November 2021

# MARITIME REPORTER AND ENGINEERING NEWS

marinelink.com

# THE DATA BARGE

**Nautilus Data Technologies, Elliott Bay Design Group & Lind Marine team to make the Floating Data Center design a reality**

Since 1939

Number 11 Volume 83

**EYE ON THE U.S. NAVY**
CONSTELLATION-CLASS BRINGS BACK THE FRIGATE

**MEET THE 'E-PUSHER'**
ADVANCING WORKBOAT FUEL FLEXIBILITY

**A SEISMIC SHIFT**
SURVEYORS DIVERSIFIED DURING THE DOWNTURN

# THE COAST GUARD FOUNDATION THANKS ITS GENEROUS CORPORATE SUPPORTERS

**THE COAST GUARD FOUNDATION CHAIRMAN'S CIRCLE** recognizes the generous partnership of those corporations that support education, morale and wellness, and emergency programs that benefit Coast Guard members and families.

"Having spent more than 40 years in the maritime sector, I know the value executives from all industries place on their relationship with the Coast Guard. Together, the maritime industry and the Coast Guard create more than $5.4 trillion of economic activity on which every American depends. My sincerest thank you to the members of the Coast Guard Foundation's Chairman's Circle. Thank you for your support of programs that keep Coast Guard members Always Ready to protect and serve our Nation, and for the contributions your companies make to national security and prosperity."

**THOMAS A. ALLEGRETTI, COAST GUARD FOUNDATION CHAIRMAN**

## WE ARE GRATEFUL FOR THE LEADERSHIP OF THE FOLLOWING MEMBERS:

**AMERICAN FUEL & PETROCHEMICAL MANUFACTURERS**
**CHET THOMPSON**
PRESIDENT AND CEO

**CHENIERE ENERGY**
**JULIE NELSON**
VP, STATE & LOCAL GOVERNMENT AFFAIRS

**CITY EXPERIENCES BY HORNBLOWER**
**KEVIN RABBITT**
CEO

**CONOCOPHILLIPS**
**CHRISTOPHER J. BULERA**
MANAGER, GLOBAL MARINE & POLAR TANKERS

**LEIDOS**
**LORI STALLARD**
VICE PRESIDENT & STRATEGIC ACCOUNT EXECUTIVE

**LOCKHEED MARTIN**
**STEPHANIE HILL**
EXECUTIVE VICE PRESIDENT, ROTARY AND MISSION SYSTEMS

**MARITIME PROFESSIONAL TRAINING**
**CAPT TED MORLEY**
COO

**MORAN TOWING CORPORATION**
**TED TREGURTHA**
PRESIDENT & CEO

**MUNICH RE US HOLDING**
**ANTHONY J. KUCZINSKI, CPA, CPCU**
PRESIDENT & CEO

**NY SHIPPING ASSOCIATION**
**JOHN J. NARDI**
PRESIDENT

GEICO MILITARY

**JOHN "JAY" SNEAD**
DIRECTOR

**THE COAST GUARD FOUNDATION IS A VITAL PARTNER TO THE COAST GUARD. WE SUPPORT MEMBERS AND FAMILIES WITH THE RESOURCES THEY NEED TO SUCCEED THROUGHOUT THEIR LIVES. LEARN MORE AT:**

**coastguardfoundation.org**

COAST GUARD FOUNDATION

DMWMARINEGROUP

Marine cranes for
SALVAGE OPERATIONS
SPECIAL OPS
COMMERCIAL WORKBOATS
MILITARY VESSELS

www.dmwmarinegroup.com • 610.827.2032

NO. 11 / VOL. 83 / NOVEMBER 2021


**32**
The E-Pusher series fast-tracks fuel flexibility.
**Source: KOTUG**

**On the Cover**
NDT's new Data Barge.
**Source: Nautilus Data Technologies**

# Features


## 20 U.S. Navy brings back the Frigate
Building new class of warship can be fraught with pain. USN is aiming to change this with its new Guided Missile Frigate (FFG) program.
*By Edward Lundquist*

## 32 E-Pusher Advances Fuel Flexibility
KOTUG's E-Pusher series is working today, built around the premise of fuel flexibility.
*By Greg Trauthwein*

## 34 Inside the Data Barge
Nautilus Data Technologies and Elliott Bay Design Group provide an interesting new twist to the maritime digitalization discussion, with the design, manufacture and delivery of an innovative 7MW data center housed on a refurbished 240-ft. deck barge.
*By Greg Trauthwein*

## 40 A Seismic *(Survey Vessel)* Shift
Despite oil prices recently edging past $80 a barrel, scars from two recent oil industry downturns in five years have forced offshore seismic surveyors to look at ways to diversify.
*By Bartolomej Tomic*


# Departments


4 **Authors & Contributors**
6 **Editorial**
8 **By the Numbers**
10 **Training Tips for Ships**
14 **Back to the Drawing Board**
18 **The Path to Zero**
24 **Digitalization**
30 **Ship Repair:** *Austal USA*


# Interviews


28 *Ronald Spithout, President, Inmarsat*
44 *Charles Good, Chairman, Cox*
48 *Arild Risholm Saether, Navtor*
50 **Tech Feature:** *LNG*
56 **Tech Feature:** *Coatings*
56 **Tech Feature:** *Heavy Lifting*
62 **Tech Files**
66 **Vessels:** *Nexans Aurora*
68 **History:** *Bear Hunting*
68 **The Final Word:** *Susan Ludwig*
75 **Buyer's Directory**
76 **Classifieds**
80 **Advertising Index**

# Authors

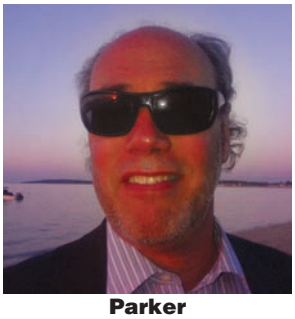
**Goldberg**

**Kinsey**

**Lundquist**

**Maslin**

**Mulligan**



**Parker**

**Sannerud**

**Tomic**

**van Hemmen**

**Goldberg**
Murray Goldberg is CEO of Marine Learning Systems, maker of MarineLMS.

**Kinsey**
Captain Andrew Kinsey is Senior Marine Risk Consultant at Allianz Global Corporate & Specialty.

**Lundquist**
Edward Lundquist is a retired naval officer who writes on naval, maritime, defense and security issues.

**Maslin**
Elaine Maslin is an offshore upstream and renewables focused journalist, based in Scotland.

**Mulligan**
Tom Mulligan is our science and technology writer based in Ireland.

**Parker**
Barry Parker, bdp1 Consulting Ltd. provides strategic and tactical support, including analytics and communications, to businesses across the maritime spectrum.

**Sannerud**
Terje Sannerud, Chief Commercial Officer, has worked at Light Structures for eight years. He is responsible for all commercial activities and development globally.

**Tomic**
Bartolomej Tomic is managing editor of Offshore Engineer and OEDigital.com.

**van Hemmen**
Rik van Hemmen is the President of Martin & Ottaway, a marine consulting firm that specializes in the resolution of technical, operational and financial issues in maritime.


**MARITIME REPORTER AND ENGINEERING NEWS**

MARINELINK.COM

**ISSN-0025-3448**
**USPS-016-750**
**No. 11 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.

**CONTACT INFORMATION:**

Email: mrcirc@marinelink.com
Web: www.marinelink.com
t: (212) 477-6700
f: (212) 254-6271

Member BPA WORLDWIDE BRAND REPORT

Business Publications Audit of Circulation, Inc.

INTERNATIONAL WORKBOAT SHOW

BOOTH # - 2055
DEC 1 - 3
NEW ORLEANS

INFRA-METALS
WWW.INFRA-METALS.COM

DELTA STEEL, INC.
WWW.DELTASTEEL.COM

NATIONAL SERVICE CENTER WITH 200,000+ TONS OF STRUCTURAL STEEL AVAILABLE FOR YOUR MARITIME NEEDS


PRESS BRAKE UP TO 60' | BLAST & PRIME | EXTENSIVE PLATE PROCESSING

**With many locations to serve you:**

Wallingford, CT
Langhorne, PA
Petersburg, VA
Atlanta, GA
Tampa, FL
Hallandale, FL
Marseilles, IL
New Boston, OH
Houston, TX
San Antonio, TX
Cedar Hill, TX
Fort Worth, TX

FULL MEMBER

**CUSTOMER SATISFACTION**
BUILT WITH STEEL

**Despite the multitude of challenges that remain from COVID and the global supply chain disruption,** many sectors of the maritime market continue to accelerate at pace. While business is popping, there is a long and growing list of generational challenges facing ship and boat owners which, as a group, is staring down the barrel of long and growing list of emission reduction and efficiency mandates. This edition discusses many of the challenges and potential solutions.

**Rik van Hemmen**, CEO of Martin & Ottaway, has been a regular contributor for more than two years, and this month's contribution … *"Where are the Transportation Macro Designers"* starting on page 14 … is one of my favorites, as it looks not simply at the ship and boat portion of the supply chain, rather the emissions impact of getting product and goods door-to-door.

On the military side, **Edward Lundquist** looks at the mission to bring frigates back to the U.S. Navy fleet. Everyone reading these pages knows well the tremendous challenges inherent in designing a new class of ships, challenges multiplied exponentially when it's a new class of war ships. The FFG program underway at Fincantieri Marinette Marine (FMM) is notable in that it aims to mitigate risk by building the class on an existing hull design, armed with 'tried-and-true' combat systems and weapons. His story starts on page 20.

A big 'thank you' is due to the crew at Elliott Bay Design Group for bringing to my attention this month's cover story, *The Data Barge,* starting on page 34. I must admit, if the barge in question was being used the haul corn or coal or oil, I don't think I would have jumped so fast. But when it's a barge outfitted with millions of dollars of computers to form a floating, movable 7MW data center on a refurbished 240-ft. deck barge, that's another matter. I had the opportunity last month to record a video interview with **Jim Connaughton**, CEO of Nautilus Data Technologies and **Mike Complita**, EBDG, to dig into some of the unique aspects of this design.

Finally, our "The Final Word" interview this month is with **Susan Ludwig**, President, Coast Guard Foundation (CGF), starting on page 72. CGF is an organization that steps in to help the members and families of the United States Coast Guard.

While much has been written, rightfully so, regarding the shameful treatment of commercial seafarers and their inability partake in crew changes during COVID, little has been written about the hardships of Coast Guard crews and their families, many of which endured prolonged duties throughout the pandemic. CGF is an organization which engages top leadership at the Coast Guard, as well as industry, to help define, fund and execute CGF's mission of supporting Coast Guard members and families across a broad spectrum of physical and increasingly mental well-being.

**Gregory R. Trauthwein**
Editor & Associate Publisher
trauthwein@marinelink.com

**MARITIME REPORTER AND ENGINEERING NEWS**

MARINELINK.COM

HQ
118 E. 25th St., 2nd Floor
New York, NY 10010 USA
T +1 212 477 6700; F +1 212 254 6271

FL Office
215 NW 3rd St
Boynton Beach, FL 33435-4009
T +1 561 732 4368; F +1 561 732 6984

**Publisher**
John C. O'Malley
jomalley@marinelink.com

**Associate Publisher/Editorial Director**
Greg Trauthwein
trauthwein@marinelink.com

**Offshore Energy Editor**
Bartolomej Tomic
tomic@offshore-engineer.com

**Science & Technology Editor**
Tom Mulligan
tom.mulligan@marinelink.com

**Production Manager**
Irina Vasilets
vasilets@marinelink.com

**Production & Graphic Design**
Nicole Ventimiglia
nicole@marinelink.com

**Corporate Staff**
Manager, Marketing
Mark O'Malley
momalley@marinelink

Accounting
Esther Rothenberger
rothenberger@marinelink.com
212-477-6700 ext 6810

**Manager, Information Technology Services**
Vladimir Bibik bibik@marinelink.com

**Circulation**
Kathleen Hickey k.hickey@marinelink.com
212-477-6700 ext 6320

**Sales**
Vice President, Sales & Marketing
Rob Howard
howard@marinelink.com; +1 561-732-4368

**Advertising Sales Managers**
National Sales Manager
Frank Covella
covella@marinelink.com; +1 561-732-1659

Lucia Annunziata
annunziata@marinelink.com;
+1 212-477-6700 ext 6240

Terry Breese
breese@marinelink.com; +1 561-732-1185

Mike Kozlowski
kozlowski@marinelink.com; +1 561-733-2477

Gary Lewis
lewis@marinelink.com; +1 516-441-7258

**International Sales**
Scandinavia & Germany
Roland Persson
Orn Marketing AB, Box 184 , S-271 24
Ystad, Sweden
roland@orn.nu; +46 411-184 00

Germany, Austria & Switzerland
Tony Stein
tony.r.stein@btinternet.com
+44 1892 512777

United Kingdom, France, Italy & Spain
Paul Barrett
Hallmark House, 25 Downham Road, Ramsden
Health, Essex CM11 1PU UK
ieaco@aol.com; +44 7778 357722

**Founder:**
John J. O'Malley [1905 - 1980]
Charles P. O'Malley [1928 - 2000]
John E. O'Malley [1930 - 2019]

# SIMPLE ISN'T ALWAYS EASY...

## BUT FURUNO RADARS ARE A SIMPLE CHOICE

Your objective is simple…Deliver your vessel and its contents safely and on time. While it might sound simple, we know it's not easy!

Whether you're navigating the open ocean, busy harbors, or through congested inland waterways, being aware of your surroundings is paramount. Your number one line of defense is a Radar you can rely on, from a company you can depend on. Furuno's award winning Radar technology is built to perform and withstand the harshest environments, keeping you, your crew and your precious cargo safe. With unique application features like ACE (Automatic Clutter Elimination), Target Analyzer, and Fast Target Tracking, Furuno Radars will help make that simple objective easier to achieve.

UHD
Ultra High Definition Radar


FURUNO
www.furunousa.com

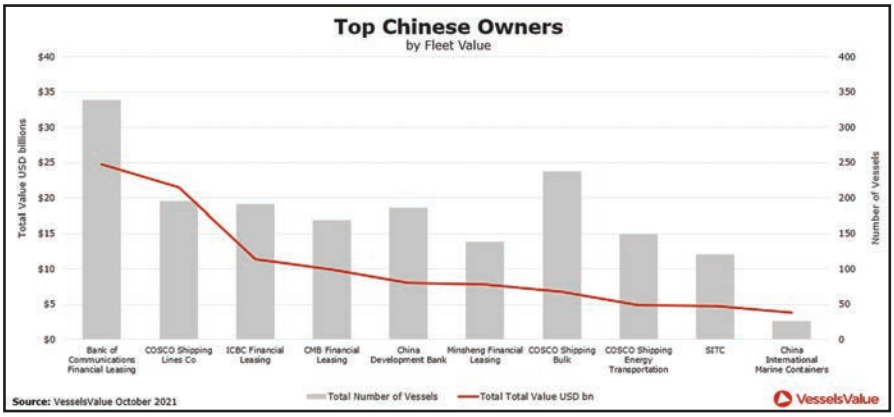
Powered by VesselsValue

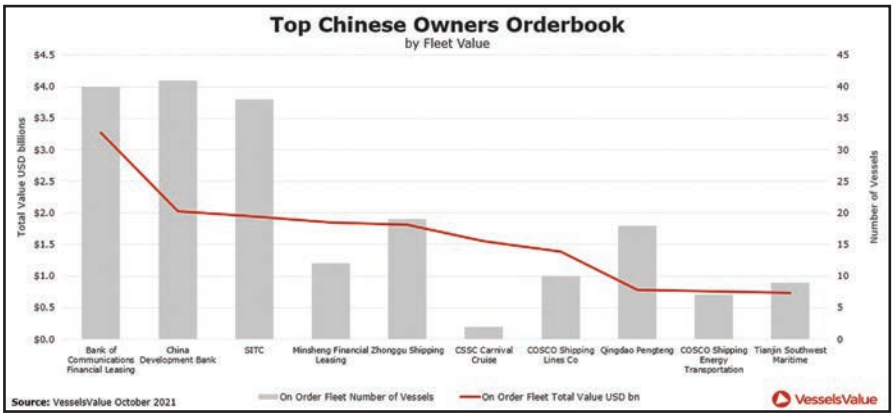
# Eye on China

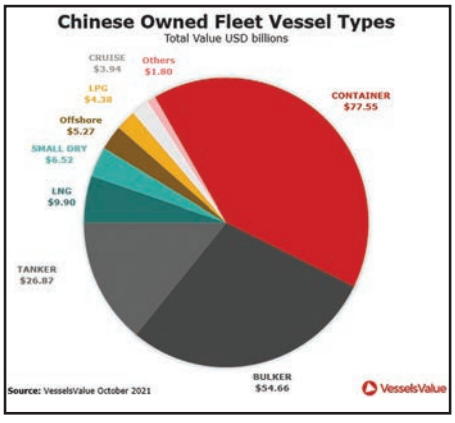
This month, courtesy of statistics from our friends at Vessels Value, we take a dip into the statistics driving China's maritime market.

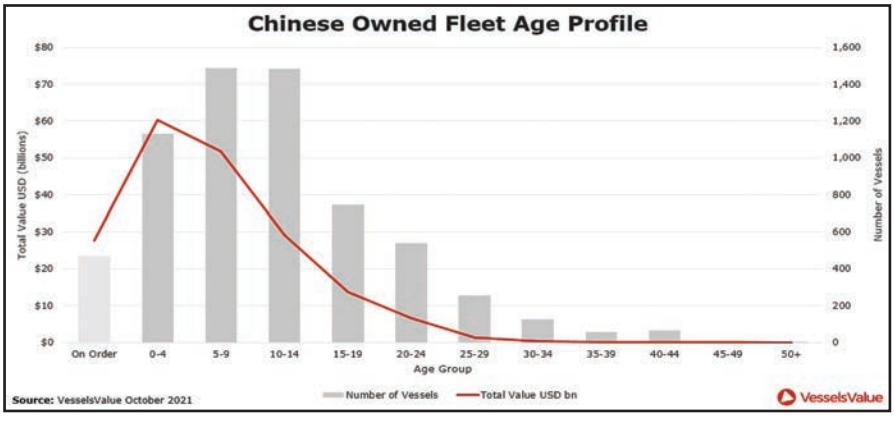
## Top Chinese Ship Owners

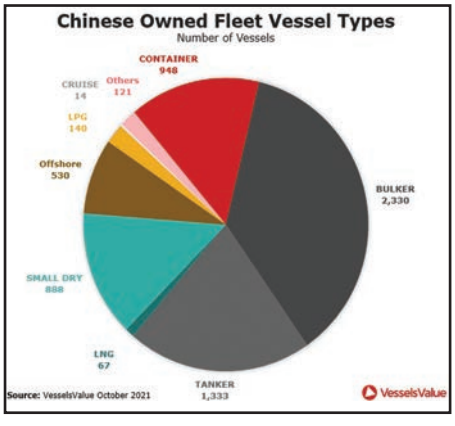
| Owner | Vessels (Live & on Order | Total Value ($B) |
|---|---|---|
| Bank of Communications Financial Leasing | 339 | $24.76 |
| COSCO Shipping Lines Co | 195 | $21.47 |
| ICBC Financial Leasing | 191 | $11.39 |
| CMB Financial Leasing | 169 | $9.93 |
| China Development Bank | 186 | $8.00 |
| Minsheng Financial Leasing | 139 | $7.81 |
| COSCO Shipping Bulk | 238 | $6.76 |
| COSCO Shipping Energy Transportation | 149 | $4.86 |
| SITC | 121 | $4.70 |
| China International Marine Containers | 26 | $3.80 |

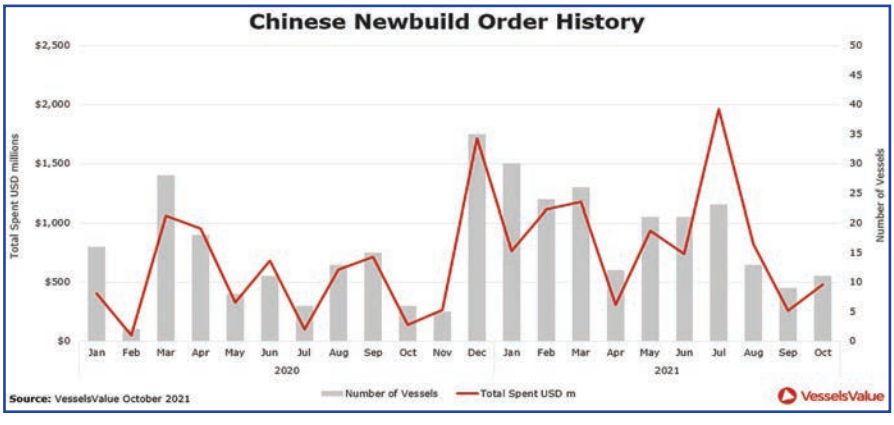


# Next Generation Vessels




## Superior Craftsmanship, On-Schedule Performance

*Today's next generation vessels are highly sophisticated and represent a much higher risk profile for a ship owner when it comes to selecting the right shipyard. Eastern Shipbuilding's proven track record of successfully engineering and building highly integrated ships on time and on budget dramatically reduces that risk. With the addition of our Port St. Joe outfitting facility, we have increased our capability to perform the extensive outfitting, testing and trials of these complex vessels. Eastern Shipbuilding is the low risk solution you can trust to deliver your next generation asset on time, every time.*

*New Port St. Joe Facility - Opened in 2021*

**EASTERN SHIPBUILDING GROUP, INC.**

Panama City • Allanton • Port St. Joe

sales@easternshipbuilding.com
850-763-1900
Follow us on

Tip #30

# Breaking Down the Training Silos


© tashatuvango/AdobeStock

Since the late 1990's the training community has understood the power of blended learning. Blended learning combines in-person and on-line training to produce better outcomes and a higher degree of trainee satisfaction. While very successful, blended learning is in fact a narrowly focused technique which hints at a much more holistic and powerful training philosophy and practice, that of integrated or "end to end" training. What is integrated training?

We typically think of (and operate) our various training activities as mostly separate endeavors. Our mariners take their courses when they are due, and they receive a grade. They travel for simulator training when scheduled and receive a certificate when it's successfully completed. Drills and exercises are practiced on-board when required and participation is recorded. And all too often, these training experiences are undertaken as separate events, and are designed, organized, and conducted by different people in separate sub-departments of corporate training. Each is in its own silo despite the reality that training topics and activities are never independent of one another.

This "siloing" creates two missed opportunities which prevent organizations from providing truly excellent training. I'll cover the first one, integrated training, in this edition of Training Tips for Ships.

Fundamentally, Integrated training recognizes that all training experiences relate to one another and can benefit from this relationship. This has long been recognized in universities and colleges where integrated programs such as "Science 1" or "Arts 1" have been created to capitalize on this relationship and generate extraordinary learning outcomes and experiences. In these programs, instead of taking 4 or 5 separate introductory classes in (for example) Science, students participate in a single, term-long integrated experience where instructors from different science disciplines work together to collectively approach related science topics from their own distinct vantage point. In Science, this means that a chemist, physicist and biologist might work together in a course to explain an evolutionary process from each of their three perspectives. Thus, rather than have one instructor teach one narrow aspect of a mechanism of evolution, evolution is taught as a process composed of many integrated components, examined concurrently from multiple

# Our Marine Headset Systems can mean the difference between an operation from hell, and a hell of an operation.

Visit Us At International
Workboat Show, Booth #3671

## David Clark Marine Headset Systems

Crews on board patrol boats, fire/rescue craft, offshore service vessels, tugs, and other workboats must perform a variety of complex operations. Wind noise, loud engines and pounding through rough waters can make boat crew communication extremely challenging.

David Clark Marine Headset Systems offer clear communication and rugged reliability in the harshest marine environments, while enhancing the safety and situational awareness of boat crew members.

Call **800-900-3434** (508-751-5800 Outside the USA) to arrange a system demo or visit **www.davidclark.com** for more information.

**Series 9100 Digital Communication System**
Scalability • Versatility • Simplicity

David Clark

WWW.DAVIDCLARK.COM

*An Employee Owned American Company*

viewpoints. It is hard to overstate the depth and effectiveness of this learning approach.

So, what could this mean for maritime training? There are many possibilities for integration. As one example, it might mean integrating different viewpoints for one topic where a deck trainer, engineering trainer and corporate health, safety and environment officer work together as a team to help trainees holistically understand all aspects of a topic such as safe passage. Alternatively, it could mean the integration of several learning activities for one topic; combining the learning of foundational knowledge, the teaching of the skills supported by that knowledge, and the experience of drills that practice and reinforce those skills. This, as opposed to treating each of those as separate and unrelated events.

In its most simple form and as a way to begin, it could mean bringing in guest speakers with a supporting viewpoint, a contrary viewpoint, or with years of related practical experience. For example, one might invite an ethics expert, a biologist, a climatologist, or even a company accountant to guest lecture in an environmental awareness class. Having diverse experts discuss and challenge one another and their trainees on a single subject creates a fuller understanding that could never be otherwise achieved.

This approach is often described as end-to-end training where single topics are examined from various perspectives, and where knowledge, skills and practical consolidation are intentionally combined and programmed as a whole. It can be applied to any subject but is especially relevant where knowledge and skills are nuanced and require a broad perspective to be fully understood. It creates an environment where trainees are challenged to exercise their judgement by assimilating diverse and sometimes conflicting information rather than simply memorizing facts. It makes training far more meaningful and relevant to your trainees and to the work that they do. And as a past faculty member who has been a guest lecturer in an integrated Science 1 program many years ago, I can assure you that it makes teaching far more engaging and satisfying. Give it a try. In next month's Training Tips for Ships, I will discuss the second opportunity created by breaking down the silos between training events. Until then, keep well and sail safely.

**The Author**

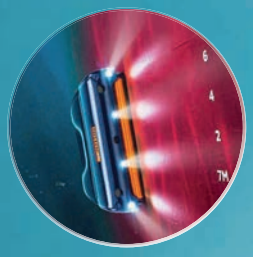
**Goldberg**

Murray Goldberg is CEO of Marine Learning Systems.
Email: Murray@MarineLS.com

Nor-Shipping 2022

Your Arena for Ocean Solutions

*Jotun developed the HullSkater - a hull cleaning robot for vessels. But they're...*



# It's hard to find the next sustainable solution, when there's an ocean between us.

*... 11240 nautical miles away from Hyundai Heavy Industries Group who constructed the world's first 14,800 TEU LNG dual-fuel VLCS.*

Nor-Shipping brings the industry together. Learn more about new ocean solutions, and meet the companies that are taking positive #ACTION, from 10-13 January 2022 in Oslo. Learn more at **nor-shipping.com**

DNB DNV Astrup Fearnley JOTUN KONGSBERG SKULD WÄRTSILÄ

# Where are the Transportation Macro Designers?

As naval architects and marine engineers we are familiar with the design spiral. While design is not truly a spiral, we use the concept to remind ourselves that all pieces of a ship design interact. The design spiral is not a standard figure and can be simplistic or overcomplicated.

A Google search image summary provides dozens of interpretations, all investigating different variables, with the only commonality that all spirals start with the "mission" variable.

Figure 1 is an old and pretty one that is still being referred to today.

It is important to stress that real design does not really work like the spiral indicates, it is both messier and more elegant, and relies heavily on the experience of the designer. Some very clever design theorists have provided alternative approaches, but as a design philosophy tool, the design spiral retains its core validity.

A beginning designer pretty much has to start at step one and go through every step, but experienced designers for a particular ship type can often jump in somewhere along the middle of the spiral and pull the whole thing off in two trips along the disk.

