November 2023

MARITIME REPORTER AND ENGINEERING NEWS

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Erika Graziuso, Crowley

Meet the CIO

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Finland
'A Birthplace for Icebreakers'

Gensets
Flex Fuel, but CapEx & OpEx Rule


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44

Finland: Where Icebreakers are Born

Captain Pasi Järvelin on the bridge of Arctia icebreaker Polaris. Järvelin has more than 40 years' experience in the maritime industry, including 36 years on icebreakers, and was part of the concept team that developed the vessel.

Photo on the Cover: Photo credit Rick Wilson/Courtesy Crowley : **Photo this page:** Eric Haun

Departments

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Authors & Contributors

Brudzinski

Ewing

Galdorisi

Goldberg

Haun

Laursen

Lewis

Riley

van Hemmen

Brudzinski
Chief Judge Brudzinski has been an Administrative Law Judge with the U.S. Coast Guard since 2003 and its Chief Administrative Law Judge since 2013.

Ewing
Tom Ewing is a freelance writer specializing in energy and environmental issues.

Galdorisi
George Galdorisi is a retired naval aviator. He enjoys writing, especially speculative fiction about the future of warfare. The opinions expressed in his article are solely those of the author. Reference to any specific commercial companies, products, process, or service does not imply its endorsement by the Department of Defense or Department of the Navy.

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

Haun
Eric Haun is editor of Marine News. He has covered the commercial maritime and offshore industries since 2013.

Laursen
Wendy Laursen has 20 years of experience as a journalist. She has a Master of Science research degree in marine ecology as well as diplomas in journalism, communication and subediting.

Lewis
Philip Lewis is Director Research at Intelatus Global Partners. He has market analysis and strategic planning experience in the energy and maritime sectors.

Riley
Robert Riley is the Information Technology & Networks Branch Chief at the USCG Research and Development Center.

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.

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CONTACT INFORMATION:

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

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Having maintained a fairly rigorous business travel schedule for nearly 30 years leading up to 2020, personally I enjoyed the COVID-induced break from the mundane ritual and inevitable headaches that come with the task. Moreso, I promised myself that I would never go back to that frequency and pace again.

As it seems, I lied to myself.

We write about the rapid technological evolution happening today in maritime, offshore energy and the subsea industry relentlessly across our multiple brands, online platforms, webTV and social channels. Courtesy of my length of service, I'm able to tap the minds of business and technology leaders around the world, and during the lull between 2020 and 2022 this mostly meant via Zoom, GoogleMeet, Teams or any other video chat medium available.

But missing was that one-on-one connection, the ability to sit in someone's office to gauge not just the words they're saying, but feel the meaning behind it and get a better view of the person themself. To jump on the bridge of a ship and give this emerging technology a trial run, to see its potential, to see its limitations, and to hear the back-chatter in the room, the off-line, not-for-attribution conversations on what really works, what does not. So as much as I enjoy working in my shorts and hoodies on the south shore of Long Island, that personal interaction is a missing link that cannot be emulated, imitated or replaced. Our cover story this month embodies nearly all I describe above. Last month I was afforded the opportunity to sit with **Erika Graziuso, Chief Information Office, Crowley,** for a top to bottom discussion on this iconic maritime brand's digital journey. An Italian native, Graziuso has exactly one year of maritime industry experience, spending the bulk of her career transforming the digital journeys of corporate behemoths like Deutsche Bank and The Adecco Group. Her attraction to the CIO post at Crowley was the ability to not just refine a digital strategy, rather create it from the ground up. In our hour or so together I learned as much about her personally, her path, her family, as much as I did about her mission to deliver for Tom Crowley and company. Our "Meet the CIO" feature starts on page 34.

Another 'hands-on' mission was **Eric Haun's** recent trek to Finland for a week's worth of visits and insights on Finnish maritime organizations and their commitment to all things maritime. Finnish maritime technology is legendary, particularly in the cruise shipping and icebreaker segments, and Finland's recent admission to NATO will open many doors, too, on the military side of the business. There are many stories to come from Eric's early October swing through Finland, but this month we offer *"Finland: Where Icebreakers are Born"* starting on page 44. Our icebreaker coverage is particularly timely, particularly as the U.S. struggles to get its own icebreaker house in order.

Gregory R. Trauthwein
Publisher & Editor
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

CEO
John C. O'Malley
jomalley@marinelink.com

President & COO
Publisher & Editor
Greg Trauthwein
trauthwein@marinelink.com

Editor - MarineNews
Eric Haun
haun@marinelink.com

Offshore Energy Editor
Bartolomej Tomic
tomic@offshore-engineer.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
Terry Breese
breese@marinelink.com; +1 561-732-1185

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

John Cagni
cagni@marinelink.com; +1 631-472-2715

Frank Covella
covella@marinelink.com; +1 561-732-1659

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

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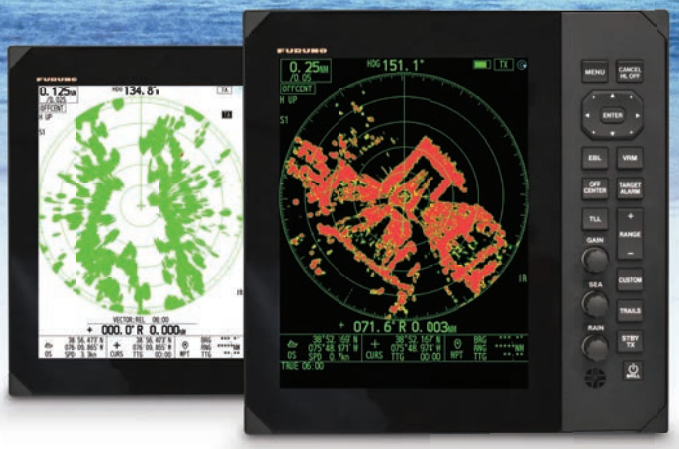

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OSVs

Powered by VesselsValue

This month VesselsValue offer insights and a breakdown of the ever-evolving, always entertaining Offshore Service Vessel (OSV) market.

Top OSV Owning Companies (Value)

Beneficial Owner	Value ($)	# Vessels
Tidewater Marine	2,099.1	152
Edison Chouest Offshore	2,059.3	153
Hornbeck Offshore Services	1,254.7	69
Bram OTM	705.9	33
Tidewater Offshore Operations	689.7	49
(By Country)		
United States of America	8,386.2	894
Norway	3,319.1	216
Brazil	3,257.6	248
Singapore	2,754.9	483
China	2,571.0	450

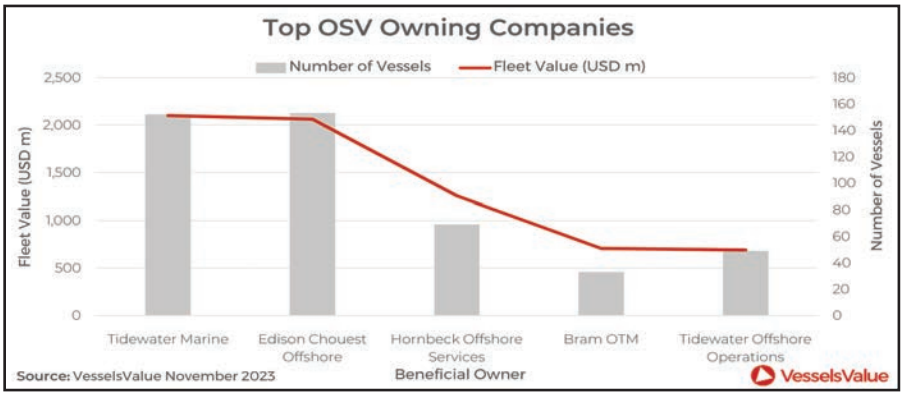
Top OSV Buying Companies (Spend)

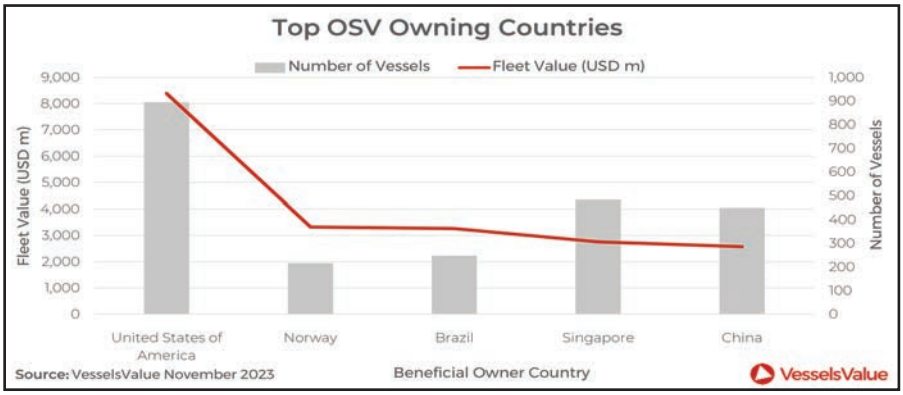
Buyer Company	Spend ($)	# Vessels
Tidewater Marine	596.7	38
Britoil Offshore	236.8	29
Hornbeck Offshore Services	146.1	9
Golden Energy Offshore	79.0	4
Posidonia Shipping and Trading	66.3	3
(By Country)		
United States of America	780.7	54
Singapore	264.4	32
Norway	179.9	11
Brazil	117.4	9
United Arab Emirates	76.6	13

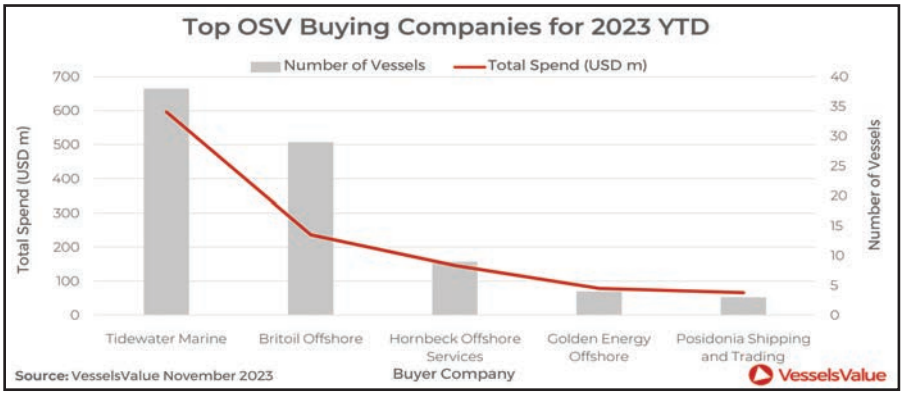
*Total spend calculated using reported sale price where known and VV value at time of sale where undisclosed.

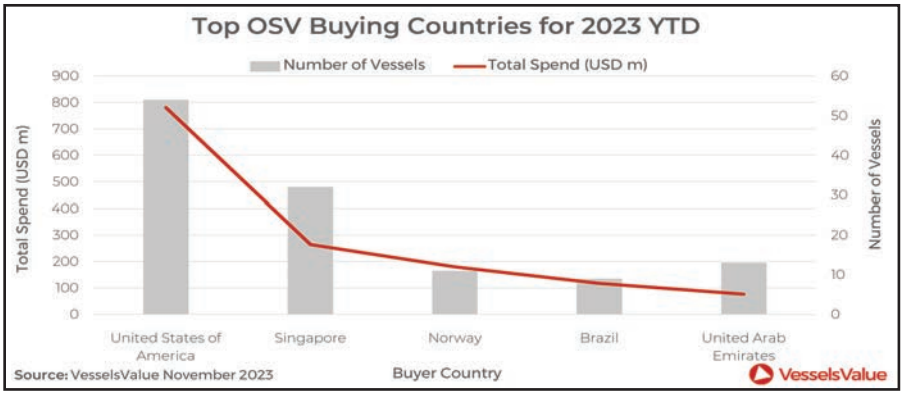
Highest Value OSV

Name	**Stepan Makarov**
IMO	**9753727**
Beneficial Owner	**Sovcomflot**
Type	**STANDBY / ERRV**
Build Date	**Jun 2017**
Age	**6.38 years**
Builder	**Helsinki Shipyard**
BHP	**24,138**
Length Overall	**104.4m**
Ice Class	**ARC6**
Market Value (USD m)	**$102.84**









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Tip #53

Data & Analytics: Taking the Next Step

By Murray Goldberg

As the world sails into this new era of digital transformation, our industry finds itself at the beginning of an enormous change, particularly in the area of training. Imagine a world where every decision, from navigation protocols to emergency responses, is optimized through intelligent analytics and predictive algorithms. The potential is enormous. By combining data science and advanced analytics and applying them to maritime training, we open up the potential to reach new levels of safety, efficiency, and skill mastery. Let's look at how these technologies promise to make all of our activities safer and more efficient. But first, what are data analytics?

In the simplest terms, data science and analytics are the computer algorithms that turn raw data into meaningful insights. Data science employs techniques from statistics, machine learning, and data mining to analyze and interpret large and complex data sets. Meanwhile, analytics utilizes these interpreted data to identify trends, patterns, and opportunities for improvement in a way that no human can. In a world that is increasingly driven by big data, these tools offer an analytical lens through which we can identify past correlations that we can use to predict the future in a way we never could before. Whether it's predicting weather conditions for a safe voyage or analyzing the effectiveness of crew training programs, data science and analytics give us the power to make informed decisions that are based on real evidence derived from past experiences. This takes much of the guesswork out of operations. So, we keep referring to this "data", but what data are we actually talking about?

In the maritime industry, there are many deep and useful data sources that we can collect and draw upon. From onboard sensors that monitor equipment performance and weather conditions to our human resource platforms, our crewing systems and our learning management systems that keep track of crew certifications and training outcomes, the pool of information is continually expanding. Training simulators and bridge monitoring systems collect metrics on how crew members respond to different scenarios, and electronic logs collect data on operational procedures. Additionally, compliance records, accident reports, and even external databases, like shipping schedules and port conditions, contribute to our useful data pool. And the great news is that most operators are already collecting much of this data by virtue of the fact that we are using computer systems to support so many of our activities. This is setting us up for a future of useful analytics even without us intentionally doing so. These broad and interconnected data create a deep well of information, ripe for analysis, that can directly influence training modules, safety protocols, and overall operational efficiency and excellence.

Consider, for example, the use of onboard sensors to monitor equipment like the ship's engine or navigation systems. By analyzing this data, training programs can incorporate real-world scenarios that mimic equipment malfunctions, teaching crew members how to respond effectively. This real-world connection improves training outcomes and relevance, supplying officers and crew with the motivation and practical knowledge they need. Another example is the analysis of human resource data or skill assessment data, which can reveal patterns like common or high-risk skill gaps among crew members. With access to this real-world information, we no longer have to guess. Instead, training can be redesigned to address these specific issues, ultimately leading to a safer and more competent workforce. Both examples demonstrate the power of using data to fine-tune training programs, creating an operational environment where safety protocols are not just followed but are ingrained in our organizational culture.

To get started on this path that leads us to data-driven maritime training, vessel operators can begin by conducting a review of existing data sources, such as equipment sensors, HR databases, LMS platforms, etc. The next step is to invest in data analytics tools or platforms, such as Tableau or Microsoft Power BI, which can integrate disparate data for cohesive analysis. Of course, much of this work requires some experience and expertise. Therefore, partnering with or hiring data scientists familiar with training and operational analytics can get you started in building predictive models tailored to your organization's specific goals and challenges. You will be amazed at how insightful and powerful these initial analytics can be. They are not only of real value, but very addictive!

Once you have reached this point and have the people and systems in place to use data, the next step is to develop a culture of being data-driven throughout the organization. This ensures that actionable insights are effectively implemented at all operational levels. In this way, individual vessel operators and our industry as a whole can unlock the tremendous potential of data science and analytics, navigating together towards a future of continually improved safety and operational excellence. Plus, of course, you will look like a hero to top management.

Thank you for reading. Until next time, keep well and sail safely.

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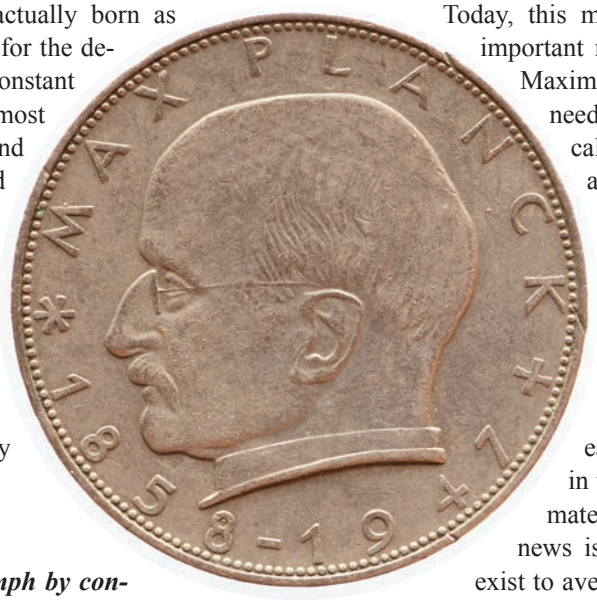
DEDICATED NAVAL ARCHITECTS

Max Planck's Maxim

By Rik van Hemmen

The physicist Max Planck (actually born as Marx Planck) is best known for the development of his universal constant that defines physics at the most basic level. It is an important number, and today it even defines the kilogram and therefore most engineering units. Regardless, in my daily life I have little use for it.

Max Planks is less known for his Principle, which, to me, is much more useful and I encounter it almost on a daily basis. Max Planck provided this Principle in his Scientific Autobiography (and Other Papers, 1950).



PLANCK'S PRINCIPLE

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it ...

An important scientific innovation rarely makes its way by gradually winning over and converting its opponents: it rarely happens that Saul becomes Paul (the Apostle, converted on the road to Damascus). What does happen is that its opponents gradually die out, and that the growing generation is familiarized with the ideas from the beginning: another instance of the fact that the future lies with the youth.

Principles are often paraphrased and a favorite paraphrase of Planck's Principle is:

"Science progresses one funeral at a time"

Maxims are defined as short, pithy statements expressing a general truth or rule of conduct. Planck's Principle can be expanded into a general truth through simple logic.

As such, with a modest addition and an alliterative switch we arrive at:

Max Planck's Maxim: ***"Science and Technology progress one funeral at a time"***

Today, this may well be humanity's most important maxim, sort of the Maximum Maxim. Today, there is an existential need for scientific and technological progress. We are not talking about minor issues such as the threat of nuclear war, or a space race, or the potential of world hunger, we are talking about the actual destruction of the only planet we have.

The first signs of planetary destruction occurred in the early 1990's, and today we are in the middle of the warming climate destruction cycle. The good news is that science and technology exist to avert the destruction, but then we have those Sauls that refuse to become Pauls.

It is probably not unreasonable to state that with the scientific debate starting in the early 90's, we now have lots of old dead scientist Sauls, a few old scientist Pauls, some remaining old scientist Sauls of no real consequence, and, for the rest, younger scientist Pauls. But to really be able to switch to sustainable energy, we need to get to the Engineering Sauls, the Political Sauls and the Public Sauls and turn them into Pauls.

I am not entirely sure as to how we can get to the Political and Public Sauls, but the game for Engineering Sauls is to convert them as young as possible. That means at the university level, and possibly even earlier. As far as my involvement in university engineering education is concerned, I see some student interest in environmental and low carbon design, but that does not create Pauls (and Paulines). A conversion to Sustainable Paul is not related to the ability to design wind turbines and methanol engine rooms, it is related to a deep conviction that design work that does not advance sustainability is anathema and even unethical. These young engineers need to be able to refer to commandments and preach like Paul.

We need to create young engineers who, regardless of potential financial gains, can say: "That does not advance sustainability and I will not engage in that." That does not mean that all those Pauls and Paulines will have to fight that fight

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every day or even martyr themselves, but when they encounter a debate about sustainability, they need to be able to stand up and say: "I am an engineer, I include sustainability in my personal professional code and it is always a main variable in my designs. Let me explain why this needs to be done, and allow me to refer you to the first and second commandments of sustainability: Love your neighbor like yourself and it is the CO2 Stupid!"

The question is: "How do we train and motivate young engineers to be able to occupy that place in the room?"

I have followed the discussion on climate change solutions in the engineering community for many years and engaged in quite a number of efforts to tighten up the focus on true climate change solutions, but frankly I am not encouraged.

There is this old engineering joke. **During the French Revolution a doctor, a lawyer, and an engineer are going to be executed by the guillotine.** The doctor is first and they ask him if he wants to be executed face up or face down. The doctor chooses face down. The lanyard is pulled, the blade whizzes down and stops within an inch of his neck. Since the sentence has been executed, he is free to walk away. They ask the lawyer how he wants to be executed. Without hesitation he adheres to precedent, and also chooses to be executed face down. The lanyard is pulled, the same thing happens, and he is free to walk. They ask the engineer how he wants to be executed, and, without hesitation he chooses face up. He is in the block looking up and says: "Oh, I see what the problem is."

Unfortunately, the joke is true. Engineers think tactically and rarely strategically.

Even at the most exalted levels this is true. I came across some 2021 comments on climate change by John Anderson, no less than the President of the National Academy of Engineers. (Search: National Academies, Engineering Response to Climate Change) He says engineering changes have to be made and goes to suggest that highways have to become more rugged, we should fit solar panels and windmills on buildings and provides other tactical responses to the problem. Not once does he say: "It is the CO2. We need to stop adding CO2 to the atmosphere and it is our prime job to force those technologies down the public's throat to save our planet."

He also does not say: "We need to question the ethics of any engineer who does not take sustainability into account in their designs."

This John may be a Paul in conviction, but he sure ain't writing a newest testament.

For each column I write, **MREN** has agreed to make a small donation to an organization of my choice. For this column I nominate ESW, Engineers for a Sustainable World ***www.eswglobal.org***. No further explanation needed.

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Able Seaman	$48,565	$24,283	$98,778
First Assistant Engineer	$86,600 - $159,914	$43,300	$223,537
Third Assistant Engineer	$69,944 - $110,479	$34,972	$190,433
Deck Engineer Machinist	$50,104 - $56,345	$10,021	$111,267
Electronics Technician	$73,643 - $86,493	$36,822	$148,763
Steward Cook	$47,351 - $53,229	$23,676	$137,583
Cook Baker	$40,722- $49,477	$8,144	$109,346

*Annual average salary includes base, overtime and other special pay.

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Revolutionizing Maritime Biofouling Management: The EverClean Hull Maintenance Solution

2023 has been a year of advancement and change in the world of biofouling management, at the business, technology and regulatory levels. At the risk of going out of chronological order, September marked the launch of Greensea IQ and its EverClean hull maintenance solution. If the EverClean name sounds familiar, that is because it was originally launched under the Armach Robotics brand. As part of a strategic realignment Greensea Systems and its subsidiaries, Bayonet Ocean Vehicles and Armach Robotics merged into a new company named Greensea IQ. This merger will allow for a more streamlined delivery of rapidly advancing robotic technologies to maritime space.

