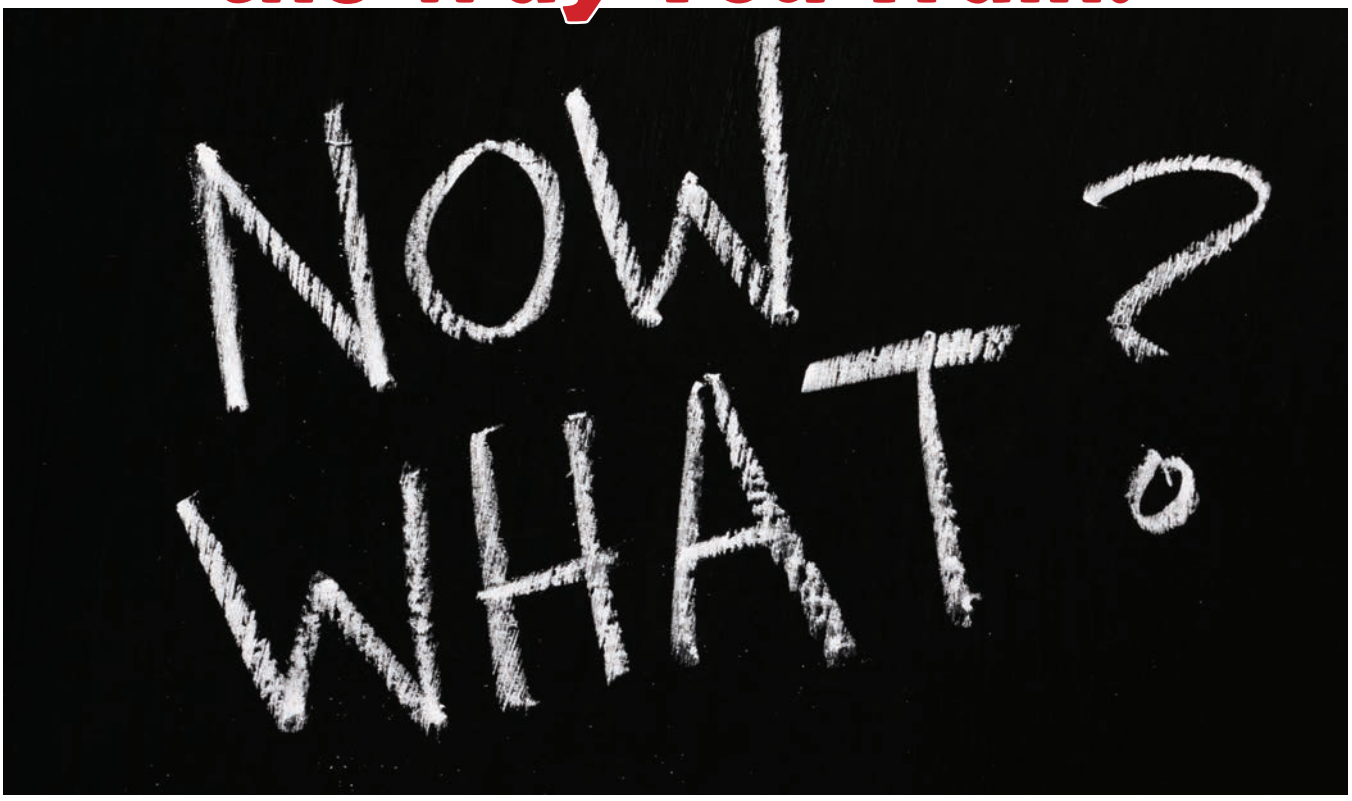
Knut Ørbeck-Nilssen, *CEO, DNV Maritime*

"Data is always important and there are still many further efficiencies to be gained in coming up with even better digital twins of the still too paper intensive worldwide container system. **That said, that system is moving 1.2 trillion TEU-miles of freight annually and that requires hard assets. The actual heavy lifting can't be done on the internet."**

John McCown, *Shipping Executive, Author of "Giants of the Sea"*

Tip #28

The Pandemic Has Changed the Way You Train.



The endless debate pitting face-to-face learning against online learning rages on and will likely do so for some time. As we entered the pandemic there was a huge and hasty shift in maritime training practices (and in the world as a whole) to online learning. This was both positive and negative. It was positive because we can all be thankful that there was a safe and available alternative to face-to-face training. It was also positive because it accelerated the implementation of digital learning to a point that would have taken years otherwise. On the negative side, the emergency nature of the training implementation did not allow for the optimal amount of consideration and planning. Thus, many implementations produced poorer outcomes and experiences than would have been available given adequate time for design and implementation. Regardless of the quality, many organizations are now in the position of having some freshly implemented eLearning programs. Now what?

Now is the time for improvement. This may always be true, but it is especially true now. There are many ways to go about this, but I'll suggest two in this article; one reasonably obvious and the other one less so.

First, it is important to understand how well our implementation is working, and more specifically, which parts are not working well. It is only with this data that we can formulate a plan for improvement. In the fullness of time this can be answered in many ways including by assessing the performance of those trained. But for now, the best initial success measure we can derive is feedback from the crew members being trained, and from the supervisors of those crew members. Many of these people will have experienced in-person training pre-pandemic and will be able to contrast their online experiences and perceived outcomes between the in-person and on-line modes. Surveys are simple and useful tools to employ here. Ask direct questions about their satisfaction and view of learning effectiveness. Specific questions about how well each training module has prepared them for their role can be quite revelatory.

Where problems are identified, consider convening a balanced focus group to hear experiences and suggestions first-hand. Not only will this yield additional, actionable data, but it will also demonstrate your organization's commitment to training improvement and excellence.

Second, as the pandemic eases and in-person training returns as an option, consider using the on-line training you've developed to create a blended learning experience. Blended learning in this context refers to combining on-line training with in-person training.

There is a vast body of evidence to show that while in-person training and on-line learning produce roughly equal outcomes, blended training produces outcomes that are superior to either of those. The hardest part of creating a blended learning experience is developing the on-line learning materials - which the pandemic has already forced us to do. Therefore, many organizations are now in an outstanding position to move to blended learning. How can this be done?

There are many ways to blend on-line and face-to-face training, but one of the most effective is called the "flipped classroom". In this model, learners will first go on-line to work through a portion of the learning materials for a course. Then, they will meet in class with an instructor to discuss the materials, ask questions, consider examples, and generally ensure that the material is internalized and well understood.

These in-person meetings are highly effective because the learners come pre-equipped with an initial understanding of the material, and the instructor can be used as an expert resource to clarify details and solidify the knowledge. This also frees the instructor from having to lecture to the learners and instead uses them to their highest advantage as experts.

There is more to discuss on the topic of blended learning, and I will undertake to do so in an upcoming Training Tips for Ships.

Until then, keep well and sail safely!

The Author

Goldberg

Murray Goldberg is CEO of Marine Learning Systems which provides software and services to optimize knowledge, skills and behavior in maritime operators. Murray@MarineLS.com

Ferries V2.0
Post COVID Opportunities

By Rik van Hemmen

Since the 1980's there has been a remarkable revival of ferry services in many U.S. waterfront cities, but COVID has wreaked havoc on the most profitable component of these services; the commuter runs. With post COVID work-at-home arrangements and part-week in-office work these ferry services have suffered a tremendous loss of income. But there are glimmers of hope that a recovery is likely, although in a different form, in a different world.

Commuter runs are often the bread and butter of a ferry services, but only in the rarest cases can a profitable ferry service be created that only runs during commuter hours. The creation of such services often resulted in a strange design conundrum. Commuters might be attracted to a cleaner, or quicker or more enjoyable commuter experience, but would often be hesitant to commit to a ferry commute if the ferry only ran during commuter hours. Many commuters have irregular hours, and, if the ferry only runs during peak hours, a commuter may not want to deal with the uncertainty of getting stuck in the city if they could not make it to the ferry by the last afternoon run.

Emerging ferry services often found that they could only capture commuters with rigid working hours and then hit a growth limit. This limit could be broken if the ferry services increased off hour runs, but since these runs would never run at full capacity, they operated at a loss, which then required an additional large investment, beyond the initial commuter service investment.

However, if the ferry service had sufficient financial legs, it could experience a second growth spurt where commuters with irregular hours will start to use the service. In addition, over time, city shoppers will start to take mid-day runs, and then business people will take the ferry for lunch or other meetings and then, on nice days, tourists and sightseers will simply take a ferry ride for the fun of it. Then the ferry company can make an additional investment into smaller day time ferries and larger rush hour ferries (hi-lo mix optimization) and start to make serious money. This is a very complex issue with subtle variations depending on the ferry service's location.

The consequence is that a ferry service take years to establish and therefore it may take years for it to turn a profit. The flip side to that issue is that once firmly established, and properly fine-tuned, ferry services can be quite profitable,

So here came COVID, and in many service areas the ferries tied up due to total loss of ridership. But with odd exceptions. One ferry service managed to make a little money by securing a contract to carry healthcare workers to suitable transit points during the worst of the pandemic. And when ferries were allowed to run at reduced capacity, another ferry operator decided to take their larger ferries and run them at much reduced capacity for whale watching cruises, which could still turn a profit at reduced capacity (and at the same time provided a very nice customer experience with lots of space on a big, fast stable boat that was much better than whale watching on a crowded, slower and rockier smaller boat). Other ferry services started to organize reduced capacity excursions for customers desperate to get out of the house.

Then post peak COVID, ferry companies attempted to revive their commuter services, mostly at government mandated reduced capacity (and much reduced profit potential). Especially in summer, ferries were an attractive commuter option since they provided more personal distancing space, and fresh air on open decks compared to buses or trains.

However, this started the ferry conundrum all over again and this time in an even more confusing form since rigid 9-to-5 style commuters that could afford ferry commuting now had become much rarer. Many of those who were rigid 9-to-5 commuters now stopped commuting entirely, or only commuted a few days per week. At reduced capacity it may be possible to fill a rush hour ferry but what about the full day service runs, which were needed to provide a viable and profitable ferry service?

Right now most ferry operators are functioning in this strange trial and error grey zone. The most frustrating part of this trial and error grey zone is that one cannot one day decide to start full day service and expect to know in one week, one month, and possibly even one year whether a full day service run is viable or not. This is due to the massive customer acceptance lag time in ferries. Ferry customers do not show up overnight; they need to be carefully cultivated and this takes a lot of time

This lag time is further affected by the uncertainties that customers themselves face. Many pre-COVID commuters simply do not know what their commute will look like. They may be facing very unpredictable personal choices and what were once vibrant commuter communities may no longer be

commuter communities, or may actually become more heavily populated by part time commuters or off hour commuters.

However, while it is a complex issue for ferry operators, when considered at a larger transportation system level, it is nowhere near the devastation that bus and train operators are facing.

When compared to trains and buses, ferry operators have a number of advantages that may actually result in further use of ferries as compared to trains and buses and also personal transportation.

Consider the customer. The commuter customer used to choose its best option between bus, train, or ferry. As long as they all provide all day service, the choice came down to time, quality and cost.

The time variable has not changed much, but the quality factor has, since ferries are inherently more outdoor oriented than trains and buses and also tend to be less crowded. As such, a commuter may now be more likely to chose a ferry over a bus or train for COVID risk reduction reasons.

With regard to cost there is little difference pre- or post-COVID for a five-day commuter, but for a part time commuter, the reduced overall cost of the two or three day per week may very well compel her to opt for the ferry instead of the bus or the train. In other words, in part time commutes ferries may very well end up gaining, while the big losers will be buses and trains.

At this stage it is difficult what the long term post COVID trends will be. An extreme result may be the total disappearance of traditional commuting. Potentially businesses may choose to shut down their center city operations and commuters as we know them may completely disappear.

Strangely, even then, ferries may still be the winners. Ex-commuters may migrate to relatively isolated places without existing public transportation infrastructure or may choose to live in places where public transportation infrastructure can be added at low cost. And the lowest initial investment public transportation infrastructure is ... ferries.

Time for Ferries V2.0. May the smartest operators win.

For each column I write, MREN has agreed to make a small donation to an organization of my choice. For this column I nominate the Worldwide Ferry Safety Association, https://www.ferrysafety.org/ and in particular its student design competition, which has provided students with challenging design assignments for eight years now https://www.ferrysafetydesigncompetition.org/

Igor Kardasov/AdobeStock

Long-Term Consequences of Covid-19's Crew Change Crisis

By Captain Andrew Kinsey, Senior Marine Risk Consultant, Allianz Global Corporate & Specialty

MARITIME REPORTER TV **Watch the interview with Captain Andrew Kinsey @ https://youtu.be/a84xb-L6sx0**

The international shipping industry continued its long-term positive safety trend over the past year. The number of large vessels lost remained at record low levels in 2020, while reported incidents declined year-on-year, according to Allianz Global Corporate & Specialty SE's (AGCS) Safety & Shipping Review 2021.

The AGCS report notes that the shipping sector has shown great resilience through the coronavirus pandemic, as evidenced by strong trade volumes and the recovery seen in several parts of the industry today. However, the crew change crisis brought on by the pandemic continues to have a major impact on the health and wellbeing of seafarers, with potentially long-term implications for safety.

Covid-19-related travel and border restrictions, and the widespread suspension of international flights, have significantly impacted the ability of ship operators to conduct crew changes. Between March and August 2020 only 25% of normal crew changes were able to take place (ICS) while at least half a million seafarers have been affected.

As of March 2021, it is estimated that some 200,000 seafarers remained on board commercial vessels, unable to be repatriated and past the expiry of their contracts, with a similar number of seafarers urgently needed to join ships to replace them. On any given day, nearly one million seafarers are working on some 60,000 large cargo vessels worldwide, according to the IMO.

The crisis raises serious welfare, safety and regulatory concerns. In addition to humanitarian and crew welfare issues, there is an increasing risk that crew fatigue could lead to human error and even serious accidents.

"Timely crew changes are vital to the safe operation of shipping, and seafarers spending extended periods on board are more at risk of mental health issues, exhaustion, fatigue, anxiety and mental stress," says Captain Nitin Chopra, Senior Marine Risk Consultant at AGCS. "There needs to be a global collaborative effort to get crews off ships. But the industry also may need to take measures to give crew some respite, such as adjustments to working hours. If crews are fatigued a vessel could potentially be considered unseaworthy under international maritime law."

Crew changes are also a compliance risk. According to the International Labour Organization (ILO) Maritime Labour Convention (MLC) crew should serve no more than 11 months continuously at sea and are entitled to access onshore medical facilities and care. According to the IMO, Covid-19 has caused many seafarers to serve significantly longer than the 11 months agreed by the ILO. If ships are unable to operate safely in compliance with international rules, vessels may have to suspend their operations.

The ongoing crew crisis is likely to have long- term consequences for the shipping industry. With hundreds of thousands of crew members stuck on board vessels or on extended contracts, I have serious concerns for the next generation of seafarers. The situation with Covid-19 means that we are not training and developing them, while the sector may struggle to attract new blood due to current working conditions.

Shipping is likely to experience a surge in demand as the economy and international trade rebounds with vaccinations. However, many crews are fatigued and have been under immense strain from Covid-19 for over a year. Potentially, we could see a shortage of seamen if the industry struggles to retain or recruit.

The crew crisis took on a new dimension in 2021. As Covid-19 infection rates escalated in India, one of the world's largest sources of seafarers, ports – including Singapore, Hong Kong and the U.K. – barred vessels and crew that had recently visited India. Vessels also stopped calling at Indian ports, which are an important stopover for trade between Europe, Africa and Asia.

In a bid to resolve the current crisis, the IMO established a Seafarer Crisis Action Team and, working with the International Chamber of Shipping (ICS), developed a 'Framework of Protocols' for safely conducting crew changes. The IMO and other organizations have repeatedly urged governments to designate seafarers and port personnel as "key workers", exempt them from national travel or movement restrictions, facilitate emergency repatriation and prioritize vaccinations. Mirroring these calls, more than 450 shipping companies and allied organizations signed the Neptune Declaration on Seafarer Wellbeing and Crew Change.

Crewing issues came under the spotlight in the wake of the Wakashio incident in July 2020 when the vessel ran aground off the coast of Mauritius, spilling hundreds of tons of oil in the process. Reports indicated at least two of the crew had been on board the vessel for more than 12 months, unable to disembark when their contracts expired because of restrictive quarantine rules worldwide.

A global vaccination program is likely to be the answer to the crew change crisis, although the situation is complicated by the international nature of shipping. In March 2021, the ICS warned that lack of access to vaccinations for seafarers is placing shipping in a "legal minefield", and could cause disruption to supply chains from cancelled sailings and port delays.

Vaccinations could soon become a compulsory requirement for work at sea because of reports that some states are insisting all crew be vaccinated as a pre-condition of entering their ports. However, over half the global maritime workforce is currently sourced from developing nations, which could take many years to vaccinate. In addition, the vaccination of seafarers by shipping companies could also raise liability and insurance issues, including around mandatory vaccination and privacy issues.

Performance Intelligence: The Key to Decarbonizing Maritime

By Herve Lours, Vice President, Marine, AVEVA

Over the last year, climate change – or more appropriately climate action – has emerged as the critical issue impacting the future of global industries. Companies are under pressure to outline plans to transition to a more sustainable way of doing business – and the shipping and maritime communities are no exception. Transportation emissions – which typically include road, rail, air and marine – are responsible for an estimated 24% of the world's carbon emissions. Transport-related pollution is expected to grow at a faster rate than any other sector, putting climate targets into question. While marine accounts for only a small share of those contributions – about 3% – projections suggest it could increase to 17% by 2050. Shipping has a colossal role to play in corporate supply chains and enabling companies to meet their own net zero targets.

Sustainability is not new to shipping. In fact, The International Maritime Organization (IMO) has indicated its full support for implementing the United Nations Sustainable Development Goals and created an initial emissions strategy in 2018 aimed at reducing emissions from shipping by 50 percent compared to 2008 levels by 2050.