Really good designers, who have made many design spiral trips, can draw a near complete design on the back of an envelope and never need to refer to the spiral. (The concept for the LST was sketched out by John Niedermair on a scrap of paper and was incredibly close to its final design. **See page 16.**)

The design spiral is actually a warning; if you skip a step, you will likely get into trouble. Design is a system of checking boxes (the Sectors) and refinement (the Spiral) and the Design Spiral explains it graphically. Often a more concise list of steps will suffice and Figure 2 is a simpler list of steps.

In this spiral, which I will call Design Spiral 1, the first step is on the outer rim and the final design is the point in the middle of the disk. While one can choose an almost limitless number of design considerations (sectors, variables), for the sake of this discussion I have provided the following design sectors: Mission, Size, Weight, Performance, Structures, Regulatory, Human Factors, Construction Cost and Operating Cost. I made it modern and included Human Factors, which is a very important consideration and was omitted in the spiral in Figure 1.

**Figure 1:** Design Spiral, Evans, J. Harvey (1959), *"Basic Design Concepts,"* Naval Engineers Journal, Vol. 21, Nov.

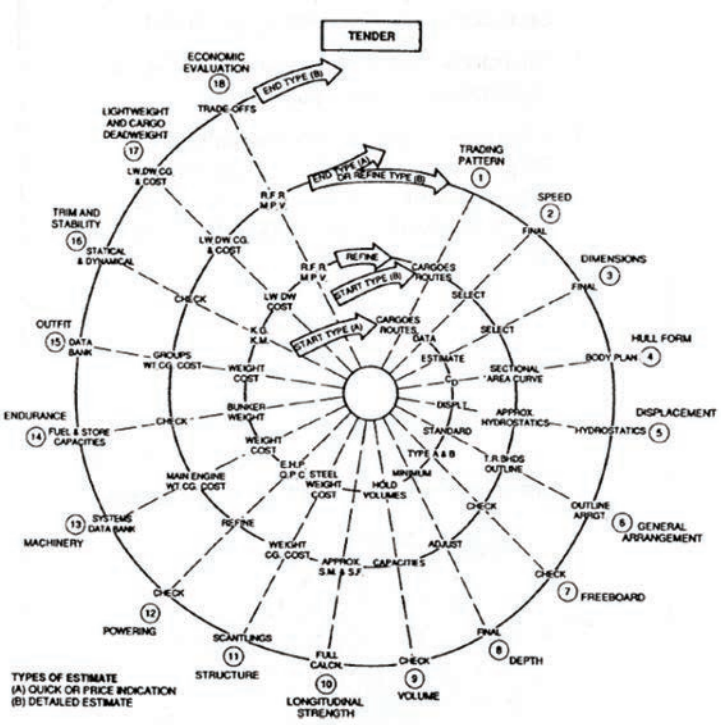
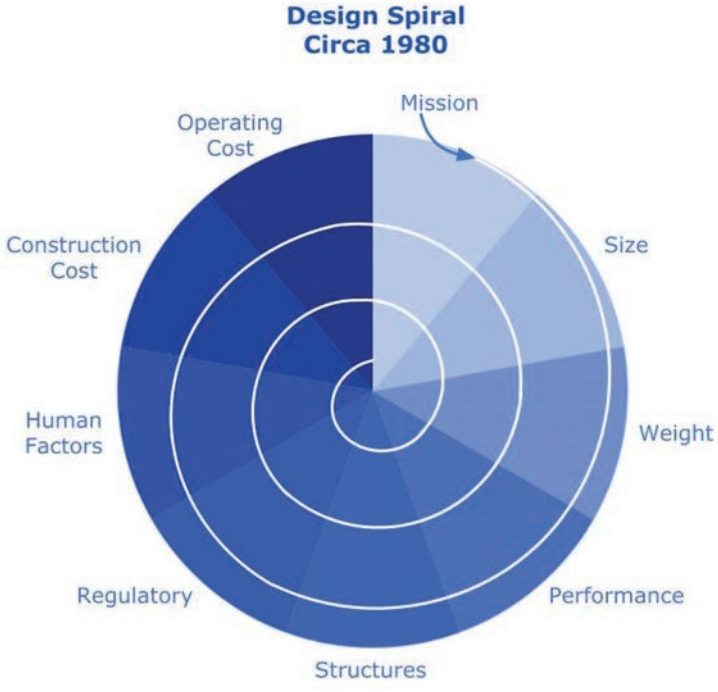



**Figure 2:** Design Spiral 1 Circa 1980



About 25 years ago I first suggested that the design spiral needed an update. Besides the common spiral sectors such as those shown in Spiral 1, I proposed that designers need to include environmental and sustainability concerns into their trip around the design spiral.

It was simply an attempt to draw attention to a changing world, and while I think my suggestion had little effect by itself (I could not "Google" a design spiral that shows these categories), it may have been a tiny cog in a large gear that has slowly turned and, today, designers do take the environment and sustainability into account in their designs. At least, at a minimum, as a regulatory requirement (EEDI). Although complying with regulations rarely means you have achieved an optimal design.

This would have changed the design spiral complexity to Spiral 2 in Figure 3.

These additional considerations have increased the complexity of the design of ships and probably have modestly increased the sustainability of shipping and reduced the environmental impact of ships. It is significant to note that with increasing sectors, increasing trips around the sectors are required to arrive at an optimized solution and therefore there are no more coils in the spiral.

Only when writing this did I realize that the design spiral has once again increased in complexity since it does not include a power source sector, which determines the level of hybridization of the power source for the ship. This is the sector where the designer does not just pick the propulsor (which would be considered under the Performance sector) but also the combination of power sources that result in the most efficient design for its mission.

Therefore, while in recent years past, the design spiral looked like Figure 3, today, it looks more like Figure 4.

However, frustratingly, ship designers only focus on specific ships for specific missions. That focus then results in efficient ships for their intended trade, but it does not provide the most efficient transportation for our world.

Efficient individual components do not necessarily result in efficient systems. Even stranger, inefficient components may very well result in very efficient larger systems. ISO shipping containers simply copied the dimensions of road cargo trailers, and nobody has ever checked if this is an efficient size. But there is no doubt the use of ISO containers has done an incredible job of increas-

**Figure 3:** Design Spiral 2 Circa 1995

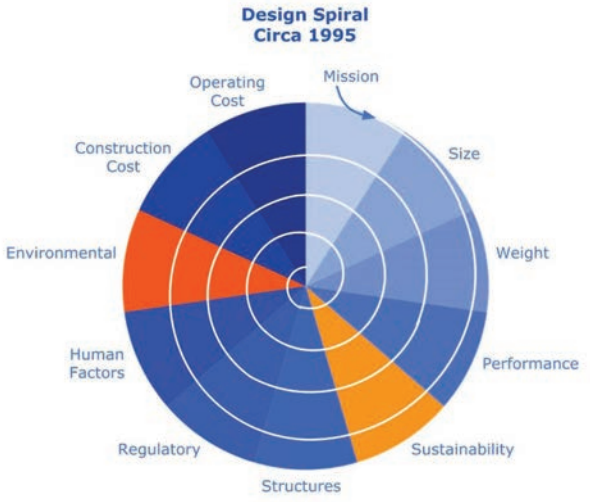



**Figure 4:** Design Spiral 3 Circa 2015

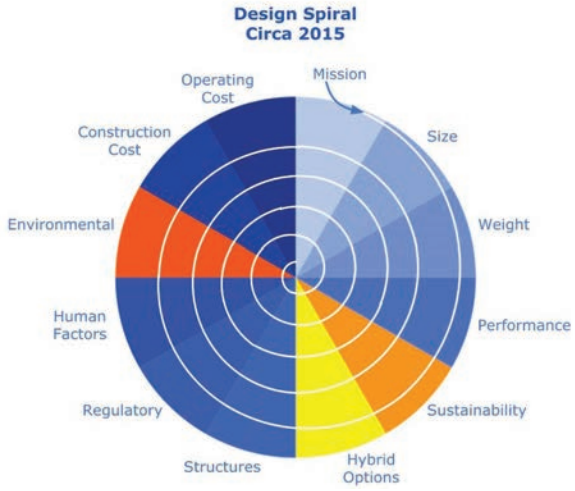
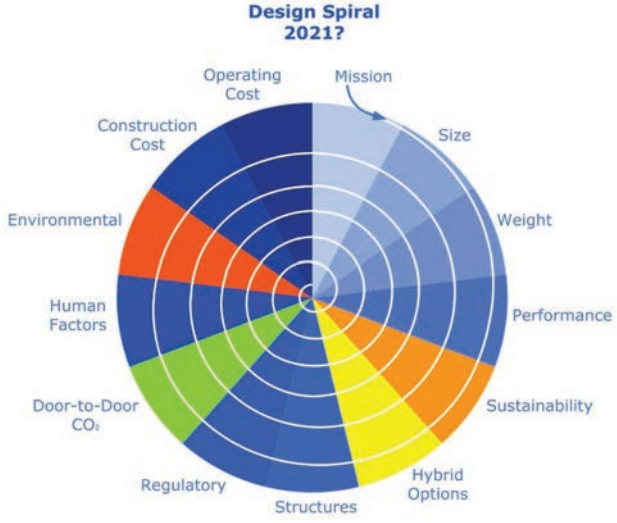



**Figure 5:** Design Spiral 4, the CO2 reality




ing worldwide cargo shipping system efficiencies.

But getting back to the inefficiency of efficient components, it is possible to design a very efficient ship, but the use of that ship can very well result in less-than-optimal transportation of the goods it is intended to transport. This is an incredibly complex issue, but if not properly analyzed and designed will result in unnecessary waste and CO2 emissions on a global level. The question is: How do we analyze that? Is there an equivalent design diagram that we can use as a mental aid?

While the design spiral can apply to all types of ships, in cargo shipping, the mission is generally defined as the ability to deliver a certain amount of cargo between two ports, but CO2 is not defined by port-to-port emissions; it is defined by door-to-door emissions.

Such a design diagram would need to straddle a new mission outlook; instead of port-to-port, we need to analyze door-to-door. I suppose we would call that full system mission, and that would add another sector beyond hybrid options and we would end up with something like Figure 5.

Very complex with many more trips around the sectors. And then the central question is this: Who are the people that would exercise this spiral to come up with viable solutions? Transportation engineers? Systems engineers? Naval Architects? Macro economists?

Or maybe a combination of them (although designers know that design by committee always results in camels). Computer engineers may look at this and think in terms of databases, computations, and optimization program loops, but, while helpful in refinement, the inspiration

**Figure 6:** John Niedermair's initial pencil sketch of the LST. His first pass around the spiral, and very nearly the last pass too. ***Brilliant.***

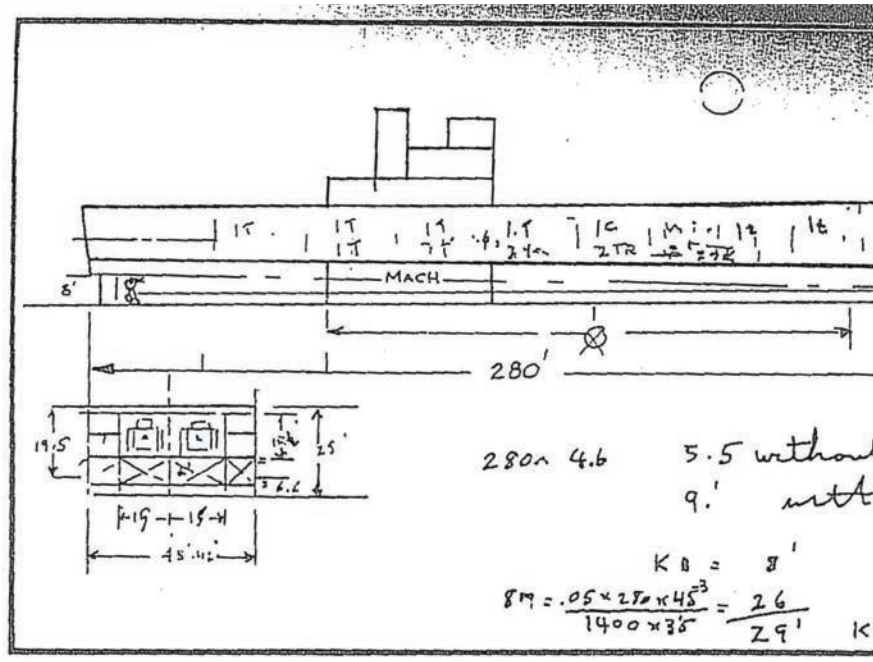


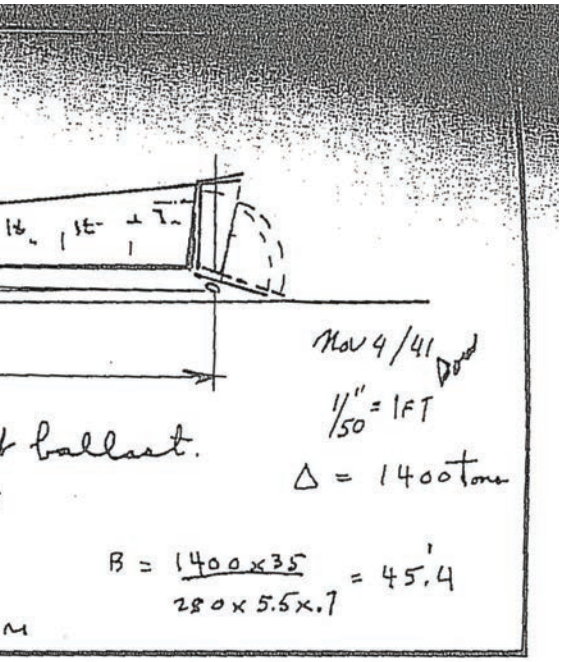

*FIGURE 7-7—Original pencil sketch of the LST by John Niedermair, head naval architect, Preliminary Design Ships. 4 November 1941. [Note: this sketch by Niedermair is to naval engineers what a Rembrandt sketch is to the Regardless of its graphic quality, it is a classic to the engineer.]*

and direction will need to come from designers that have entered the twilight zone spiral for many years. This type of design may very well be the last place where AI will take over, if at all.

Do these professionals actually exist? We need this type of analysis, but who is doing it?

These professionals would be the transportation macro designers. I have looked far and wide, but, so far, have never seen an engineer specialize at that level. And without the benefit of those elusive engineers, we are bound to come up with the wrong solution time after time. Not a pleasant prospect.

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 Center for Post Carbon Logistics. **www.postcarbonlogistics.org** They are not quite doing the macro economics thing, but at least are knocking on its door.




, Bureau of
art world.

Source: SNAME


**The Author**

## van Hemmen

Rik van Hemmen is the President of Martin & Ottaway, a marine consulting firm that specializes in the resolution of technical, operational and financial issues in maritime.

# Environmental Challenges Abound for International Shipping

The international shipping industry produced just over one billion tons of greenhouse gases (GHG) in 2018, almost 10% more than in 2012. The rise in GHG emissions was mostly due to an increase of global maritime trade, according to the latest IMO GHG study. Despite an expected short-term reduction due to the pandemic, emissions are forecast to increase further from about 90% (of 2008 levels) in 2018 to 90% to 130% (of 2008 emissions) by 2050.

The shipping industry broadly acknowledges the need to reduce emissions, although progress has been slow. The IMO GHG Strategy of 2018 set ambitious targets to halve emissions from international shipping by 2050 and reduce carbon intensity by 40% by 2030, and 70% by 2050. A revised GHG strategy is due to be adopted in 2023. With momentum gathering behind international efforts to tackle climate change, the industry is likely to come under increasing pressure to accelerate its efforts.

Ahead of the UN's COP26 climate change summit in November 2021, shipping industry emissions are coming into sharp focus. The UK government recently added shipping to its plans for a 78% cut in GHG emissions by 2035. In April, the US called for the IMO to target net-zero emissions by 2050, and said it would consider domestic measures to cut emissions from shipping.

In October 2020, the IMO's Intersessional Working Group on Reduction of GHG Emissions from Ships pushed ahead with its GHG-cutting strategy, approving amendments to the pollution prevention treaty MARPOL. Due to be adopted by the IMO in June 2021, the amendments pave the way for a carbon-intensity rating for vessels above 5,000 gross tonnage, as well as adding further technical and operational carbon-intensity reduction requirements for all ships.

## ESG Considerations

In addition to tougher emissions targets, growing Environmental, Social and Governance (ESG) reporting requirements will increasingly affect shipping. Investors, banks, insurers and customers will require information on the environmental impact of shipping companies. Going forward, shipping companies will be required to demonstrate their environmental impact when seeking investment, accessing financing and arranging insurance.

Demand for green investments is rising and a growing number of financial institutions, including insurers, have committed to reducing their environmental impact, including through their investments, underwriting and lending activities. Insurers are increasingly subject to ESG reporting requirements, which will require incorporating ESG principles and the green credentials of vessels into their underwriting.

According to the IMO, short-term options for reducing GHGs include operational changes – such as speed optimization – and the use of biofuels, as well as initiating research into alternative low-carbon and zero-carbon fuels. Potentially, the industry could face a carbon tax, or a levy on emissions – the Marshall Islands and the Solomon Islands have called for the IMO to impose a levy on carbon emissions by ships from 2025.

In April 2021, a group of prominent shipping organizations called on world leaders to bring forward discussions on the development of market-based measures to incentivize the industry to reduce greenhouse gases and adopt green technologies and fuels. The group, including the International Chamber of Shipping, BIMCO and the World Shipping Council, submitted a proposal to the IMO to expedite the development of market-based measures (such as a global carbon tax on shipping fuel), as well as accelerate research and development efforts for zero-carbon technologies.

According to the ICS, the industry needs to invest billions of dollars in the development of zero-emissions ships and fuels – such as those based on ammonia and hydrogen, as well as a wider roll-out of electrification – at speed and scale. A group of shipping organizations and maritime nations have asked the IMO to establish an International Maritime Research and Development Board to help develop green shipping technologies.

According to the IMO, the carbon intensity of the shipping industry as a whole improved by 20% to 30% between 2012 and 2018 – due to the increased size of vessels, as well as design and operational improvement – although the pace of reduction has slowed since 2015. Going forward, the IMO says it will be difficult to achieve the 2050 GHG reduction ambition through energy-saving technologies and speed reduction of ships alone. A large share of the total amount of CO2 reduction will have to come from the use of low-carbon alternative fuels.

Meeting GHG emission-cutting targets will require substantial investments in research and development and big changes in ship design and propulsion, which will have implications for risk and supply chains.


© Murrstock/AdobeStock

**IMO 2020**

The transition to low-sulphur shipping has been smoother than many predicted, although there have been some issues with bunkering and the use of scrubbers. Since January 1, 2020, the cap on the sulphur content of ships' fuel oil was cut to 0.5% (from 3.5%). Known as IMO 2020, the mandatory limit is expected to reduce emissions of harmful sulphur oxide (SOx) emissions from shipping by 77%, which should bring huge environmental and health benefits.

Vessels have several options to comply with IMO 2020, namely switching to low-sulphur fuels or the fitting of so-called scrubbers, which remove SOx from exhaust gases for vessels using heavy marine fuel. However, open loop scrubbers, which discharge sulphur contaminated wash water into the sea, face restrictions and bans in many ports and waters, including the US, Europe and parts of Asia. A number of ports and countries, including the US Coast Guard, say they plan to rigorously enforce IMO 2020, and could detain ships or impose large fines for vessels found in non-compliance.

Most vessels have so far opted for low-sulphur fuels, although the number fitting scrubbers is expected to rise as operators become more comfortable with the technology. According to BIMCO the number of ships fitted with scrubbers doubled to just over 4,000 in the 13 months after IMO 2020 came into force. Around 16% of container ships, representing 36% of container-carrying capacity, are expected to have scrubbers in 2021, 15% of bulk carriers and one in 10 oil tankers.

Insurers have seen a number of machinery damage claims related to scrubbers and some arising from the use of 'blended' low-sulphur fuels. For example, there have been instances of aviation fuel – sold off cheaply due to a drop off in air traffic during the pandemic – being added to bunkers in Asia to produce blended low-sulphur fuel, which could cause resulting issues for shippers. Jet fuel has a lower flash-point and adding too much can lower the temperature at which fuels catch fire, creating a serious risk for vessels.

A study on the impact of IMO 2020 by Cefor noted that the transition to low-sulphur fuels had not been without challenges. In some cases, the use of low-sulphur fuels has led to severe damage and some significant claims for insurers from the cost of repairs and loss of earnings while awaiting repairs, often because critical spare parts were not available from stock. The cause of damage was often related to the cleaning of tanks, condition of filters, fuel stability and the effect of lube oil. Bunkering of fuels remains a complex issue, and poor fuels and poor handling of fuels constitute a significant risk for vessels.

By and large the shipping industry has responded well to the new regulations, and the increased cost of using low-sulphur fuel has been in part compensated by higher freight rates. At Allianz Global Corporate & Specialty, we have seen a small number of machinery claims related to the use of low-sulphur fuels and scrubbers, and this is an area we continue to monitor. However, scrubbers are just an interim solution and ultimately the industry will need to invest in cleaner vessels.

**The Author**

**Kinsey**

Captain Andrew Kinsey is Senior Marine Risk Consultant at Allianz Global Corporate & Specialty.

Fincantieri Marinette Marine

*Artist's concept of the new Constellation class of guided missile frigates.*

# Constellation-class brings Frigates back to the U.S. Fleet

## *Navy hopes for smooth sailing with frigate introduction*

***By Edward Lundquist***

Introducing a new class of warship can be fraught with pain, and the first ship is always the hardest – almost always behind schedule and over budget. And trying something new and transformational is even harder.

The U.S. Navy knows this from experience. That's one reason why the Navy is opting for a lower risk design for its next class of guided missile frigates (FFGs).

Just about every new class has experienced a rough start. Although the USS Arleigh Burke-class of guided missile destroyers (DDGs) today represent the largest and most successful class of warships, with 68 active ships in the fleet and ships still being built at two shipyards, the lead ship was over budget and behind schedule.

To manage risk, the Navy has often taken measured steps in introducing transformational technology in new classes of ships. The Spruance class of destroyers had a legacy combat system, but a new hull and gas turbine propulsion plant. The Ticonderoga class guided missile cruisers (CGs) had a transformational Aegis combat system, but were built upon the Spruance hull. The Arleigh Burkes had a new and stealthier hull design, but with essentially the same gas turbine propulsion plant and Aegis combat system.

### Class half empty

Although there are no frigates in the fleet today, they have served in large numbers in the past, and many other navies have them During World War II, the U.S. called them destroyer escorts (DEs) (which in 1975 were reclassified as frigates—slower and less lethal than destroyers, but constructed in large numbers. The were designed to escort relatively slow convoys.

An October 2021 report by the Congressional Research Service explained that "frigates are generally intended to operate more in lower-threat areas. U.S. Navy frigates perform many of the same peacetime and wartime missions as U.S. Navy cruisers and destroyers, but since frigates are intended to do so in lower-threat areas, they are equipped with fewer weapons, less-capable radars and other systems, and less engineering redundancy and survivability than cruisers and destroyers."

As an example, the Charles F. Adams class of guided missile destroyers and the Knox class of frigates were contemporaries of sorts, and about the same size and displacement, but the Adams class had two guns, four boilers and two screws, while the Knox class had one gun, two boilers and one screw. That may be an overly simplified comparison, but it serves to make the point.

The Navy introduced new capabilities with successive class-

es of DEs and FFs. Each new class brought something new to the fleet, but they were not totally transformational. This approach was taken with the introduction of the Garcia, Brooke, Knox and Oliver Hazard Perry classes of FFs and FFGs.

The same cannot be said for the littoral combat ship (LCS) and Zumwalt class of DDGs, which are technologically and conceptually different in just about every way. With LCS, the Navy selected not one but two totally different designs, with different hull, mechanical, electrical and combat systems. While it's important to embrace the most modern technology to stay ahead of potential adversaries, it can lead to significant delays and costs in trying to introduce too much too fast. Placing new systems on top of the legacy fleet infrastructure complicates logistics, training and sustainment.

For battle group commanders, frigates might have been less capable, but not less valuable, because they could do missions that were more appropriate for a smaller ship, and call at ports that larger ships couldn't enter.

Now the frigates are coming back. The Navy has embarked on a new program to build the Constellation (FFG 62) class of guided missile frigates. To reduce risk to budget and schedule, it will be built on an existing hull design and armed with tried-and-true combat systems and weapons. The current program of record is for 20 ships, although it could be more. The current contractor, Fincantieri Marinette Marine (FMM) of Marinette, Wisc., has been awarded a detail design and construction (DD&C) for up to 10 ships in the program—the lead ship plus nine option ships, although a contract could be awarded to a second yard to get more ships into the fleet sooner.

FMM's yard is currently optimized to build LCS, which it does for prime contractor Lockheed Martin. It will build four additional multi-mission surface combatant hulls of a similar design for the Royal Saudi Navy, and possibly one for the Hellenic Navy. But it has now turned its attention to reconfiguring the production facilities to build the larger FFGs.

FMM is making capital investments to its infrastructure, including a new or upgraded automated panel line; preparation and blast paint facility; construction facility for modules and grand modules; and a final hull erection and outfitting facility. The yard at Marinette has traditional launch ships sideways into the Menominee River, but is procuring a new shiplift. Ships at land level are moved onto the shiplift, which then submerges so the ships can float free.

FMM's Bay Shipyard at Sturgeon Bay is also getting a steel

processing and fabrication facility to be able to work on naval vessels, and will perform FGG 62 work in a new module/super construction and hull erection facility.

Just about all of the hardware and software is proven technology, so risk should be reduced. Unlike the two variants of LCS, which had new propulsion systems, the frigate will be based on a proven design, albeit modified for more American content. However, Congress has directed the Navy to make sure it works by establishing a land-based test site and validate the design.

According to the CRS report, "Under the DD&C contract, the Navy has the option of recompeting the program after the lead ship (if none of the nine option ships are exercised), after the 10th ship (if all nine of the option ships are exercised), or somewhere in between (if some but not all of the nine option ships are exercised)."

## Parental guidance advised

To reduce risk, the FFG 62 is based upon a "parent design," the Italian-French FREMM (Fregata Europea Multi-Missione) frigate, a ship that is being been built in in France and Italy for their respective navies and a few foreign customers. FMM's parent company, Fincantieri builds the ships at their Muggiano shipyard at La Spezia, Italy.

Although the parent design is European, FFG 62 will have significant American content, to include a government furnished combat system centered around the new SPY 6 radar and newest baseline of the Aegis Combat System and other U.S. sensors and systems.

The U.S. frigate will be about 23 feet longer and about 500 tons heavier than their European cousins to provide margin for growth and to accommodate future weapons such as lasers, although the bridge and propulsion plant layout is the same. It will be equipped with a 32-cell, strike-length MK 41 vertical launch system (VLS) launcher and armed with Standard Missiles, Naval Strike Missile capable and Evolved Sea-Sparrow Missile (ESSM) Block II; a Mk110 57mm main gun, and have the RAM close-in system for point defense. It will have a flight deck and hangar for MH-60R helicopters. It will have essentially the same anti-air and anti-submarine warfare capability as the newest Flight III DDGs.

Speaking at the Surface Navy Association's annual symposium earlier this year, FFG program manager Capt. Kevin Smith said, "We have ample margin for this hull form. We also have in our requirement space, weight, power and cooling margin to accommodate upgrades down the road over the


*ITS Carabinieri (F 590) while under construction at Fincantieri's shipyard in L Spezia, Italy.*

Edward Lundquist

service life of the ship. Some of those could lead to direct energy type projects and other capability."

The Navy's current force plan calls for 52 small combatants, made up of the 32 littoral combat ships and 20 of the new FFGs.