The technology behind EverClean continues to advance, while service capabilities expand. EverClean uses autonomous robots to deliver proactive hull cleaning services, allowing ship owners to operate with always clean hulls. By using small autonomous robots specifically designed to target microfouling (the early slime and algae that forms on ship hulls), hull cleaning can be completed more economically and efficiently than was previously possible. The EverClean solution requires little manpower and overhead infrastructure, allowing for cleaning operations to be conducted during a vessel's normally scheduled port call. A significant new addition to the EverClean portfolio is the ability to deliver a resident solution to vessel owners. The resident solution merges the autonomous robot with long range command and control capabilities, allowing for proactive cleaning to occur during any idle time. For example, this capability now allows for vessels to be cleaned while at anchor, awaiting arrival in port, or during a port call in a location not currently serviced by an EverClean team. This new capability has become a reality by matching the previously developed on-hull navigation and autonomy capabilities with Greensea IQ's SafeC2 technology that is designed over the horizon command and control of marine robotics. As the EverClean robot operates with a high degree of autonomy, very few control actions need to be sent between the operator and the robot, optimizing how limited radio or satellite bandwidth is used. A vessel's crew merely needs to communicate back to Greensea IQ that they would like a hull cleaning and that they are in a safe environment to do

All images courtesy of Greensea IQ

so. A service supervisor at Greensea IQ's remote service center in Plymouth Massachusetts will then supervise the deployment of the EverClean robot, and set it on its mission. The service supervisor also monitors the onboard video feed documenting any items of concern seen during the cleaning. All data is logged onboard the vessel and uploaded to Greensea IQ after evolution.

Upon completion of the cleaning, the data collected can be compiled into a thorough inspection report, through an online service known as EverClean IQ. EverClean IQ is designed to leverage the positionally referenced data collected from the robot to provide the vessel owner an unprecedented level of information about the vessel's hull condition. By digitizing the complete data and image set, owners will receive highly detailed post cleaning reports that can show the complete condition of the hull in a manageable and navigable format, vice receiving representative images. Further, the owners will be able to precisely compare new reports with past reports, allowing for better change detection, and ultimately enabling better performance optimization and maintenance decisions.

All of this work is designed to help with the environmental performance for the global shipping fleet, and must fit within the wide range of regulations, standards and guidelines governing biosecurity. Greensea IQ has worked diligently to ensure alignment with emerging standards, and when possible, contribute to the development of and outreach for these standards. In July of 2023, the International Maritime Organization released its 2023 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES, which direct routine hull inspections and support the proactive cleaning of microfouling from ship's hull. Building on the IMO's Guidelines, the International Standards Organization (ISO) has a work group in place working on standards for conducting and documenting hul cleaning, as well as on the testing and verification of hull cleaning systems. Australia, New Zealand and Canada have all released national policies or best practices on management of biofouling, and the United States appears to be taking steps to follow suit with the forthcoming Vessel Incidental Discharge Act.

New EverClean Robot ready for service.

For all that has happened throughout 2023, it appears that the coming years will bring forth even more advancement and Greensea IQ and EverClean are well positioned to help lead the industry towards a more environmentally sound future.

The Author

Lander

Karl Lander is the Director, Regulatory Compliance and Outreach for EverClean at Greensea IQ having held the role at Armach Robotics following 4+ years with Greensea Systems, where he was Director, Hull Robotics.

Structural Safeguards in Coast Guard Suspension and Revocation Proceedings

By Walter J. Brudzinski

This article examines ten structural safeguards in Coast Guard Suspension and Revocation (S&R) Proceedings that ensure Coast Guard Administrative Law Judge (ALJ) decisional independence. These safeguards separate potential agency influences from the ALJ decision making process and are critical to mariner due process and fundamental fairness.

We will start with an overview of Coast Guard S&R proceedings, followed by brief discussions of the Administrative Procedure Act, Administrative Law Judges, and U.S. Office of Personnel Management oversight. We will then examine the ten structural safeguards and conclude by identifying the outcomes these structural safeguards produce.

Background Discussion on S&R Proceedings

To promote safety at sea, sections 7701-7706 of title 46, U.S. Code provide mariner credentials may be suspended or revoked for misconduct, negligence, violation of law or regulation, use of dangerous drugs or convictions involving dangerous drugs, certain other criminal convictions, incompetence, a security risk threatening safety or security, or having committed sexual assault or sexual harassment.

After a Coast Guard Investigating Officer (IO) collects sufficient evidence demonstrating and supporting that the mariner committed any of these acts, that IO initiates the formal suspension and revocation process by preparing a Complaint alleging the necessary facts to put the mariner on notice of the offense(s) committed. The IO also includes a proposed sanction in the Complaint which is typically suspension or revocation of the mariner's credential.

The IO then serves the Complaint on the mariner and files a copy with the Administrative Law Judge Docketing Center. The mariner must file an Answer to the Complaint within twenty days. In a typical case, once the Complaint is filed and served, and the mariner files an Answer, the Chief Administrative Law Judge, through the Hearing Docket Clerk, assigns the case to an ALJ.

Occasionally, the mariner and the IO will enter into a settlement agreement early in the process and the ALJ will issue an Order consenting or rejecting the settlement agreement. In the absence of an early settlement agreement, the ALJ convenes a pre-hearing teleconference to select the date and place for hearing and establish a schedule for the parties to file their motions and exchange witness and exhibit lists. The case will then proceed to hearing like a civil trial without a jury as allowed in federal or state court.

At the close of the hearing, the parties are provided the opportunity to submit post hearing briefs and proposed findings and conclusions, unless waived. If both parties waive that right, the ALJ my issue a decision from the bench, in which case the decision takes effect immediately; otherwise, the ALJ will issue a decision and order after receiving the post hearing briefs and proposed findings and conclusions. The parties may appeal the ALJ's decision to the Commandant and then to the National Transportation Safety Board, followed by an appeal to the appropriate U.S. Circuit Court of Appeals, then to the Supreme Court of the United States.

The Administrative Procedure Act and Administrative Law Judges

The Administrative Procedure Act (APA) of 1946 created the Administrative Law Judge (ALJ or Judge) function to ensure fairness in formal administrative proceedings before federal government agencies. The Coast Guard is one of thirty-two federal agencies conducting formal adjudication proceedings requiring a decision on the record by an Administrative Law Judge after an opportunity for hearing in accordance with the Administrative Procedure Act (APA) and the agency's regulations. 5 U.S.C. §§ 551-559. The Coast Guard is authorized seven ALJs which are individually located in Seattle, Alameda, Houston, New Orleans, Baltimore, and New York. The Chief Judge is in Washington, DC.

Office of Personnel Management Oversight

The U.S. Office of Personnel Management (OPM) is responsible for ensuring the independence of ALJs. It does so by assuring ALJ appointments, pay, tenure, promotions, transfers, reinstatements, reassignments, and discipline, among other things, are consistent with applicable laws and regulations by providing for separation and insulation between the ALJ position and the employing agency. 5 C.F.R. §§ 930.201 - 211.

Structural Safeguards

First, for the Coast Guard, ALJs may not "be responsible to or subject to the supervision or direction of an employee or agent engaged in the performance of investigative or prosecuting functions." 5 U.S.C. § 554(d)(2); 33 C.F.R. § 20.206(a).

Coast Guard ALJs are senior civilian officials selected by the Coast Guard and appointed by the Secretary of Homeland Security. They perform their adjudicative functions pursuant to the APA and agency regulations which provide them with decisional independence within the parameters of the regulations and Commandant Appeal Decisions. ALJs are vested with complete decisional independence in their decisions and orders; however, applicable statutes, regulations, and Commandant Decisions on Appeal or Review are binding on ALJs unless those Decisions are modified or rejected by competent authority. 46 C.F.R. § 5.65.

Second, ALJs may not perform duties inconsistent with their duties and responsibilities as administrative law judges. 5 U.S.C. § 3105; 5 C.F.R. § 930.207. This safeguard prevents agencies, including the Coast Guard, from assigning ALJs duties outside their normal duties of hearing and deciding cases. It ensures ALJs devote their full-time efforts to adjudication.

Third, 5 C.F.R. § 930.201(c) prescribes "[t]he title 'administrative law judge' is the official title for an administrative law judge position. Each agency must use only this title for personnel, budget, and fiscal purposes." This regulation recognizes the unique position and separate duty status of administrative law judges compared to other agency senior personnel. It promotes ALJ independence by preventing agencies from absorbing ALJs into the agency's general leadership, management, and administration by assigning them duties inconsistent with administrative law judge duties.

Fourth, agencies, including the Coast Guard, may not require job performance evaluations of their ALJs. 5 C.F.R. § 930.206(a). This safeguard protects the decisional independence of the ALJ by removing agency performance pressures on the ALJ, thereby removing the potential for ALJ bias or implicit bias toward the agency.

Fifth, the agency may not grant any monetary or honorary award or incentive to an ALJ. 5 C.F.R. §930.206(b). Awards or incentive pay can create the appearance of potential bias against the mariner. Removing possible awards to ALJs protects the mariner and buttresses ALJ independence.

Sixth, Congress established a separate pay system for ALJs under 5 U.S.C. § 5372. OPM, not the agency, including the Coast Guard, sets and manages ALJ pay levels. 5 C.F.R. § 930.205. This safeguard protects the ALJ by creating a greater distance between the employing agency and ALJs on matters of compensation and promotion, thereby further enabling ALJs to direct their attention towards adjudicating the cases before them independently.

Seventh, 33 C.F.R.§ 20.206(b) takes the structural separation described in the First Safeguard one step further. It precludes anyone who investigates or represents the Coast Guard in any factually related administrative proceeding from participating or advising in the ALJ's decision or in the Commandant's decision on appeal, except as a witness or counsel in the proceeding or the appeal.

Even further, ALJs may not speak to the Coast Guard Investigating Officer, prosecutor, or respondent about the merits of a case without the opposing party being present. This is commonly known as ex parte communication. 5 U.S.C. § 554(d)(1). Ex parte communication is defined by the Administrative Procedure Act at 5 U.S.C. 551(14) as "an oral or written communication not on the public record with respect to which reasonable prior notice to all parties is not given, but it shall not include requests for status reports on any matter or proceeding covered by this subchapter."

An extensive and detailed list of established guidelines to avoid prohibited ex parte communications among all Coast Guard entities involved in an S&R case is found in COMDTINST 5830.3 and is available at ***https://media.defense.gov/2017/Mar/15/2001716720/-1/-1/0/CI_5830_3.PDF***. For example, guideline #1 under paragraph "9.c" of that Instruction provides "Coast Guard personnel participating in a pending S&R case or who have developed or are developing a position in a pending case are not to communicate the merits of that case with any ALJ or ALJ employee advising the Judge in that case or any factually related cases except on the record."

Even when handling inquiries and requests to examine and copy records, ALJ Docketing Center personnel are not to discuss the merits of any pending case or reveal pre-decisional information. COMDTINST 5830.3 at 9.e(3). This safeguard further separates the ALJ from the agency's investigating and prosecuting functions, thereby preserving the ALJ's independence, the mariner's due process rights, and fundamental fairness.

Eighth, the mariner has a right to have an attorney or representative present during all S&R proceedings. 33 C.F.R. § 20.301. If the mariner is of limited means to afford an attorney, the Office of the Chief Administrative Law Judge has established a pro bono program. Private sector attorneys interested in assisting mariners in their S&R matters as a pro bono endeavor have provided their name and contact information to us so that the mariner respondent can contact the attorney and arrange representation. Because the attorney is offering to take on these cases at a lower cost or free of charge, the mariner would need to demonstrate his or her needy circumstances. Our website, at ***www.uscg.mil/Resources/Administrative-Law-Judges*** under the heading "Free Legal Assistance" provides guidance on obtaining a volunteer attorney.

Ninth, at the end of the hearing, the parties will have the opportunity to submit closing briefs and proposed findings of fact and conclusions of law. 5 U.S.C. § 557; 33 C.F.R. § 20.710. This is further due process after the in-person hearing and provides the mariner with another opportunity to argue the facts presented at hearing.

Tenth, after the ALJ issues the Decision and Order, mariners have a right to appeal the ALJ's decision to the Commandant. 33 C.F.R. § 20.1001. The mariner can further appeal the Commandant's decision to the National Transportation Safety Board (49 C.F.R. part 825) and thence to the appropriate Circuit Court of Appeals. From there, the mariner can petition

the Supreme Court of the United States. Contained within the right to appeal to the Commandant is the safeguard that no Coast Guard person who investigated or prosecuted the case may participate or advise in the decision of the ALJ or of the Commandant. 33 C.F.R. § 20.206(b). Finally, the mariner may also petition to reopen the case if it is shown that any change in fact or law, or that the public interest, warrants re-opening. 33 C.F.R. § 20.904.

Eleventh, the law requires that when an agency, including the Coast Guard, finds it necessary to remove an ALJ from government service, or suspend, reduce in grade, or furlough an ALJ for 30 days or less, it may not do so unless it establishes good cause as determined by the Merit Systems Protection Board on the record after opportunity for hearing before the Board. 5 U.S.C. § 7521; 5 C.F.R. § 930.211. This safeguard further insulates the ALJ's decisional independence from agency actions for reasons less than good cause.

To initiate a disciplinary action, the agency must file a Complaint against the ALJ with the Merit Systems Protection Board. The Complaint must allege conduct that, if found proved, would constitute good cause for the agency to take the disciplinary action requested. The Board appoints an ALJ to conduct the proceedings which mirror a civil case initiated in U.S. District Court without a jury. At the conclusion of the proceedings and post hearing briefs, the MSPB designated ALJ issues an Initial Decision which the Respondent may appeal to the Board. The Board's decision may be appealed to the U.S. Circuit Court of Appeals for the Federal Circuit and thence to the Supreme Court.

Conclusion

These structural safeguards ensure Coast Guard Administrative Law Judge (ALJ) decisional independence and protect a mariner's right to due process and fundamental fairness. For Coast Guard ALJs, these protections allow the judges to perform their judicial duties fairly, impartially, and in a manner that secures the trust and confidence of the parties to the dispute, the regulated community, and to the public. Coast Guard ALJs further that trust and confidence by treating the parties with respect and by issuing clear decisions and orders the public understands and accepts as correct, fair, and well-reasoned.

** The opinions expressed in this article are the author's alone and do not necessarily reflect the official policy of the U.S. Coast Guard.*

The Author

Brudzinski

Chief Judge Brudzinski has been an Administrative Law Judge with the U.S. Coast Guard since 2003 and its Chief Administrative Law Judge since 2013. He has authored many articles for MarineLink publications, among others.

Decarbonization Requires Move from Talk to Action

More vessels need to be connected to digital systems to realize zero-emissions shipping and data sharing is essential.

The Inmarsat Connected Future Conference at this year's London International Shipping Week examined how the industry can move from talk to practical solutions that can ensure satellite technology plays a decisive role in shaping smarter and more sustainable shipping.

Inmarsat Maritime president Ben Palmer provided the scene-setting keynote address for the first panel discussion on collaboration, technology, data sharing and balancing the imperatives of growth with reduced ship emissions.

He reiterated his message that "connectivity is the oxygen-sustaining opportunities for shipping to create value and cut its CO2 emissions."

And guest speaker Helen Sharman CMG OBE, who became the UK's first astronaut in 1991, wrapped up the afternoon with an inspiring speech about the importance of collaborative team efforts in space missions.

The panel, which was moderated by Giampiero Soncini, Managing Director, Oceanly, included Peter Schellenberger, Founder of Novamaxis, James Pomeroy, Global Economist, HSBC; and Marco Cristoforo Camporeale, Senior Director, Strategy at Inmarsat Maritime as speakers.

Peter Schellenberger of Novamaxis stressed that it was now "high time for action" to advance shipping's smart and sustainable agenda, picking low hanging fruits by adopting proven solutions from other sectors, such as the aviation industry.

Breaking down silos that prevent necessary information sharing was being helped by the need to respond to environmental, social, and governance (ESG) criteria, he said.

However, he cautioned that more standardization of maritime protocols was a vital first step, citing 14 non-compatible types of noon report as having to be written by one ship management company.

Leaders in ship supply and management are needed to bring greater compatibility, Schellenberger said. "If we all put our heads together, we can make our lives so much easier. In this new world reliable information and access to it is the backbone of future changes."

Empowerment of vessel control centers is also necessary to achieve efficiency gains, he added, and "will drive meaningful change."

Maritime software veteran Giampiero Soncini, who now heads Oceanly, said: "Everyone wants control centers, but few have a clear understanding on how to effectively use them."

Inmarsat's Marco Camporeale said just 40,000 out of 170,000 ships registered by the IMO have data transmission speeds capable of taking advantage of onboard digital systems for voyage optimization.

"So, four out of five ships do not have the level of connectivity required to power artificial intelligence and machine learning. We are still far from realizing that vision of a con-

nected future, where we can look at a shipping industry that can meet the 2050 IMO targets for decarbonization" he said.

It is not just a question of data speeds, but understanding the value that can be extracted from connectivity, he added, but discussions on creating a standard automated version for noon reports are still ongoing.

Schellenberger responded that greater integration of IT systems is also required. Most historical systems do not have open APIs to integrate them. It could take up to 20 emails to order one spare part, he said.

Seafarers, who have their own phones and computers, step back technologically 20-30 years when they board a ship, and training has not kept pace with changes coming to the equipment and alternative fuels they will use in future, Schellenberger said.

One in three seafarers looks for connectivity on board as more important than salary when looking at which owner or ship manager to work for, added Camporeale.

Soncini said Japan is leading the race toward autonomous shipping allowing fewer crew to operate vessels. "In the last seven years the Japanese have congregated everyone – classification societies, ship managers, owners and shipyards - and standardized everything."

The rest of the world needs to follow suit to achieve decarbonization, he said.

Shipping had remained too reactive to legislative change, rather than proactive, Soncini added, with recent changes like the Carbon Intensity Indicator (CII) imposed in ways that left it unclear how decarbonization would result.

Economists had not woken up to the importance of shipping in supply chains until the shock of the Covid pandemic, said James Pomeroy at HSBC, but that had changed now.

The last 12 months had seen a period of inventory rebuilding as demand fell back after the surge during the pandemic when supply chains were unable to respond. New demand from Asia was likely to lead recovery even if China's role switched from production of goods to a buyer of them.

Pomeroy said: "The outlook for now for the economy feeding back into shipping isn't great, but it will come back. We are not forecasting recessions or a collapse in demand. You just need this inventory cycle to play through and you will get a natural pick up. It's probably going to be a 2024 story".

However, he said inflation was a factor with wage rises in parts of the supply chain currently exceeding price increases, such as a shortage of drivers for haulage.

Image courtesy U.S. Navy

Additive Manufacturing to Support 'One plus Two'

Austal USA Advanced Technologies is working with the US Navy on technical solutions that will power the next-gen of navy assets. ***Don Hairston*** *recently took the helm of the AAT team, and discusses how* **additive manufacturing** *and* **artificial intelligence** *are powering the future of naval asset design, construction and lifecycle maintenance.*

By Greg Trauthwein

Don, what specifically attracted you to the position as GM of Austal USA Advanced Technologies?

I liked Austal USA as an up-and-comer; it offers tremendous growth opportunities. I also like the advanced technology aspect, especially in the additive manufacturing (AM) space. Our mission in AM is to support the submarine industrial base in achieving the 'one plus two' goal … that's construction of one Columbia and two Virginia class submarines per a year. The only way we're going succeed is through automation, a big part of which is additive manufacturing. It was appealing to me coming into Austal USA leading the Advanced Technology division, with a clear focus on the Navy's Additive Manufacturing Center of Excellence in Danville, Virginia.

What are the key technology drivers of your primary customer – the US Navy?

If we look at the submarine industrial base, there is a growing need for people, processes and automation, to support the growing scope of additive manufacturing; our partnership with the Institute for Advanced Learning and Research, also located in Danville, is a key element for achieving the Navy's one plus two requirement. Fundamentally, you need people, and the Institute brings a pipeline of highly-skilled, trained operators in skills critical to manufacturing submarines. We have everything from training all the way through manufacturing and part delivery co-located in Danville. That end-to-end capability is what we're driving to support the US Navy with particular emphasis on the submarine industrial base.

In the context of AAT is doing for the Navy, what specifically does additive manufacturing mean?

Today, the submarine industrial base relies on forging and casting houses to provide mission-critical parts, and unfortunately the existing industrial base cannot support the one plus two cadence. Instead of growing the casting and forging industrial base footprint, we're looking to expand and evolve that footprint through additive manufacturing. We are leveraging cutting-edge modalities for additive manufacturing such as laser powder bed fusion, direct energy deposition, friction stir processing and cold spray. Coupled with the different modalities are various alloy types; our plan is to combine up to six different alloy types with the appropriate modality to ensure that the right part is built with the right process and the right alloy. Essentially, we are building the right "recipes", in the form of Technical Data Packages (TDPs), that prescribe an alloy type and AM modality for the industrial supply base to scale production of AM parts. The AM Center of Excellence is assembling the TDPs for dissemination to a network of additive manufacturers, and other machines within the network that we're establishing, to inject AM parts into the supply stream as alternatives to forgings and the castings. We're not going away from forging and castings; we're supplementing production capacity.

Images courtesy AAT

"Drones and autonomy are a key piece of the US Navy's future requirements, and Austal USA Advanced Technologies is poised to bring additive manufacturing capabilities to the rapid production and deployment of unmanned systems to meet that need."

Don Hairston,
General Manager, Austal USA Advanced Technologies

Cheap asymmetric systems are proving effective against much larger, much more expensive and powerful assets. How are these trends impacting your work?

Austal USA has expanded its focus area to address these trends – I believe that large numbers of autonomous drones are the right answer. For instance, we are supporting L3Harris in building out the GHOST fleet, and we are participating in the Overlord program, currently building vessel #3 and the earlier vessels on which Austal's automated machinery control systems have been installed. Also, through Saildrone, Austal USA is building a 65-foot ISR and ocean mapping vessel called Surveyor. Austal USA has also integrated layers of autonomous systems on EPF-13 with success; these integrated layers include automated machinery controls, L3Harris's ASView, as well as General Dynamics wave predictive capabilities. Tying these capabilities together on an integrated backbone on EPF-13 effectively demonstrated the possibility of an autonomous large surface vessel to the US Navy. Austal is also pursuing a prime contract to build the Large Unmanned Surface Vessels (LUSV). Drones and autonomy are a key piece of the US Navy's future requirements, and Austal USA Advanced Technologies is poised to bring additive manufacturing capabilities to the rapid production and deployment of unmanned systems to meet that need. We must to be ready to scale up using additive manufacturing production capabilities for small and medium vessels. In the future, we will be in a position to print small sized vessels, but currently our focus is the submarine industrial base.

What tech do you see in the formative stage that will determine the size and shape of the US Navy fleet of tomorrow?

Data analytics and AI are pivotal as we build Navy's future fleet. They offer the opportunity to have fleets of unmanned vessels of all sizes and shapes, in the air, on land, and on the surface and underwater. The ability to support assets from a predictive modeling perspective and a product lifecycle management standpoint is critical; end-to-end performance-based logistics is possible through the fundamental understanding of system engineering and the system engineering model, working in concert with data analytics and AI. It's one thing to have a fleet, it's another thing to support it, and through data analytics and AI, I believe that is going to be a game changer.

What are your objectives in the coming 12 to 24 months?

The priority is transforming the submarine industrial base with AM and developing a highly skilled workforce to support it. Our near-term goal is to build out the network of suppliers, not only at the Center of Excellence, but growing our partners as well. We are activating suppliers by guiding them through Navy AM technical requirements, flowing down quality standards, and helping them to establish robust AM capabilities. Our AM base is being primed to print good parts using TDP recipes that are ready for install. We're investigating process automation to improve the efficiency of supplier activation to more rapidly expand our network. Right now, we're producing tens of TDPs per quarter, but our ultimate goal is to produce hundreds of TDPs per quarter. We want to scale from tens of parts to thousands of parts per year. This exponential growth is necessary to support that 'one plus two' initiative from a production standpoint. Other critical focus areas include building the training pipeline, and automating the entire supply chain process to support this growth mindset.