Companies, including AVEVA, have already started aligning efforts and shifting operations to support net zero targets. From 2019 to 2020, the number of companies and governments setting net zero targets doubled and alliances like the UN's Race to Zero campaign – the largest ever initiative of its kind – are further spurring action.

Commitments and partnership, while an important factor in moving the needle, are only part of the equation. The hard work comes with shifting decades-long operations and processes. A challenge, to say the least, but one that can be streamlined and made efficient through digital solutions.

Accelerating Sustainability Through Digital Transformation

Realizing the sustainable industries of the future starts with accelerating the adoption of proven technologies today. Advancing a sustainable agenda across an entire industry has its challenges, but existing technology offers scalable and efficient ways to show real progress.

Technology for new shipping vessels is rapidly changing as companies consolidate, regulations become more rigorous, and shipyards globally face new challenges. Today it's possible for ship makers and marine companies to powerfully optimise the end-to-end journey from vessel development to seaborne operations by leveraging technology, such as cloud, sensors, AI, and data analytics monitoring.

As a leader in industrial software, AVEVA has worked with maritime and other industry leaders to understand and develop digital solutions to help drive sustainability across some of the most complex and carbon-intensive sectors, including marine.

By connecting the power of information and AI with human insight, the latest solutions enable the marine sector to more effectively execute projects, providing industry-tuned features to connect the business-critical processes of engineering, design, materials, planning and construction. What's more, such technology can turn operational data into insights for downtime analysis, monitor schedules, digitise maintenance procedures and efficiently manage asset performance.

Such software solutions are already helping to deliver 15–30 percent savings in energy costs and reduce carbon emissions by 9-15 percent, while cutting downtime by 25 percent. The goal is to help optimize production, increase energy efficiency, reduce waste, boost circularity, and maximize sustainable performance.

Shipyards and Shipbuilding: Where Technology and Productivity Meet

Shipbuilding excellence is heavily

reliant on design-to-production, agility, and efficiency across all project streams, as well as effective resource management and design quality leading to error-free production. Last year, AVEVA introduced updated capabilities tailored to the marine sector to address these requirements, including the first release of the AVEVA E3D Hull Basic Design Module.

The module is used for the preliminary design of a ship's hull structure, and supports key decisions regarding naval architectural characteristics, space management, outfitting design, and drawings.

It represents the most integrated 3D environment for working with as-built and as-designed data in the marine market. It was developed in response to the ever-growing and changing needs of ship owners and shipyards and provides a solution that meets sustainability goals, maximizes business agility, and improves operational performance.

An integrated design and engineering tool, the module streamlines the process, improves speed, and removes cost and complexity.

The software allows marine operators to realize up to 40 percent gains in engineering efficiency. It also builds on AVEVA Unified Engineering solution, which brings together design and engineering data with 3D design tools for industrial users.

What's more, companies have chosen to adopt AVEVA's design software. Intuitive and easy-to-use, the package combines the latest three-dimensional graphics and user interface technologies with state-of-the-art data management. The new capabilities demonstrate continued proactive innovation, providing new tools to anticipate market needs, and offering new capabilities and greater efficiency.

Technology is a driver of innovation and provides a path to a sustainable transition. As companies look to decarbonize, maritime partners that take steps to digitize their operations will have a competitive advantage – potentially unlocking new business opportunities. Yet, the benefits go beyond business and extend to helping tackle the biggest challenge the world has faced – climate change. AVEVA and its maritime partners are steadfastly working to increase energy efficiency, minimize noxious emissions, and optimize the effective use of valuable natural resources to shape a better world.

Photo courtesy Mercy Ships

THE QUEST TO BUILD GLOBAL MERCY

Mercy Ships is known globally for its charitable work performing medical procedures in developing countries. For the first time, the organization has a new ship, Global Mercy, recently delivered from a shipyard in China. **Jim Paterson**, Marine Executive Consultant, Mercy Ships takes us inside the construction of the world's largest civilian hospital ship.

By Greg Trauthwein

GLOBAL MERCY EQUIPMENT LIST

Ship Name: ..... *Global Mercy*
Ship Type: ..... Hospital Ship
Ship Builder: ..... Tianjin Xingang Shipyard
Material: ..... Steel
Ship Owner: ..... Mercy Ships
Ship Operator: ..... Mercy Ships
Ship Designer: ..... Deltamarin
Delivery Date: ..... June 16, 2021
Classification: ..... Passenger Ship

Main Particulars
Length, (o.a.): ..... 174 m
Length, (b.p.): ..... 167 m
Breadth, (molded): ..... 28.6 m
Depth, (molded): ..... 9.5 m
Draft, (designed): ..... 6.1 m
Draft, (scantling): ..... 6.4 m
DWT (at design draft): 6,523
Speed: ..... 12 knots service, 14 knots top speed
Fuel Type: ..... HFO/ MGO
Main engines: ... 2 x ABB Azipod CO1400L 4 blades 3.8m ..... diameter propulsion units
Total installed power: 4 x2, 880kW
Bow Thrusters: ..... 1 x Berg 1500kW
Propellers: ..... 2 x ABB Azipod CO1400L 4 blades 3.8m ..... diameter propulsion units
Diesel Generators: ..... 4 x Wartsila 6L32 2,880kW each .....driving ABB Alternators 690V 60Hz
Engine controls: ..... Kongsberg
Radars: .....Furuno x2 FAR2127; x1 FAR3000
Depth Sounders: ..... Furuno FE-800
Auto Pilot: ..... Keiki PR-9000-E
Radios: Furuno SSB FS 2575C; x2 Furuno VHF FM-8900S
AIS: ..... Furuno x2 FA-170
GPS: ..... Furuno x3 GP170
GMDSS: ..... Furuno x2 Felcom 18, 1 Felcom 19,
SatCom: ..... Furuno FB-8000
Mooring equipment: .....MacGregor x5 mooring winches ... 200EW, MacGregor x2 anchor windlass/mooring winch
Fire extinguishing systems: .....SEMCO. Watermist system
Fire detection system: ..... Consilium
Heat exchangers: .....Alfa Laval, Heatmaster
Motor starters: .....Vacon, ABB Variable Frequency Drives
Lifeboats: . Palfinger x2 130 Person plus Palfinger 2 x 70 ..... person combined Lifeboat Rescue Boat
Liferafts: ..... Viking x 10 25 Person inflatables
Coatings: ..... Jotun
Ballast Water Management System: .....Headway
Deck Cranes ..... KGW x2 with two hooks 31T and 5T
Stores and Passenger elevators .....(6) Kone
Hospital equipment ..... Phillips Cat Scan, Steris washer disinfectors/sterilizers, etc.

Jim Paterson already had a career and Chief Engineer's Certificate when he joined Mercy Ships nearly 34 years ago, in search of a life change to make a difference. "I sailed commercially for a few years and traveled the world and saw some really sad spots," said Paterson. "I remember being up the river in Guayaquil in Ecuador and there were people begging for food … they were just so hungry. I got to know my minister back home, and I said, 'This world just seems a mess. What can I do to make a difference?'"

His minister encouraged him to join an organization where he could leverage his marine engineer skills, which is how he found Mercy Ships. "We had Anastasis, our first ship, and I made an application. I thought we would do two years and go back home again … but here we are 34 years later."

Paterson and his growing family spent eight years onboard ship, but "as the kids grew and the cabins weren't getting any bigger," he came ashore and made home in East Texas by the Mercy Ships headquarters, effectively starting the Mercy Ships Marine Operations Department.

"Prior to that, we did everything from the ship itself: we organized the dry dock, spare parts, everything. It was quite complicated back then, as there wasn't email; we had to do everything by fax. It was much easier once we established the marine operations department here. With the introduction of the ISM Code, it was actually about to become a requirement." With Anastasis approaching the end of its service life, the organization found itself in need of a new ship. After much searching and inspecting various secondhand tonnage, it opted to convert a retired Danish rail ferry ship in the U.K. "The conversion took longer than expected, and we put that ship (Africa Mercy) into service in 2007; but we had already started to dream about another ship," said Paterson. Living through the pitfalls of a conversion project, the organization started exploring a newbuild, and 2010 the decision was taken by the board to pursue new construction. "We weren't used to building new ships, our broker friend Gilbert Walter from BRS introduced us to Stena RoRo, who had experience building ships," said Paterson. So in partnership with Stena RoRo, a Tender Package was prepared and a bid package was sent out by BRS to 12 globally, with Tianjin Shipyard in Tianjin, China, emerging the winner to build the world's largest civilian hospital ship.

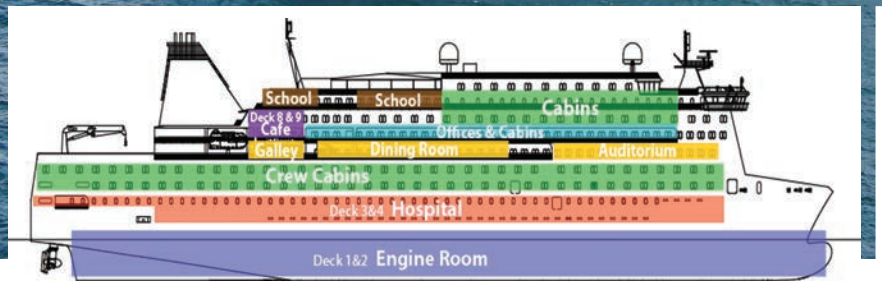


Photo courtesy Mercy Ships

Inside Global Mercy

Today Mercy Ships has one operational ship, with the new ship on its way to becoming operational, enroute from China to Europe. "The ship is complete in all respects," said Paterson, "but the hospital itself still needs to be fitted up and made to work." Building the ship in China during a global pandemic didn't help to make the process more efficient, so Paterson said there remains some work to finish the ship's IT systems. "There's a lot of work still to do, but once the ship comes online and works with Africa Mercy, we will more than double the impact of Mercy Ships delivering healthcare services to the countries that need it most, and primarily those that happen to be in West Africa."

In designing the new ship, the first consideration was size, both to accommodate the needed crew, staff and medical facilities, but also a ship that wasn't too big, as it is usually on scene for up to 10 months at a time, and many of the African ports are still developing, space constrained and extremely busy.

"So the ship is 174 meters long with a 28.6 meter beam and a 6.4 meter maximum draft, which allows it to go into quite a wide number of ports and not take up too much space," said Paterson. With 12 decks and a gross tonnage of approximately 38,000, "it's a big volume and a relatively short length" which allows for a 7,000-square-meter hospital including six operating rooms and 202 beds total, which includes 90 "low care beds for pre- and post-op that don't need nursing care."

"The ship is diesel electric (4 x Wärtsilä 6L32s, just under 3MW) because we spend such a long time tied up alongside, we want to maximize the installed power plant, so we rotate the generators through on a regular basis," said Paterson. Designed by DeltaMarin in Finland, the ship uses ABB pods for propulsion for a 12-knot service speed.

"The amount of fuel that we use to push the ship through the water is quite small. The biggest electrical load actually is the air conditioning, and the air conditioning is probably the most complex part of the ship," said Paterson. "We used Trident to do the design of the air conditioning and also the commissioning. The HVAC equipment is primarily comprised of four York Centrifugal Chiller Units and Flakt Woods Air Handlers. Airflow in the hospital is quite difficult, and also keeping it as energy efficient as possible with 100% fresh air. That took a lot of effort from Trident commissioning engineers."

"But otherwise, the ship is pretty much like any passenger ship/RoRo ferry in terms of the construction; nothing too complicated," said Paterson. "We do have quite a sophisticated waste management system on board, of course. We've got an advanced membrane reactor for treating the sewage produced by EVAC. The rest of the dry waste processing plant came from a variety of sources all integrated by the EVAC team. When operating properly the discharge should be fresh water and ash from the incinerator. One of our biggest challenges in the ports we go to is fresh potable water, because we're sitting there for so long. We have to rely usually on water supply from the shore, sometimes not a problem, sometimes it can be a struggle. So we're looking at how can we put a water maker on board that will actually make water from harbor water, and that's easier said than done. We do collect, treat and filter the condensate water from the air

handlers and use it for technical water such as laundry water."

In terms of fuel for the ship, ultra low sulfur diesel was the choice, as alternatives such as LNG were not an option premised on the ship's area of operation and fuel availability. "One of our biggest challenges at the moment is availability of some of these alternative fuels. In West Africa there's not a lot to choose from, so we're stuck with diesel for the time being. But the ship can burn different fuels, and in the future (fuel selection) may change."

Other technical features include sophisticated self-tensioning winches to hold the ship steady for operations, and two large cranes capable of lifting 31 tons for lifting supplies on and off. "We send a couple of containers every month to keep the hospital going, and of course supply food, too."

Aside from the challenges presented by COVID, Paterson said the newbuild process proceeded relatively smoothly, particularly given that this was the largest civilian hospital ship of international class ever built. "We were blessed to have a senior surveyor from Lloyd's Register who had quite a bit of welding experience, and he actually taught the shipyard how to weld thin plate without buckling it," said Paterson. "So the shipyard was grateful for that, and after the first couple of blocks, I've heard people comment, 'You couldn't get blocks better than this in Europe.'"

One hurdle to overcome early was the 'Safe Return to Port' mandate, "which actually set us back quite a bit on the design period. The safe return to port says you have to have an advised speed of 6 knots in Beaufort force eight if you lose half your propulsion. Well, if you only have 12 knots to start with and you're trying to do six knots at Beaufort force eight, that's quite a challenge.

Working with the designers, the shipyard, the flag state (Malta) and LR, the ABB pods ended up as the game changer as steering the ship at slower speeds in rough conditions was achievable. "You can steer a ship, basically, just over zero knots with podded propulsion," said Paterson. "So once the shipyard got comfortable with that, we moved ahead. During the tank tests, she was doing six knots on one pod no problem. At sea trials, although the design speed is 12 knots, we actually were sailing along at 16 knots at one point. So she far outperformed her design."

The Volunteer Model

Global Mercy will be operated by a full crew complement of *650+ skilled crew of mariners, medical professionals, galley staff, teachers, and many other professions with two things in common – they love the mission of Mercy Ships and they're volunteering their time. In fact, it is this volunteer model that has allowed for Mercy Ships to deliver free healthcare services for more than 40 years. With the addition of the *Global Mercy* to the Mercy Ships fleet of hospital ships, the need for volunteers to join the Mercy Ships family will continue to grow.

https://opportunities.mercyships.org/

LESSONS LEARNED IN SETTING UNDERWATER RADIATED NOISE TARGETS: A BC FERRIES CASE STUDY

*By **Greg Peterson** BC Ferries, Director of Engineering, **Chanwoo Bae**, BC Ferries, Engineering Manager (Naval Architecture), and **Derek White**, Vancouver Fraser Port Authority, ECHO Program Project Manager*

In a typical year, the waters surrounding British Columbia's Port of Vancouver host approximately 3,000 deep sea commercial vessels and 19 of the 35 ferries operated by BC Ferries, one of the largest ferry operators in the world. These waters are also home to a wide variety of aquatic wildlife, including the southern resident killer whales (SRKW), which have been listed as endangered in Canada since 2003.

With vessel-generated acoustic disturbances identified by Fisheries and Oceans Canada as one of four key threats to the SRKW, the Vancouver Fraser Port Authority launched the Enhancing Cetacean Habitat and Observation (ECHO) Program in 2014 to better understand and manage the impacts of commercial vessel traffic on at-risk whales, with a particular focus on vessel-generated underwater noise.

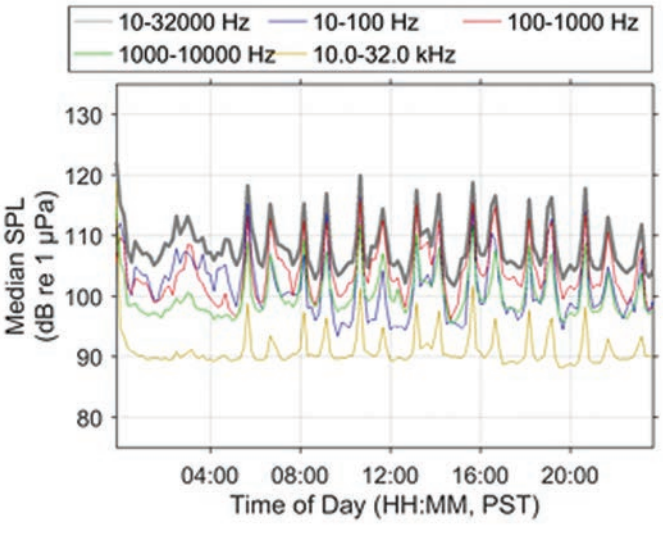


FIGURE 1: Sound Pressure Levels measured in the Strait of Georgia during a typical day.

In moving towards this goal, in 2015, the ECHO Program began monitoring underwater noise through a cabled hydrophone system installed in the Strait of Georgia, near the international shipping lane. The hydrophone system continuously measured underwater noise, showing that peak noise levels strongly correlated with BC Ferries' ferry schedule between Tsawwassen and Nanaimo (Figure 1). This initial study compelled BC Ferries — one of the ECHO Program's founding advisory working group members — to undertake research to better understand the underwater noise contributions of its fleet.

Measuring & Setting Targets for Underwater Noise Levels

Between 2015 and 2017, BC Ferries contracted dedicated vessel sound trial measurements in addition to measurement opportunities via the shipping lane hydrophone system. As part of this baselining effort, an unusual trend was noted in BC Ferries' larger vessels: its C-Class (Queen vessels), Spirit Class and Celebration Class vessels. In each case the radiated noise levels (RNL) level did not change, or even increased, as vessel speed was reduced. This finding is unlike the trend observed in most vessels, where a decrease in speed has a significant impact in reducing underwater radiated noise.

Following this baseline effort, BC Ferries identified underwater noise reduction as an objective and set an ambitious fleet-wide target of a 50 percent reduction in underwater noise based on typical sound levels from ferries crossing Strait of Georgia in the 2016 measurements.