The Navy estimates the cost per ship at about $870 million. The Congressional Budget Office said that estimate may be low. "Compared with the design on which it is based, the FFG(X) will be more densely built and will have somewhat more complex weapon systems."

The lead ship is planned for delivery to the Navy in around 2026. The first 12 FFGs will be assigned to Everett, Wash., along with the training and support infrastructure concentrated there. Eventually the FFGs will have Blue and Gold Crews, with 24 crews based at Everett, but the lead ship will be initially manned with a single crew.

The Italian FREMMs are classified as either general purpose or ASW. There are differences in weapons and sensors. The GP variant has a bigger gun, while the ASW variant has a towed acoustic array, for example.

The Navy sees the new FFG as a flexible platform for independent operations, convoy escort or strike group integration.

## Risk reduction

After fits and starts with truly transformational warships—namely the Ford-class aircraft carrier, Zumwalt-class guided missile destroyers and the Freedom and Independence classes of littoral combat ships—the U.S. Navy's next class of surface combatant will hopefully have less risk.

At the same time, the Navy is completing its buy of LCS, and the Flight IIA DDG 51 Arleigh Burke-class of guided missile destroyers. The next generation of DDG 51s – the more advanced Flight IIIs – have begun production, and will serve as a bridge between the retirement of the CG 47 Ticonderoga class of guided missile cruisers and the arrival of the yet-to-be fully defined but probably pretty transformational large surface combatant. The Navy simply can't afford to have a program beset by delays while things settle down and it figures out the technology out, so its counting on a smooth introduction of the frigate into the fleet.

# Keeping Your (hull) Stress and Fatigue Under Control

*Digitalization is expediting and maximizing the safety and economics of structural stress and fatigue measurement technologies.* ***Terje Sannerud, Chief Commercial Officer*** *at Light Structures, explains.*

Yet to be mandated by the IMO or included in any SOLAS regulations, structural stress and fatigue monitoring systems have in fact been used for providing real-time safety warnings on large and specialist vessels for more than two decades. They are used to measure the impact of dynamic forces on a ship's hull and structure to provide data that captains, and navigators can act on to ensure safe operations in practically any conditions.

There are two competing approaches to hull stress monitoring, setting ship managers and owners up with a choice between electro-mechanical systems or fiber optic technology. The latter is the basis for the SENSFIB Hull measuring system developed by Light Structures, which uses an accurate, high-level multi point monitoring technique called Fiber Bragg Grating (FBG) to deliver more precise data covering diverse local loads and global loads such as deflection, slamming, whipping and springing.

Light Structures was responsible for commercializing FBG-based hull stress sensors as a spin-off from a Norwegian Defense Association project around the turn of the century. The ambition was to provide commercial customers with access to stress and fatigue measurement data that was not only more resilient and granular than that provided by electro-mechanical systems, but was also more cost-effective due to being easier to install and having no requirements for annual recalibration.

## Specialist Vessels

The puzzling lack of a regulatory focus on either electro-mechanical or fiber optic stress monitoring systems has meant that only vessels with very specific requirements have so far adopted the technology. Still, despite the lack of pressure from authorities, there are now more than 300 customized SENSFIB installations currently active on the largest commercial ships, oil & gas platforms, FPSOs and naval or coast guard vessels.

The hull stress data acquired via SENSFIB has undoubtedly contributed to reducing maritime casualty statistics, but as the technology and its use as an early warning system on board

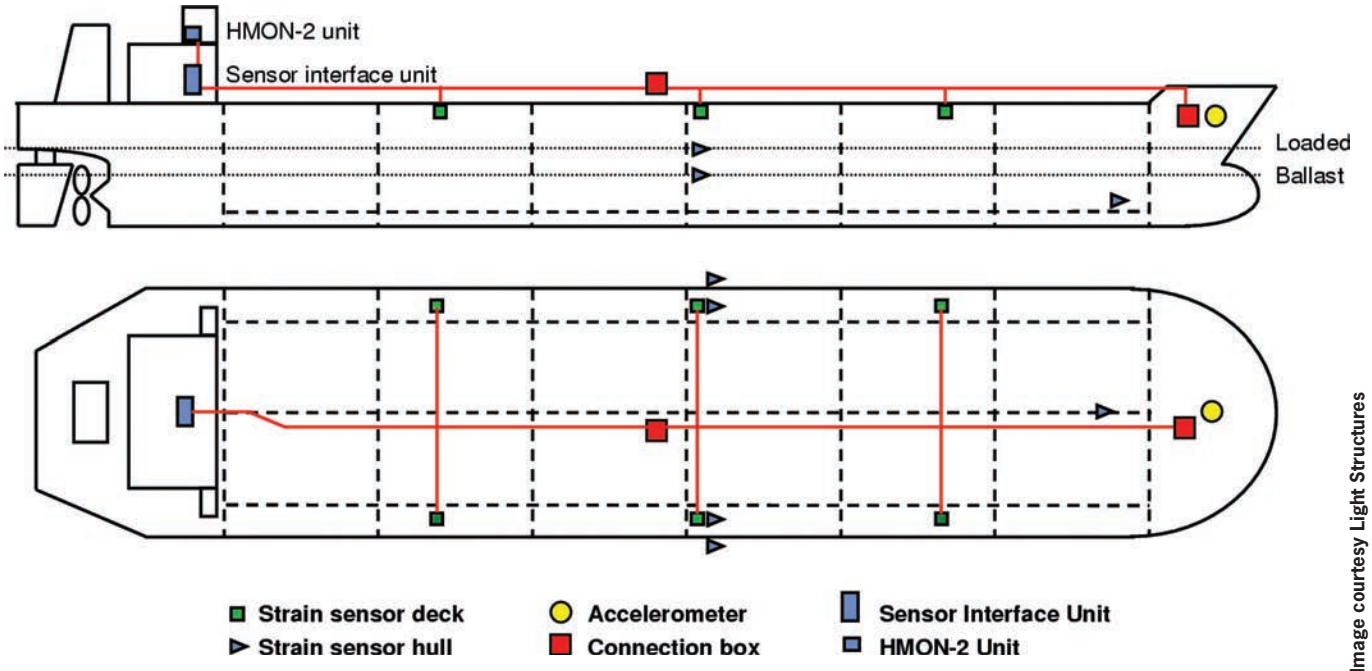



Image courtesy Light Structures

matures, new avenues for unlocking insight from the data are opening up, especially as maritime digitalization takes hold. Improved fatigue measurements, calculated as a result of monitored deflection and vibrations is perhaps the most advantageous of the emerging uses for structural stress data, especially when applied to verify the design numbers of expensive, one-of-a-kind vessels or to improve asset management across a large fleet of identical, or similar ships.

Comparison of actual fatigue life with design fatigue life is a standard function in SENSFIB systems. Results are normally presented based on the latest half hour of data (single point in time) with a bar graph, and the time history of the comparison implemented as an onshore function. A graphical representation of the timeline can be implemented onboard as a custom function in the SENSFIB operator station and in case there is a significant difference between the actual fatigue life and the design life, the system can provide the user with advice on the cause of this difference.

The standard function is to present the overall fatigue life calculation together with the contribution due to wave loading (included in design life) and contributions due to vibrations (not included in design life). With access to a full set of design parameters and environmental data, including wave data, it is possible to extend the advisory function to include a comparison of the actual loading conditions with the loading conditions used for design life calculations, as well as a comparison of the actual wave scatter with the design wave scatter.

## Unlocking Data

To date, fatigue calculations from stress monitoring measurements have been somewhat constrained because the raw data would normally have to be hand delivered on back-up media to the shore office, and then analyzed or applied in what is essentially, an operational silo. Lower cost satellite connectivity and the deeper integration possibilities of digitalization and the Internet of Things are bringing new life to stress and fatigue monitoring data though, and nowhere is this more important than efforts to maximize operational lifetimes of multi-million-dollar maritime assets.

With online access to SENSFIB data uploaded direct from ocean going assets, Light Structures can help to verify or refute complex vessel designs on an on-going basis. Over time, this will contribute to building even safer, more effective and less costly ships and maritime assets. Further, through digitaliza-

tion of SENSFIB data, it's possible to measure fatigue across entire fleets of identical vessels in order to ascertain how certain maritime environments affect the condition of ships.

As part of a Condition Monitoring System for instance, this data could allow for preventative maintenance on stress and fatigue hotspots as well as providing a platform for improved fleet management. With the ability to measure the impact of dynamic forces in any particular region, the lifespan of vessels across an entire fleet could be improved by minimizing exposure to environments that have been measured to cause more damage to vessels. By 'swapping out' vessels, there is potential to spread the financial and asset life expectancy cost of operating areas with high fatigue rates, therefore reducing damage or downtime caused by fatigue across an entire fleet.

The optional SENSFIB Active Fatigue Management (AFM) system is a service that adds advanced fatigue analysis functionality to the core system, including; a rainflow counting algorithm and miner's sum calculations for calculating actual fatigue damage at sensor locations; hotspot monitoring by sensors in coldspots, by scaling measurements with Stress Concentration Factors (SCFs preferably provided by yard based on structural analyses); virtual sensors, i.e. each actual sensor is scaled with different SCFs for several nearby hotspots; life-time usage based on comparison over time between the actual fatigue life consumption and the nominal consumption for design life; separate calculations of fatigue damage due to wave-driven stresses and fatigue damage due to vibration phenomena and; low-cycle fatigue calculations to include the contribution from loading and offloading cycles.

## Long-term Fatigue

Light Structures has already developed methodologies and workflows to apply SENSFIB data for long-term fatigue measurement. The US Coast Guard's Service Life Extension Program (SLEP) is an ideal example, where fatigue data has helped to signpost specific maintenance requirements. With data collected manually however, the complexity has made it the preserve of the particular dedicated owner or operator. It's no surprise that an organization that is duty bound to maximize the lifespan of its assets will carry out such an undertaking then. For the rest, digitalization is making lifetime fatigue monitoring more viable due to instant access to data and the ability to analyze seemingly disparate data in a single platform, which ultimately, can provide more connected insight and even more value.

Light Structures is leveraging more connectivity with the SENSFIB Integrated Marine Monitoring System (IMMS), which combines comprehensive stress monitoring with environment monitoring parameters and advanced processing for real-time analysis of live data and theoretical models. Third party data from environmental monitoring systems, loading computers, DGPS and mooring tension measurements can be combined with data from the FBG sensors for stress and strain monitoring, as well as the motion sensors and wave spectrum analysis that make up a standard SESNSFIB installation.

This is also just the start. Light Structures' stress and fatigue data will be used as an essential component in Digital Twins and CBM systems, and through this, the combinations of data types are practically endless. And so too is the insight that

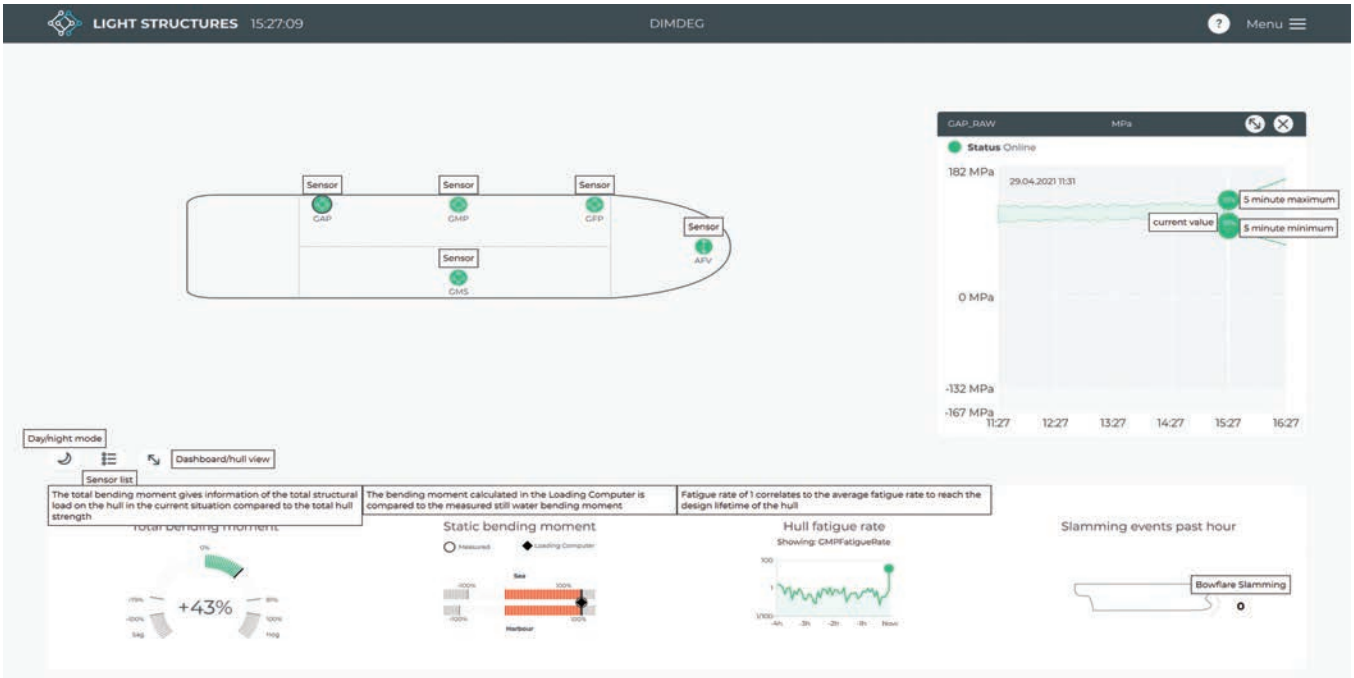


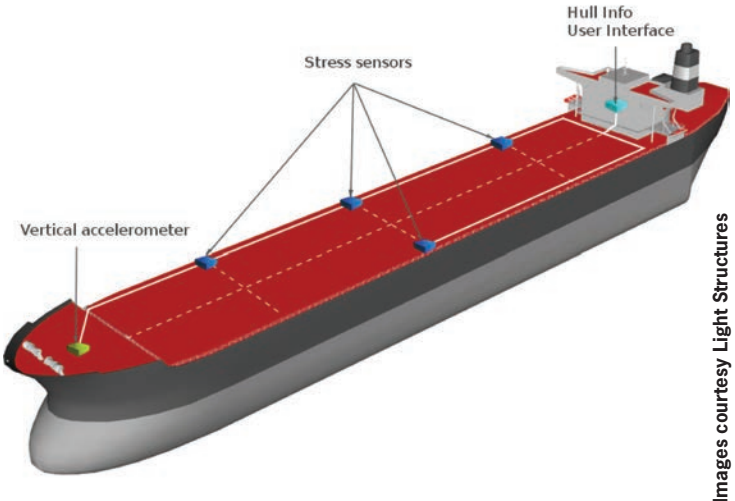

Image courtesy Light Structures

can be gained. Regulations or not, the savings enabled by extending the useable lifespan of a vessel or an entire fleet are an attractive proposition for ship owners and managers counting on digitalization to deliver operational efficiency.

**The Author**

## Sannerud

Terje Sannerud, Chief Commercial Officer, has worked at Light Structures for eight years. He is responsible for all commercial activities and development globally.




Images courtesy Light Structures

# The Satcom 'Highway' *will Enable Maritime Digitalization & IoT Solutions*

*By Greg Trauthwein*


**Global maritime communications powerhouse Inmarsat earlier this year announced a pair of new tech offerings – ORCHESTRA and ELERA – that are touted as 'the communications network of the future.' We caught up with Ronald Spithout, President, Inmarsat Maritime, for additional insights on how these services will power the future of maritime IoT.**

## Meet Orchestra

"In my view, with an engineering background, (ORCHESTRA) is simply cool," said Spithout. "We call it the communication network of the future because it will redefine our mobility offering in the industry, not only in maritime, but in all verticals. It is doing that by leveraging all kinds of underlying networks that we have at our disposal."

Inmarsat ORCHESTRA is designed to be a "global, multi-dimensional, dynamic mesh network that will redefine connectivity at scale" as Inmarsat said when introducing it this summer. ORCHESTRA is envisioned to be a seamless configuration of Inmarsat's ELERA (L-band) and Global Xpress (Ka-band) networks with terrestrial 5G, targeted low earth orbit (LEO) capacity, a layered approach supplemented by a 'dynamic mesh network', which allows individual terminals to act as nodes to route traffic to and from other terminals.

"Depending on where you are and what you need, the 5G element automatically picks up the best performance needed for your application," said Spithout. Adhering to the adage there is power in numbers, "this will be a dynamic mesh network, whereby vessels are repeating each other signal," similar to the way a home router handles WiFi.

The layered approach is designed to meet the accelerating bandwidth requirements of more diverse, demanding and ever more widely adopted applications in the commercial and government mobility markets, as Spithout explains Inmarsat is "targeting the markets that are absolutely dependent on mission critical mobility."

ORCHESTRA is part evolution and revolution, as it combines the power of existing Inmarsat services and satellites, while adding the dynamic mesh technology and additional low orbit satellites as needed.

## ELERA

In concert with ORCHESTRA, ELERA is designed to be a catalyst for increased IoT solutions across all vertical markets that Inmarsat services, including maritime and offshore energy.

"The drivers (for ELERA) are the accelerated demands on IOT and the ongoing growth of functionality where you need


Image courtesy Inmarsat

**"We call it the communication network of the future because it will redefine our mobility offering in the industry, not only in maritime, but in all verticals."**

• • •

**Ronald Spithout**
President, Inmarsat Maritime, discussing the creation of Orchestra.

it for your safety services," said Spithout, noting that the new technology is designed to be smaller, lighter, faster and cheaper, and confirms Inmarsat's commitment to L-band services.

ELERA will be designed to create the smallest footprint, low-cost terminal for L-band users, according to Inmarsat "delivering the ideal framework for satcom IoT at scale with supporting cloud-based management." Inmarsat is launching a pair of new satellites to enhance the ELERA network, with the first I-6 satellite scheduled to launch at the end of 2021. The I-6 satellites are significant as the L-band capacity on each I-6 will be substantially greater than Inmarsat's 4th generation spacecraft and, among other enhancements, they will deliver 50% more capacity per beam.

The new innovations that Inmarsat is investing in include spectrum management technology to deliver L-band speeds up to 1.7Mbps, the smallest footprint, low-cost L-band terminal and two new L-band satellites.

The new spectrum management capabilities (known as Carrier Aggregation) being incorporated into the ELERA network will deliver the fastest speeds globally available to L-band customers, according to Inmarsat.

Live customer trials in commercial aviation are scheduled to start during the course of 2022 and the technology will be rolled out in the coming years.

## Digitalization Fast-Track & the Seafarer

The COVID pandemic has helped to fast-track IoT and digitalization trends in tandem, across all industries. And while Inmarsat is playing a pivotal role in this high-tech phenomena that is driving shipping and business efficiency, Spithout focuses first on digitalization as it applies to the human aspects, specifically the plight of seafarer.

As has been well-documented, COVID has had a dramatic, negative impact on the world's 1.6 million seafarers, and a majority of countries have still not yet declared seafarers as "Key Workers", a designation which would help to facilitate more efficient crew changes. The situation, which is easing now but is still pervasive, has taken a tremendous toll on the physical and mental health and welfare of seafarers, men and women who helped keep ships running and global commerce flowing during the pandemic.

"People tend to forget is that more than 90% of (most everything you purchase) is coming to you by a ship," said Spithout. While it could never replace human interaction, Spithout said that throughout ships outfitted could use a digital link to provide connectivity for social interaction between seafarers and their families and friends, while also providing the conduit to quickly and efficiently deploy physical and mental health assistance.

"This was a proof point that we, together with our application partners, could roll it out quickly to vessels while they were at sea. That is one side of digitalization that had an enormous boost because of COVID, but it's not a good one because it came over the back of seafarers suffering."

In looking at the myriad of companies that generate their revenues by physically being in touch with the ship, the rapid advance of COVID effectively thwarted this basic connection, forcing companies and stakeholders to find alternate ways of working. Enter IoT.

"In the beginning of the pandemic, a lot of those vessels couldn't be 'touched.' You couldn't get to the vessel," said Spithout. "It made people aware that not only do they need a different way of working to circumvent the fact that they couldn't physically visit vessels, and also that you can change the way you provide your services by the smart use of applications over a digital platform," touting for instance the fast-track of classification societies' use of remote inspection technologies.


**Harley Combs,** *Director, Austal West Campus Ship Repair*

# Austal USA Opens Ship Repair Business in Mobile

**Known best for its construction of U.S. Navy warships, Austal USA in September 2020 acquired waterfront property along the Mobile River and established a commercial ship repair facility. Mike Bell, Austal's VP Operations and Harley Combs, Director, Austal West Campus Ship Repair discuss the plan.** By Greg Trauthwein

Austal USA's long-established shipbuilding facility in Mobile, Alabama, is a modern ship manufacturing factory, one of the largest aluminum warship builders in the world producing new ships for the U.S. Navy. But the company is not resting on its laurels, investing mightily in the middle of the pandemic to create both the capacity to build steel ships as well as the opening of a new ship repair facility.

"As part of the overall plan, we wanted to be in control of our own destiny when it came to launching ships, and that's where West Campus came into play," said Bell, noting the new drydock that came with the new land purchase. While commercial ship repair is new for the company, Austal USA ops are global like that of its main customer – the U.S. Navy – and today it has a growing facility in San Diego, offices in Singapore and 'fly away' teams that are perpetually on the move to service the fleet it has built.

The company's recent acquisition of property, directly across the Mobile River from Austal USA's 165-acre corporate headquarters, resulted in the opening of a new home for commercial ship repair in the Gulf of Mexico. At the same time, it is installing a new 100,000 sq. ft. steel panel line at its headquarters, scheduled to open in Q2 2022; a pair of investments that will help drive the company's business for the next generation.

## Inside Austal West Campus

Austal's acquisition included 15 acres of waterfront property spanning almost 3,000 linear feet of waterfront pier space, a 20,000-ton certified Panamax-class floating dry dock, a 300,000 sq. ft. outside fabrication area, and 100,000 sq. ft. of covered fabrication facilities located 30 miles from the Gulf of Mexico.

A big selling point for the new repair yard is its proximity to Austal USA headquarters. "We believe in being vertically

integrated, because that allows us to control quality and cost," said Bell. "So, if Harley runs into something (and needs resources) he just makes a phone call. There happens to be a river between the two campuses. If there wasn't, you wouldn't even know that it was a different part of Austal the way it's set up right now."

In addition, Combs said Austal USA was able to retain 40 people that had worked at the ship repair facility previously on the premises, a talent-base which gives the Austal USA commercial ship repair upstart immediate credibility and experience. "We have maintained a project management team over here that has been doing this work now for more than 20 years," said Combs. "I've got a couple of them that have more than 30 years of experience. The people that were here were the result of a downsizing over the last few years of the previous company. When we got the people that were left here, we got the best of the best."

The Austal West Campus repair facility provides access to deep water berthing for vessels up to 1,000 feet, advanced manufacturing capabilities including a friction stir welder, CNC machines, CNC cutting tables, and a carpenter shop, machine shop and electrical and pipe shops. The repair facility also offers heavy-lifting capability with mobile cranes, overhead cranes and wing wall cranes that travel the length of the 668-foot dry dock. The services provided by Austal's Mobile ship repair operation range from conversions and upgrades to advanced ship repair.

The machine shop and fabrication areas are fully equipped with overhead cranes, lathes, and CNC plasma cutters, and notably it is able to turn shafts up to 55-ft. long on a lathe. Other technical services offered to the company's service clients include full-service detail design capability, 3D modeling, field engineering support and dimensional accuracy control.

At it headquarters across the river, Austal USA is putting the finishing touches on its new 100,000 sq. ft. steel panel line. "This is geared towards us being a full-blown steel ship construction yard," said Bell. "We're the largest aluminum ship builder in the U.S.; probably the largest aluminum warship builder in the world." But in analyzing the market, Austal USA assessed that the Navy, Coast Guard and Military Sealift Command – "needs somebody like us on the steel side. So we made that investment." To accommodate the new steel line, Austal will literally split its modular manufacturing facility down the middle. "One side will be kicking out aluminum modules, the other side will be kicking out steel modules," said Bell.

# KOTUG's E-Pusher Series Advances Fuel Flexibility

**KOTUG's new E-Pusher series is flexible to design, build and operate, with an eye on vessels that are efficient and help cut emissions for inner cities. Almar van Herk, Senior Business Development Manager, KOTUG, discussed the concept and the plan with Maritime Reporter TV.**

***By Greg Trauthwein***

Earlier this year, KOTUG established an inland shipping division premised on electric powered pusher tugs featuring 'swappable' energy containers and smart AI-driven dispatch and route planning applications for the inland water transportation industry.

There are many simultaneous efforts globally to decarbonize the maritime sector, and inclusion of KOTUG in the conversation helps drive others to the design table. KOTUG is a fourth-generation family owned Dutch company which, since its start in 1911, has a long history of innovation leadership in the space – including the establishment of Rotortug in 1996 as the shipbuilding and trading arm of KOTUG International.

The move for KOTUG to establish the new inland shipping division was a move driven simultaneously by the global energy transition and the continuing modal shift from road to water for efficient movement of goods

"As a marine company with a strong heritage, a long tradition, we are developing on a range of activities," said van Herk in discussing the rationale behind the decision to fast-track an electric pusher tug series. "The biggest challenge in the shipping market today is 'how do we go about with the energy transition?'" The company saw the start of activities for the inland shipping market as a natural development and a step forward in its ambition to be part of the solution of the transition towards a zero-emission maritime industry.

The E-Pusher Series is touted as a range of modular and scalable electric pusher tugs, powered by swappable energy containers. To date, the E-Pusher Series has three models – the S, the M and the L – ranging from 5.5 to 22 meters in length and a maximum depth of 0.45 to 1.35 meters, which the company claims is a draft that is 30% less than conventional pusher tug designs, all on a steel or aluminum frame with two or three electric thursters.

"We already started with serving city logistics with the E-Pusher S series," said van Herk, noting that via KOTUG CityBarge B.V. it started activities in Leiden with a 5.5m E-Pusher *(pictured above)* providing a zero-emission alternative for heavy truck transport in inner-cities. KOTUG CityBarge

MARITIME REPORTER TV **Watch the video @ bit.ly/3EAL7fm**



Images courtesy KOTUG

**Almar van Herk, Senior Business Development Manager, KOTUG,**

BV. is a partnership of KOTUG with Circle Line Logistics B.V., designed to make cities more liveable by restoring existing inner-city waterways by using them to transport garbage, construction materials and retail products.

In addition to the quantifiable emission reductions, there are tangible business drivers too, as with the modular approach and lean assembly method, KOTUG says the construction time of the E-Pusher vessels is cut dramatically compared to conventional vessels. "If you look into conventional pushers, the construction will take you about approximately 12 months or more," said van Herk. "We can build this vessel in four months." As he explained, it is essentially analogous to a large LEGO set, with construction enabled nearly anywhere, from a traditional shipyard setting to a lake or, if desired, "in the middle of the desert."

While there are many, arguably the biggest design highlight is the variety of energy containers ranging from Stage V diesel, (bio)gas and hydrogen to battery solutions, capable of handling both AC or DC power.

"The design is developed to handle all kinds of energy types to (help) facilitate the energy transition," said van Herk. "So at the start, the ePusher series is able to handle more traditional diesel stage five containers or gas containers that can be easily swapped to either battery, hydrogen or any other type," based on availability and the economics of the solution.

## Smart Routing

While fuel and energy consumption is an obvious and large portion of the decarbonization discussion, equally important is the digitalization discussion, specifically optimizing route and propulsion performance regardless of fuel.

Enter OptiPort.