Source Maersk

METHANOL: FIRST IN A LONG LINE

If there's one vessel that sparked the rapidly increasing number of methanol-fueled newbuilding orders, it's the new container feeder, ***Laura Maersk.***

By Wendy Laursen

At last count, A.P. Moller - Maersk has 24 more methanol-fueled ships on order. The first, the dual-fuel methanol container feeder, Laura Maersk, will gain experience for those that follow.

The 172-meter (564-foot) 2,100 TEU Laura Maersk was ordered from Hyundai Mipo in 2021, a time when the industry's only experience with methanol as fuel was the retrofitted ferry Stena Germanica and a handful of tankers. Officially named in September 2023, it is the first methanol-powered vessel that doesn't carry methanol as cargo and the first vessel with 4-stroke dual fuel methanol auxiliary engines.

Laura Maersk was built to ABS class and features a classic design: the innovation comes in the engines. Both the 2-stroke MAN B&W 6G50ME-LGIM main engine built by HHI-EMD and two HHI-EMD Himsen H32DF-LM 4-stroke auxiliary engines will be methanol dual-fuel.

Maersk sees methanol as a scalable fuel for this decade and therefore critical for meeting its goal of being net zero by 2040. When all current orders are deployed and have replaced older vessels, they will generate annual CO2 emissions savings of around 2.3 million tons from the 33 million tons currently emitted.

More than half Maersk's customers have set or are setting ambitious supply chain decarbonization targets. Laura Maersk will trade in Sealand Europe network, with ice class suitable for year-round Baltic operation and a design speed of 17.4 knots.

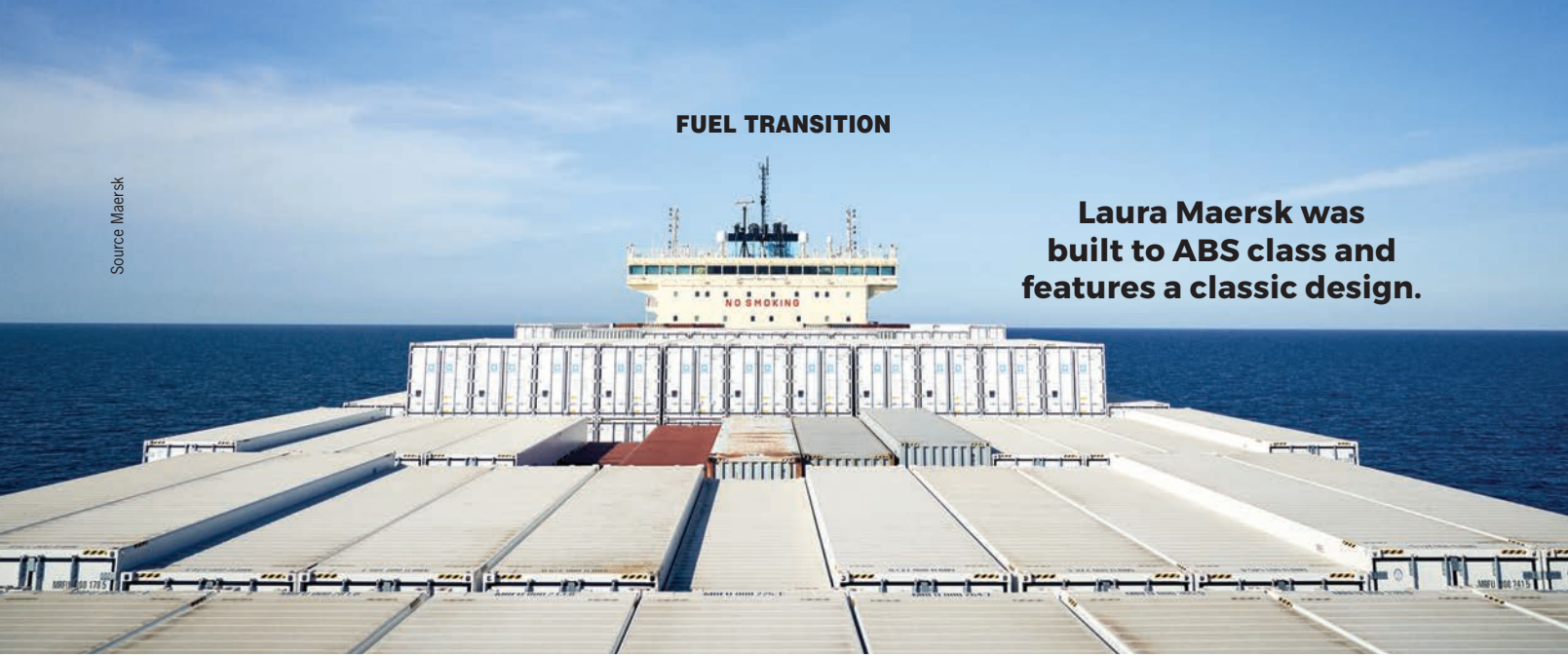
"We have started the transition," says Ole Graa Jakobsen, head of fleet technology at Maersk. This comes with additional cost, he says, however the additional capex for the dual-fuel capability compared to a conventional vessel is declining from around 15% to 8-12%.

"The first mover will of course always take a larger part of the cost, because this is the first product," he says. "Even as the scaling comes in, it will probably never be as cheap as a

Officially named in September 2023, it is the first methanol-powered vessel that doesn't carry methanol as cargo.

Source Maersk

Godmother of Laura Mærsk, EU Commission President Ursula von der Leyen, in front of the vessel with Ane Maersk Mc-Kinney Uggla, Maersk Chair, Robert Uggla, Maersk CEO Vincent Clerc, Denmark's Minister of Business, Morten Bodskov, President and CEO of HD Hyundai, Kisun Chung flanked by the Captains and Chief Engineers of the vessel.



Source Maersk

Laura Maersk was built to ABS class and features a classic design.

traditional investment." For Maersk, the cost should not be an excuse for not acting.

Jakobsen considers the cost premium fair given that Maersk will be able to offer customers carbon neutral logistics at scale whilst also retaining the ability to run on biofuels as a backup if methanol bunkering is not rolled out as fast as expected.

The dual fuel technology includes a separate injection system for methanol and biodiesel. Both fuel systems will be operating in parallel as methanol require a small pilot fuel burst to ignite in the Diesel cycle. As both fuel systems are pressurized it is possible to shift to pure diesel use "on the fly."

The Specified Maximum Continuous Rating (SMCR) of this 6G50ME-C9.6-LGIM engine is higher than previously delivered methanol engines of similar cylinder and mark number. Methanol operation is possible between 10% and 100% load with the same high efficiency in both methanol and fuel oil modes.

All the fuel equipment is located in a fuel preparation room on upper deck area with ventilated double wall piping to the engines. The systems are automatically nitrogen purged when not in use or in case of a methanol system failure or leak detection.

The Stena Germanica was initially bunkered from truck to ship, but from the beginning of 2023, ship-to-ship bunkering has been undertaken successfully. Maersk has followed this development of bunkering procedures very closely.

Maersk's new vessel has larger methanol tanks (1,500m3) so bunkering will need to take place either from a bunker barge or a tanker, says Rene Laursen, Director, Fuels and Technology, ABS. "A risk assessment will have to be completed for each of the ports where the ship is going to bunker methanol. This will ensure that hazards related to local conditions are taken into consideration in the bunkering procedures and could be a special requirement to the local marine environment and/or implications for people living and working in the port and surrounding area."

Laursen explains fuel storage tank safety: The methanol fuel tanks must be surrounded by cofferdams except surfaces bound by shell plating below the lowest possible water line, while fuel preparation spaces must be safeguarded with additional ventilation and continuous monitoring in case of methanol leakage. Cofferdams must be a minimum of 600mm in size, just enough space so the tank can be inspected from the outside. The cofferdam needs to be equipped with sensors to monitor if there is any methanol leakage, and it should be possible to purge the cofferdam with nitrogen in case of leakage, or fill the cofferdam with water as mitigation.

Laura Maersk was sized to suit the largest MAN dual-fuel methanol engine that was available at the time, but the next eight vessels Maersk ordered, expected to be delivered in 2024, come with considerable innovation and a considerably larger MAN G95ME-LGIM10.5 EGR-TC engine. Compared to industry-standard vessels, these 350-meter (1,148-foot) 16,000 TEU vessels will be 20% more energy efficient per transported container. The vessels will have a 16,000m3 methanol tank, so they will be able to complete an entire round-trip, for example Asia-Europe, on green methanol.

The crew accommodation and bridge will be located at the bow to enable increased container capacity. The funnel will be in the aft, and only on one side of the vessel, thereby providing further space for cargo. Overall, the vessel will have 7% more cargo capacity to existing vessels in the class. New arrangements for lifeboats and navigational lights had to be developed, plus new cameras to support the captain's view when navigating. As the accommodation will be closer to mooring equipment, it will have additional sound insulation. The hull will have extra reinforcement to counter the potential for increased torsional movement as a result of the new design.

All currently-ordered vessels are expected to be delivered by 2027, and Maersk has also signed a contract with MAN PrimeServ for the retrofit of the main engines aboard 11 container vessels equipped with MAN B&W 8G95ME-C9.5 prime movers. They will be retrofitted to dual-fuel MAN B&W 8G95ME-LGIM10.5 types capable of operation on methanol.

For Vincent Clerc, CEO of Maersk, there is a tangible and optimistic path toward a sustainable future.

Source Maersk

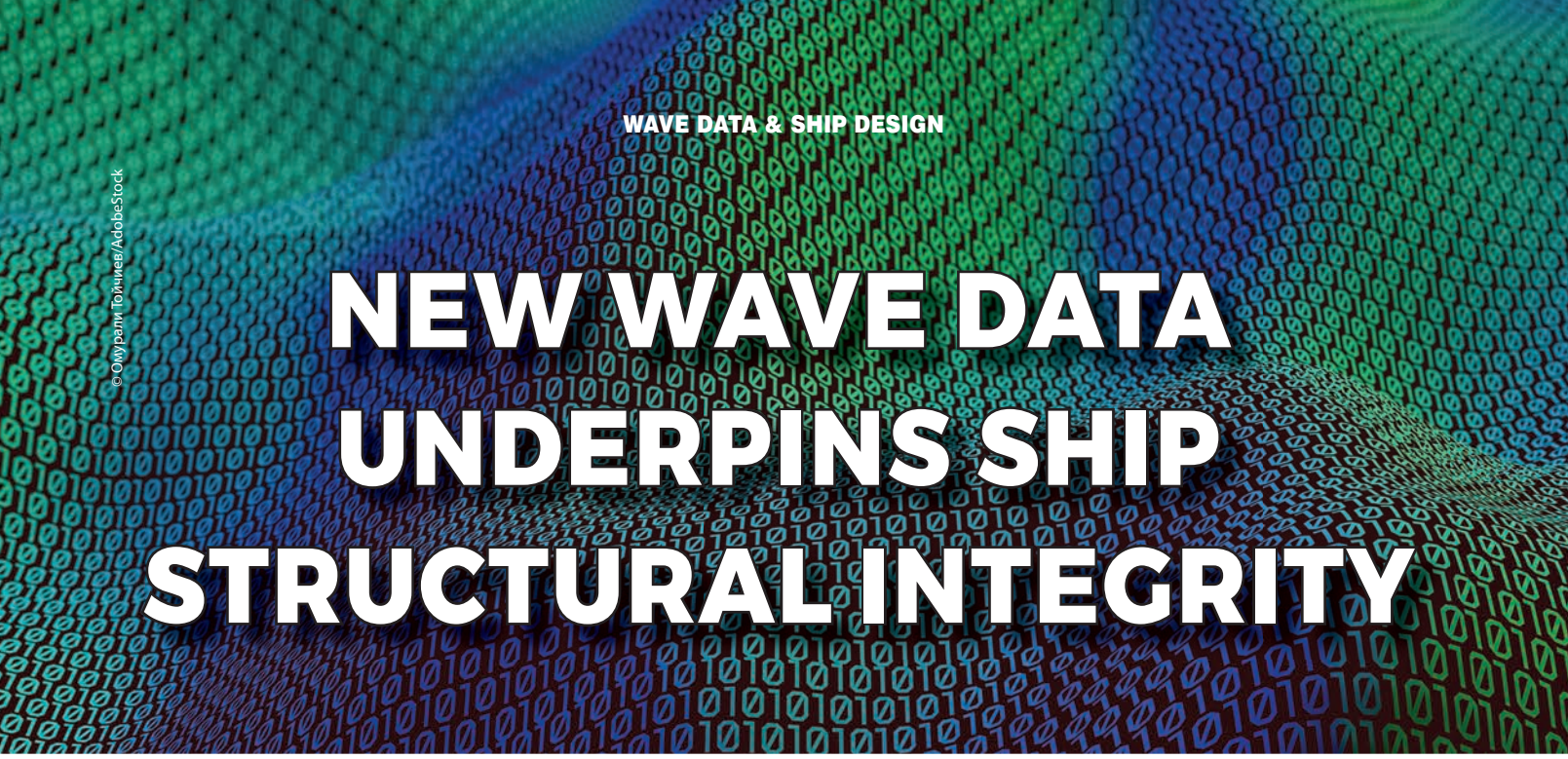
The 2-stroke MAN B&W 6G50ME-LGIM main engine installed on Laura Maersk.

Source Maersk

The 172-meter (564-foot) 2,100 TEU Laura Maersk was ordered from Hyundai Mipo in 2021.

Laura Maersk is the first methanol-powered vessel with 4-stroke dual fuel methanol auxiliary engines.

Source Maersk



NEW WAVE DATA UNDERPINS SHIP STRUCTURAL INTEGRITY

We have enough data about ocean waves to keep ships safe. ***Or do we?***

By Wendy Laursen

The loss of the Stellar Daisy in 2017 was a tragic reminder of the importance of wave data to ship design and operation. The vessel sank in the South Atlantic Ocean, with 22 of 24 crewmembers lost. The structural failure of the vessel was attributed to several factors including material fatigue and the forces imposed on the hull as a result of the weather conditions.

Survey requirements for some vessel types have since been tightened, but even before this tragedy, work was underway to evaluate the wave data used to determine ship structural integrity requirements. In 2016, the International Association of Classification Societies (IACS) began a re-evaluation of the scatter diagram and wave spectra that define the environmental conditions used for its wave load, fatigue, and seakeeping calculations.

The resulting Version 2 of IACS Recommendation No. 34 is based on several sources of wave data, including altimetry (measurements from satellite), hindcast models (re-analysis of past weather), and wave buoys. These new, more modern, data sources represent a significant improvement in the quality of data, given that previous wave data was collected in the second half of the 20th century from visual observations onboard ships. The most recent data dated back to 1984.

It's difficult to characterize how wave height has changed over that time. While maximum significant wave height (18.5m) in Version 2 is larger than before (16.5m), the mean significant wave height is less.

Like IACS, wave and weather analysis companies rely on a wide range of data sources. "Every day, we ingest about 2.25 million discrete data points," says Dr. Rafael Soutelino of MetOcean Solutions. This data comes from modelled data from global weather and marine models as well as satellite, lightning, weather station, wave buoy, current meter, and tide gauge data. Some data is displayed directly on the company's MetOceanView interface, and some is shown to provide comparisons with the system's modelled data, for example wave buoy data is displayed on a graph comparing observed to forecasted wave height.

That comparison was pertinent on February 14, 2023, the day that Tropical Cyclone Gabrielle hit New Zealand. Port of Napier's Wave Rider Buoy measured significant wave heights of up to 6m before waves broke it free from its mooring. The forecast was 5.4m. MetOcean's subsequent analysis suggested that a sea state with wave heights of 6m would occur on average only once every 3,000 years at the location.

Dr Tim Janssen, Co-Founder and CEO of ocean buoy and data specialist Sofar Ocean, says that if we liken the amount of data generated each year to the distance between the Earth and the sun, the amount of data we generate about the ocean would only get us 100m from the Earth's surface. While Sofar Ocean's hundreds of Spotter buoys already continuously contribute masses of accurate data, he sees the current global

data gap ready to be drastically reduced through Bristlemouth, the first open ocean connectivity standard. A collaboration between Sofar and strategic partners in the public and private sector, Bristlemouth delivers plug-and-play hardware interfaces to simplify connectivity between devices and is expected to accelerate the development of scalable ocean sensing systems and applications.

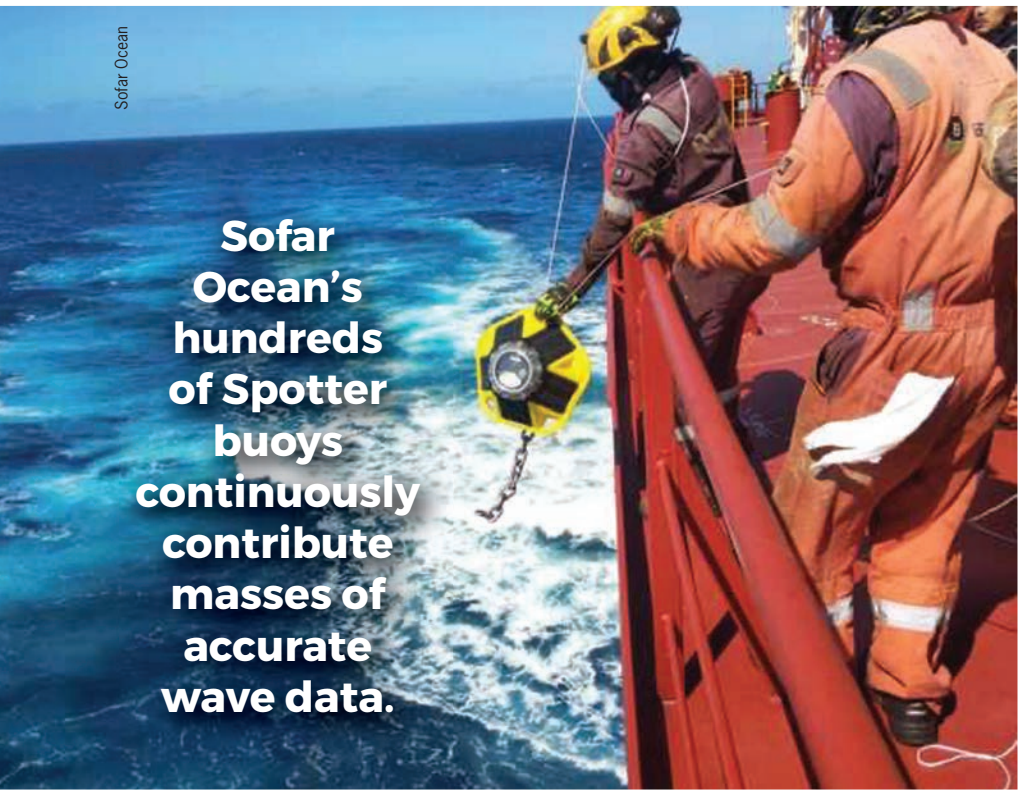
Boosting the scope of wave monitoring could, for example, much more accurately detect and predict the impact of climate change. Based on what we know now, can we say that wave conditions are already affected? "If you get better at sensing, you can actually inadvertently create biases. If your sensor is more accurate now, you could have the perception that measurements are increasing when in reality you don't know what impact the change in device has had. The same thing goes if you observe in more places. That might tilt your average wave height up or down," Janssen says.

Many forecasters use the same mathematical models – it is the data fed in to those models that determines how accurate the results will be. "Is the climate changing? Absolutely," says Janssen. "Is it going to change our weather systems over the ocean? 100%. Do we know exactly what that is looking

StormGeo

"By applying accurate weather forecasts predicting the wave height and direction days ahead, and combining this with vessel-specific response models, the captain gets alerts if the estimated vessel movement along the planned route exceeds acceptable limits."

– Petter Andersen,
SVP, Shipping Digital, StormGeo


Sofar Ocean

Sofar Ocean's hundreds of Spotter buoys continuously contribute masses of accurate wave data.


Sofar Ocean

"Is the climate changing? ***Absolutely.*** *Is it going to change our weather systems over the ocean?* ***100%.*** *Do we know exactly what that is looking like? No, I don't believe we do yet. This speaks to our urgent need to rapidly expand ocean data collection at scale."*

– Dr. Tim Janssen, Co-Founder and CEO, Sofar Ocean

Light Structures

Hull stresses can be measured directly from installed sensors.

like? No, I don't believe we do yet. This speaks to our urgent need to rapidly expand ocean data collection at scale."

IACS researchers have determined that while Version 2 does not include any climate forecasts, IPCC projections of changes in extreme wave height are unlikely to affect the scatter diagram.

Day-to-day forecasts are, however, particularly vulnerable to the "butterfly effect." Previous work by ClassNK indicates that as atmospheric circulation has the nature of chaos, if there is an error in an initial value, the error in the predicted value will increase exponentially over time. Wave forecasts, therefore, are often limited to about 10 days.

Digital solution providers, including Sofar, are giving captains more sophisticated voyage planning tools so they can adapt their voyage plans to avoid adverse weather and therefore protect crew, vessel and cargo.

And that's the purpose of StormGeo's s-Planner Seakeeping module. Wave data is an essential component for planning a safe and efficient voyage, says Petter Andersen, Senior Vice President Shipping Digital at StormGeo. "By applying accurate weather forecasts predicting the wave height and direction days ahead, and combining this with vessel-specific response models, the captain gets alerts if the estimated vessel movement along the planned route exceeds acceptable limits."

Hull stresses can be measured directly from installed sensors, and this enables navigators to receive early warning when there is a significant probability of exceeding stress and fatigue limits set by class societies – for example with Light Structures' SENSFIBTM technology. "The application of structural health monitoring data is starting to become more diverse," says Terje Sannerud, Chief Commercial Officer at Light Structures. "It can be utilized in condition-based inspection routines to identify the development of cracks in a structure as well as in risk-based inspection programs where the established Fatigue Design Factor can be measured against the accumulation of actual fatigue. Both examples have the potential to reduce the cost of maintenance over a vessel's entire designed lifecycle, while of course ensuring better safety, especially during extreme weather incidents."

He says that the investigation report into the loss of the Stellar Daisy does not mention if any form of hull monitoring solution was installed, but if it had been, the effects of stress and fatigue could potentially have been addressed prior to the tragedy.

FEET ON THE GROUND, EYES ON THE SKY

***Erika Graziuso**, Chief Information Officer, Crowley, brings a breadth and depth of non-maritime experience to bear in her quest to drive Crowley's digital transformation in the name of decarbonization, holistic transportation efficiency and crew attraction and retention.*

By Greg Trauthwein

Photo credit Rick Wilson/Courtesy Crowley

Emulating best practices from industries outside of maritime has been a mantra in boardrooms and conferences for decades, as traditional maritime mindset has, at times, been seen as an impediment to achieving next-level efficiency.

Enter Erika Graziuso, Chief Information Officer, Crowley.

Her tenure at Crowley and her experience in maritime match: one year. But while Graziuso is short on maritime experience, she comes well-equipped with a depth and breadth of digital transformation experience and accomplishments, working globally with huge, complex, organizations, includin nearly two decades with Deutsche Bank [50,000+ employees] and another five at The Adecco Group [35,000+ employees], a Fortune 500 company leader in the HR industry.

So while the transition from corporate behemoths to a medium-sized American company might not seem the most logical move, Graziuso saw opportunity aplenty, starting with the roots of this iconic U.S. maritime company.