In 2018, BC Ferries advanced this effort by including un-

derwater radiated noise (URN) performance requirements in the specifications for a new major vessel procurement intended to replace its existing C-Class ferries.

To address the frequency ranges of greatest sensitivity to SRKW, BC Ferries developed specific targets based on the frequency ranges used by the whales. This resulted in three spectrum based underwater radiated noise targets: a general broadband target, a SRKW communication band target, and a SRKW echolocation band target (Figure 2, next page).

Despite the fact that the planned replacement vessels are intended to be larger and faster than the previous C-Class ferries, BC Ferries set a very aggressive broadband underwater radiated noise targeted reduction of 14dB. This equates to a 97 percent reduction in total under water radiated sound intensity (Table 1).

In addition to the BC Ferries URN criteria, a Classification Society URN notation was also specified; this ensured the contracted Class (ABS) was engaged in the URN design process.

Underwater noise targets are only one performance metric stated in the new ferry build requirements and needed to be considered in conjunction with BC Ferries' other required performance characteristics. There was limited research available about how underwater radiated noise limits might be accomplished in concert with other critical performance requirements like speed and operational efficiency essential to maintaining a scheduled ferry service.

BC Ferries contracted Det Nortske Veritas (DNV) as its third party expert in underwater radiated noise. In 2019, BC Ferries also released a global Request for Expressions of Interest (RFEOI) for the Major Vessel Replacement Program to solicit interest, capacity and capability to be considered for the procurement. For many shipyards, this would have been the first set of performance requirements for a ferry build that included underwater radiated noise targets and requirements.

In a design build contract, the shipyard would shoulder the primary risk in meeting the underwater noise requirements. Unlike some other performance requirements, achievement of the URN contract requirement might not be possible to fully assess at the design stage. Once measurements are obtained during sea trials following construction, there may be little opportunity for the shipyard to apply corrective solutions. Thus the development of design tools (software and databases) is a critical element to achieve the program goals.

Vessel Particulars	New Major Vessel	C-Class Vessels to be Retired
Vessel Type	Double-ended Ro/Pax	Double-ended Ro/Pax
Length	167-172m max	139m
Beam	28.2	27.1
Speed (max)	21 knots service speed	20.5 knots
Power Plant	TBD	Diesel gearbox
Propulsion	CP Prop combinator; or Azimuthing thruster/pods with Fixed Pitch Props	CPP combinator
Capacity	360 vehicles, 2100 pass/crew	315 vehicles, 1494 pass/crew
URN Level	175 dB	189 dB

TABLE 1: Sound Pressure Levels measured in the Strait of Georgia during a typical day.

Assessing Propeller Design & Propeller Systems as Contributors to Underwater Noise

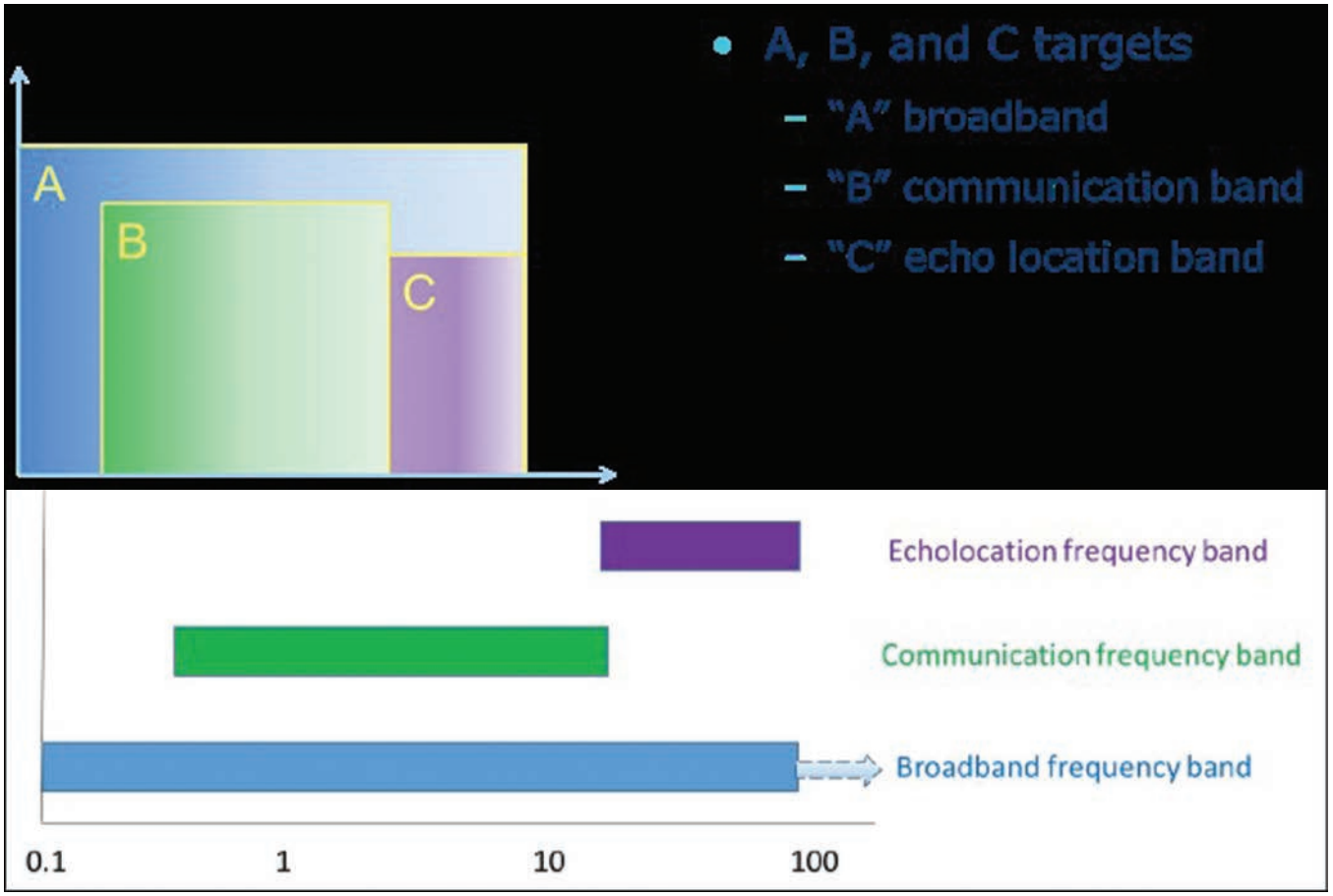
With support from Transport Canada, BC Ferries and DNV conducted a study to understand how underwater noise could be reduced in the current fleet by modelling propellers using the latest numerical tool and altering design parameters to observe change in URN signatures. Studies have estimated that up to 80 percent of the underwater noise a ship produces comes from cavitation at the propeller; therefore the study focused on propeller design (Figure 3). Cavitation is caused when low pressure regions created during propeller motion create vapor bubbles which implode or pop and can generate high intensity sound waves over long distances. This action occurs at much higher frequencies than other ship-sourced noise (e.g. propeller blade pass, engine firing rates) and therefore is of greatest concern when mitigating impacts on the SRKW population.

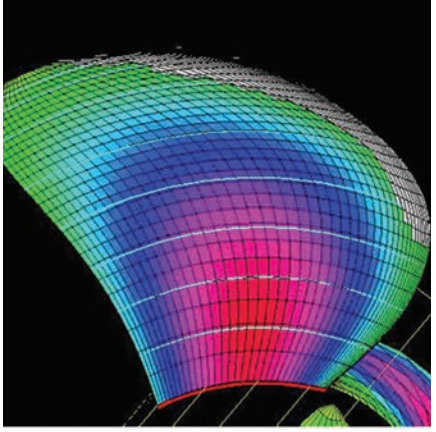
By exploring options to redesign the existing propellers that were optimized primarily for propulsion efficiency, the study by BC Ferries, Transport Canada and DNV showed that careful design could reduce underwater emitted noise from the propeller and hull arrangement. The study also showed that a propeller designed to minimize underwater radiated noise will sacrifice some power or efficiency resulting in reduced speed and/or increased fuel consumption. Key lesson learned are that underwater radiated noise needs to be balanced with other requirements and variations in the operational profile of the vessel and must be considered in the process to optimize a new vessel design.

Beyond the study on propeller design, BC Ferries also undertook preliminary consultation with key vendors to determine how propulsion systems could be best optimized for the quietest operation. One potential opportunity with electrically-driven ferries, for example, is to combine a variable frequency drive (VFD) with a conventional controllable pitch propeller design, which would allow the propeller shaft speed to be matched with propeller pitch to minimize unwanted cavitation at slower speeds. As with any potential solution, there are performance impacts beyond underwater radiated noise that must be considered.

The vessel noise emission profile data and research initiatives described above can be shared with the successful shipyard. In any future project, BC Ferries intends to work directly with the shipyard and the ship classification society through the design and build phases, to improve the likelihood that the design targets can be achieved in sea trials.

FIGURE 2: Underwater Radiated Noise Targets as a function of Frequency.





Lessons Learned

In 2021 the ECHO Program contracted West Pacific Marine to work with BC Ferries to prepare a case study report to capture the findings and learnings summarized in this article. While the New Major Vessel Replacement Program procurement process has been delayed due to COVID-19 impacts, the case study report illustrated that the initial phases of work undertaken by BC Ferries have led to some key learnings for other vessel operators considering the implementation of underwater radiated noise targets:

- *Obtain baseline measurements of your fleet to determine where your starting point is before setting underwater noise reduction goals;*
- *Make design decisions in consideration of the larger system. Underwater radiated noise is a function of many complex interactions within a vessel, and as such, it is important to design the propeller and propulsion systems in concert with the hull design to ensure that functional requirements are accounted for;*
- *Engage an underwater radiated noise expert to assess design impacts and conduct trade-off analysis. Ensure the expertise is available when working closely with the selected shipyard throughout the detailed design and build process;*
- *Anticipate conflicting requirements as a part of the design optimization process. For BC Ferries, for example, meeting underwater radiated noise reduction requirements while achieving improved energy efficiency is a balancing act that requires careful consideration.*

Underwater radiated noise is still a nascent field in the commercial shipping sector, but one that is gaining attention and focus. A collaborative work environment between the operator, owner, shipyard, naval architect and ship classification society is vital. As we continue to improve our understanding of quiet vessel design's possibilities and limits, we expect underwater radiated noise targets to be included in a growing number of new vessel builds. Understanding and managing the risk is necessary to encourage innovation.

FIGURE 3: Propeller cavitation simulation modelling.

Multi-physics Simulation (MPS) & Decarbonization Walk Hand-in-Hand

Chris Wiernicki, CEO, ABS, discusses the evolution of multi-physics simulation and its importance in reaching decarbonization goals through 2050.

By Greg Trauthwein

As the pace of technological evolution rapidly quickens, shipowners are increasingly forced to embrace change to ensure their fleets stay in compliance with new regulations and stave off obsolescence.

Going forward, efficient, cost-effective delivery of goods from 'point A to point B' must be done in a more environmentally benign manner, as shipowners and marine technology companies are staring down the barrel of the global decarbonization drive with strict new emissions limits coming into force by 2050, limits that today are unattainable with current technology.

"I believe we're going to see more innovation in the next 10 years than we saw it in the last century," said Chris Wiernicki, CEO, ABS, in a recent interview with ***Maritime Reporter TV***. While the digitalization and decarbonization trends are certainly nothing new, Wiernicki sees the last 18 months of COVID-19 – particularly in regards to digitalization – as a catalyst to fast-track development further and faster.

Wiernicki reckons that the maritime industry needs "radical advances" in technology to cope with the demands of decarbonization mandates, and that one such radical advance is Multi-Physics Simulation (MPS) and its potential to help unlock the next generation of vessels and technologies.

What is Multi-Physics Simulation (MPS)?

To start, it's important to understand that MPS and "digital twins" are not the same thing, as MPS is a technique that integrates multiple engineering strands with 3D tools to turn a design into an active digital model that mirrors physical reality … the ability to model various systems and understand their inoperability. "Simulation actually comes before a digital twin: digital twin connects itself with reality through Y-data, whereas simulation is a representation of reality," Wiernicki said. What's important for simulation is that verification and validation piece going forward.

"When you take a simulation and you combine it with an engine fuel consumption simulation, and then you combine that, let's say, a power limitation simulation and a weather planning and seakeeping model, it becomes a multi-physics model," Wiernicki said. The multi-physics model allows the designer to understand how each of the variable impact the

Photo courtesy ABS

design as a whole. "More importantly, as the industry looks at where we are now relative to future-proofing, it allows us to look at the impact of electrification, for example, or an alternate fuel. It allows us to look at the impact of batteries. Looking at the impact of certain decisions made on voyage performance, relative to hull resistance, relative to alternative fuels. So MPS is a technology that allows us to, with confidence, digitally touch where things are, allowing us to shape a framework and pathway going forward."

The value of MPS increases exponentially as it enables new concepts in design, engineering and operations to be assessed while a vessel is in its formative stage, helping to make changes in design – from the simple to the radical – very early on in the process. Logically, this helps to dramatically cut development costs and accelerate the time of the design from inception to delivery. In addition, bringing the matter full circle and into the wheelhouse of classification, MPS is an enabling technology that will eliminate paper drawings from the workflow altogether, enabling totally digital classification.

While MPS is a digital solution, it sits at the center of the 'future fuels' conversation, too. Wiernicki reasons that alternative fuels lie at the heart of all future vessel design, and the ability to efficiently test how different fuels will ultimately impact a ship's final design look and function will be dramatically enabled by MPS, to understand not only the vessel modification requirements, but to also catch in advance any unintended safety consequences premised on fuel choice.

"When you look at the complexity and you look at the significant increase of system interconnectivity, you begin to ask yourself, how am I going to really understand and begin to rationalize what is going on?" Wiernicki said. "This is where simulation comes in. It's an engineering technology that allows us to visualize the interconnectivity of various cyber-enabled physical systems."

"We can all understand the potential of alternate fuels in shipping's push to achieve a sustainable footing," Wiernicki said. "However, at ABS we see the potential of MPS, sitting as it does at the intersection of data, digital and decarbonization, as another, less heralded, advance with the potential to make a significant contribution."

"We can all understand the potential of alternate fuels in shipping's push to achieve a sustainable footing ... however **we see the potential of MPS, sitting as it does at the intersection of data, digital and decarbonization**, as another, less heralded, advance with the potential to make a significant contribution."

Chris Wiernicki, CEO, ABS

2050 or Bust

Wiernicki and his ABS team are bullish on the potential for MPS to make a meaningful impact in helping shipowners hurdle the challenges ahead.

"Imagine being able to run a digital model of an asset through a digital model of an experience and, informed by an immense amount of well-chosen, comprehensive and appropriate data on many factors such as ship structures, machinery behavior and ocean forces, obtain a rigorously accurate picture of what is most likely to happen to that asset in real life," Wiernicki said. "Today MPS is on the cutting edge of resolving decarbonization and efficiency challenges, but in a not-too-distant tomorrow it will be a legacy component of a new technology that can provide such a degree of insight and understanding as to enable us to truly maximize vessel efficiency, environmental protection and safety at sea."

He said meeting the emissions reductions challenges of 2030 is feasible with today's technology, but 2050 is "a story that has not been written."

And even though the technologies and fuels don't exist today to get to the 2050 emission levels, the ships that are currently being designed and built using, for example, liquefied natural gas (LNG) as fuel, must be looked at through the lens of future proofing them for conversion to hydrogen, liquefied petroleum gas (LPG), ammonia or biodiesel.

"I am convinced going forward that the chief technology officer and the chief financial officer are going to be sitting next to each other in the boardroom, really trying to assess the commercial risks of developing technology more so now than ever before."

At the end of the day, MPS, future fuels, digitalization and everything else intertwined comes down to managing risks effectively and efficiently. "So, what we're really looking is to find a little bit more clarity, a little bit more definition to some of these swim lanes, so we can as an industry collectively begin to really focus in on making the right investment decisions going forward," Wiernicki said.

Rather than physically testing everything, you're able to form an "ultimate testing envelope," said Wiernicki, and this virtual testing envelope is particularly important when you're talking about technologies that either have not been developed or are not yet scalable. "What simulation does is it gives you a very cost-effective way to begin to understand where you should be focusing your priorities. In the case of ABS, it is going to be all about helping us understand where are those unintended safety consequences. It's no longer going to be component-by-component. Simulation gives you that framework to be able to do that."

Calling it a "digital sixth sense to help us continue to do what we do well," Wiernicki noted, "We are a safety centered organization."

Simulation is a point of investment for ABS today and in the future, with a new Simulation Center of Excellence in Singapore underway, and more to come around the world. "Just about every one of our joint development projects, whether it's with a yard, an owner or an equipment manufacturer has some level of simulation embedded in it," Wiernicki said. In fact, he sees simulation and MPS as central to ABS' evolving role. "It allows us, to some extent with our data analytics capability, to even predict things going forward. It allows us to begin to extend our classification role to something even furthermore like an integrator, an assessor, a predictor, that go-to solutions advisor to help the industry."

And with the myriad of challenges ahead, shipowners will need all of the resources they can muster.

"As we moved to 2050, that story hasn't been written yet. We're going to need to visually simulate so we understand what is going on. The automotive and the aerospace industry taught us the science of simulation. What we want to do right now in the maritime sector is begin to apply that."

DNV takes on the & Digital, Decarbonization Challenges

By Greg Trauthwein

While COVID has posed some enormous challenges to business globally, the pandemic has also conspired to fast-track many changes already in motion, namely in terms of decarbonization and digitalization. "I think if you look at the industry, the pandemic probably accelerated digitalization by half a decade," said Knut Ørbeck-Nilssen, CEO, DNV Maritime. "Apart from that, there's a big change also on the awareness of the CO2 emissions and greenhouse gases. It's certainly something that we've seen accelerated over the last 1.5 to three years." Ørbeck-Nilssen spoke to ***Maritime Reporter TV*** on the eve of DNV's release of its anticipated *"Maritime Forecast to 2050: Energy Transition Outlook 2021."* With a footprint of nearly 12,000 employees in 74 countries crewing 283 offices serving maritime, energy, health, food and even the automotive industries, DNV is global and positioned to give a multi-sector bird's eye view.