"OptiPort is a dispatch, routing and reporting tool created to schedule and sail vessels from A to B," said van Herk. "Traditionally, this (activity) is done manually, but with OptiPort this process is fully automated," an automated dispatching system based on historical and real-time information bridging port and terminal information with ship operations. Just as importantly, OptiPort is not simply a concept, rather a reality, already working in the real world with multiple references. OptiPort is a tool supporting fleet owners in optimizing expected departure- and arrival times, routing and speed control, leading to reduced energy usage and just-in-time departure and arrival. The system is active since 2017, currently in use by vessel operators in Australia, Japan, the U.S., Canada, Belgium and the Netherlands.

# THE DATA BARGE

## Silicon Valley meets maritime in the making of a Barge-Based Data Center

*Nautilus Data Technologies (NDT) and Elliott Bay Design Group (EBDG) provide an interesting new twist to the maritime digitalization discussion, with the design, manufacture and delivery of an innovative 7MW data center housed on a refurbished 240-ft. deck barge.* ***Jim Connaughton, CEO, NDT*** *&* ***Michael Complita, PE – VP Strategic Expansion, EBDG,*** *discuss the strategic and environmental advantages as well as the future of housing massive computer banks on barges.*

Photo courtesy Nautilus Data Technologies

When one says "Silicon Valley", the first image to come to mind likely is not a barge. In fact, arguably, a barge would not make the "Top 100,000".

Jim Connaughton and NDT are aiming to change that, as it teamed Elliott Bay Design Group, Lind Marine, Veolia and the Port of Stockton to refurbish and deliver a data center on the water, a concept that NDT says offers many intriguing strategic and environmental advantages that could make barge-based data centers the wave of the future.

"Data centers are now new mission-critical essential infrastructure, just like power plants, just like shipping and ports, just like water treatment facilities," said Connaughton. "With our partners at Elliott Bay Design Group we've married the best of maritime technology and adapted that for use in the data center environment to produce a data center that is among the highest performing in the world, the most energy efficient in the world, and critically, super sustainable. Now, when you put those three things together, the fourth feature is flexibility and mobility, similar to other forms of infrastructure such as floating power plants, floating water treatment facilities or floating offshore housing facilities."

*(Connaughton's enthusiasm for the project is palpable, as you can see in watching the full interview on* **Maritime Reporter TV** *@ bit.ly/3mtZmw9).*

## Heat's a (computer) Killer

"When you think of a data center, it's like a Costco with a hundred times the air conditioning (requirement)," said Connaughton, as data centers by their nature – with rows and rows of high-power, high-value, power-hungry computers – require massive cooling units to ensure the computers remain at optimal temperature for functionality and long-life. Here in lies one of the big strategic advantages for a barge-based system, as the proximity to the water provides an abundance of natural water cooling, which is a long- proven solution to keep ship and boat engines cool. NDT's patented Total Resource Usage Effectiveness (TRUE) cooling closed water loop technology is central to the concept's success.

"At Nautilus we put our heads together with Elliot Bay and said, "Hey, let's figure out how we can create a floating data center and take advantage of the natural coldness of the water around it to cool that data center," said Connaughton. While

*"With our partners at Elliott Bay Design Group we've married the best of maritime technology and adapted that for use in the data center environment to produce a data center that is among the* **highest performing** *in the world, the* **most energy efficient** *in the world, and critically,* **super sustainable** *... the fourth feature is* **flexibility and mobility.**"

**– Jim Connaughton, CEO, NDT –**

MARITIME REPORTER TV **Watch the interview @ bit.ly/3mtZmw9**

the cooling solution provides a preferable solution to keeping the computers cool, it also provides another key strategic advantage according to Connaughton: Sustainability.

"We gather up cool water and circulate that through an open loop to a heat exchanger. Then we connect that to a closed loop of pure water inside the data halls, and we bring that cold water right to the back of the computer racks to pull the heat off the servers. Then we take that warm water back out to the open loop and put it back in the environment, with a very low (return) temperature impact. So we are harmonious with the thermal signature of this industrial activity, which means we can do this without any concern about harm to fish and wildlife."

According to NDT, the barge-based data center is 75% more energy efficient in cooling compared to air conditioning, which is a powerful argument in and of itself. But add in that the barge-based system consumes no water – "we just borrow it for 16 seconds," said Connaughton – and is uses no water treatment chemicals or refrigerants, the 'Sustainability' claim grows stronger.

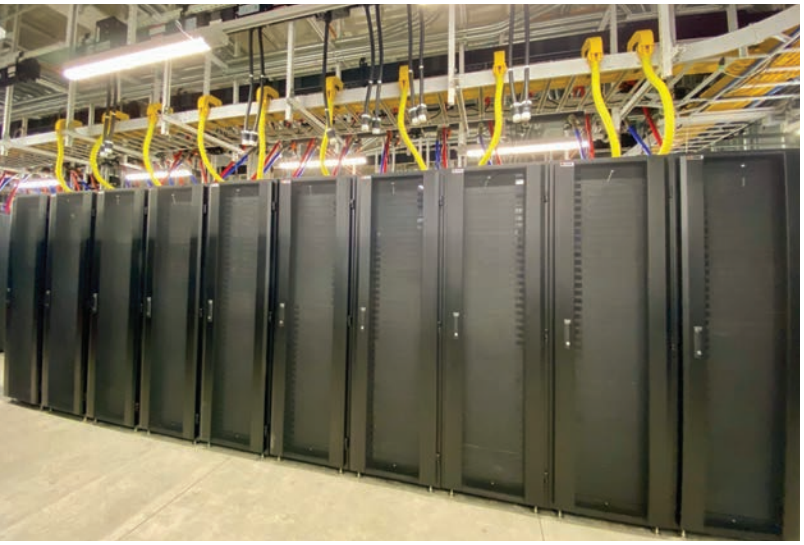
## Not your Standard Barge Load

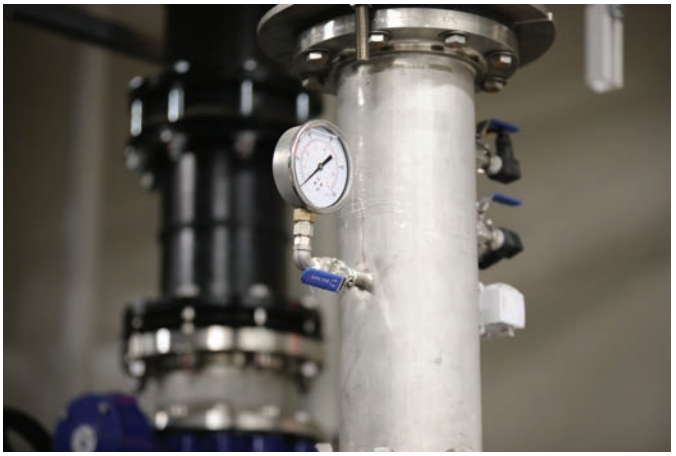
While the cargo on NDT's data barge might be unique, the barge itself will look most familiar according to Michael Complita, PE – VP Strategic Expansion, EBDG. "From a naval architecture side, I would say in one respect nothing's really different about this barge from most of the barges out there," he said, noting that the NDT units are designed and built to ocean marine standards "so that barge can be pulled anywhere on the planet and stand-up to the ocean environment, mobilized and re mobilized anywhere in the world."

On the other hand, Complita calls it "Probably one of the most unique vessels I've ever worked on," premised on the unique systems found onboard, including the orientation of the sea water cooling system. "In most barges and ships you have a sea chest at the aft end of the vessel, kind of down low, where you take in the water and then discharge back out in that same area or back out the stern. In (the case of the barge-based data center), because we're facing upstream in a current, we're taking advantage of that natural flow and the water comes in to the intakes at the very front of the barge and then runs through the piping system in the vessel and then back out the back end of the vessel."

With an eye on both keeping the valuable 'cargo' sufficiently cooled and being kind to the environment, the seawater cooling lines on the barge-based data center are large and unique – 18-inches in diameter – "which is done intentionally with some other features to minimize the environmental impact to the sea life in the area." To that end, there are large rotating screens on the end of the vessel where the water comes in, using the natural convection of the river to ensure that the flow through the system is very light.

NAUTILUS® DATA TECHNOLOGIES





"So any fish that do get into the vicinity of the intakes are able to swim away. They're not going to get sucked into that screen and held there until they die. The screen is also a very fine mesh, with a system that continually moves to keep it clean and clear of any debris," and to keep fish and other sea life from being sucked into the system.

Once the water gets into the system, there is an ultraviolet light treatment designed to keep barnacle and muscle growth in check. "From that point it's pretty much a traditional (maritime) seawater heat exchanger," said Complita.

A critical design element in both maritime and data centers is redundancy, and Complita said that all of the primary systems that serve the data storage are fully redundant, and there are duplicate systems for the raw water intakes. "Also the electrical system is pretty unique on this, too," said Complita. "A lot of vessels have redundant electrical systems, but Nautilus has gone so far as to actually separate the shore power into a

*With an eye on both keeping the valuable 'cargo' sufficiently cooled and being kind to the environment,* **the seawater cooling lines on the barge-based data center are large and unique – 18-inches in diameter –** *"which is done intentionally with some other features to minimize the environmental impact to the sea life in the area."*

**– Michael Complita, PE**
**– VP Strategic Expansion, EBDG –**

50/50 split at the forward end and aft end of the vessel for redundancy. So if one whole side of the server system goes down, they still have that backup power and storage for serving their customers."

## "Get Smart"

With the first barge-based data centered delivered in late 2020 and now fully operational in the Port of Stockton, CA, Connaughton envisions a vibrant and growing market globally, a solution that intersects with urban planners' mission to build and maintain 'smart' transportation and cities.

"Ports are our friends, and we can bring new economic activity and vitality to the ports," he said. "We can (for example) be the anchor for the cable landing stations that typically come through the ports, we intersect with smart maritime, smart transportation, smart cities. You hear about 'smartness,' all the time. Well, to make smartness smart, you need data centers. And the best place to get those data centers right in the heart of our population centers is to partner with the ports and the other shore-side industrial players."

In particular, Connaughton sees smaller, secondary ports as prime partners, as many of these ports have lost business to the larger ports as containerships and containerization continues to grow. But critically, the NDT data barge solution is not targeted solely to developed countries, as the barge … which is designed to either sit in the water or land-side next to the water … doesn't even need a finished berth to be installed and operational.

"As long as we've got a good stable shoreline and the sufficient water depth of about five meters, we can just float the data center right in," said Connaughton. "We take some technology from the liquified natural gas sector in terms of the pilings that we use to moor the vessel; it's a sliding piling system and then some relatively straightforward shoreside electrical and mechanical infrastructure."

This could be particularly attractive to developing nations, where the need for computing power is high and, generally, the port facilities are already some of the more developed industrial areas in the country.

## Next Steps

With the NDT barge installed at the end of 2020 during the height of COVID, Connaughton said this start-up just started really marketing itself in the spring of 2021, and the next steps include first the standardization of the design so that it can be replicated with increasing ease and efficiency globally in the years to come.

"We are in design work with Elliot Bay right now to take all of this custom work and create a classic modular construction and deployment capability," said Connaughton, noting that talks are ongoing with port globally – from Ireland to Australia, France to Africa – and in the coming 24 to 36 months he hopes to get 10 or more built.

## Pro's & Con's: Water-based v. Land-based Data Centers

Project Nautilus is the first commercial waterborne data center, commissioned in December 2020 and located in the Port of Stockton, Calif. According to **Jim Connaughton**, CEO of Nautilus Data Technologies, barge-based data centers offer a number of quantifiable business and environmental advantages versus land-based centers. While he discussed the drawbacks, too, he is quick to point out that "our business model was to eliminate the cons."

### *The Pro's*

- **Sustainable:** Natural water cooling versus chilled air systems help reduce electric, water and chemical consumption. A near 'zero-impact' facility.
- **Mobile & Flexible:** Data centers can float in and out with minimal port/shore infrastructure needs.
- **Prefabrication:** Everything can be built and tested in a controlled environment, the shipyard.
- **Old Ports, New Markets:** In the developed world, as Panamax ports get bigger, the mid-size ports have capacity. NDT and its barge-based data centers can help restore economic opportunity. In the developing world, the core of these country's economic resiliency is in their ports, with industrial facilities at the shoreline.

### *The Cons*

- **Mindset:** This is new geography for the client, Connaughton said, with the data center sitting in a port or industrial area instead of the more expensive commercial real estate side of town.
- **Water:** While waterfront proximity for cooling is a striking advantage, it could also be a concern as land-based facilities don't have a circulating water loop inside the data hall. The solution: tried and tested maritime technique and technology found in everything from tankers to aircraft carriers."As an added layer of assurance for our customers, we can show them how this closed loop operates under about half a bar of negative pressure. That means if something happened like a hose popped or a valve was open, air gets sucked in instead of water coming out. The entire system is redundant."

DedMityay/AdobeStock

# A SEISMIC SHIFT

*Despite oil prices recently edging past $80 a barrel, scars from two recent oil industry downturns in five years have forced offshore seismic surveyors to look at ways to diversify.*

**By Bartolomej Tomic**

Marine seismic survey companies provide essential data to offshore oil and gas explorers to make better-informed drilling decisions. However, with every oil industry downturn, seismic players are among the first to feel the pang, as exploration budgets usually get cut significantly and revenue streams for seismic data firms dry up.

This was particularly the case last year when the industry was hit with a double whammy: COVID-19 and a global lockdown that hit demand for oil plus a fallout between Russia and OPEC that flooded the market with oil, sending the prices down even further. As expected, exploration budgets were cut, and seismic players revenues were hit, with some of them, such as Polarcus, going out of business.

Now, with oil prices back up to around $80, the situation for explorers has improved, with Rystad Energy recently reporting that vessel utilization in the offshore oil and gas seismic data acquisition sector had reached pre-pandemic levels in the third quarter of 2021.

Rystad, which monitors the activity of 106 seismic vessels, said the seismic fleet's hibernation was over, with around 68% of the fleet now surveying or underway. According to Rystad, the seismic fleet matches the utilization levels of the first quarter of 2020, before the pandemic-induced slowdown hit the seismic industry.

The worst time for the fleet was from the third quarter of 2020 through March 2021, when 46% of the global fleet was inactive (either standby in port or stacked), Rystad said.

## (Partial) Pivot

While the market sentiment seems to be improving, pessimistic long-term views on the future of oil, recent and frequent oil downturns, and environmental pressure, have forced seismic data companies to start looking beyond the oil and gas industry. In the past year, seismic firms have thus started working to diversify their offering, find their role in the accelerating energy transition towards renewables, and make themselves "futureproof," by not depending solely on offshore oil and gas.

One of the most active seismic companies in this push to diversify is Norway-based seismic data company TGS, which earlier this year formed the New Energy Solutions (NES) business unit, to pursue opportunities related to the energy transition, in industries contributing to the reduction of GHG emissions, such as Carbon Capture and Storage (CCS), Deep Sea Mining (DSM), geothermal energy, wind energy, and solar energy.

"Many of the investments required in renewable energy and CCS have long pay-back times. It is therefore critical to make well-informed and precise investment decisions. Our aim is to be the leading provider of data and insights that help de-risk investments and reduce the time-to-market," TGS, which doesn't

own seismic vessels, but rents them as needed, said at the time.

Shortly after the formation of NES, TGS announced its entry into the offshore wind arena, buying 4C Offshore, a market intelligence and consultancy firm providing research and insights to the offshore wind industry. At the time of the acquisition, 4C Offshore, based in Lowestoft, UK, employed 29 people and provided data on more than 2,000 offshore wind projects, and had recurring revenue streams from a diversified base of almost 350 clients, serving 2,200 users.

In 2020, subscription payments for 4C Offshore's data services accounted for almost 80% of revenues, TGS said, without sharing info on the level of 4C Offshore's revenues.

TGS then, in the same month, signed an agreement with the Norwegian low-carbon tech company Horisont Energi to jointly work on the identification and classification of CO2 storage reservoirs and develop new Carbon Capture and Storage (CCS) technologies.

A few days later, TGS announced a collaboration with oilfield services giant Halliburton to bring advanced seismic imaging to fiber optic sensing to help oil firms boost output rates, but also explore carbon storage options, such as carbon storage monitoring, in another proof that the whole oil industry has taken note of the blowing energy transition winds.

Talking about winds, TGS in August announced its involvement in the growing U.S. offshore wind market, expanding its coverage of numerical weather prediction (NWP) model data for offshore wind off the East Coast U.S., extending from Massachusetts to North Carolina to create a higher resolution dataset than publicly available with coverage over the key offshore wind industry focus areas on the U.S. coast.

## Seabed Minerals

Another Norwegian seismic company, SeaBird Exploration, has in the past year announced forays into deepsea mining and offshore wind. It launched Green Minerals, a company focused on deep-sea mining of marine minerals and Rare Earth Elements (REE) "key to the green shift," and "eliminating the social costs in onshore mining while reducing the environmental footprint."

The company said that medium-term, Green Minerals' plan is to win licenses to survey, explore, and produce Marine Minerals on the Norwegian Shelf, "thereby "capitalizing on $79 billion worth of resource potential.

Norway could license companies for deep-sea mining as early as 2023, potentially becoming one of the first countries to harvest seabed metals for electric vehicle batteries, wind turbines, and solar farms, according to a Reuters article, published in January.

In November 2020, the American Bureau of Shipping's Vice President of Global Offshore Markets Matt Tremblay said the world demand for metals required for new forms of transportation and electrical storage is increasing. "Metals such as cop-

per, cobalt, nickel, and manganese exist on land, but are increasingly difficult to extract sustainably. Subsea mining, with the abundant resources on the seabed, offers an alternative," he said.

Green Minerals expects to have its marine minerals production system ready to start pilot production in 2026. Apart from the seabed minerals push, SeaBird Exploration in April this year announced its first foray into the offshore wind industry, with a contract secured for its Petrel Explorer vessel, to serve as an accommodation vessel for a wind farm maintenance campaign in the Baltic Sea. According to the vessel's spec sheet, the Petrel Explorer offers 54 berths in 40 cabins.

## Monitoring from Space

French seismic company CGG has been transforming for a few years now, going asset-light, but also delving into new non-traditional business areas.

It sold its vessels to Shearwater in January 2020, with the deal including a five-year vessel capacity agreement for marine seismic acquisition services between the two companies. While the sale was dubbed CGG's exit from the marine data acquisition business, CGG is still conducting seismic surveys, but it is doing so using Shearwater's vessels.

CGG also this year announced deals not typical for an oil and gas seismic data company.

It in April it partnered with dCarbonX, a company looking to develop offshore geothermal energy and storage sites for CO2, hydrogen, and ammonia in Ireland and UK.

CGG will bring its geoscience solutions to help identify and de-risk subsurface storage, sequestration and geothermal energy sites using its expertise in geological, geophysical, engineering, modeling and monitoring technologies, including instrumentation from Sercel, its equipment division, it said.

Also in April, a consortium led by CGG was picked by the European Space Agency's Space Solutions initiative for a study aimed at developing new environmental monitoring technology and services to help combat the global marine litter crisis.

CGG will collaborate with Mott MacDonald, a global engineering, management and development consultancy, and Brunel University London to develop new environmental monitoring solutions based on CGG's analysis and processing of Earth observation data and using its artificial intelligence models.

The first 12-month phase of the study will focus on establishing the technical feasibility and commercial viability of new satellite-based services for detecting large aggregations of floating plastics to improve understanding of the sources, pathways and trends of plastic pollution in marine and coastal environments.

Apart from this, CGG in May launched a maritime pollution monitoring solution named SeaScope.

CGG said SeaScope would help a range of offshore industries mitigate risks, respond quickly to events, and support their environmental and operational transparency measures.

The solution was developed with the support of the European Space Agency together with a group of energy companies and emergency response organizations. CGG earlier this year via its Satellite Mapping group completed a high-resolution hydrocarbon seeps study commissioned by the Norwegian Petroleum Directorate (NPD).

The study aimed to increase petroleum system knowledge across a relatively data-poor area of the northern Barents Sea.

CGG Satellite Mapping's SAR satellites acquired a large collection of high-spatial-resolution SAR imagery at a high revisit frequency. Ensuing processing and analysis by its CGG specialists identified the presence of small-scale naturally occurring seepage slick features, unlocking, what CGG says is valuable subsurface intelligence.

Also, in July this year, CGG, with the Norwegian marine seismic data acquisition company PGS, announced a plan to combine its seismic MultiClient products and technical capabilities applied to the Carbon Capture Utilization and Storage (CCUS) industry.

"Together, the companies intend to explore, conceptualize and create new derivative data products using existing seismic data to facilitate screening and evaluation of carbon storage sites," the two companies said.

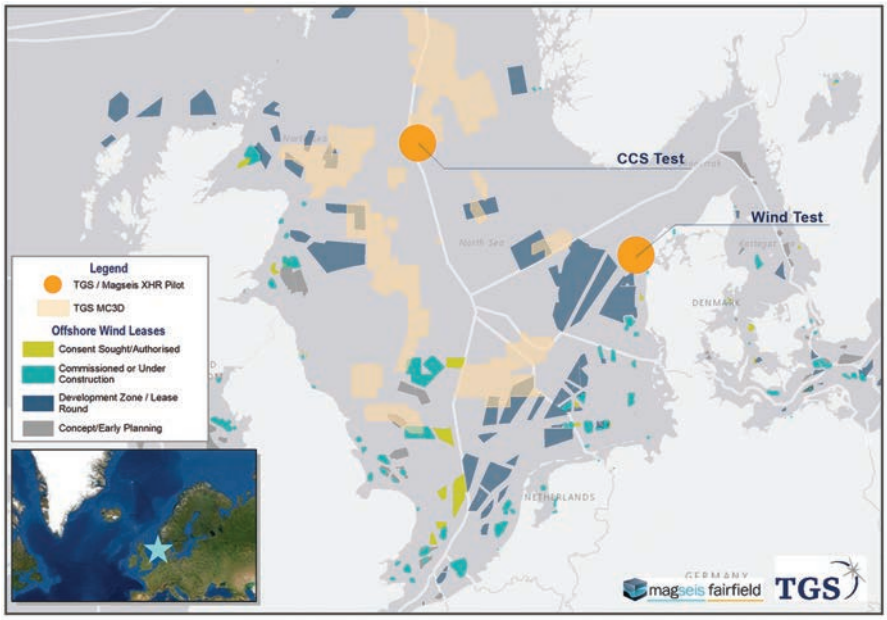



Image courtesy TGS

## Carbon capture and storage

Carbon capture and utilization seems to be a running theme among seismic data companies. OBN seismic contractor Magseis Fairfield recently formed a subsidiary focused on the energy transition, called Magseis Renewables.

Magseis Renewables in August announced two initiatives focused on carbon capture.

First, it entered an agreement to join the Greensand carbon capture and storage (CCS) project in the Danish North Sea. The project entails transporting CO2 by ship to the Nini West reservoir off Denmark, and injecting it via the offshore wellhead platform. The CO2 will be stored in depleted oil and gas sandstone reservoirs 1500m below the seabed, and existing infrastructure will be repurposed from oil and gas production to CO2 injection. Magseis Renewables will provide its OBN technology and imaging solutions to contribute to the development of CCS monitoring technologies.

Separately, the company entered two technology pilot projects for carbon capture and storage (CCS) and offshore wind in partnership with TGS.

The first project will use high-resolution 3D seismic acquisition in Norway at a carbon storage area to demonstrate technology for highly detailed imaging of the full section from the seabed to the targeted storage reservoir.

The second project will utilize ultra-high-resolution 3D seismic acquisition in Denmark over an offshore wind farm with known near seabed challenges to demonstrate applying a high-frequency source coupled with TGS' data processing technologies, the partners said.

## Full pivot (eventually)?

Oslo-listed seismic surveyor Axxis Geo-Solutions recently changed its name to Carbon Transition, reflecting its new strategy. Cabon Transition said it would focus on investing in private companies and have "a goal of positively impacting the value creation of its investments."

As for its seismic business, the company said it would continue going forward but will be subject to requirements for satisfactory rates of return.

"The board of directors considers the new strategy of the company to allow for its current seismic business area to be included in Carbon Transition in such manner for a transition period. Seismic contracts and seismic data library are expected to generate revenues to finance the new strategy.

"It is essential that the costs related to operating this part of Carbon Transition's business are kept low. Over time the objective is to utilize revenue from the node technology and multi-client revenues to new investments within the "energy transition" area," Carbon Transition said in July.

However, while other seismic companies are looking at carbon capture, seabed minerals, space monitoring, offshore wind, Carbon Transition has invested in black pellets.

Namely, the company has invested a Arbaflame AS that has developed a patented technology that enables the production of black pellets from biowaste - called ArbaCore - which can, reportedly, "fully replace coal in coal-fired power plants worldwide," and cut CO2 emissions by around 90% compared to coal.

# Charles Good Chairman Cox Powertrain

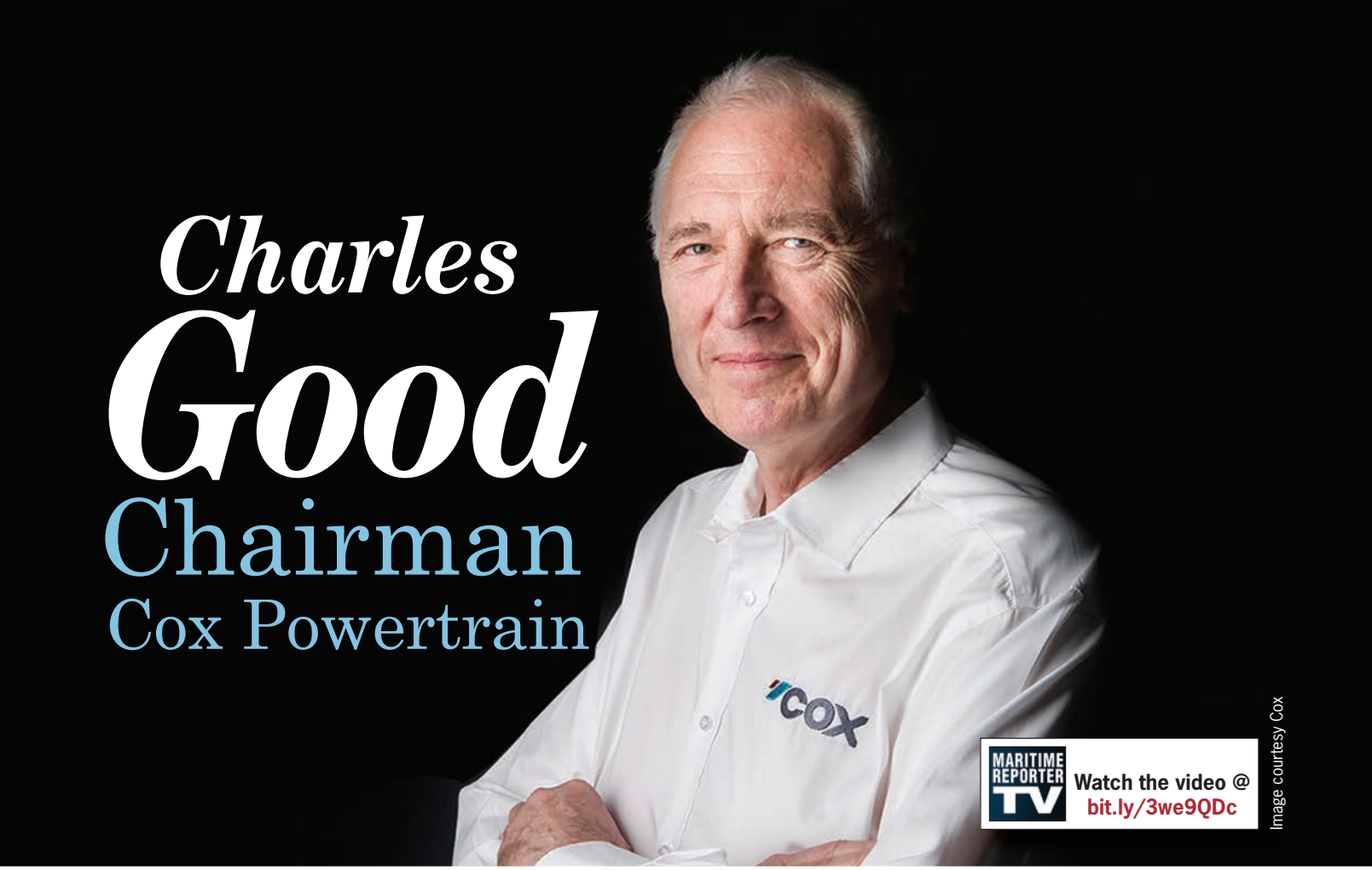



Image courtesy Cox

**Born from the mindset of Formula F1 racing, the Cox Marine CXO300 diesel outboard engine is seeking to take share of market from the gasoline outboard sector. Charles Good, Chairman, Cox Powertrain, discusses the company's evolution.**

*By Greg Trauthwein*

### When did the notion of a marine diesel outboard engine strike you as a good idea?

We have to go back to 1966 when I was 20 years old. In Greece, where we were staying on my mother's ancient wooden Greek boat, I was decanting petrol from a large container to a small one for our outboard motor and spilled a large quantity on the deck. It erupted into flames and a serious fire ensued. Luckily no one was hurt and we did contain the fire, but it left an indelible mark. So that was really the initial instigation in the back of my mind that somebody one day needs to come up with an outboard that uses diesel.