"There were a few things that attracted me to shift my career from huge European companies to a U.S. medium sized company in a completely different industry," said Graziuso. The first was the legacy of the company itself, started by one man with one boat in 1892, building a legacy and a family company that has not only withstood the test of time and generations, it has flourished and grown to be a brand and culture leader in the sector.

"I was fascinated by the idea of how it is to be in a company where there is this concept of being a family. Obviously, we are professional, but still there is this strong concept of belonging to a legacy."

In tandem, she was intrigued to jump into an industry that was far from its peak of digital transformation. "The banking started its technology transformation years ago due to regulation, competition, and market pressure," said Graziuso, seeing her new job with Crowley and maritime as more creation than refinement of digital transformation.

Last, but certainly not least, she gives props to her new boss, his forward-looking perspective and his vision to build on the organization's 130-year legacy, as well as his penchant to not simply 'talk the talk' but to also 'walk the walk' in terms of real and meaningful investment. "The long-term strategy that Tom Crowley has in mind, not just for shipping but for all business lines, is forward looking and exciting; it is with feet on the ground and eyes on the sky. It's a balance between being practical in what we are doing today, but having an eye on the future."

So today Graziuso sits at the helm of Crowley's digital transformation across business lines. "It's the infrastructure, it's the technology to enable the business growth, it's data, it's everything that is related to digital journey," she said. "Unlike big organization where they have these roles split in three C levels – CDO, CIO and CTO – because of our size, and also because of the synergies of our teams, I have a combined responsibility. In a nutshell, I'm responsible for the technology of the company plus the data strategy and the digital journey."

"He [Tom Crowley] knows the importance of technology; we don't have to convince him," said Graziuso, noting that's not always the case as "technology can be a heavy lift from a cost standpoint. When there are tensions from revenues and the bottom line, the first thing you do is to cut technology costs, which is not the case here."

STARTING THE 1,000-MILE JOURNEY

The axiom *'a 1,000-mile journey starts with a single step'* is apt in Graziuso's case when joining the maritime industry, as she readily admits she had a lot to learn when looking at the company assets and assessing the job to connect them.

"In my mind the ship was like a building, and the only difference was that one is floating [with 30-40 people in it], another is attached to the ground." In looking at it from that perspective, she questioned the complexity and amount of investment.

But it didn't take her long to realize that here initial perception was wrong.

"I realized that it's not just a floating building, it's much more complex from many points of view. The first one is our crew, the mariners and the people that spend their time on the vessel. They do not consider it just a building, but their house, too," said Graziuso.

Also, in the case of a physical building, if there's an IT problem the connection to the building can be cut overnight or over the weekend. "That's a concept you cannot apply on the vessel, because it's not just work, it's their life and they need to be connected" she said, particularly the new generation that "is born with a cell phone in their hand. In the past [24/7 high speed connectivity] was a luxury, now it is a 'must,'" and in fact, foundational to the digitalization journey.

Courtesy of easy access to the ships, captains and crew, Graziuso quickly changed her initital perception and "heard loud and clear" that having a high-speed network available 24/7/365 was a 'must have.' She considers the connectivity a foundational element in building Crowley's digital pyramid, a mandate that is being carried out today. By the end of the year nearly every vessel in the fleet will be connected this way.

While high-speed connectivity is an imperative to attract and retain mariners, it's a business priority too, enabling the entire crew to stop working in offline silos, waiting to upload or transmit only when close to shore where high-speed connectivity was traditionally had.

In this regard, Crowley has evolved to Starlink with Inmarsat as a back-up, helping to digitalize onboard processes and create a seamless, always-on workflow as if the crew were sitting on their desktops and laptops on shore. Having a back-up system is also key to ensuring safety at sea, and when it comes

"The high-speed network is the base of a pyramid, its foundation. We are working to make sure that we go paperless, that we use data as much as we can to [for example] become predictive from a maintenance and repair perspective and the consumption of our resources."

Erika Graziuso,
Chief Information Officer, Crowley

Photo credit Rick Wilson/Courtesy Crowley

*Augmented reality tested onboard El Coqui – in this case by the author – with **Jeffrey Jönsson**, Director of Process Engineering, Crowley Petroleum Services.*

Image courtesy Crowley

to network connectivity, Graziuso is brand agnostic. "I don't think the brand is important; today it's Starlink, tomorrow it could be something else," said Graziuso, noting that what is relevant is that her team will seek, evaluate and implement innovation, regardless of brand, that provides a 24/7 high-speed network that foundational enabler for Crowley's digital processes. "The high-speed network is the base of a pyramid, its foundation. We are working on to make sure that we go paperless, that we use data as much as we can to [for example] becoming predictive from a maintenance and repair perspective and the consumption of our resources."

EYING THE *'FUTURE OF THE FUTURE'* ... DECARBONIZATION

While Graziuso admits that everything in her department is geared toward making an impact, from crew attraction and retention to process simplification, she has her eye in the sky today as Crowley invests in "the future of the future, which is decarbonization." Here, as every shipowner knows all too well, is where the picture starts to muddle, particularly when investing in upgrading existing ships and boats.

"[The path to decarbonization] does not just come with new tools, new software as a service; that comes with the building new ships that are enabled to be hybrid or completely electric," she said, with Crowley aiming to have a state-of-the-art vessel that can be a role model from the next-generation of technology.

Naturally, talk quickly turns to machine learning and artificial intelligence (AI) in any digital journey conversation, but Graziuso positions the conversation differently.

"Everyone talks of AI, but AI needs data and data needs to be timely, accurate, and relevant," said Graziuso. "To have timely, accurate, and relevant data, you need a very simple operation tool or an operation tool that is built with the simplicity; not a very simple operation tool because being simple is complex."

She sees machine learning and AI as an enabler, a tool that could be particularly useful in conducting predictive maintenance onboard vessels, for example; to enable onboard inspection before a ship comes into port and without someone stepping onboard; and in leveraging shoreside assets to keep onboard crew out of dirty and dangerous spaces. It all comes back to the pyramid analogy, of having the connectivity foundation; acquiring that timely, accurate and relevant data, and utilizing that data to generate meaningful impact.

"You can't go to the tip [of the pyramid] without having the foundation. Does that mean we are working on [one layer at a time?] … No. This is a staggered pyramid where we work on the different layers [simultaneously], and at a certain point they will all align. So today we are working on the foundation, the network; we are working on the operation and we are halfway through. By the middle of next year this will be done. But in parallel we are working on what to do with the data, too."

DIGITAL PATH & AUTONOMY

Bundling digital technologies with AI talk often turns to full autonomy. While there are some amazing advances in autonomous boats and ships, most anyone in the industry today is

highly unlikely to see autonomy become mainstream during their career.

Graziuso thinks this is an important message to convey, rationalizing that new mariners coming into the industry today are likely to have a long career with little to no concern of losing their jobs to autonomous technologies.

"I don't see technology as a threat for our mariners, rather an argumentation to do their job better, and to facilitate what they do today."

"One of the things that technology can do is to increase our level of safety and keep our crew out of things that are, quote/unquote 'dangerous': Going into an engine room to take data, this can be replaced by technology."

Two months ago Crowley and ABS inked a deal to jointly explore how to advance the use of augmented and virtual reality technologies for vessels and other marine environments, building on Crowley's new service network using augmented reality on select vessels. The crew wear goggle technology to provide real-time visuals of ship equipment to remote technicians to collaborate on solutions. The technology, developed by Kognitiv Spark, allows mariners and shoreside crew to more quickly complete maintenance, updates and upgrades on board.

ABS and Crowley will collaborate in a joint pilot project for classification-related survey support activities, such as aspects of annual and special surveys including task crediting. In addition, the project will include a variety of activities involving surveyors, engineers and back-office survey support, virtual walkthroughs and livestreaming using fully remote and hybrid survey techniques. Successful class surveys are important to operate vessels.

"[This project] leverages augmented reality," said Graziuso, experimenting with the ability to leverage shoreside expertise and resources to help conduct onboard situations, helping to address and solve onboard problems before the vessel returns to shore. "We have already done a couple of the tests – proof of concepts – and we are very satisfied with the outcome. Think of it how this can change the industry overall, because today inspections are done when a vessel arrives to the port [and an inspector comes onboard]. "Tomorrow – and it's not tomorrow like decarbonization, which is still 20 years down the line – really tomorrow, this can be done wherever you are."

Image courtesy of Hyundai Heavy Industries Engine & Machinery Division

HHI-EMD has developed a 4-stroke HiMSEN methanol engine.

GENSETS

NEW FUELS BUT PERENNIAL GOALS

Fuel flexibility may be a key driver for recent developments in gensets, but the perennial goals of lowering CapEx and OpEx remain.

By Wendy Laursen

Fuel flexibility is one of the pillars of decarbonization that is being embraced by genset OEMs. Fuel efficiency, a second pillar, goes hand in hand with that because new fuels will be more expensive, but these concerns come in addition to the on-going drive to reduce CapEx and OpEx for shipowners.

MAN Energy Solutions introduced its auxiliary MAN 35/44DF CD engine in June 2023. It is designed to be future-proof and will be ready for methanol operation by 2026. Sephardim Koblenz, Head of Licensing, MAN Energy Solutions, notes though: "Both shipyards and shipowners greatly appreciate auxiliary engines that are easily installed and maintained, while reliability and cost-optimization are also key."

MAN also recently received its first order for small-bore, seven-cylinder MAN 21/31DF-M methanol-burning gensets for six PCTCs being built by China Merchants Heavy Industry for China Merchants Energy Shipping. The 21/31DF-M is based on a simple port fuel-injection concept that optimizes reliability, while simultaneously minimizing capital outlay.

"The foundation for the new L21/31DF-M genset is the existing L21/31 genset which has accumulated more than 55 million operating hours with thousands of engines in service," says Bjarne Foldager, Senior Vice President and Head of Two-Stroke Business. "The L21/31DF-M power range spans 1,000-1,980kW, which makes it suitable for most merchant vessels."

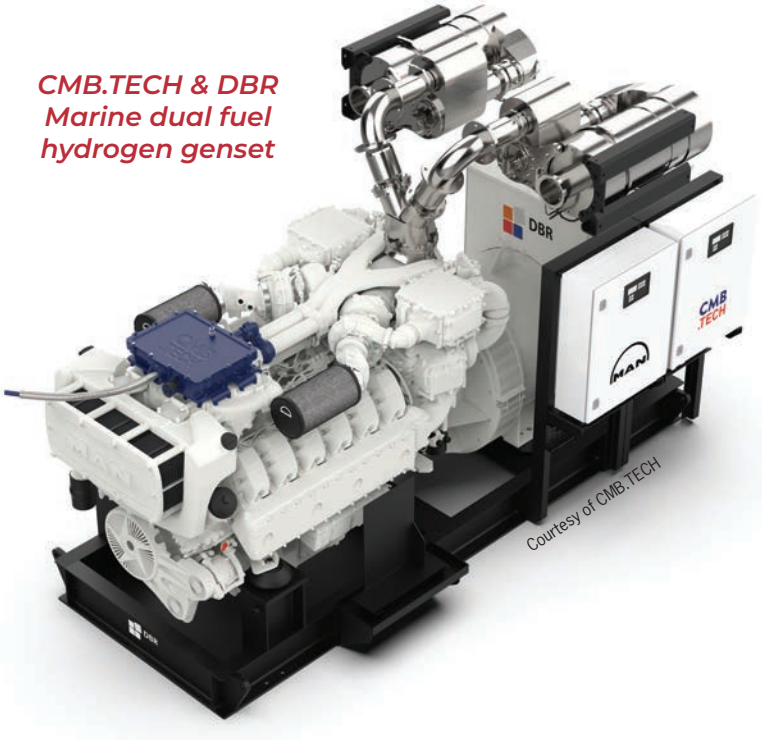
Foldager expects methanol to figure prominently as a future fuel across all vessel segments. "The new genset benefits from the high reliability, high performance and fuel flexibility of the 21/31 engine platform, while the possibility to operate on green methanol as a drop-in fuel increases its fuel-flexibility. Simultaneously, it also increases methanol's potential as an

option for genset power generation aboard large marine merchant vessels."

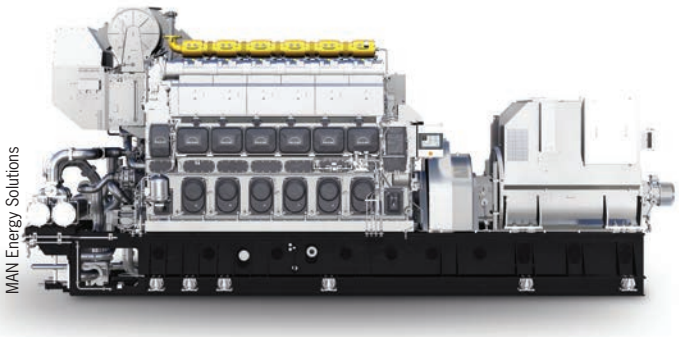
Other OEMs also have new fuel developments on-going. HHI-EMD has developed a 4-stroke HiMSEN methanol engine, and Caterpillar Marine is designing alternative-fuel gensets with a current focus on methanol. Yanmar Power Technology is concurrently developing hydrogen, ammonia and methanol engines and has commercialized a hydrogen fuel cell system.

Volvo Penta and CMB.TECH have collaborated to create dual-fuel, hydrogen engines, and CMB.TECH's collaboration with DBR has seen the development of dual fuel hydrogen gensets. The core of the technology is the proven MAN V12-24l engine. The genset has a maximum output of 940kVA / 752 kWe at 60 Hz (1800 rpm) and can operate on diesel or in dual fuel mode where emission savings of up to 83% can be achieved. The genset is also available in 50Hz (1500rpm) which can deliver 822kVA of power.

Wärtsilä announced in August that it will supply methanol-fueled Wärtsilä 32M auxiliary gensets for six 15,000 TEU container ships which are being built at the Dalian Shipbuilding for CMA CGM. Future fuels development is



CMB.TECH & DBR Marine dual fuel hydrogen genset



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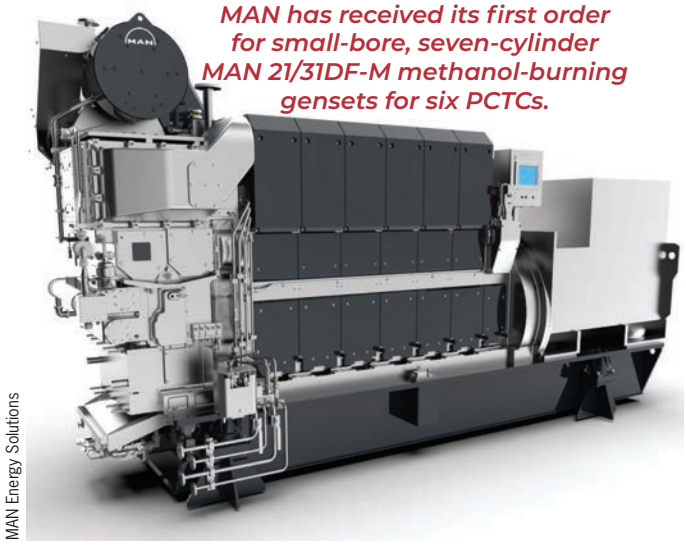


MAN Energy Solutions

Volvo Penta and CMB.TECH have collaborated to create dual-fuel, hydrogen engines.

CMB.TECH

a key part of Wärtsilä's decarbonization strategy, but when asked what the most important developments in gensets were, Janne Klemola, General Manager, Product Management – Wärtsilä Marine Power, said: maximizing fuel efficiency. "That's why one of the most important developments in gensets is around improving the reliability of the power - this can support with driving higher fuel efficiency and in turn lowering overall emissions from a vessel. What's more, if you can also extend the time needed between overhauls and/or major repairs - through using cutting edge artificial intelligence and advanced diagnostics – this can help vessel owners improve asset efficiency and reduce both operating costs and emissions."

Klemola sees this as part of a larger endeavor to continue to refine and enhance genset technology. Another part is the ongoing development of genset automation and integration of controls with other systems, such as energy storage systems.

Mark Harrison, Product Strategy Manager for Caterpillar Marine, says: "The most important developments that we are seeing in gensets at the moment is how they are being applied differently in modern power systems. How can we best utilize batteries, hybrids, and gensets in harmony to achieve our objectives? Can those benefits overcome the inherent CapEx and OpEx challenges? At Caterpillar, we are focusing on overall system efficiency: Are our generators optimally sized? Are those generators operating at peak efficiency? Can we start or stop a genset to operate at a more efficient point from an overall vessel perspective? Are we optimizing the usage of electrons versus fuel molecules for the best blend of reliability and efficiency?"

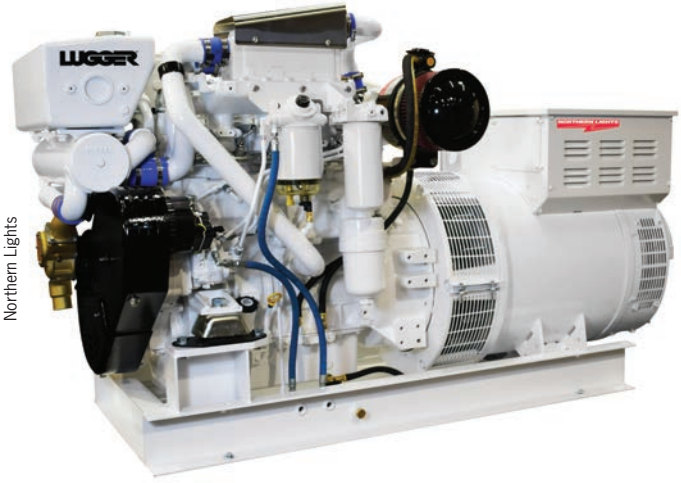
The days of simply specifying in gensets seems to be fading quickly, he says. "Customers now need to decide more than ever if larger gensets for reliability are more important than smaller, more power dense ones, based on how they are expected to operate in real life. One specific change we are expecting is the generators of the future (integrated into hybrid systems) will operate at much higher load factors. Have we optimized the gensets for this new reality?"

A modular, hybrid and fuel-flexible approach to onboard power has the potential change thinking about gensets and ship design, and it is becoming evident in newbuilding orders. Dutch shipping company Transtal Shipping has signed a contract with Thecla Bodewes Shipyards for the construction of a 5,100dwt diesel-electric multi-purpose vessel. Fuel flexibility is key to the design which incorporates three gensets and two electric motors. The vessel is ready for future fuels such as methanol or hydrogen, with space reserved on board for alternative energy sources without having to replace the electric propulsion system.

Sam Gombra, co-founder of ÈTA Shipping, came up with a highly flexible solution for a coastal cargo ship. The design, ÈTA 6700, is initially diesel-electric, but is designed so that

Northern Lights

Northern Lights introduced the M4105 and M6105 genset series with kilowatt ratings from 125 to 245 at 60 Hz.



Northern Lights

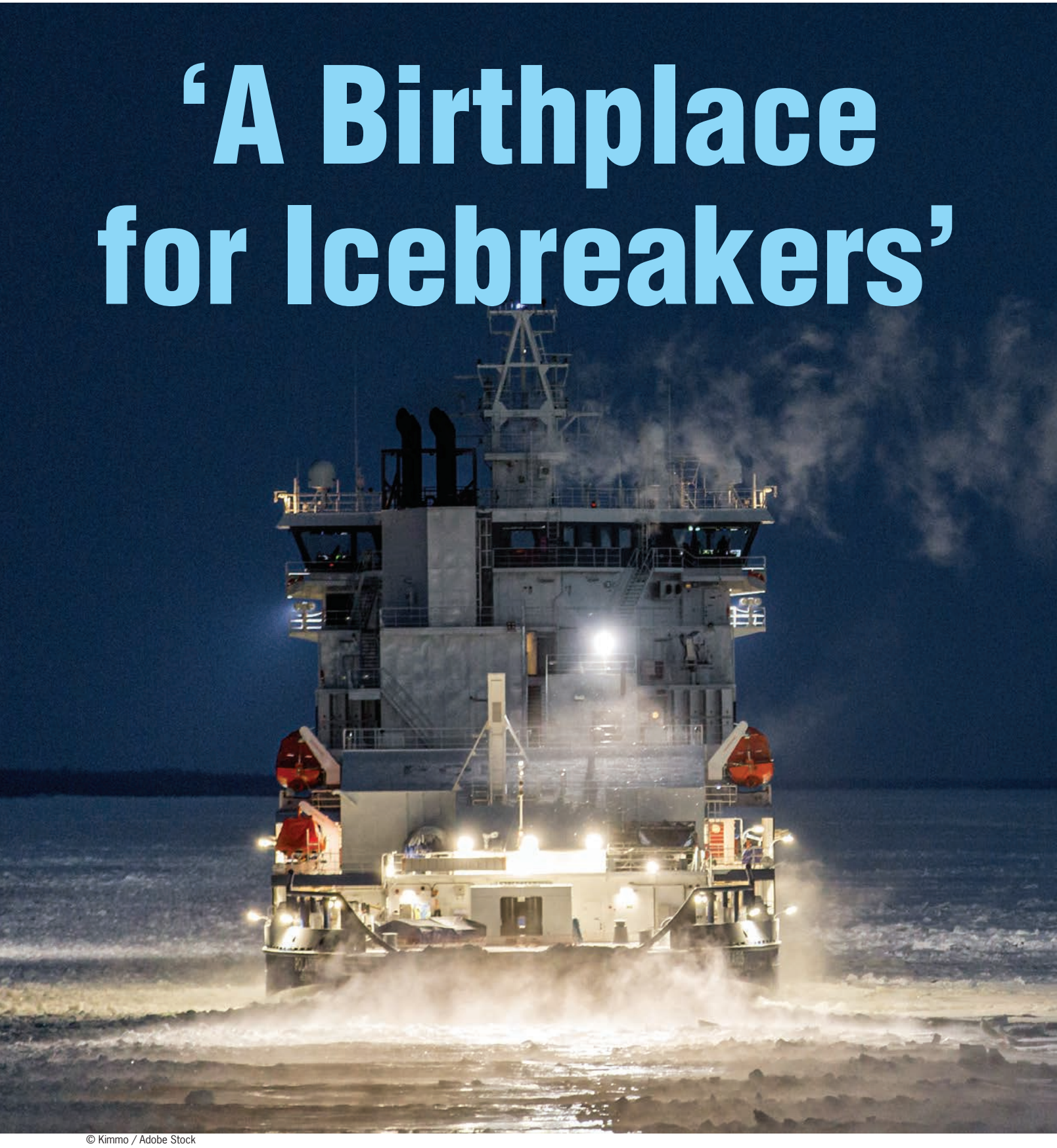
CMB.TECH

From left to right: Vincent Gerritse (DBR), Roy Campe (CMB.TECH), Arwout Verwoerd (DBR), Ron Verheul (DBR) and Mijndert Wiesenekker (Damen Shipyards Group)

it can sail on methanol, ammonia or hydrogen in the future. There is no main engine. Initially, power is provided by three 600kW Mitsubishi generators, each installed in its own container, but it is possible to incorporate any containerized sustainable power source. Gombra estimates that it will take less than a day to remove the existing power generation system and replace it, without the need for a shipyard. The company has already partnered with Mercuria on a series of vessels expected to be delivered starting in 2025.

Transtal Shipping and Mercuria are demonstrating the desire for fuel flexibility shipowners have as they endeavor to balance regulation with technology developments and economics. Genset OEMs are working to ensure their CapEx and OpEx can be minimized as well.