"You can see that there is quite a lot of different activities that goes with the DNV brand, which in and of itself is a strength," said Ørbeck-Nilssen. "And we see that developments in certain industries can be taken back into the maritime industry," noting the recent combination of DNV's maritime and health services in its certification of infection prevention through the cruise industry at the outset of COVID. Cross sector knowledge is particularly instructive today in maritime, an industry in the cross hairs of a generational change in regards to digitalization, decarbonization and autonomy.

The Decarb Challenge

While the maritime industry is broadly characterized as slow to move in the adoption of new technology, Ørbeck-Nilssen sees this as much a function of the industry's structure rather than an aversion to tech itself. "The shipping industry is quite fragmented, with more than 70,000 vessels sailing the seven seas and the average shipowner probably operating around 10 vessels," he said. "To get momentum it takes time."

While maritime today faces challenges aplenty, it is broadly agreed that the decarbonization is the biggest hump for most ship owners to navigate. "If you go back to the beginning of last year, we saw that the total number of orders for the dual-fuel gas engine vessels really pick up," said Ørbeck-Nilssen. While the number of dual fuel vessels is still a small percentage of the existing fleet, the orderbook tells a different story. "If you look to the order book for new construction, around 12% of the current order book are looking at alternative fuel systems, where dual-fuel gas systems are the main trend."

This trend is expected to increase, particularly with the IMO's introduction of the Energy Efficiency Existing Ship Index (EEXI) and the Carbon Intensity Indicator (CII) this summer, both due to enter force in January 2023.

DNV is involved in a number of Joint Industry Projects and R&D programs with various industry stakeholders to pitch in and develop potential solutions to these vexing emissions questions. While he is often asked to pick the 'fuel of the future,' Ørbeck-Nilssen offers notes of perspective and caution.

"When it comes to alternative fuels, I'm a big fan of the French philosopher, Voltaire: 'Let's not make perfect the enemy of good.' Maybe, we don't have the perfect solution, but it's certainly important to start moving in the right direction."

By most accounts it's still too early to pick the alternate fuel that will dominate maritime for the coming century. "I think in this, we shouldn't be so concerned about picking winners and losers. I think it's really all about having an effort, with different parts of the industry coming together to collaborate, to work and to make progress."

"The only word of caution that I have is, let's make sure that we are not creating talking clubs. Let's make sure that we are actually putting concrete projects into the efforts and that we are trying to produce something which can be useful

There are owners out there that are really forward-leaning, very advanced, using remote operation centers, making sense of all the data from the vessels, and putting algorithms on the data to discover deficiencies and make forecasts. **Then, on the other end of the scale, we have some owners that probably don't even have a PC in their office.**"

Knut Ørbeck-Nilssen,
CEO, DNV Maritime

Photo courtesy DNV

> "When it comes to alternative fuels, I'm a big fan of the French philosopher, Voltaire: **'Let's not make perfect the enemy of good.'** *Maybe, we don't have the perfect solution, but it's certainly important to start moving in the right direction"*

in the end." Ørbeck-Nilssen said DNV has been running joint industry projects for decades, including the Singapore Decarbonization Center that was recently formed together with several other key players in the Far East, as well as the Maritime Technologies Forum, where a number of class societies and flag states come together to work on R&D and safety-related issues.

Digitalization

The digitalization of maritime is another of Ørbeck-Nilssen's so dubbed 'tectonic shifts' sweeping through the industry, and akin to the trends of decarbonization and autonomy, there is little consensus regarding 'how far, how fast.'

"(Implementation) is varied," said Ørbeck-Nilssen. "There are owners out there that are very advanced, using remote operation centers, making sense of all the data from the vessels, and putting algorithms on the data to discover deficiencies and make forecasts. Then, on the other end of the scale, we have some owners that probably don't even have a PC in their office." But he warns that the decarbonization and digitalization trends cannot be looked at in a vacuum, as regulations will mandate the need to, for example, gather information about emissions, bringing decarbonization and digitalization into the same conversation. While much of the focus and attention lands with regulators, there is a long and growing list of stakeholders – from banks, to ports, to shippers to manufacturers – that will require increased amounts of data and analytics to use to factor into their own carbon footprint analysis. "DNV, via the Veracity platform, is working on what we call the Emission Insights," said Ørbeck-Nilssen. "This is a digital tool available to our customers, and use of this (and other tools on the Veracity platform) makes a lot of sense when it comes to compliance on the regulatory side when it comes to emissions."

From the side of class, the digitalization trend is taking many shapes, particularly in the ability to conduct remote surveys when in-person is impractical or impossible. "Maybe the most predominant change (from the pandemic) is the use of remote surveys," said Ørbeck-Nilssen. "We (DNV) were in a very fortunate situation because we already launched the concept of remote surveys back in 2018, well ahead of the pandemic. And then, naturally when the pandemic hit, we were able to really leverage this." Regardless of the technical challenge ahead, Ørbeck-Nilssen advises that collaboration is the key. In Norwegian, we call this *Dugnad*. That means everyone is coming together to work on something for the common good. I think that should be at the sentiment."

ClassNK invests in Decarb R&D

Photo courtesy ClassNK

While the maritime industry faces a long 'to do' list for the coming three decades, ***Hiroaki Sakashita****, CEO, ClassNK, sees decarbonization as the definitive trend that will most dramatically impact the design, construction and life-cycle operation of ships.*

By Greg Trauthwein

"It is decarbonization."

Hiroaki Sakashita, CEO, ClassNK, is definitive when asked to discuss the biggest challenge facing shipowners today. "Decarbonization will change the structure of seaborne trade, ships' specification and design, ships' operation, and the economic mechanism of maritime transportation. It will profoundly affect all stakeholders involved in the shipping business."

Like his colleagues across the maritime world, Sakashita views collaboration as the key to solving some of the maritime industry's most vexing problems, which has been the driver for ClassNK to triple its involvement in cutting edge Research and Development partnership projects in the last five year, both with leading maritime equipment makers, shipbuilders and owners in Japan, as well as around the world. "We are working on a wide range of advanced projects, not only hydrogen, ammonia, bio, and other transition or alternative fuels, but also wind power propulsion, CO2 capture and storage, and ships engaging in hydrogen or CO2 transportation."

"I'm expecting to join more and more pioneering initiatives, especially for decarbonization," as ClassNK, its clients and its partners traverse the "maze" of options and future solutions, with ClassNK helping to move initiatives forward and "providing the industry with findings so that industry stakeholders can find and establish appropriate solutions as quickly as possible."

As with the pace of change in technology, Sakashita expects the pace of change in decarbonization to increase, too, in the coming years.

No business discussion, still today, cannot be had without looking through the lens of COVID, and Sakashita admits that despite all of the logistical problems the pandemic has caused, the situation with seafarers unable to effectively enact crew changes has had, and will have, the biggest impact. "The world's shipping trade has maintained its function to support people's life and society during the COVID-19 pandemic," said Sakashita. "When the pandemic is over, the most important thing should be the normalization of crew changes. Today, seafarers underpinning seaborne trade are forced to

> "**Decarbonization will change the structure of seaborne trade, ships' specification and design**, ships' operation, and the economic mechanism of maritime transportation. It will profoundly affect all stakeholders involved in the shipping business."
>
> **Hiroaki Sakashita**, CEO, ClassNK

live and work in unreasonable conditions. This should not be overlooked and allowed." ClassNK, like all throughout the industry, have been challenged in terms of travel and delivering services in-person as was the norm prior to 2020. "The continuity of service has been the biggest challenge for us during this very serious pandemic," said Sakashita. "But in spite of various restrictions, ClassNK has been able to provide services to support seaborne trade, and I'm proud of the effort and dedication of our team. Digital technologies such as remote survey and electronic documentation certification, which we have been preparing before COVID-19, have worked well and its use has progressed faster than I expected."

Following is a snapshot of some recent ClassNK initiatives:

Data: ClassNK released its "Data Quality Guidelines" for facilitating processes of collecting and utilizing shipboard data among various stakeholders. The guidelines outline points to note for ensuring high data quality in accordance with the related international standards. The guidelines are available to download free of charge via ClassNK's website.

3D Printing: ClassNK released its "Guidelines for Additive Manufacturing(3D Printing)" that summarize the approval requirements for metallic marine equipment by additive manufacturing technology. While the use of additive manufacturing technology has been rapidly expanding in manufacturing metallic products, particularly in automotive, aerospace and medical care, there are still few examples of the use of this technology in the maritime industry. But it is expected that metallic products by additive manufacturing technology will become widespread in the future as a lot of marine equipment are metallic products.

CO2 Recovery on Ships: Mitsubishi Shipbuilding, "K" Line and ClassNK have teamed to conduct test operations and measurements for a small-scale demonstration plant of the "Marine-based CO2 Capture System." The equipment was installed on the Corona Utility, a coal carrier for Tohoku Electric Power Co., Inc. operated by "K" Line. The project is being conducted with support from the Maritime Bureau of Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and the demonstration involves converting the design of an existing CO2 capture system for onshore power plants to a marine environment. Dubbed "Carbon Capture on the Ocean" (CC-Ocean), it is intended to achieve CO2 capture at sea, a world first.

Future Fuels: ClassNK is involved in a wide scope of projects to investigate the feasibility of future fuels. Recently Japan-based Itochu Corporation formed a joint study framework of 23 companies and organizations with the objective of collaboratively discussing common issues in pursuit of the utilization of ammonia as an alternative marine fuel. ClassNK recently issued an approval in principle (AIP) to Eco Marine Power for the development of a renewable energy system for ships, Aquarius Marine Renewable Energy with EnergySail, which uses a combination of renewable energy, including wind and solar, obtained by a rigid sails and solar panels deployed on deck. ClassNK also issued AIP to Kawasaki Heavy Industries, Ltd. (KHI) for the design of a cargo containment system (CCS) of the world's largest capacity (40,000 cu. m. class per tank) developed for use on a large liquefied hydrogen carrier. The CCS will be designed to enable transportation of cryogenic liquefied hydrogen in large amounts, thanks to tank capacity on par with tanks used on large liquefied natural gas (LNG) carriers. In addition it is designed to use BOG as fuel to power the ship, thus contributing to reduced CO2 emissions from liquefied hydrogen transport operations.

Interview:

Kevin Humphreys, Marine and Offshore President, the Americas, Lloyd's Register

*With $1 billion in turnover and 7,100 employees globally, Lloyd's Register is on a mission to grow. Earlier this summer it tapped **Kevin Humphreys** to lead its Americas business, and he interviewed with Maritime Reporter TV to discuss the path ahead.*

By Greg Trauthwein

Kevin, looking at the Americas, where is Lloyd's Register traditionally strongest?

One of our core business sectors in the Americas is the cruise sector (with about 35% of global construction market share). We also have a large presence in Canada, (as the Canadian Navy and Coast Guard) rely heavily on LR for their building standards and risk management. Lastly, I would (broadly categorize) complex projects in the offshore sector.

When you look at LR in the Americas, where do you see weakness, and what is your strategy to improve?

That's a fair question. One of the places we're investing significantly is platforms, digital platforms, both on our internal processes, and as that flows out to the external processes for our customers. We want to be able to deliver bread-and-butter services to our customers seamlessly, painlessly and efficiently. I'm used to being in companies with great, smart, technical people, very smart engineers, very good at what they do. But you need to create a cultural where they understand what they do in terms of the value of the clients. We're selling expertise to help our clients grow.

With decarbonization, digitalization and autonomy, maritime is at an interesting crossroads. What are LR America's priorities in the coming years?

This is really a dynamic regulatory environment, and the environmental concerns have radically changed. You see individuals in risk counterparties to deals asking questions they were never asking before, looking for counsel (on issues) that they never asked before.

Traditionally, the maritime lending industry was always very staid and in the background. You weren't concerned who an owner's lenders were. You weren't concerned who an owner's main customers, charters, or beneficial cargo owners were. That has totally changed. All of these parties now need advice; to understand (and manage) the risk. So, the conversations have changed (among all key stakeholders to better manage risk).

That's the context of what's going on, and one of the biggest pieces of that, I think, is the digital world. How do I squeeze out efficiencies? How do I reduce emissions? How do I have compliance that's fair and equitable across the board? Digital technology help to do that (and more).

If you think about charter party agreements, they're essentially unchanged for 300 years: "Get my cargo from A to B at a certain delivery date." Well, can we make that dynamic? Can the port send signals based on traffic that adjusts the charter party agreement electronically using data? These are the places where digital can really impact an operation. I have a unique perspective on digital as it leads into this change. I lived in New York for five years, and at the time I was in law enforcement, not the maritime world. At the time, New York City and Mayor Giuliani really wanted to drive down crime rates, so they instituted a tool called CompStat. Now CompStat is not horribly sophisticated by today's standards, but the idea was, for the first time, I'm collecting data so I can understand relationships; when I do something here, what happens

Photo courtesy LR

there? And now I can hold individuals or entire organizations accountable.

I think these are the places where shipowners are really looking to use digital. Charters are looking for this. Banks even want to understand now – with the Poseidon Principles – what's going on … how do we verify, how do we contribute? So, this is where I think digital is going to play out for this industry.

While COVID-19 has created many challenges, it has also created opportunities, particularly in the digital and remote work world. How has it, and how will it continue to impact class and the delivery of your services?

One of the biggest things is remote surveys. Of the approximate 30,000 surveys that we do in a year, about a third of those are done remotely via video feeds and remote inspections. This is where we're leveraging that technology to get the job done and to make it much more efficient.

You're going to see more and more digital data coming in from various engine OEMs and process equipment OEMs, digital data that's aggregated in a core platform that your class society will be able to use in the course of inspections and risk management.

As you settle into your new position, what are your priorities for the coming 12 to 24 months?

Immediate service to our clients to deal with (various rules and regulations coming in), from EEXI to the Poseidon Principles and Sea Cargo Charter. Owners, charters and banks need to understand managing that risk going forward so that they're not holding stranded assets, assets that can't perform under the new regimes. Second is the cruise industry. Getting our cruise clients up running safely is a key priority for us, and LR has the resources to help the cruise industry with their health and safety plans.

Recently LR announced the divestment of its business assurance and inspection services division. The idea is we really want to focus on what are our core ocean economy clients need. Where there may be overlap, we will still work together seamlessly with business assurance, but what this means for Lloyd's, and what it means for our clients, is we will be investing and reinvesting back into our operations, building those capabilities to do all those things I talked about, delivering bread-and-butter services well, helping customers with digital platforms as well as risk management going into the future.

MEETING THE DECARB CHALLENGE BY DESIGN

Photo courtesy Glosten

Naval architects and marine engineers sit on the front lines of the maritime industry's battle toward decarbonization. ***Morgan Fanberg****, President, Glosten, discusses the challenges and opportunities ahead.*

By Greg Trauthwein

Put in context the challenge ahead for ship owners and ship designers to meet emission targets of 2050?

I started my career in 1998 and as a young marine engineer, the challenges that I faced were taking old boats and meeting SOLAS requirements, developing ship yard packages for modifications such as oily water separator upgrades (for example). So the challenges from my early career do not compare at all to the challenges that we're facing with decarbonization and the IMO emission reduction goals.

How is Glosten investing today to ensure that it is well-armed to meet the challenges ahead?

Shortly after I became president we developed a program to formalize our R&D, because we knew we needed to use some of our profits to invest in our future. This program helps us prioritize. One of the projects that we just approved is to develop our internal expertise on all decarbonization topics, as I want our entire engineering staff to be completely knowledgeable (on the topic for the benefit of our clients).

From the vessel owners that you talk to, how high is decarbonization on their agenda today?

It really depends on the operator and the sector of the industry that they're in. If you operate a passenger vessel on a route suitable for electrification, decarbonization is a priority. You are certainly looking at implementing battery technology into your fleet. If you're an owner of an aged fleet with little capital, you're just trying to keep up with maintenance, and decarbonization may only mean finding a way to reduce fuel consumption. I recently testified in front of Congress to get the federal government, through MARAD and the DOE, to start funding grant opportunities so operators and owners have the capital means to meet some of these challenges.

As we push towards decarbonization, what do you see as the highest hurdle today?

First and foremost, the technology must be proven to be readily available and reliable. Once that has been accomplished, the hurdle will be cost. There's no question about it. It must cost less to build and operate vessels with these new technologies, or we might not meet the IMO reduction goals. Specific examples of those hurdles are carbon neutral fuels like biodiesel. They're going to need a subsidy to be the same or less cost; ammonia and hydrogen will require significant capital investment, both in propulsion plants and the distribution infrastructure.

Do you see a single fuel, a single technology or technique that will go furthest fastest to help meet these emission reduction goals?

If only I had a crystal ball it would be amazing for Glosten and for me. That said, we are seeing some early winners in this race. The two things that need to happen for a fuel or technol-

ogy to win: First, the fuel needs to be produced at scale from a green source of energy without a huge premium over diesel. Hydrogen and ammonia are widely available today as industrial chemicals with a distribution network in place, but neither are produced at scale from green sources of energy. There are a number of green hydrogen pilot projects planned right now, so it's moving in the right direction. Second, the on-vessel propulsion systems need to be commercially available and proven. Commercial fuel cells, hydrogen and ammonia fuel combustion engines are in development, but it's going to take some time.

So right now there is no clear winner.

Can you discuss industry projects Glosten is engaged in that are aiming to jointly develop a solution?

Glosten is a founding member of the nonprofit organization called Washington Maritime Blue. Its goal is to connect maritime businesses to progress the industry through different projects. Our all-electric foil ferry project is a Washington Maritime Blue joint innovation project (allowing us to build partnerships with many local engineers, port authorities, vendors, manufacturers and regulators.