### What was the pivotal relationship that made Cox a 'go'?

For 50 years I felt the solution needed to be found for this, and the key was looking at marinized inboard engines. They were lorry engines that were converted for marine use; wonderful engines, extremely long lives, but they're very big and heavy. (Big and heavy) was never going to be an option for an outboard motor, and the key was to get the size and weight of the engine down. And then just over 10 years ago I was introduced to David Cox.

David had a career as an outstanding creative engineer with a background in Formula One racing here in the UK. He had been looking at designing a lightweight diesel for a different purpose, military drones. I spotted in that an opportunity to look at the possibility of using this creative thinking, mainly driven from Formula One racing where there's a culture of driving engine power up and weight down. So that was when the dream started to become a reality.

### When you look at the company you created, and the company that you see today, how is it most the same; how is it most different?

Cox is most of the same because of our ability to analyze technical challenges, work through them, resolve them and deliver. So at the outset, we were entirely focused around how do we create a brand new diesel outboard competitive with gasoline outboards; a considerable challenge. Along the way we've produced a great list of patents which is a strength to our business.

Where we're most different today is that we've transitioned in the last 18 months from being an early stage startup, effectively a startup development business, to a full blown manufacturer supplying product to a global market. This has involved a big shift in culture, skillsets in our organization, as well as the development of a number of commercial relationships around the globe on the supply side, and even more extensively on the sales side, through our distributors, which we've amassed across five continents. So the transition from a developer of technology to a manufacturer and seller of that technology globally, that's the migration we've been through.

### I'm sure there have been many hurdles along the way. Which was the greatest and how did you get over that challenge?

Undoubtedly the greatest single challenge was the power head, getting the weight down and to the package size that is comparable with a petrol outboard, because conceptually we wanted the diesel outboard to be interchangeable (with the gasoline version). Getting the weight out and the package size down meant looking at every single component from a blank sheet of paper and seeing how we could maintain its strength, but do it with a minimum weight. And this really came from our Formula One background and heritage from David.

### What is it about your new engine, the CXO 300 in today's decarbonization environment that tells you this is the engine of the future?

I think that's a really good question, and there is no doubt that market has already changed to some extent. It certainly has in automotive big time, and aviation and marine are definitely looking at how best to decarbonize. I did a degree in physics and I was given an option of a topic that I wanted to write about in my degree course, and I chose the application of hydrogen and fuel cells for automotive in inner cities, because I'd been brought up in London through two huge smogs which had killed tens of thousands of people through pollution. I was very aware then, as a young man or child in the first one, how dangerous nasty pollution can be. So I, and everyone at Cox, are very conscious of that.

I think it's all too easy, reading the headlines, to forget why diesel has become such a dominant fuel source for marine for so long. And that is that we save 25-30% in terms of fuel, and that means that the carbon dioxide emissions are similarly reduced by 25 to 30% versus gasoline.

It's also true to say that the new emerging technologies are not there yet for marine. In marine, you need to be able to go offshore; you need range. So battery technology is, at the moment, not there. Hydrogen could be an answer, but truly green hydrogen is not yet available. So to answer your question, we believe that this is a good solution for the moment to reduce emissions and that we have a pathway of at least two decades and probably three. But we're not going to sit on our hands. We are going to carry on innovating and looking at what technologies could be used to further improve our carbon footprint.

### So let's fast track to today, if that's okay. Can you give us a by the numbers look at Cox Marine using the metrics of your choice.

Yes, I've got a few for you: 10 years from first concept to reality; 150 members on staff; nearly $200 million invested; and hundreds of engines operational in 21 countries across five continents. Plus 4,000 units per annum is the capacity of the existing production facility we built in the UK.


Image courtesy Cox

**You've already discussed many of the hurdles that you've had to overcome, but it's taken a long time for the CX0300 to get into production, with the first unit just coming out in 2020. Simply put, what took so long?**

Looking back at it now, I don't think it actually has taken us very long. If you look at the cycle time for brand new products in other industries, they're typically 5 to 10 years if it is a genuinely new product. Now throw in the fact that we had to develop a totally new diesel engine layout which has never been done before, one with a vertical crankshaft, and then on top of that throw in a global pandemic, I don't think effectively 10 years from original inception and less than five since the base design was settled on is a very long time.

**What are your engine production rates, and looking at the coming five years, how do you see that evolving?**

We're still at the backend of a pandemic, which has brought with it supply side, logistical problems, shortages of containers and bottlenecks all over the place. So we have deliberately reined back production in the short term, partly because of those factors. But also because we want to walk before we run. At the moment we're producing 10 units a week. *(*Note: this interview was conducted in August 2021).* Our short-term plan is that this will gradually rise through the rest of this year to 40 a week, and then of course, as the market evolves, our plan is to get to our target rate of production from the existing facility of 80 to 90 units a week.

**For readers that are considering an outboard diesel engine, what do you consider the main advantages for the diesel version?**

It depends on what the use case is. But the majority of our early adopters will be in the, what we would call the commercial segment, whether it's coast guard or other commercial operators, or indeed the high-end leisure market, typically super yachts, where these boats and engines get used a great deal. And there, the principle driver to adopt one of our engines is simply the fuel saving. We've got one customer who is a heavy user who's already estimated, their numbers, not ours, an annual saving of $150,000 for each pair

> *"Getting the weight out and the package size down meant looking at every single component from a blank sheet of paper and seeing how we could maintain its strength, but do it with a minimum weight."*
>
> ***Charles Good***
> ***Chairman, Cox Powertrain***

of Cox engine they're using versus gasoline. That's a huge payback. So there's an immediate financial benefit for anyone who's using the engine a great deal. It is true the engines are more expensive initially, but you get paid back very quickly, over months, not years.

On top of that, for the wider market, you can add substantial increase in range from the same size fuel tank. Fuel safety, obviously, which I've touched on. And I think also importantly, particularly outside the U.S., is the ubiquitous availability of diesel on any part of the coastline where obviously there's human activity, which cannot be said of gasoline. In other parts of the world, gasoline is actually quite difficult to get hold of versus diesel, which is used by everyone else on water. Large boats use diesel almost exclusively. So availability is, I think, another big driver for many people.

### I know that we can easily explore the technical specifications of the CXO 300 online, but can you take a moment and discuss what you see as the key technical attributes and parameters of the engine?

This is a big and powerful engine, and I think the key number is 300 horsepower delivered at 4,000 RPM. It's a conservatively rated engine. And we offer 479 ft. pounds of torque, which is a lot of torque for an engine of this size and delivered over a very broad rev range. So the engines give a lot of grunt at low revs. Obviously the 25 to 30% fuel savings versus gasoline. We offer two gear ratios, which is useful for different use cases. We also offer a wide range of leg lengths. 25 inches, 30 inches, and 35. Not all the 300 horsepower petrol guys are offering three leg lengths, but we decided we wanted to cover pretty much every conceivable application that our engine might be used for. And finally, long life. We anticipate our engines having three times the useful life of a petrol outboard.

### What's next for Cox?

It is early days for us. We've just launched our first product, but we are already are looking at new product cycles yet to be announced. What we're doing is looking at the clear trends that exist in the premium petrol outboard market, especially with the move towards higher power. So when we first set out designing this engine, we went for 300 horsepower because, at the time, that was the largest petrol outboard. It's interesting that in the five years since we settled the design, the petrol outboard market has actually moved, as you know, quite a long way, 450 being reasonably commonplace last year, and now even 600 horsepower. So there's no doubt that we will be looking at some point in the future, not too far away at higher power outputs. The core technology is available to do this.

# Maritime Digitalization & Decarbonization Walk Hand-in-Hand

**As shipowners take on decarbonization challenges, Arild Risholm Sæther, Head of Business Development, NAVTOR, advises a close look for answers inside your digital systems.**

*By Greg Trauthwein*

The digital evolution is somewhat of a conundrum: while we are able to monitor and receive an increasing amount of information, both real-time and within a historical context, putting all of that information to efficient use is arguably as big of a challenge than selecting the right technical tools to start.

In the context of ship and fleet performance monitoring and control, there are disparate groups – from the onboard crew to the technical teams to executive management – that must work in their own silos of data, information and performance, as well as together as a team to make the decisions that will ultimately drive safe, compliant and economical ship performance. And trust that "performance" is far more than simply measuring fuel consumption and emissions.

Enter NAVTOR, a company that is a relatively short in years – this year celebrating its 10th anniversary – but one that is long on experience and references, a leader of e-Navigation services with its system on more than 7,400 vessels and customers in more than 60 countries.

Via its NavFleet system, the company is taking a major leap into the world of performance and optimization, aiming to prove how smart digital solutions are very much at the heart of the maritime industry's decarbonization path. "Earlier this year we acquired a company called Tres Solutions, a leading maritime software and analytics company from the U.S. with performance optimization expertise that fits very well into the NavFleet system," said Risholm Sæther.

## *Meeting Maritime's Evolving Challenges*

"We know that many (maritime) companies are having the same types of challenges," said Risholm Sæther. "They need to comply with a lot of regulations. They need to reduce emissions and fuel consumption." In addition, they need to prove it.

"We see not only an increase in requirements for transparency, we also see that our customers are seeking better tools that can help them address these challenges" said Risholm Sæther. In a market sector that is becoming increasingly crowded with 'digital solutions,' Risholm Sæther said Navtor's aim is providing both technical excellence, but importantly, technical excellence that is inherently easy to use.

"We respect that on all teams you will find the different personalities, different levels of experience and knowledge, and different backgrounds," said Risholm Sæther. "We have this in mind when we develop all of our products (which are all developed in-house), so you don't need to be a navigator or a naval architect to understand and use NavFleet."

NavFleet is a platform for different services in addition to being a monitoring tool, able to monitor voyage and vessel performance, for example. "NavFleet is the only product today that can offer total integration in one single product," said Risholm Sæther. "So let's say for navigational safety and monitoring, when you start your route monitoring aboard your vessel, the exact route is sent automatically into NavFleet to monitor automatically, without skipping a beat."

So in one neat package captain and crew, without the need to import or export anything, hold navigation planning, with the route set and notifications of problems or deviations received automatically, for example. "And in that same application, you will find information about the vessel performance, information about your compliance to EU MRV regulations, reporting information, and much more," said Risholm Sæther. "What makes NavFleet unique isn't just what we measure, but also how we deliver the insights to the shipping companies."

For commercial teams it may be tools such as predictive


fuel tables to improve fixtures; for operational teams, it may help with bunker planning or propellor performance to identify the optimal time for cleaning, for example.

"For the technical teams, we monitor a range of engine focused parameters daily, but also monthly to support the best practices for engine maintenance," said Risholm Sæther. With the dizzying number of new regulations on the regional, national and international front, NavFleet delivers as well, helping companies to not only monitor and improve key metrics such as energy and efficiency operational indexes, but also the new carbon intensity indicator. "It supports the ongoing awareness of the environmental performance, as well as the adoptions of the new CO2 regulations, which takes effect from 2023," said Risholm Sæther.

As is the case in any tech sector, NavFleet continues to evolve daily with input from in-house staff and clients alike. "NavFleet takes a holistic approach to monitor and improve fleet performance. And these capabilities are only expanding," said Risholm Sæther.

### *Taming the Firehose of Data*

With the acceleration of technology comes an acceleration in the speed and quantity of data, and becoming overwhelmed in a sea of data is more the norm than exception.

"One of the problems today is the overwhelming focus on the real time data, without exactly knowing how you actually should benefit from all this information," said Risholm Sæther. As he mentioned, while NavFleet is designed to cater to many different users with different levels of knowledge and experience, a focal point is keeping things easy and understandable. "In the NavFleet application, you can assign different roles to different people," said Risholm Sæther. "Everyone doesn't need to see everything; the operational teams can see information relevant for them; the technical teams can see information relevant for them. And of course, someone can see everything if they like."

In addition to the technology, Navtor delivers an in-house team for analytics, a performance team that holds monthly review meetings with ship owners and operators to go through all metrics, vessel by vessel, and discuss the different actions they can take to improve.

### *What's Next?*

As connectivity and bandwidth continues to expand onboard ships and boats, so too does the potential to use real-time data and analytics for monitoring of navigational safety.

"Efficient navigation, green and safe navigation, is all about integration of data and services into one secure platform," said Risholm Sæther. "And we participate actively to develop solutions that contributes to a greener more sustainable shipping. So we are involved in several R&D projects where we can use the results to improve all of our products," whether it's in regards to cyber security, data collection, autonomous shipping, bunker planning, route optimization, just-in-time arrivals, or really, anything that can be monitored, measured, reported, analyzed and acted upon.

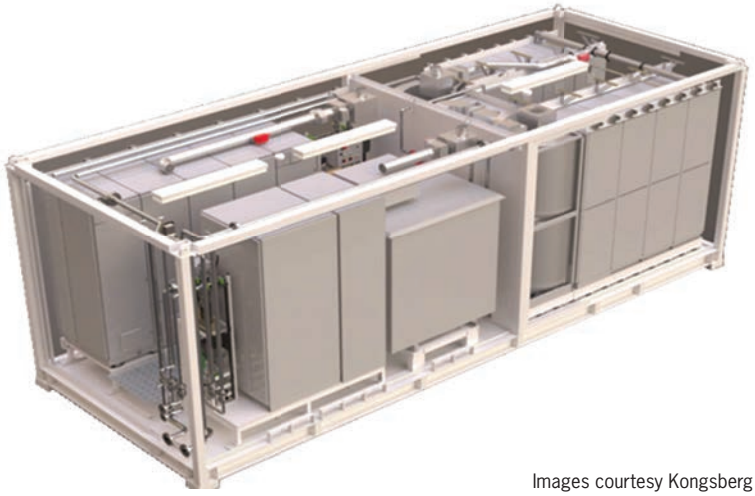
"We will continue to evolve the analytics and optimization functionalities in NavFleet, trying to make them smarter, try to make them better. Because we think that smarter data utilization and integration is the best answer to some of the maritime industry's biggest challenges. So to reduce emissions and costs, to increase performance, to increase navigational safety and compliance with regulations; we think that total integration and monitoring is the key."

# LNG & INTELLIGENT POWER GENERATION:

# A fast-track to Sustainability for the Container Sector

*LNG fuel and use of PTOs could be key to ensuring that container vessels are as efficient, sustainable and future-ready as possible*


## THE BATTERY CONTAINERS



Images courtesy Kongsberg

There are some areas where leading the market is a bad thing, and producing the highest GHG (greenhouse gas) emissions is one of them. Energy production and use accounts for nearly three-quarters of global GHG emissions, or the equivalent of 36 billion tonnes of carbon dioxide (CO2eq) a year. Of that, around a quarter (8 billion tonnes CO2eq) is generated by transport, with shipping responsible for approximately 10% (800 million tonnes CO2eq).

The largest contributors to this are container vessels, but even the most ardent environmentalist would struggle to argue that change is easy. Containerization is the lifeblood of our global economy – so how can we set about maintaining trade while at the same time minimizing its effect on the planet? Driven by environmental awareness and the ongoing introduction of increasingly stringent regulations, many container shipping companies are already achieving significant emissions reductions through the simple strategy of slowing down, but this approach is necessarily limited. New vessels need to use fuel more cleanly and efficiently, and refits should follow the same path as closely as possible.

The IMO (International Maritime Organization) agrees. In phase 3 of the EEDI, or Energy Efficiency Design Index, all newbuilds are required to be 30% more energy-efficient by 2025 than those constructed in 2014. For larger container vessels this deadline has been moved forward, from 2025 to 2022. The same focus on larger vessels continues when we look at the reduction targets: smaller 15,000-40,000 dwt (approx. 1,250 to 3,350 TEU) container vessel newbuilds will be allowed to meet the standard 30% EEDI reduction rate, but this then rises incrementally with vessel size up to a 50% EEDI reduction rate for the largest container vessels of 200,000 dwt (approximately 20,000 TEU) and beyond. Combine this with the IMO strategy to cut CO2 emissions from 2008 levels by 40% before 2030 and 50% by 2050, and the urgency of this issue becomes clear.

Kongsberg Maritime (KM) has been developing a range of solutions for container ships to help address these targets and boost sustainability within the industry. With strategies for everything from 2,000 TEU feeder vessels and 15,000 TEU Panamax ships up to the largest 24,000 TEU vessels, KM has devised future-proof and cost-effective design proposals which offer shipowners practical and workable strategies to assist them in planning their future newbuild, upgrade and refit paths, and in addressing their emissions reduction targets.

## SHAFT GENERATORS

For container vessels, one of KM's strategies in the effort to lower emissions is the adoption of LNG as a fuel. The CO2 emissions from LNG are as much as 24% lower than for diesel/MGO, SO2 is reduced by around 99% and NOx by around 87%, which teamed with negligible ash and particulate pro-

duction makes it one of the most environmentally friendly fuels currently available. Robert Eriksson, Senior Concept Engineer, Business Concepts, Kongsberg Maritime, explains: "Use of dual-fuel engines and LNG contributes to significant emissions savings over MGO, from 14-21% depending on the engine," he said. "This takes into account pilot fuel use and methane slip, as well as LNG use. It also has a significant effect on OPEX; teamed with careful management of power generation capacity, we believe savings of up to 20% can be achieved."

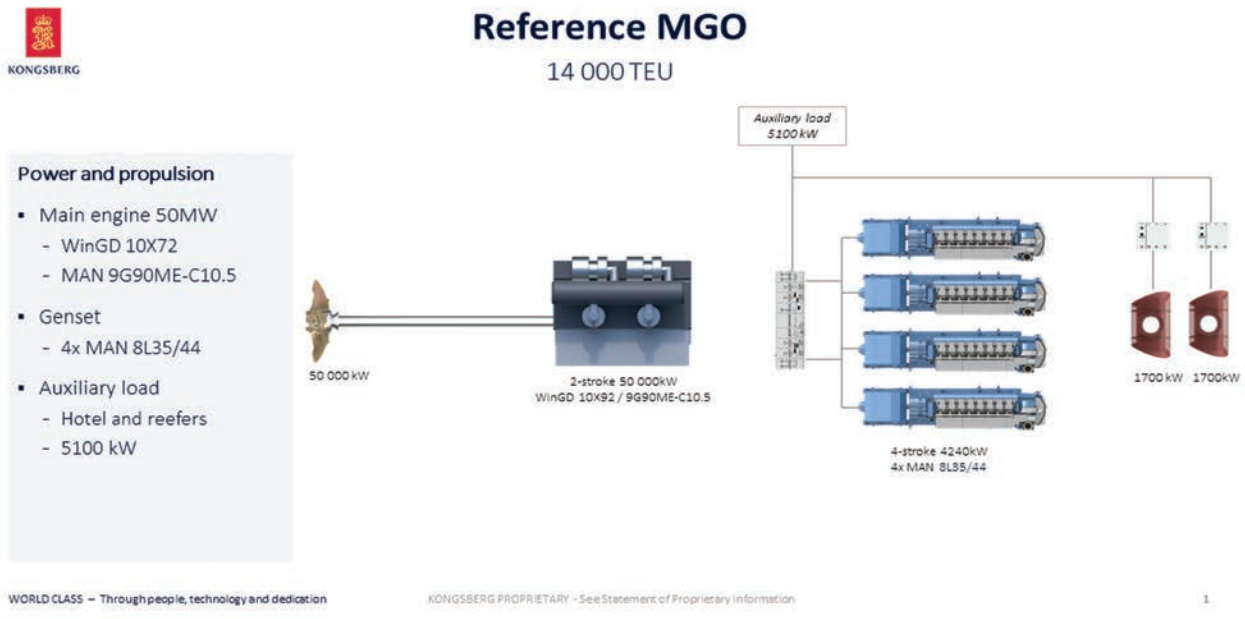
A key difference between container ships and other vessels is the sheer amount of power required. "Container vessels can consume huge amounts of electricity, especially when carrying refrigerated containers," said Eriksson. "Therefore, you see quite big gensets on these vessels. LNG-fuelled vessels tend to have two-stroke dual-fuel engines for propulsion and four-stroke dual-fuel engines for auxiliary power. These auxiliary engines can be bigger than many other ships' main engines, and you'll usually have at least four of these gensets on board. If we can reduce their use and/or number, we can save both emissions and running costs."

KM's solution to this high-power demand is to add a shaft generator to the main, two-stroke propulsion engine as a power take off (PTO): a more efficient arrangement than running auxiliary generator sets. The aim is that, through use of PTOs, some of these engines need not be used at all – or even fitted, in the case of newbuild vessels. Research carried out by KM's Business Concepts team proposes that, by adding a PTO, a 14,000 TEU vessel – which might typically use a 50MW, two-stroke propulsion engine and four 4,240kW four-stroke auxiliary generator sets – can be more efficiently powered using just three generator sets and the PTO output from the main engine. Generator sets cost more than PTOs, so this represents a significant CAPEX saving, as well as reducing OPEX by around 2% and CO2 equivalent emissions by up to 3%.

*"We've shown that there are some definite OPEX benefits to using LNG and our PTO strategies, but what about CAPEX? Installing a PTO can pay for itself, as they are cheaper than generator sets, but there's no doubt that LNG systems are more expensive – up to $20m more than for an MGO-fuelled vessel. But we did some calculations, and the additional machinery costs can be offset by the efficiency savings over a period of between 10 and 15 years, taking financing costs into account."*

**– Paul Fredrik Gjerpe, Vice President, Business Concepts, Kongsberg Maritime**

"Using a PTO reduces overall running hours for the generator sets," said Eriksson. "The propulsion engines are running anyway, so by using a PTO we just take advantage of unused capacity. This allows one or more generator sets to be shut down. In addition, the larger cylinder sizes of the two-stroke propulsion engines are inherently more efficient, so it's a win-win situation."




Images courtesy Kongsberg

For vessels running on LNG, this setup will also reduce methane slip, the process by which unburned fuel escapes into the atmosphere. "A two-stroke dual-fuel engine will have significantly lower methane slip than a four-stroke, so avoiding running the four-stroke reduces methane slip," Eriksson said. "Combined with the fuel savings, that's a compelling environmental argument for a PTO system."

## EFFICIENT POWER

A wider study carried out by Kongsberg Maritime, comparing the per-hour running costs and energy curves of two-stroke and four-stroke engines, highlights another benefit of shifting load to the propulsion engines. "Two-stroke engines run very slowly," said Eriksson. "80-90rpm at steaming speed, while four-stroke engines typically run at 720rpm. Because they move a lot more, the operating costs in terms of wear are actually very high. Four-stroke engines also have many more cylinders, which has a direct effect on wear and consequent maintenance. If you've got four of them, you're logging many hours of service time.

"Two-stroke engines are also more efficient than four-stroke. Four-stroke engines are at their most efficient running at around 85% load, using less energy per kilowatt hour produced than at lower loads. But even when a four-stroke engine is running at peak efficiency, the two-stroke engine will be about 10% more efficient. Add the fact that the two-stroke efficiency curve is flatter everywhere, and that's the whole reason why you'd want to take energy from two-stroke engines instead of four-stroke: it's simply more efficient, less costly and has less of an environmental impact."

Optionally, adding energy storage can introduce a level of redundancy which enables further reductions in the use of auxiliary generator capacity, as well as load smoothing and peak shaving capacity. The containerized, lithium-ion battery modules which constitute the core of KM's SAVe Energy storage system for hybrid power operate on the principle of Dynamic Inertia Control. This is designed to optimize generators' fuel efficiency by apportioning power usage between all components.

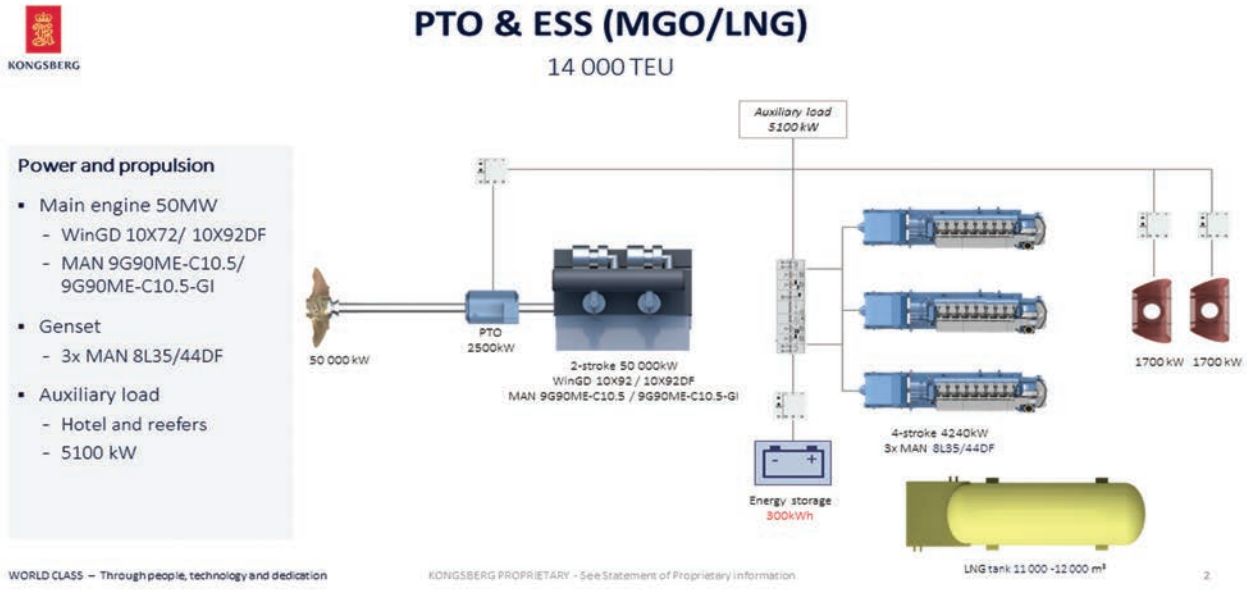
By charging batteries when generator capacity permits and providing supplementary power at times of peak loading, a reduction in overall emissions, noise, vibration and operational/maintenance costs can be achieved. In a similar study carried out by KM for LNGC, addition of an Energy Storage System delivered modest reductions in annual emissions and OPEX of 0.7% and 0.9% respectively, largely due to a projected reduction in auxiliary generator running hours of 78%, compared with 65% for a PTO without energy storage.