‘A Birthplace for Icebreakers’



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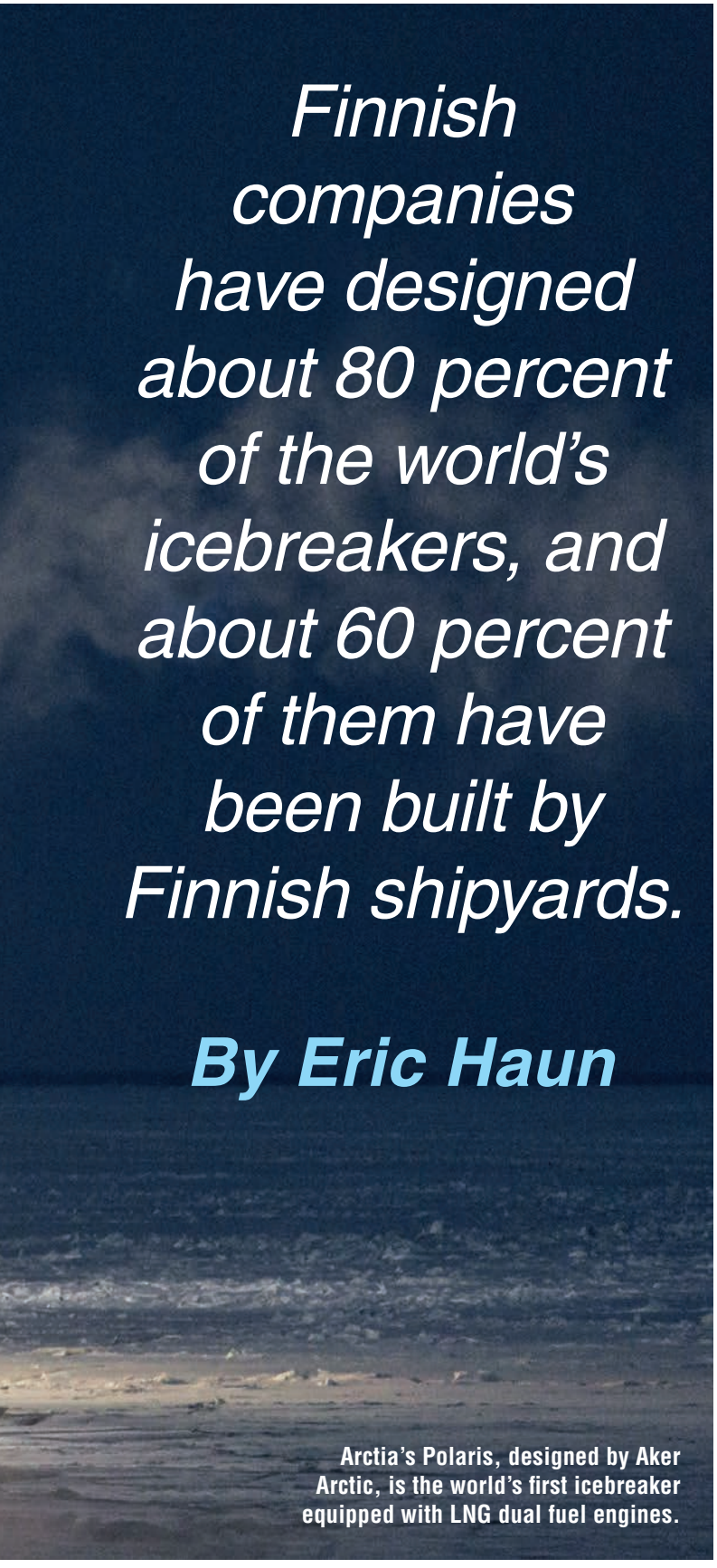
Finnish companies have designed about 80 percent of the world's icebreakers, and about 60 percent of them have been built by Finnish shipyards.

By Eric Haun



Arctia's Polaris, designed by Aker Arctic, is the world's first icebreaker equipped with LNG dual fuel engines.

Finland is home to a strong and vibrant maritime cluster, with a mix of large, medium and small shipyards, as well as a deep pool of marine engineering expertise and a broad network of vessel equipment suppliers.

As one of the world's northernmost countries, Finland is also home to a fleet of icebreakers that keep imports and exports flowing through its harbors, even during the coldest winter months. All Finnish ports are prone to freezing over, and the country's icebreaking season typically starts in early December and can last through May.

It's only natural, then, that Finland is a leading hub for icebreaking expertise. About 80% of the world's icebreakers have been designed by Finnish companies, and some 60% of all icebreakers were built at Finnish shipyards, according to figures from Business Finland.

"Developing, designing and building icebreaking vessels is very strong in Finland," said Reko-Antti Suojanen, managing director at Aker Arctic Technology, an engineering company specializing in icebreakers. "We hold the position as the world leader in this segment."

Suojanen describes Aker Arctic as "a birthplace for icebreakers" because the company has provided design and engineering for the majority of the world's icebreaking fleet.

Aker Arctic, established as an independent company in 2005, has roots that go back nearly 100 years, but today is majority owned by the Finnish government (Finnish Industry Investment, 66.4%) as well as industrial partners ABB (16.8%) and Aker Solutions (16.8%).

Aker Arctic specializes in the development, design, engineering and testing services for icebreakers and other ice-going vessels. Its experts know the ins and outs of icebreaker design and engineering, all the way down to the very last detail. "That's part of the specialty of designing ships for ice conditions," Suojanen said.

The company's Helsinki headquarters houses the world's sole privately owned ice model testing facility, complete with a 75- by 8-m basin that allows engineers to study the performance and behavior of their designs in real ice conditions, including first and multi-year level ice, brash ice channels, ice rubble and ridges, floe ice, and first and multi-year ridges. "One of the benefits of this laboratory is that we can test new concepts and ideas," Suojanen said.

Through the years Aker Arctic has developed a number of breakthrough innovations, such as double acting icebreakers, designed to travel forward in open water and thin ice, but turn around and proceed astern in heavy ice conditions, as well as oblique icebreakers, which operate not only ahead and astern, but also sideways to clear a larger lane through ice. Aker Arctic's intellectual property includes 12 patented inventions in 20 countries.

Photo: Eric Haun

From left: Aker Arctic Technology managing director, Reko-Antti Suojanen, with director of sales and marketing, Arto Uuskallio.

FUTURE DEMANDS AND OPPORTUNITIES

There are currently about 155 icebreakers in operation globally, with another 24 under construction or on order. According to Suojanen, the need for new icebreakers is growing for many reasons. One of these is the arrival of stricter emissions regulations that restrict the power of non-icebreaking vessels entering and exiting ice-encased Finnish ports, as these ships will require more icebreaking assistance.

Suojanen also sees opportunity for fleet renewal, noting that the global icebreaking fleet is aging, with nearly 50 vessels in service today that are more than 40 years old, including 13 over 50—though icebreakers are often designed and built to live longer than typical commercial vessels.

One country currently working to renew its fleet is Sweden, which engaged Aker Arctic to design a pair of new icebreakers. The project is moving toward the build phase as the Swedish Maritime Administration evaluates shipyards with the expertise and capability to build such vessels.

Notably, the ships will be the first methanol-ready and potentially the first methanol-fueled icebreakers in the world, as maritime stakeholders seek new ways to minimize their environmental footprint. Under current plans, the new icebreakers will be built initially to run on fossil-free renewable diesel oil—hydrotreated vegetable oil, (HVO)—but its engines will be ready to adapt for future methanol use as the technology matures and fuel availability is secured.

Icebreakers, like other commercial and working vessels, are candidates for other future fuels such as ammonia and hydrogen, and Aker Arctic is examining these options to help meet the International Maritime Organization's decarbonization targets. "Icebreakers are definitely one of the most difficult [vessel types] to decarbonize because we need, first of all, a lot of power, and quite often long endurance," Suojanen said.

But before exploring "future fuels", it is important to improve the overall efficiency of the vessel design, Suojanen said. "You need to reduce the energy consumption," he explained. "Then the second step is to look at which fuel to use to meet this energy requirement."

In the case of Sweden's new icebreakers, Aker Arctic has helped to create a more efficient hull form that is unlike any previously built. The result is an icebreaker with extremely low ice resistance for its size, reducing fuel burn—and therefore emissions and fuel cost. An onboard energy storage system (ESS) will also contribute to help slash emissions and service costs. All told, the vessels will consumer 45% less energy and emit 70% less CO2 than the 1970s-built Atle-class icebreakers serving in Sweden and Finland.

Canada is another nation in the midst of renewing its fleet of ice-capable vessels. Earlier this year, Aker Arctic completed the hull form and contributed to the concept development for Canadian Coast Guard's 16 new multipurpose vessels slated to be built by Seaspan Shipyards. The firm is also supporting Canada's program to build a pair of new polar icebreakers; the first vessel will be built by Seaspan Shipyards followed by the second at Davie.

Elsewhere, Aker Arctic is supporting Argentina's program

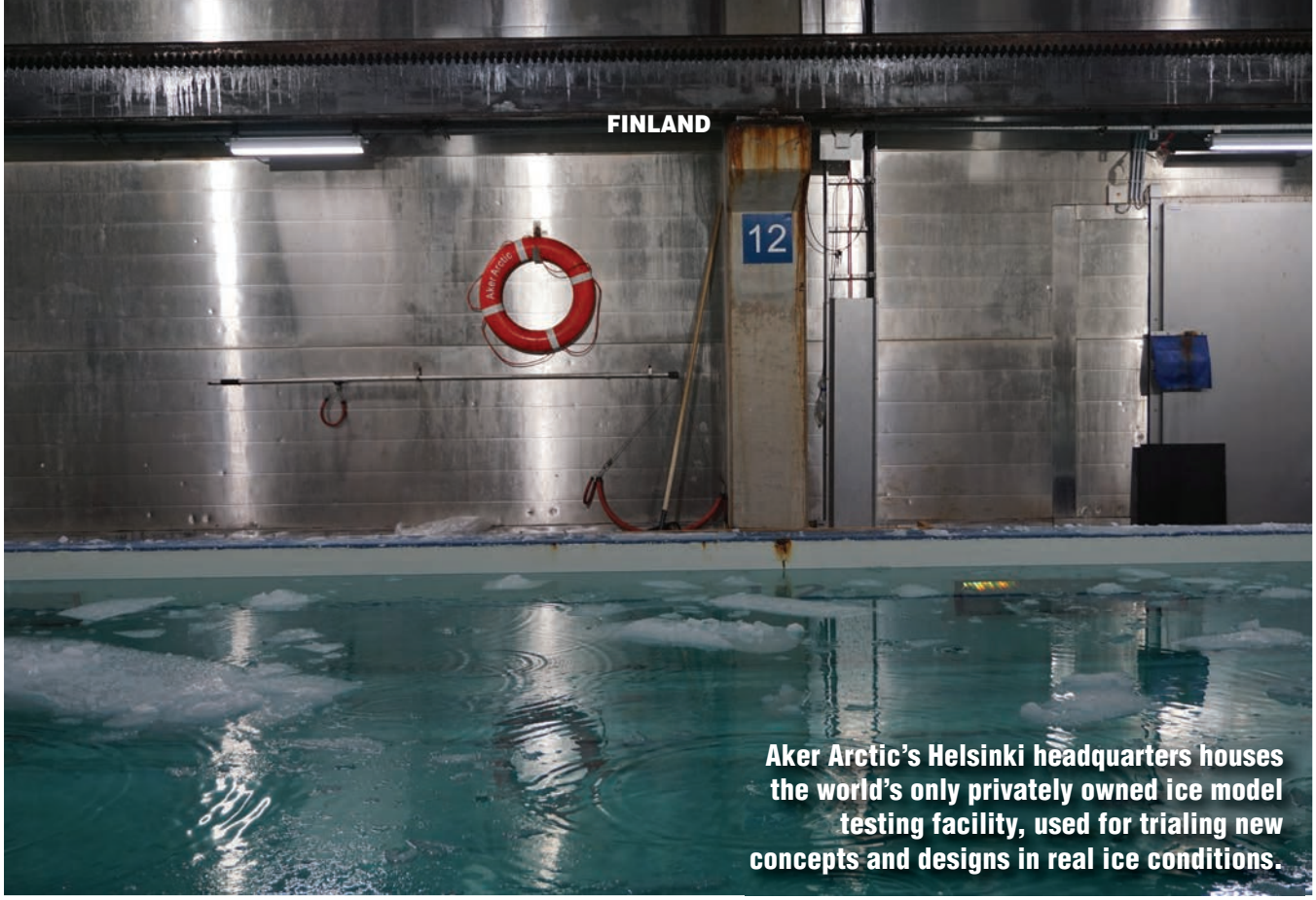


Photo: Eric Haun

Aker Arctic's Helsinki headquarters houses the world's only privately owned ice model testing facility, used for trialing new concepts and designs in real ice conditions.

Arctia-operated Fennica is designed to be used as an icebreaker in the Baltic Sea during the winter and an offshore support vessel in warmer weather.

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Photo: Eric Haun

Captain Pasi Järvelin on the bridge of Arctia icebreaker Polaris. Järvelin has more than 40 years' experience in the maritime industry, including 36 years on icebreakers, and was part of the concept team that developed the vessel.

to build a new icebreaking vessel for the supply of its 13 Antarctic stations. In addition, Aker Arctic has helped to develop an ice-strengthened propulsion line for the new Pohjanmaa-class multi-role naval corvettes being built for the Finnish Navy at Rauma Marine Constructors (RMC). While not icebreakers, the naval ships will be built to withstand harsh winter conditions.

Ironically, a warming planet creates new demand for icebreakers. As the world thaws, Suojanen sees opportunities opening up in the high north. The Northwest Passage is now more accessible to vessel traffic, including cargo shipping and expedition cruising. In 2021, Ponant's Le Commandant Charcot was delivered, featuring a world-first Polar Class 2 (PC2) hull designed by Aker Arctic. The company said the vessel's performance is comparable to existing polar icebreakers, but with lower ice resistance, ensuring better fuel economy. The double acting ship combines smooth icebreaking ahead in up to 2.5-meter-thick multiyear ice, and astern in more severe ice conditions such as heavy ice ridges.

BREAKING THE ICE

Finnish state-owned Arctia operates a fleet of eight vessels that provide icebreaking services for the Finnish Transport Agency during winter. All ships calling Finnish ports are required to pay fairway dues to the Finnish government, which uses the funds to help pay for Arctia's service. The company clears frozen shipping lanes and frees any vessels that get stuck in the ice.

"We're the only country in the world where all of the ports freeze during the winter months," said Paavo Kojonen, Arctia's senior vice president of icebreaking.

"When you come in wintertime with your vessel, you are supposed to proceed on your own. And when you get stuck, you get assistance to the port," Kojonen said. "Obviously,

Arctia's newest icebreaker, Polaris, was designed by Aker Arctic to operate in all local ice conditions. Built by Arctech Helsinki Shipyard in 2016 based up the Aker ARC 130 concept, the vessel is 110 meters long with a 24-meter beam and an 8-meter draft, allowing the vessel to operate in all major Finnish shipping lanes. The combined output of the vessel's electrical power plant is about 22.5 megawatts (MW), making it the most powerful in the Finnish fleet. The state-of-the-art vessel features dual-fuel engines capable of using both marine diesel and liquefied natural gas (LNG), meaning it is also Arctia's greenest.

© Marko Hannula / Adobe Stock

there are limitations of what kind of vessel you can use during the wintertime."

It is expected that cargo tonnage entering and exiting Finnish ports will increase dramatically over the coming decade, meaning greater demand for Arctia's services, Kojonen said, noting changes to the merchant fleet as another driver. "Vessels are getting bigger, but less powerful due to environmental regulation changes."

In the context of climate change, Kojonen said winters are trending shorter, but conditions at sea are becoming more difficult. "Climate change brings more extremes—warmer winters, but also more severe winters. It doesn't look like it's easing in Baltic waters in the coming decades," he said. "There might be less ice coverage in square kilometers, but the ice is moving all about; it doesn't freeze and stay there. The conditions, from what I hear from the captains, are getting more difficult over time."

Photo courtesy Archipelago Philippine Ferries Company/FastCat

FASTCAT IS ON A MISSION TO CONNECT THE PHILIPPINES

What are the first thoughts to cross your mind when you hear "Philippine ferries"? Old vessels ... Unsafe ships ... Accidents? If so, that perception is mostly accurate. But the reality is changing today, courtesy of the **Pastrana family and Archipelago Philippine Ferries Company – aka FastCat –** *which continues to build, crew and operate a fleet of modern, internationally classed RoPax ferries to service the Philippines vast expanse of islands.* **FastCat operates 20 modern ships today, and is aiming to ramp that up to 60 by 2030.**

By Greg Trauthwein

Archipelago Philippine Ferries Company is best known by the brand FastCat, connecting select Philippine Islands via modern catamaran RoPax ferries. Today it operates 20 vessels on nine routes in the Philippines, and according to Mary Ann Pastrana, Chairperson, the goal is 60 FastCats by 2030. "Pre-pandemic, we carried about 4 million passengers per year, and while the number dropped during the pandemic, it's going back up."

In total, the Philippines are made up of 7,641 islands. "We're divided by water," said Pastrana, "and we connect the major routes via the so-called 'Nautical Highway' on the Central, Western, and Eastern sides."

Today FastCat has about 600 employees, 300 on shore, 300 on the ships. But the story of FastCat transcends the pure business aspect of maritime, as it is through and through a family business, a family that sees the work it has done to build a modern fleet of RoPax ships as a central tenant to helping build its country's national economy. And the Pastrana family are 'all in' – from Mary Ann and her husband Christopher; to their two sons who are learning the maritime trade in the U.S. at SUNY Maritime; to their two son-in-law's that have embraced key positions in the company.

Humble Beginnings

The company started 20 years ago when Christopher Pastrana bought a fleet of tugs and barges to carry bagged cargo, expanding soon thereafter with seven secondhand RoRo ship.

"Our start was connecting the islands with secondhand older ships," said Mary Ann, noting that it was difficult and costly "running different size ships with different engines. The maintenance was a challenge, finding parts for older ships and the lack of a steel industry in the Philippines. Everything was imported, so we slowly started selling the tugs and barges, some for scrap, then the RoRo fleet, too."

Hitting bottom did not mean quitting, and the decision was made to change its course. “We will give our country what it needs – safe maritime transportation,” said Mary Ann. So in 2010 the company switched gears and decided to take the plunge and invest in new, modern tonnage. Looking at the traditional ferry fleets serving the region, the Pastrana’s surmised that passenger ships in the region were too slow, operating at about eight knots. “We needed faster ships, we needed safe ships,” said Mary Ann, noting too that it was determined to make onboard staple amenities – such as food facilities and toilets – comparable to international standards.

So the Pastrana team hit the road, “knocking on doors looking for partners, investors, bankers with the plan to modernize the Philippine ferry fleet. The first approval to build a modern ship in 2010, starting with 10 FastCat and building to 20 by 2023.”

And with it was born a modern RoPax industry in the Philippines with the company tagline being: *"Ferry Safe, Ferry Fast, Ferry Convenient."*

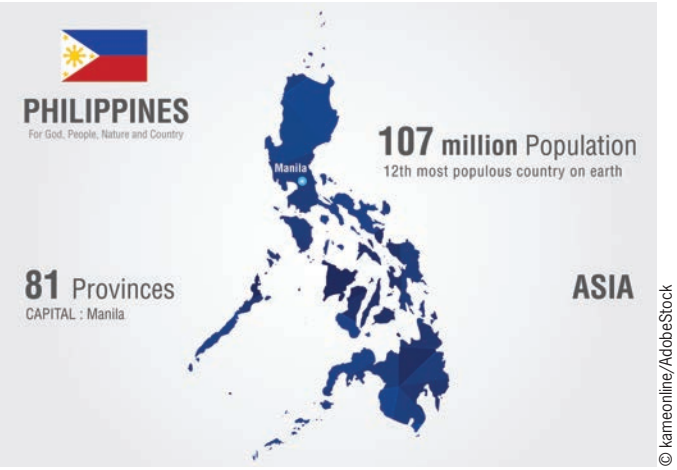
Challenges Aplenty

FastCat, like every other vessel operator on the planet, has more than its fair share of challenges. First and foremost is its area of operation. With a Filipino population estimated to top 117 million in 2023 and 7,641 islands in country, the simple logistics of servicing all of the islands is not practical.

While operating vessels is challenge enough, the Pastrana’s look at the maritime port and terminal supply chain wholistically, a vision not shared by the Philippine government.

“I always like to think that it's just not the ship alone in this business, it's ships, ports and people,” said Mary Ann. “So shipping alone is not complete, it's not enough. We have to think systematically, which is still not happening in the Philippines.”

For the most part, the country’s ports, terminals and facilities are substandard, with the lack of basic infrastructure taking a toll on the FastCat fleet, how it looks, how it performs, how much has to go into repair and maintenance. “When my husband and I attend conferences or go abroad, we ride as many ferries as we can for the experience and to learn. We’ll be in Australia, and I ask them, "How old is the ship?" The answer is 20 years old, but it looks new. Our ships are younger, but it looks so old. It's because of the ports. We don't get the support we need in terms of fendering or the depth of the pier or the support system in navigational aids.”



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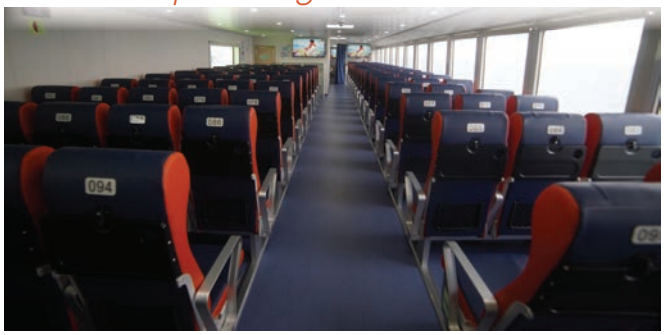
Another challenge is crewing, which might seem counter-intuitive considering that the Philippines is the world’s largest origin – an estimated 25% – of the global population of nearly 1.9 million seafarers worldwide.

“The Philippines is known as the ‘crewing capital of the world’,” said Mary Ann, but this abundance of seafaring riches does not help the domestic market. “Even if we are the manning capital of the world, we are fighting the global market which pays more compared to serving in the domestic fleet,” she said. The fact that Filipinos more often than not opt for the international shipping market is somewhat of a Catch-22, as Filipino seafarer wages pump about $6.5B into the country’s economy by her estimation. But FastCat is on a mission to have seafarers consider the home country as a place to work, and it leverage relationships, foreign and domestic – from the

"[Hong Kong mogul] Sir Gordon Wu *came to our office, and we also went to his office in Hong Kong; he was interested to get into this business. He told me:* **'Mary Ann, as long as there's water, you have business. The name of the game is efficiency.'** *So I guess the challenge for us is finding that efficiency so that we strike a balance between profitability, connecting our islands, and providing reliable service."*



All photos on spread: Archipelago Philippine Ferries Company/FastCat

public schools to WISTA – to attract and retain the seafarers it needs to power its growth.

For the Pastranas it's about communication, starting in the early years to inform young students about the opportunities in maritime, and to the seafarers – sharing the company's Vision 2050 plan – to discuss with them a career path that has them, for example, starting in the Philippines, earning the international dollars for 10 years or so, but then eventually returning home to the local industry to share knowledge and experience, improving the home market's maritime sector.

"Finding people is not the problem," as the Philippines has more than its fair share that are willing and able to become seafarers. "But now, the challenge is in upskilling and reskilling them, getting them tech-savvy, improving their cognitive and creative skills so that we become designers or we become ship managers" said Mary Ann. "It's creating that conversation to bring up the level of education and training."