We recently reported on an all-electric ferry design for Skagit County Public Works. Can you give us an overview of the project?

We started working with Skagit County Public Works in 2017, initially studying its future transportation system needs, as its existing ferry is 40 years old and due for replacement. Because the route is only a half mile from Anacortes to Guemes Island, it's a perfect environment and scenario for an all-electric ferry. After delays in securing funding, the project picked back up in 2019, and earlier this year Skagit approved our preliminary design of a double-ended ferry that can accommodate 28 cars. This will be an all-electric ferry with redundant battery banks, a split main DC bus. There's also a backup generator, so in the event that there's an emergency on the island and we need to get emergency vehicles back and forth, they're not going to have the battery capacity for that. So we have this backup generator for above peak demand. The large tidal ranges have created some interesting challenges to integrate the ship charging equipment, but we've developed a couple different concepts (for which) we have submitted environmental permit applications. Also, finally, because it's important for this project to have a single integrator for the electrical systems on the ship and the shore, we have supported Skagit with the release of the electrical integrator RFP. So that RFP is on the streets right now. A selection will be probably made in October, and then we can start finishing up the contract design and then proceed to the construction phase.

Are there any other recent additional projects that illustrate how Glosten is engaged in this decarbonization challenge?

Yes, absolutely. In addition to supporting clients on fuel and propulsion plants, we're also active in the green energy sector, specifically the wind industry where our PelaStar floating wind turbine platform is gaining attention. We recently partnered with General Electric on the ARPA-E ATLANTIS Project. GE designed and developed advanced controls to support a 12MW wind turbine based on our PelaStar platform. This resulted in the design of a lighter, lightweight, floating turbine that will significantly reduce the cost of energy. Hopefully with that project and some other things we have in the works, we're really hopeful that we will see floating wind turbines mounted on our PelaStar platform in the near future.

All images courtesy Glosten

MARITIME REPORTER TV Watch the video @ https://youtu.be/nW2d1nUEbDs

BMT Tapped to Design Ferry Pair for Isles of Scilly Steamship

Image courtesy BMT

Sylvain Julien, *Director, Naval Architecture, Specialized Ship Design, BMT, discusses how local stakeholder demands and futureproofing shipboard technologies drove the design of a pair of ferries for the Isles of Scilly Steamship Company.*

By Greg Trauthwein

The Isles of Scilly Steamship Company Ltd. has provided a lifeline to the Isles of Scilly since it was formed in 1920. When attention turned to designing a pair of new vessels – one passenger and one cargo – to service the island, it teamed up with BMT to deliver a design that was not only aesthetically pleasing, but also able to carry more passengers and more cargo, faster but with reduced fuel consumption.

The new 72-meter passenger ferry is designed to carry 600 passengers over three decks with a contemporary seating arrangement, onboard coffee shop and retail area. This vessel has a designed service speed of 18 knots, effectively cutting the journey time by 20% as compared to the current vessel servicing the route. It is outfitted with an anti-roll stabilization system for passenger comfort and a hybrid propulsion system to help reduce emissions. The passenger vessel was constrained in its dimensions by the size of the pilot gate and the water depths available at the harbor, so BMT had to better utilize the space available and strike a balancing act between the space requirement of each of the vessel's functions.

"The first step of our work was to develop a set of requirements based on the operational needs, which took the form of discussions with the crew and shore team," said Julien. "We also surveyed the vessel and port infrastructure, to ensure that we had a good picture of their needs."

The BMT team also reviewed and incorporated the wishes of the local community. "The Isles of Scilly Steamship operates a lifeline service between Penzance and the Isles of Scilly, and they benefit from a very strong relationship with the local community," Julien said. "It's really important for them that the community's concerns and wishes are addressed throughout this project."

The vessel being replaced, Scillonian Three, was built in 1977 and is an iconic vessel in the region. Julien and his team knew it had to offer an improved passenger experience and a forward-looking vision, technologically. But also, too, the fundamentals of vessel operation were a top priority. "For example, this may be ensuring that the design allows for different cargo to be loaded and unloaded in a specific order, to mesh seamlessly

Image courtesy BMT

with the shore infrastructure. I think for them, this is a once in a lifetime fleet change, as they are changing all of their vessels."

One of the key aspects of the design is the introduction of a completely different passenger space, compared to the existing vessel. The design is much more modern, to allow for an increased passenger number, but also to provide improved external views.

In addition to the passenger vessel, the BMT team were asked to design a 45-meter cargo vessel to replace the Gry Maritha. The new ship will have an increased cargo capacity, including more space for chilled and frozen goods, a crane that can lift eight tons and a lounge for up to 12 passengers. This cargo ferry will be designed for a 12-knot service speed, allowing for significantly faster journey times between St. Mary's and the off-islands, a 50% increase in cargo capacity, and will have a reduced fuel consumption of 55%.

"We worked with the Isles of Scilly in a very similar way to support the new development," Julien said. "The focus here, of course, was firmly on the logistics operation. Unlike the passenger vessel, which only operates part of the year, the cargo vessel operates all year round and is the only freight service to the Isles of Scilly. Although less glamorous than the passenger vessel, both the community and the Isles of Scilly Steamship have high expectations for these vessels. It is their lifeline."

Flexibility was the keyword in designing the cargo vessel, as cargo needs and types vary widely to support the summer tourism season, as compared to the colder months during the 'off-season' when it primarily serves local residents.

As the cargo vessel, too, was limited in its dimensions, BMT worked on a modular cargo layout, to handle the variation of cargo type during the year, including an increased capacity for frozen cargo without compromising the overall layout.

As for propulsion, on both vessels the environment, flexibility and 'future-proofing' the vessel were drivers, and a hybrid diesel electric configuration with ample battery capacity was the choice.

"In practice, this takes a form of a mechanical propulsion system," Julien said. "Here you're talking about the traditional shaft and propulsion and diesel engine. This system is then supported by an electric motor that can also act as a generator, and this electric side is then coupled to an energy storage solution, batteries. The system mix is the best use of each part of the system, to reduce fuel consumption overall."

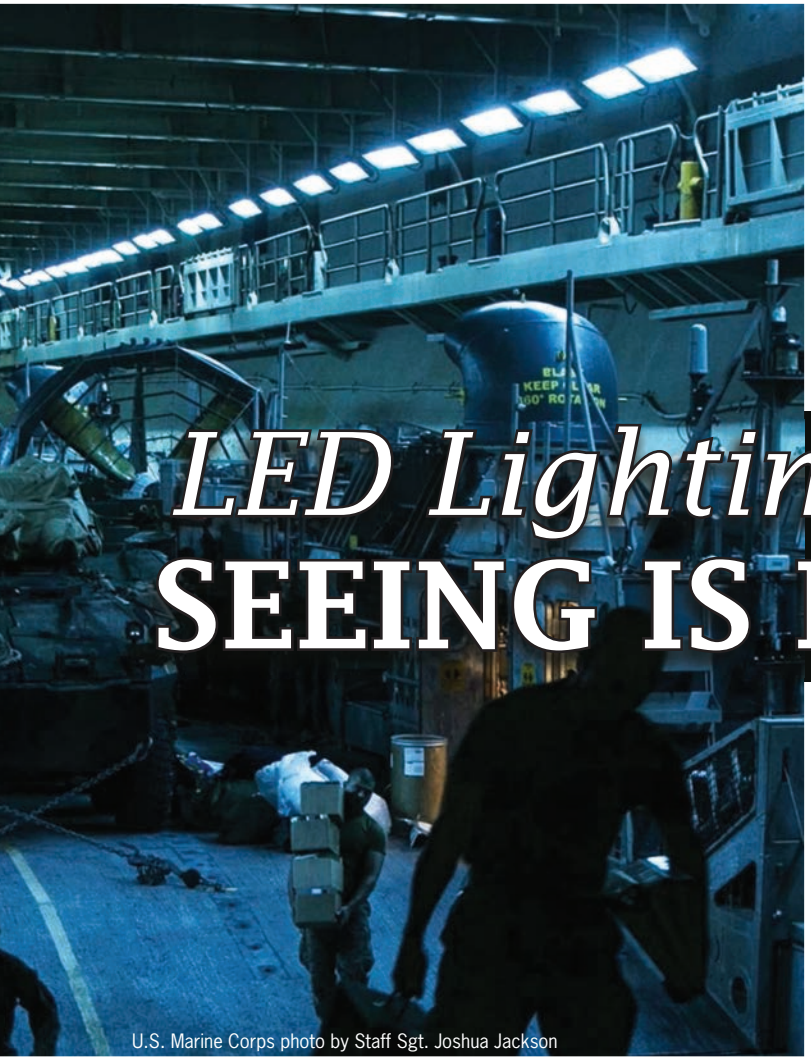
Importantly, it allows the vessels to be emissions free while at berth, relying on battery energy storage for power.

Second, and equally important, is future-proofing the vessel so that it is suitable for upcoming upgrades as the technology, the fuel and the shore infrastructure develops.

"The aim is to allow the vessel to continue enlarging its emissions free part of its operation, as throughout the life of the vessel," Julien said.

At press time, the owner, designer and shipbroker Blair Reid, were reaching out to more than 30 shipyards to identify potential build slots and cost.

U.S. Navy photo by Mass Communication Specialist 3rd Class Michael Duran



U.S. Marine Corps photo by Staff Sgt. Joshua Jackson

LED Lighting for Ships
SEEING IS BELIEVING

New Lighting Technology offers bright ideas for better interior and exterior lighting that saves money and manpower.

By Edward Lundquist

The U.S. Navy is leaving traditional lighting behind for Solid State Lighting (SSL) with very long-life solid-state light-emitting diode (LED) lighting. Technology has illuminated new ways to light ships that are safer, more efficient and more affordable. Taking advantage of the new technology has its challenges, such as finding cost effective lighting that is rugged enough to meet current Navy requirements and military specifications.

Lighting on Navy ships must deal with the harsh conditions of salt spray, dust, vibration and temperature extremes, power surges, and potentially shock and battle damage. While consumers have taken a shine to LED lighting in homes and offices, military and maritime lighting installations must be evaluated and certified.

Images above, right to left:
U.S. Marines unload gear from their vehicles in the well deck of the amphibious assault ship USS Essex (LHD 2).

The Military Sealift Command fleet replenishment oiler USNS Laramie (T-AO 203) conducts a replenishment at sea with the amphibious assault ship USS Peleliu (LHA 5).

Ben Hatch, in-service engineering subject matter expert at the Naval Surface Warfare Center Philadelphia Division, said new technologies are making many of the old lighting requirements and specifications obsolete.

Hatch said the Navy is trying to balance the importance of the existing specifications with the flexibility that new technologies like LED provide. “We don’t need to have the same size light fixtures anymore. We can make an LED array any size we want,” he said, citing one example.

Over the years we have pretty much standardized on a two-foot fluorescent lamp for overhead lighting. The fixtures, bulbs, starters and ballasts were interchangeable. But we’re basically limited by the variations of size and number of bulbs.

Glass incandescent and fluorescent bulbs haven’t changed much in the last 50 or 60 years. They’re fragile, and they shatter. New LED lights are sturdier.

There’s a real balance between trying to figure out which of the old ways of lighting are worth keeping and which of the new ones we should adopt. We’re trying to open it up for companies to show us new and different ways of lighting.

"We've proven that we can use LED on ships—they'll survive, and they'll work. Now we have to figure out how we want to do things differently than we have been doing with these options."

There are specific requirements for shipboard lighting, to include applicable industry standards and those issued by classification societies like ABS.

"You can't just put any light fixture or light on board a ship, said Christopher Nemarich, engineering manager for shipboard electrical systems- lighting and instrumentation (NAVSEA 05Z33). "All general purpose and task lighting that goes onboard a Navy ship must meet the requirements of MIL DTL 16377J, which was issued in 2014 and has its latest amendment in 2019, which covers fluorescent, incandescent and solid-state LED lighting, luminaires and parts used for general illumination on naval ships and submarines. The specifications don't tell industry how to make the lights; they specify what attributes those lights have to have. If they make a light that meets the requirements then maybe we'll buy it."

However, the specifications need to catch up with the state of technology. During the energy crisis in the 1970s the Navy replaced many incandescent lights with more efficient fluorescent tubes, so those specifications are now at least 40 years old. LED technology is evolving faster than the documentation can keep up with it.

Nemarich said the Navy still has the detailed specification sheets for overhead fluorescent lighting because there continues to be tens of thousands of fixtures in the fleet. But if a ship wants to replace some two-foot fluorescent fixtures with new LED lights, they can find another fixture that is going to bolt up to the same pattern and function in the same way. And while there are LED lights that can replace those fluorescent tube fixtures on a one-for-one basis, they are not limited to those linear lamps. "We are not confined to that linear format anymore. The commercial market has lighting of all shapes and sizes. The technology has just moved ahead so fast. Solid-state lighting was a revolution in the lighting industry. What you can buy today is a vast improvement from just 10 or 15 years ago, with many more options, and less cost. So, we want to make sure that the lighting we put on board ship meets our requirements," Nemarich said. "What we don't want to do is limit technological advances that the Navy could be taking advantage of."

While the Navy generally follows commercial standards, the Navy standards can be stricter. "There are certain things that you just can't get around. For example, you can't put a product on board ship that would give off a toxic gas if it burned. It also has to survive if the electrical shipboard power distribution

system experiences transients in the voltage, or an environment subject to electromagnetic and radio frequency interference.

Some solid-state light power supplies, called drivers, generate interference that which can affect sensitive electronics. "In your home, you can just move the light away from your TV, but on a ship, it could be more problematic," Nemarich said. "To make sure, we have to thoroughly test the lighting fixtures to ensure that they are not generating an unacceptable level of electromagnetic or radio frequency interference. And we have to ensure systems are grounded properly, have the appropriate shielding in, and use higher quality components that don't generate that noise level."

In many cases, it isn't necessary to change fixture. With 12-inch fluorescent bunk light fixtures in the berthing spaces, for example, the fluorescent tube can be replaced with an LED tube, and the ballast and starter can be removed. "We even provide the instructions for how rewire the fixture by removing the ballast and the starter--but it's not a requirement," said Nemarich.

Jason Farmer is part of Huntington Ingalls Industries research and technology group, looking for new technologies that improve ship classes and systems, and ways to reduce maintenance and sustainment costs, as well as energy consumption. One way to do that is through more efficient lighting that performs better. There are a number of requirements that we need for meet for each class of ship, including the levels of lighting and the specifications of fixtures that the system has to perform to. When we replace legacy incandescent and fluorescent systems, we have to change the components of the fixture and the voltage. The newer solid-state lighting last longer and consume less energy, and with that come multiple benefits when we're evaluating these newer technologies.

According to Farmer, legacy fluorescent tubes are fragile and prone to shatter, and there is a significant storage requirement for replacement and spent bulbs. "When you move to a LED based system, you're replacing them less often. And they're smaller, so you need a smaller footprint for those spare parts."

With the many existing interior 2- and 4-foot fluorescent fixtures in place on ships today, new LED lights are being made to fit those fixtures. Exterior fixtures are different, with many topside lights being incandescent bulbs sealed inside a glass globe with a metal grate to protect the light from impact and moisture.

While LED products have become readily available, home or even industrial lighting are unlikely to be unsuitable for maritime applications, and will not deliver the desire benefits of LED lighting.

"Exterior lights are only considered 'marine grade' when

Military Sealift Command hospital ship USNS Mercy's (T-AH 19) sits anchored off the coast of Trincomolee, Sri Lanka in support of Pacific Partnership 2018 (PP18), April 26, 2018.

U.S. Navy photo

they have been designed and engineered specifically for the rigors of the marine environment. They should operate within a wide -40C to +50C ambient temperature range and withstand corrosive marine conditions and constant shock and vibration.," said Ryan Hertel of Milwaukee-based Phoenix Lighting. "Most exterior lights promoted in the market today do not meet those requirements, and will never reach their rated lifespans. Installation of these unproven fixtures will ultimately cost the user more to repair or replace when compared to a purpose-built marine-grade LED fixture."

Profound Knowledge

Somebody who actually has to change a light bulb has profound knowledge on the subject, especially if they have to change hundreds or thousands of them.

Mark Richards is a port engineer for TOTE Services, responsible for two 40,000-ton MARAD SL7 strategic sealift Con-Ro ships in the Ready Reserve Fleet, SS Regulus and SS Pollux, currently based in Beaumont, Texas. "I'm not a lighting engineer; I'm an end user. But my ships have a lot of lights, and I've learned a lot in the past few years about what the new technologies can and cannot do."

"Our ships are in a reduced crew status," Richards said. "I could use two of my people to do nothing but change bulbs all day long. When they're done doing that, they have to start all over again. Now, with our LED lights, we improve the lighting on the ship, save energy, and can cut way back on maintenance. We don't have to store thousands of bulbs on board, or deal with the disposal of the hazardous waste.

"We have a lot of lights that are very inaccessible, so we've prioritized the renewal of those lights with LEDs. We've already converted a large number of spaces because once we replace them, they will last a very long time. I can't say how long, because we haven't had to replace them. But it's been several years and I haven't had to change an LED fixture that we have installed. If you walk into a space where we've installed all LED lighting and compare it to one that we haven't converted yet, the old lighting makes those spaces look like dungeons. It's such a noticeable difference."

Richards said any additional costs for LED lights makes sense in the long run. "Generally, in marine applications, when you spend a little bit more money for something of higher quality like LED lighting, in the long run it saves when money not only when you consider the cost of replacing incandescent/fluorescent bulbs, disposing of them but the labor costs associated with that continual effort and maintaining the fixtures themselves. I would prefer to deal an issue once the right way and not have to come back to it again. Once most LED lights are installed, they are basically 'hands off.'"