## NEW CONCEPTS

KM are demonstrating that efficient use of existing technologies can already make huge differences to the sustainability of container ship operations, both for newbuild and existing vessels. At the same time however, they have an eye for the future – these concepts will be as relevant when next-generation fuels become commonplace as they are today.

Of course, any change has to made in the harsh light of business reality, but KM's studies have taken this into account. Paul Fredrik Gjerpe, Vice President, Business Concepts, Kongsberg Maritime, said "We've shown that there are some definite OPEX benefits to using LNG and our PTO strategies, but what about CAPEX? Installing a PTO can pay for itself, as they are cheaper than generator sets, but there's no doubt that LNG systems are more expensive – up to $20m more than for an MGO-fuelled vessel. But we did some calculations, and the additional machinery costs can be offset by the efficiency savings over a period of between 10 and 15 years, taking financing costs into account. That makes economic sense, as well as helping to make the vessel as future-proof as possible."

"There's no doubt that a fuel transition is on the horizon," adds




Oskar Levander, SVP Business Concepts, Kongsberg Maritime. "The problem is, we don't know what it will be. By designing our solutions around LNG we are making them as future-proof as possible: HVO (Hydrotreated Vegetable Oil), biogas and synthetic methane can all be used by dual fuel LNG engines without any major modifications, and an LNG system designed the right way can be converted for use with ammonia, albeit with uprated and increased tank capacity to cope with the lower energy density of the fuel. Of course, a dual fuel engine can also burn MGO, so that gives six possible fuels to choose from."

"Choosing the right fuel is going to be important," said Gjerpe. "But we're also looking at the wider picture – how to make sure that get the best from your fuel. There are still efficiencies to be made, and the use of PTOs is a key enabler for this. Our research is quite clear – propulsion engines and generators sets are often underutilised, which means that they're not running efficiently. PTOs allow use of spare capacity, meaning fewer generator sets need to be running, saving fuel, emissions, wear

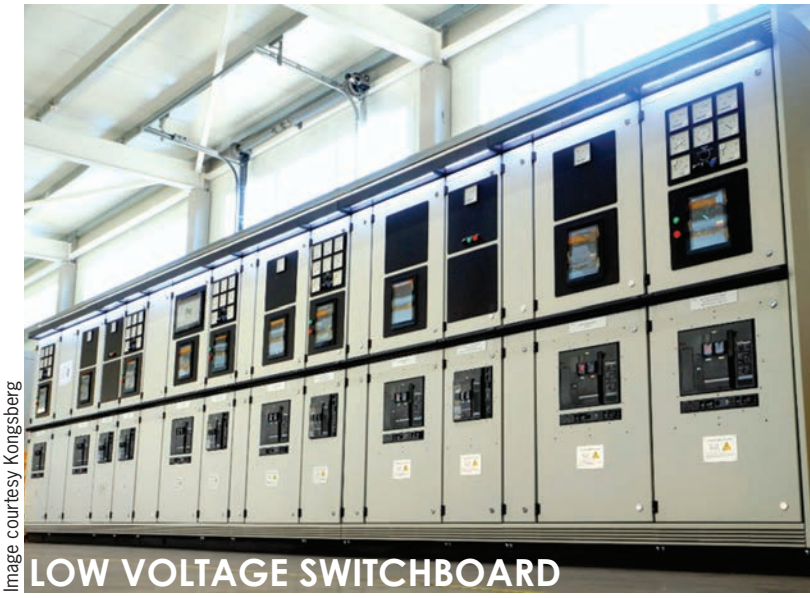


Image courtesy Kongsberg

LOW VOLTAGE SWITCHBOARD

# The SHAPE that fits your ship

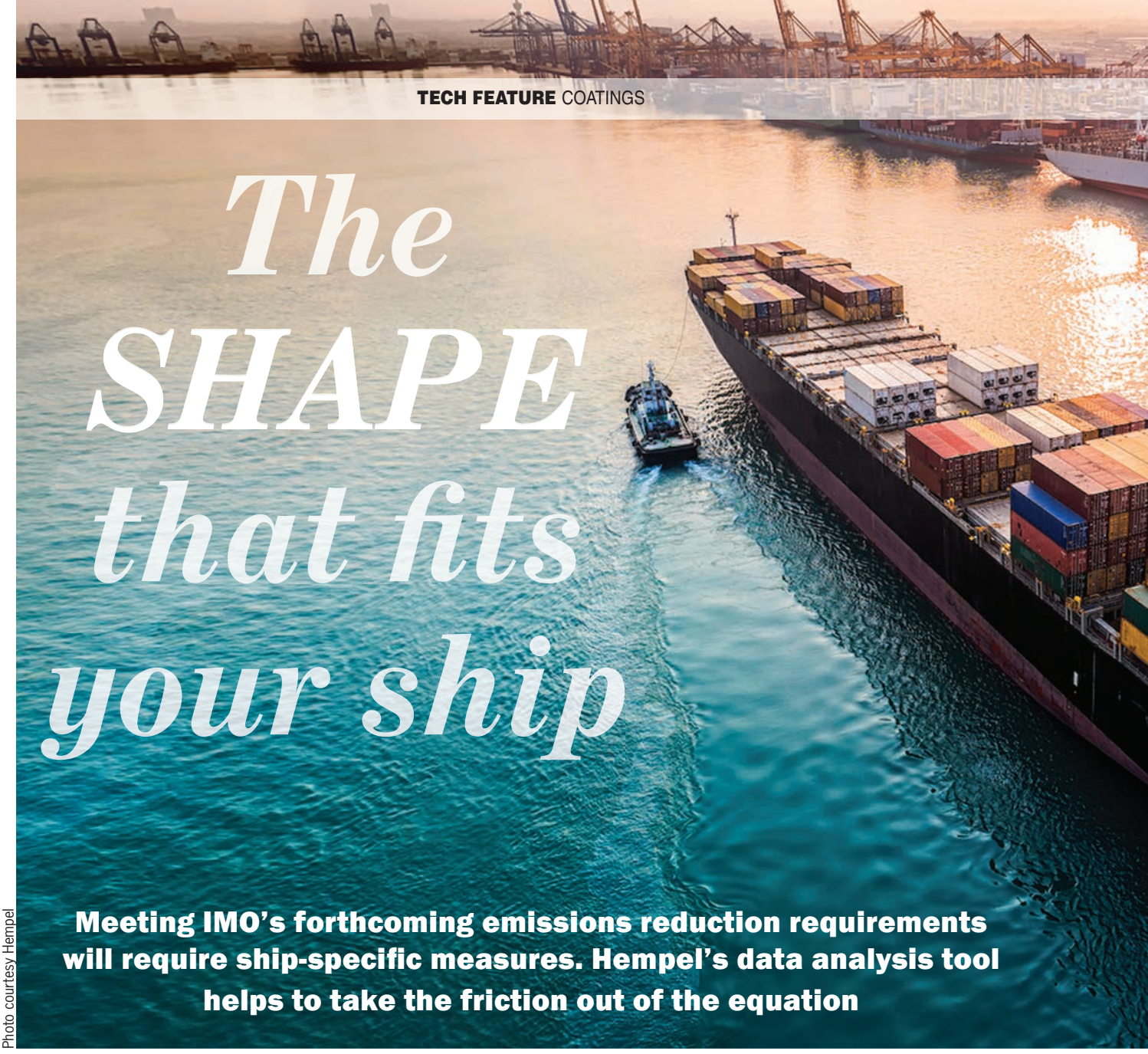


Photo courtesy Hempel

**Meeting IMO's forthcoming emissions reduction requirements will require ship-specific measures. Hempel's data analysis tool helps to take the friction out of the equation**

*By Mads Raun Bertelsen, Head of Hull Performance, Hempel*

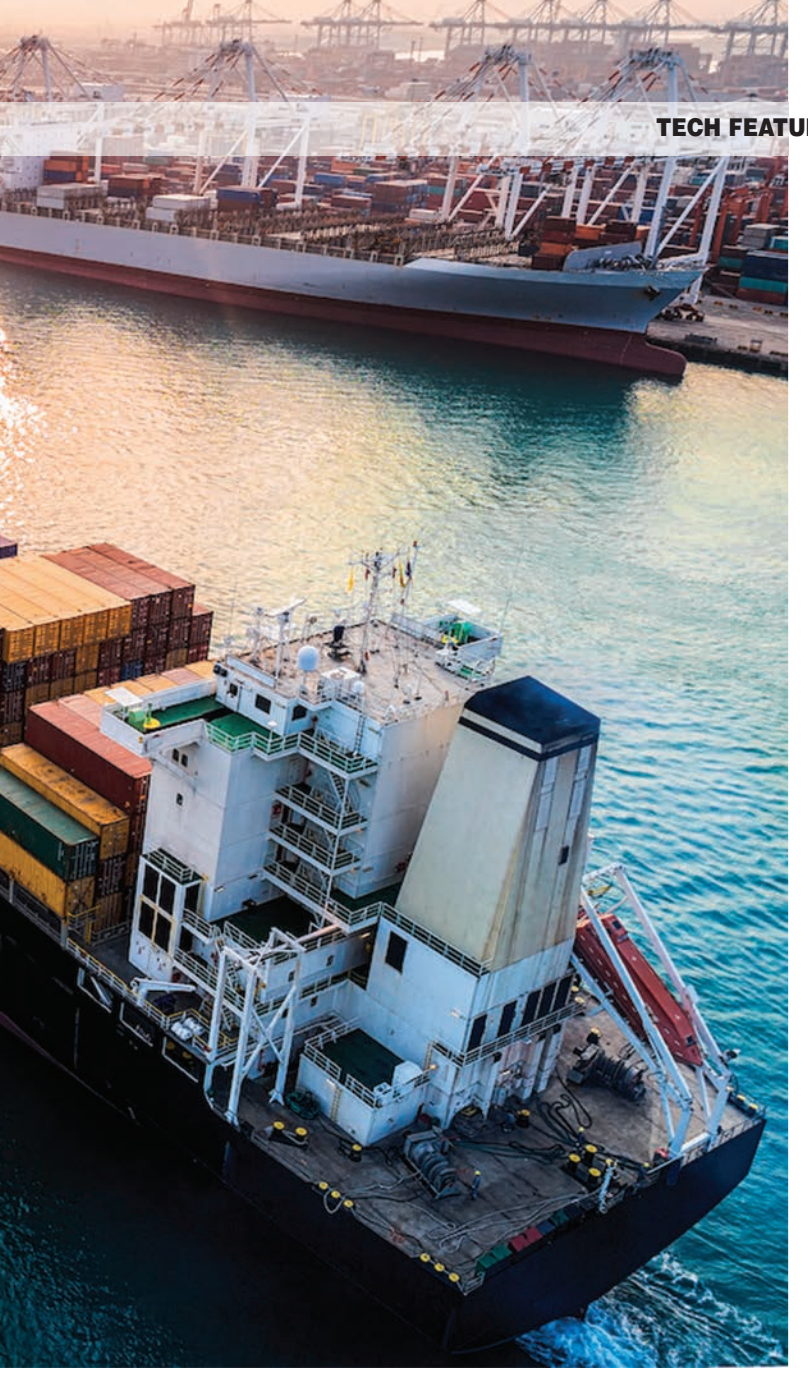
At its last meeting in Q2 this year, the International Maritime Organization's (IMO) IMO's Marine Environment Protection Committee (MEPC76) adopted two amendments to the MARPOL Annex VI regulations (the industry regulations governing marine pollution) – the Energy Efficiency Existing Ship Index (EEXI) and the Carbon Intensity Indicator (CII). In order to meet these requirements, shipowners, operators and managers will need to provide data to the relevant flag state administration that proves their vessels' emissions are within the allowable limits.

The CII requirements are particularly challenging for shipowners given that it is a yearly commitment for shipowners and operators of cargo or passenger vessels of or over 5000gt to measure and submit to their flag state administration their vessels' CO2 emissions, calculated per cargo-carrying capacity and nautical mile. The ship is then rated from A to E with E being the lowest.

These requirements place expectations firmly upon the vessel owner, operator and management to measure, monitor and manage vessel emissions on an ongoing basis, and to demonstrate tangible efforts to lower the impact of each vessel's operations on the environment. How to improve efficiency and reduce emissions will be different for each vessel and will rely on bona fide data monitoring and reporting from each vessel.

## *Every Player has a Part*

To accurately gauge a ship's emissions performance, it's important to understand how each component affects the way



it moves though the water with the overall aim of making it as frictionless as possible. Data shows that the right hull coating can improve vessel performance irrespective of its age, size and operating patterns. To understand the impact of coatings on in-water performance and associated emissions in real-terms, global coatings manufacturer Hempel uses SHAPE (Systems for Hull and Propeller Efficiency) its digital analysis tool that gathers ship-specific data through strategically placed sensors on the ship's hull and propellers.

SHAPE uses in-service performance KPIs to track long-term trends that generate important data for fact-based decisions. The system is founded on the ISO 19030 framework and is a process of measurement over time. To ensure detailed data collection, six key stages comprise the SHAPE measuring and monitoring system. First, the vessel's individual speed power reference curves are established. This is followed by collecting in-service data which is then cleansed and purified to eliminate extreme operating conditions and the effects of environmental factors. Next, a precise speed loss calculation is made. This is a critical measure for understanding vessel performance and fuel efficiency as power increase and speed loss are directly related.

From this, the four KPIs are calculated:

- Dry docking performance (calculates the changes in hull and propeller performance before and after drydocking);
- In-service speed loss (calculates the effectiveness of the vessel's hull and propeller solutions by measuring performance in year two, year five and comparing against performance in year one);
- Maintenance trigger (calculates the change in hull and propeller performance over a given period between drydocking and in-service use); and
- Maintenance effect (calculates the change in hull and propeller performance before and after a maintenance event).

All of these indicators are dependent on the specified coatings system, in addition to being influenced by various environmental conditions such as water temperature or biofouling nutrient pressure.

This ability to monitor routinely is central to meeting CII requirements – an obligation which will have commercial implications. When the regulation comes into force the CII rating will be bonded with the owner, and the lower the rating the less competitive the vessel will be. The result being that environmental gains sit alongside potential commercial benefits, as IMO calls on ports and other industry players to use these instruments to offer incentives to high scoring (low emitting) ships. Thresholds for CII ratings will become higher over the next nine years to encourage continuous improvement, so the goalposts will keep moving, which while welcome, is of course challenging.

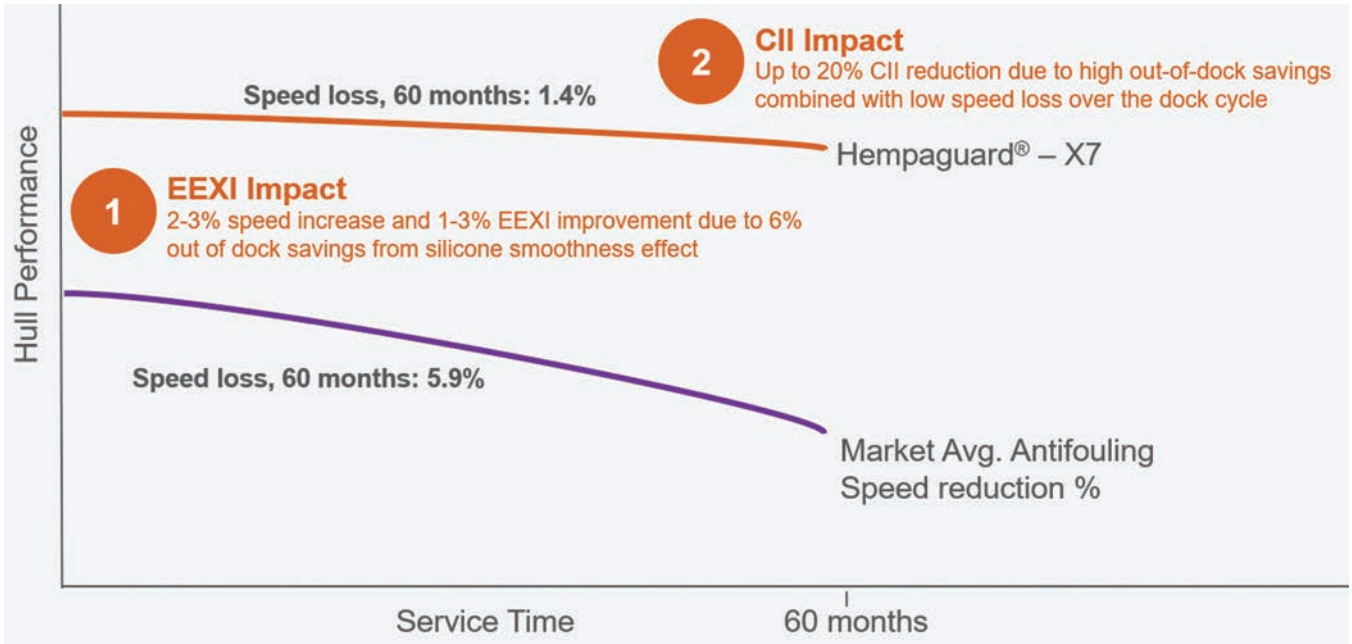
Using these results of SHAPE and working in close coordination with the vessel owner or manager, Hempel can create a coatings system that suits the precise needs of each vessel, and it can advise owners of CII benefits of different coating systems, based on a large dataset with performance insights. As a result, shipowners can improve efficiency and lower operating costs in line with the expectations of the EEXI and CII, and crucially, they can verify the efforts made to reduce emissions.

## *The Proof is in the Numbers*

Of course, not all coatings are equal in terms of the emissions savings they can deliver. It is documented that Hempel's fouling defense coating, Hempaguard X7's – when compared to a market average traditional antifouling – will provide an out-of-dock EEXI improvement of 1-3 percent by smoothening the hull and a CII improvement of up to 20

percent when combining with an industry leading speed loss over 60 months of 1.4 percent, without scheduled underwater hull cleanings required. For a bulk carrier with a bunker consumption of 50 tons per day, overall activity level of 70 percent, service interval of 60 months and a bunker cost of $500 per ton, Hempaguard X7 would provide fuel savings of $6.2 million and reduce CO2 emissions by 35,000 metric tons, compared with a market average antifouling. It is built on Hempel's patented Actiguard technology that was the first paint to combine both silicone-hydrogel and advanced biocide control in a single coating.

Actiguard works by forming a biocide-activated hydrogel on the surface of the fouling defence coating. As the biocide diffuses out of the film, it is trapped in the hydrogel layer which increases its surface concentration and prolongs the time the biocide is retained at the surface of the coating. This means that less biocide is needed and its effectiveness in preventing the settlement of biofouling organisms is greatly enhanced. Additionally, it also means that the concentration of biocide is maintained at a level where the silicone coating retains all its antifouling and smooth surface properties.




## *It's All in the Detail*

A good way to understand and demonstrate the impact of hull coatings on fuel efficiency is with a comparative performance analysis on the propulsion efficiency of a number of vessels in the same fleet. Hempel recently performed such a study using a fleet of 20 tankers. Seven tankers were coated with Hempaguard X7 hull coating: the others with SPC antifouling coatings. From the results, it was clear that Hempaguard X7 delivered significantly higher savings in fuel consumption and associated emissions.

Good quality and high-density data were available for all the tankers, enabling accurate hull and propeller analyses. The ISO 19030 standard was followed, and its 'in-service performance' indicator was quantified in terms of speed loss in percent for all the tankers over a full-service interval of 60 months. It is worth noting that some of the ships received underwater hull cleaning in order to rectify under performance, but the ISO 19030 standard's 'in-service performance' indicator does not exclude the effect of a hull cleaning.

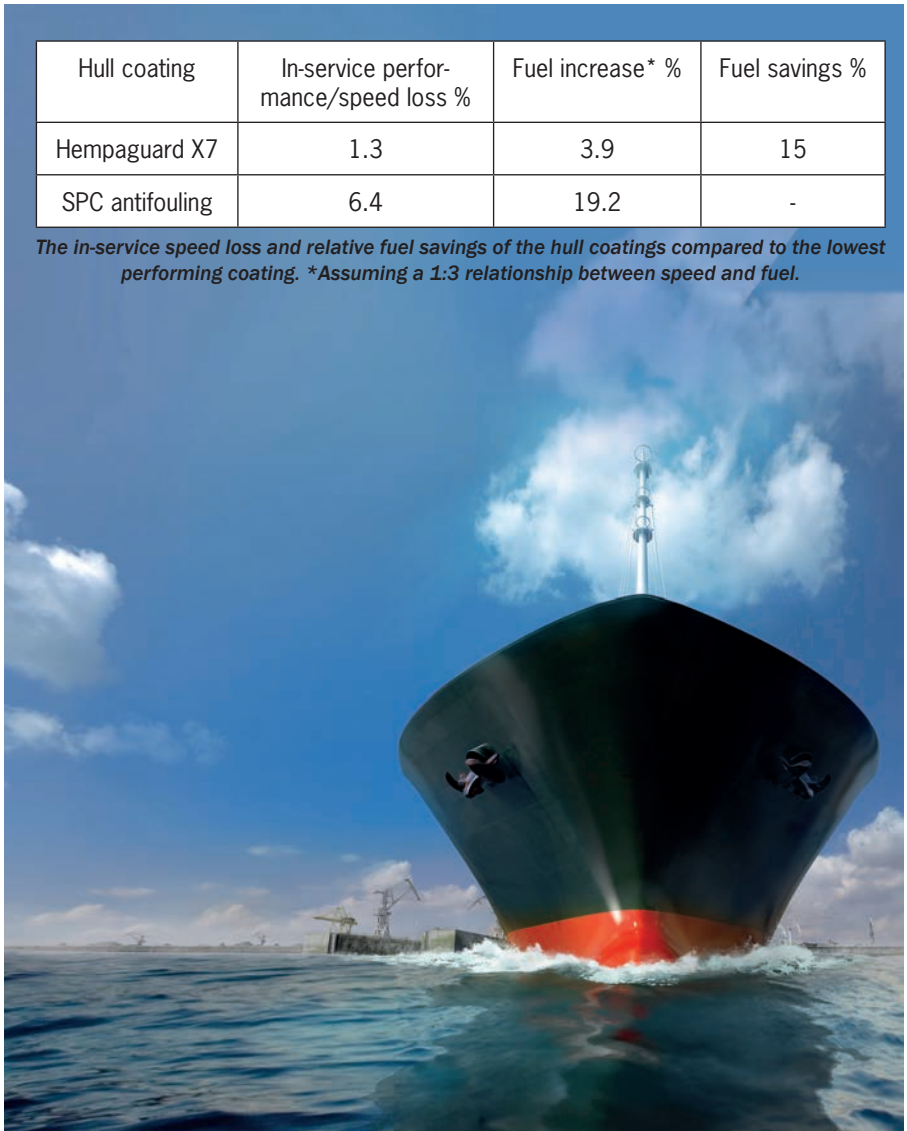
The performance analysis of the fleet showed that the seven vessels coated with Hempaguard X7 had an average speed loss of 1.3 percent over 60 months. The 13 other vessels, all coated with SPC antifouling coatings, had an average speed loss of 6.4 percent. Across the fleet, the average daily fuel consumption of a vessel was 70 tons per day, with an overall activity level of 70 percent. With an average bunker cost of $500 per ton over the 60-month period, Hempaguard X7 provided accumulated savings of $6.7 million on each vessel it was applied.

## *Transiting to a Sustainable Shipping Landscape*

It is clear that the obligation to lower emissions will fall largely at the foot of shipowners, operators and managers. While this is of course challenging, Hempel wants to see shipping reach its emissions reduction targets and this is one reason behind its decision to join the Getting to Zero Coalition. The partnership, between the Global Maritime Forum, Friends of Ocean Action, and the World Economic Forum, seeks ways to get commercially viable zero-emission ships sailing by 2030. Through such global initiatives, as well as our range of products, and crucially through our data-driven SHAPE analysis tool, Hempel will continue to support shipowners, operators and managers as we make the transition to a sustainable shipping landscape, one regulation at a time.

| Hull coating | In-service performance/speed loss % | Fuel increase* % | Fuel savings % |
|---|---|---|---|
| Hempaguard X7 | 1.3 | 3.9 | 15 |
| SPC antifouling | 6.4 | 19.2 | - |

*The in-service speed loss and relative fuel savings of the hull coatings compared to the lowest performing coating. *Assuming a 1:3 relationship between speed and fuel.*




# Sennebogen "Green Machines" Give Heavy Marine Operations A Lift

*By Ryan Kolb, Sennebogen LLC*

The towering green booms of Sennebogen material handlers have become an increasingly familiar site on U.S. waterways. While the machines most commonly are deployed in barge-loading applications, more recently, they are seen in shoreline construction, dredging and remediation projects. Traditionally, such operations are assigned to excavators, often with conversions to help them lift loads instead of digging. However, owners have come to find that the Sennebogen's offer advantages as machines that are purpose-built to lift and swing large loads quickly.

At the Guntersville terminal on the Tennessee River, owner Mike Leuken said the long reach of his Sennebogen 860 R-HD was a compelling feature. "It lets you get all the way over to the other side of the barge, to the outside wall and move the material directly to truck or conveyor. Given the cycle times and the flexibility we have, we can shave off 20% of our unloading time." Moving loads of more than eight tons at its full 70-ft. reach, its capability saves logistic time at the docks, too. "Often times, you either have to move your material handler along the dock wall or move the barge. If our push boats are busy, we have to wait on that movement before we continue production. With this Sennebogen, we don't have to move anywhere near the frequency that we did before."

On the Gulf Coast of Louisiana, Chip Broussard said his giant 875 R-HD allowed his firm to become a top competitor for shoreline restoration projects. "On some of these rock jobs, the stones are more than the clamshell can handle, so we have the grapple for that." The 875 first showed off its production capacity in dredging projects. "We were loading some material barges. One can hold up to 350 tons; we loaded it in about 20 minutes." He estimates that, on the right job, the 875 could move as much as 600 tons per hour. The 875's "Green Hybrid" energy recovery system also helps Broussard to quote competitively. He anticipates running the 875 on eight to 10 gallons of diesel per hour: which is about the same as his cable crane consumes while moving less than a third as much material.

Bilal General Transport LLC (BGT) has been leading the La Mer project in Dubai, building seawalls to reclaim nearly 250 acres (one million sq. m.) of new land for urban expansion. The project requires the contractor to move around 11 million yards of sand and up to 6.5 million tons of rock. BGT deployed Sennebogen's 880 EQ equilibrium handler to precisely position stone blocks weighing up to seven tons. Guided by a GPS system in the cab, operators can reach up to 115 ft. (35 m) to place riprap stones, accurate to within a quarter inch and able to complete a placement cycle in as little as 40 seconds. With this system, BGT no longer needs spotter boats in the water to help their operators to pick and place the rocks accurately.

While Sennebogen machines claimed their place in land-based projects, they are equally adept in open water. Tom Russell brought Sennebogen material


All photos courtesy Sennebogen

**Photos, Left to Right:**
**Great Lakes Dock & Material said that the stability and uniform 360° load limits of their Sennebogen machines are an essential part of both jobsite safety and productivity.**

**At Guntersville barge terminal, the 70-ft. reach of their 860 R-HD means less time wasted jockeying barges or relocating the material handler.**

**Broussard Bros get extra duty from its 300,000 lb 875 R-HD by simply driving the machine from barge to dock for both dredging and shoreline construction projects.**

handlers to Great Lakes Dock & Material (GLDM), in Michigan, after seeing them at work in other marine applications. "They all have full load capacity through their 360° working radius," he said. "Being on barges or improvised platforms, we felt this capability was essential for our machines. Even with its boom fully extended, our 840 can lift well over 8,800 lbs. (4,000 kg) and move it safely through its full 360° range of swing."