Blazing the Path

The Pastrana's are quite adept at depending on themselves to get things done, and as an operator of modern, safe tonnage in the Philippines, in many regards they are pioneers. But being a first-mover has its fair share of ups and downs, as she shares the company's foray into online ticketing. "In some areas, the local government will say, *'Okay, it's peak season, the lines are long, therefore we're suspending buying tickets.'* We ask: do you do this to the airlines? No, you don't. But how come you get to do this to shipping ?"

But ultimately, the family sees itself doing its part, on a mission to help its country. "We don't only connect people, we affect industries like agriculture, tourism and education."

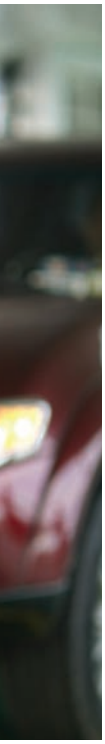
Today the company carries about 70% rolling cargo and 30% passengers. Like the rest of the world, online shopping is impacting package transport, and while in the U.S. it's Amazon, in the Philippine Islands it's Shopee or Lazada. "We carry those, as well as agriculture products plus fish, pork and chicken. But looking to 2030, that 60 ships [projected growth] is not enough. We have government officials coming to our office, asking us to connect certain islands. I always say, "I wish I could go to a dealership, walk in and buy a ship; but it doesn't happen that way."

But the need is real, and the economic impact results of their operation are proven and a point of satisfaction. "We want to help our country have that strong network of ferries that will connect our islands, because we see the ripple effect once the islands are connected."

For example, in 2004 when the company was just starting, it was instrumental in connecting a part of Luzon, the big island, to Mindoro, which is not so big, and then to the next bigger island, Visayas. "This was in 2004, and the president of the Philippines boarded our ship to take that route. My husband has the bragging rights that he was the first to connect those two major islands." But to the Patrana's, it's far more than bragging rights.

"Before the connection, the islands were isolated and property prices were low, no business establishments, no cargo movements. Once we connected the islands, it grew, and there was a ripple effect when we built that major infrastructure."

"We believe that we have a purpose and a mission. And despite the difficulties that we have undergone, that we still undergo, we trust and believe that if we are very serious with our vision, it will all be for good."



All in the Family

The Pastrana family is a maritime family top to bottom, from Christopher and Mary Ann to their two sons and two sons-in-law. “For continuity and succession planning, we asked our children if they are interested to take this on,” said Mary Ann, noting that the family regularly partakes in a ‘visioning exercise’ which helps provide focus and guidance.

“Our two sons were interested to continue the family business, so they both studied in New York at **SUNY Maritime College**, and in fact one graduated and is now interning at **NYC Ferries**, where he’s learning hands on from the engine room on up. Our other son is also at SUNY Maritime, entering his senior year and planning to continue to get his master's in logistics.”

One daughter is a doctor, currently at Northwestern University taking up her fellowship on dermatology pediatrics, and her husband is running the snack bars on all boats. Their other son-in-law joined as head of procurement, taking care of that “big money, big budget area, helping to bring down costs and make operations efficient.”

Then they have their industry family too, courtesy of **Interferry**, which has provided global connections that have led to internships and opportunities for the family, to work and learn the ferry business from an outside perspective. “I think that's one of the benefits of being a member of Interferry. We get to know ship owners and their families, and we get our sons support, creating the pathway for success in the ferry world.”

Image courtesy HDR

SECURING FEDERAL GRANT RESOURCES FOR U.S. PORTS

Leveraging IIJA Funds to Deliver Crucial Solutions for Ports

By Nathan Macek, Aurah Landau, and Kevin Keller

Like many ports, the Alaskan Port of Homer faces aging infrastructure and capital needs well beyond the local funding capacity. The port is a key link in the supply chain for 47 remote, rural, disadvantaged or Alaska Native communities served by Homer, making proposed port infrastructure upgrades critical for shipping statewide as well as for the local community.

Enter the Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law. This unprecedented influx of federal funds has provided ports in the United States a significant opportunity to make much-needed improvements. From coast to coast, at inland ports and intermodal facilities in between, ports are taking advantage of funding to plan and construct more resilient facilities and infrastructure, reduce emissions, and enhance intermodal connectivity.

But it's not as simple as filling out an application form. Though federal funding levels in IIJA have increased, competition for grant awards is intense, with demand far exceeding available funds. Transportation infrastructure owners/operators who are successful at obtaining federal funding know that strategic planning must begin well before a notice of funding opportunity is released. Proactive infrastructure owners and operators invest in master plans and are prepared to justify the need for their project before the NOFO is published and a grant application is prepared.

The Port of Homer has positioned itself strategically using a methodical process to align capital projects to specific federal grant programs and produce the most competitive grant application possible:

1. Assess a project's readiness, eligibility, and merit
2. Align it with a grant program
3. Invest in project development
4. Prepare a standout application

Readiness, Eligibility, Merit

Infrastructure owners should begin with the key documents that establish readiness, such as a master plan or capital improvement program. When evaluating upcoming grant opportunities, port officials can compare the requirements to the projects identified in the plan and identify the best grants to pursue. A master plan also helps the owner take a programmatic approach — organizing projects by need and grouping similar projects to maximize available funding.

Long before the NOFO is released, an owner should begin the pre-positioning process — a deliberate approach to ready projects for grant application. This begins with evaluating projects identified in the master plan to match them to available grants, then prioritizing projects based on readiness, eligibility and merit.

Project steps that should be complete before the NOFO is released include engineering, cost estimation, environmental clearance, and other project development activities to advance project readiness; preparing an initial benefit-cost analysis, a frequent requirement for many grant programs; lining up political support; and registering for grant information on the websites Grants.gov and Sam.gov.

This kind of pre-positioning work can increase grant award success, identify funding streams and allow for greater emphasis on performance measurement.

REM Tool: Selecting a Grant Program

For larger ports with several projects in the planning stages, HDR has created a Readiness, Eligibility and Merit tool to help owners/operators assess and prioritize projects for federal grant funding. The REM tool evaluates a variety of inputs to assess the competitiveness of individual projects in a capital program based on federal funding requirements. The results help an owner prioritize which projects to apply for grants now, and which to invest in additional project development activities to better prepare the project for consideration in a future year based on specific grant program requirements.

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Aligning a Project to a Grant Program

An array of grant opportunities is available to ports and intermodal facilities, and successful applicants will carefully choose the appropriate program. The HDR infrastructure finance team has created a system to compare grant opportunities and identify the best programs to meet a project's needs. This assists ports in pursuing applications likely to have a greater chance of award.

Consider the Port Infrastructure Development Program. Eligible projects for this program must do the following:

- Improve the safety, efficiency or reliability of the movement of goods, operational improvements (including resiliency), or environmental and emissions mitigation
- Provide shore power to cruise, ferry and cargo vessels

Grant funds cover the planning, environmental review and final design of eligible projects.

Before applying for PIDP, or any grant program, consider: Does the project fit the criteria? What are the proof points, both qualitative and quantitative, that objectively demonstrate the project fits?

If a project doesn't fit into these categories, don't shoehorn it. Find a grant program that aligns with the project's goals. Other programs to consider are RAISE, INFRA or Mega. (See below for a list of grant programs to consider.)

Also consider what stages of project development are funded by a grant. If a project is in the planning stage, but a grant only funds design or construction, it is not the appropriate grant. It's best for ports to submit only one project per grant program each year to maximize chances for success. A benefit-cost analysis is key, as it shows the merits of the project.

Invest in Project Development

If a project is not at the right stage of development for a grant, another option is to invest in project development to help with grant positioning.

Many federal grant programs require a project to have completed a certain amount of planning. For example, some

Image courtesy HDR

require planning to be complete. Others want to see environmental work or design. Port leaders must know what phases are covered by the grant, what needs to be complete and by when it should be done.

Strong Grant Applications

A grant application tells the story of why a community needs and deserves federal funding for its project. Ports can gather data to show the importance of their freight movement to the local or regional economy. This builds the case via the benefit-cost analysis. The BCA is key in demonstrating the need for the project.

A strong grant application also includes:

- A complete description of the project: goals, purpose and need, implementation
- Clear alignment with the grant program's merit criteria
- A well-articulated statement of work with specific scope, schedule, and budget
- A clear, cohesive, and complete narrative
- A BCA demonstrating positive public economic and societal outcomes (ratio greater than 1.0) that fully meets grant requirements, when applicable/required
- Matching state, local, or private cash contributions that exceed the proposed federal grant program requirements — preferably including private-sector contributions
- Strong, specific support for the project from one or more private partners, senators or congressional representatives and from the governor's office

Ports around the United States are eligible for funding that can help them modernize their facilities and energize their regional economies. Take advantage of this once-in-a-generation funding opportunity by following HDR's grant-winning approach.

Case Study: Georgia Ports Authority

With HDR's assistance, the Georgia Ports Authority received four grants between 2017 and 2023, totaling $140 million to support $570 million in project costs. This includes one FASTLANE grant, one INFRA grant and two Port Infrastructure Development Program grants. With this funding the port authority has been able to finish key projects including reconfiguration of the Port of Savannah's on-dock intermodal container transfer facilities.

The ports authority found success by tailoring its projects to the requirements of the grants programs. For example, for the Colonel's Island Terminal needed to increase capacity for cargo. Our team along with the port authority assessed several grant programs and selected the PIDP as the best fit. However, the project did not fit the requirements. So we proposed tailoring the project to better suit the benchmarks in the program. The port authority added a livability improvement by removing some at-grade rail crossings on local arterial streets. This meaningful upgrade to the local community increased the cost but also greatly increased the project's likeliness of obtaining grant funding.

Another key area to look at is sustainability and resiliency. Many grant programs include those areas as a requirement. Owners should consider whether their project can include an element of reducing emissions or decreasing waste streams, depending on the grant program selected.

Case Study: Port of Homer

The State of Alaska transferred the Homer Port to the city in 1999, leaving the local community responsible for extensive deferred maintenance. Some floats were already 10 years beyond design life at the time. State maintenance funds were not made available upon transfer, and the city assumed ownership without replacement reserves, which under best practices would have been accruing at 2.5 to 5% of the asset's value throughout its intended life cycle. The floats are now 37 to 60 years old, well past their designed service life of 25 years.

To pursue funding to address these needs, HDR worked with the City of Homer to develop a comprehensive multi-year grant strategy that complements the port's capital improvement plan. HDR and Homer staff reviewed documents related to project scope and benefits, funding sources, project and city financial plans, community planning, and public engagement to identify project characteristics and funding plans. The team matched capital improvement plan projects with federal discretionary grants and other funding opportunities, developed funding recommendations and actionable work plans for each project and group of projects, provided a schedule of application/funding activities by year, and documented and presented findings.

The group made recommendations based on project specific analyses combined with HDR's knowledge of federal grant programs, analysis of recent NOFOs, fiscal year 2022 award announcements including HDR-supported wins, and discussions with federal agency staff.

These insights were used to assess the readiness of projects and the presence of merit elements in the projects, with the goal of determining the optimal alignment between projects and available grant opportunities. From there, the City of Homer staff prioritized projects for various grant applications based on available workload and political priorities to the community.

This thorough approach gave the city the tools it needed to be purposeful in addressing the port's capital needs. The city has already submitted one Port Infrastructure Development Program grant and is positioned for other prospects to capture funding.

Grant Opportunities to Consider

- **PIDP – Port Infrastructure Development Program:** Administered by the Maritime Administration, this federal grant program provides funding for port and intermodal infrastructure projects, including the construction and rehabilitation of marine terminals.
- **Reduction of Truck Emissions at Port Facilities Program:** This program aims to reduce truck emissions at port facilities. FHWA will coordinate and provide funding to test, evaluate and deploy projects that reduce port-related emissions from idling trucks, including through the advancement of port electrification and improvements in efficiency, focusing on port operations, including heavy-duty commercial vehicles, and other related projects.
- **RAISE – Rebuilding American Infrastructure with Sustainability and Equity:** This U.S. Department of Transportation program provides funding for transportation projects that have a significant regional or national economic impact and includes a category for port infrastructure projects. It prioritizes projects with benefits in the areas of safety, sustainability, quality of life, mobility/connectivity, economic competitiveness, state of good repair, partnership and collaboration, and innovation.
- **PROTECT – Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program:** PROTECT is a competitive discretionary grant program through the Federal Highway Administration. It funds projects that make transportation infrastructure more resilient to natural hazards and the effects of climate change, including severe storms, flooding, drought, levee and dam failures, wildfire, rockslides, mudslides, sea level rise, extreme temperatures, and earthquakes.
- **Port Security Grant Program:** This grant program supports the development and implementation of security measures at critical infrastructure sites, including marine terminals. It could include surveillance cameras, new control systems, implementation of cyber security protocols, or advanced emergency response technologies. To be eligible for Port Security funding, applicants must demonstrate that their proposed security measures will enhance the safety and security of their facility.
- **INFRA – Infrastructure for Rebuilding America:** This federal grant program provides funding for infrastructure of national significance, which could include improvements to container wharves. Eligibility requirements for INFRA funding include demonstrating that the project has significant national or regional economic benefits and that it addresses a critical transportation need.
- **Mega – National Infrastructure Project Assistance**

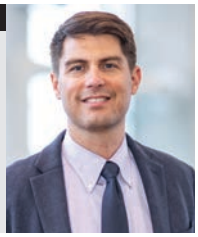
Program: This program supports large, complex projects that are difficult to fund by other means and likely to generate national or regional economic, mobility or safety benefits.

- **FEMA BRIC – Building Resilient Infrastructure and Communities:** Aims to categorically shift the federal focus away from reactive disaster spending toward research-supported, proactive investment in community resilience. Projects must reduce or eliminate risk from natural hazards through infrastructure projects, policy development or workforce enhancements.
- **FRA CRISI – Consolidated Rail Infrastructure and Safety Improvements:** Invests in projects to improve railroad safety, efficiency and reliability; mitigate congestion at intercity passenger and freight rail chokepoints to support more efficient travel and goods movement; enhance multimodal connections; and lead to new or substantially improved intercity passenger rail transportation corridors.
- **USDOT SMART – Strengthening Mobility and Revolutionizing Transportation:** Provides grants to conduct demonstration projects focused on advanced smart city community technologies and systems in a variety of communities to improve transportation efficiency and safety.

The Author

Macek

Nathan Macek serves as HDR's infrastructure finance director. He has more than 20 years of experience applying innovative approaches to budgetary challenges faced by public agencies. His passion is assisting infrastructure owners in evaluating funding options and developing strategies to secure grants and other funding.



The Author

Landau

Aurah Landau is a trusted Alaskan advisor on federal infrastructure grants and is a sought-after speaker, strategist, and team leader. She leads HDR's Alaska Area grant program and supports infrastructure grant and strategic communication projects across the state.

The Author

Keller

Kevin Keller is HDR's intermodal transportation planning lead, with more than 30 years of experience in the A/E/C industry. He has specialized in grant-writing, primarily for ports and rail owners. In that time, he has helped more than 25 port and rail clients successfully obtain more than $400m in grant funding.

Image courtesy HDR

The $1 Billion Offshore Wind Prize for U.S. Shipyards

The growing CTV and SOV market represents a long-term demand for at least 60 to more than 130 vessels.

By Philip Lewis, Research Director, Intelatus Global Partners

The U.S. offshore wind market presents a $1 billion long-term opportunity to builders of crew transfer vessels (CTV) and service operation vessels (SOV) that will support both wind farm construction and long-term operations and maintenance. Unlike many of the construction vessels to be deployed on U.S. wind projects, CTVs and SOVs must be Jones Act compliant, meaning they will be built, owned and operated by U.S. companies and personnel. However, although seen as somewhat commoditized vessels, a clear understanding of the commercial technical drivers in each of the segments is required. These are the findings of our new analysis of the global CTV market.

The CTV and SOV opportunity

By the end of 2024, the U.S. Tier 1 (purpose built) and Tier 2 CTV (conversions) fleet will have grown to 23 vessels, with owners holding options to build at least a further 12 vessels.

Long-term, the market has a potential O&M related demand for 60-130 CTVs with additional CTVs required for logistics during the offshore construction of wind farms. MARAD Title XI loan guarantee documentation indicates U.S. CTV pricing of around $12 million per vessel. As a result, the net long-term capital requirement for new CTV construction is $440-1,140 million. Construction cycle time is at least 12 months per vessel (and as much as 15-20 months) excluding design and approvals. Most yards involved in the building of CTVs for the U.S. market appear to be able to produce between one and four CTVs annually.

By comparison, leading Southeast Asian yards will sell European specification CTVs for around $5.5-6 million per vessel, with build cycles of 8-10 months and capacity to produce 10 vessels a year.

We note similar pricing trends in the SOV segment as seen in the CTV segment. We have reported previously the price difference in U.S. built SOVs compared to those deployed in Europe and the three Tier 1 vessels currently being built in the U.S. are reported to cost between $97 and 162 million each. SOVs contracted for the European market at a similar time to the three Jones Act vessels cost between $67-75 million.

Where the right conditions exist, such as a developer or turbine OEM operating a large number of turbines in a relatively close geographic proximity, Tier 1 SOVs will be used for turbine commissioning and O&M support. Tier 2 walk-to-walk vessels, mainly redeployed from the Gulf of Mexico's oil & gas sector, will also be used for turbine commissioning and some maintenance work from time to time. Vessels falling into this category include the Paul Candies and one of the Hornbeck HOSSOV 300E MPSVs.

There remains potential for additional Tier 1 vessels, with at least three vessels currently identified by developers, for an estimated CAPEX of $450-500 million.

To confirm the theme of comparatively high costs for locally built vessels, in its Q2-23 financial reporting, Dominion Energy has reported that the construction of the U.S.-built wind turbine installation vessel (WTIV) Charybdis had cost $367 million as of June 30, 2023, and is forecast to rise to around $625 million by time of delivery at the end of 2024 or early 2025. To put this in context, WTIVs contracted in Asian yards with similar specifications in the same time period as Charybdis, cost around $325 million. The delayed delivery means that the vessel will (most likely) not be deployed on Ørsted's Revolution Wind and Sunrise Wind projects.

Drivers for CTV and SOV Demand

Those reading about U.S. offshore wind over the last few months will have experienced roller coaster emotions, lurching between optimism and pessimism.

Developers have reported projects have become unfinanceable due to a combination of inflationary factors, U.S. specific tax credits and supply chain challenges. Several of these developers have sought to renegotiate or cancel contracts to sell electricity to states for agreed rates by agreed dates. As a result, some projects will see completion dates shift back for several months to even years.

However, the fundamental drivers for offshore wind remain sound. At the federal level, the current administration is focus-

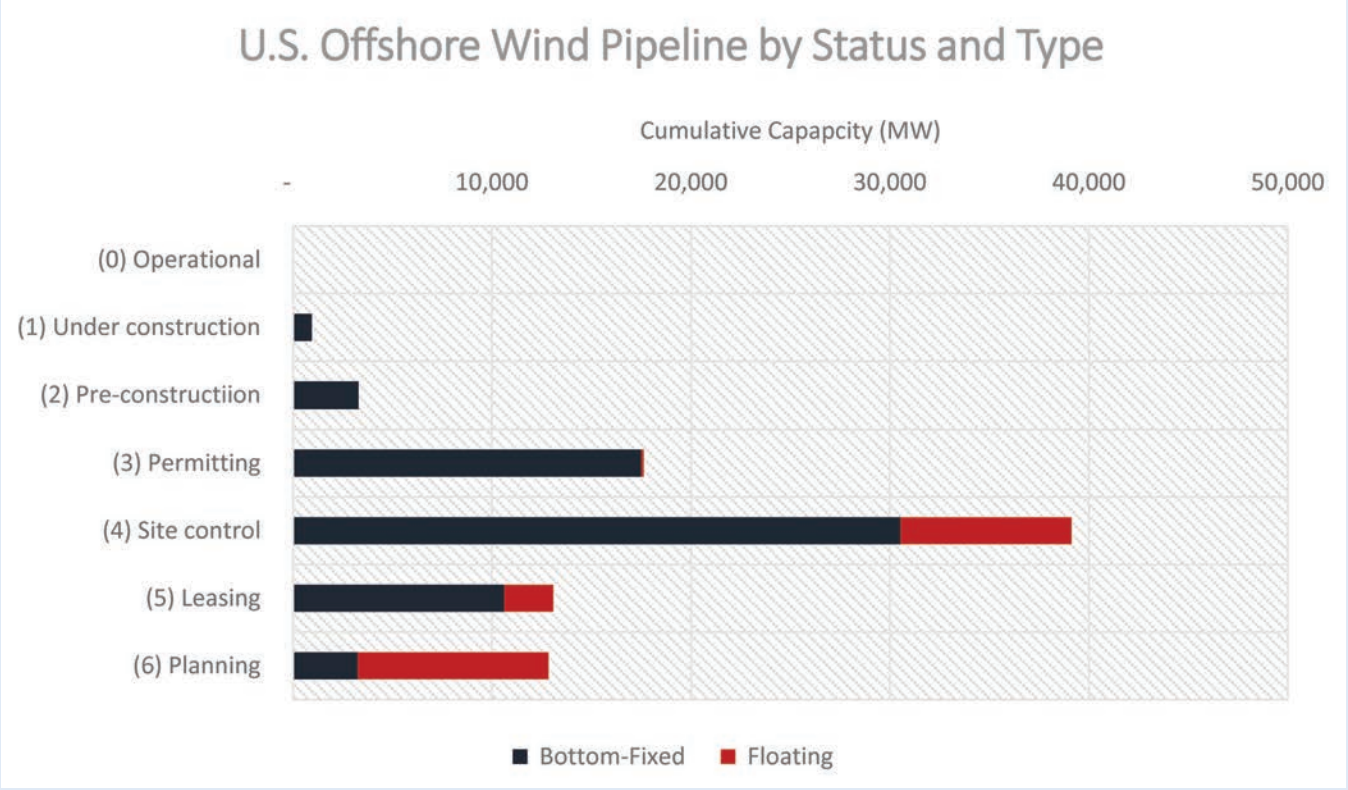


Chart Intelatus Global Partners

ing resource on the leasing and permitting of offshore wind and plans to approve over 13 GW of project capacity before the end of 2024 and provide financing support through the Inflation Reduction Act related tax credits.

At the state level, especially for the Northeast and Mid-Atlantic segment, we see states with clear ambitions to increase the use of renewable energy, reduce the amount of imported hydrocarbons, setting offshore wind procurement targets and creating a clear route to market for developers.

Our 87 GW project pipeline, shown in the chart, covers 73 wind farms located in federal and state waters off the Atlantic. Pacific and Gulf of Mexico Coasts as well as in the Great Lakes. 42 MW of capacity is operational, 938 MW currently in offshore construction and a further 3.3 GW of capacity has passed the final investment decision hurdle.

A good barometer for long-term CTV activity is to look at the number of turbines that will be installed as during their long lifetime, they will require constant routine inspection, repair and maintenance, the technicians for which are transported and/or housed on CTVs and SOVs.