The safety factor also has financial implications. Better lighting saves lives, not to mention lawsuits or workman's comp cases. "How many lawsuits have you seen where somebody says, 'It was too dark, I couldn't see really well.' Whatever money you were trying to save on cheap lighting solutions or turning off lights to conserve power and save money, goes over the side when somebody trips and falls and ends up in the hospital. You just lost everything you were trying to save. Good lighting absolutely improves both safety and productivity."

Powerful Benefits

According to Gary McKerrow, a senior project engineer at Fincantieri Marinette Marine Corp., designing ships for legacy lighting systems have well understood challenges. Using LED lighting offers new challenges and opportunities.

For example, LED lights have vastly reduced power requirements, so shipboard electrical systems can be designed in new and different ways. Half of the power going to an incandescent or fluorescent bulb is radiated as heat, which affects the calculations of your airflow in order to keep spaces at the desired temperature. LED heat is negligible, so you need less cooling and air circulation, both of which take up space, weight and power, and that can translate to a decrease in fuel consumption and an increase in endurance. "You don't have to run your generators so hard," McKerrow said. "You can expect as much as three percent more endurance, which is significant during a long deployment.

FMC: Ocean Shipping Challenges Abound

Photo courtesy Port of Los Angeles

Supply chain issues tied to liner shipping have been front page news throughout 2021; just about everyone agrees that there's a problem. The underlying cause is right out of Economics 101: a surge in demand for moving containerized cargo, in the face of "inelastic" throughput capacity (which includes vessels and their landside interfaces to surface transportation, trucks and rail) that could not handle the swell, attributable to re-stocking of containerized cargo as economic activity recovered from the pandemic induced jolts.

By Barry Parker

Gordon Downes, the Chief Executive Officer of New York Shipping Exchange (NYSHEX), told *Maritime Reporter & Engineering News* "Like most markets, the price of container shipping is determined by supply and demand. Container shipping has long been characterized by notoriously volatile prices primarily due to significant variations in demand, with supply being relatively stable. But the extreme volatility we have seen in the container market recently is completely unprecedented, and it is being driven by supply constraints coinciding with a surge in demand. This is a normal free-market response to external 'shocks'…"

Gene Seroka, Executive Director at the Port of Los Angeles, a frequent and highly quotable spokesperson on the ongoing crunch, analogized the situation at his port in a mid-August press briefing as: "…squeezing 10 lanes of freeway traffic into five lanes."

At the time of Mr. Seroka's remarks, dwell times for boxes at the port (in warehouses, or on trucks or at rail sidings) were increasing, and the numbers of vessels anchored and waiting for berths in the port were climbing towards levels not seen since late winter. In late Spring and early Summer, 2021, port officials at Los Angeles and at neighboring Long Beach had been touting reduced waiting times at anchorage, and for boxes on the landside. By later Summer, disruptions at Asian ports- notably Yantian and Ningbo, and the seasonal volume build, had reversed these improvements.

Congestion on the West Coast has motivated cargo interests to shift their Asian-origin imports to the East Coast. John McCown, a long-time container industry executive (who once worked alongside the legendary Malcom McLean), noted in his August 2021 edition of the McCown Container Report, that "Inbound volume growth rates have peaked … July saw a dichotomy between the West Coast [up 3.9% year on year] and East/Gulf Coast port ranges [up 27.7% … I suspect that routing choices by shippers are the key driver in recent East/Gulf Coast over performance."

After noting the disparaging reports of West Coast congestion, he said that: "These decisions are made easier by the fact that linehaul transportation costs of moving containers to most eastern points are irrefutably lower with all or more water vessel service to the East Coast compared to rail intermodal service via the West Coast." These observations are borne out by a look at the maps on MarineTraffic.com and similar online platforms; in late August, more than a dozen liners were waiting outside Savannah, Georgia.

"Data is always important and there are still many further efficiencies to be gained in coming up with even better digital twins of the still too paper intensive worldwide container system. **That said, that system is moving 1.2 trillion TEU-miles of freight annually and that requires hard assets. The actual heavy lifting can't be done on the internet."**

John McCown, Shipping Executive, Author of ***"Giants of the Sea"***

The Politicians Get Involved

Though cargo interests and carriers have created "hands on" fixes to difficulties in moving goods, for example Home Depot and Walmart chartering vessels, or CMA-CGM running freighters in the skies, the search for solutions has attracted the attention of politicians, and has devolved into finger-pointing, as well.

The cargo interests and carriers staked out their opposing positions in early August. Responding to the concerns of U.S. exporters in the agricultural trades who had experienced difficulties in securing container capacity during the ongoing supply chain disruptions, Republican Congressman Dusty Johnson (South Dakota) and Democrat John Garamendi (California) introduced the Ocean Shipping Reform Act of 2021 (OSRA 2021), into the House of Representatives. On a call just prior to the bill's introduction, Garamendi explained the bill's main objectives; these include minimum requirements for service contracts and anti-retaliation provisions in the event of complaints by a cargo shipper.

The bill would beef up the enforcement powers of the Federal Maritime Commission (FMC) to initiate investigations into demurrage and detention issues (frequent subjects of complaints from shippers) but also anti-competitive practices. Paradoxically, the successes of the carriers in managing capacity as demand plummeted during Spring, 2020, have put them in the regulatory cross-hairs. Through the ability to cancel scheduled sailings (known as "blanking") and slow steaming, the lines were able to maintain their pricing and avoid the historical racing to the bottom in efforts to fill up ships. In explaining the rationale for OSRA 2021, Congressman Johnson (who was involved in regulation of utilities prior to serving in Congress) was quick to point to the increased market concentration in the liner business, with the top 10 carriers controlling more than 80% of capacity.

As drafts of the OSRA 2021 legislation were being circulated in early August, the Washington, D.C. based World Shipping Council (WSC), providing a voice on Capitol Hill for the top international liner carriers serving the United States, quickly responded. In its brief, WSC offered three major objections to OSRA 2021; refuting the inference that "… ocean carriers are solely responsible for the current supply chain congestion", disputing the suggestion " that existing legislation is infused with fundamental unfairness", and asserting that " the bill ignores the fact that all supply chain participants are working collaboratively to find solutions to today's problems." It went on to stress that: "Supply chain participants including ports, carriers, labor, marine terminal operators, rail, truckers, chassis providers and shippers are collaboratively working to find operational solutions to increase efficiency and cargo velocity."

Containerized cargo was already on the radar in Washington, D.C. even prior to the introduction of OSRA 2021. The Biden administration had included liner shipping in an early July Executive Order (EO) titled *"Promoting Competition in the American Economy"*, imploring the FMC to take a hard look at the ongoing sources of complaints from the cargo side. The FMC was also encouraged to work closely with the Department of Justice (DOJ) in reviewing potential antitrust issues. Around the same time, President Joe Biden launched a Supply Chain Task Force (the result of a review initiated a month after his inauguration) headed up by the Secretaries of Commerce, Transportation, and Agriculture. While shipping is not mentioned specifically, the White House states that: "The

Containership assist docking at Port of Los Angeles.

Photo courtesy Port of Los Angeles

Punch and Counterpunch

In the week just prior to the introduction of OSRA 2021, the carriers and shippers were already jousting. Shortly after a late July announcement from the FMC that it would be examining the actions of nine large carriers serving U.S. markets concerning detention and demurrage charges, a Pennsylvania-based furniture importer filed a complaint with the agency claiming market manipulation by two carriers (MSC and Cosco), seeking some $600,000 in damages. At issue was the furniture shipper's inability to source freight under service contracts it had signed with the carrier. After the complaint was revealed in early August, MSC fired back, expressing "shock" at the accusations on allocating space under contracts, as well as further accusations of collusion among the liner carriers (with the complaint referencing the policy of blanking sailings during the tough days in Spring, 2020).

Readers can decide for themselves:

https://www2.fmc.gov/readingroom/proceeding/21-05/
(first document is the actual complaint)

https://www.msc.com/bwa/press/press-releases/2021-august/mcs-industries-shipper-complaint

Photo courtesy Port of Los Angeles

Technology on the Horizon

Technologies are a handmaiden of logistics- in recent years, as digitalization has impacted both the operational side of shipping but also the commercial side: booking freight, handling payments and documentation. Importantly, the largest ports have recognized the need to handle information, as well as cargo. Rotterdam, with 14.8 million TEU throughput in 2019, has been at the forefront of efforts to bring artificial intelligence to the management of port operations. Los Angeles- on track to move a record nearly 11 million TEU in 2021, has announced that it will be sharing data from its Port Optimizer data management platform with the FMC, as the agency looks at removing supply chain bottlenecks. The port's Executive Director, Gene Seroka, has long championed the idea of a nationwide port information system. Across San Pedro Bay, the Long Beach Container Terminal (a one time OOCL facility) has now been completed after a multi-year construction project. With low emission electric equipment, the partially automated facility has been described as "… a state-of-the-art terminal, one of the wonders of the maritime industry," according to Mario Cordero, the port's Executive Director- who served as Chairman of the FMC during 2013 to 2017.

NYSHEX's Gordon Downes noted that: "There are many examples where technology can improve efficiencies and help both carriers and shippers perform better. One example is where both shippers and carriers leverage technology and data to more accurately forecast future supply and future demand, then it is possible for carriers adjust their service networks to better meet the demand, and potentially for shippers to adjust their supply chains to avoid bottle necks and constraints etc. At NYSHEX we are developing technology that helps our shipper and carrier members to better anticipate changes in future supply and demand."

John McCown reminded ***Maritime Reporter*** about the nuts and bolts of moving cargo, saying: "Data is always important and there are still many further efficiencies to be gained in coming up with even better digital twins of the still too paper intensive worldwide container system. That being said, that system is moving 1.2 trillion TEU-miles of freight annually and that requires hard assets. The actual heavy lifting can't be done on the internet."

U.S. government must implement a comprehensive strategy to push back on unfair foreign competition that erodes the resilience of U.S. critical supply chains and industries."

OSRA 2021 was driven by difficulties in securing "empties" for export cargo back to Asia, seemingly one aspect of a far broader set of issues, albeit a great source of inefficiencies. Indeed, Los Angeles's Gene Seroka, in his recent remarks, noted that: "Our largest export commodity continues to be air as we reposition empty containers back to Asia." While there have been loud complaints from the cargo side, the carriers also face uncertainties in planning for future loads as cargo customers adjust their programs. Gordon Downes, from NYSHEX, tells *Maritime Reporter:* "What carriers and shippers really need is the ability to make enforceable contracts, where both parties are committed to the terms of the contract. Of course, carriers and shippers should always have a choice, either to lock in a price and service level to "hedge" against the volatility, or to 'ride' the market. NYSHEX provides a digital mechanism that enables carriers and shippers to lock in through 2-way committed contracts that are always fair to both parties."

All of the dialogue has occurred at a time of bigger vessels. In discussing broad solutions to the supply chain crises, John McCown stressed that the vessels themselves, which now top out around 24,000 TEU with recent newbuilds (such as HMM's HMM Algeciras, Evergreen's Ever Ace, MSC's Gülsün class vessels and the 23,000 TEU LNG-fueled vessels being deployed by CMA-CGM) "… deliver extraordinary efficiencies and can access many ports directly…" (unlike the dinosaur-like ULCCs which failed in the tanker trades). McCown, author of the book *Giants of the Sea*, told *Maritime Reporter,* "Recent events demonstrate that bottlenecks have occurred … but these efficient vessels are not the problem and our gaze should be focused elsewhere." Commenting on regulatory issues, including OSRA 2021, he said: "Shipping is a cyclical business and things should be looked at in terms of impact over the entire cycle. While any abuses need to be checked, circumspection is in order for changes directed at temporary issues that the market will correct."

Carrier and Tonnage Provider Stocks

Through share purchases in listed carriers, or tonnage providers (shipowners who charter their vessels to the carriers), investors who climbed aboard in late 2020, and into early 2021, have been able to reap large gains as these shares out-paced the broader market. Stocks that U.S. investors can trade include: ZIM ("ZIM", carrier), Danaos ("DAC", tonnage provider), Atlas Corporation ("ATCO", parent of tonnage provider Seaspan Corp.) and Costamare ("CMRE", tonnage provider). In a mid August research report covering ZIM, Jefferies and Co. shipping equities analyst Randy Giveans wrote: "Container freight rates and containership charter rates have climbed higher throughout the year as demand for containerized goods, especially in the US and Europe, remains robust, availability of spot vessels remains constrained, and persistent congestion is removing effective supply from the market. The Shanghai Containerized Freight Index is up over 50% year to date to an all-time high of $4,282/TEU last week... We expect rates to remain very robust through 2021 and well into 2022." In an early August report on DAC, Mr. Giveans highlighted the dynamic of carriers chartering in vessels from tonnage providers, saying: "…charterers are currently booking vessels further in advance and for longer durations of 3-4 years." John McCown, in his report estimates that in Q1 2021, the carriers earned a record setting aggregate $19.1 billion, a mark likely to be exceeded once all the Q2 results are available.

MARINE BIOFOULING IN PORTS

Wet Docks acting as 'Hot Spot' biofouling transfer stations.

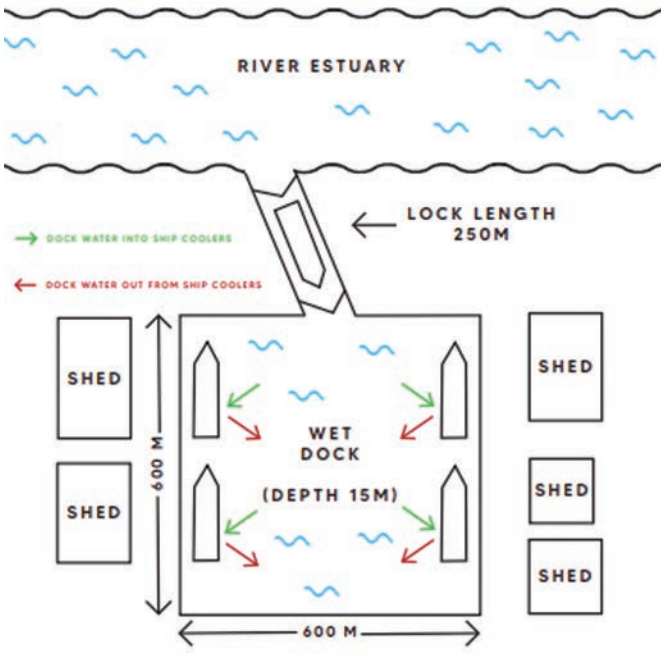
By David Smith

The GEF-UNDP-IMO Glofouling partnership (2017) is a global initiative to counter the environmental issue of invasive aquatic species (IAS) and the resulting harmful ecological and financial damage that can occur when such invasion events are introduced through the medium of biofouling on ships hulls and other marine structures such as those found in the oil and gas industries.

One of the key objectives of the Glofouling project is to develop a Global Knowledge Hub and also identify areas where current information may be lacking but is relevant to the understanding of how IAS is transported via biofouling in ships at both local and international level.

One such knowledge gap is where enclosed wet docks may provide an enhanced haven and vector platform for IAS to relocate between ships at berths within the facility. The nature of such a transfer phenomenon is briefly described in this article along with some potential mitigation measures that vessels or ports may employ to reduce the perceived threat.

Figure 1
Typical Wet Dock arrangement



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Vessels arriving in ports from other bioregions can introduce an extensive range of potentially invasive aquatic species via the medium of the accumulated biofouling carried on their hulls and other underwater appendages (miller et al, 2018).

To determine the level of this hazard posed by shipping in particular ports, there has been some work done to develop risk assessment methodologies which can be utilized to quantify the biosecurity danger; such as that described by the Australian Department of Agriculture, Fisheries and Forest (DAFF, 2011) which analyzes the factors determining port inoculation events.

When considering the possibility of biofouling species transfers within a port, the local hydrodynamic environment has been identified as a factor which can magnify the intensity of fouling both on substrates such as the harbor structures and also on the hulls of vessels visiting the port. The influence of port features such as breakwaters, berthing arrangements and confined entrance channels all have an effect on tidal flushing and the potential consequent accumulation of viable propagules for biofouling transmission (Floerl and Inglis, 2003).

Wet Docks are port facilities where the water is enclosed and kept at a certain level to allow for the loading and unloading of ships. A representative wet dock arrangement is shown in Figure 1. Such docks are often found upstream in rivers and allow for ship cargo operations to take place near hinterland industrial areas, regardless of tidal constraints. They provide sheltered conditions where a ship can remain afloat at all times. Ship access to the dock is via a lock system fitted with sealing gates and pumps to regulate the lock water level from the external tide height to that of the operational depth of the dock.

Once berthed within such a dock, conventional transfers of hull biofouling organisms may occur through the deposit into the dock water of detached biological material as a result of physical contact with Tugs and berth fenders or the spontaneous release of fertilized cells arising from other stimuli such as temperature and salinity changes (Minchin and Gollasch, 2003).

Due to the nature of water enclosure in a wet dock, it is suggested that this may represent a significant increase of biofouling risk as opposed to ports which are open to sea or river

environments. There appears to be a lack of study concerning the biofouling transfer mechanisms within such enclosed port areas. An area of particular note is the possible effect of a ships cooling water system in these docks and the consequent potential for berthed ships to more rapidly exchange different biofouling species within the confines of the dock itself.

While hull surfaces are a commonly acknowledged transport pathway for biofouling and IAS, there have also been studies carried out to highlight the biofouling accrued by ships in their internal sea water cooling systems and the enhanced biosecurity risk that this may also represent (Growcott et al, 2016).

For ships, external sea or dock water is used as a cooling source for the main and auxiliary engines via an internal heat exchanger system (Jones and Little 1990).