Russell also notes a difference between purpose-built material handlers and excavators. "On a barge, your work is often in front of you and the material barge is at the side. You want as much reach as you can. You're working at maximum radius most of the time. The arch in the banana boom allows us to reach over the coaming of the material barges, down 20 ft. (6 m) below the tracks and lift it up. An excavator doesn't have that lift above the track level capability (at full radius) and, the Sennebogen works fast."

According to Mike Leuken, it's a difference that operators appreciate, too. "They love the balance of the machine," says Lueken. "It gives them confidence to be able to lift in all directions without worrying about the length of the reach from side-to-side on the barge or for placing the load."

Russell and Leuken agree that the balance and stability of the Sennebogen's are valuable safety factors on land or on water. It also gives the operator more flexibility to load and swing in any direction.

Despite the size of the Sennebogen machines – the 875 Green Hybrid model weighs in at 300,000 lbs – their owners are impressed by the versatility of these purpose-built handlers. Their mobility is what first attracted Chip Broussard to the Sennebogen line. "We had seen similar machines in the area, but nothing of this size, and the other machines have to be welded down to the barge. The Sennebogen is on tracks. At times, we might be doing rock work and we want a crane on the ground; then we pick up another job and want to put the Sennebogen on the barge. Because of its versatility, we didn't have to get another barge."

The crawler mounted undercarriages give GLDM more choices in how to approach varied projects. Tom Russell notes the stability his machines offer to work in unimproved sites, as well as safety benefits when walking machines onto and off of barges. Russell says the 835 R-HD, with its retractable telescoping tracks, is easy to transport quickly between jobsites. "It's a high production machine with the travel footprint of a much smaller model."

# Tech Files

Innovative products, technologies and concepts

## Shed the Satellite: Quantum Sensors hold Promise for future compact, fieldable, GPS-Free Navigation

Don't let the titanium metal walls or the sapphire windows fool you. It's what's on the inside of this small, curious device that could someday kick off a new era of navigation.

For more than a year, the avocado-sized vacuum chamber has contained a cloud of atoms at the right conditions for precise navigational measurements. It is the first device that is small, energy-efficient and reliable enough to potentially move quantum sensors — sensors that use quantum mechanics to outperform conventional technologies — from the lab into commercial use, said Sandia National Laboratories scientist Peter Schwindt. Sandia developed the chamber as a core technology for future navigation systems that don't rely on GPS satellites, he said. It was described earlier this year in the journal A*VS Quantum Science.*

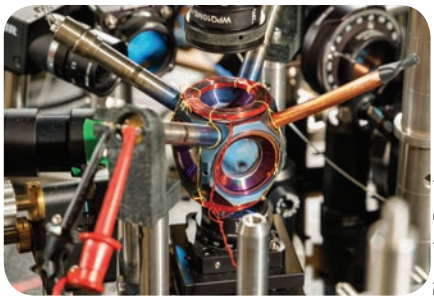


Photo by Bret Latter

**A compact device designed & built at Sandia National Laboratories could become a pivotal component of next-generation navigation systems.**

Countless devices around the world use GPS for wayfinding, but GPS signals can be jammed or spoofed. So instead of relying on satellites, Schwindt said future vehicles might keep track of their own position.

They could do that with on-board devices as accurate as atomic clocks, but that measure acceleration and rotation by shining lasers into small clouds of rubidium gas like the one Sandia has contained.

While work is progressing at speed, there remain hurdles: namely size and energy consumption.

"When you move it into the real world there are lots of problems you have to solve. Two are making the sensor compact and rugged. The physics takes place all in a cubic centimeter (0.06 cubic inches) of volume, so anything larger than that is wasted space," said Sandia postdoctoral scientist Bethany Little, who is contributing to the research.

The Sandia team is continuing to monitor the device. Their goal is to keep it sealed and operational for five years, an important milestone toward showing the technology is ready to be fielded. In the meantime, they're exploring ways to streamline manufacturing.

## Artificial Intelligence: NYK, Orca AI partner on safety support systems for autonomous vessels

Nippon Yusen Kabushiki Kaisha (NYK) and MTI Co. Ltd. (MTI) installed Orca AI's Automatic Ship Target Recognition System onto an NYK Group ship for research on the future of autonomous operations. Orca's system will be installed on a trial basis to verify whether the safety of the ship's operation can be improved by automating the task of recognizing dangerous objects.

This trial will assess the system's ability to automatically recognize dangerous targets and other vessels that may be overlooked by the human eye, especially at night and in congested waters through vision sensors and Thermal cameras, as well as AI-powered algorithms which constantly analyze the environment and alert crew to dangerous situations.

Photo by Orca AI

**The ORCA AI platform.**

A camera unit will shoot day and night to automatically recognize ships and targets and measure the distance to them. Information obtained from navigational equipment; including vessel names, distance, and time when the ship is closest to the target, can be superimposed and displayed in an integrated manner to a tablet or touch-panel monitor display.

In addition, the system is epoch-making because it can independently recognize small fishing boats and small markers that are not captured by radar and not equipped with AIS.

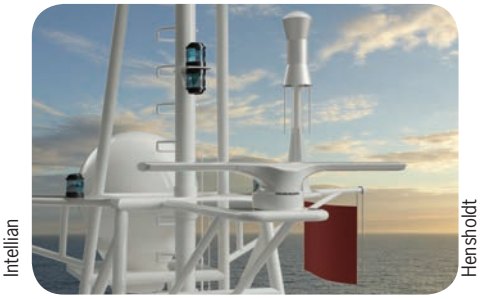
Raytheon Anschütz

## Raytheon Anschütz's eLog

Raytheon Anschütz launched an electronic logbook for ships. Dubbed eLog, it is designed to provide secure, quality logbook data and is positioned by the company as a step toward paperless shipping and improved efficiency of onboard processes. Featuring automatic data entry from navigation systems such as the automatic identification system (AIS) or the integrated navigation system (INS), at defined intervals, eLog also enables data input by crews via laptop or mobile devices, including approval workflows. Consisting of a small gateway computer, which needs a connection to AIS or INS to enable the automatic data entries, and a web browser application for manual data inputs and data access, eLog uses blockchain technology to ensure secure, tamperproof digital archiving of data. \In this first version, the eLog covers the deck logbook, the bell book and the noon report. The eLog is type-approved under the ISO standard 21745:2019 'electronic record books for ships.' Start of sales is expected for the end of October 2021.


## FB250 L-Band Terminal

Intellian received type approval from Inmarsat for its new FB250 and Fleet One L-band terminals, making it one of the first to market with user terminals for operation on Inmarsat's catalyst L-band network, ELERA. The FB250 is a multi-functional terminal, either acting as a stand-alone primary communications terminal or combining with Intellian's market-leading GX60NX and GX100NX to create the perfect Fleet Xpress (FX) solution. The Fleet One terminal is designed to provide an easy-to-install, reliable voice and data solution, targeting for smaller fishing and leisure vessels. Intellian's FB250 User Terminal is a compact solution for vessel operations, safety and crew welfare, enabling simultaneous voice and data connectivity up to 284kbps. Features include a built-in firewall, analog and digital voice lines, soft PABX and a WAN port, which will support existing and future terrestrial networks such as 3G/LTE/5G and more. The FB250 represents a robust choice for a range of data critical maritime applications.



Intellian

Hensholdt

## Manta NEO Radar

Hensoldt introduced its new Manta NEO X band radar system, designed for all types of ships from workboats up to tankers and cruise ships. It uses CHIRP pulse compression and beam sharpening technology.

The Manta NEO X band radar is compatible with Kelvin Hughes Multifunction Displays, including 22" and 26" Panel PC Display, 24″ and 27″ Manta NEO Smart Display and 32″, 43 and 55″ Manta NEO Navigation Display.

# Clutch Performance

## 2-in-1 Combo Coupling/Clutch Assemblies

Stromag's pre-engineered single-piece combinations is designed to replace the need for custom solutions.

Equipment and machinery OEMs are challenged to design cost-effective drivetrains that fit into ever-shrinking spaces. In the case of mobile equipment designers, reducing overall system weight is also critically important.

Stromag, which offers couplings and clutches, is positioned to respond to the growing demand for innovative drivetrain solutions.

To this end, the Stromag engineering team recently designed a new line of unique, modular 2-in-1 coupling/clutch combination assemblies. The pre-engineered combinations feature an existing Stromag flexible coupling configured with an existing switchable clutch model for a compact, single-piece solution.

Depending on the application, various models from the line up of Stromag couplings and clutches are combined for electric, hydraulic or pneumatic actuation. Suitable 2-in-1 solutions are available for nearly every combination between drive electric motors or diesel engines, and pumps, generators and belt drives. The power spectrum of the 2-in-1 clutch/coupling combinations ranges from a few hundred to several ten thousand Newton meters.

"Instead of designing from scratch to meet specific customer requirements, the 2-in-1 modular smart design concept allows our engineers to select from

Images courtesy Stromag

**Stromag's modular 2-in-1 pre-engineered combinations feature an existing Stromag flexible coupling configured with an existing switchable clutch model for a compact, single-piece solution.**

a carefully pre-configured family of paired flexible couplings and clutches. These compact pre-engineered combinations can then be quickly modified to meet particular customer needs." said Ralph Breuer, director of engineering and product management at Stromag.

The modular design approach can help reduce costs and lead times.

Stromag couplings include plug-in, flexible Periflex VN disc couplings and TRI-R couplings featuring a combination ring element and diaphragm.

"Stromag's know-how in Torsional Vibration Analysis (TVA) constitutes the core of each coupling design," said Breuer. "It provides a comprehensive analysis of loads in the crankshaft, coupling and driven side to ensure that critical speeds can be moved per application requirements."

Unevenly rotating systems can severely degrade product quality and cause great harm to the powertrain. The TVA team at Stromag work daily on the challenge of detecting such deviations by measuring them and protecting the entire powertrain. Stromag calculates stationary and transient operating conditions while considering the stiffness and damping of a particular coupling's elastomers.

Stromag flexible couplings also accommodate various levels of radial, axial and angular misalignment, depending on the model. Stromag MWU electromagnetic pole-face friction clutches, KHA and KHR multi-disc clutches, and KPR clutches have a record of long-life performance in a variety of demanding applications.

Since the 2-in-1 combinations are configured into a single piece, there is no need for individual housings, bushings or keyways. These part reductions combine to provide weight savings which are especially important for marine and mobile equipment applications.

Stromag combination assemblies are provided as an open-running solution which is required for resiliently mounted engines and rigidly arranged drive lines. However, if desired, the combination units can be integrated into a single SAE housing for direct mounting to diesel engines. Stands and IIoT options are also available.

**Depending on the application, various models from the Stromag line up of-couplings and clutches are combined for electric (left), hydraulic (center) or pneumatic (right) actuation.**

## Hybrid Power for CTV

MHO-Co's two new crew transfer vessels (CTVs) – MHO Asgard and MHO Apollo – have been put through their paces, travelling 12,000 nautical miles on delivery from China's AFAI Southern Shipyard to Denmark, literally a voyage of discovery for both Volvo Penta and Danfoss Editron, collaborators on the vessel's hybrid power system. The 34.4 x 11m CTVs will be run by operator MHO-Co and service the Hornsea Project 2 offshore wind farm in the North Sea. The vessels' power system is a fully integrated solution made up of a Danfoss Editron electric drivetrain supported by Volvo Penta variable speed gensets that drive two of the first Electric Volvo Penta Inboard Performance System (IPS) units (pictured below), as well as two D13 Volvo Penta IPS units. The new IPS units have already achieved 1,000 hours of operation before even reaching the customer.

Danfoss Editron and Volvo Penta treated the journey from China to Denmark as a pilot project and a time to work with the captains and crew to tweak the technology onboard and make it as reliable and efficient as possible for the customer. The companies were able to test different power combinations, such as diesel-electric operation or diesel-only. In Dynamic Positioning System mode fuel consumption is below 20 liters/hr. and can be as low as 17 liters/hr.

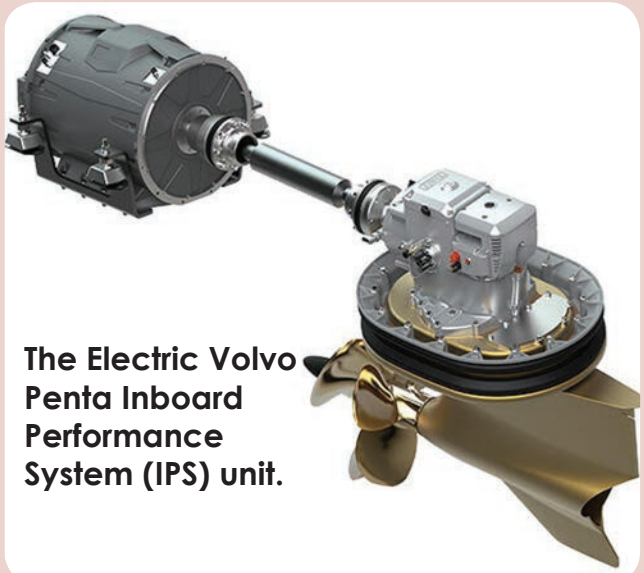


## Emergency Release for Ship-to-Ship Tranfer Ops

Unexpected mooring breakouts have always been the biggest risk during offshore STS operations. In the oil Ship-to-Ship Transfer Industry the cargo transfer operations are carried out with no passive or active protection installed. Improvements to the systems have seen the use of Camlock fittings that allow a much quicker manual disconnection; however, the problem remains that in an emergency the quick disconnection of a hose filled with oil and blanking it off for passing back to the other vessel, or dropping it in the water, is at times simply not possible.

SafeSTS, working in co-operation with Gall Thomson, launched the Protective Transfer System (PTX). Utilizing the flip-flap marine breakaway coupling technology proven within other Gall Thomson products for more than two decades, the PTX is designed to provide rapid, safe, on-demand release within the marine hose transfer system.

An ultra-compact system which includes its own HPU and transport and reset skid, the PTX is located directly over the vessel's manifold drip tray, minimizing the risk of spills and providing leak-tight shut off following closure.



**The Electric Volvo Penta Inboard Performance System (IPS) unit.**

Image courtesy Volvo Penta

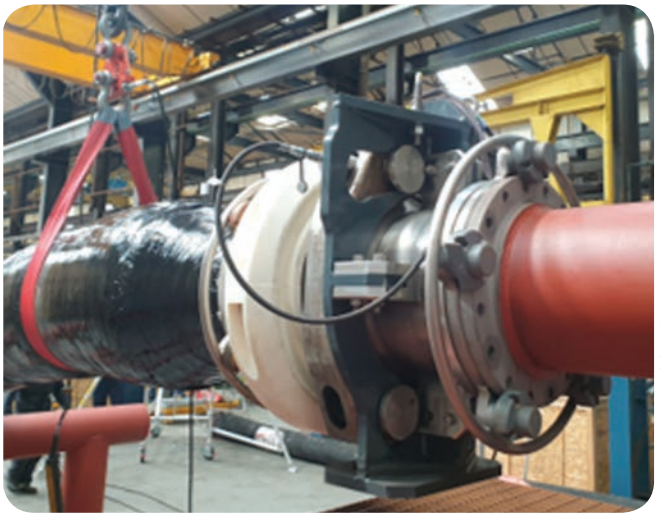
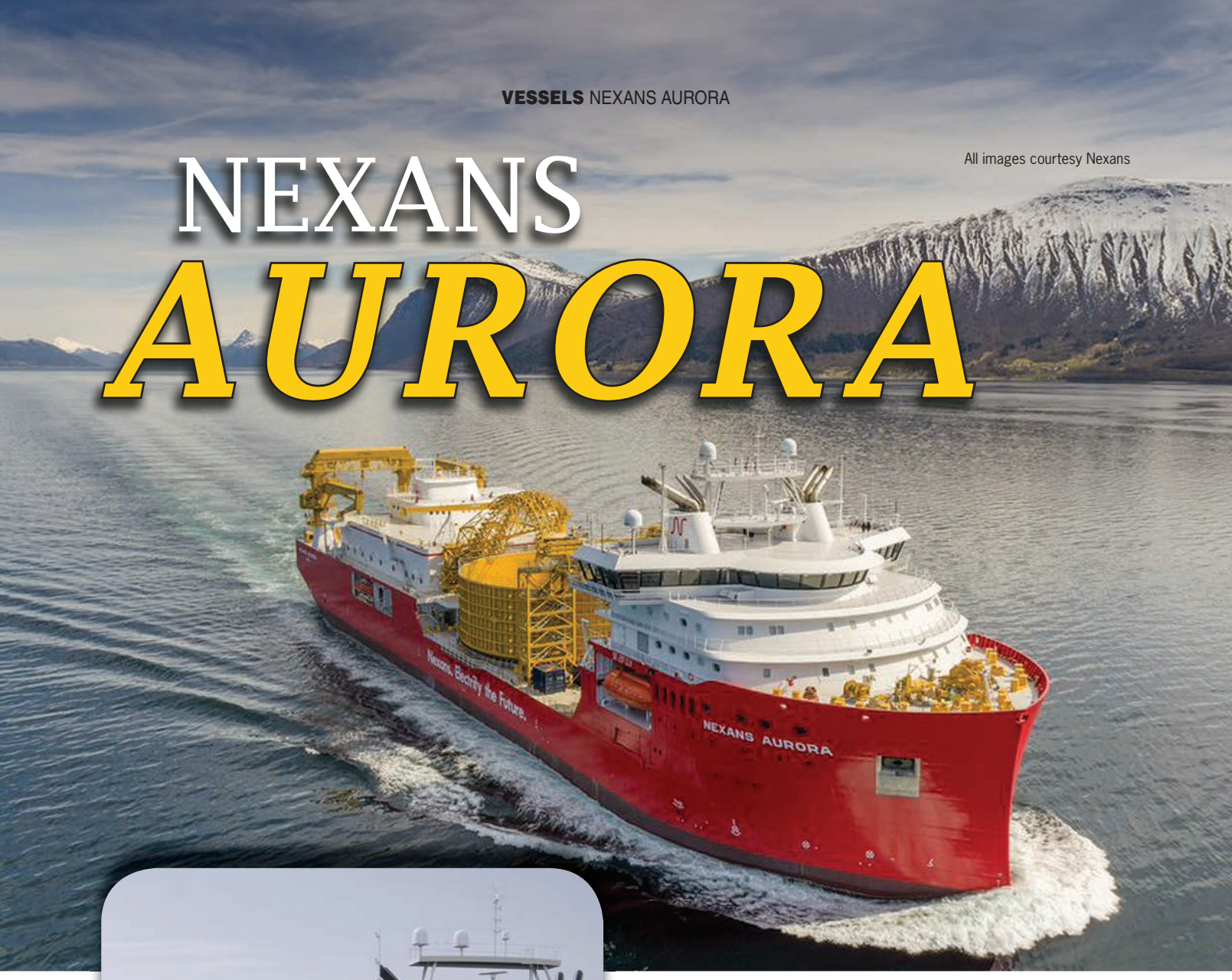


Image courtesy of Gall Thomson

All images courtesy Nexans

# NEXANS AURORA





*Nexans Aurora is more than a cable laying ship: Nexans Aurora is central to the company's core electrification strategy, of playing a key role in the NetZero journey, as Bjørn Ladegård, Director - Subsea Services and Installation, Nexans, discussed.*

**By Greg Trauthwein**

**Bjørn Ladegård**
Director, Subsea Services & Installation, Nexans

Electrification is at the heart of what Nexans does, and its latest fleet addition – Nexans Aurora which has been four years in the making – is designed to help effectively extend the company's capabilities globally, particularly in regards to the laying of increasingly complex and deep cable arrays to serve the growing offshore wind industry.

With the arrival of Aurora – designed by Skipsteknisk and built at Ulstein Yard – Nexans effectively doubles the physical fleet size, but the story on additional capabilities transcends the addition of one ship. Aurora is the company's second main cable-laying vessels joining the 1976-built Skagerrak, as well as a pair of high-capacity storage and installation barges called the UR141 and the EB32.

"We pride ourself in being a turnkey solution provider for cabling solutions for offshore wind power and interconnector. We needed to add a vessel to be able to make up for all cable projects we saw coming," said Ladegård. Nexans Skagerrak was the starting point of the design of Aurora. "A lot of the main parameters have been replicated in order to build on the success of this ship, but to do it bigger and better, quicker and cheaper, so we could continue supporting bigger projects."

The quest to design Aurora was dictated largely by the size and quantity of equipment and capability needed onboard. "We needed to make the ship wrap around the equipment rather than equipment fit on the ship," said Ladegård, "and I think we got the best of both worlds."

Some of these enhanced capabilities are related to the carrying capacity of the cables. "We can have 10,000 tons carrying capacity in the turntable, in addition, we have 450 tons of fiber optic key cable capacity. For interconnectors and HVDC, it's equipped with a dual turntable and laying lines for bundled DC applications," a new capability.

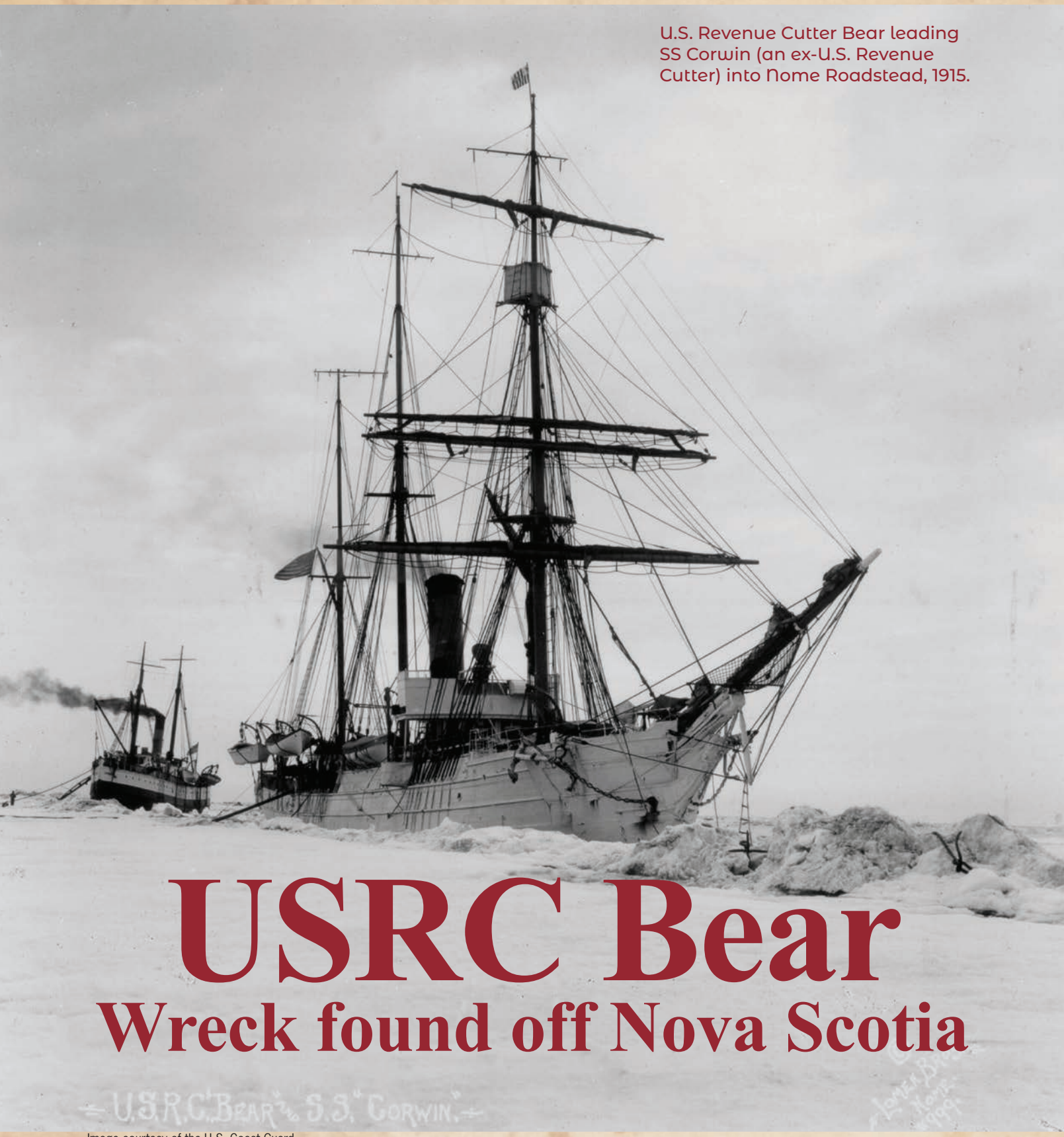
Another highlight of Aurora is its shallow water capabilities, as it is here that difficult seabed topography and adverse weather conditions can really impact operations. "This is extremely important because we are normally ending up with a cable end in the landing operation, and the closer you can get to the shore and have safe operations while landing the cable, the better," said Ladegård

As it is designed to operate globally, Nexans Aurora had to be powerful enough to safely transit the high seas, but to transit efficiently, courtesy of a 20,000 kW diesel-electric powerplant running on low sulfur MGO, a system that is future-proofed with the ability to add batteries when the technology matures further. In addition, it has Dynamic Position for station-keeping abilities in rough weather.

Once delivered Aurora is scheduled to get to work immediately, an interconnector project in Greece that will provide a link between mainland Greece and the island of Crete in depths of up to 1600m.

The first project in the offshore wind segment will be the Seagreen wind farm in Scotland. In addition, the company is looking to build on its existing presence in the US with its cable manufacturing plant in Charleston, which will produce high voltage subsea cables.

"We have followed projects in the US for many years and we anticipate ongoing growth in the US's offshore wind sector, especially with the federal Government's strong support for the sector," Nexans said in a release introducing Aurora. "As preferred supplier for Equinor's Empire Wind, and our frame agreement with Orsted for the US market, Nexans is well placed to support the US with further energy transition projects."




U.S. Revenue Cutter Bear leading SS Corwin (an ex-U.S. Revenue Cutter) into Nome Roadstead, 1915.

# USRC Bear

## Wreck found off Nova Scotia

Image courtesy of the U.S. Coast Guard

The decades long mystery of a missing U.S. Coast Guard Ship has finally been solved. U.S. Revenue Cutter (USRC) Bear, lost at sea in 1963, has been found on the seafloor about 90 miles south of Cape Sable, Nova Scotia, NOAA Rear Adm. Nancy Hann announced last month.

Widely considered one of the most historically significant ships in American history, Bear was purchased by the U.S. government and first put into service by the U.S. Navy as part of the rescue fleet for the Greely Expedition to the Arctic in 1884, attaining legendary status for the rescue of the expedition's few survivors. The Bear was transferred from the Treasury Department for service in the Arctic in 1885 as a Revenue Cutter, and for 41 years, patrolled the Arctic, saving lives and dispensing justice in the remote and challenging region.

Many years later, and after several roles including patrol missions for the U.S. Navy during World War II, Bear was ultimately sold to an entrepreneur who planned to turn it into a museum and restaurant on the Philadelphia waterfront, but the famed ship sunk while being towed to its new berth.

A team of researchers from NOAA, USCG and partnering academic institutions have spent nearly two decades trying to locate the Bear's final resting place. The mission, it turns out, was quite challenging and complex.