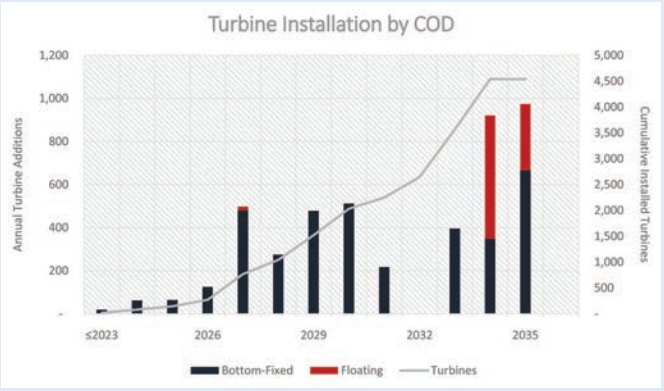


Chart Intelatus Global Partners

Based on current developer plans, the pipeline translates to close to 4,500 turbines being installed in U.S. waters by 2035, which are expected to be supplied by the three dominant western OEMS: Siemens, GE and Vestas.

Looking to Other Markets for Guidance

The mature and large European offshore wind market can be used as a guideline to developments in the CTV and SOV market space. Europe is expected to have installed close to 7,000 turbines in total by the end of 2024. By the end of 2024, slightly more than 400 Tier 1 CTVs will be operational in Europe, supporting both long-term operations and maintenance support for existing wind farms as well as construction and commissioning of new wind farms. At the same time, 43 Tier 1 SOVs are expected to be working for developers and OEMs, a number which will jump to 64 by 2026 (although not all of these are contracted).

What about Tier 1 Technical Trends?

On average, CTVs have become longer, wider and feature increased passenger capacity.

Catamarans remain the dominant hull type, but there are also an interesting number of surface effect vessels, SWATH (small waterplane area twin hull), trimarans, CTVs featuring outriggers and a CTV featuring a hydrofoil.

Waterjets and twin fixed pitch propellors are the leading so-

CTV Technical Trends

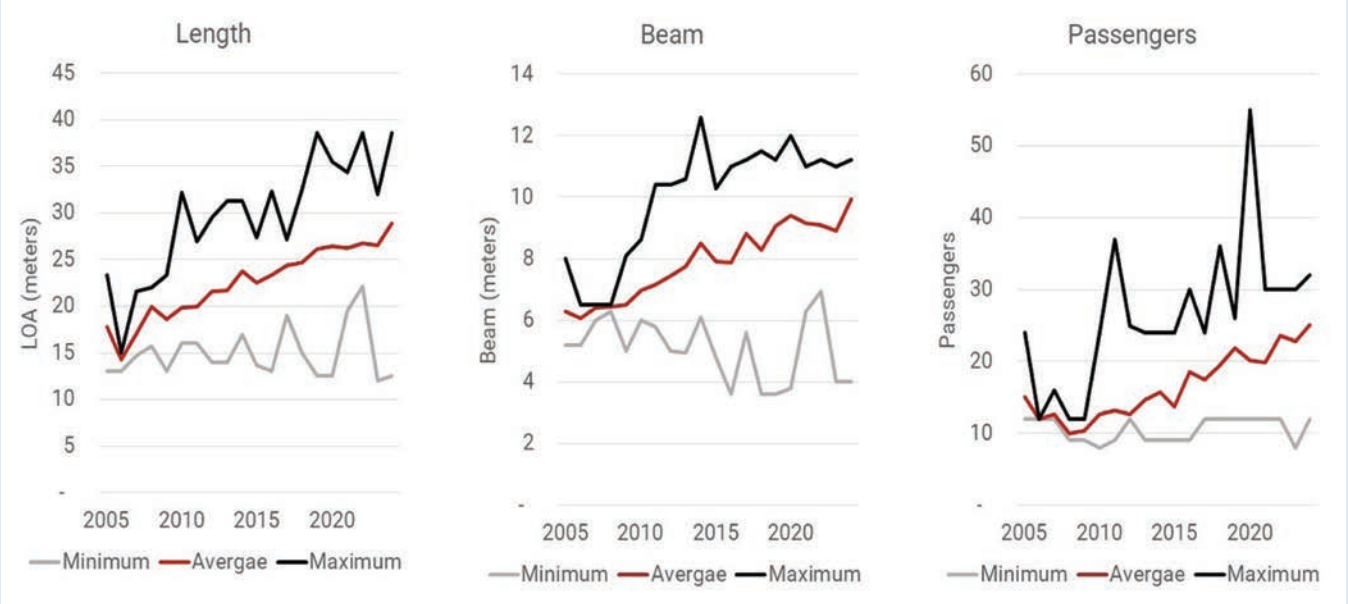


Chart Intelatus Global Partners

lutions for active vessels, but the Volvo Penta quad IPS system has gained much favor, featuring in over 50% of new builds.

The SOV segment is defined by those vessels more focused towards longer term O&M work and those vessels suited to turbine commissioning projects, the latter which generally requires more technicians to be housed. As the charts show, the long-term contracted SOV supply has grown at a fairly steady rate, whereas the SOV segment is currently going through a significant growth spurt. The one concern for this segment remains that SOVs are a comparatively commoditized item, which is relatively easy to package and explain to investors, fueling the risk for speculative and over-building.

The trend for the SOV segment is for battery-based diesel electric propulsion systems, where the engines feature some form of fuel flexibility to accommodate hydrogen energy carriers, such as methanol and liquid organic hydrogen carriers (LOHC).

Still a Bright Future

Offshore wind projects, whether in the U.S. or globally, are navigating some significant obstacles, whether supply chain bottlenecks, financial support or inflationary pressures. However, the fundamentals remain strong for growth of offshore wind projects in Europe, East Asia and the U.S. Further, we anticipate new market entrants, including South America and Australia.

A common theme of all of these projects is that they will require logistical support during construction and operations. CTVs and SOVs remain key assets for these activities, and more will be required.

But to avoid the challenges that have been faced by many early movers, lower risk long-term charter contracts with no early termination provisions should always be considered as a potential option.

SOV Technical Trends

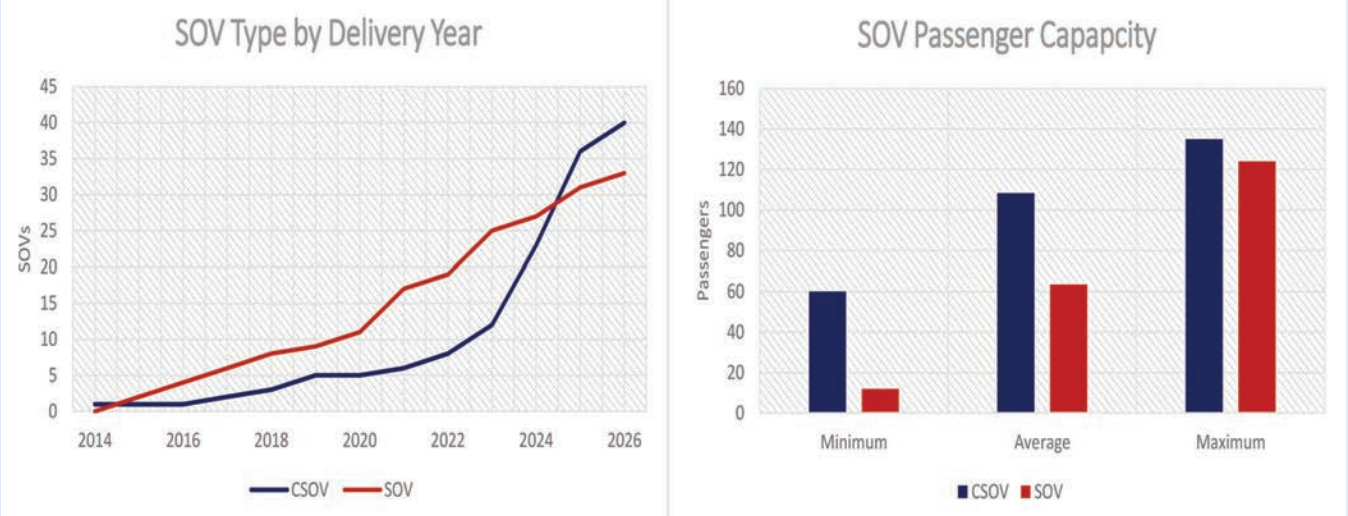


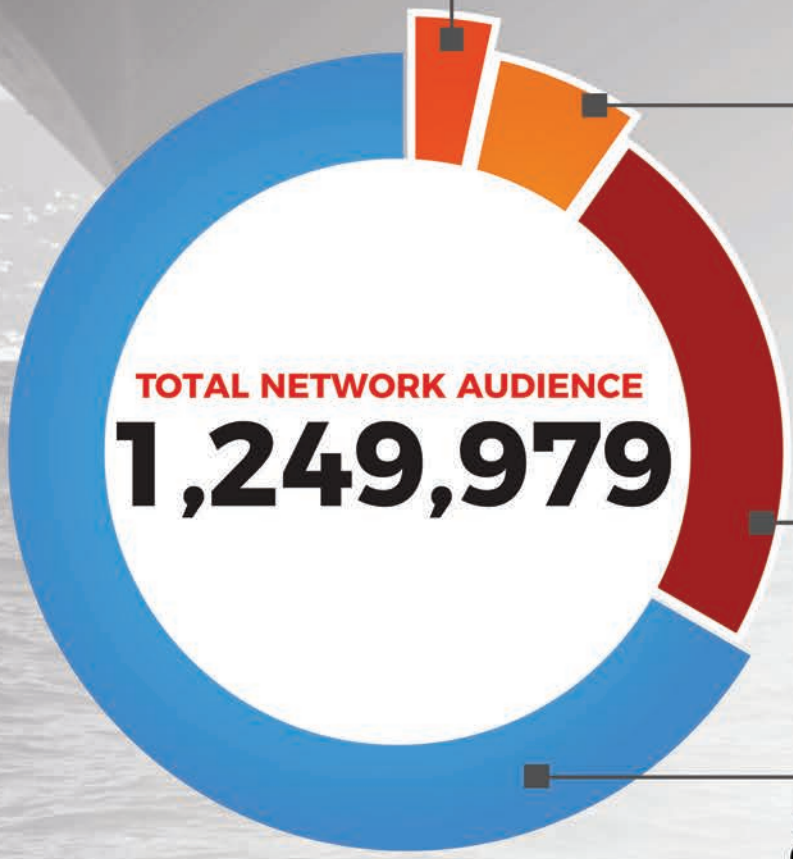
Chart Intelatus Global Partners

MARITIME REPORTER AND ENGINEERING NEWS

Marine News

MARINELINK

THE INDUSTRY'S LARGEST PORTFOLIO OF PRINT, DIGITAL & SOCIAL MEDIA IS GROWING LARGER EVERY DAY



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77,498
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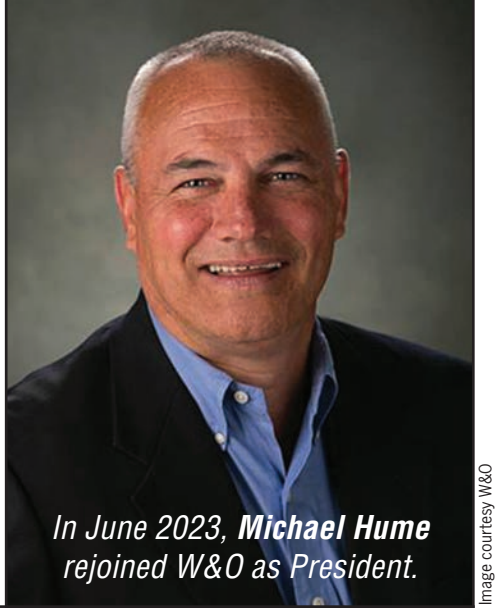
Company in Focus: W&O



*In June 2023, **Michael Hume** rejoined W&O as President.*

Image courtesy W&O

For more than 48 years, W&O has focused exclusively on serving the maritime industry with products and services that go far beyond the expected. As a leader in the marine industry, W&O operates a network of strategically located branches in North America, Europe and Singapore with more than 330 maritime professionals.

W&O is a global source for actuated valves, valves and specialty products to the marine and upstream oil & gas industry. Through the years, W&O broadened its offerings to include value added engineered solutions including actuated valve expertise, non-welded piping systems, sealing penetration systems, steering gear and controls consultancy, and project-management services. We support our customer base with over $60+ million in stock.

W&O has built a well-earned reputation for going the extra mile to make and work hard to ensure we support our client's requirements, forming win-win strategic partnerships with those we serve. The industries we serve work 24/7, and so does W&O. Around the clock, every day of the year, we provide mission-critical products and services from our many strategically located service centers. It's this kind of responsiveness and proactive spirit that truly sets us apart.

In addition, EMI, a W&O Company, provides state-of-the art engineering design and manufacturing of marine control systems from electro-hydraulic steering to vessel monitoring and controls. Located in St. Rose, LA, EMI's marine control systems can also be manufactured to meet "Buy America" requirements. With an in-house staff of engineers, programmers, project managers, and service personnel, EMI can provide multiple products, systems and seamless integration with other auxiliary equipment installed on vessels. EMI's growing service department with a dedicated team of service technicians has expanded its footprint to include local service technicians in New Orleans, Houston, and Paducah.

W&O operates its global branch network from Jacksonville, FL. The network includes locations in the USA, Canada, Europe and Asia. With steady growth over the years, W&O has expanded its products and territories and is a major supplier of valves, actuated valves, and engineered solutions to the marine and upstream oil and gas industries.

Primary Product/Service

W&O focuses solely on the maritime industry with products and services. We represent a variety of recognizable brands and maintain a large stock in strategic locations to support our customers which is why we have been a go-to solutions provider in the maritime industry for over 48 years. No one knows the business better, and no one puts more time, energy and resources into serving our customers specific and unique requirements. We serve all segments, including commercial shipping, the U.S. Navy, Military Sealift Command, MARAD, U.S. Coast Guard, cruise lines, barge owners, upstream oil and natural-gas rigs, and contractors, shipyards that build and repair vessels of all sizes. We also support our friends in the design and engineering side of the business with technical support.

W&O understands the unique needs of ship building as well as the repair and retrofitting industry for all types of maritime vessels. Our global footprint allows us to service our customers' needs from multiple locations in the world and provide exceptional customer service. We provide complete valve-automation packages that are assembled, tested, delivered and ready to install in ships or upstream oil and gas platforms being built or repaired around the world.

Recent Highlights

After 20 years as a Pon Holdings operating company, the Netherlands-based Pon sold W&O to MiddleGround Partners II, LP. The Kentucky-based firm acquired PVI Holdings, Inc., the parent company of W&O Supply, Setpoint Integrated Solutions and A-T Controls. MiddleGround is an operationally focused private equity firm that makes controlled investments in middle market B2B industrial and specialty distribution companies.

Earlier this year in June 2023, Michael Hume rejoined W&O as President. Hume replaced Todd Nestel, who will work on special projects after four years in the role. Nestel joined W&O in 2012 and played an instrumental role in accelerating the organization's evolution from a reliable supplier to a provider of complete technical solutions.

2024 Editorial Calendar

MARITIME REPORTER AND ENGINEERING NEWS

January 2024

Cruise Ships & Ferries

- Marine Interior Outfitting
- Coatings & Corrosion Control
- Autonomous Ship Systems
- Water Treatment System

Event Distribution:
Seatrade Cruise: Apr 8-10, Miami
PVA Maritrends: Jan 27-30, Portland

February 2024

The Ship Repair & Conversion Edition

- Marine Hybrid Propulsion
- Marine Fuels and Lubricants
- Marine Electronics
- Special Report: Japanese
- Shipbuilding & Ship Equipment

Event Distribution:
CMA: Mar 12-14, Stamford, CT
Electric & Hybrid: Mar 13-14, Long Beach, CA
Europe Offshore Wind: Mar 19-21, Bilbao, Spain
Sea Japan: Apr10-12, Tokyo
Sea Air Space: Apr 8-10, Washington, DC

March 2024

E-Magazine Edition
Dredging

April 2024

Offshore Energy: Ship, Boat & Rig Building

- SOVs
- Marine Gears & Transmissions
- Deck Machinery & Cranes
- Maritime Universities & Academies

Event Distribution:
OTC: May 6-9, Houston, TX
IPF Wind: Apr 23-25, New Orleans

May 2024

Green Ship Technologies

- Tugboats & Towboats
- Marine Salvage
- Marine Batteries & Fuel Cells
- Classification Societies

Event Distribution:
Posidonia, June 3-7, Athens, Greece
Inland Marine Expo: May 29-31, Nashville

June 2024

Digitalization

- Wind Turbine Installation Vessels
- Fast Attack and Patrol Craft Builders
- Green Hydrogen
- Water Jets, Thrusters & Propellers

Event Distribution:
Multi-Agency Combat Craft (MACC)
Marine Money Week, New York, NY

July 2024

E-Magazine Edition
Navy & Coast Guard

August 2024

The Shipyard Annual

- Pipes, Pumps & Valves
- Ballast Water Management
- Tools: Welding & Cutting Equipment
- Special Report: German Shipbuilding & Ship Equipment

Event Distribution:
SMM 2024, Hamburg, Germany

September 2024

Marine Design Edition

- Energy Transition & Marine Design
- Naval Architects & Marine Engineers
- CAD/CAM Software
- Special Report: Shipping & Port Logistics

Event Distribution:
Breakbulk Americas: Houston,TX
SNAME 2024
Shipping Insight: Oct, Stamford, CT, USA
Maritime Week Americas
Interferry

October 2024

E-Magazine Edition
Offshore Energy: Oil & Gas * Wind *Wave

November 2024

Workboat Edition

- Autonomous Workboats
- Diesel Engine Technology
- Deck Equipment: Winches & Cranes
- Training and Simulation

Event Distribution:
Int'l Workboat Show: Dec, New Orleans, LA

December 2024

Great Ships of 2024

- Alternative Ship Propulsion Assist Technologies
- Marine Robotics
- Safety Equipment
- Navigation: Radar, ECDIS & Collision Avoidance

Event Distribution:
Surface Navy Assoc: Jan 2025

While the Karl Senner LLC reference list is long, a strong recent win was last-month's delivery of a pair of Damen 3013 Multi Cats, built by Conrad Shipyard for Great Lakes Dredge & Dock.

Credit: Great Lakes Dredge & Dock

Gearing Up for a Hybrid Future

***Karl Senner LLC** is a fixture in the maritime community, a third generation, long-tenured player in the marine propulsion sector, known for marine propulsion, most commonly known as the North American distributor and service provider of REINTJES Gearboxes. Today, as it enters its 51st year, the company has built a presence that exceeds the selling/servicing of heavy machinery, positioning itself as propulsion experts, staffed and outfitted to meet some of the industry's greatest challenges related to the entire propulsion system, including electrification, both hybrid drives and full electric solutions.*

By Greg Trauthwein

Brothers Karl and Chris Senner sit at the helm today – Karl the President, Chris the Executive Vice President – and together they and their team of 59 employees have come out the other side of the Covid pandemic stronger, with a new headquarters, and facilities in Kenner, La., plus an expanded network of physical facilities (in Channelview, TX, Paducah, KY, and Seattle, WA) and personnel located in key U.S. maritime hubs on the West Coast, Gulf Coast, East Coast, and Inland Waterways.

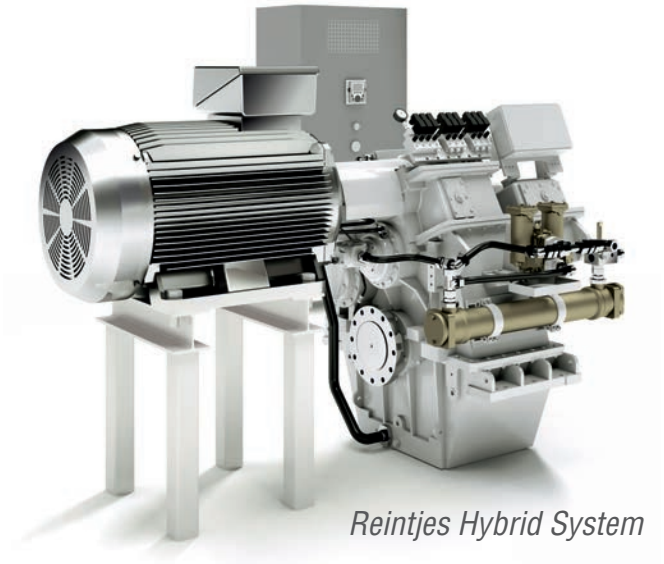
"We are uniquely positioned as a company when it comes to our extensive parts inventory," said Karl Senner, noting that the company keeps in stock about $25 million in parts – including everything from small consumables, and maintains about 50 complete marine gearboxes in the 500-3,000 hp per shaft line range. "This is not something we put in place during with Covid, it's something we've always done. This strategy proved particularly valuable during the supply chain disruptions during Covid."

Key market segments served by the Karl Senner LLC team in recent years include the towboat market, passenger vessels, dredging, and fishing.

"While interest continues to grow on the Hybrid and Electrification arenas, we aim to keep our systems simple and serviceable," said Chris Senner. "As we see a growing demand in the market, we are increasing our capacity to deliver more complex systems. It's exciting to sit down with customers, understand their specific needs, and configure an optimal propulsion system solution for their operation, whether for shafted fixed pitch propeller (FPP), controllable pitch propeller (CPP), azimuth (Z or L Drive), or waterjet. At the end of the day, we remain flexible to meet our customer's needs, and offer the best propulsion and electrical solutions when it comes to reliability, serviceability, efficiency, safety, CapEx and OpEx."

"We see a strong future in multiple market segments, particularly as we expand into electrical system and alternative energy solutions," said Karl Senner, noting the industry's energy transition evolution, encompassing electromechanical

Image courtesy Reintjes



Reintjes Hybrid System

Karl Senner

Chris Senner

Images courtesy Karl Senner LLC

hybrids, fully electric vessels, energy storage systems, fuel cells, alternative fuels, and everything in between.

Key areas of increased penetration in the market include delivering Reintjes solutions to the lower end of the horsepower range, from 500 hp per shaft line and up, said Karl Senner, and its increased focus on the electrification side of the business, adding key personnel and capability, leading to a bevy of new projects including:

- Propulsion solution for a fully electric inland towboat;
- Hybrid gears for an electromechanical hybrid propulsion system onboard a ferry being built by Senesco for the State of Maine;
- L-Drives with integrated permanent magnet motors for HYDROGEN ONE, being built for Maritime Partners; and
- Several new passenger vessels on the East Coast, each including gearboxes and electrical system, including inverters for batteries and the main switchboard.
- Two REINTJES Dredge Gearboxes (RDGL 630), each driving 6300hp cutter heads for Callan Marine.
- Main Propulsion Gearboxes, Bow Thrusters (BT), BT Gearboxes, Intermediate Shafts with Shaft Brakes for BTs, Main Propulsion Control System, and BT Control System for Port Jefferson Ferry being built at Eastern Shipbuilding Group.

While the Karl Senner LLC reference list is long, a strong recent win was last-month's delivery of a pair of Damen 3013 Multi Cats, built by Conrad Shipyard for Great Lakes Dredge & Dock.

Houston-based dredging contractor Great Lakes Dredge & Dock Corporation announced it has taken delivery of the Cape Hatteras and the Cape Canaveral, the two Damen 3013 Multi Cats built by Conrad Shipyard in Morgan City, La.

"This is a milestone for our company and the U.S. dredging industry," said Chris Gunsten, Great Lakes' senior vice president of project services and fleet engineering. "The Multi Cat brings step change safety improvements to Great Lakes' dredge pipeline operations, which was a prime driver for the investment. Pipe handling and connection work can now take place securely on deck, which will greatly reduce the risk of man overboard. These vessels will also enhance and improve Great Lakes' pipe and anchor operations. Further, the Multi Cats' two crane and multiple winch and wire tugger arrangements will significantly reduce manual work and the risk of soft tissues injuries. These vessels support our strong safety culture and gives us the ability to dredge with enhanced operating efficiencies needed to maintain our shorelines and waterways."