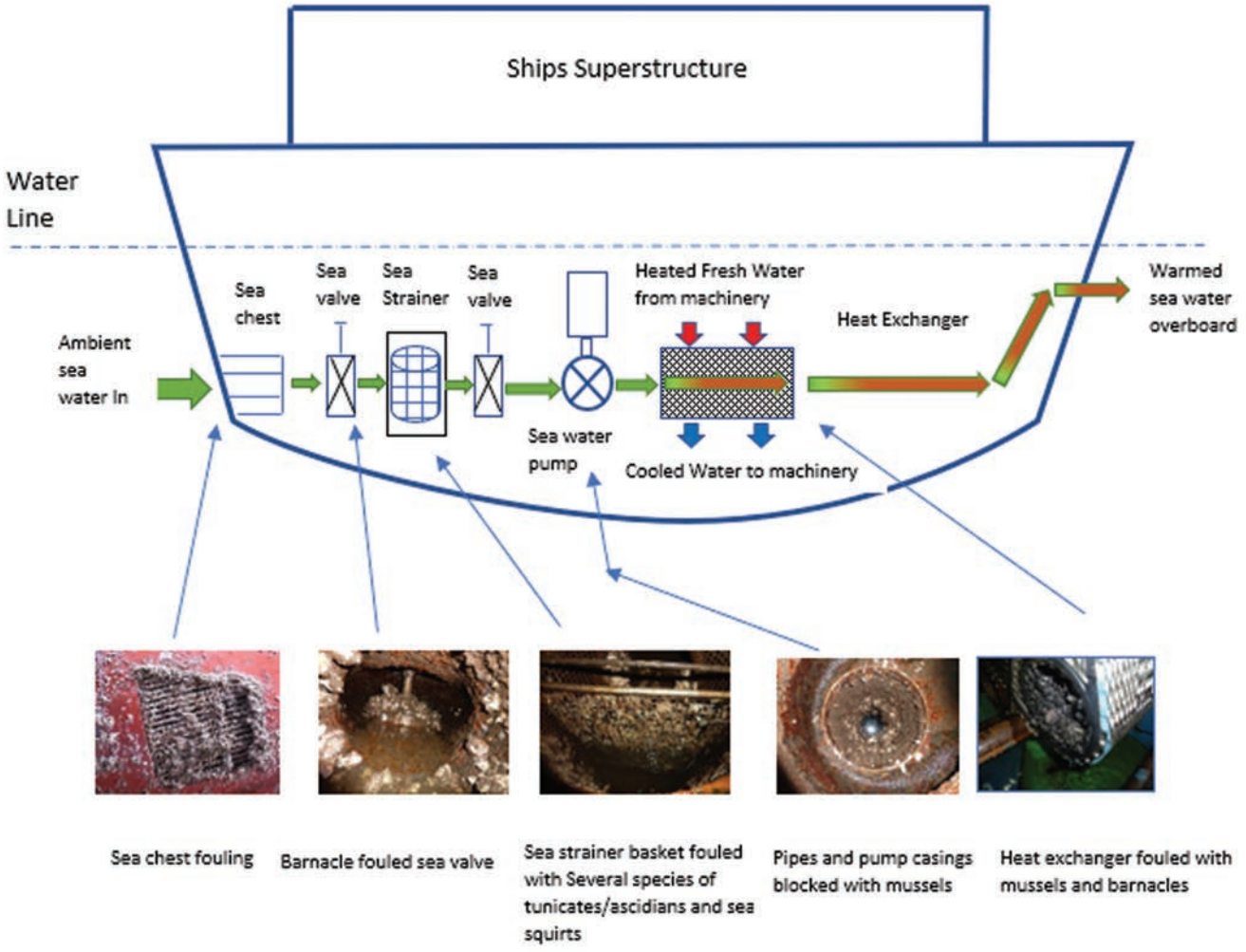
A simplified schematic of a sea water cooling system and its principal components is shown in Figure 2.

For a ship berthed in a wet dock, incoming dock water at ambient temperature enters the cooling system via the sea chest and strainer. The sea water circulating pump creates a rapid flow of cooling water to the heat exchanger. The heat exchanger contains heated fresh water arriving in a closed circuit from the various items of machinery on board such as diesel engines, oil coolers and refrigeration plant. Dock water is passed through the exchanger in sealed tubes or plates and comes into contact with the surrounding heated fresh water circuit. The heat is transferred to the pumped dock water as it passes through the exchanger. The cooled fresh water is then returned to the machinery distribution arrangement whilst the heated dock water is passed overboard back to the dock again.

The cooling systems are often fitted with internal biofouling growth prevention measures but, as can be seen from the photos in Figure 2, they are not always effective in removing

Figure 2

Ships Sea Water Cooling System Components



all the biofouling accumulation.

To realize the potential scale of the cooling water biofouling issue related to ships in wet docks, the temporal volumes of cooling water that ships can take up and discharge in the dock need to be considered:

With regard to larger vessels in the region of 200 metres in length (as represented in Figure 1), while the main engines would not be running in the dock, there could still be a considerable cooling water demand for extra generator power requirements associated with cargo handling, etc. For the purpose of demonstration and subject to vessel type, an estimate for a vessel of this size in port could involve pumping through some 450 cu. m./hr. of water from the dock into the internal cooling system and back out into the dock.

The total stored water capacity of the representative dock in Figure 1, with an operating depth of 15 meters, would be in the region of 5,400,000 cu. m. of dock water. Thus, with five ships in the port exchanging a total of approximately 54,000 cu. m. of dock water in every 24 hours, around 10% of the total water available is being processed daily through the berthed ships cooling water systems. This represents a substantial quantity of circulated dock water, which has the potential to double every day that the vessels remain in port.

This mass rotation of shared dock water, with each vessel vacuuming up 450 cu. m. of dock water every hour, passing it over all the possibly fouled internal components of the cooling system, warming it up and then ejecting it back into the dock, as shown in Figure 1, may represent a considerably enhanced biosecurity risk. Once again, detachment of material or spawning events within the cooling system will increase the propagule pressure within the wet dock water mass.

Further to this, given that different species may have been brought into the dock by vessels from varying geographical regions, the enclosed dock and the circulating gyres of warmed dock water created by the berthed vessels cooling water pumps introduce the prospect of each vessel more rapidly sharing its biological load with others and departing the port having been duly seeded with additional species.

It is recognized that the use of the entrance lock facility may result in some exchange of dock water with the adjacent river estuary or coastal region as would water quality supervision through the use of pumps to exchange water or allowing 'free flow' of river water through the locks for limited periods when tidal constraints allow.

When considering the potential mitigation measures to reduce this latent risk of biofouling and hence IAS transfer when ships are berthed in Wet Docks, the following can be considered:

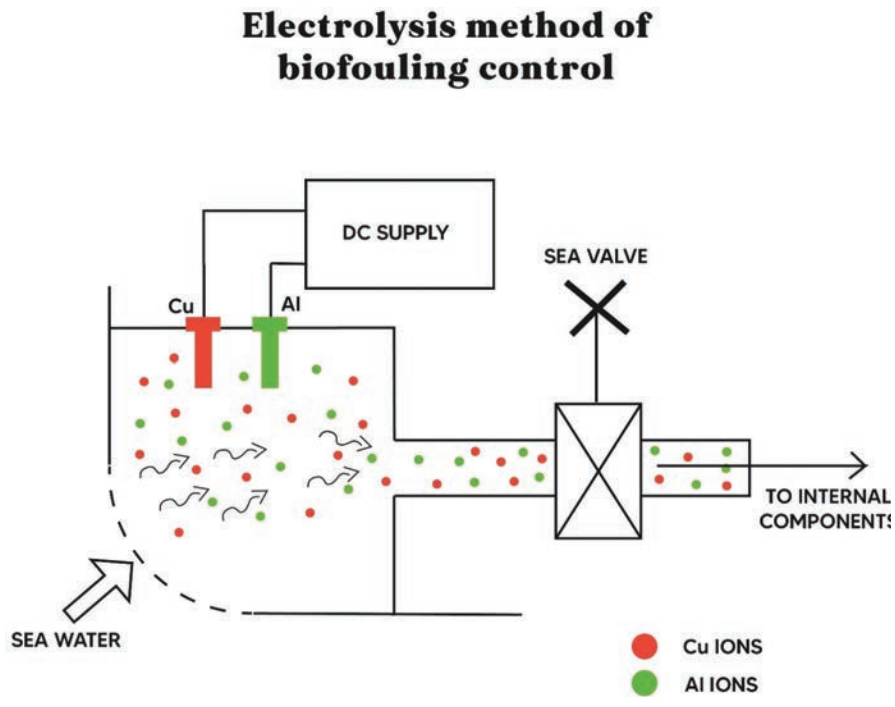
The biofouling of the internal components of a ship cooling water system has been traditionally addressed by the use of biocidal agents such as copper ions produced by electrically fed anodes in the sea chest as shown in Figure 3 or the direct injection of low concentrations of cleansing chemicals such as sodium hypochlorite either supplied to the ship in bulk drums or produced by electrolysis systems on board.

A typical anode system will employ Copper ions for biofouling control and Aluminium ions for corrosion control. Whilst these methods can be successful if maintained correctly, they may have some deleterious effects by passing their low concentration toxic substances overboard into the receiving dock water, potentially affecting other untargeted organisms in the vicinity.

The undesired chemical side effects of these biocidal type systems and their questionable environmental standing has resulted in the development of more ecologically responsive solutions such as those employing the use of fit-

Figure 3

Typical Copper Anode arrangement fitted to a ship's sea chest



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ted transducers, as shown in Figure 4. These are designed to transmit Ultra Sonic Frequencies, creating non-inertial cavitation which is designed to destroy the biofouling organisms within the cooling system in a localized manner without the use of potentially harmful compounds. It is worthy to note that the use of this ultrasonic technology is not limited to sea water cooling systems and has been employed to counter marine biofouling in other areas of a ship such as on propellors and rudders

Given the large quantity of cooling water that is taken up and discharged by the cooling pumps fitted to a ship, it is often the case that the cooling water pump capacity may be set at a fixed rate to accommodate all the calculated heat exchange requirements when the vessel is at sea with her main engines and all other associated machinery running.

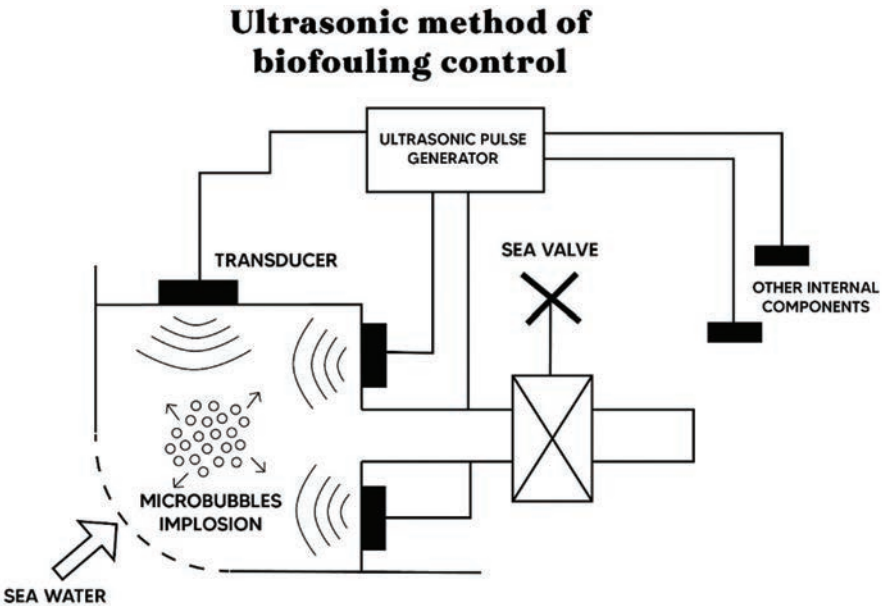
When in a wet dock, it may be useful to be able to control the pump speed directly to reduce the throughput of cooling water rather than using a by-pass system to alter the water flow to the heat exchanger. Investigative work by Theotokas (2017) showed that the use of variable speed pumps (VSP) for the cooling systems could not only reduce the annual power consumption of a ship but also increase system performance by closer control of key temperature parameters. Another advantage of using VSP in this case would be the reduced volume of water being circulated between ships in a wet dock and hence a lower risk of IAS spread within the dock.

Possibly the most effective measure to combat the movement of IAS within a wet dock and indeed at any port facility would be not to use the ships machinery to generate electrical power when at a berth but instead use a shore electrical supply. This technology is termed 'Cold Ironing' and was first introduced several years ago as a measure to reduce Greenhouse Gas Emissions by ships in port. By effectively removing the demand for generated power, the need for significant quantities of cooling water is also removed and the cooling water pumps may be stopped altogether subject to vessel design. This would significantly reduce the risk of IAS transfer from the cooling water system. This technology is now available in several North America and European Ports and is growing in use.

It is noted that wet docks offering communal berths for ships have a clear potential to act as 'hot spots' for the transfer of biofouling species. A more detailed understanding of the complexity of wet dock biological mechanisms, with a particular reference to the influence of ship processes, could assist with more effective port environmental management, reduce the risk of IAS transmission and assist with the compliance with other regulatory demands such as water quality directives.

Figure 4

Ultrasonic Transducer arrangement fitted to a ship's sea chest



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Chile's Constitutional Future: *What it means for shipping*

By Felipe Simian, CEO, Nachipa

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Felipe Simian, a third-generation shipowner and ship operator of Handysizes from Chile, reflects on his country's recent social upheaval, and its maritime possibilities. Chile has long been a major dry bulk exporter, but Simian believes that focusing on a new generation of natural resources could make it a much more regular port of call for containers and tankers too.

The results of May's constitutional election in Chile are clear: a rejection of politics as usual and a rejection of the politicians who have left Chile in its current state. Chileans have voted for change and it is time for those who were elected to work together to create a constitution that reinforces democracy, provides legal fairness, and supports Chile's development and growth.

This process has had a bumpy start, nevertheless most Chileans have high hopes for our new constitution and for the sake of our country this process needs to work. We must trust in a positive outcome and respect the historic moment we are having.

However, unless there is open dialogue, rational approach, and the result is politically inclusive, the constitutional assembly is likely to create a divisive text that will not be ratified.

The Wealth of Chile

We have more than 6,400 kilometres of coast bordering the Pacific and Atlantic oceans, a fishing fleet of approximately 14,000 vessels and a seafood

sector that employs nearly 170,000 people. Moreover, with more than 40% of Chile's waters – bigger than Colombia's land area – in marine protection areas we are a world leader in ocean safeguarding.

We are also home to an abundance of commodities. Everyone knows how valuable copper, timber, and precious metals are to Chile's economy. But our future prosperity may lie in different natural resources. In almost every region Chile has been blessed with the potential for enormous renewable energy wealth.

The Atacama desert gets clear skies for more than 350 days a year on average, and northern Chile has the highest solar incidence of anywhere in the world; we have huge forests in the Coastal and Andean mountain ranges for biomass; and as home to 15% of the world's volcanoes we have enormous geothermal potential in regions like Antofagasta.

Any country would be happy with that, but Chile has more. We have huge hydropower resources in places like Maule and Bío Bío, that already produce half of our total electricity generation, and our huge, windswept coastline puts us in pole position to become as important to the 21st century's green economy as the Middle East was to the 20th century's hydrocarbon economy.

Yet even with all of this Chile was an oil import-dependent country for most of the 20th century, and often paid the highest power rates in Latin America. Chile must never go back to that era. Now is the time to look forward and realise the potential Chile has to create a fairer, cleaner, and more prosperous nation.

Chile's Maritime Future

The economies with the biggest manufacturing sectors are located in regions with the cheapest labour. In the coming decades as automation increases and clean power becomes a priority, it is likely that factories will move closest to the places that can provide low-cost green energy. Should that happen, we would see huge growth in the container shipping market and the creation of thousands of well-compensated maritime jobs.

We can achieve carbon neutrality domestically and capitalise on this foreseeable trend for nearshoring. When the Economist Intelligence Unit evaluated the potential of South American countries to compete with supply chains based in Asia, Chile won the silver medal and scored particularly highly for Political Effectiveness, Foreign Direct Investment Policy, and Foreign Exchange & Exchange Controls. It is vitally important that the new constitution doesn't undermine these competitive advantages.

Chile's green energy also has the potential to make its mining and commodities industries much more attractive as exports because it can hugely eliminate their direct emissions and reduce – and potentially eliminate – many of their indirect emissions.

As part of this Chile can become the world's lowest-cost producer of green hydrogen, i.e. water electrolysis powered by solar, wind or other renewable sources. According to calculations by the Environmental Defense Fund and Ricardo Energy & Environment, it would only require "Four electrofuels plants with dedicated renewable facilities located adjacent to the port of Mejillones to provide fuel to 730 mid-size vessels per year, or about 10% of the fuel demand for ships visiting Chile's ports in 2018."

Furthermore, "Supplying clean electrofuels for all ships departing Chile's ports could unlock an estimated $65-90 billions of investment in clean infrastructure – and turn Chile into a marine fuels and supply chain hub." These clean sources of energy have the potential to rival the $30-40 billions that the copper sector creates for Chile's economy each year, and turn it into a global leader and maritime hub to rival Singapore.

It was enormously encouraging to recently see our Ministry of Energy sign an MoU with the Port of Rotterdam Authority – Europe's largest and busiest port – regarding the export of green hydrogen to it. We must ensure that this is only the first step and not the end of the road for this development. Our current situation is the perfect time to ensure that we create the conditions for these nascent industries to thrive and provide the foundations for the prosperity of generations of Chileans.

To do that we must continue to improve our infrastructure and talent development, and ensure legal, political, and economic stability. We have a great opportunity in front of us to overcome climate change, the energy transition, and make our country more prosperous. Let's work together to make it happen.