A breakthrough came during a side scan survey in Canadian waters in 2019, when a team from NOAA Ocean Exploration and NOAA National Marine Sanctuaries' Maritime Heritage Program, working off the USCG's medium-endurance cutter Bear (named for USRC Bear), found two targets for further exploration while mapping 62 square miles of seabed in the area near various last known positions reported during the Bear's sinking in 1963.

"One target in particular was very promising as it was in the proximity of the last known position where Bear was lost at sea in 1973, and it appeared to roughly match the dimensions of the ship," said Brad Barr, Expedition Coordinator, NOAA Office of National Marine Sanctuaries Maritime Heritage Program.

Coast Guard and NOAA researchers returned to sea earlier this year on the USCG oceangoing buoy tender Sycamore, this time with operators from Marine Imaging Technologies and a remotely operated vehicle (ROV) equipped with high-resolution underwater video cameras. Despite difficult operational conditions on site, the team was able to collect enough video and still images to provide the documentation needed for maritime archaeologists and historians to identify the historic wreck.


**Figure 2:** Forefoot of U.S. Revenue Cutter Bear under repair (c. 1924-1925).

Image courtesy of the U.S. Coast Guard

**Figure 9:** Location and detail of the propeller post on Bear of Oakland, 1933.

Image courtesy of the Boston Public Library, Leslie Jones Collection

Key indicators highlighted as compelling evidence of the identity of the ship included the bow staple and steel sheathing configurations, multiple layers of bow planking and the stern tube bolt patterns, as well as its location close to the reported last known position and lack of other wrecks in the vicinity.

"While no feature identified in the 2021 ROV survey, by itself, would have likely been considered absolutely definitive, taken together, the body of evidence was considered, by the evaluation team, more than sufficient to identify the wreck as Bear with a reasonable degree of certainty," Barr said.

Now that it has been found, attention turns toward efforts that will help preserve the shipwreck.

Barr noted that the Canadian Department of Fisheries and Oceans is considering establishing a marine protected area that would include the Bear wreck site. While not explicitly recognizing the historic importance of the shipwreck, the designation could help to alleviate any continuing damage to the wreck from mobile fishing gear, he added.

"Some joint U.S./Canadian recognition of this significant historic site might also be possible, but time will tell whether such a collaborative agreement has the potential to be developed and implemented," Barr said.

## THE LEGENDARY *"BEAR"*

In the cumulative maritime history of the U.S., few ships have been so routinely identified as "iconic" and "legendary," and none more historically significant than U.S. Revenue Cutter Bear. Largely associated with polar exploration, and particularly its Arctic service, the ship's history is a series of compelling stories of bravery in the face of peril, dedication to duty, and legendary exploits.

Built in Scotland originally as a sealer in 1874, for the first 10 years of service, Bear operated as part of the commercial sealing fleet off Newfoundland.

Purchased by the U.S. Government, she was put into service by the U.S. Navy as part of the rescue fleet for the Greely Expedition to the Arctic in 1884, and first came to world-wide acclaim as the vessel that rescued the few survivors of that disastrous expedition. In 1885, Bear was transferred from the Treasury Department for service in the Arctic as a Revenue Cutter, and for an unprecedented 41 years, ably patrolled the Arctic, saving lives and dispensing justice in this remote and often challenging region.

Between 1886-1895, Bear's captain was the legendary "Hell Roaring" Mike Healy. While he never, during his lifetime, self-identified as African American, perhaps to avoid the prejudice he would likely have encountered in in personal life and career, he was in reality the first person of African American descent to command a ship of the U.S. Government. The U.S. Coast Guard Cutter Healy, commissioned in 1999 and routinely operating in Alaska, was named in his honor.

Also notable was the so-called "Overland Rescue of 1897." Discovering that eight whaling ships were trapped in the ice off Barrow, a small team was dispatched from Bear, lead by LT David Jarvis and accompanied by LT Ellsworth Berthoff and ship's surgeon Dr. Samuel Call, from Nelson Island near the Bering Strait to drive a herd of 450 reindeer 1,600 miles, in the driving snow and perilous conditions of the Arctic winter, to Barrow to provide food to the 275 men from the whaling ships stranded onshore. To this day, the U.S. Coast Guard's highest honor for bravery is named for the leader of that expedition, Lt. David Jarvis.

Bear remained in meritorious service in the Arctic until 1917, when she was transferred back to the U.S. Navy during World War I. After the war, Bear returned to again patrol Arctic waters. Notable during this second patrol was the ship's support of relief operations in the region during the Spanish Flu Epidemic of 1919.

The ship was decommissioned by the U.S. Government in 1929 and given to the City of Oakland, California, where she was repurposed as a maritime museum and used as the movie set for the 1930 film of Jack London's The Sea Wolf. However, the ship was not long idle, as Admiral Richard Byrd purchased the still stout ship for his second Antarctic expedition. She was refit and performed admirably for both this successful expedition, in 1933-1935, and later for the U.S. Antarctic Expedition of 1939-1941. During World War II, Bear again went into service for the U.S. Navy in the Greenland Patrol and notably participated in the capture of a German spy vessel, the trawler Buskoe.

Ending her service as a commissioned vessel in 1944, Bear was sold in 1948 to a Canadian steamship company to be re-converted to her original purpose as a sealer, but poor market conditions caused the company to abandon her on a wharf in Nova Scotia. The ship was saved from this fate by an entrepreneur from Pennsylvania, who purchased Bear in the early 1960s to become a museum and restaurant on the waterfront in Philadelphia, Pennsylvania. Unfortunately, the ship was lost while being towed to her new berth in 1963, and her final resting place lies, according to the position recorded at the time of the sinking, somewhere around 260 miles off Boston, approximately 90 miles South of Cape Sable, Nova Scotia.

*Excerpted from Brad Barr, Expedition Coordinator, NOAA Office of National Marine Sanctuaries Maritime Heritage Program*

**Figure 13:** Dimensions of the "unidentified wreck" explored in 2021.

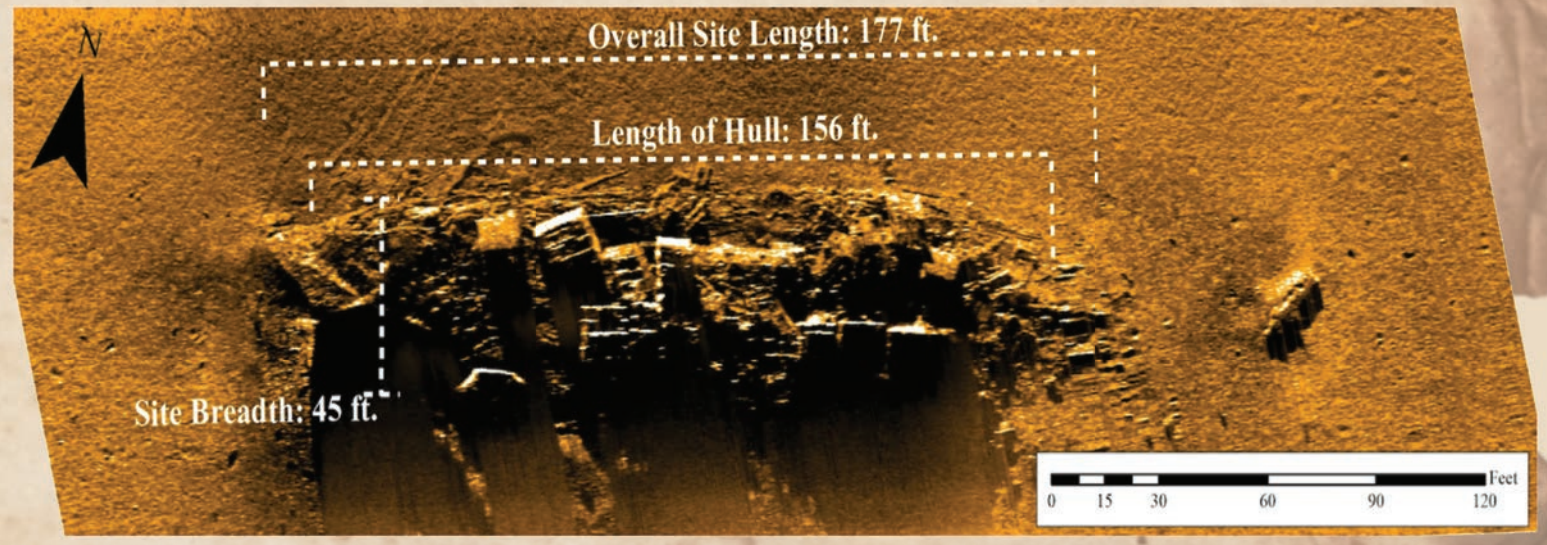



Image courtesy of NOAA/ONMS

# *Five Minutes with*
# Susan Ludwig
## *President, Coast Guard Foundation*

*COVID has presented numerous challenges, particularly to the members of the U.S. Coast Guard. The Coast Guard Foundation (CGF) has stood strong throughout to assist, as Susan Ludwig discussed with Maritime Reporter TV.* **By Greg Trauthwein**

**When COVID shut down the world in 2020, everyone had to make adjustments. How did the CGF respond?**

We did what everybody else did; we planned for the worst on a weekly basis. We took a look at not being able to host our in-person events for the year, and anticipated a lower amount of donor giving. So we took about 35% of our normal funding out, and we cut expenses short-term by the same amount.

**How did the CGF adjust its programs to better serve Coast Guard members and their families during COVID?**

We leaned into the relationship we have with our Coast Guard leaders, because we knew their mission components were shifting and changing, and we wanted to be where they needed us. The first thing they told us was we need COVID support. Imagine a large crew on a National Security Cutter whose deployments went from eight months to about 16 months. So we outfitted those large ships with morale items to boost their wellness. We also helped with the isolation spaces that the Coast Guard was setting up for their members that needed to quarantine. And in addition to those members needing to quarantine, remember in the military service, you've got families that are needing to transfer every three years. So if you have to go from area A to area B, you also needed to quarantine for a couple weeks. So we outfitted those spaces with morale gear, video games, books and cooking utensils. We adjusted all that we could within the confines of our support.

**For the last 20 months, COVID put a brake on many things, but it wasn't able to put the brakes on natural disasters, and there have been few. How did the CGF respond?**

You are absolutely right, Greg, Mother nature did not take a knee! During wildfires and hurricanes, these folks are running into the fray to rescue people and homes, while their own homes are being damaged or destroyed; they live in the communities in which they serve. So we've gotten this down to where we can get funds out to the individual families in harm's way in less than three days.

**You have a number of programs aimed to help Coast Guard families. What did those programs look like during COVID?**

We have three major areas, in which we support Coast Guard members and their families, and the buckets are loosely defined as education, emergency and tragedy assistance, and morale. During COVID, we can move in and out of those in significant ways. So, we moved deadlines. We made sure to work with Coast Guard leadership on that COVID piece to hold up the morale for those that needed to be isolated. The other really great piece that we will continue beyond COVID is we started working with the Coast Guard chaplains to better define how we could help with our funds. We have been setting up pilots that have been successful for peer-to-peer train-


ing. So instead of just the chaplains having to lift that work, now they've got others in the various Coast Guard areas that are also trained in suicide prevention (and other helpful services). Although it's in its pilot stage now, we have strong indicators that we will continue. So in addition to the physical morale and keeping them mission ready with all the exercise equipment and outdoor pieces, we're very proud that we're also doing a lot more on the mental wellness side.

**For anyone reading (or watching), how can the maritime industry help the CGF fulfill its mission?**

We have 26,000 donors, made up of corporate supporters and individual supporters. Our 80-member national board is as active as any board I've ever been part of, and they do a lot of this lifting. We have many of your maritime supporters and would welcome any others that want to get closer to this mission. It's about matching that passion of the people they work with every day to the needs of the Coast Guard members. We are about to set up our 2022 events schedule, and I'm happy to say we'll have eight of the 'Salute the Coast Guard' dinners as well as two golf tournaments. They're evenings of community where maritime members are together in one room with Coast Guard leadership, and we salute Cast Guard heroes from the stage. We have many maritime partners who want to help in specific areas of support. One of them that comes to mind is education. Within the education bucket of dependent scholarships and enlisted grants and spouse grants, we also have a program called workforce development that sprung organically from a conversation that one of our directors had in Miami three and a half years ago, where Coast Guard members were telling him that they needed additional credentialing. So, the Coast Guard will obviously credential them in captain's and aviation licenses, but they wanted to go beyond that, to be more mission ready in their current job, and then to be more marketable once they retire. So we set up classes, and we have classes of captain's licenses and a whole lot of other solutions that we fund.





All image courtesy of the Coast Guard Foundation

UNITED STATES POSTAL SERVICE®

## Statement of Ownership, Management, and Circulation (Requester Publications Only)

| 1. Publication Title | 2. Publication Number | 3. Filing Date |
|---|---|---|
| Maritime Reporter and Engineering News | 0 1 6 - 7 5 0 | September 28, 2021 |
| 4. Issue Frequency | 5. Number of Issues Published Annually | 6. Annual Subscription Price (If any) |
| Monthly | 12 | None |

7. Complete Mailing Address of Known Office of Publication (Not printer) (Street, city, county, state, and ZIP+4®)
Maritime Activity Reports, Inc. 118 East 25th Street, 2nd Floor, New York, NY 10010

Contact Person: Kathleen Hickey
Telephone (Include area code): 212-477-6700

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer)
Maritime Activity Reorts, Inc. 118 East 25th Street, 2nd Floor, New York, NY 10010

9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not leave blank)

Publisher (Name and complete mailing address)
John C. O'Malley, Maritime Activity Reports, Inc. 118 East 25th Street, 2nd Floor, New York, NY 10010

Editor (Name and complete mailing address)
Gregory Trauthwein, Maritime Activity Reports, Inc. 118 East 25th Street, 2nd Floor, New York, NY 10010

Managing Editor (Name and complete mailing address)

10. Owner (Do not leave blank. If the publication is owned by a corporation, give the name and address of the corporation immediately followed by the names and addresses of all stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, give the names and addresses of the individual owners. If owned by a partnership or other unincorporated firm, give its name and address as well as those of each individual owner. If the publication is published by a nonprofit organization, give its name and address.)

| Full Name | Complete Mailing Address |
|---|---|
| John C. O'Malley | Maritime Activity Reports, Inc. |
| | 118 East 25th Street, 2nd Floor |
| | New York, NY 10010 |
| | |
| | |

11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check box. → ☑ None

| Full Name | Complete Mailing Address |
|---|---|
| | |
| | |
| | |
| | |

12. Tax Status (For completion by nonprofit organizations authorized to mail at nonprofit rates) (Check one)
The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes:
☑ Has Not Changed During Preceding 12 Months
☐ Has Changed During Preceding 12 Months (Publisher must submit explanation of change with this statement.)



| 13. Publication Title | 14. Issue Date for Circulation Data Below |
|---|---|
| Maritime Reporter and Engineering News | September 2021 |

| 15. Extent and Nature of Circulation (Requester) | | | Average No. Copies Each Issue During Preceding 12 Months | No. Copies of Single Issue Published Nearest to Filing Date |
|---|---|---|---|---|
| a. Total Number of Copies (Net press run) | | | 10758 | 12889 |
| b. Legitimate Paid and/or Requested Distribution (By mail and outside the mail) | (1) | Outside County Paid/Requested Mail Subscriptions stated on PS Form 3541. (Include direct written request from recipient, telemarketing, and Internet requests from recipient, paid subscriptions including nominal rate subscriptions, employer requests, advertiser's proof copies, and exchange copies.) | 9559 | 10917 |
| | (2) | In-County Paid/Requested Mail Subscriptions stated on PS Form 3541. (Include direct written request from recipient, telemarketing, and Internet requests from recipient, paid subscriptions including nominal rate subscriptions, employer requests, advertiser's proof copies, and exchange copies.) | 0 | 0 |
| | (3) | Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid or Requested Distribution Outside USPS® | 0 | 0 |
| | (4) | Requested Copies Distributed by Other Mail Classes Through the USPS (e.g., First-Class Mail®) | 892 | 956 |
| c. Total Paid and/or Requested Circulation (Sum of 15b (1), (2), (3), and (4)) ▶ | | | 10451 | 11873 |
| d. Non-requested Distribution (By mail and outside the mail) | (1) | Outside County Nonrequested Copies Stated on PS Form 3541 (include sample copies, requests over 3 years old, requests induced by a premium, bulk sales and requests including association requests, names obtained from business directories, lists, and other sources) | 0 | 0 |
| | (2) | In-County Nonrequested Copies Stated on PS Form 3541 (include sample copies, requests over 3 years old, requests induced by a premium, bulk sales and requests including association requests, names obtained from business directories, lists, and other sources) | 0 | 0 |
| | (3) | Nonrequested Copies Distributed Through the USPS by Other Classes of Mail (e.g., First-Class Mail, nonrequestor copies mailed in excess of 10% limit mailed at Standard Mail® or Package Services rates) | 50 | 120 |
| | (4) | Nonrequested Copies Distributed Outside the Mail (Include pickup stands, trade shows, showrooms, and other sources) | 30 | 550 |
| e. Total Nonrequested Distribution [Sum of 15d (1), (2), (3) and (4)] | | | 85 | 670 |
| f. Total Distribution (Sum of 15c and e) ▶ | | | 10536 | 12543 |
| g. Copies not Distributed (See Instructions to Publishers #4, (page #3)) ▶ | | | 222 | 346 |
| h. Total (Sum of 15f and g) | | | 10758 | 12889 |
| i. Percent Paid and/or Requested Circulation (15c divided by 15f times 100) ▶ | | | 99.2% | 95% |

* If you are claiming electronic copies, go to line 16 on page 3. If you are not claiming electronic copies, skip to line 17 on page 3.





UNITED STATES POSTAL SERVICE®

## Statement of Ownership, Management, and Circulation (Requester Publications Only)

| 16. Electronic Copy Circulation — Maritime Reporter and Engineering News | Average No. Copies Each Issue During Previous 12 Months | No. Copies of Single Issue Published Nearest to Filing Date |
|---|---|---|
| a. Requested and Paid Electronic Copies ▶ | 15043 | 17184 |
| b. Total Requested and Paid Print Copies (Line 15c) + Requested/Paid Electronic Copies (Line 16a) ▶ | 25494 | 29057 |
| c. Total Requested Copy Distribution (Line 15f) + Requested/Paid Electronic Copies (Line 16a) ▶ | 25579 | 29727 |
| d. Percent Paid and/or Requested Circulation (Both Print & Electronic Copies) (16b divided by 16c × 100) ▶ | 99.7% | 97.7% |

☑ **I certify that 50% of all my distributed copies (electronic and print) are legitimate requests or paid copies.**

17. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the November 2021 issue of this publication.

| 18. Signature and Title of Editor, Publisher, Business Manager, or Owner | Date |
|---|---|
| Kathleen Hickey | 9/28/2021 |

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

# BUYER'S DIRECTORY

This directory section is an editorial feature published in every issue for the convenience of the readers of MARITIME REPORTER. A quick-reference readers' guide, it includes the names and addresses of the world's leading manufacturers and suppliers of all types of marine machinery, equipment, supplies and services. A listing is provided, at no cost for one year in all issues, only to companies with continuing advertising programs in this publication, whether an advertisement appears in every issue or not. Because it is an editorial service, unpaid and not part of the advertisers contract, MR assumes no responsibility for errors. If you are interested in having your company listed in this Buyer's Directory Section, contact Mark O'Malley at momalley@marinelink.com

### ANCHORS & CHAINS

Anchor Marine & Supply, INC., 6545 Lindbergh Houston, Texas 77087 , tel:(713) 644-1183, fax:(713) 644-1185, david@anchormarinehouston.com

### APPROVED U.S. COAST GUARD MARINE SANITATION DEVICES

Environmental Marine, Inc., 711 Colyer Rd., Bronson, KY , USA , tel:(606) 561-4697, bobkenison@aol.com contact: Bob Kenison, www.envmar.com

### AUTOMATIC IDENTIFICATION SYSTEM (AIS) AND VHF DATA EXCHANGE SYSTEM (VDES)

Saab AB (publ) TransponderTech, SE-589 41 Linkoping , tel:46 13 180000, Info.transpondertech@saabgroup.com

### COMMUNICATIONS

David Clark Company (Wireless Headset Communication Systems), 360 Franklin Street, Worcester, MA 77060, USA , tel:(800) 298-6235 , www.davidclarkcompany.com/marine

### EXHAUST

Marine Exhaust Systems of Alabama, 757 Nichols Ave. Fairhope, Alabama 36532 , tel:(251) 928-1234, mark@mesamarine.com

### INERTIAL SENSING SYSTEMS

Silicon Sensing Systems Ltd, Clittaford Road Southway, Plymouth, Devon PL6 6DE United Kingdom , UK , tel:+44 (0) 1752 723330, sales@siliconsensing.com

### MECHANICALLY ATTACHED FITTINGS (MAFS)

Viega, 585 Interlocken Blvd., Broomfield, CO , USA , tel:(410) 299-6724, tj.tracy@viega.us contact: T.J. Tracy, www.Viega.us

### MEMS MOTION SENSING

Silicon Sensing Systems Ltd, Clittaford Road Southway, Plymouth, Devon PL6 6DE United Kingdom , UK , tel:+44 (0) 1752 723330, sales@siliconsensing.com

### NAVAL ARCHITECTS, MARINE ENGINEERS

All American Marine, 1010 Hilton Ave. Bellingham, WA 98225 U.S.A. , tel:(360) 647-7602, marketing@allamericanmarine.com

Bristol Harbor Group, Inc., 103 Poppasquash Rd., Bristol, RI 02809, USA , tel:401-253-4318, fax:401-253-2329, design@bristolharborgroup.com

The Shearer Group, Inc, 3118 Harrisburg Blvd., Suite 100, Houston, TX , USA , tel:(281) 532-2080, info@shearer-group.com

### PIPING SYSTEMS FOR SHIP REPAIR & NEW CONSTRUCTION

Viega, 585 Interlocken Blvd., Broomfield, CO , USA , tel:(410) 299-6724, tj.tracy@viega.us contact: T.J. Tracy, www.Viega.us

### PRESS FITTINGS

Viega, 585 Interlocken Blvd., Broomfield, CO , USA , tel:(410) 299-6724, tj.tracy@viega.us contact: T.J. Tracy, www.Viega.us

### RUST AND PAINT REMOVAL

Rustibus, 2901 WEST SAM HOUSTON PKWY, N. SUITE E-325 HOUSTON, TX 77043 , tel:(832) 203-7170, fax:(832) 203-7171, kd@rustibus.com , www.rustibus.com

### SENSORS

Silicon Sensing Systems Ltd, Clittaford Road Southway, Plymouth, Devon PL6 6DE United Kingdom , UK , tel:+44 (0) 1752 723330, sales@siliconsensing.com , www.siliconsensing.com

### SHIP REPAIR, CONVERSION, REFIT, DRYDOCKING AND MAINTENANCE

Blohm+Voss B.V. & Co. KG, Hermann-Blohm-Strasse 3, 20457 Hamburg, Germany , tel:+49 40 3119 2110, shipservices@blohmvoss.com , www.blohmvoss.com

## Employment

*www.MaritimeJobs.com*

# MARKETPLACE

## Products & Services

*www.MaritimeEquipment.com*



## Vessels, Barges & Real Estate for Sale/Rent

# ADVERTISER INDEX

| Page | Advertiser | Website | Phone# |
|---|---|---|---|
| C3 | ABS | www.eagle.org | Please visit us online |
| 41 | Advanced Mechanical Enterprises | www.amesolutions.com | (954) 764-2678 |
| 53 | Anchor Maine & Supply, Inc | www.anchormarinehouston.com | (800) 233-8014 |
| 25 | BMT DESIGNERS AND PLANNERS | www.bmt.org | (703) 920-7070 |
| 43 | Carver Pump | www.carverpump.com | (563) 263-3410 |
| 31 | Cimolai Technology S.P.A. | www.cimolaitechnology.com | 011 39 049 940 4539 |
| 27 | Click Bond, Inc. | www.clickbond.com/MR8 | (775) 885-8000 |
| C2 | Coast Guard Foundation | www.CoastGuardFoundation.org | (860) 535-0786 |
| 63 | Creative Systems, Inc. | www.ghsp0ort.com | (360) 385-6212 |
| 55 | Crowley Maritime Corp | www.crowley.com/shipping | Please visit us online |
| 11 | David Clark Company | www.davidclark.com | (800) 298-6235 |
| 47 | Detyens Shipyards, Inc. | www.detyens.com | (843) 308-8000 |
| 1 | DMW Marine Group, LLC | www.dmwmarinegroup.com | (610) 827-2032 |
| 23 | E4 Power LLC | www.e4powerllc.com | (754) 715-0818 |
| 9 | Eastern Shipbuilding Group | www.easternshipbuilding.com | (850) 763-1900 |
| 7 | Furuno USA, Inc. | www.furunousa.com | Please visit our website |
| 39 | GULF COPPER MFG CORP | www.gulfcopper.com | (281) 752-4835 |
| 37 | H.O. Bostrom | www.hobostrom.com | (262) 542-0222 |
| 63 | Hougen Inc. | www.hougen.com | (800) 426-7818 |
| 5 | Infra-Metals | www.infra-metals.com | (630) 913-6064 |
| 15 | MAN Energy Solutions SE | www.man-es.com | Please visit us online |
| 59 | McDermott | www.mcdermott.com/careers | (281) 870-5000 |
| 13 | Nor-Shipping | www.nor-shipping.com | Please visit us online |
| 17 | Omnithruster | www.omnithruster.com | (330) 963-6310 |
| 45,65 | Prime Mover Controls | www.pmc-controls.com | (604) 433-4644 |
| 43 | R.M. Young Company | www.youngusa.com | (231) 946-3980 |
| C4 | R.W. Fernstrum & Company | www.fernstrum.com | (906) 863-5553 |
| 3 | Sea Machines | www.sea-machines.com | Please visit us online |
| 21 | W&O Supply | www.wosupply.com | (904) 354-3800 |
| 35 | Walz & Krenzer | www.wkdoors.com | (203) 267-5712 |

*The listings above are an editorial service provided for the convenience of our readers.*
*If you are an advertiser and would like to update or modify any of the above information, please contact: productionmanager@marinelink.com*

ABS

OFFSHORE WIND REPORT

# SAFETY AND COMPLIANCE INSIGHTS: UNDERSTANDING U.S. REGULATIONS FOR OFFSHORE WIND VESSELS

DOWNLOAD THE REPORT TODAY

www.eagle.org

# We take the heat, so you don't have to.

**Cool. Because you need it.**

We deliver cool based on your reality. So no matter where you operate, hot days and heavy loads will never slow you down.

## GRIDCOOLER® Keel Cooler

- **One Piece Head Design** maintains greater structural integrity.
- **Higher Silver Content Braze Joints** resist fatigue and maintain the strength of surrounding material.
- **Better Penetration at Braze Joints** places more braze material with less heat, making joints stronger.
- **2-Year Warranty on Copper Nickel GRIDCOOLER Keel Coolers:** Industry-leading design, craftsmanship and materials create industry-leading products.
- **70 Years of Experience with Fully Assembled Packaged Keel Coolers**: Our focus is and always has been heat exchangers.

## WEKA Boxcooler®

- **Over 20 Years of Experience with Copper Nickel Boxcoolers** offering longer product life cycle than standard coated tube units.
- **Manufactured in the USA and The Netherlands:** provides the greatest product availability.
- **Weka Guard and Protector** eliminate the need for bulky and costly copper sacrificial anodes.

Visit us at the International Workboat Show booth #2529

FERNSTRUM®

R.W. Fernstrum & Company

fernstrum.com | 1.906.863.5553 | sales@fernstrum.com | ISO 9001:2015