The two identical vessels measure approximately 99 feet in length and are each powered by three EPA Tier III Caterpillar C32 TTA engines capable of meeting speeds of 10.2 knots and will have maximum bollard pull of approximately 32 short tons.

Onboard Karl Senner, LLC equipped the M/V Cape Hatteras with three WAF 464L Reverse Reduction Gearboxes and a two-Station Main Propulsion Control System.

Each gearbox is fitted with Vulkan Torsional Couplings, Mechanical Trailing Pumps (allowing for unlimited freewheeling), and Temperature Control Valves.

Equipped with two large winches and two deck cranes, the dredge support vessels are able to perform a wide range of tasks including handling submerged and floating pipelines as well as anchor handling and logistics supply. Efficiency is also greatly enhanced by eliminating the need for assorted floating support equipment such as derrick barges, towboats and anchor barges.

The two vessels are the first Damen Multi Cats to be built in the U.S. and are fully compliant with the U.S. Coast Guard and U.S. Army Corps of Engineers stability criteria.

Photos courtesy Dave Meron

International Efforts Accelerate the Development of Unmanned Maritime Systems

By George Galdorisi

Few would argue that unmanned systems represent one of the breakthrough technologies that could lead to a revolution in military affairs. Until recently, attention has focused on unmanned aerial systems and unmanned ground systems due to the fact that the wars in Iraq and Afghanistan saw a rapid growth in their development and use. Today, unmanned maritime systems have begun to take center stage.

Today, unmanned maritime systems have begun to take center stage for reasons that are clear. Like their air and ground counterparts, these unmanned maritime systems are valued because of their ability to reduce the risk to human life in high threat areas, to deliver persistent surveillance over areas of interest, and to provide options to warfighters that derive from the inherent advantages of unmanned technologies.

Russia's invasion of Ukraine has brought new attention to the value of using unmanned systems in conflict. While there are many stories that have been generated regarding this conflict, as well as some nascent lessons learned, one of the most prominent is how Ukraine has been able to use unmanned surface vehicles to attack Russian ships.

The attack on the Russian Navy in the port of Sevastopol in October 2022, as well as subsequent attacks on Russian vessels as brought new attention to the capabilities of these unmanned maritime systems, and will likely spur the development of USVs by many nations and navies. But lost in the breathless daily reporting of the conflict in Ukraine is the fact that many nations and navies have been experimenting with unmanned surface vehicles.

International Maritime Exercise 2022 (IMX 22) held in the Arabian Gulf and led by Commander Task Force 59 focused on the integration of manned and unmanned vessels and included operations with a number of regional partners. Navies and Coast Guards of several nations worked to fully explore the capabilities of unmanned systems such as the Saildrone, the MARTAC MANTAS and Devil Ray, and many other USVs from participating nations.

The Commander of U.S. Naval Forces Central Command, Vice Admiral Brad Cooper, noted: "The Navy has been working with manufacturers to test new technologies, including firms such as Saildrone and MARTAC under a contractor-owned, contractor-operated model. Sixty nations are participating in IMX 22. It is the largest unmanned exercise in the world…We're taking off-the-shelf emerging technology in unmanned and coupling with artificial intelligence and machine learning to bring new capabilities to the region."

IMX 22 was not a "one-of." Rather, manned-unmanned integration operations in the Arabian Gulf continued. In October 2022, the United Kingdom and the United States held joint exercises in the Arabian Gulf in the wake of Iran's seizure of a U.S. Navy Saildrone USV. The United States and its allies want a force of 100 unmanned surface vessels patrolling waters from the Red Sea to the Arabian Gulf by the end of this year.

MARTAC unmanned surface vehicles MANTAS and Devil Ray were mainstays of this exercise. Here is how one defense analyst captured the essence of MARTAC's participation in IMX 22:

MARTAC has a strong presence in 5th Fleet operating with Task Force 59, a Middle-East-based task force working on the development of unmanned systems…Typical missions for MARTAC include intelligence, surveillance and reconnaissance, port and harbor security and sensing capabilities.

Soon after IMX 22, the Australian Defence Force (ADF) began Exercise Autonomous Warrior 2022 (AW 22). This Royal Australian Navy-led event was designed to test and evaluate uncrewed, robotic and autonomous systems in Jervis Bay and in the nearby East Australian Exercise Area. Australia's Chief of Navy, Vice Admiral Michael Noonan, noted that AW 22 was designed to help implement the Navy's RAS-AI 2040 strategy.

AW 22 participants included Australia, New Zealand, the United Kingdom and the United States, and featured a total of thirty autonomous systems. The unmanned surface vehicles that were part of this two-week exercise were the Saildrone, MANTAS, and Devil Ray featured in IMX 22, the Atlas Elektronik ARCIMS, the Elbit Systems Australia SEAGULL, and the Ocius Bluebottle. One demonstration featured the 12-foot MANTAS being carried by the 38-foot Devil Ray, something made possible due to their common HME systems.

The biennial Rim of the Pacific (RIMPAC) exercise provided the opportunity for international navies to assess the attributes of the four unmanned surface vehicles participating in this event. Here is how U.S. Navy Commander Jeremiah Daley, commodore of the U.S. Navy's Unmanned Surface Vessel Division One, described what was accomplished:

An exercise like RIMPAC can further test safety and navigation capabilities of a USV, assess the strain on mechanical and electrical systems during combat-relevant operations, and identify the right payloads—including an electronic warfare suite and a towed sonar array, in this case. This all helps the service figure out how USVs can contribute to the fight.

On the other side of the world, NATO exercises REPMUS 22, and the follow-on Dynamic Messenger 22, provided an opportunity for NATO nations to evaluate unmanned systems and their ability to coordinate on, above and under the sea. These exercises focused on the integration of 120 autonomous assets into a single network. Several organizations: from NATO's Allied Command Transformation, to NATO's Allied Maritime Command, to the NATO Center of Excellence, to the NATO Center for Maritime Research and Experimentation, as well as partners in academia and industry, were stakeholders in these exercises.

One of the important lessons learned during REPMUS 22 was that drones have utility beyond intelligence, surveillance, and reconnaissance. They can be used to mislead opponents' scouting efforts, and swarms can stimulate defense systems, revealing enemy dispositions. Royal Netherlands Navy drones were part of exercise REPMUS 22, which evaluated and integrated NATO nations' uncrewed systems and procedures.

Soon after REPMUS 22, the U.S. Navy and partner navies conducted exercise Digital Horizon 2022, a three-week event in the Middle East focused on employing artificial intelligence and 15 different unmanned systems (12 USVs and 3 UAVs),. The exercise, meant to be a continuation of IMX 22 but at a significantly larger scale, was hosted by Task Force 59, and built on the work done during IMX 22. During Digital Horizon, Task Force 59 leveraged artificial intelligence to create an interface on one screen, also called a "single pane of glass." The screen displayed relevant data from multiple unmanned systems for watchstanders in Task Force 59's Robotics Operations Center. One of the features of Digital Horizon 2022, and in line with the first word of the exercise, "Digital," was the ability of a single operator to command and control five unique drones. It is difficult to overstate the true revolution in military affairs that the use of USVs will mean in terms of warfighting possibilities going forward, especially in holding naval forces at risk to low cost, highly effective, armed USVs. Use of these weapons as a new way of warfighting is a revolution in military affairs that is gaining traction among world navies. More international naval exercises, most featuring unmanned surface vehicles—both commercial-off-the-shelf (COTS) unmanned maritime systems, as well as other USVs in various stages of development—are planned in the years ahead. These exercises and initiatives are important if navies are to convince their political establishments to invest in these highly capable systems.

In the Shipyard

Latest Deliveries, Contracts and Designs

Marcelle Melosira: Hybrid Research Vessel

Derecktor Shipyards NY in Mamaroneck, N.Y. has delivered a new hybrid research catamaran to the University of Vermont (UVM). The innovative vessel, Marcelle Melosira, will serve as a floating classroom and laboratory, enabling advanced research operations and hands-on educational programs. Designed by Chartwell Marine and built in collaboration with UVM and Chartwell, the 64-foot research catamaran has been crafted to fulfill the functions outlined by UVM's Rubenstein School of Environment & Natural Resources. These functions include low emissions, low fuel burn rates, a stable and safe platform for research, high maneuverability, and the ability to tow trawls sleds, and plankton nets. The vessel will also facilitate the launch and recovery of scientific equipment, small remotely operated vehicles (ROVs) and sediment sampling devices.

Photo Derecktor Shipyards

The Marcelle Melosira is equipped with a hybrid-electric power and propulsion system supplied and integrated by BAE Systems. The vessel is also equipped with dual control stations to maximize operability, and offers a large interior space and an expansive exterior aft deck area. Constructed of aluminum, the vessel is designed to operate on Lake Champlain in up to 1.5-meter Significant Wave Height conditions.

Electric Tugs @ Sea Trial

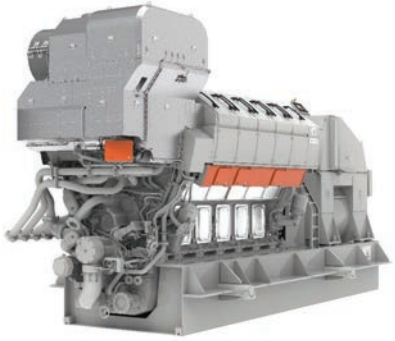
Two electric-powered emissions-free electric tugboats built by Sanmar Shipyards in Türkiye are undergoing sea trials ahead of being delivered to SAAM Towage's Canadian fleet. The tugs are based on the ElectRA 2300SX design from Robert Allan Ltd (RAL). They were launched on April 8 and September 9 respectively, and measure 23.4m LOA, with an 11.9m beam and maximum draft of 5.5m, and a bollard pull of 70 tonnes based on a battery power of 3616 kWh.

The tugs have Schottel SRP460 LE thrusters with 2,700mm diameter propellers, and can achieve a speed ahead of 11.5 knots. Their two CAT C32 back-up gen sets, each producing 940ekW at 1,800 rev/min, are IMO Tier III compliant. At full capacity, the new units will reduce 2,400 tons of greenhouse gases each year.

Photo Sanmar Shipyards

Tech Files

Wärtsilä 31DF Engine



© Wärtsilä Corporation

ZF AT 90 Thruster

Image courtesy ZF

Methanol Superstorage

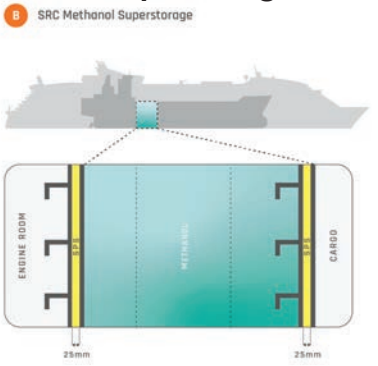


Image courtesy LR/SRC Group

Wärtsilä 31DF Engine

Wärtsilä introduced a new ultra-low emissions version of its Wärtsilä 31DF engine. While operating on LNG, it is designed to reduce methane emissions on a 50 percent load point by up to 56 percent and nitrogen oxide (NOx) by up to 86 percent. On a weighted average, this new technology can reduce methane emissions by 41 percent more than the standard Wärtsilä 31DF engine.

ZF AT 90 Thruster

ZF said the latest product in its azimuth thruster (AT) series, the ZF AT 90, will be commercially available in December 2023. This well-mounted, Z-Drive thruster is compatible with a wide range of commercial vessels, supporting max power of 1,978 kW/2,651hp, increasing the power and thrust capabilities of the thruster product line. It is fully customizable to nearly any hull shape or vessel profile, and it also supports auto-trolling. The ZF AT 90 can be executed as part of a hybrid or fully electric system.

Methanol Superstorage

A new and space efficient retrofit methanol storage solution from SRC Group has received Approval in Principle (AIP) from Lloyd's Register (LR). Methanol Superstorage offers the potential for ships with years of service ahead to be considered for transition to this alternative marine fuel.

While renewably-sourced methanol fits the net-zero framework laid out by the IMO, and is fairly easy to store and handle, it takes twice as much to generate the same energy as HFO. On board ship, this is a major storage issue, especially because low flashpoint fuel tanks conventionally require cofferdams.

Although space penalties can be addressed in newbuild ship design, even the youngest existing ships were not built with retrofitting methanol in mind. Methanol Superstorage avoids cofferdams by constructing tank walls using Sandwich Plate System Technology, in a solution boosting volume by up to 85%. The gain can be retrofitted with minimal impact on the general arrangement.

Hydrogen Fuel Ship AIP

ClassNK issued an Approval in Principle (AiP) for a parcel layout concept for a hydrogen-fueled multi-purpose vessel developed by Mitsui O.S.K. Lines, Ltd. (MOL), MOL Drybulk Ltd. (MOL Drybulk), Onomichi Dockyard Co., Ltd. (Onomichi Dockyard), Kawasaki Heavy Industries, Ltd. (Kawasaki), Japan Engine Corporation (J-ENG). This is the world's first AiP certification for a ship equipped with a large low-speed two-stroke hydrogen-fueled engine as the main propulsion engine. According to the companies, demonstration operation of the vessel will be conducted for two years from around FY2027 as part of the *"Development of marine hydrogen engines and Marine Hydrogen Fuel System (Marine Hydrogen Fuel Tank and Fuel Supply System)"* which was adopted by Green Innovation Funding Program of the New Energy and Industrial Technology Development Organization (NEDO).

Hydrogen Fueled Ship AIP

Image courtesy J-ENG

IGP

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The Next Evolution in Maritime Communication is Now

By Robert Riley, Information Technology & Networks Branch Chief, USCG R&D Center

Any Coastie who has served onboard a Coast Guard vessel of any size, or class can attest to the same call to action … more bandwidth now, please? It goes without saying that effective and efficient communications are the coin of life for operations. This is true for business, government or military services. With that said, this cannot occur without a dedicated and reliable communications network, which includes infrastructure, as well as a reliable point-of-presence (POP) aka connection source. Once the customer is connected, the next critical milestone for a network in our current hyper connected environment is throughput or bandwidth.

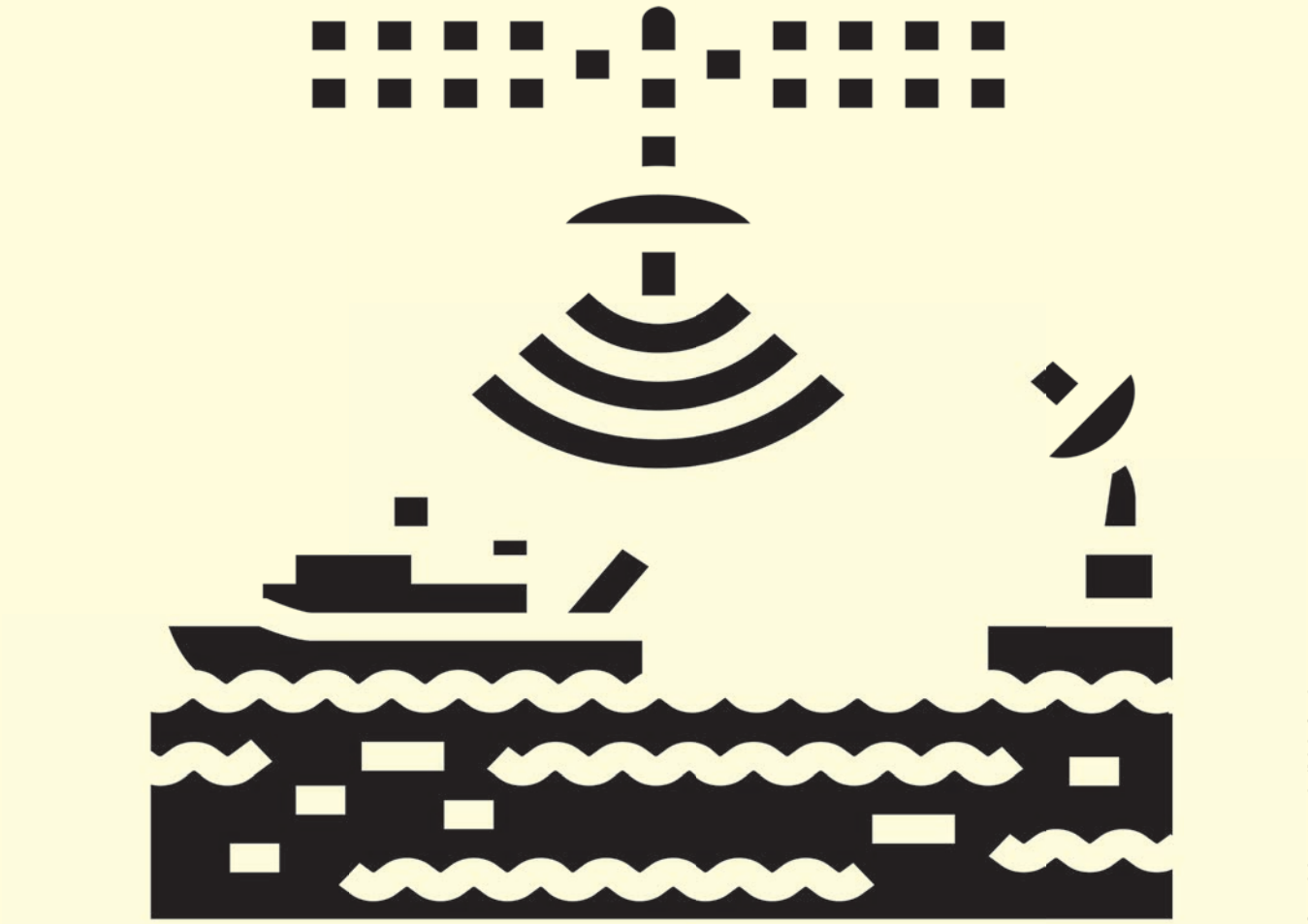
The emergence of space-based communications technology is swiftly proving to be the electric jolt the Coast Guard needs to propel itself into a higher state of connectivity. The USCG has long relied upon legacy satcom technologies for decades, technologies that were game changers at their time of inception. Stately plainly, these technologies cannot keep pace with the digital innovations and demands that are emerging almost daily. As a result of these known technological gaps and or deficiencies, in addition to costs, the Coast Guard Research and Development Center (RDC), embarked upon a mission, with the support of the Air Force Research Lab (AFRL) to open the communications aperture. Researchers wanted to look more broadly into the current state of communications options to see what the market bares now that might meet our collective needs.

The RDC has been evaluating and testing Starlink and related technologies such as OneWeb, ViaSat and MUOS in hopes of improving communication efficiency both afloat, near our coasts as well as remote high-latitude locations. The data shows that new Low Earth Orbit and Geosynchronous Satellite constellations systems that use KA and KU bands of the electromagnetic spectrum for communications are the future. Commercial communications competition has quickly filled operational niches, traditionally held by military and nation states, resulting in much needed resilience and access on a global scale. Well, the preliminary results are in; the technology not only works, it exceeds expectations at every level. Testing has shown connection speeds in excess of 280Mbs for upload and 50Mbs download speeds with close to zero delays in the case of Starlink.

During an underway period, last winter, Coast Guard Cutter HEALY, successfully achieved usage levels that exceeded 14 terabytes in one month. Based on current Starlink pricing strategies, this level of connectivity would have cost roughly $25K. A more modest data allocation of 1-5 terabytes would have cost about $5K a month. Pricing strategies aside, the bandwidth that a Starlink-like technology solution could provide operational forces is many orders of magnitude higher than the typical T1 allocation of 1.544Mbs. Afloat testers at one point had upwards of 165 devices digitally streaming media with no loss of service or connectivity 300 miles offshore of Antarctica. Separate, but related research by the US Navy at the Joint Interagency Task Force South (JIATF-South) produced similar results in areas with no cell phone connectivity, but within 20NM from land. The testing was performed at various speeds and sea states with results remaining consistent, albeit with acceptable drops in bandwidth. In comparison, the legacy technologies fell short, as for example a typical connection has download speeds on average of 250Kbs and uploads of 2Kps.

The road to bandwidth liberation is well within reach with the only limiting factor being availability and full satellite constellation deployment, which will occur sometime this year, depending on the provider. These results are so promising that the USCG Command Control Communications Computers Cyber Intelligence Service Center (C5ISC) is already examining the feasibility of replacing legacy systems with satellite communications platforms such as Starlink on a phased schedule. To date, the RDC has successfully tested Starlink on Coast Guard Cutters POLAR STAR, HEALY and at least 20 Cutters spanning multiple classes such as National Security Cutters (NSCs) and Fast Response Cutters (FRCs) to name a few.

The RDC's ultimate goal is to prove the feasibility of le-



veraging these technologies at every level of operations. This is why the RDC is working and has worked with organizations such as the US Navy, National Reconnaissance Office (NRO), and US Marines Corps under the TriSevice Strategy and related research agreements to improve interoperability between afloat units. The RDC believes that by providing hard hitting and relevant research results, our organization raises our standard of excellence and value not only to the US Coast Guard, but also to taxpayers. Our Coast Guard personnel whether ashore or afloat should expect nothing less that real time solutions, tailored to fulfill operational requirements and challenges at the speed of need. The Coast Guard's C5ISC has already authorized the purchase of more than 90 Starlink terminals for the Fleet. The only obstacles to even broader application of the technology are necessary testing and approval in accordance with the Department of Defense's Risk Management Framework (RMF). Sustained funding will also present its challenges, but if the USCG continues with its phased approach, in addition to recouping funding by sunsetting antiquated systems such as a few mentioned above, this technology will pay for itself in relatively short order. Imagine, in one fell swoop, the USCG improving operational efficiency with the stroke of a pen, while instantly improving morale and retention as the service continues to answer its nation's call to action. The future outlined in the TriService Strategy is slowly beginning to take shape. If all goes according to plan, the Coast Guard of tomorrow, will absolutely not look like the Coast Guard of today. Semper Paratus!

** The opinions expressed are those of the author's. They do not purport to reflect the opinions or views of the publisher.*

The Author

Riley

Robert Riley is the Information Technology & Networks Branch Chief at the USCG Research and Development Center. He retired from the U.S. Navy as an Officer in 2016 after 26.5 years of service. After retirement he worked in industry in the areas of software development, AR/VR, electronic warfare and intelligence.

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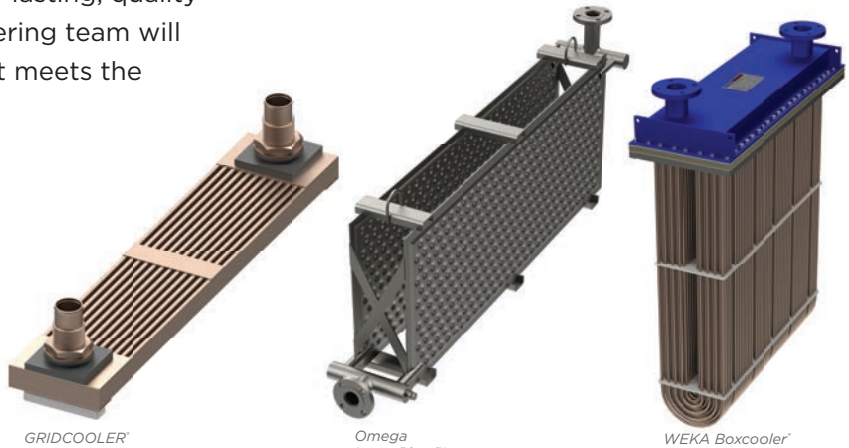

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