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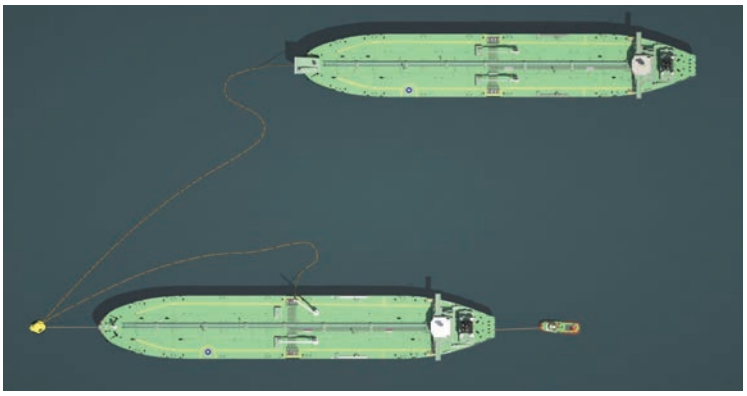

SafeSTS

'Green Tech' for Ship-to-Ship Transfers

A new ship-to-ship cargo transfer system has been developed and patented by SafeSTS for the Dynamic Positioning (DP) shuttle tankers sector. It is designed to provide increased flexibility and efficiency for the export of oil from offshore fields in the challenging offshore environments. The SafeSTS Transfer Via buoy Terminal (TVB) is designed to enable export tankers to load or discharge at a single point mooring (SPM) type terminal, with the DP shuttle tankers discharging in DP mode while keeping at a pre-determined distance of circa 150 meters from the export tanker.

In the event of squalls or other environmental events, system stability is provided by the export tanker hold-back tug, whilst the DP shuttle tanker independently holds station in relation to the export tanker. The TVB Terminal has no subsea structure apart from anchors and chains, and with the dual-carcass floating hoses containing the oil always visible on the surface, regular maintenance and inspection is easily conducted without the use of specialist underwater personnel and equipment.

The TVB Terminal can be located close to the production fields to provide both exceptional operational availability and increased commercial and environmental capability.

www.safests.com

Wärtsilä Regas System for India LNG Terminal

Wärtsilä will develop the regasification system for a new offshore LNG terminal to be built in the Bay of Bengal. The project is headed by Crown LNG, a Norwegian group specialising in developing LNG infrastructure for harsh weather conditions, with Oslo-based engineering company Aker Solutions as the main contractor. Wärtsilä Gas Solutions will conduct the front-end engineering and design (FEED) of the regasification system. The terminal will sit on the seabed approximately 19 km north-east of Kakinada on India's east coast, approximately 11 km from the shoreline. The Wärtsilä system will serve the terminal with an annual regasification capacity of 7.2 million metric tonnes, and will include the boil-off gas (BOG) handling and fuel gas systems.

www.wartsila.com

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Odfjell Oceanwind WindGrid Floating Power

DNV completed a concept verification review of Odfjell Oceanwind's WindGrid system for Mobile Offshore Wind Units (MOWUs). DNV's review confirms the technical feasibility of the WindGrid system, and that expected reductions in CO2-emissions for North Sea applications are in the range of 60-70%, compared to generation of electricity from conventional gas turbines. Odfjell's WindGrid is a solution for providing an uninterrupted power supply from Mobile Offshore Wind Units (MOWUs) to micro-grids. It combines energy storage, grid converters and floating wind turbines in order to enable gas turbine generators to be shut down during peak wind power production.

www.oceanwind.no/about

DNV/Odfjell

© Wärtsilä Corporation

New Propulsion Arrangement Designed to help 'Future Proof' Ships

Wärtsilä and RINA announced a 'novel propulsion arrangement' that is designed to offer the benefits of full redundancy, less machinery, lower capital expenditure, reduced operational complexity and optimized fuel consumption. The conventional approach in ship design has been to use two-stroke engines for propulsion and four-stroke engines for electric power generation. The Wärtsilä/RINA arrangement requires just two four-stroke dual-fuel (DF) engines, with options for electric power back-up from batteries or a small DF generator when the ship is idle. According to the manufacturer and the class society, the design can achieve a reduction of up to 50 percent from the Energy Efficiency Design Index (EEDI) reference level value, and immediate compliance with the IMO's 2030 targets. Highlights of the system include:

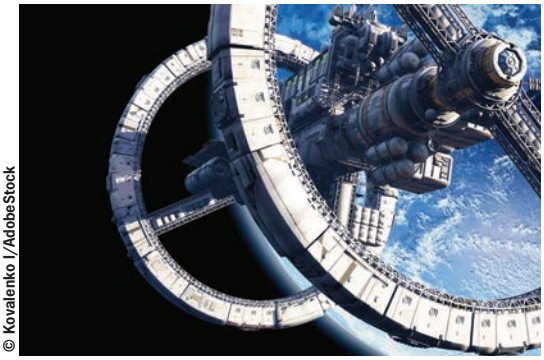
- Single engine needed for both propulsion and electric power
- Ship design EEDI value can be lowered by up to 50 percent
- Immediate compliance with IMO 2030 targets

www.wartsila.com

Space Tech Meet Maritime

A pioneering project to adapt technology developed for use in space to maritime LNG fuel tanks has received design approval from ABS.

It's a key milestone in the SpaceTech4Sea project, which sees ABS, OceanFinance and Cimarron Composites joining forces to adapt composite technologies developed for the space industry to shipping. The team's goal is creating ultra-lightweight LNG fuel tanks which will attract both new buildings and LNG fuel retrofits by cutting costs, reducing weight and increasing vessels' capacity. Although the technology can have a wide range of applications, the SpaceTech4Sea project focuses initially on high-speed vessels with small LNG fuel tank capacities. It offers weight savings of up to 80 percent over existing equivalent LNG tank designs, is not affected by corrosion, and also introduces space technology safety standards to marine operations. The project, which is supported by €1m funding from the EU.



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BMT REMBRANDT in the Clouds

In trials BMT conducts its first-ever remote, simulator-based ship navigation training program – the latest REMBRANDT digital configuration is a full mission DNV approved ship simulator solution that's targeted at multiple training stakeholders, including those onboard and ashore, and benefits from de-risked and highly immersive learning environments

BMT's REMBRANDT maritime simulator has successfully trialled its first virtually operated maritime simulation. This 'digital advance' will enable maritime operators and trainers to safely plan, train and prepare for marine navigation in a simulated environment operated from a remote computer. This cutting-edge trial was delivered in partnership with SeaChange Resources and their BridgeQuest training course.

www.bmt.org

BMT

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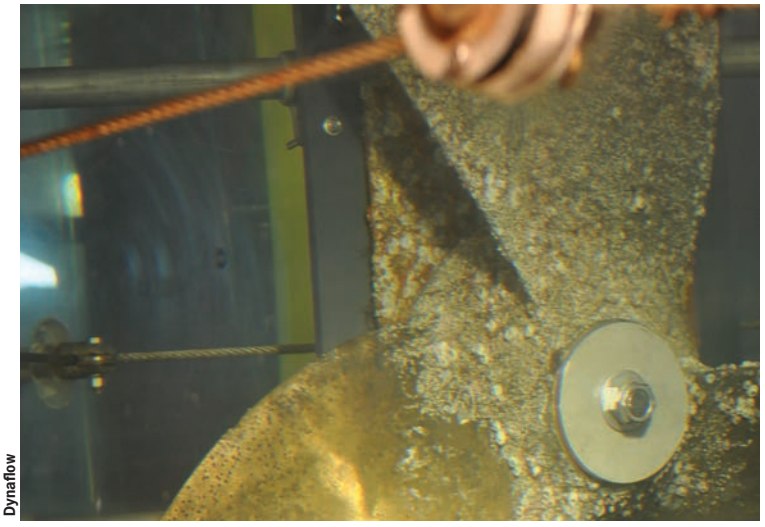


Dynaflow

Non-Abrasive Prop Cleaning

Dynaflow developed a second generation Dynajets non-abrasive Diver Tool (NADT) that is small, lightweight, quiet and efficient. The NADT uses advanced resonating and cavitating jet nozzles in a rotating head housed in a shroud that protects the surface being cleaned and reduces the noise. The NADT was shown to remove propeller fouling including calcareous growth and hard and soft biofouling with no damage to the underlying propeller metal.

The NADT reduces the propeller cleaning time by half relative to abrasive brushes, which cannot be used on the edges, and does not damage the blade surfaces including edges and fillets. Field demonstrations have confirmed the removal of soft and hard biofouling, including barnacle basal plates, and calcareous growth with no damage to the propeller surfaces. The benefits to the diver are a zero-thrust counter thruster so the diver is not pushed away from the blade, lower ambient noise than other water jet cleaning tools, light-weight, neutral buoyancy, small tool head for access to tight areas such as hubs and fillets.

www.dynaflow-inc.com

Su-Nav Rolls our Clean Water Tech to Fleet

Su-Nav, an integrated ship management company, has rolled out the latest sustainable, green product from its Su-Nav Aeronero Innovation Center which will provide thousands of seafarers with pure drinking water, free from harmful bacteria and eliminating the use of plastic bottles.

The machine, which has been installed on three vessels, is especially designed for marine applications by considering the adverse conditions, internal operations in the vessel & inability for servicing/maintaining. It can generate 150 to 1000 litres of pure drinking water per day. Since it uses the humidity to produce water, the marine environment provides optimum conditions for its use. The stainless-steel body also ensures longevity for use at sea.

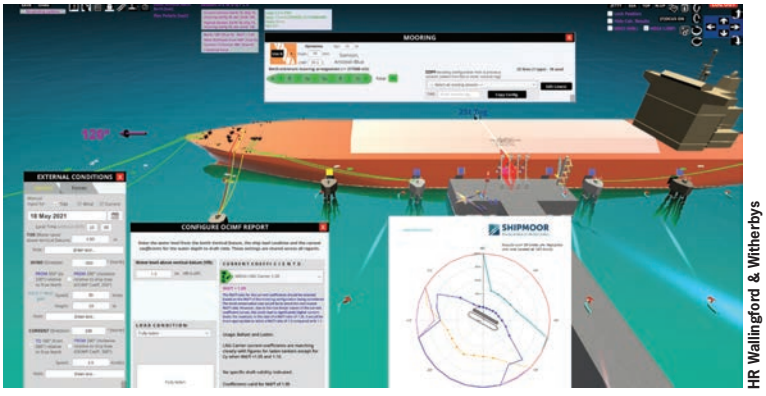
"The seafarers are forced to consume water from tanks or plastic bottles received from different countries which results in various potentially harmful microbes in the gut. There is also the possibility of water contamination from fresh water being loaded into our tanks," said Sachit Sahoonja, CEO of Su-Nav. "The use of plastic is extremely harmful to the environment, so our Innovation Centerhas produced a machine that is plastic free, sustainable and produces unlimited clean drinking water."

www.su-nav.co

SHIPMOOR: New Mooring Tool

SHIPMOOR, a new ship mooring tool designed to perform static and dynamic ship mooring analyses in a rapid, user friendly and intuitive manner, has been launched by HR Wallingford and Witherbys. Created to make the assessment of mooring an LNG carrier a straightforward and user driven process, SHIPMOOR provides ransparency and accurate data alongside a 3D visualization of any arrangement. Developed with security at its heart, SHIPMOOR runs within an internet browser and meets the IMO's newly introduced cybersecurity requirements.

www.shipmoor.com



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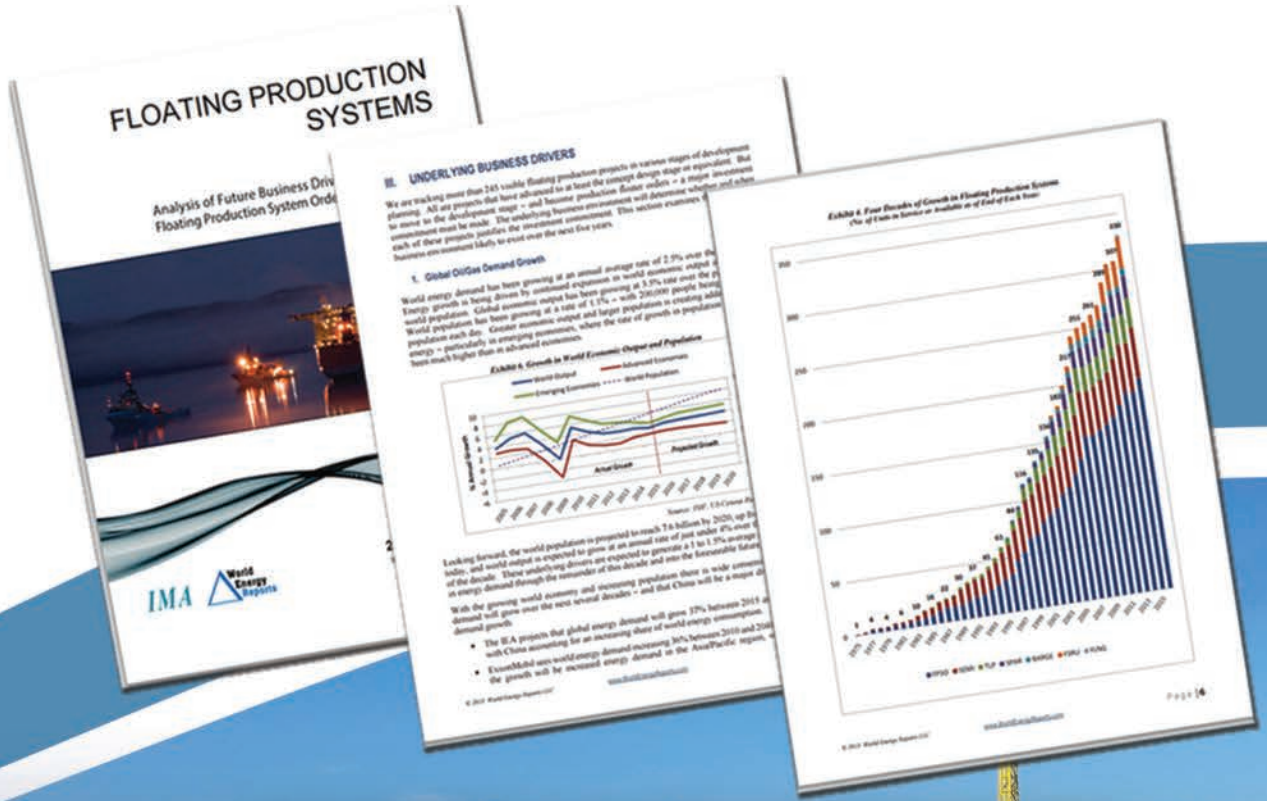

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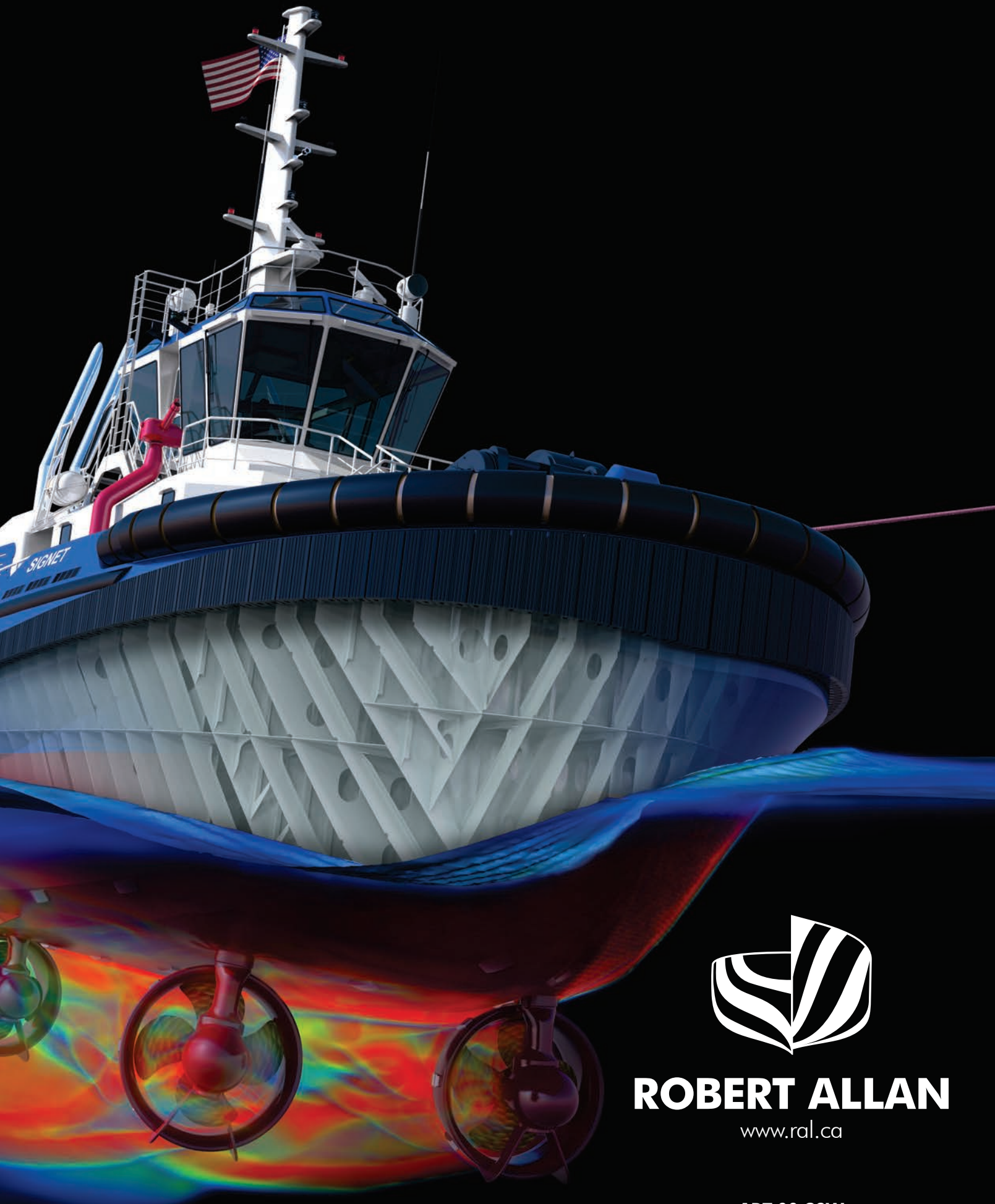

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